NIKO®

NIPPON KODO
AUTOMATION TECHNOLOGY

# Ball and Roller Bearings 2012

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# Ball Bearings

## Taper Roller Bearing



## Spherical Roller Bearngs

# Rod Ends

# TECHNICAL TABLES

# Technical Information

## 1. Bearing materials

### 1.1 Raceway and rolling element materials

#### 1.1.1 High/mid carbon alloy steel

In general,steel varieties which can be hardened not just on the surface but also deep hardened by the so-called "through hardening method" are used for the raceways and rolling elements of bearings. Foremost among these is high carbon chromium bearing steel, which is widely used.

#### 1.1.2 Mid-carbon chromium steel

Mid-carbon chromium steel incorporating silicone and manganese, which gives it hardening properties comparable to high carbon chromium steel.

### 1.2 Cage materials

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

#### 1.2.1 Pressed cages

For small and medium sized bearings, pressed cages of cold or hot rolled steel with a low carbon content of approx. 0.1% are used. However, depending on the application, austenitic stainless steel is also used.

#### 1.2.2 Plastic cages

Injection molded plastic cages are now widely used: most are made from fiber glass reinforced heat resistant polyamide resin. Plastic cages are light weight, corrosion resistant and have excellent dampening and sliding properties. Heat resistant polyamide 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.

## 2. External bearing sealing devices

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.

### 2.1 Non-contact seals:

Non-contact seals utilize a small clearance between the shaft and the housing cover. Theref ore friction is negligible,making them suitable forhigh speed applications. In order to improve sealing capability, clearance spaces are often filled with lubricant.

### 2.2 Contact seals:

Contact seals accomplish their sealing action through the contact pressure of a resilient the seal ( the lip is often made of synthetic rubber ) the sealing surface. Contact seals are generally far superior to noncontact seals in sealing efficieny, although their friction torque and temperature rise coefficients are higher. Furthermore, because the portion of a contact seal rotates while in contact wi the shaft,the allowable seal peripheral speed varie depending on seal type.

## 3. Ball bearing tolerances

### 3.1 Standard of tolerances

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

**Table 3.1 Comparison of tolerance classifications of national standards**

| Standard | | Tolerance class | | | | |
|---|---|---|---|---|---|---|
| Japanese industrial standard (JIS) | JIS | class 0, 6X | class 6 | class 5 | class 4 | class 2 |
| International Organization for Standardization (ISO) | ISO | Normal class Class 6X | Class 6 | Class 5 | Class 4 | Class 2 |
| Deutsches Institut fur Normung(ISO) | DIN | P0 | P6 | P5 | P4 | P2 |
| American National Standards Institute (ANSI) | ANSI/ABMA | ABEC-1 | ABEC-3 | ABEC-5 | ABEC-7 | ABEC-9 |

### 3.2 Tolerances for radial bearings

**Table 3.2 Inner rings** (Unit : μ m)

| Nominal bore diameter $d$ mm | | Single plane mean bore diameter deviation $\Delta d_{mp}$ | | | | | | | | | | Single radial plane bore diameter variation $V_{dp}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | diameter series 9 | | | | | maxdiameter series 0.1 | | | | |
| | | class 0 | | class 6 | | class 5 | | class 4* | | class 2* | | class 0 | class 6 | class 5 | class 4 | class 2 | class 0 | class 6 | class 5 | class 4 | class 2 |
| over | incl. | high | low | high | low | high | low | high | low | high | low | max. | | | | | max. | | | | |
| 10 | 18 | 0 | -8 | 0 | -7 | 0 | -5 | 0 | -4 | 0 | -2.5 | 10 | 9 | 5 | 4 | 2.5 | 8 | 7 | 4 | 3 | 2.5 |
| 18 | 30 | 0 | -10 | 0 | -8 | 0 | -6 | 0 | -5 | 0 | -2.5 | 13 | 10 | 6 | 5 | 2.5 | 10 | 8 | 5 | 4 | 2.5 |
| 30 | 50 | 0 | -12 | 0 | -10 | 0 | -8 | 0 | -6 | 0 | -2.5 | 15 | 13 | 8 | 6 | 2.5 | 12 | 10 | 6 | 5 | 2.5 |
| 50 | 80 | 0 | -15 | 0 | -12 | 0 | -9 | 0 | -7 | 0 | -4.0 | 19 | 15 | 9 | 7 | 4.0 | 19 | 15 | 7 | 5 | 4.0 |
| 80 | 120 | 0 | -20 | 0 | -15 | 0 | -10 | 0 | -8 | 0 | -5.0 | 25 | 19 | 10 | 8 | 5.0 | 25 | 19 | 8 | 6 | 5.0 |

**Table 3.3 Inner rings**

| Nominal bore diameter $d$ mm | | Single radial plane bore diameter variation $V_{dp}$ | | | | | Mean single plane bore diameter variation $V_{dmp}$ | | | | | Inner ring radial runout $K_{ia}$ | | | | | Face runout with bore $S_d$ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | maxdiameter series 2,3,4 | | | | | | | | | | | | | | | | | |
| | | class 0 | class 6 | class 5 | class 4 | class 2 | class 0 | class 6 | class 5 | class 4 | class 2 | class 0 | class 6 | class 5 | class 4 | class 2 | class 5 | class 4 | class 2 |
| over | incl. | max. | | | | | max. | | | | | max. | | | | | max. | | |
| 10 | 18 | 6 | 5 | 4 | 3 | 2.5 | 6 | 5 | 3 | 2.0 | 1.5 | 10 | 7 | 4 | 2.5 | 1.5 | 7.0 | 3.0 | 1.5 |
| 18 | 30 | 8 | 6 | 5 | 4 | 2.5 | 8 | 6 | 3 | 2.5 | 1.5 | 13 | 8 | 4 | 3.0 | 2.5 | 8.0 | 4.0 | 1.5 |
| 30 | 50 | 9 | 8 | 6 | 5 | 2.5 | 9 | 8 | 4 | 3.0 | 1.5 | 15 | 10 | 5 | 4.0 | 2.5 | 8.0 | 4.0 | 1.5 |
| 50 | 80 | 11 | 9 | 7 | 5 | 4.0 | 11 | 9 | 5 | 3.5 | 2.0 | 20 | 10 | 5 | 4.0 | 2.5 | 8.0 | 5.0 | 1.5 |
| 80 | 120 | 15 | 11 | 8 | 6 | 5.0 | 15 | 11 | 5 | 4.0 | 2.5 | 25 | 13 | 6 | 5.0 | 2.5 | 9.0 | 5.0 | 2.5 |

Table 3.4 Inner rings

| Nominal bore diameter $d$ mm | | Inner ring axial runout (with side) $S_{ia}$● | | | Inner ring width deviation $\triangle B_s$ | | | | | | | | | | Inner ring width variation $V_{Bs}$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | normal | | | | | | modified● | | | | | | | | |
| | | class 5 | class 4 | class 2 | class 0,6 | | class 5,4 | | class 2 | | class 0,6 | | class 5,4 | | class 0 | class 6 | class 5 | class 4 | class 2 |
| over | incl. | | | | high | low | high | low | high | low | high | low | high | low | max. | | | | |
| 10 | 18 | 7 | 3 | 1.5 | 0 | -120 | 0 | - 80 | 0 | - 80 | 0 | - 250 | 0 | - 250 | 20 | 20 | 5 | 2.5 | 1.5 |
| 18 | 30 | 8 | 4 | 2.5 | 0 | -120 | 0 | -120 | 0 | -120 | 0 | -250 | 0 | -250 | 20 | 20 | 5 | 2.5 | 1.5 |
| 30 | 50 | 8 | 4 | 2.5 | 0 | -120 | 0 | -120 | 0 | -120 | 0 | -380 | 0 | -250 | 20 | 20 | 5 | 3.0 | 1.5 |
| 50 | 80 | 8 | 5 | 2.5 | 0 | -150 | 0 | -150 | 0 | -150 | 0 | -380 | 0 | -250 | 25 | 25 | 6 | 4.0 | 1.5 |
| 80 | 120 | 9 | 5 | 2.5 | 0 | -200 | 0 | -200 | 0 | -200 | 0 | -380 | 0 | -380 | 25 | 25 | 7 | 4.0 | 2.5 |

Note: ❶ The dimensional difference $\triangle ds$ of bore diameter to applied for class 4 and 2 is the same as the tolerance of dimentional difference $\triangle dmp$ of average bore diameter. However, the dimensional difference is applied to diameter series 0, 1, 2, 3 and 4 against Class 4, and to all the diameter series against Class 2.

● To be applied for deep groove ball bearing and angular contact ball bearings.

❸ To be applied for individual raceway rings manufactured for combined bearing use.

Table 3.5 Outer rings (Unit : μ m)

| Nominal Outside diameter $D$ mm | | Single plane mean outside diameter deviation $\triangle D_{mp}$ | | | | | | | | | | Single radial plane outside diameter variation $V_{Dp}$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | diameter series 9 | | | | | maxdiameter series 0.1 | | | | |
| | | class 0 | | class 6 | | class 5 | | class 4● | | class 2● | | class 0 | class 6 | class 5 | class 4 | class 2 | class 0 | class 6 | class 5 | class 4 | class 2 |
| over | incl. | high | low | high | low | high | low | high | low | high | low | max. | | | | | max. | | | | |
| 6 | 18 | 0 | -8 | 0 | -7 | 0 | -5 | 0 | -4 | 0 | -2.5 | 10 | 9 | 5 | 4 | 2.5 | 8 | 7 | 4 | 3 | 2.5 |
| 18 | 30 | 0 | -9 | 0 | -8 | 0 | -6 | 0 | -5 | 0 | -4.0 | 12 | 10 | 6 | 5 | 4.0 | 9 | 8 | 5 | 4 | 4.0 |
| 30 | 50 | 0 | -11 | 0 | -9 | 0 | -7 | 0 | -6 | 0 | -4.0 | 14 | 11 | 7 | 6 | 4.0 | 11 | 9 | 5 | 5 | 4.0 |
| 50 | 80 | 0 | -13 | 0 | -11 | 0 | -9 | 0 | -7 | 0 | -4.0 | 16 | 14 | 9 | 7 | 4.0 | 13 | 11 | 7 | 5 | 4.0 |
| 80 | 120 | 0 | -15 | 0 | -13 | 0 | -10 | 0 | -8 | 0 | -5.0 | 19 | 16 | 10 | 8 | 5.0 | 19 | 16 | 8 | 6 | 5.0 |
| 120 | 150 | 0 | -18 | 0 | -15 | 0 | -11 | 0 | -9 | 0 | -5.0 | 23 | 19 | 11 | 9 | 5.0 | 23 | 19 | 8 | 7 | 5.0 |
| 150 | 180 | 0 | -25 | 0 | -18 | 0 | -13 | 0 | -10 | 0 | -7.0 | 31 | 23 | 13 | 10 | 7.0 | 31 | 23 | 10 | 8 | 7.0 |
| 180 | 250 | 0 | -30 | 0 | -20 | 0 | -15 | 0 | -11 | 0 | -8.0 | 38 | 25 | 15 | 11 | 8.0 | 38 | 25 | 11 | 8 | 8.0 |

Table 3.6 Outer rings

| Nominal Outside diameter $D$ mm | | Single radial plane outside diameter variation $V_{Dp}$ | | | | | Single radial plane outside diameter variation $V_{Dp}$● | | Mean single plane outside diameter variation $V_{Dmp}$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | maxdiameter series 2.3.4 | | | | | capped bearings diameter series | | | | | | |
| | | class 0 | class 6 | class 5 | class 4 | class 2 | 2,3,4 class 0 | 0,1,2,3,4 class 6 | class 0 | class 6 | class 5 | class 4 | class 2 |
| over | incl. | max. | | | | | max. | | max. | | | | |
| 6 | 18 | 6 | 5 | 4 | 3 | 2.5 | 10 | 9 | 6 | 5 | 3 | 2.0 | 1.5 |
| 18 | 30 | 7 | 6 | 5 | 4 | 4.0 | 12 | 10 | 7 | 6 | 3 | 2.5 | 2.0 |
| 30 | 50 | 8 | 7 | 5 | 5 | 4.0 | 16 | 13 | 8 | 7 | 4 | 3.0 | 2.0 |
| 50 | 80 | 10 | 8 | 7 | 5 | 4.0 | 20 | 16 | 10 | 8 | 5 | 3.5 | 2.0 |
| 80 | 120 | 11 | 10 | 8 | 6 | 5.0 | 26 | 20 | 11 | 10 | 5 | 4.0 | 2.5 |
| 120 | 150 | 14 | 11 | 8 | 7 | 5.0 | 30 | 25 | 14 | 11 | 6 | 5.0 | 2.5 |
| 150 | 180 | 19 | 14 | 10 | 8 | 7.0 | 38 | 30 | 19 | 14 | 7 | 5.0 | 3.5 |
| 180 | 250 | 23 | 15 | 11 | 8 | 8.0 | — | — | 23 | 15 | 8 | 6.0 | 4.0 |

Table 3.7 Outer rings

| Nominal Outside diameter $D$ mm | | Outer ring radial runout $K_{ea}$ | | | | | Outside surface inclination $S_D$ | | | Outside ring axial runout $S_{ea}$ ● | | | Outer ring width deviation $\Delta_{Cs}$ | Outer ring width variation $V_{Cs}$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| over | incl. | class 0 max. | class 6 max. | class 5 max. | class 4 max. | class 2 max. | class 5 max. | class 4 max. | class 2 max. | class 5 max. | class 4 max. | class 2 max. | all type | class 0,6 | class 5 max. | class 4 max. | class 2 max. |
| 6 | 18 | 15 | 8 | 5 | 3 | 1.5 | 8 | 4 | 1.5 | 8 | 5 | 1.5 | Identical to $\Delta B_s$ of inner ring of same bearing | Identical to $\Delta B_s$ and $V_{Bs}$ of inner ring of same bearing | 5 | 2.5 | 1.5 |
| 18 | 30 | 15 | 9 | 6 | 4 | 2.5 | 8 | 4 | 1.5 | 8 | 5 | 2.5 | | | 5 | 2.5 | 1.5 |
| 30 | 50 | 20 | 10 | 7 | 5 | 2.5 | 8 | 4 | 1.5 | 8 | 5 | 2.5 | | | 5 | 2.5 | 1.5 |
| 50 | 80 | 25 | 13 | 8 | 5 | 4.0 | 8 | 4 | 1.5 | 10 | 5 | 4.0 | | | 6 | 3.0 | 1.5 |
| 80 | 120 | 35 | 18 | 10 | 6 | 5.0 | 9 | 5 | 2.5 | 11 | 6 | 5.0 | | | 8 | 4.0 | 2.5 |
| 120 | 150 | 40 | 20 | 11 | 7 | 5.0 | 10 | 5 | 2.5 | 13 | 7 | 5.0 | | | 8 | 5.0 | 2.5 |
| 150 | 180 | 45 | 23 | 13 | 8 | 5.0 | 10 | 5 | 2.5 | 14 | 8 | 5.0 | | | 8 | 5.0 | 2.5 |
| 180 | 250 | 50 | 25 | 15 | 10 | 7.0 | 11 | 7 | 4.0 | 15 | 10 | 7.0 | | | 10 | 7.0 | 4.0 |

Note: ❺ The dimensional difference $\Delta D_s$ of outer diameter to be applied for classes 4 and 2 is the same as the tolerance of dimensional difference $\Delta D_{mp}$ of average outer diameter. However,the dimensional difference is applied to diameter series 0,1,2,3 and 4 against Class 4, and also to all the diameter series against Cfass 2.
● To be applied in case snap rings are not installed on the bearings.
❼ To be applied for Deep Groove Ball Bearings and Angular Contact Ball Bearings.

## 4. Bearing fits

### 4.1 Interference

For rolling bearings, inner and outer rings are fixed on the shaft or in the housing so that relative movement does not occur between fitted surfaces during operation or under load. This relative movement (referred to as "creep") between the fitted surfaces of the bearing and the shaft or housing can occur in a radial direction, an axial direction, or in the direction of rotation. To help prevent this creeping movement, bearing rings and the shaft or housing are installed with one of three interference fits, a "tight fit" (also called shrink fit), "transition fit," or "loose fit" (also called clearance fit), and the degree of interference between their fitted surfaces varies.

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

### 4.2 The necessity of a proper fit

In some cases, improper fit may lead to damage and shorten bearing life, therefore it is necessary to make a careful analysis in selecting a proper fit. Some of the negative conditions caused by improper fit are listed below.

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

4.3 Fit selection

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

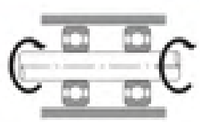
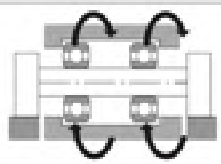
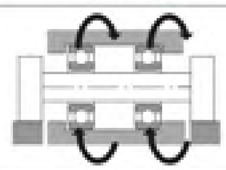
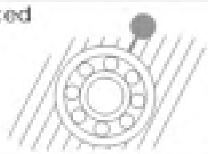
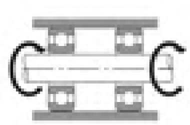
- Shaft and housing material, wall thickness, finished surface accuracy, etc.
- Machinery operating conditions ( nature and magnitude of load, rotational speed, temperature, etc.)

4.3.1 "Tight fit," "transition fit," or "loose fit"

For raceways under rotating loads, a tight fit is necessary. (Refer to Table 4.1) "Raceways under rotating loads" refers to raceways receiving loads rotating relative to their radial direction. For raceways under static loads, on the other hand, a loose fit is sufficient.
(Example) Rotating inner ring load the direction of the radial load on the inner ring is rotating relatively.

For non-separable bearings, such as Deep Groove Ball Bearings, it is generally recommended that either the inner ring or outer ring be given a loose fit.

**Table 4.1 Radial load and bearing**

| Illustration | | Bearing rotation | | Ring load | Fit |
|---|---|---|---|---|---|
| Static load |  |  | Inner ring: Rotating<br>Outer ring: Stationary | Rotating inner ring load | Inner ring: Tight fit |
| Unbalanced load |  |  | Inner ring: Stationary<br>Outer ring: Rotating | Static outer ring load | Outer ring: Loose fit |
| Static load |  |  | Inner ring: Stationary<br>Outer ring: Rotating | Static inner ring load | Inner ring: Loose fit |
| Unbalanced load |  |  | Inner ring: Rotating<br>Outer ring: Stationary | Rotating outer ring load | Outer ring: Tight fit |

## 5. Ball bearing internal clearance

Ball bearing internal clearance (initial clearance) is the amount of internal clearance a bearing has before being installed on a shaft or in a housing. The internal clearance valves for NIKO ball bearing classes are shown in tables 5.1 to 5.5

Table 5.1 Radial internal clearance of Deep Groove Ball Bearings (Unit : μm)

| Nominal bore diameter d (mm) | | C2 | | CN | | C3 | | C4 | | C5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| over | incl. | min. | max. | min. | max. | min. | max. | min. | max. | min. | max. |
| 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 |

Table 5.2 Radial internal clearance for Self-aligning Ball Bearings (for bearing with cylindrical bore) (Unit : μm)

| Nominal bore diameter d (mm) | | Bearing with cylindrical bore | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | C2 | | Normal | | C3 | | C4 | |
| over | incl. | min. | max. | min. | max. | min. | max. | min. | max. |
| 6 | 10 | 2 | 9 | 6 | 17 | 12 | 25 | 19 | 33 |
| 10 | 14 | 2 | 10 | 6 | 19 | 13 | 26 | 21 | 35 |
| 14 | 18 | 3 | 12 | 8 | 21 | 15 | 28 | 23 | 37 |
| 18 | 24 | 4 | 14 | 10 | 23 | 17 | 30 | 25 | 39 |
| 24 | 30 | 5 | 16 | 11 | 24 | 19 | 35 | 29 | 46 |
| 30 | 40 | 6 | 18 | 13 | 29 | 23 | 40 | 34 | 53 |
| 40 | 50 | 6 | 19 | 14 | 31 | 25 | 44 | 37 | 57 |
| 50 | 65 | 7 | 21 | 16 | 36 | 30 | 50 | 45 | 69 |
| 65 | 80 | 8 | 24 | 18 | 40 | 35 | 60 | 54 | 83 |

Table 5.3 Radial internal clearance for Self-aligning Ball Bearings (for bearing with tapered bore) (Unit : μm)

| Nominal bore diameter d (mm) | | Bearing with tapered bore | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | C2 | | Normal | | C3 | | C4 | |
| over | incl. | min. | max. | min. | max. | min. | max. | min. | max. |
| 6 | 10 | — | — | — | — | — | — | — | — |
| 10 | 14 | — | — | — | — | — | — | — | — |
| 14 | 18 | — | — | — | — | — | — | — | — |
| 18 | 24 | 7 | 17 | 13 | 26 | 20 | 33 | 28 | 42 |
| 24 | 30 | 9 | 20 | 15 | 28 | 23 | 39 | 33 | 50 |
| 30 | 40 | 12 | 24 | 19 | 35 | 29 | 46 | 40 | 59 |
| 40 | 50 | 14 | 27 | 22 | 39 | 33 | 52 | 45 | 65 |
| 50 | 65 | 18 | 32 | 27 | 47 | 41 | 61 | 56 | 80 |
| 65 | 80 | 23 | 39 | 35 | 57 | 50 | 75 | 69 | 98 |

Table 5.4 Radial internal clearance of double row Angular Contact Ball Bearings (Unit : μm)

| Nominal bore diameter d (mm) | | C2 | | Normal | | C3 | | C4 | |
|---|---|---|---|---|---|---|---|---|---|
| over | incl. | min. | max. | min. | max. | min. | max. | min. | max. |
| - | 10 | 6 | 12 | 8 | 15 | 15 | 22 | 22 | 30 |
| 10 | 18 | 6 | 12 | 8 | 15 | 15 | 24 | 30 | 40 |
| 18 | 30 | 6 | 12 | 10 | 20 | 20 | 32 | 40 | 55 |
| 30 | 50 | 8 | 14 | 14 | 25 | 25 | 40 | 55 | 75 |

Table 5.5 Radial internal clearance of bearings for electric motor

(Unit : μm)

| Nominal bore diameter d (mm) | | Radial internal clearance CM Deep groove ball bearings | |
|---|---|---|---|
| over | incl. | min. | max. |
| 10(incl.) | 18 | 4 | 11 |
| 18 | 24 | 5 | 12 |
| 24 | 30 | 5 | 12 |
| 30 | 40 | 9 | 17 |
| 40 | 50 | 9 | 17 |
| 50 | 65 | 12 | 22 |
| 65 | 80 | 12 | 22 |

## 6. Lubrication

### 6.1 Lubrication of rolling bearings

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) Friction and wear reduction
(2) Friction heat dissipation
(3) Prolonged bearing life
(4) Prevention of rust
(5) Protection against harmful elements

In order to achieve the above effects, the most effective lubrication method for the operating conditions must be selected. Also a good quality, reliable lubricant must be selected. In addition, an effectively designed sealing system that prevents the intrusion of damaging elements ( dust, water, etc. ) into the bearing interior, removes other impurities from the lubricant, and prevents lubricant from leaking to the outside, is also a requirement.

Almost all rolling bearings use either grease or oil lubrication methods, but in some special applicatic solid lubricant such as molybdenum disulfide or graphite may be used.

6.2 Grease lubrication
Grease type lubricants are relatively easy to handle require only the simplest sealing devicesfor these reasons, grease is the most widely used lubricant rolling bearings.

6.2.1 Types and characteristics of grease
Lubricating grease are composed of either a mineral base or a synthetic oil base. To this base a thicks other additives are added. The properties of all greases are mainly determined by the kind of base oil use the combination of thickening agent and various additives.

Standard greases and their characteristics are Table 6.2. As performance characteristics of even same type of grease will vary widely from brand, it is best to check the manufacturers' data when selecting a grease.

**Table 6.1 Grease varieties and characteristics**

| Grease name | Lithium grease | | | Sodium grease (Fiber grease) | Calcium compound base grease |
|---|---|---|---|---|---|
| Thickener | Li soap | | | Na soap | Ca+Na soap<br>Ca+Li soap |
| Base oil | Mineral oil | Diester oil | Silicone oil | Mineral oil | Mineral oil |
| Dropping poin °C | 170 ~ 190 | 170 ~ 190 | 200 ~ 250 | 150 ~ 180 | 150 ~ 180 |
| Operating temperature range °C | -30 ~ +130 | -50 ~ +130 | -50 ~ +160 | -20 ~ +130 | -20 ~ +120 |
| Mechanical stability | Excellent | Good | Good | Excellent ~ Good | Excellent ~ Good |
| Pressure resistance | Good | Good | poor | Good | Excellent ~ Good |
| Water resistance | Good | Good | Good | Good ~ poor | Good ~ poor |
| Applications | Widest range of applications.<br><br>Grease used in all types of rolling bearings. | Excellent low temperature and wear characteristics.<br><br>Suitable for small sized and miniature bearings. | Suitable for high and low temperatures.<br><br>Unsuitable for heavy load applications due to low oil film strength. | Some emulsification when water is introduced.<br><br>Excellent characteristics at relatively high temperatures. | Excellent pressure resistance and mechanical stability.<br><br>Suitable for bearings receiving shock loads. |

| Grease name | Aluminum grease | Non-soap base grease Thickener | |
|---|---|---|---|
| Thickener | Al soap | Bentone, silica gel, urea, carbon black, fluorine compounds, etc. | |
| Base oil | Mineral oil | Mineral oil | Synthetic oil |
| Dropping poin ˚C | 70 ~ 90 | 250 or above | 250 or above |
| Operating temperature range ˚C | -10 ~ +80 | -10 ~ +130 | -50 ~ +200 |
| Mechanical stability | Good ~ poor | Good | Good |
| Pressure resistance | Good | Good | Good |
| Water resistance | Good | Good | Good |
| Applications | Excellent viscosity characteristics.<br><br>Suitable for bearings subjected to vibrations. | 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.<br><br>Grease used in all types of rolling bearings. | |

## 7. Load rating and life

### 7.1 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 olling element surfaces occurs.

Other causes of bearing failure are often attributed to problems such as seizing, abrasions, cracking, chipping, gnawing, rust, etc. However, these so called "causes" of bearing failure are usually themselves caused by improper installation, insufficient or improper lubrication, faulty sealing or inaccurate bearing selection. Since the above mentioned "causes" of bearing failure can be avoided by taking the proper precautions,and are not simply caused by material fatigue, they are considered separately from the flaking aspect.

### 7.2 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.

The basic dynamic load rating is an expression of the load capacity of a bearing based on a constant load which the bearing can sustain for one million revolutions (the basic life rating). For radial bearings this rating applies to pure radial loads, and for thrust bearings it refers to pure axial loads. The basic dynamic load ratings given in the bearing tables of this catalog are for bearings constructed of NIKO standard bearing materials, using standard manufacturing techniques. Please consult NIKO engineering for basic load ratings of bearings constructed of special materialsor using special manufacturing techniques.

The relationship between the basic rating life, the basic dynamic load rating and the bearing load is given in formula (7.1).

$$L_{10} = \left(\frac{C}{P}\right)^{p} \text{..............(7.1)}$$

where,

$P = 3$ ················· For ball bearings

$L_{10}$ : Basic rating life 106 revolutions

C : Basic dynamic rating load, $n$

($C_r$: radial bearings)

P : Equivalent dynamic load, $n$

($P_r$: radial bearings)

The basic rating life can also be expressed in terms of hours of operation (revolution), and is calculated as shown in formula (7.2).

$$L_{10h} = 500 f_h^{\,p} \text{..............(7.2)}$$

$$f_h = f_n \frac{C}{P} \text{...............(7.3)}$$

$$f_n = \left(\frac{33.3}{n}\right)^{1/p} \text{..........(7.4)}$$

where,

$L_{10}$ : Basic rating life, $h$

$f_h$ : Life factor

$f_n$ : Speed factor

$n$ : Rotational speed, r/min

**Ball bearings**

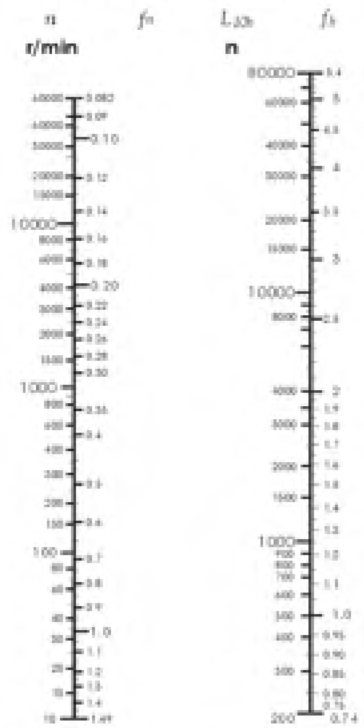



Fig.7.1 Bearing life rating scale

Formula (7.2) can also be expressed as shown in formula (7.5).

$$L_{10h} = \frac{10^6}{60n}\left(\frac{C}{P}\right)^{p} \text{..............(7.5)}$$

The relationship between rotational speed n and speed factor fn as well as the relation between the basic rating life L10h and the life factor fn is shown in Fig. 7.1. 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 7.6). The total bearing life of the unit is a life rating based on the viable lifetime of the unit before even one of the bearings fails due to rolling contact fatigue.

$$L = \frac{1}{\left(\frac{1}{L_1^{e}} + \frac{1}{L_2^{e}} + \dots \frac{1}{L_n^{e}}\right)^{1/e}} \text{..............(7.6)}$$

where,
$e$ = 10/9......................For ball bearings
$L$ = Total basic rating life or entire unit, $h$
$L_1, L_2 ... L_n$ : Basic rating life or individual bearings, 1, 2,...$n$, $h$

When the load conditions vary at regular intervals, the life can be given by formula (7.7).
$L_m = (\Sigma \phi_j / L_j)^{-1}$..............................(7.7)

where,
$\phi_j$ : Frequency of individual load conditions
$L_j$ : Life under individual conditions

7.3 Machine applications and requisite life
When selecting a bearing, it is essential that the requisite life of the bearing be established in relation to the operating conditions.The requisite life of the bearing is usually determined by the type of machine in which the bearing will be used, and duration of service and operational reliability requirements. When determining bearing size, the fatigue life of the bearing is an important factor; however, besides bearing life, the strength and rigidity of the shaft and housing must also be taken into consideration.

7.4 Adjusted life rating factor
The basic bearing life rating (90% reliability factor) can be calculated through the formulas mentioned earlier in Section 7.2. However, in some applications a bearing fife factor of over 90% reliability may be required. To meet these requir ements, bearing life can be lengthened by the use of specially improved bearing materials or special construction techniques. Moreover, according to elastohydrodynamic lubrication theory, it is clear that the bearing operating conditions (lubrication, temperature, speed, etc.) all exert an effect on bearing life. All these adjustment factors are taken into consideration when calculating bearing life, the adjusted bearing life can be determined.

$L_{na} = a1 \cdot a2 \cdot a3 \cdot (C/P)^P$...........(7.8)

where,
$L_{na}$ : Adjusted life rating in millions of revolutions ($10^6$)(adjusted for reliability, material and operating conditions)
$a1$ : Reliability adjustment factor
$a2$ : Material adjustment factor
$a3$ : Operating condition adjustment factor

7.4.1 Life adjustment factor for reliability $a_l$
The values for the reliability adjustment factor ai (for a reliability factor higher than 90%) can be found in Table 7.1

**Table 7.1 Reliability adjustment factor values $a_l$**

| Reliability % | $L_n$ | Reliability factor $a_l$ |
|---|---|---|
| 90 | $L_{10}$ | 1.00 |
| 95 | $L_5$ | 0.62 |
| 96 | $L_4$ | 0.53 |
| 97 | $L_3$ | 0.44 |
| 98 | $L_2$ | 0.33 |
| 99 | $L_1$ | 0.21 |

7.4.2 Life adjustment factor for material $a_2$

The life of a bearing is affected by the material type and quality as well as the manufacturing process.In this regard, the life is adjusted by the use of an $a_2$ factor.

The basic dynamic load ratings listed in the catalog are based on NIKO's standard material and process, therefore, the adjustment factor $a_2$ =1. When special materials or processes are used the adjustment factor can be larger than 1.

NIKO bearings can generally be used up to 120°C. If bearings are operated at a higher temperature, the bearing must be specially heat treated ( stabilized ) so that inadmissible dimensional change does not occur due to changes in the micro-structure. This special heat treatment might cause the reduction of bearing life because of a hardness change.

7.4.3 Life adjustment factor $a_3$ for operating conditions

The operating conditions life adjustment factor $a_3$ is used to adjust for such conditions as lubrication, operating temperature, and other operation factors which have an effect on bearing life.

Generally speaking, when lubricating conditions are satisfactory, the $a_3$ factor has a value of one; and when lubricating conditions are exceptionally favorable, and all other operating conditions are normal, as can have a value greater than one.

However, when lubricating conditions are particularly unfavorable and the oil film formation on the contact surfaces of the raceway and rolling elements is insufficient, the value of $a_3$ becomes less than one. This Insufficient oil film formation can be caused, for example, by the lubricating oil viscosity being too low for the operating temperature (below13 $mm^2/s$ for ball bearings or by exceptionally low rotational speed (nr/min x dpmm less than 10,000). For bearings used under special operating conditions, please consult NIKO engineering.

As the operating temperature of the bearing increases, the hardness of the bearing material decreases. Thus, the bearing life correspondingly decreases. The opera-ting temperature adjustment values are shown in Fig.7.2.

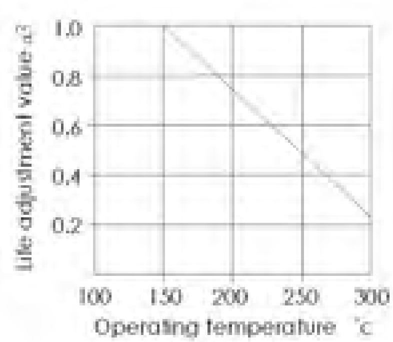



Fig. 7.2 Life adjustment value for operating temperature

7.5 Basic static load rating

When stationary rolling bearings are subjected to static loads, they suffer from partial permanent deformation of the contact surfaces at the contact point between the rolling elements and the raceway. The amount of deformity increases as the load increases, and if this increase in load exceeds certain limits, the subsequent smooth operation of the bearings is impaired.

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

The basic rating static load 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 (except Self-aligning Ball Bearings) | 4,200 Mpa |
| For Self-aligning Ball Bearings | 4,600 Mpa |

7.6 Allowable static equivalent load

Generally the static equivalent load which can be permitted is limited by the basic static load rating However, depending on requirements regarding friction and smooth operation, these limits may be greater or lesser than the basic static rating load In the following formula (3.9) and Table 7.3 the safety factor $S_o$ can be determined considering the maximum static equivalent load.

$S_o = C_o/P_o$ ......... (3.9)

where,

$S_o$ : Safety factor

$C_o$ : Basic static rating load, N (radial bearings: $C_{or}$)

$P_o\,max$ : Maximum static equivalent load, N (radial: $P_{or}$ max)

**Table 7.3 Minimum safety factor values $S_o$**

| Operating conditions | Ball Bearings |
|---|---|
| High rotational accuracy demand | 2 |
| Normal rotating accuracy demand (Universal application) | 1 |
| Slight rotational accuracy deterioration permitted (Low speed, heavy loading, etc.) | 0.5 |

## 8. Bearing handling

Bearing storage

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

## 9. Allowable speed

As bearing speed increases, the temperature of the bearing also increases due to friction heat generated in the bearing interior. If the temperature continues to rise and exceeds certain limits, the efficiency of the lubricant start to fail down drastically, and the bearing can no longercontinue to operate in a stable manner. Therefore, the maximum speed at which it is possible for the bearing to continuously operate without the generation of excessive heat beyond specified limits, is called the allowable speed ( r/min ). The allowable speed of a bearing depends on the type of bearing, bearing dimensions, type of cage, load, lubricating conditions, and cooling conditions.

The allowable speeds listed in the bearing tables for grease and oil lubrication are for standard NIKO bearings under normal operating conditions, correctly installed, using the suitable lubricants with adequate supply and proper maintenance. Moreover, these values are based on normal load conditions ($P \leq 0.09C$, $Fa/Fr \leq 0.3$). For ball bearings with contact seals (LLU type), the allowable speed is determined by the peripheral lip speed of the seal.

For bearings to be used under heavier than normal load conditions, the allowable speed values listed in the bearing tables must be multiplied by an adjustment factor. The adjustment factors $f_L$ and $f_C$ are given in Figs. 9.1 and 9.2.

Also, when radial bearings are mounted on vertical shafts, lubricant retentions and cage guidance are not favorable compared to horizontal shaft mounting.

Therefore, the allowable speed should be reduced to approximately 80% of the listed speed.

It is possible to operate precision bearings with high speed specification cages at speeds higher than those listed in the bearing tables , if special precautions are taken. These precautions should include the use of forced oil circulation methods such as oil jet or oil mist lubrication.

Under such high speed operating conditions , when special care is taken , the standard allowable speeds given in the bearing tables can be adjusted upward. The maximum speed adjustment values, /B, by which the bearing table speeds can be multiplied, are shown in Table 9.1. However, for any application requiring speeds in excess of the standard allowable speed, please consult NIKO Engineering.

**Fig.9.1 Value of adjustment factor FL depends on bearing load**

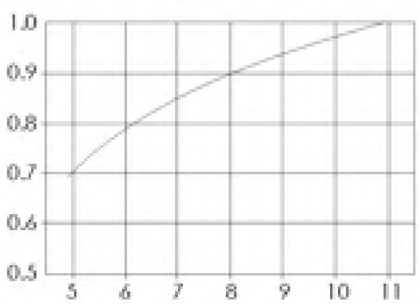



**Fig.9.2 Value of adjustment factor Fc depends on combined load**

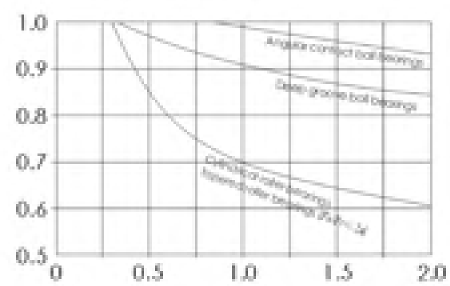
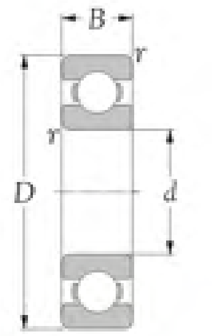


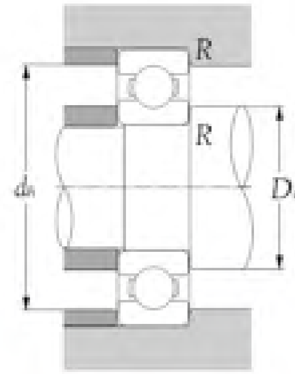

**Table 9.1 Adjustment factor, $f_B$, for allowable number of revolutions**

| Type of bearing | Adjustment factor $f_B$ |
|---|---|
| Deep groove ball bearings | 3.0 |
| Angular contact ball bearings | 2.0 |


# DIMENSION TABLES

## Ball Bearing
## series 60




| Boundary dimensions mm | | | | Basic load ratings dynamic static N | | Limiting speeds rpm | | Bearing numbers | Abutment and fillet dimensions mm | | | Mass kg(s). |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $d$ | $D$ | $B$ | $r_{s\,min}$ | $C_r$ | $C_{0r}$ | grease | oil | | $D_a$ min | $d_h$ max | $R$ max | (approx.) |
| 10 | 26 | 8 | 0.3 | 4,550 | 1,960 | 29,000 | 34,000 | **6000** | 12.5 | 23.5 | 0.3 | 0.019 |
| 12 | 28 | 8 | 0.3 | 5,100 | 2,390 | 26,000 | 30,000 | **6001** | 14.5 | 25.5 | 0.3 | 0.021 |
| 15 | 32 | 9 | 0.3 | 5,600 | 2,840 | 22,000 | 26,000 | **6002** | 17.5 | 29.5 | 0.3 | 0.030 |
| 17 | 35 | 10 | 0.3 | 6,800 | 3,350 | 20,000 | 24,000 | **6003** | 19.5 | 32.5 | 0.3 | 0.039 |
| 20 | 42 | 12 | 0.6 | 9,400 | 5,050 | 18,000 | 21,000 | **6004** | 25.0 | 37.0 | 0.6 | 0.069 |
| 25 | 47 | 12 | 0.6 | 10,100 | 5,850 | 15,000 | 18,000 | **6005** | 30.0 | 42.0 | 0.6 | 0.080 |
| 30 | 55 | 13 | 1.0 | 13,200 | 8,300 | 13,000 | 15,000 | **6006** | 36.0 | 49.0 | 1.0 | 0.116 |
| 35 | 62 | 14 | 1.0 | 16,000 | 10,300 | 12,000 | 14,000 | **6007** | 41.0 | 56.0 | 1.0 | 0.155 |
| 40 | 68 | 15 | 1.0 | 16,800 | 11,500 | 10,000 | 12,000 | **6008** | 46.0 | 62.0 | 1.0 | 0.190 |
| 45 | 75 | 16 | 1.0 | 21,000 | 15,100 | 9,200 | 11,000 | **6009** | 51.0 | 69.0 | 1.0 | 0.237 |
| 50 | 80 | 16 | 1.0 | 21,800 | 16,600 | 8,400 | 9,800 | **6010** | 56.0 | 74.0 | 1.0 | 0.261 |
| 55 | 90 | 18 | 1.1 | 28,300 | 21,200 | 7,700 | 9,000 | **6011** | 62.0 | 83.0 | 1.0 | 0.388 |
| 60 | 95 | 18 | 1.1 | 29,500 | 23,200 | 7,000 | 8,300 | **6012** | 67.0 | 88.0 | 1.0 | 0.414 |
| 65 | 100 | 18 | 1.1 | 30,500 | 25,200 | 6,500 | 7,700 | **6013** | 72.0 | 93.0 | 1.0 | 0.421 |
| 70 | 110 | 20 | 1.1 | 38,000 | 31,000 | 6,100 | 7,100 | **6014** | 77.0 | 103.0 | 1.0 | 0.604 |
| 75 | 115 | 20 | 1.1 | 39,500 | 33,500 | 5,700 | 6,700 | **6015** | 82.0 | 108.0 | 1.0 | 0.649 |
| 80 | 125 | 22 | 1.1 | 47,500 | 40,000 | 5,300 | 6,200 | **6016** | 87.0 | 118.0 | 1.0 | 0.854 |
| 85 | 130 | 22 | 1.1 | 49,500 | 43,000 | 5,000 | 5,900 | **6017** | 92.0 | 123.0 | 1.0 | 0.890 |
| 90 | 140 | 24 | 1.5 | 58,000 | 49,500 | 4,700 | 5,600 | **6018** | 98.5 | 131.5 | 1.5 | 1.020 |
| 95 | 145 | 24 | 1.5 | 60,500 | 54,000 | 4,500 | 5,300 | **6019** | 103.5 | 136.5 | 1.5 | 1.080 |
| 100 | 150 | 24 | 1.5 | 60,000 | 54,000 | 4,200 | 5,000 | **6020** | 108.5 | 141.5 | 1.5 | 1.150 |

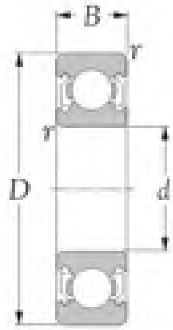
**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | P0 | Shell Alvania S2 |
| Polymid - | X | Class 6 (JIS) | Multemp SRL |
| Brass - | X | | |

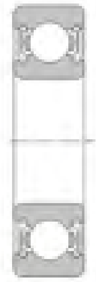
Remark: If you have more inquiry of technical, please inquire
NIKO web-site: Http://www.nipponkodobearings.com

## Ball Bearing

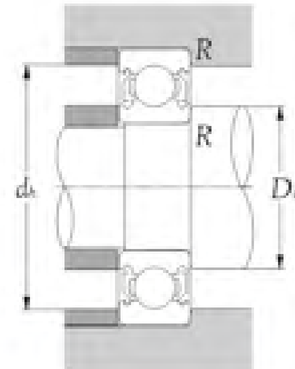
## Series 60..LLB, 60..ZZ




Shielded type (ZZ)



Non-contact sealed type (LLB)




| Boundary dimensions mm | | | | Basic load ratings dynamic static N | | Limiting speeds rpm | | Bearing numbers | | Abutment and fillet dimensions mm | | | | Mass kg(s). |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | $r_{s\,min}$ | $C_r$ | $C_{or}$ | grease | oil | | | $D_s$ min | max | $d_h$ max | R max | (approx.) |
| 10 | 26 | 8 | 0.3 | 4,550 | 1,960 | 29,000 | 21,000 | 6000 LLB | 6000 ZZ | 12.5 | 13.5 | 23.5 | 0.3 | 0.019 |
| 12 | 28 | 8 | 0.3 | 5,100 | 2,390 | 26,000 | 18,000 | 6001 LLB | 6001 ZZ | 14.5 | 16.0 | 25.5 | 0.3 | 0.021 |
| 15 | 32 | 9 | 0.3 | 5,600 | 2,840 | 22,000 | 15,000 | 6002 LLB | 6002 ZZ | 17.5 | 19.0 | 29.5 | 0.3 | 0.030 |
| 17 | 35 | 10 | 0.3 | 6,800 | 3,350 | 20,000 | 14,000 | 6003 LLB | 6003 ZZ | 19.5 | 21.0 | 32.5 | 0.3 | 0.039 |
| 20 | 42 | 12 | 0.6 | 9,400 | 5,050 | 18,000 | 11,000 | 6004 LLB | 6004 ZZ | 25.0 | 26.0 | 37.0 | 0.6 | 0.069 |
| 25 | 47 | 12 | 0.6 | 10,100 | 5,850 | 15,000 | 9,400 | 6005 LLB | 6005 ZZ | 30.0 | 30.5 | 42.0 | 0.6 | 0.080 |
| 30 | 55 | 13 | 1.0 | 13,200 | 8,300 | 13,000 | 7,700 | 6006 LLB | 6006 ZZ | 36.0 | 37.0 | 49.0 | 1.0 | 0.116 |
| 35 | 62 | 14 | 1.0 | 16,000 | 10,300 | 12,000 | 6,800 | 6007 LLB | 6007 ZZ | 41.0 | 42.0 | 56.0 | 1.0 | 0.155 |
| 40 | 68 | 15 | 1.0 | 16,800 | 11,500 | 10,000 | 6,100 | 6008 LLB | 6008 ZZ | 46.0 | 47.0 | 62.0 | 1.0 | 0.190 |
| 45 | 75 | 16 | 1.0 | 21,000 | 15,100 | 9,200 | 5,400 | 6009 LLB | 6009 ZZ | 51.0 | 52.5 | 69.0 | 1.0 | 0.237 |
| 50 | 80 | 16 | 1.0 | 21,800 | 16,600 | 8,400 | 5,000 | 6010 LLB | 6010 ZZ | 56.0 | 57.5 | 74.0 | 1.0 | 0.261 |
| 55 | 90 | 18 | 1.1 | 28,300 | 21,200 | 7,700 | 4,500 | 6011 LLB | 6011 ZZ | 62.0 | 64.0 | 83.0 | 1.0 | 0.388 |
| 60 | 95 | 18 | 1.1 | 29,500 | 23,200 | 7,000 | 4,100 | 6012 LLB | 6012 ZZ | 67.0 | 69.0 | 88.0 | 1.0 | 0.414 |
| 65 | 100 | 18 | 1.1 | 30,500 | 25,200 | 6,500 | 3,900 | 6013 LLB | 6013 ZZ | 72.0 | 73.0 | 93.0 | 1.0 | 0.421 |
| 70 | 110 | 20 | 1.1 | 38,000 | 31,000 | 6,100 | 3,600 | 6014 LLB | 6014 ZZ | 77.0 | 80.5 | 103.0 | 1.0 | 0.604 |
| 75 | 115 | 20 | 1.1 | 39,500 | 33,500 | 5,700 | 3,300 | 6015 LLB | 6015 ZZ | 82.0 | 85.5 | 108.0 | 1.0 | 0.649 |
| 80 | 125 | 22 | 1.1 | 47,500 | 40,000 | 5,300 | 3,100 | 6016 LLB | 6016 ZZ | 87.0 | 91.5 | 118.0 | 1.0 | 0.854 |
| 85 | 130 | 22 | 1.1 | 49,500 | 43,000 | 5,000 | 2,900 | 6017 LLB | 6017 ZZ | 92.0 | 97.0 | 123.0 | 1.0 | 0.890 |
| 90 | 140 | 24 | 1.5 | 58,000 | 49,500 | 4,700 | 2,800 | 6018 LLB | 6018 ZZ | 98.5 | 102.0 | 131.5 | 1.5 | 1.020 |
| 95 | 145 | 24 | 1.5 | 60,500 | 54,000 | 4,500 | 2,600 | 6019 LLB | 6019 ZZ | 103.5 | 109.0 | 136.5 | 1.5 | 1.080 |
| 100 | 150 | 24 | 1.5 | 60,000 | 54,000 | 4,200 | 2,600 | 6020 LLB | 6020 ZZ | 108.5 | 110.0 | 141.5 | 1.5 | 1.150 |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | P0 | Shell Alvania S2 |
| Polymid - | X | Class 6 (JIS) | Multemp SRL |
| Brass - | X | | |

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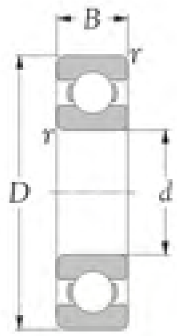
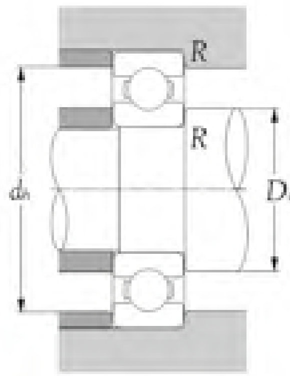
# BALL BEARING
## SERIES 62




| Boundary dimensions mm | | | | Basic load ratings dynamic static N | | Limiting speeds rpm | | Bearing numbers | Abutment and fillet dimensions mm | | | Mass kg(s). |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $d$ | $D$ | $B$ | $r_s$ min[1] | $C_r$ | $C_{or}$ | grease | oil | | $D_s$ min | $d_h$ max | $R$ max | (approx.) |
| 10 | 30 | 9 | 0.6 | 5,100 | 2,390 | 25,000 | 30,000 | **6200** | 15.0 | 25.0 | 0.6 | 0.032 |
| 12 | 32 | 10 | 0.6 | 6,100 | 2,750 | 22,000 | 26,000 | **6201** | 17.0 | 27.0 | 0.6 | 0.037 |
| 15 | 35 | 11 | 0.6 | 7,750 | 3,600 | 19,000 | 23,000 | **6202** | 20.0 | 30.0 | 0.6 | 0.045 |
| 17 | 40 | 12 | 0.6 | 9,600 | 4,600 | 18,000 | 21,000 | **6203** | 22.0 | 35.0 | 0.6 | 0.066 |
| 20 | 47 | 14 | 1.0 | 12,800 | 6,650 | 16,000 | 18,000 | **6204** | 26.0 | 41.0 | 1.0 | 0.106 |
| 25 | 52 | 15 | 1.0 | 14,000 | 7,850 | 13,000 | 15,000 | **6205** | 31.0 | 46.0 | 1.0 | 0.128 |
| 30 | 62 | 16 | 1.0 | 19,500 | 11,300 | 11,000 | 13,000 | **6206** | 36.0 | 56.0 | 1.0 | 0.199 |
| 35 | 72 | 17 | 1.1 | 25,700 | 15,300 | 9,800 | 11,000 | **6207** | 42.0 | 65.0 | 1.0 | 0.288 |
| 40 | 80 | 18 | 1.1 | 29,100 | 17,800 | 8,700 | 10,000 | **6208** | 47.0 | 73.0 | 1.0 | 0.366 |
| 45 | 85 | 19 | 1.1 | 32,500 | 20,400 | 7,800 | 9,200 | **6209** | 52.0 | 78.0 | 1.0 | 0.398 |
| 50 | 90 | 20 | 1.1 | 35,000 | 23,200 | 7,100 | 8,300 | **6210** | 57.0 | 83.0 | 1.0 | 0.454 |
| 55 | 100 | 21 | 1.5 | 43,500 | 29,200 | 6,400 | 7,600 | **6211** | 63.5 | 91.5 | 1.5 | 0.601 |
| 60 | 110 | 22 | 1.5 | 52,500 | 36,000 | 6,000 | 7,000 | **6212** | 68.5 | 101.5 | 1.5 | 0.783 |
| 65 | 120 | 23 | 1.5 | 57,500 | 40,000 | 5,500 | 6,500 | **6213** | 73.5 | 111.5 | 1.5 | 0.990 |
| 70 | 125 | 24 | 1.5 | 62,000 | 44,000 | 5,100 | 6,000 | **6214** | 78.5 | 116.5 | 1.5 | 1.070 |
| 75 | 130 | 25 | 1.5 | 66,000 | 49,500 | 4,800 | 5,600 | **6215** | 83.5 | 121.5 | 1.5 | 1.180 |
| 80 | 140 | 26 | 2.0 | 72,500 | 53,000 | 4,500 | 5,300 | **6216** | 90.0 | 130.0 | 2.0 | 1.400 |
| 85 | 150 | 28 | 2.0 | 83,500 | 64,000 | 4,200 | 5,000 | **6217** | 95.0 | 140.0 | 2.0 | 1.790 |
| 90 | 160 | 30 | 2.0 | 96,000 | 71,500 | 4,000 | 4,700 | **6218** | 100.0 | 150.0 | 2.0 | 2.150 |
| 95 | 170 | 32 | 2.1 | 109,000 | 82,000 | 3,700 | 4,400 | **6219** | 107.0 | 158.0 | 2.0 | 2.620 |
| 100 | 180 | 34 | 2.1 | 122,000 | 93,000 | 3,500 | 4,200 | **6220** | 112.0 | 168.0 | 2.0 | 3.140 |

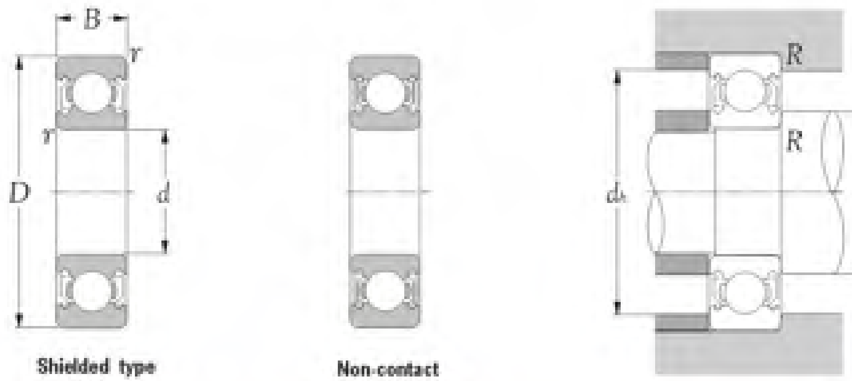
**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | P0 | Shell Alvania S2 |
| Polymid - | X | Class 6 (JIS) | Multemp SRL |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## BALL BEARING

## SERIES 62..LLB, 62..ZZ




Shielded type (ZZ)

Non-contact sealed type (LLB)

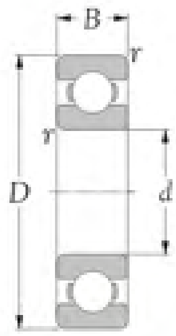
| Boundary dimensions mm | | | | Basic load ratings dynamic static N | | Limiting speeds rpm | | Bearing numbers | | Abutment and fillet dimensions mm | | | | Mass kg(s). |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $d$ | $D$ | $B$ | $r_{s\,min}$[1] | $C_r$ | $C_{or}$ | grease | oil | | | $D_s$ min | $D_s$ max | $d_a$ max | $R$ max | (approx.) |
| 10 | 30 | 9 | 0.6 | 5,100 | 2,390 | 25,000 | 18,000 | **6200 LLB** | **6200 ZZ** | 15.0 | 16.0 | 25.0 | 0.6 | 0.032 |
| 12 | 32 | 10 | 0.6 | 6,100 | 2,750 | 22,000 | 16,000 | **6201 LLB** | **6201 ZZ** | 17.0 | 17.5 | 27.0 | 0.6 | 0.037 |
| 15 | 35 | 11 | 0.6 | 7,750 | 3,600 | 19,000 | 15,000 | **6202 LLB** | **6202 ZZ** | 20.0 | 20.5 | 30.0 | 0.6 | 0.045 |
| 17 | 40 | 12 | 0.6 | 9,600 | 4,600 | 18,000 | 12,000 | **6203 LLB** | **6203 ZZ** | 22.0 | 23.0 | 35.0 | 0.6 | 0.066 |
| 20 | 47 | 14 | 1.0 | 12,800 | 6,650 | 16,000 | 10,000 | **6204 LLB** | **6204 ZZ** | 26.0 | 28.0 | 41.0 | 1.0 | 0.106 |
| 25 | 52 | 15 | 1.0 | 14,000 | 7,850 | 13,000 | 8,900 | **6205 LLB** | **6205 ZZ** | 31.0 | 32.0 | 46.0 | 1.0 | 0.128 |
| 30 | 62 | 16 | 1.0 | 19,500 | 11,300 | 11,000 | 7,300 | **6206 LLB** | **6206 ZZ** | 36.0 | 39.0 | 56.0 | 1.0 | 0.199 |
| 35 | 72 | 17 | 1.1 | 25,700 | 15,300 | 9,800 | 6,300 | **6207 LLB** | **6207 ZZ** | 42.0 | 45.0 | 65.0 | 1.0 | 0.288 |
| 40 | 80 | 18 | 1.1 | 29,100 | 17,800 | 8,700 | 5,600 | **6208 LLB** | **6208 ZZ** | 47.0 | 51.0 | 73.0 | 1.0 | 0.366 |
| 45 | 85 | 19 | 1.1 | 32,500 | 20,400 | 7,800 | 5,200 | **6209 LLB** | **6209 ZZ** | 52.0 | 55.5 | 78.0 | 1.0 | 0.398 |
| 50 | 90 | 20 | 1.1 | 35,000 | 23,200 | 7,100 | 4,700 | **6210 LLB** | **6210 ZZ** | 57.0 | 60.0 | 83.0 | 1.0 | 0.454 |
| 55 | 100 | 21 | 1.5 | 43,500 | 29,200 | 6,400 | 4,300 | **6211 LLB** | **6211 ZZ** | 63.5 | 67.0 | 91.5 | 1.5 | 0.601 |
| 60 | 110 | 22 | 1.5 | 52,500 | 36,000 | 6,000 | 3,800 | **6212 LLB** | **6212 ZZ** | 68.5 | 75.0 | 101.5 | 1.5 | 0.783 |
| 65 | 120 | 23 | 1.5 | 57,500 | 40,000 | 5,500 | 3,600 | **6213 LLB** | **6213 ZZ** | 73.5 | 80.5 | 111.5 | 1.5 | 0.990 |
| 70 | 125 | 24 | 1.5 | 62,000 | 44,000 | 5,100 | 3,400 | **6214 LLB** | **6214 ZZ** | 78.5 | 85.0 | 116.5 | 1.5 | 1.070 |
| 75 | 130 | 25 | 1.5 | 66,000 | 49,500 | 4,800 | 3,200 | **6215 LLB** | **6215 ZZ** | 83.5 | 90.5 | 121.5 | 1.5 | 1.180 |
| 80 | 140 | 26 | 2.0 | 72,500 | 53,000 | 4,500 | 3,000 | **6216 LLB** | **6216 ZZ** | 90.0 | 95.5 | 130.0 | 2.0 | 1.400 |
| 85 | 150 | 28 | 2.0 | 83,500 | 64,000 | 4,200 | 2,800 | **6217 LLB** | **6217 ZZ** | 95.0 | 103.0 | 140.0 | 2.0 | 1.790 |
| 90 | 160 | 30 | 2.0 | 96,000 | 71,500 | 4,000 | 2,600 | **6218 LLB** | **6218 ZZ** | 100.0 | 109.0 | 150.0 | 2.0 | 2.150 |
| 95 | 170 | 32 | 2.1 | 109,000 | 82,000 | 3,700 | 2,500 | **6219 LLB** | **6219 ZZ** | 107.0 | 116.0 | 158.0 | 2.0 | 2.620 |
| 100 | 180 | 34 | 2.1 | 122,000 | 93,000 | 3,500 | 2,300 | **6220 LLB** | **6220 ZZ** | 112.0 | 122.0 | 168.0 | 2.0 | 3.140 |

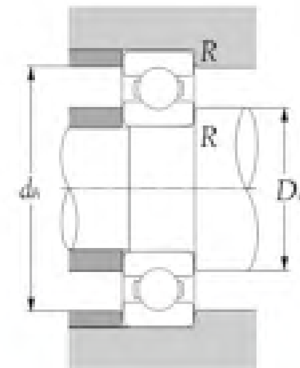
**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | P0 | Shell Alvania S2 |
| Polymid - | X | Class 6 (JIS) | Multemp SRL |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## Ball Bearing
## series 63



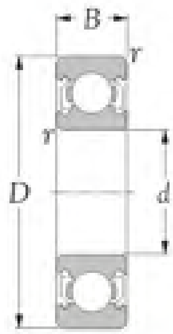

| Boundary dimensions mm | | | | Basic load ratings N | | Limiting speeds rpm | | Bearing numbers | Abutment and fillet dimensions mm | | | Mass kg(s). |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $d$ | $D$ | $B$ | $r_{s\,min}$ | dynamic $C_r$ | static $C_{or}$ | grease | oil | | $D_s$ min | $d_h$ max | $R$ max | (approx.) |
| 10 | 35 | 11 | 0.6 | 8,200 | 3,500 | 23,000 | 27,000 | **6300** | 15.0 | 30.0 | 0.6 | 0.053 |
| 12 | 37 | 12 | 1.0 | 9,700 | 4,200 | 20,000 | 24,000 | **6301** | 18.0 | 31.0 | 1.0 | 0.060 |
| 15 | 42 | 13 | 1.0 | 11,400 | 5,450 | 17,000 | 21,000 | **6302** | 21.0 | 36.0 | 1.0 | 0.082 |
| 17 | 47 | 14 | 1.0 | 13,500 | 6,550 | 16,000 | 19,000 | **6303** | 23.0 | 41.0 | 1.0 | 0.115 |
| 20 | 52 | 15 | 1.1 | 15,900 | 7,900 | 14,000 | 17,000 | **6304** | 27.0 | 45.0 | 1.0 | 0.144 |
| 25 | 62 | 17 | 1.1 | 21,200 | 10,900 | 12,000 | 14,000 | **6305** | 32.0 | 55.0 | 1.0 | 0.232 |
| 30 | 72 | 19 | 1.1 | 26,700 | 15,000 | 10,000 | 12,000 | **6306** | 37.0 | 65.0 | 1.0 | 0.360 |
| 35 | 80 | 21 | 1.5 | 33,500 | 19,100 | 8,800 | 10,000 | **6307** | 43.5 | 71.5 | 1.5 | 0.457 |
| 40 | 90 | 23 | 1.5 | 40,500 | 24,000 | 7,800 | 9,200 | **6308** | 48.5 | 81.5 | 1.5 | 0.630 |
| 45 | 100 | 25 | 1.5 | 53,000 | 32,000 | 7,000 | 8,200 | **6309** | 53.5 | 91.5 | 1.5 | 0.814 |
| 50 | 110 | 27 | 2.0 | 62,000 | 38,500 | 6,400 | 7,500 | **6310** | 60.0 | 100.0 | 2.0 | 1.070 |
| 55 | 120 | 29 | 2.0 | 71,500 | 45,000 | 5,800 | 6,800 | **6311** | 65.0 | 110.0 | 2.0 | 1.370 |
| 60 | 130 | 31 | 2.1 | 82,000 | 52,000 | 5,400 | 6,300 | **6312** | 72.0 | 118.0 | 2.0 | 1.730 |
| 65 | 140 | 33 | 2.1 | 92,500 | 60,000 | 4,900 | 5,800 | **6313** | 77.0 | 128.0 | 2.0 | 2.080 |
| 70 | 150 | 35 | 2.1 | 104,000 | 68,000 | 4,600 | 5,400 | **6314** | 82.0 | 138.0 | 2.0 | 2.520 |
| 75 | 160 | 37 | 2.1 | 113,000 | 77,000 | 4,300 | 5,000 | **6315** | 87.0 | 148.0 | 2.0 | 3.020 |
| 80 | 170 | 39 | 2.1 | 123,000 | 86,500 | 4,000 | 4,700 | **6316** | 92.0 | 158.0 | 2.0 | 3.590 |
| 85 | 180 | 41 | 3.0 | 133,000 | 97,000 | 3,800 | 4,500 | **6317** | 99.0 | 166.0 | 2.5 | 4.230 |
| 90 | 190 | 43 | 3.0 | 143,000 | 107,000 | 3,600 | 4,200 | **6318** | 104.0 | 176.0 | 2.5 | 4.910 |
| 95 | 200 | 45 | 3.0 | 153,000 | 119,000 | 3,300 | 3,900 | **6319** | 109.0 | 186.0 | 2.5 | 5.670 |
| 100 | 215 | 47 | 3.0 | 173,000 | 141,000 | 3,200 | 3,700 | **6320** | 114.0 | 201.0 | 2.5 | 7.000 |

**Technical supplement**

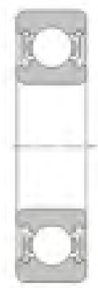
| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | | |
| Polymid - | X | Class 6 (JIS) | Multemp SRL |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

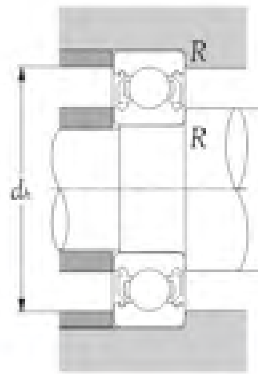
## Ball Bearing
## series 63..LLB, 63..ZZ




Shielded type
(ZZ)



Non-contact
sealed type
(LLB)



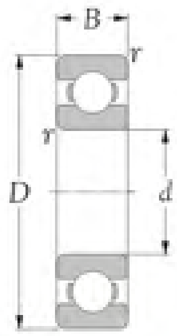

| Boundary dimensions mm | | | | Basic load ratings dynamic static N | | Limiting speeds rpm | | Bearing numbers | | Abutment and fillet dimensions mm | | | | Mass kg(s). |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $d$ | $D$ | $B$ | $r_s$ min[1] | $C_r$ | $C_{or}$ | grease | oil | | | $D_s$ mm | max | $d_h$ max | $R$ max | (approx.) |
| 10 | 35 | 11 | 0.6 | 8,200 | 3,500 | 23,000 | 16,000 | **6300 LLB** | **6300 ZZ** | 15.0 | 17.0 | 30.0 | 0.6 | 0.053 |
| 12 | 37 | 12 | 1.0 | 9,700 | 4,200 | 20,000 | 15,000 | **6301 LLB** | **6301 ZZ** | 18.0 | 18.5 | 31.0 | 1.0 | 0.060 |
| 15 | 42 | 13 | 1.0 | 11,400 | 5,450 | 17,000 | 12,000 | **6302 LLB** | **6302 ZZ** | 21.0 | 23.0 | 36.0 | 1.0 | 0.082 |
| 17 | 47 | 14 | 1.0 | 13,500 | 6,550 | 16,000 | 11,000 | **6303 LLB** | **6303 ZZ** | 23.0 | 25.0 | 41.0 | 1.0 | 0.115 |
| 20 | 52 | 15 | 1.1 | 15,900 | 7,900 | 14,000 | 10,000 | **6304 LLB** | **6304 ZZ** | 27.0 | 28.5 | 45.0 | 1.0 | 0.144 |
| 25 | 62 | 17 | 1.1 | 21,200 | 10,900 | 12,000 | 8,100 | **6305 LLB** | **6305 ZZ** | 32.0 | 35.0 | 55.0 | 1.0 | 0.232 |
| 30 | 72 | 19 | 1.1 | 26,700 | 15,000 | 10,000 | 6,600 | **6306 LLB** | **6306 ZZ** | 37.0 | 43.0 | 65.0 | 1.0 | 0.360 |
| 35 | 80 | 21 | 1.5 | 33,500 | 19,100 | 8,800 | 6,000 | **6307 LLB** | **6307 ZZ** | 43.5 | 47.0 | 71.5 | 1.5 | 0.457 |
| 40 | 90 | 23 | 1.5 | 40,500 | 24,000 | 7,800 | 5,300 | **6308 LLB** | **6308 ZZ** | 48.5 | 54.0 | 81.5 | 1.5 | 0.630 |
| 45 | 100 | 25 | 1.5 | 53,000 | 32,000 | 7,000 | 4,700 | **6309 LLB** | **6309 ZZ** | 53.5 | 61.5 | 91.5 | 1.5 | 0.814 |
| 50 | 110 | 27 | 2.0 | 62,000 | 38,500 | 6,400 | 4,200 | **6310 LLB** | **6310 ZZ** | 60.0 | 68.5 | 100.0 | 2.0 | 1.070 |
| 55 | 120 | 29 | 2.0 | 71,500 | 45,000 | 5,800 | 3,900 | **6311 LLB** | **6311 ZZ** | 65.0 | 74.0 | 110.0 | 2.0 | 1.370 |
| 60 | 130 | 31 | 2.1 | 82,000 | 52,000 | 5,400 | 3,600 | **6312 LLB** | **6312 ZZ** | 72.0 | 80.5 | 118.0 | 2.0 | 1.730 |
| 65 | 140 | 33 | 2.1 | 92,500 | 60,000 | 4,900 | 3,300 | **6313 LLB** | **6313 ZZ** | 77.0 | 86.0 | 128.0 | 2.0 | 2.080 |
| 70 | 150 | 35 | 2.1 | 104,000 | 68,000 | 4,600 | 3,100 | **6314 LLB** | **6314 ZZ** | 82.0 | 92.5 | 138.0 | 2.0 | 2.520 |
| 75 | 160 | 37 | 2.1 | 113,000 | 77,000 | 4,300 | 2,900 | **6315 LLB** | **6315 ZZ** | 87.0 | 99.0 | 148.0 | 2.0 | 3.020 |
| 80 | 170 | 39 | 2.1 | 123,000 | 86,500 | 4,000 | 2,700 | **6316 LLB** | **6316 ZZ** | 92.0 | 105.0 | 158.0 | 2.0 | 3.590 |
| 85 | 180 | 41 | 3.0 | 133,000 | 97,000 | 3,800 | 2,600 | **6317 LLB** | **6317 ZZ** | 99.0 | 112.0 | 166.0 | 2.5 | 4.230 |
| 90 | 190 | 43 | 3.0 | 143,000 | 107,000 | 3,600 | 2,400 | **6318 LLB** | **6318 ZZ** | 104.0 | 118.0 | 176.0 | 2.5 | 4.910 |
| 95 | 200 | 45 | 3.0 | 153,000 | 119,000 | 3,300 | 2,300 | - | **6319 ZZ** | 109.0 | 125.0 | 186.0 | 2.5 | 5.670 |
| 100 | 215 | 47 | 3.0 | 173,000 | 141,000 | 3,200 | 2,200 | - | **6320 ZZ** | 114.0 | 133.0 | 201.0 | 2.5 | 7.000 |

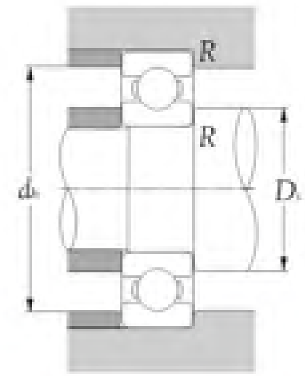
**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | | |
| Polymid - | X | Class 6 (JIS) | Multemp SRL |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire
NIKO web-site: Http://www.nipponkodobearings.com

## BALL BEARING
## SERIES 160



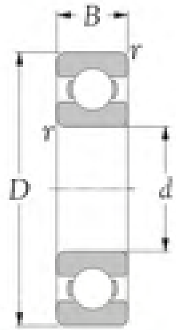

| Boundary dimensions mm | | | | Basic load ratings dynamic static N | | Limiting speeds rpm | | Bearing numbers | Abutment and fillet dimensions mm | | | Mass kg(s). |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $d$ | $D$ | $B$ | $r_s$ min[1] | $C_r$ | $C_{0r}$ | grease | oil | | $D_s$ min | $d_h$ max | $R$ max | (approx.) |
| 12 | 28 | 7 | 0.3 | 5,100 | 2,390 | 26,000 | 30,000 | **16001** | 14.5 | 25.5 | 0.3 | 0.019 |
| 15 | 32 | 8 | 0.3 | 5,600 | 2,840 | 22,000 | 26,000 | **16002** | 17.5 | 29.5 | 0.3 | 0.025 |
| 17 | 35 | 8 | 0.3 | 6,800 | 3,350 | 20,000 | 24,000 | **16003** | 19.5 | 32.5 | 0.3 | 0.032 |
| 20 | 42 | 8 | 0.3 | 7,900 | 4,500 | 18,000 | 21,000 | **16004** | 22.5 | 39.5 | 0.3 | 0.051 |
| 25 | 47 | 8 | 0.3 | 8,350 | 5,100 | 15,000 | 18,000 | **16005** | 27.5 | 44.5 | 0.3 | 0.060 |
| 30 | 55 | 9 | 0.3 | 11,200 | 7,350 | 13,000 | 15,000 | **16006** | 32.5 | 52.5 | 0.3 | 0.091 |
| 35 | 62 | 9 | 0.3 | 11,700 | 8,200 | 12,000 | 14,000 | **16007** | 37.5 | 59.5 | 0.3 | 0.110 |
| 40 | 68 | 9 | 0.3 | 12,600 | 9,650 | 10,000 | 12,000 | **16008** | 42.5 | 65.5 | 0.3 | 0.125 |
| 45 | 75 | 10 | 0.6 | 12,900 | 10,500 | 9,200 | 11,000 | **16009** | 50.0 | 70.0 | 0.6 | 0.171 |
| 50 | 80 | 10 | 0.6 | 13,200 | 11,300 | 8,400 | 9,800 | **16010** | 55.0 | 75.0 | 0.6 | 0.180 |
| 55 | 90 | 11 | 0.6 | 18,600 | 15,300 | 7,700 | 9,000 | **16011** | 60.0 | 85.0 | 0.6 | 0.258 |
| 60 | 95 | 11 | 0.6 | 20,000 | 17,500 | 7,000 | 8,300 | **16012** | 65.0 | 90.0 | 0.6 | 0.283 |
| 65 | 100 | 11 | 0.6 | 20,500 | 18,700 | 6,500 | 7,700 | **16013** | 70.0 | 95.0 | 0.6 | 0.307 |
| 70 | 110 | 13 | 0.6 | 24,400 | 22,600 | 6,100 | 7,100 | **16014** | 75.0 | 105.0 | 0.6 | 0.441 |
| 75 | 115 | 13 | 0.6 | 25,000 | 24,000 | 5,700 | 6,700 | **16015** | 80.0 | 110.0 | 0.6 | 0.464 |
| 80 | 125 | 14 | 0.6 | 25,400 | 25,100 | 5,300 | 6,200 | **16016** | 85.0 | 120.0 | 0.6 | 0.597 |
| 85 | 130 | 14 | 0.6 | 25,900 | 26,200 | 5,000 | 5,900 | **16017** | 90.0 | 125.0 | 0.6 | 0.626 |
| 90 | 140 | 16 | 1.0 | 33,500 | 33,500 | 4,700 | 5,600 | **16018** | 96.0 | 134.0 | 1.0 | 0.848 |
| 95 | 145 | 16 | 1.0 | 34,500 | 35,000 | 4,500 | 5,300 | **16019** | 101.0 | 139.0 | 1.0 | 0.885 |
| 100 | 150 | 16 | 1.0 | 35,000 | 36,500 | 4,200 | 5,000 | **16020** | 106.0 | 144.0 | 1.0 | 0.910 |
| 105 | 160 | 18 | 1.0 | 52,000 | 50,500 | 4,000 | 4,700 | **16021** | 111.0 | 154.0 | 1.0 | 1.200 |
| 110 | 170 | 19 | 1.0 | 57,500 | 56,500 | 3,800 | 4,500 | **16022** | 116.0 | 164.0 | 1.0 | 1.460 |
| 120 | 180 | 19 | 1.0 | 63,000 | 63,500 | 3,500 | 4,100 | **16024** | 126.0 | 174.0 | 1.0 | 1.560 |

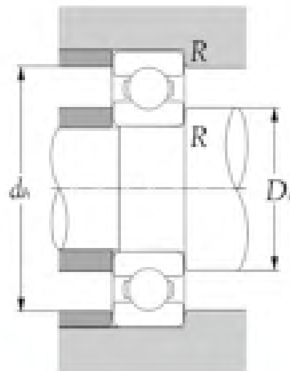
**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | Class 6 (JIS) | Nil |
| Polymid - | X | | |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## Ball Bearing
## series 68



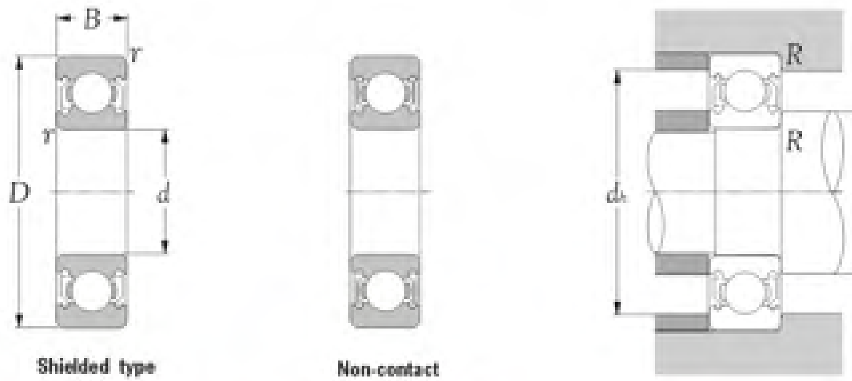

| Boundary dimensions mm | | | | Basic load ratings dynamic static N | | Limiting speeds rpm | | Bearing numbers | Abutment and fillet dimensions mm | | | Mass kg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $d$ | $D$ | $B$ | $r_{s\,min}$ | $C_r$ | $C_{or}$ | grease | oil | | $D_s$ min | $d_h$ max | $R$ max | (approx.) |
| 10 | 19 | 5 | 0.3 | 1,830 | 925 | 32,000 | 38,000 | **6800** | 12 | 17 | 0.3 | 0.005 |
| 12 | 21 | 5 | 0.3 | 1,920 | 1,040 | 29,000 | 35,000 | **6801** | 14 | 19 | 0.3 | 0.006 |
| 15 | 24 | 5 | 0.3 | 2,080 | 1,260 | 26,000 | 31,000 | **6802** | 17 | 22 | 0.3 | 0.007 |
| 17 | 26 | 5 | 0.3 | 2,810 | 1,720 | 24,000 | 28,000 | **6803** | 19 | 24 | 0.3 | 0.008 |
| 20 | 32 | 7 | 0.3 | 4,000 | 2,470 | 21,000 | 25,000 | **6804** | 22 | 30 | 0.3 | 0.019 |
| 25 | 37 | 7 | 0.3 | 4,300 | 2,950 | 18,000 | 21,000 | **6805** | 27 | 35 | 0.3 | 0.022 |
| 30 | 42 | 7 | 0.3 | 4,700 | 3,650 | 15,000 | 18,000 | **6806** | 32 | 40 | 0.3 | 0.026 |
| 35 | 47 | 7 | 0.3 | 4,900 | 4,050 | 13,000 | 16,000 | **6807** | 37 | 45 | 0.3 | 0.029 |
| 40 | 52 | 7 | 0.3 | 5,100 | 4,400 | 12,000 | 14,000 | **6808** | 42 | 50 | 0.3 | 0.033 |
| 45 | 58 | 7 | 0.3 | 6,400 | 5,650 | 11,000 | 12,000 | **6809** | 47 | 56 | 0.3 | 0.040 |
| 50 | 65 | 7 | 0.3 | 6,600 | 6,100 | 9,600 | 11,000 | **6810** | 52 | 63 | 0.3 | 0.052 |
| 55 | 72 | 9 | 0.3 | 8,800 | 8,100 | 8,700 | 10,000 | **6811** | 57 | 70 | 0.3 | 0.083 |
| 60 | 78 | 10 | 0.3 | 11,500 | 10,600 | 8,000 | 9,400 | **6812** | 62 | 76 | 0.3 | 0.106 |
| 65 | 85 | 10 | 0.6 | 11,600 | 11,000 | 7,400 | 8,700 | **6813** | 69 | 81 | 0.6 | 0.128 |
| 70 | 90 | 10 | 0.6 | 12,100 | 11,900 | 6,900 | 8,100 | **6814** | 74 | 86 | 0.6 | 0.137 |
| 75 | 95 | 10 | 0.6 | 12,500 | 12,900 | 6,400 | 7,600 | **6815** | 79 | 91 | 0.6 | 0.145 |
| 80 | 100 | 10 | 0.6 | 12,700 | 13,300 | 6,000 | 7,100 | **6816** | 84 | 96 | 0.6 | 0.154 |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | Class 0 (JIS) | Shell Alvania S2 |
| Polymid - | X | | |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## BALL BEARING
## SERIES 68..LLB, 68..ZZ




Shielded type
(ZZ)

Non-contact
sealed type
(LLB)

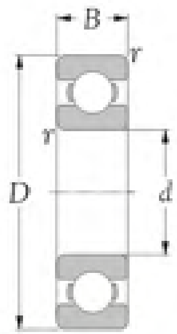
| Boundary dimensions mm | | | | Basic load ratings dynamic static N | | Limiting speeds rpm | | Bearing numbers | | Abutment and fillet dimensions mm | | | | Mass kg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | rs min | Cr | Cor | grease | oil | | | Ds mm | Ds max | dh max | R max | (approx.) |
| 10 | 19 | 5 | 0.3 | 1,830 | 925 | 32,000 | 24,000 | **6800 LLB** | **6800 ZZ** | 12 | 12.5 | 17 | 0.3 | 0.005 |
| 12 | 21 | 5 | 0.3 | 1,920 | 1,040 | 29,000 | 20,000 | **6801 LLB** | **6801 ZZ** | 14 | 14.5 | 19 | 0.3 | 0.006 |
| 15 | 24 | 5 | 0.3 | 2,080 | 1,260 | 26,000 | 17,000 | **6802 LLB** | **6802 ZZ** | 17 | 17.5 | 22 | 0.3 | 0.007 |
| 17 | 26 | 5 | 0.3 | 2,810 | 1,720 | 24,000 | 15,000 | **6803 LLB** | **6803 ZZ** | 19 | 19.5 | 24 | 0.3 | 0.008 |
| 20 | 32 | 7 | 0.3 | 4,000 | 2,470 | 21,000 | 13,000 | **6804 LLB** | **6804 ZZ** | 22 | 23.0 | 30 | 0.3 | 0.019 |
| 25 | 37 | 7 | 0.3 | 4,300 | 2,950 | 18,000 | 10,000 | **6805 LLB** | **6805 ZZ** | 27 | 28.0 | 35 | 0.3 | 0.022 |
| 30 | 42 | 7 | 0.3 | 4,700 | 3,650 | 15,000 | 8,800 | **6806 LLB** | **6806 ZZ** | 32 | 33.0 | 40 | 0.3 | 0.026 |
| 35 | 47 | 7 | 0.3 | 4,900 | 4,050 | 13,000 | 7,600 | **6807 LLB** | **6807 ZZ** | 37 | 38.0 | 45 | 0.3 | 0.029 |
| 40 | 52 | 7 | 0.3 | 5,100 | 4,400 | 12,000 | 6,700 | **6808 LLB** | **6808 ZZ** | 42 | 43.0 | 50 | 0.3 | 0.033 |
| 45 | 58 | 7 | 0.3 | 6,400 | 5,650 | 11,000 | 5,900 | **6809 LLB** | **6809 ZZ** | 47 | 48.0 | 56 | 0.3 | 0.040 |
| 50 | 65 | 7 | 0.3 | 6,600 | 6,100 | 9,600 | 5,300 | **6810 LLB** | **6810 ZZ** | 52 | 54.0 | 63 | 0.3 | 0.052 |
| 55 | 72 | 9 | 0.3 | 8,800 | 8,100 | 8,700 | 4,800 | **6811 LLB** | **6811 ZZ** | 57 | 59.0 | 70 | 0.3 | 0.083 |
| 60 | 78 | 10 | 0.3 | 11,500 | 10,600 | 8,000 | 4,400 | **6812 LLB** | **6812 ZZ** | 62 | 64.5 | 76 | 0.3 | 0.106 |
| 65 | 85 | 10 | 0.6 | 11,600 | 11,000 | 7,400 | 4,100 | **6813 LLB** | **6813 ZZ** | 69 | 70.0 | 81 | 0.6 | 0.128 |
| 70 | 90 | 10 | 0.6 | 12,100 | 11,900 | 6,900 | 3,800 | **6814 LLB** | **6814 ZZ** | 74 | 75.5 | 86 | 0.6 | 0.137 |
| 75 | 95 | 10 | 0.6 | 12,500 | 12,900 | 6,400 | 3,600 | **6815 LLB** | **6815 ZZ** | 79 | 80.0 | 91 | 0.6 | 0.145 |
| 80 | 100 | 10 | 0.6 | 12,700 | 13,300 | 6,000 | 3,400 | **6816 LLB** | **6816 ZZ** | 84 | 85.0 | 96 | 0.6 | 0.154 |

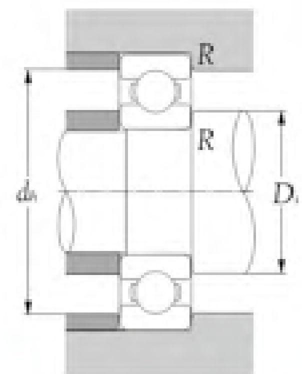
**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | Class 0 (JIS) | Shell Alvania S2 |
| Polymid - | X | | |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

# BALL BEARING
## SERIES 69



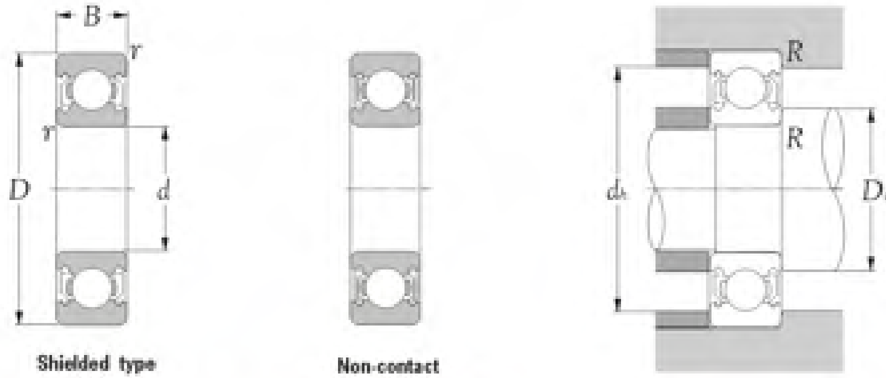

| Boundary dimensions mm | | | | Basic load ratings N dynamic | static | Limiting speeds rpm | | Bearing numbers | Abutment and fillet dimensions mm | | | Mass kg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $d$ | $D$ | $B$ | $r_{s\,min}$[1] | $C_r$ | $C_{0r}$ | grease | oil | | $D_a$ min | $d_a$ max | $R$ max | (approx.) |
| 10 | 22 | 6 | 0.3 | 2,700 | 1,270 | 30,000 | 36,000 | **6900** | 12 | 20 | 0.3 | 0.009 |
| 12 | 24 | 6 | 0.3 | 2,890 | 1,460 | 27,000 | 32,000 | **6901** | 14 | 22 | 0.3 | 0.011 |
| 15 | 28 | 7 | 0.3 | 4,100 | 2,060 | 24,000 | 28,000 | **6902** | 17 | 26 | 0.3 | 0.016 |
| 17 | 30 | 7 | 0.3 | 4,650 | 2,580 | 22,000 | 26,000 | **6903** | 19 | 28 | 0.3 | 0.018 |
| 20 | 37 | 9 | 0.3 | 6,400 | 3,700 | 19,000 | 23,000 | **6904** | 22 | 35 | 0.3 | 0.036 |
| 25 | 42 | 9 | 0.3 | 7,050 | 4,550 | 16,000 | 19,000 | **6905** | 27 | 40 | 0.3 | 0.042 |
| 30 | 47 | 9 | 0.3 | 7,250 | 5,000 | 14,000 | 17,000 | **6906** | 32 | 45 | 0.3 | 0.048 |
| 35 | 55 | 10 | 0.6 | 11,200 | 7,450 | 12,000 | 15,000 | **6907** | 39 | 51 | 0.6 | 0.074 |
| 40 | 62 | 12 | 0.6 | 14,600 | 10,200 | 11,000 | 13,000 | **6908** | 44 | 58 | 0.6 | 0.110 |
| 45 | 68 | 12 | 0.6 | 15,100 | 11,200 | 9,800 | 12,000 | **6909** | 49 | 64 | 0.6 | 0.128 |
| 50 | 72 | 12 | 0.6 | 15,600 | 12,200 | 8,900 | 11,000 | **6910** | 54 | 68 | 0.6 | 0.132 |
| 55 | 80 | 13 | 1.0 | 16,000 | 13,300 | 8,200 | 9,600 | **6911** | 60 | 75 | 1.0 | 0.180 |
| 60 | 85 | 13 | 1.0 | 16,400 | 14,300 | 7,600 | 8,900 | **6912** | 65 | 80 | 1.0 | 0.193 |
| 65 | 90 | 13 | 1.0 | 17,400 | 16,100 | 7,000 | 8,200 | **6913** | 70 | 85 | 1.0 | 0.206 |
| 70 | 100 | 16 | 1.0 | 23,700 | 21,200 | 6,500 | 7,700 | **6914** | 75 | 95 | 1.0 | 0.334 |
| 75 | 105 | 16 | 1.0 | 24,400 | 22,600 | 6,100 | 7,200 | **6915** | 80 | 100 | 1.0 | 0.353 |
| 80 | 110 | 16 | 1.0 | 24,900 | 24,000 | 5,700 | 6,700 | **6916** | 85 | 105 | 1.0 | 0.373 |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | | |
| Polymid - | X | Class 0 (JIS) | Shell Alvania S2 |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire
NIKO web-site: Http://www.nipponkodobearings.com

# BALL BEARING
## SERIES 69..LLB, 69..ZZ




Shielded type (ZZ)

Non-contact sealed type (LLB)

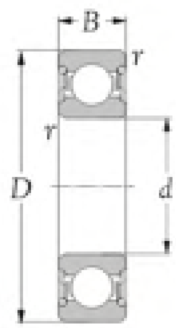
| Boundary dimensions mm | | | | Basic load ratings N dynamic | static | Limiting speeds rpm | | Bearing numbers | | Abutment and fillet dimensions mm | | | | Mass kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | $r_s$ min[1] | $C_r$ | $C_{or}$ | grease | oil | | | $D_s$ min | max | $d_b$ max | R max | (approx.) |
| 10 | 22 | 6 | 0.3 | 2,700 | 1,270 | 30,000 | 21,000 | 6900 LLB | 6900 ZZ | 12 | 13.0 | 20 | 0.3 | 0.009 |
| 12 | 24 | 6 | 0.3 | 2,890 | 1,460 | 27,000 | 19,000 | 6901 LLB | 6901 ZZ | 14 | 15.0 | 22 | 0.3 | 0.011 |
| 15 | 28 | 7 | 0.3 | 4,100 | 2,060 | 24,000 | 16,000 | 6902 LLB | 6902 ZZ | 17 | 18.0 | 26 | 0.3 | 0.016 |
| 17 | 30 | 7 | 0.3 | 4,650 | 2,580 | 22,000 | 14,000 | 6903 LLB | 6903 ZZ | 19 | 20.0 | 28 | 0.3 | 0.018 |
| 20 | 37 | 9 | 0.3 | 6,400 | 3,700 | 19,000 | 12,000 | 6904 LLB | 6904 ZZ | 22 | 24.0 | 35 | 0.3 | 0.036 |
| 25 | 42 | 9 | 0.3 | 7,050 | 4,550 | 16,000 | 9,800 | 6905 LLB | 6905 ZZ | 27 | 29.0 | 40 | 0.3 | 0.042 |
| 30 | 47 | 9 | 0.3 | 7,250 | 5,000 | 14,000 | 8,400 | 6906 LLB | 6906 ZZ | 32 | 34.0 | 45 | 0.3 | 0.048 |
| 35 | 55 | 10 | 0.6 | 11,200 | 7,450 | 12,000 | 7,100 | 6907 LLB | 6907 ZZ | 39 | 40.0 | 51 | 0.6 | 0.074 |
| 40 | 62 | 12 | 0.6 | 14,600 | 10,200 | 11,000 | 6,300 | 6908 LLB | 6908 ZZ | 44 | 45.0 | 58 | 0.6 | 0.110 |
| 45 | 68 | 12 | 0.6 | 15,100 | 11,200 | 9,800 | 5,600 | 6909 LLB | 6909 ZZ | 49 | 51.0 | 64 | 0.6 | 0.128 |
| 50 | 72 | 12 | 0.6 | 15,600 | 12,200 | 8,900 | 5,100 | 6910 LLB | 6910 ZZ | 54 | 55.5 | 68 | 0.6 | 0.132 |
| 55 | 80 | 13 | 1.0 | 16,000 | 13,300 | 8,200 | 4,600 | 6911 LLB | 6911 ZZ | 60 | 61.5 | 75 | 1.0 | 0.180 |
| 60 | 85 | 13 | 1.0 | 16,400 | 14,300 | 7,600 | 4,300 | 6912 LLB | 6912 ZZ | 65 | 66.5 | 80 | 1.0 | 0.193 |
| 65 | 90 | 13 | 1.0 | 17,400 | 16,100 | 7,000 | 4,000 | 6913 LLB | 6913 ZZ | 70 | 71.5 | 85 | 1.0 | 0.206 |
| 70 | 100 | 16 | 1.0 | 23,700 | 21,200 | 6,500 | 3,700 | 6914 LLB | 6914 ZZ | 75 | 77.5 | 95 | 1.0 | 0.334 |
| 75 | 105 | 16 | 1.0 | 24,400 | 22,600 | 6,100 | 3,500 | 6915 LLB | 6915 ZZ | 80 | 82.5 | 100 | 1.0 | 0.353 |
| 80 | 110 | 16 | 1.0 | 24,900 | 24,000 | 5,700 | 3,200 | 6916 LLB | 6916 ZZ | 85 | 88.0 | 105 | 1.0 | 0.373 |

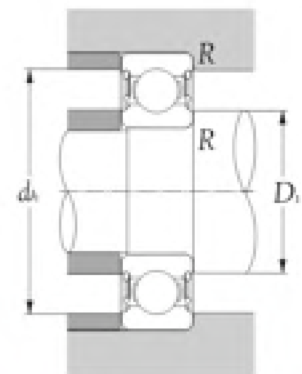
**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | Class 0 (JIS) | Shell Alvania S2 |
| Polymid - | X | | |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## Ball Bearing
## series 622..2RS



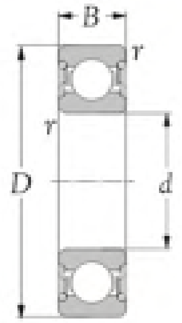

| Boundary dimensions mm | | | | Basic load ratings dynamic static N | | Speed rating rpm | Bearing numbers | Abutment and fillet dimensions mm | | | | Mass kg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | $r_{s\,min}$ | $C_r$ | $C_{or}$ | | | $D_a$ min | $D_a$ max | $d_a$ max | R max | (approx.) |
| 10 | 30 | 14 | 0.6 | 5,070 | 2,360 | 17,000 | **62200 2RS** | 14.0 | 14.5 | 26.0 | 0.6 | 0.040 |
| 12 | 32 | 14 | 0.6 | 6,890 | 3,100 | 15,000 | **62201 2RS** | 16.0 | 16.0 | 28.0 | 0.6 | 0.045 |
| 15 | 35 | 14 | 0.6 | 7,800 | 3,750 | 13,000 | **62202 2RS** | 19.0 | 19.0 | 31.0 | 0.6 | 0.054 |
| 17 | 40 | 16 | 0.6 | 9,560 | 4,750 | 12,000 | **62203 2RS** | 21.0 | 21.0 | 36.0 | 0.6 | 0.083 |
| 20 | 47 | 18 | 1.0 | 12,700 | 6,550 | 10,000 | **62204 2RS** | 25.0 | 25.5 | 42.0 | 1.0 | 0.130 |
| 25 | 52 | 18 | 1.0 | 14,000 | 7,800 | 8,500 | **62205 2RS** | 30.0 | 31.0 | 47.0 | 1.0 | 0.150 |
| 30 | 62 | 20 | 1.0 | 19,500 | 11,200 | 7,500 | **62206 2RS** | 35.0 | 37.0 | 57.0 | 1.0 | 0.240 |
| 35 | 72 | 23 | 1.1 | 25,500 | 15,300 | 6,300 | **62207 2RS** | 41.5 | 43.5 | 65.5 | 1.0 | 0.370 |
| 40 | 80 | 23 | 1.1 | 30,700 | 19,000 | 5,600 | **62208 2RS** | 46.5 | 49.5 | 73.5 | 1.0 | 0.440 |
| 45 | 85 | 23 | 1.1 | 33,200 | 21,600 | 5,000 | **62209 2RS** | 51.5 | 54.0 | 78.5 | 1.0 | 0.480 |
| 50 | 90 | 23 | 1.1 | 35,100 | 23,200 | 4,800 | **62210 2RS** | 56.5 | 58.0 | 83.5 | 1.0 | 0.520 |

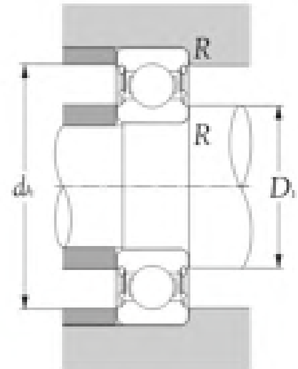
**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | | |
| Polymid - | X | Class 0 (JIS) | Shell Alvania S2 |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## Ball Bearing
## series 623..2RS



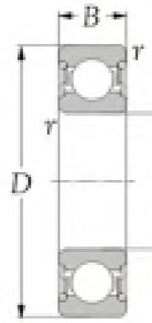

| Boundary dimensions mm | | | | Basic load ratings dynamic static N | | Speed rating rpm | Bearing numbers | Abutment and fillet dimensions mm | | | | Mass kg(s). |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | $r_{s\,min}$ | $C_r$ | $C_{0r}$ | | | $D_a$ min | $D_a$ max | $d_a$ max | R max | (approx.) |
| 10 | 35 | 17 | 0.6 | 8,060 | 3,400 | 15,000 | **62300 2RS** | 14.0 | 15.0 | 31.0 | 0.6 | 0.06 |
| 12 | 37 | 17 | 1.0 | 9,750 | 4,150 | 14,000 | **62301 2RS** | 17.0 | 17.0 | 32.0 | 1.0 | 0.07 |
| 15 | 42 | 17 | 1.0 | 11,400 | 5,400 | 12,000 | **62302 2RS** | 20.0 | 20.5 | 37.0 | 1.0 | 0.11 |
| 17 | 47 | 19 | 1.0 | 13,500 | 6,550 | 11,000 | **62303 2RS** | 22.0 | 23.5 | 42.0 | 1.0 | 0.15 |
| 20 | 52 | 21 | 1.1 | 15,900 | 7,800 | 9,500 | **62304 2RS** | 26.5 | 27.0 | 45.5 | 1.0 | 0.20 |
| 25 | 62 | 24 | 1.1 | 22,500 | 11,600 | 7,500 | **62305 2RS** | 31.5 | 33.5 | 55.5 | 1.0 | 0.32 |
| 30 | 72 | 27 | 1.1 | 28,100 | 16,000 | 6,300 | **62306 2RS** | 36.5 | 41.5 | 65.5 | 1.0 | 0.48 |
| 35 | 80 | 31 | 1.5 | 33,200 | 19,000 | 6,000 | **62307 2RS** | 43.0 | 44.0 | 72.0 | 1.5 | 0.66 |
| 40 | 90 | 33 | 1.5 | 41,000 | 24,000 | 5,000 | **62308 2RS** | 48.0 | 50.5 | 82.0 | 1.5 | 0.89 |
| 45 | 100 | 36 | 1.5 | 52,700 | 31,500 | 4,500 | **62309 2RS** | 53.0 | 56.5 | 92.0 | 1.5 | 1.15 |
| 50 | 110 | 40 | 2.0 | 61,800 | 38,000 | 4,300 | **62310 2RS** | 59.0 | 63.0 | 101.0 | 2.0 | 1.55 |

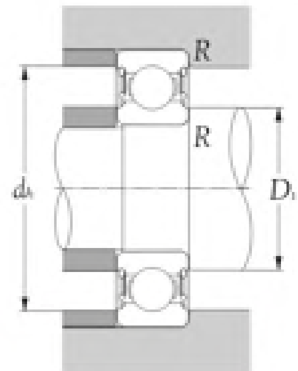
**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | Class 0 (JIS) | Shell Alvania S2 |
| Polymid - | X | | |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## BALL BEARING
## SERIES 630..2RS



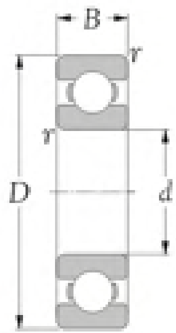

| Boundary dimensions mm | | | | Basic load ratings dynamic static N | | Speed rating rpm | Bearing numbers | Abutment and fillet dimensions mm | | | | Mass kg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | $r_s$ min | $C_r$ | $C_{or}$ | | | $D_a$ min | $D_a$ max | $d_a$ max | R max | (approx.) |
| 10 | 26 | 12 | 0.3 | 4,620 | 1,960 | 19,000 | **63000 2RS** | 12 | 12.5 | 24 | 0.3 | 0.025 |
| 12 | 28 | 12 | 0.3 | 5,070 | 2,360 | 17,000 | **63001 2RS** | 14 | 14.5 | 26 | 0.3 | 0.029 |
| 15 | 32 | 13 | 0.3 | 5,590 | 2,850 | 14,000 | **63002 2RS** | 17 | 18.0 | 30 | 0.3 | 0.039 |
| 17 | 35 | 14 | 0.3 | 6,050 | 3,250 | 13,000 | **63003 2RS** | 19 | 20.0 | 33 | 0.3 | 0.052 |
| 20 | 42 | 16 | 0.6 | 9,360 | 5,000 | 11,000 | **63004 2RS** | 24 | 24.5 | 38 | 0.6 | 0.086 |
| 25 | 47 | 16 | 0.6 | 11,200 | 6,550 | 9,500 | **63005 2RS** | 29 | 29.0 | 43 | 0.6 | 0.100 |
| 30 | 55 | 19 | 1.0 | 13,300 | 8,300 | 8,000 | **63006 2RS** | 35 | 35.5 | 50 | 1.0 | 0.160 |
| 35 | 62 | 20 | 1.0 | 15,900 | 10,200 | 7,000 | **63007 2RS** | 40 | 40.5 | 57 | 1.0 | 0.210 |
| 40 | 68 | 21 | 1.0 | 16,800 | 11,600 | 6,300 | **63008 2RS** | 45 | 46.0 | 63 | 1.0 | 0.260 |
| 45 | 75 | 23 | 1.0 | 20,800 | 14,600 | 5,600 | **63009 2RS** | 50 | 51.0 | 70 | 1.0 | 0.340 |
| 50 | 80 | 23 | 1.0 | 21,600 | 16,000 | 5,000 | **63010 2RS** | 55 | 56.0 | 75 | 1.0 | 0.370 |

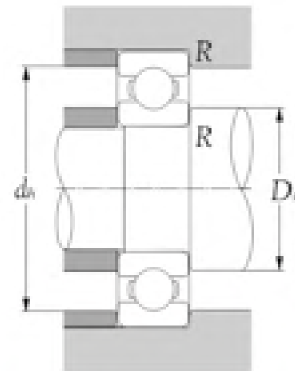
**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | | |
| Polymid - | X | Class 0 (JIS) | Shell Alvania S2 |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire
NIKO web-site: Http://www.nipponkodobearings.com

## Ball Bearing
## series 64



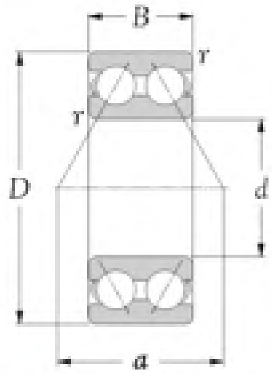

| Boundary dimensions mm | | | | Basic load ratings dynamic static N | | Limiting speeds rpm | | Bearing numbers | Abutment and fillet dimensions mm | | | Mass kg(s). |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $d$ | $D$ | $B$ | $r_{s\ min}$ | $C_r$ | $C_{or}$ | grease | oil | | $D_s$ min | $d_h$ max | $R$ max | (approx.) |
| 17 | 62 | 17 | 1.1 | 22,700 | 10,800 | 14,000 | 16,000 | **6403** | 24.0 | 55.0 | 1.0 | 0.270 |
| 20 | 72 | 19 | 1.1 | 28,500 | 13,900 | 12,000 | 14,000 | **6404** | 27.0 | 65.0 | 1.0 | 0.400 |
| 25 | 80 | 21 | 1.5 | 34,500 | 17,500 | 10,000 | 12,000 | **6405** | 33.5 | 71.5 | 1.5 | 0.530 |
| 30 | 90 | 23 | 1.5 | 43,500 | 23,900 | 8,800 | 10,000 | **6406** | 38.5 | 81.5 | 1.5 | 0.735 |
| 35 | 100 | 25 | 1.5 | 55,000 | 31,000 | 7,800 | 9,100 | **6407** | 43.5 | 91.5 | 1.5 | 0.952 |
| 40 | 110 | 27 | 2.0 | 63,500 | 36,500 | 7,000 | 8,200 | **6408** | 50.0 | 100.0 | 2.0 | 1.230 |
| 45 | 120 | 29 | 2.0 | 77,000 | 45,000 | 6,300 | 7,400 | **6409** | 55.0 | 110.0 | 2.0 | 1.530 |
| 50 | 130 | 31 | 2.1 | 83,000 | 49,500 | 5,700 | 6,700 | **6410** | 62.0 | 118.0 | 2.0 | 1.880 |
| 55 | 140 | 33 | 2.1 | 89,000 | 54,000 | 5,200 | 6,100 | **6411** | 67.0 | 128.0 | 2.0 | 2.290 |
| 60 | 150 | 35 | 2.1 | 102,000 | 64,500 | 4,800 | 5,700 | **6412** | 72.0 | 138.0 | 2.0 | 2.770 |

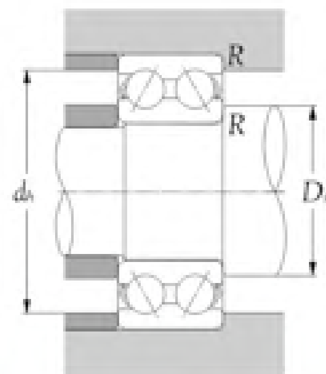
**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | Class 0 (JIS) | Nil |
| Polymid - | X | | |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## BALL BEARING
## SERIES 52



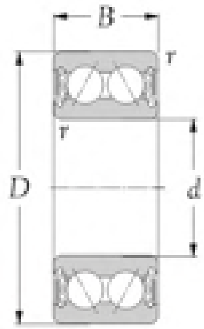

| Boundary dimensions mm | | | | Basic load ratings N | | Limiting speeds rpm | | Bearing numbers | | Abutment and fillet dimensions mm | | | | Mass kg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | dynamic | static | | | | | | | | | |
| $d$ | $D$ | $B$ | $r_s$ min[1] | $C_r$ | $C_{or}$ | grease | oil | | | $D_s$ min | $d_h$ max | $R$ max | $a$ | (approx.) |
| 10 | 30 | 14.3 | 0.6 | 6950 | 3800 | 14000 | 19000 | **5200 (UG)** | **5200 A (UG)** | 15 | 25 | 0.6 | 17.5 | 0.049 |
| 12 | 32 | 15.9 | 0.6 | 9150 | 5050 | 13000 | 17000 | **5201 (UG)** | **5201 A (UG)** | 17 | 27 | 0.6 | 19.0 | 0.057 |
| 15 | 35 | 15.9 | 0.6 | 10000 | 6050 | 11000 | 15000 | **5202 (UG)** | **5202 A (UG)** | 20 | 30 | 0.6 | 21.0 | 0.064 |
| 17 | 40 | 17.5 | 0.6 | 12800 | 7900 | 9900 | 13000 | **5203 (UG)** | **5203 A (UG)** | 22 | 35 | 0.6 | 24.0 | 0.096 |
| 20 | 47 | 20.6 | 1.0 | 19000 | 12100 | 8800 | 12000 | **5204 (UG)** | **5204 A (UG)** | 26 | 41 | 1.0 | 28.0 | 0.153 |
| 25 | 52 | 20.6 | 1.0 | 20600 | 14300 | 7300 | 9800 | **5205 (UG)** | **5205 A (UG)** | 31 | 46 | 1.0 | 31.5 | 0.175 |
| 30 | 62 | 23.8 | 1.0 | 28600 | 20400 | 6300 | 8400 | **5206 (UG)** | **5206 A (UG)** | 36 | 56 | 1.0 | 36.5 | 0.286 |
| 35 | 72 | 27.0 | 1.1 | 38000 | 27800 | 5500 | 7400 | **5207 (UG)** | **5207 A (UG)** | 42 | 65 | 1.0 | 42.5 | 0.436 |
| 40 | 80 | 30.2 | 1.1 | 42500 | 32500 | 4900 | 6600 | **5208 (UG)** | **5208 A (UG)** | 47 | 73 | 1.0 | 47.5 | 0.590 |
| 45 | 85 | 30.2 | 1.1 | 48000 | 37000 | 4400 | 5900 | **5209 (UG)** | **5209 A (UG)** | 52 | 78 | 1.0 | 50.5 | 0.640 |
| 50 | 90 | 30.2 | 1.1 | 51000 | 42000 | 4000 | 5300 | **5210 (UG)** | **5210 A (UG)** | 57 | 83 | 1.0 | 54.0 | 0.689 |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | | |
| Polymid - | A | Class 0 (JIS) | Shell Alvania S2 |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire
NIKO web-site: Http://www.nipponkodobearings.com

## Ball Bearing
## series 52..2RS



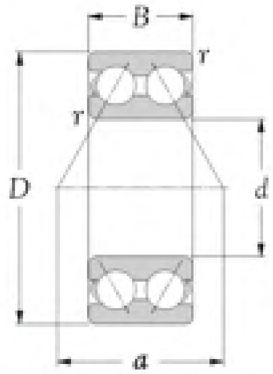

| Boundary dimensions mm | | | | Basic load ratings dynamic static N | | Limiting speeds rpm | | Bearing numbers | | Mass kg. |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | rs min[1] | Cr | Cor | grease | oil | | | (approx.) |
| 10 | 30 | 14.3 | 0.6 | 7150 | 3900 | 16000 | 22000 | **5200 2RS** | **5200 A 2RS** | 0.045 |
| 12 | 32 | 15.9 | 0.6 | 10600 | 5850 | 15000 | 20000 | **5201 2RS** | **5201 A 2RS** | 0.050 |
| 15 | 35 | 15.9 | 0.6 | 11700 | 6950 | 12000 | 17000 | **5202 2RS** | **5202 A 2RS** | 0.068 |
| 17 | 40 | 17.5 | 0.6 | 14800 | 9000 | 10000 | 15000 | **5203 2RS** | **5203 A 2RS** | 0.090 |
| 20 | 47 | 20.6 | 1.0 | 19500 | 12200 | 9000 | 13000 | **5204 2RS** | **5204 A 2RS** | 0.140 |
| 25 | 52 | 20.6 | 1.0 | 21200 | 14600 | 8000 | 11000 | **5205 2RS** | **5205 A 2RS** | 0.160 |
| 30 | 62 | 23.8 | 1.0 | 29600 | 21200 | 7000 | 9500 | **5206 2RS** | **5206 A 2RS** | 0.260 |
| 35 | 72 | 27.0 | 1.1 | 37700 | 27500 | 6000 | 8000 | **5207 2RS** | **5207 A 2RS** | 0.400 |
| 40 | 80 | 30.2 | 1.1 | 44900 | 34000 | 5600 | 7500 | **5208 2RS** | **5208 A 2RS** | 0.530 |
| 45 | 85 | 30.2 | 1.1 | 48800 | 39000 | 5000 | 6700 | **5209 2RS** | **5209 A 2RS** | 0.570 |

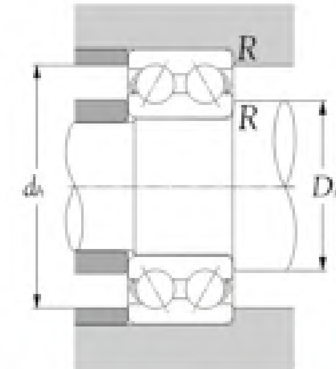
**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | | |
| Polymid - | A | Class 0 (JIS) | Shell Alvania S2 |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

# Ball Bearing
## series 53



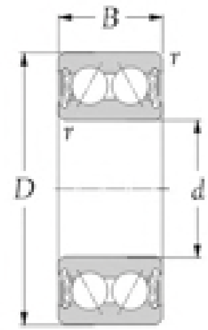




| Boundary dimensions mm | | | | Basic load ratings N dynamic | static | Limiting speeds rpm | | Bearing numbers | | Mass kg. |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | $r_{s\,min}$ | $C_r$ | $C_{or}$ | grease | oil | | | (approx.) |
| 1150 | 4230 | 19.014.31.0 | 0.47,200 | 7150,100 | 93900 | 13,0006000 | 5302 (UG) 2 5302 A (UG) | 5200 2RS 36.0 | 5200 A 2RS | 0.082 |
| 1712 | 4752 | 22.215.91.0 | 0.60,400 | 10600,100 | 9,8000 | 12,0005000 | 5303 (UG) 0 5303 A (UG) | 5201 2RS 41.0 | 5201 A 2RS | 0.080 |
| 2015 | 5235 | 22.215.91.1 | 0.60,600 | 11700,700 | 8,6900 | 11,0002000 | 5304 (UG) 7 5304 A (UG) | 5202 2RS 45.0 | 5202 A 2RS | 0.068 |
| 2517 | 6230 | 25.417.51.1 | 0.60,500 | 14800,500 | 6,9000 | 8,9000000 | 5305 (UG) 5 5305 A (UG) | 5203 2RS 55.0 | 5203 A 2RS | 0.080 |
| 3020 | 7247 | 30.220.61.1 | 1.09,500 | 19500,500 | 5,2000 | 7,6009000 | 5306 (UG) 3 5306 A (UG) | 5204 2RS 65.0 | 5204 A 2RS | 0.140 |
| 3525 | 8052 | 34.920.61.5 | 1.09,500 | 21200,000 | 5,4000 | 6,6008000 | 5307 (UG) 1 5307 A (UG) | 5205 2RS 71.5 | 5205 A 2RS | 0.768 |
| 4030 | 9062 | 36.523.81.5 | 1.00,500 | 29600,000 | 8,1000 | 5,9007000 | 5308 (UG) 9 5308 A (UG) | 5206 2RS 81.5 | 5206 A 2RS | 0.060 |
| 4535 | 10072 | 39.727.01.5 | 1.72,500 | 37700,000 | 8,7600 | 5,3006000 | 5309 (UG) 8 5309 A (UG) | 5207 2RS 91.5 | 5207 A 2RS | 0.300 |
| 5040 | 11080 | 44.430.22.0 | 1.85,500 | 44900,500 | 3,4000 | 4,8005600 | 5310 (UG) 7 5310 A (UG) | 5208 2RS 100.0 | 5208 A 2RS | 0.530 |
| 45 | 85 | 30.2 | 1.1 | 48800 | 39000 | 5000 | 6700 | 5209 2RS | 5209 A 2RS | 0.570 |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | Class 0 (JIS) | Shell Alvania S2 |
| Polymid - | A | | |
| Brass - | X | | |

## BALL BEARING
## SERIES 53..2RS



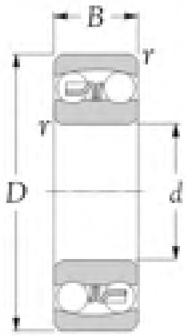

| Boundary dimensions mm | | | | Basic load ratings N dynamic | static | Limiting speeds rpm | | Bearing numbers | | Mass kg(s). |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | $r_{s\ min}$[1)] | $C_r$ | $C_{or}$ | grease | oil | | | (approx.) |
| 15 | 42 | 19.0 | 1.0 | 17,200 | 10,100 | 9,900 | 13,000 | **5302 2RS** | **5302 A 2RS** | 0.132 |
| 17 | 47 | 22.2 | 1.0 | 20,400 | 12,100 | 9,000 | 12,000 | **5303 2RS** | **5303 A 2RS** | 0.181 |
| 20 | 52 | 22.2 | 1.1 | 22,500 | 14,600 | 8,500 | 12,000 | **5304 2RS** | **5304 A 2RS** | 0.200 |
| 25 | 62 | 25.4 | 1.1 | 30,700 | 20,400 | 7,500 | 10,000 | **5305 2RS** | **5305 A 2RS** | 0.320 |
| 30 | 72 | 30.2 | 1.1 | 41,600 | 29,000 | 6,300 | 8,500 | **5306 2RS** | **5306 A 2RS** | 0.480 |
| 45 | 100 | 39.7 | 1.5 | 72,800 | 53,000 | 4,500 | 6,000 | **5309 2RS** | **5309 A 2RS** | 1.150 |

**Technical supplement**

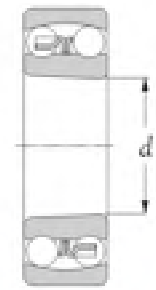
| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | | |
| Polymid - | A | Class 0 (JIS) | Shell Alvania S2 |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire
NIKO web-site: Http://www.nipponkodobearings.com

## Ball Bearing
## series 12,12..K




Cylindrical bore




Tapered bore
taper 1:12

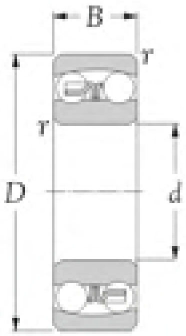
| Boundary dimensions mm | | | | Basic load ratings N dynamic | static | Limiting speeds rpm | | Bearing numbers | | Mass kg(s). cylindrical bore | tapered bore |
|---|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | $r_{s\,min}$ | $C_r$ | $C_{0r}$ | grease | oil | | | (approx.) | |
| 10 | 30 | 9 | 0.6 | 5,500 | 1,190 | 21,000 | 24,000 | **1200 E** | - | 0.033 | - |
| 12 | 32 | 10 | 0.6 | 5,600 | 1,270 | 18,000 | 22,000 | **1201 E** | - | 0.040 | - |
| 15 | 35 | 11 | 0.6 | 7,450 | 1,750 | 16,000 | 19,000 | **1202 E** | - | 0.049 | - |
| 17 | 40 | 12 | 0.6 | 7,900 | 2,010 | 14,000 | 17,000 | **1203 E** | - | 0.072 | - |
| 20 | 47 | 14 | 1.0 | 9,900 | 2,610 | 13,000 | 15,000 | **1204** | **1204 K** | 0.116 | 0.114 |
| 25 | 52 | 15 | 1.0 | 12,100 | 3,300 | 11,000 | 13,000 | **1205** | **1205 K** | 0.138 | 0.135 |
| 30 | 62 | 16 | 1.0 | 15,600 | 4,650 | 9,200 | 11,000 | **1206** | **1206 K** | 0.217 | 0.213 |
| 35 | 72 | 17 | 1.1 | 15,800 | 5,100 | 8,000 | 9,400 | **1207** | **1207 K** | 0.317 | 0.312 |
| 40 | 80 | 18 | 1.1 | 19,300 | 6,550 | 7,100 | 8,400 | **1208** | **1208 K** | 0.414 | 0.407 |
| 45 | 85 | 19 | 1.1 | 21,900 | 7,350 | 6,400 | 7,500 | **1209** | **1209 K** | 0.457 | 0.448 |
| 50 | 90 | 20 | 1.1 | 22,700 | 8,100 | 5,800 | 6,800 | **1210** | **1210 K** | 0.515 | 0.504 |
| 55 | 100 | 21 | 1.5 | 26,800 | 10,000 | 5,300 | 6,200 | **1211** | **1211 K** | 0.692 | 0.679 |
| 60 | 110 | 22 | 1.5 | 30,000 | 11,500 | 4,900 | 5,800 | **1212** | **1212 K** | 0.879 | 0.864 |
| 65 | 120 | 23 | 1.5 | 31,000 | 12,500 | 4,500 | 5,300 | **1213** | **1213 K** | 1.130 | 1.110 |
| 70 | 125 | 24 | 1.5 | 34,500 | 13,800 | 4,200 | 4,900 | **1214** | - | 1.240 | - |
| 75 | 130 | 25 | 1.5 | 39,000 | 15,700 | 3,900 | 4,600 | **1215** | **1215 K** | 1.330 | 1.310 |
| 80 | 140 | 26 | 2.0 | 40,000 | 17,000 | 3,700 | 4,300 | **1216** | **1216 K** | 1.650 | 1.620 |

**Technical supplement**

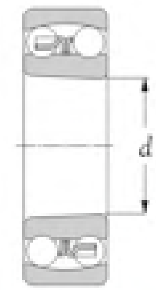
| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | Class 0 (JIS) | Nil |
| Polymid - | E | | |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire
NIKO web-site: Http://www.nipponkodobearings.com

## BALL BEARING
## SERIES 13,13..K




Cylindrical bore




Tapered bore
taper 1:12

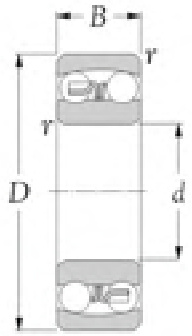
| Boundary dimensions mm | | | | Basic load ratings dynamic static N | | Limiting speeds rpm | | Bearing numbers | | Mass kg(s) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | dynamic | static | | | | | cylindrical bore | tapered bore |
| d | D | B | $r_{s\,min}$ | $C_r$ | $C_{or}$ | grease | oil | | | (approx.) | |
| 10 | 35 | 11 | 0.6 | 7,250 | 1,620 | 18,000 | 21,000 | **1300 E** | - | 0.058 | - |
| 12 | 37 | 12 | 1.0 | 9,450 | 2,160 | 16,000 | 18,000 | **1301 E** | - | 0.066 | - |
| 15 | 42 | 13 | 1.0 | 9,550 | 2,300 | 13,000 | 16,000 | **1302 E** | - | 0.092 | - |
| 17 | 47 | 14 | 1.0 | 12,500 | 3,200 | 12,000 | 14,000 | **1303 E** | - | 0.128 | - |
| 20 | 52 | 15 | 1.1 | 12,400 | 3,350 | 11,000 | 13,000 | **1304** | **1304 K** | 0.160 | 0.158 |
| 25 | 62 | 17 | 1.1 | 18,000 | 5,000 | 9,100 | 11,000 | **1305** | **1305 K** | 0.255 | 0.251 |
| 30 | 72 | 19 | 1.1 | 21,300 | 6,300 | 7,700 | 9,100 | **1306** | **1306 K** | 0.383 | 0.377 |
| 35 | 80 | 21 | 1.5 | 25,100 | 7,850 | 6,800 | 8,000 | **1307** | **1307 K** | 0.500 | 0.492 |
| 40 | 90 | 23 | 1.5 | 29,600 | 9,700 | 6,000 | 7,000 | **1308** | **1308 K** | 0.709 | 0.698 |
| 45 | 100 | 25 | 1.5 | 38,000 | 12,700 | 5,400 | 6,300 | **1309** | **1309 K** | 0.953 | 0.938 |
| 50 | 110 | 27 | 2.0 | 43,500 | 14,100 | 4,900 | 5,800 | **1310** | **1310 K** | 1.200 | 1.180 |
| 55 | 120 | 29 | 2.0 | 51,500 | 17,900 | 4,500 | 5,200 | **1311** | **1311 K** | 1.580 | 1.560 |
| 60 | 130 | 31 | 2.1 | 57,000 | 20,800 | 4,100 | 4,800 | **1312** | **1312 K** | 1.960 | 1.930 |

**Technical supplement**

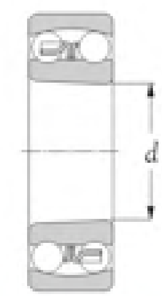
| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | Class 0 (JIS) | Nil |
| Polymid - | E | | |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire
NIKO web-site: Http://www.nipponkodobearings.com

## Ball Bearing
## series 22, 22..K




Cylindrical bore




Tapered bore
taper 1:12

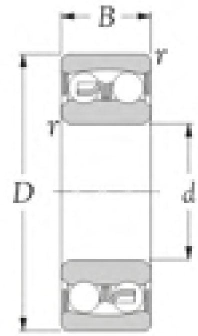
| Boundary dimensions mm | | | | Basic load ratings N dynamic | static | Limiting speeds rpm | | Bearing numbers | | Mass kg(s). cylindrical bore | tapered bore |
|---|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | rs min1) | Cr | Cor | grease | oil | | | (approx.) | |
| 10 | 30 | 14 | 0.6 | 7,300 | 1,590 | 19,000 | 23,000 | 2200 E | - | 0.047 | - |
| 12 | 32 | 14 | 0.6 | 7,600 | 1,730 | 17,000 | 20,000 | 2201 E | - | 0.051 | - |
| 15 | 35 | 14 | 0.6 | 7,700 | 1,850 | 15,000 | 18,000 | 2202 | - | 0.060 | - |
| 17 | 40 | 16 | 0.6 | 9,800 | 2,410 | 13,000 | 16,000 | 2203 | - | 0.088 | - |
| 20 | 47 | 18 | 1.0 | 12,600 | 3,300 | 12,000 | 14,000 | 2204 | 2204 K | 0.140 | 0.137 |
| 25 | 52 | 18 | 1.0 | 12,300 | 3,450 | 10,000 | 12,000 | 2205 | 2205 K | 0.157 | 0.153 |
| 30 | 62 | 20 | 1.0 | 15,200 | 4,500 | 8,600 | 10,000 | 2206 | 2206 K | 0.256 | 0.250 |
| 35 | 72 | 23 | 1.1 | 21,500 | 6,600 | 7,500 | 8,800 | 2207 | 2207 K | 0.392 | 0.382 |
| 40 | 80 | 23 | 1.1 | 22,300 | 7,350 | 6,700 | 7,900 | 2208 | 2208 K | 0.493 | 0.482 |
| 45 | 85 | 23 | 1.1 | 23,200 | 8,150 | 6,000 | 7,100 | 2209 | 2209 K | 0.540 | 0.528 |
| 50 | 90 | 23 | 1.1 | 23,200 | 8,450 | 5,500 | 6,400 | 2210 | 2210 K | 0.583 | 0.569 |
| 55 | 100 | 25 | 1.5 | 26,500 | 9,900 | 5,000 | 5,800 | 2211 | 2211 K | 0.787 | 0.769 |
| 60 | 110 | 28 | 1.5 | 34,000 | 12,600 | 4,600 | 5,400 | 2212 | 2212 K | 1.080 | 1.060 |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | | |
| Polymid - | E | Class 0 (JIS) | Shell Alvania S2 |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire
NIKO web-site: Http://www.nipponkodobearings.com

## Ball Bearing
## series 22..2RS



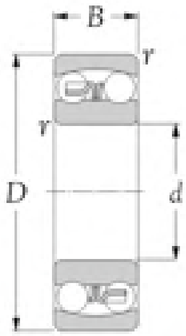

| Boundary dimensions mm | | | | Basic load ratings N dynamic | static | Speed rating rpm | Bearing numbers | Mass kg(s). |
|---|---|---|---|---|---|---|---|---|
| d | D | B | rs min | Cr | Cor | grease | | (approx.) |
| 10 | 30 | 14 | 0.6 | 5,530 | 1,180 | 17,000 | **2200 E 2RS** | 0.048 |
| 12 | 32 | 14 | 0.6 | 6,240 | 1,430 | 16,000 | **2201 E 2RS** | 0.053 |
| 15 | 35 | 14 | 0.6 | 7,410 | 1,760 | 14,000 | **2202 2RS** | 0.058 |
| 17 | 40 | 16 | 0.6 | 8,840 | 2,200 | 12,000 | **2203 2RS** | 0.089 |
| 20 | 47 | 18 | 1.0 | 12,700 | 3,400 | 10,000 | **2204 2RS** | 0.140 |
| 25 | 52 | 18 | 1.0 | 14,300 | 4,000 | 9,000 | **2205 2RS** | 0.160 |
| 30 | 62 | 20 | 1.0 | 15,600 | 4,650 | 7,500 | **2206 2RS** | 0.260 |
| 35 | 72 | 23 | 1.1 | 19,000 | 6,000 | 6,300 | **2207 2RS** | 0.410 |
| 40 | 80 | 23 | 1.1 | 19,900 | 6,950 | 5,600 | **2208 2RS** | 0.500 |
| 45 | 85 | 23 | 1.1 | 22,900 | 7,800 | 5,300 | **2209 2RS** | 0.530 |
| 50 | 90 | 23 | 1.1 | 22,900 | 8,150 | 4,800 | **2210 2RS** | 0.570 |
| 55 | 100 | 25 | 1.5 | 27,600 | 10,600 | 4,300 | **2211 2RS** | 0.790 |
| 60 | 110 | 28 | 1.5 | 31,200 | 12,200 | 3,800 | **2212 2RS** | 1.050 |

**Technical supplement**

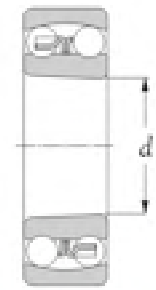
| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | | |
| Polymid - | E | Class 0 (JIS) | Shell Alvania S2 |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire
NIKO web-site: Http://www.nipponkodobearings.com

## Ball Bearing
## series 23, 23..K




Cylindrical bore




Tapered bore
taper 1:12

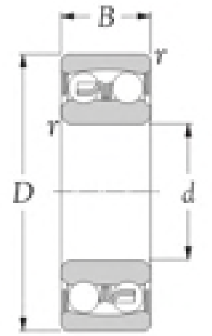
| Boundary dimensions mm | | | | Basic load ratings dynamic static N | | Limiting speeds rpm | | Bearing numbers | | Mass kg(s). cylindrical bore | tapered bore |
|---|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | rs min[1] | Cr | Cor | grease | oil | | | (approx.) | |
| 10 | 35 | 17 | 0.6 | 10,100 | 2,150 | 17,000 | 20,000 | **2300 E** | - | 0.083 | - |
| 12 | 37 | 17 | 1.0 | 11,800 | 2,710 | 15,000 | 17,000 | **2301 E** | - | 0.091 | - |
| 15 | 42 | 17 | 1.0 | 12,000 | 2,900 | 13,000 | 15,000 | **2302** | - | 0.114 | - |
| 17 | 47 | 19 | 1.0 | 14,400 | 3,550 | 11,000 | 14,000 | **2303** | - | 0.156 | - |
| 20 | 52 | 21 | 1.1 | 18,100 | 4,700 | 10,000 | 12,000 | **2304** | **2304 K** | 0.206 | 0.201 |
| 25 | 62 | 24 | 1.1 | 24,400 | 6,600 | 8,500 | 10,000 | **2305** | **2305 K** | 0.334 | 0.326 |
| 30 | 72 | 27 | 1.1 | 31,500 | 8,750 | 7,200 | 8,500 | **2306** | **2306 K** | 0.496 | 0.485 |
| 35 | 80 | 31 | 1.5 | 39,500 | 11,300 | 6,300 | 7,400 | **2307** | **2307 K** | 0.671 | 0.653 |
| 40 | 90 | 33 | 1.5 | 45,000 | 13,500 | 5,600 | 6,600 | **2308** | **2308 K** | 0.918 | 0.895 |
| 45 | 100 | 36 | 1.5 | 54,000 | 16,700 | 5,000 | 5,900 | **2309** | **2309 K** | 1.230 | 1.200 |
| 50 | 110 | 40 | 2.0 | 64,500 | 20,200 | 4,600 | 5,400 | **2310** | **2310 K** | 1.630 | 1.590 |
| 55 | 120 | 43 | 2.0 | 75,500 | 24,000 | 4,200 | 4,900 | **2311** | **2311 K** | 2.100 | 2.050 |
| 60 | 130 | 46 | 2.1 | 87,000 | 28,200 | 3,800 | 4,500 | **2312** | **2312 K** | 2.590 | 2.520 |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | | |
| Polymid - | E | Class 0 (JIS) | Shell Alvania S2 |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire
NIKO web-site: Http://www.nipponkodobearings.com

## Ball Bearing
## series 23..2RS




| Boundary dimensions mm | | | | Basic load ratings dynamic N | static | Speed rating rpm | Bearing numbers | Mass kg(s). |
|---|---|---|---|---|---|---|---|---|
| *d* | *D* | *B* | $r_s$ min[1] | $C_r$ | $C_{0r}$ | grease | | (approx.) |
| 15 | 42 | 17 | 1.0 | 10,800 | 2,600 | 12,000 | **2302 2RS** | 0.11 |
| 17 | 47 | 19 | 1.0 | 12,700 | 3,400 | 11,000 | **2303 2RS** | 0.16 |
| 20 | 52 | 21 | 1.1 | 14,300 | 4,000 | 9,500 | **2304 2RS** | 0.21 |
| 25 | 62 | 24 | 1.1 | 19,000 | 5,400 | 7,500 | **2305 2RS** | 0.34 |
| 30 | 72 | 27 | 1.1 | 22,500 | 6,800 | 6,700 | **2306 2RS** | 0.51 |
| 35 | 80 | 31 | 1.5 | 26,500 | 8,500 | 5,600 | **2307 2RS** | 0.70 |
| 40 | 90 | 33 | 1.5 | 33,800 | 11,200 | 5,000 | **2308 2RS** | 0.96 |
| 45 | 100 | 36 | 1.5 | 39,000 | 13,400 | 4,500 | **2309 2RS** | 1.30 |
| 50 | 110 | 40 | 2.0 | 43,600 | 14,000 | 4,000 | **2310 2RS** | 1.65 |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | | |
| Polymid - | E | Class 0 (JIS) | Shell Alvania S2 |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire
NIKO web-site: Http://www.nipponkodobearings.com

# TAPER ROLLER BEARING

# Technical Tables

## 1. Bearing materials

### 1.1 Raceway and rolling element materials

#### 1.1.1 High/mid carbon alloy steel

In general, steel varieties which can be hardened not just on the surface but also deep hardened by the so-called "through hardening method" are used for the raceways and rolling elements of bearings. Foremost among these is high carbon chromium bearing steel, which is widely used.

#### 1.1.2 Mid-carbon chromium steel

Mid-carbon chromium steel incorporating silicone and manganese, which gives it hardening properties comparable to high carbon chromium steel.

## 2. Cage

### 2.1 Cage materials

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

### 2.2 Pressed cages

For small and medium sized bearings, pressed cages of cold or hot rolled steel with a low carbon content of approx. 0.1% are used. However, depending on the application, austenitic stainless steel is also used.

### 2.3 Plastic cages

Injection molded plastic cages are now widely used: most are made from fiber glass reinforced heat resistant polyamide resin. Plastic cages are light weight, corrosion resistant and have excellent dampening and sliding properties. Heat resistant polyamide 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.

## 3. Bearing tolerances

### 3.1 Standard of tolerances

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

**Table 3.1 Bearings types and applicable tolerance**

| Bearing type | Applicable standard | Applicable tolerance class | | | | Applicable table |
|---|---|---|---|---|---|---|
| Taper roller bearing | JIS B 1514 (ISO 492)<br>(NIKO standard) | class 0, class 6X | class 6 | class 5 | class 4 | Table 3.2 |

**Table 3.2 Tolerance for radial bearings**

**Table 3.2.1 Inner rings**

| Nominal bore diameter $d$ mm | | Single plane mean bore diameter deviation $\Delta d_{mp}$ | | | | | | Single radial plane bore diameter variation $V_{dp}$ | | | | Mean single plane bore diameter variation $V_{dmp}$ | | | | Inner ring radial runout $K_{ia}$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | class 0 class 6X | | class 5 class 6 | | class 4 ❶ | | class 0 class 6X | class 6 | class 5 | class 4 | class 0 class 6X | class 6 | class 5 | class 4 | class 0 class 6X | class 6 | class 5 | class 4 |
| over | incl. | high | low | high | low | high | low | max. | | | | max. | | | | max. | | | |
| 18 | 30 | 0 | -12 | 0 | -8 | 0 | -6 | 12 | 8 | 6 | 5 | 9 | 6 | 5 | 4 | 18 | 8 | 5 | 3 |
| 30 | 50 | 0 | -12 | 0 | -10 | 0 | -8 | 12 | 10 | 8 | 6 | 9 | 8 | 5 | 5 | 20 | 10 | 6 | 4 |
| 50 | 80 | 0 | -15 | 0 | -12 | 0 | -9 | 15 | 12 | 9 | 7 | 11 | 9 | 6 | 5 | 25 | 10 | 7 | 4 |
| 80 | 120 | 0 | -20 | 0 | -15 | 0 | -10 | 20 | 15 | 11 | 8 | 15 | 11 | 8 | 5 | 30 | 13 | 8 | 5 |
| 120 | 180 | 0 | -25 | 0 | -18 | 0 | -13 | 25 | 18 | 14 | 10 | 19 | 14 | 9 | 7 | 35 | 18 | 11 | 6 |
| 180 | 250 | 0 | -30 | 0 | -22 | 0 | -15 | 30 | 22 | 17 | 11 | 23 | 16 | 11 | 8 | 50 | 20 | 13 | 8 |
| 250 | 315 | 0 | -35 | - | - | - | - | 35 | - | - | - | 26 | - | - | - | 60 | - | - | - |

Note: ❶ The dimensional difference $\Delta d_s$ of the bore diameter to be applied for class 4 is the same as the tolerance of dimensional difference $\Delta d_{mp}$ of the average bore diameter

(Unit: μm)

| Face runout with bore $S_d$ | | Inner ring axial runout (with side) $S_{ia}$ | Inner ring width deviation $\Delta B_s$ | | | | | | Single-row bearing width deviation $\Delta T_s$ | | | | | | Double-row bearing width deviation $\Delta B1S$, $\Delta C1S$ | | Four-row bearing width deviation $\Delta B2S$, $\Delta C2S$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| class 5 | class 4 | class 4 | class 0 class 6 | | class 6X | | class 5 class 4 | | class 0 class 6 | | class 6X | | class 5 class 4 | | class 0 class 6 class 5 | | class 0 class 6 class 5 | |
| max. | | max. | high | low | high | low | high | low | high | low | high | low | high | low | high | low | high | low |
| 8 | 4 | 4 | 0 | -120 | 0 | -50 | 0 | -200 | +200 | 0 | +100 | 0 | +200 | -200 | - | - | - | - |
| 8 | 4 | 4 | 0 | -120 | 0 | -50 | 0 | -240 | +200 | 0 | +100 | 0 | +200 | -200 | +240 | -240 | - | - |
| 8 | 5 | 4 | 0 | -150 | 0 | -50 | 0 | -300 | +200 | 0 | +100 | 0 | +200 | -200 | +300 | -300 | - | - |
| 9 | 5 | 5 | 0 | -200 | 0 | -50 | 0 | -400 | +200 | -200 | +100 | 0 | +200 | -200 | +400 | -400 | +500 | -500 |
| 10 | 6 | 7 | 0 | -250 | 0 | -50 | 0 | -500 | +350 | -250 | +150 | 0 | +350 | -250 | +500 | -500 | +600 | -600 |
| 11 | 7 | 8 | 0 | -300 | 0 | -50 | 0 | -600 | +350 | -250 | +150 | 0 | +350 | -250 | +600 | -600 | +750 | -750 |
| - | - | - | - | -350 | 0 | -50 | - | - | +350 | -250 | +200 | 0 | - | - | +700 | -700 | +900 | -900 |

**Table 3.2.2 Outer rings**

| Nominal outside diameter | | Single plane mean outside diameter deviation | | | | | | Single radial plane outside diameter variation | | | | Mean single plane outside diameter variation | | | | Outer ring radial runout | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $D$ mm | | $\Delta D_{mp}$ | | | | | | $V_{Dp}$ | | | | $V_{Dmp}$ | | | | $K_{ea}$ | | | |
| | | class 0 class 6X | | class 5 class 6 | | class 4❷ | | class 0 class 6X | class 6 | class 5 | class 4 | class 0 class 6X | class 6 | class 5 | class 4 | class 0 class 6X | class 6 | class 5 | class 4 |
| over | incl. | high | low | high | low | high | low | max. | | | | max. | | | | max. | | | |
| 18 | 30 | 0 | -12 | 0 | -8 | 0 | -6 | 12 | 8 | 6 | 5 | 9 | 6 | 5 | 4 | 18 | 9 | 6 | 4 |
| 30 | 50 | 0 | -14 | 0 | -9 | 0 | -7 | 14 | 9 | 7 | 5 | 11 | 7 | 5 | 5 | 20 | 10 | 7 | 5 |
| 50 | 80 | 0 | -16 | 0 | -11 | 0 | -9 | 16 | 11 | 8 | 7 | 12 | 8 | 6 | 5 | 25 | 13 | 8 | 5 |
| 80 | 120 | 0 | -18 | 0 | -13 | 0 | -10 | 18 | 13 | 10 | 8 | 14 | 10 | 7 | 5 | 35 | 18 | 10 | 6 |
| 120 | 150 | 0 | -20 | 0 | -15 | 0 | -11 | 20 | 15 | 11 | 8 | 15 | 11 | 8 | 6 | 40 | 20 | 11 | 7 |
| 150 | 180 | 0 | -25 | 0 | -18 | 0 | -13 | 25 | 18 | 14 | 10 | 19 | 14 | 9 | 7 | 45 | 23 | 13 | 8 |
| 180 | 250 | 0 | -30 | 0 | -20 | 0 | -15 | 30 | 20 | 15 | 11 | 23 | 15 | 10 | 8 | 50 | 25 | 15 | 10 |
| 250 | 315 | 0 | -35 | 0 | -25 | 0 | -18 | 35 | 25 | 19 | 14 | 26 | 19 | 13 | 9 | 60 | 30 | 18 | 11 |

Note: ❷ The dimensional difference $\Delta d_s$ of the outer diameter to be applied for class 4 is the same as the tolerance of dimensional difference $\Delta D_{mp}$ of the average outer diameter.

(Unit: $\mu$m)

| Outside surface inclination | | Outside ring axial runout | Outer ring width deviation | | | |
|---|---|---|---|---|---|---|
| $S_D$ | | $S_{ea}$ | $\Delta C_s$ | | | |
| class 5 | class 4 | class 4 | class 0 class 6 class 5 class 4 | | class 6X | |
| max. | | max. | high | low | high | low |
| 8 | 4 | 5 | Identical to $\Delta B_s$ of inner ring of same bearing | | 0 | -100 |
| 8 | 4 | 5 | | | 0 | -100 |
| 8 | 4 | 5 | | | 0 | -100 |
| 9 | 5 | 6 | | | 0 | -100 |
| 10 | 5 | 7 | | | 0 | -100 |
| 10 | 5 | 8 | | | 0 | -100 |
| 11 | 7 | 10 | | | 0 | -100 |
| 13 | 8 | 10 | | | 0 | -100 |

## 4. Bearing fits

4.1 Interference

For rolling bearings, inner and outer rings are fixed on the shaft or in the housing so that relative movement does not occur between fitted surfaces during operation or under load. This relative movement (referred to as "creep") between the fitted surfaces of the bearing and the shaft or housing can occur in a radial direction, an axial direction, or in the direction of rotation. To help prevent this creeping movement, bearing rings and the shaft or housing are installed with one of three interference fits, a "tight fit" (also called shrink fit), "transition fit," or "loose fit" (also called clearance fit), and the degree of interference between their fitted surfaces varies.

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

4.2 The necessity of a proper fit

In some cases, improper fit may lead to damage and shorten bearing life, therefore it is necessary to make a careful analysis in selecting a proper fit. Some of the negative conditions caused by improper fit are listed below.

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

4.3 Fit selection

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

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

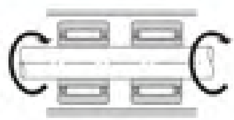
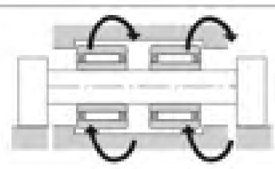
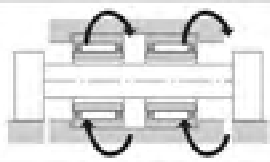
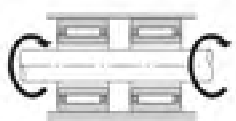
4.3.1 "Tight fit," "transition fit," or "loose fit"

For raceways under rotating loads, a tight fit is necessary. (Refer to Table 3.1)

"Raceways under rotating loads" refers to raceways receiving loads rotating relative to their radial direction. For raceways under static loads, on the other hand, a loose fit is sufficient. ( Example ) Rotating inner ring load - the direction of the radial load on the inner ring is rotating relatively

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

**Table 4.1 Radial load and bearing**

| Illustration | Bearing rotation | | Ring load | Fit |
|---|---|---|---|---|
| Static load  |  | Inner ring: Rotating<br>Outer ring: Stationary | Rotating inner ring load | Inner ring: Tight fit |
| Imbalanced load  |  | Inner ring: Stationary<br>Outer ring: Rotating | Static outer ring load | Outer ring: Loose fit |
| Static load  |  | Inner ring: Stationary<br>Outer ring: Rotating | Static inner ring load | Inner ring: Loose fit |
| Imbalanced load  |  | Inner ring: Rotating<br>Outer ring: Stationary | Rotating outer ring load | Outer ring: Tight fit |

4.3.2 Recommended Fits

The system of limits and fits define the tolerances of the outside diameter of the shaft or the bore diameter of a housing ( the shaft or housing to which a metric bearing is installed). Bearing fit is governed by the selection of tolerances for the shaft outside diameter and housing bore diameter. Fig . 4.1 summarizes the interrelations between shaft outside diameter and bearing bore diameter, and between housing bore diameter and shaft outside diameter.Table 4.2 provides the recommended fits for common radial needle roller bearings (machined ring needle roller bearings with inner ring), relative to dimensions and loading conditions. Table 4.3 is a table of the numerical value of fits.

4.3.3 Interference minimum and maximum values

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

- In calculating the minimum required amount of interference keep in mind that:
  1) interference is reduced by radial loads
  2) interference is reduced by differences between bearing temperature and ambient temperature
- 3) interference is reduced by variation of fitted surfaces

Maximum interference should be no more than 1:1000 of the shaft diameter or outer diameter. Required interference calculations are shown below.

4.3.3.1 Fitted surface variation and required interference

Interference between fitted surfaces is reduced by roughness and other slight variations of these surfaces which are flattened in the fitting process. The degree of reduced interference depends upon the finish treatment of these surfaces, but in general it is necessary to assume the following interference reductions.

For ground shafts: 1.0 ~ 2.5 μm
For lathed shafts : 5.0 ~ 7.0 μm

4.3.3.2 Maximum interference

When bearing rings are installed with an interference fit, tension or compression stress may occur along their raceways. If interference is too great, this may cause damage to the rings and reduce bearing life . For these reasons , maximum interference should not exceed the previously mentioned ratio of 1:1,000 of the shaft or outside diameter.

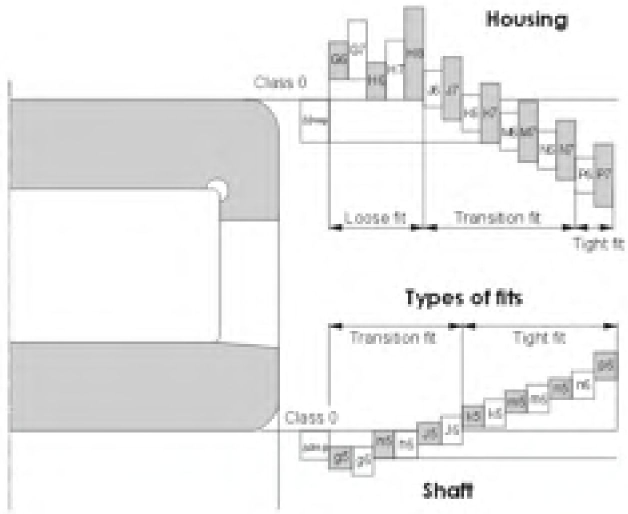



Fig. 4.1

**Table 4.2 General standards for taper roller bearing fits**

**Table 4.2.1 Shaft fits**

| Nature of load | Fit | Load condition, magnitude | Shaft diameter mm over | Shaft diameter mm incl | Tolerance class | Remarks |
|---|---|---|---|---|---|---|
| Indeterminate direction load Rotating inner ring load | Tight fit/ Transition fit | Light load❶ | ~ | 40 | js6 | When greater accuracy is required m5 may be substituted for m6. |
| | | | 40 ~ | 140 | k6 | |
| | | | 140 ~ | 200 | m6 | |
| | | Normal load❶ | ~ | 40 | k5 | |
| | | | 40 ~ | 100 | m5 | |
| | | | 100 ~ | 140 | m6 | |
| | | | 140 ~ | 200 | n6 | |
| | | | 200 ~ | 400 | p6 | |
| | | Heavy load❶ or shock load | 50 ~ | 140 | n6 | When greater accuracy is required m5 may be substituted for m6. |
| | | | 140 ~ | 200 | p6 | |
| | | | 200 ~ | | r6 | |
| Static inner ring load | Transition fit | Inner ring axial displacement possible | All shaft diameters | | g6 | When greater accuracy is required use g5. For large bearings, f6 may be used. |
| | | Inner ring axial displacement unnecessary | | | h6 | When greater accuracy is required use h5. |
| Centric axial load only | Transition fit | All loads | All shaft diameters | | h9/IT5 | General: depending on the fit, shaft and inner rings are not fixed. |

❶ Standards for light loads, normal loads, and heavy loads

Light loads : equivalent radial load ≤ 0.06 Cr

Normal loads: 0.06 Cr < equivalent radial load ≤ 0.12 Cr

Heavy loads : 0.12 Cr <equivalent radial load

Note: All values and fits listed in the above tables are for solid steel shafts.

**Table 4.2.2 Housing fits (Housing of the drawn cup taper roller bearings.)**

| Housing | Solid housing or split housing | | Split housing |
|---|---|---|---|
| Load condition, magnitude | Static outer load | All loads | H7 |
| | | with large temperature different | G7 |
| | Direction indeterminate load | Light to normal load | JS7 |
| Tolerance class | | Normal to heavy load | K7 |
| | | Heavy shock load | M7 |
| | Outer ring Rotating load | Light or variable load | M7 |
| | | Normal to heavy load | N7 |
| | | Heavy load (thin wall housing) or heavy shock load | P7 |

Note: All values add fits listed in the above tables are for cast iron or steel housings.
Select more tighten tolerance class for light weight alloy housings.

**Table 4.3 Numeric value table of fitting for radial bearing of class 0**

**Table 4.3.1 Fitting against shaft**

| Nominal bore diameter of bearing $d$ mm | | Single plane mean bore diameter deviation $\Delta dmp$ | | g5 | g6 | h5 | h6 | j5 | js5 | j6 |
|---|---|---|---|---|---|---|---|---|---|---|
| over | incl. | high | low | bearing shaft | bearing shaft | bearing shaft | bearing shaft | bearing shaft | bearing shaft | bearing shaft |
| 10 | 18 | 0 | -8 | 2T ~ 14L | 2T ~ 17L | 8T ~ 8L | 8T ~ 11L | 13T ~ 3L | 12T ~ 4L | 16T ~ 3L |
| 18 | 30 | 0 | -10 | 3T ~ 16L | 3T ~ 20L | 10T ~ 9L | 10T ~ 13L | 15T ~ 4L | 14.5T ~ 4.5L | 19T ~ 4L |
| 30 | 50 | 0 | -12 | 3T ~ 20L | 3T ~ 25L | 12T ~ 11L | 12T ~ 16L | 15T ~ 5L | 17.5T ~ 5.5L | 23T ~ 5L |
| 50 | 80 | 0 | -15 | 5T ~ 23L | 5T ~ 29L | 15T ~ 13L | 15T ~ 19L | 21T ~ 7L | 21.5T ~ 6.5L | 27T ~ 7L |
| 80 | 120 | 0 | -20 | 8T ~ 27L | 8T ~ 34L | 20T ~ 15L | 20T ~ 22L | 26T ~ 9L | 27.5T ~ 7.5L | 33T ~ 9L |
| 120 | 140 | | | | | | | | | |
| 140 | 160 | 0 | -25 | 11T ~ 32L | 11T ~ 39L | 25T ~ 18L | 25T ~ 25L | 32T ~ 11L | 34T ~ 9L | 39T ~ 11L |
| 160 | 180 | | | | | | | | | |
| 180 | 200 | | | | | | | | | |
| 200 | 225 | 0 | -30 | 15T ~ 35L | 15T ~ 44L | 30T ~ 20L | 30T ~ 29L | 37T ~ 13L | 40T ~ 10L | 46T ~ 13L |
| 225 | 250 | | | | | | | | | |
| 250 | 280 | 0 | -35 | 18T ~ 40L | 18T ~ 49L | 35T ~ 23L | 35T ~ 32L | 42T ~ 16L | 46.5T ~ 11.5L | 51T ~ 16L |
| 280 | 315 | | | | | | | | | |

**Table 4.3.2 Fitting against housing**

| Nominal outside diameter of bearing $d$ mm | | Single plane mean outside diameter deviation $\Delta Dmp$ | | G7 | H6 | H7 | J6 | J7 | Js7 | K6 |
|---|---|---|---|---|---|---|---|---|---|---|
| over | incl. | high | low | housing bearing | housing bearing | housing bearing | housing bearing | housing bearing | housing bearing | housing bearing |
| 10 | 18 | 0 | -8 | 6L ~ 32L | 0 ~ 19L | 0 ~ 26L | 5T ~ 14L | 8T ~ 18L | 9T ~ 17L | 9T ~ 10L |
| 18 | 30 | 0 | -9 | 7L ~ 37L | 0 ~ 22L | 0 ~ 30L | 5T ~ 17L | 9T ~ 21L | 10.5T ~ 19.5L | 11T ~ 11L |
| 30 | 50 | 0 | -11 | 9L ~ 45L | 0 ~ 27L | 0 ~ 36L | 6T ~ 21L | 11T ~ 25L | 12.5T ~ 23.5L | 13T ~ 14L |
| 50 | 80 | 0 | -13 | 10L ~ 53L | 0 ~ 32L | 0 ~ 43L | 6T ~ 26L | 12T ~ 31L | 15T ~ 28L | 15T ~ 17L |
| 80 | 120 | 0 | -15 | 12L ~ 62L | 0 ~ 37L | 0 ~ 50L | 6T ~ 31L | 13T ~ 37L | 17.5T ~ 32.5L | 18T ~ 19L |
| 120 | 150 | 0 | -18 | 14L ~ 72L | 0 ~ 43L | 0 ~ 58L | 7T ~ 36L | 14T ~ 44L | 20T ~ 38L | 21T ~ 22L |
| 150 | 180 | 0 | -25 | 14L ~ 79L | 0 ~ 50L | 0 ~ 65L | 7T ~ 43L | 14T ~ 51L | 20T ~ 45L | 21T ~ 29L |
| 180 | 250 | 0 | -30 | 15L ~ 91L | 0 ~ 59L | 0 ~ 76L | 7T ~ 52L | 16T ~ 60L | 23T ~ 53L | 24T ~ 35L |
| 250 | 315 | 0 | -35 | 17L ~ 104L | 0 ~ 67L | 0 ~ 87L | 7T ~ 60L | 16T ~ 71L | 26T ~ 61L | 27T ~ 40L |

Note: T = tight, L = loose

(Unit: μm)

| js6 bearing shaft | k5 bearing shaft | k6 bearing shaft | m5 bearing shaft | m6 bearing shaft | n6 bearing shaft | p6 bearing shaft | r6 bearing shaft | Nominal bore diameter of bearing d mm over | incl |
|---|---|---|---|---|---|---|---|---|---|
| 13.5T ~ 5.5L | 17T ~ 1T | 20T ~ 1T | 23T ~ 7T | 26T ~ 7T | 31T ~ 12T | 37T ~ 18T | — | 10 | 18 |
| 16.5T ~ 6.5L | 21T ~ 2T | 25T ~ 2T | 27T ~ 8T | 31T ~ 8T | 38T ~ 15T | 45T ~ 22T | — | 18 | 30 |
| 20T ~ 8L | 25T ~ 2T | 30T ~ 2T | 32T ~ 9T | 37T ~ 9T | 45T ~ 17T | 54T ~ 26T | — | 30 | 50 |
| 24.5T ~ 9.5L | 30T ~ 2T | 36T ~ 2T | 39T ~ 11T | 45T ~ 11T | 54T ~ 20T | 66T ~ 32T | — | 50 | 80 |
| 31T ~ 11L | 38T ~ 3T | 45T ~ 2T | 48T ~ 13T | 55T ~ 13T | 65T ~ 23T | 79T ~ 37T | — | 80 | 120 |
| 37.5T ~ 12.5L | 46T ~ 3T | 53T ~ 3T | 58T ~ 15T | 65T ~ 15T | 77T ~ 27T | 93T ~ 43T | 113T ~ 63T | 120 | 140 |
| | | | | | | | 115T ~ 65T | 140 | 160 |
| | | | | | | | 118T ~ 68T | 160 | 180 |
| 44.5T ~ 14.5L | 54T ~ 4T | 63T ~ 4T | 67T ~ 17T | 76T ~ 17T | 90T ~ 31T | 109T ~ 50T | 136T ~ 77T | 180 | 200 |
| | | | | | | | 139T ~ 80T | 200 | 225 |
| | | | | | | | 143T ~ 84T | 225 | 250 |
| 51T ~ 16L | 62T ~ 4T | 71T ~ 4T | 78T ~ 20T | 87T ~ 20T | 101T ~ 34T | 123T ~ 56T | 161T ~ 94T | 250 | 280 |
| | | | | | | | 165T ~ 98T | 280 | 315 |

(Unit: μm)

| K7 housing bearing | M7 housing bearing | N7 housing bearing | P7 housing bearing | Nominal outside diameter of bearing d mm over | incl |
|---|---|---|---|---|---|
| 12T ~ 14L | 18T ~ 8L | 23T ~ 3L | 29T ~ 3L | 10 | 18 |
| 15T ~ 15L | 21T ~ 9L | 28T ~ 2L | 35T ~ 5L | 18 | 30 |
| 18T ~ 18L | 25T ~ 11L | 33T ~ 3L | 42T ~ 6L | 30 | 50 |
| 21T ~ 22L | 30T ~ 13L | 39T ~ 4L | 52T ~ 8L | 50 | 80 |
| 25T ~ 25L | 35T ~ 15L | 45T ~ 5L | 59T ~ 9L | 80 | 120 |
| 28T ~ 30L | 40T ~ 18L | 52T ~ 6L | 68T ~ 10L | 120 | 150 |
| 28T ~ 37L | 40T ~ 25L | 52T ~ 13L | 68T ~ 3L | 150 | 180 |
| 33T ~ 43L | 46T ~ 30L | 60T ~ 16L | 79T ~ 3L | 180 | 250 |
| 36T ~ 51L | 52T ~ 35L | 66T ~ 21L | 88T ~ 1L | 250 | 315 |

## 5. Bearing internal clearance

**Table 5.1 Radial internal clearance of taper roller bearings** **(Unit: μm)**

| Nominal bore diameter $d$ (mm) | | C2 | | CN | | C3 | | C4 | | C5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| over | incl. | min. | max. | min. | max. | min. | max. | min. | max. | min. | max. |
| 10 | 24 | 0 | 25 | 20 | 45 | 35 | 60 | 50 | 75 | 65 | 90 |
| 24 | 30 | 0 | 25 | 20 | 45 | 35 | 60 | 50 | 75 | 70 | 95 |
| 30 | 40 | 5 | 30 | 25 | 50 | 45 | 70 | 60 | 85 | 80 | 105 |
| 40 | 50 | 5 | 35 | 30 | 60 | 50 | 80 | 70 | 100 | 95 | 125 |
| 50 | 65 | 10 | 40 | 40 | 70 | 60 | 90 | 80 | 110 | 110 | 140 |
| 65 | 80 | 10 | 45 | 40 | 75 | 65 | 100 | 90 | 125 | 130 | 165 |
| 80 | 100 | 15 | 50 | 50 | 85 | 75 | 110 | 105 | 140 | 155 | 190 |
| 100 | 120 | 15 | 55 | 50 | 90 | 85 | 125 | 125 | 165 | 180 | 220 |
| 120 | 140 | 15 | 60 | 60 | 105 | 100 | 145 | 145 | 190 | 200 | 245 |
| 140 | 160 | 20 | 70 | 70 | 120 | 115 | 165 | 165 | 215 | 225 | 275 |
| 160 | 180 | 25 | 75 | 75 | 125 | 120 | 170 | 170 | 220 | 250 | 300 |
| 180 | 200 | 35 | 90 | 90 | 145 | 140 | 195 | 195 | 250 | 275 | 330 |
| 200 | 225 | 45 | 105 | 105 | 165 | 160 | 220 | 220 | 280 | 305 | 365 |
| 225 | 250 | 45 | 110 | 110 | 175 | 170 | 235 | 235 | 300 | 330 | 395 |
| 250 | 280 | 55 | 125 | 125 | 195 | 190 | 260 | 260 | 330 | 370 | 440 |
| 280 | 315 | 55 | 130 | 130 | 205 | 200 | 275 | 275 | 350 | 410 | 485 |

## 6. Lubrication

### 6.1 Lubrication of rolling bearings

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) Friction and wear reduction
(2) Friction heat dissipation
(3) Prolonged bearing life
(4) Prevention of rust
(5) Protection against harmful elements

In order to achieve the above effects, the most effective lubrication method for the operating conditions must be selected. Also a good quality, reliable lubricant must be selected. In addition, an effectively designed sealing system that prevents the intrusion of damaging elements ( dust, water, etc. ) into the bearing interior, removes other impurities from the lubricant, and prevents lubricant from leaking to the outside, is also a requirement.

Almost all rolling bearings use either grease or oil lubrication methods, but in some special applicatic solid lubricant such as molybdenum disulfide or graphite may be used.

## 6.2 Grease lubrication

Grease type lubricants are relatively easy to handle require only the simplest sealing devicesfor these reasons, grease is the most widely used lubricant rolling bearings.

### 6.2.1 Types and characteristics of grease

Lubricating grease are composed of either a mineral base or a synthetic oil base. To this base a thicks other additives are added. The properties of all greases are mainly determined by the kind of base oil use the combination of thickening agent and various additives.

Standard greases and their characteristics are Table 6.2. As performance characteristics of even same type of grease will vary widely from brand, it is best to check the manufacturers' data when selecting a grease.

**Table 6.1 Grease varieties and characteristics**

| Grease name | Lithium grease | | | Sodium grease (Fiber grease) | Calcium compound base grease |
|---|---|---|---|---|---|
| Thickener | Li soap | | | Na soap | Ca+Na soap<br>Ca+Li soap |
| Base oil | Mineral oil | Diester oil | Silicone oil | Mineral oil | Mineral oil |
| Dropping poin ˚C | 170 ~ 190 | 170 ~ 190 | 200 ~ 250 | 150 ~ 180 | 150 ~ 180 |
| Operating temperature range ˚C | -30 ~ +130 | -50 ~ +130 | -50 ~ +160 | -20 ~ +130 | -20 ~ +120 |
| Mechanical stability | Excellent | Good | Good | Excellent ~ Good | Excellent ~ Good |
| Pressure resistance | Good | Good | poor | Good | Excellent ~ Good |
| Water resistance | Good | Good | Good | Good ~ poor | Good ~ poor |
| Applications | Widest range of applications.<br><br>Grease used in all types of rolling bearings. | Excellent low temperature and wear characteristics.<br><br>Suitable for small sized and miniature bearings. | Suitable for high and low temperatures.<br><br>Unsuitable for heavy load applications due to low oil film strength. | Some emulsification when water is introduced.<br><br>Excellent characteristics at relatively high temperatures. | Excellent pressure resistance and mechanical stability.<br><br>Suitable for bearings receiving shock loads. |

| Grease name | Aluminum grease | Non-soap base grease Thickener | |
|---|---|---|---|
| Thickener | Al soap | Bentone, silica gel, urea, carbon black, fluorine compounds, etc. | |
| Base oil | Mineral oil | Mineral oil | Synthetic oil |
| Dropping poin ˚C | 70 ~ 90 | 250 or above | 250 or above |
| Operating temperature range ˚C | -10 ~ +80 | -10 ~ +130 | -50 ~ +200 |
| Mechanical stability | Good ~ poor | Good | Good |
| Pressure resistance | Good | Good | Good |
| Water resistance | Good | Good | Good |
| Applications | Excellent viscosity characteristics.<br><br>Suitable for bearings subjected to vibrations. | 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.<br><br>Grease used in all types of rolling bearings. | |

## 7. Load rating and life

### 7.1 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, gnawing, rust, etc. However, these so called "causes" of bearing failure are usually themselves caused by improper installation, insufficient or improper lubrication, faulty sealing or inaccurate bearing selection. Since the above mentioned "causes" of bearing failure can be avoided by taking the proper precautions, and are not simply caused by material fatigue, they are considered separately from the flaking aspect.

### 7.2 Basic rated life and basic dynamic load rating

A group of seemingly identical bearings when subjected to identical load and operating conditions will exhibit a wide diversity in their durability. This " life " disparity can be accounted for by the difference in the fatigue of the bearing material itself. This disparity is considered statistically when calculating bearing life, and the basic rated life is defined as follows.

The basic rated 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 rated life (90% reliability) is expressed in the total number of hours of operation.

The basic dynamic load rating is an expression of the load capacity of a bearing based on a constant load which the bearing can sustain for one million revolutions (the basic life rating). For radial bearings this rating applies to pure radial loads, and for thrust bearings it refers to pure axial loads. The basic dynamic load ratings given in the bearing tables of this catalog are for bearings constructed of NIKO standard bearing materials, using standard manufacturing techniques. Please consult NIKO Engineering for basic load ratings of bearings constructed of special materials or using special manufacturing techniques.

The relationship between the basic rated life, the basic dynamic load rating and the bearing load is given in formula (7.1).

$$L_{10} = \left(\frac{C}{P}\right)^{P} \text{ ............ Formula (7.1)}$$

where,

$P = 10/3$ ··········· For needle roller bearings

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

C : Basic dynamic rating load, N
($C_r$: radial bearings, $C_a$: thrust bearings)

P : Equivalent dynamic load, N
($P_r$ : radial bearings, $P_a$: thrust bearings)

The basic rating life can also be expressed in terms of hours of operation (revolution), and is calculated as shown in formula (7.2).

$L_{10h} = 500\ f_h^{P}$ .............. Formula (7.2)

$f_h\ = f_n \frac{C}{P}$ ................ Formula (7.3)

$f_n = (\frac{33.3}{n})^{1/p}$............. Formula (7.4)

where,
$L_{10}$ : Basic rating life, *h*
$f_h$ : Life factor
$f_n$ : Speed factor
$n$ : Rotational speed, r/min

Formula (7.2) can also be expressed as shown in formula (7.5).

$L_{10h} = \frac{10^6}{60n} (\frac{C}{P})^P$..................... Formula (7.5)

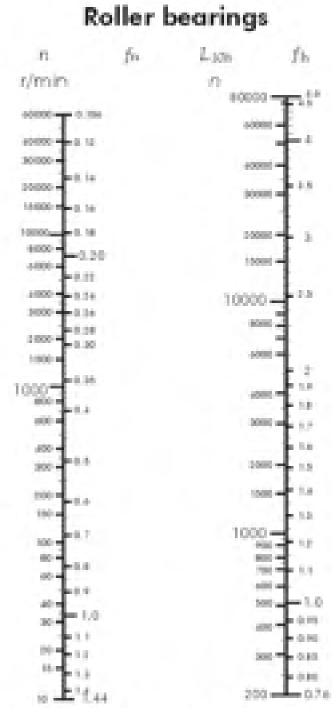


Fig. 7.1 Bearing life rating scale

The relationship between Rotational speed n and speed factor fn as well as the relation between the basic rating life L10h and the life factor fn is shown in Fig. 7.1. When several bearings are incorporated in machines or equipment as complete units, all the bearings in the unit are considered as a whole whencomputing bearing life (see formula 7.6). The total bearing life of the unit is a life rating based on the viable lifetime of the unit before even one of the bearings fails due to rolling contact fatigue.

$L = \frac{1}{(\frac{1}{L_1^e} + \frac{1}{L_2^e} + ... \frac{1}{L_n^e})^{1/e}}$ .............. Formula (7.6)

where,
$e$ = 9/8.......................For roller bearings
$L$ = Total basic rating life or entire unit, *h*
$L_1, L_2 ... L_n$ : Basic rating life or individual bearings, 1, 2,...*n*, *h*

7.3 Machine applications and requisite life

When selecting a bearing, it is essential that the requisite life of the bearing be established in relation to the operating conditions. The requisite life of the bearing Is usually determined by the type of machine in which the bearing will be used, and duration of service and operational reliability requirements. A general guide to these requisite life criteria is shown in Table 7.1. When determining bearing size, the fatigue life of the bearing is an important factor; however, besides bearing life, the strength and rigidity of the shaft and housing must also be taken into consideration.

### 7.4 Adjusted life rating factor

The basic bearing life rating ( 90% reliability factor) can be calculated through the formula mentioned earlier in Section 6.2. However, in some applications a bearing life factor of over 90% reliability may be required. To meet these requirements, bearing life can be lengthened by the use of specially improved bearing materials or special construction techniques. Moreover, according to elastohydrodynamic lubrication theory, it is clear that the bearing operating conditions (lubrication, temperature, speed, etc.) all exert an effect on bearing life.

$L_{na} = a_1 \cdot a_2 \cdot a_3 \, (C/P)^P$......... Formula (7.7)

where,

$L_{na}$ : Adjusted life rating in millions of revolutions ($10^6$)(adjusted for reliability, material and operating conditions)

$a_1$ : Reliability adjustment factor

$a_2$ : Material adjustment factor

$a_3$ : Operating condition adjustment factor

### 7.4.1 Life adjustment factor for reliability $a_1$

The values for the reliability adjustment factor as (for a reliability factor higher than 90%) can be found in Table 7.1.

**Table 7.1 Reliability adjustment factor values $a_1$**

| Reliability % | $L_n$ | Reliability factor $a_1$ |
|---|---|---|
| 90 | $L_{10}$ | 1.00 |
| 95 | $L_5$ | 0.62 |
| 96 | $L_4$ | 0.53 |
| 97 | $L_3$ | 0.44 |
| 98 | $L_2$ | 0.33 |
| 99 | $L_1$ | 0.21 |

7.4.2 Life adjustment factor for material $a_2$

The life of a bearing is affected by the material type and quality as well as the manufacturing process. In this regard, the life is adjusted by the use of an $a_2$ factor.

The basic dynamic load ratings listed in the catalog are based on NIKO's standard material and process, therefore, the adjustment factor $a_2=1$. When special materials or processes are used the adjustment factor can be larger than 1.

NIKO bearings can generally be used up to 120˚C . If bearings are operated at a higher temperature, the bearing must be specially heat treated (stabilized) so that inadmissible dimensional change does not occur due to changes in the micro-structure. This special heat treatment might cause the reduction of bearing life because of a hardness change.

7.4.3 Life adjustment factor $a_3$ for operating conditions

The operating conditions life adjustment factor $a_3$ is used to adjust for such conditions as lubrication, operating temperature, and other operation factors which have an effect on bearing life.

Generally speaking, when lubricating conditions are satisfactory, the $a_3$ factor has a value of one; and when lubricating conditions are exceptionally favorable, and all other operating conditions are normal, $a_3$ can have a value greater than one.

However, when lubricating conditions are particularly unfavorable and the oil film formation on the contact surfaces of the raceway and rolling elements is insufficient, the value of $a_3$ becomes less than one. This insufficient oil film formation can be caused, for example, by the lubricating oil viscosity being too low for the operating temperature (below 13 $mm^2/s$ for taper roller bearings; below 20 $mm^2/s$ for roller bearings); or by exceptionally low rotational speed ($n_r$/min x $d_p$ mm less than 10,000). For bearings used under special operating conditions, please consult NIKO Engineering.

As the operating temperature of the bearing increases, the hardness of the bearing material decreases. Thus, the bearing life correspondingly decreases. The operating temperature adjustment values are shown in Fig. 7.2.

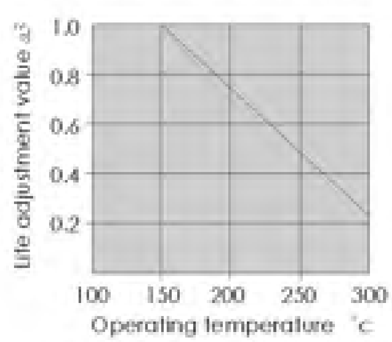



**Fig. 7.2 Life adjustment value for operating temperature**

7.5 Life of bearing with oscillating motion

The life of a radial bearing with oscillating motion can be calculated according to formula (7.8).

$L_{OSC} = \Omega L_{Rot}$ ............... Formula (7.8)

where,

$L_{OSC}$ : life for oscillating bearing

$L_{Rot}$ : rating life at assumed number of rotations same as oscillation cycles

$\Omega$ : oscillation factor (Fig.7.3 indicates the relationship between half oscillation angle $\beta$ and $\Omega$).

Fig. 7.3 is valid only when the amplitude exceeds a certain degree (critical angle 2βc). The critical angle is determined by the internal design of the bearing, in particular by the number of rolling elements in one row. Critical angle values are given in Table 7.3. When the magnitude of the oscillation is less than the critical angle, the life may be shorter than that calculated to be the value in Fig.7.3 It is safer to calculate life with the factor Ω corresponding to the critical angle. For the critical angle of an individual bearing, please consult NIKO Engineering. Where the amplitude of the oscillation 2β is small, it is difficult for a complete lubricant film to form on the contact surfaces of the rings and rolling elements, and fretting corrosion may occur. Therefore it is necessary to exercise extreme care in the selection of bearing type, lubrication and lubricant.

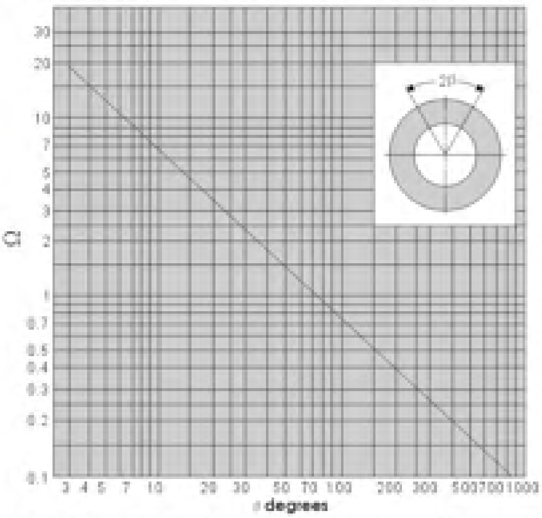



Fig. 7.3 Relationship between half angle β and factor Ω

**Table 7.3 Critical angle**

| Number of rolling elements | Half critical angle βc |
|---|---|
| 10 | 10° |
| 25 | 4° |
| 40 | 2.6° |

7.6 Life of bearing with linear motion

With a linear motion bearing such as a linear ball bearing or linear flat roller bearing, the relation among the axial travel distance, bearing load, and load rating is expressed by formulas (7.9).

When the rolling elements are rollers:

$$L = 100 \times \left(\frac{C_r}{P_r}\right)^{\frac{10}{3}} \quad \text{.....................(7.9)}$$

where,

L : Load rating km

$C_r$ : Basic dynamic load rating [kgf]

$P_r$ : Bearing load [kgf]

Fig. 7.4 summarizes the relation between $C_r/P_r$ and L.

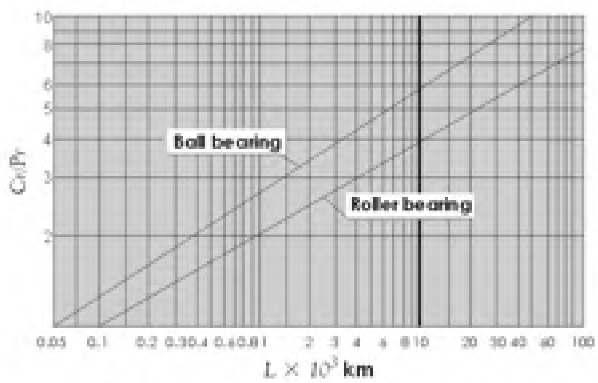



Fig. 6.4 Life of bearing with axial motion

If the cycle and travel distance within a particular travel motion remain constant, the rating life of the bearing can be determined by formulas (7.10) .

$L_h = \frac{50X10^3}{10 \cdot S}(\frac{C_r}{P_r})^{\frac{10}{3}}$ ................. Formula (7.10)

Where,
$L_h$ : Travel life, h
$S$ : Travel distance per minute, m/min.
$S = 2 \cdot L \cdot N$
$L$ : Stroke length, m
$n$ : Stroke cycle, N(kgf)

7.7 Basic static load rating
When stationary rolling bearings are subjected to static loads, they suffer from partial permanent deformation of the contact surfaces at the contact point between the rolling elements and the raceway. The amount of deformity increases as the load increases, and if this increase in load exceeds certain limits, the subsequent smooth operation of the bearings is impaired.

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

The basic rated static load 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 roller bearings 4,000 Mpa

7.8 Allowable static equivalent load
Generally the static equivalent load which can be permitted is limited by the basic static rated load as stated in Section 7.7. However, depending on requirements regarding friction and smooth operation, these limits may be greater or lesser than the basic static rated load.

In the following formula (7.11) and Table 6.4 the safety factor $S_o$ can be determined considering the maximum static equivalent load.

$S_o = C_o / P_o$ ...... Formula (7.11)

where,
$S_o$ : Safety factor
$C_o$ : Basic static rated load, $N$
(radial bearings: $C_{or}$, thrust bearings: $C_{oa}$ )
$P_{o\,max}$ : Maximum static equivalent load, $N$
(radial: $P_{or\,max}$, thrust: $C_{oa\,max}$)

**Table 7.4 Minimum safety factor values $S_0$**

| Operating conditions | Roller bearings |
|---|---|
| High rotational accuracy demand | 3.0 |
| Normal rotating accuracy demand (Universal application) | 1.5 |
| Slight rotational accuracy deterioration permitted (Low speed, heavy loading, etc.) | 1.0 |

Note 1 : For drawn-cup spherical roller bearings, min. $S_0$ value=3.
2 : When vibration and/or shock loads are present, a load factor based on the shock load needs to be included in the $P_0$ max value.

## 8. Bearing handling

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

## 9. Allowable speed

As bearing speed increases, the temperature of the bearing also increases due to friction heat generated in the bearing interior. If the temperature continues to rise and exceeds certain limits, the efficiency of the lubricant start to fail down drastically, and the bearing can no longercontinue to operate in a stable manner. Therefore, the maximum speed at which it is possible for the bearing to continuously operate without the generation of excessive heat beyond specified limits, is called the allowable speed ( r/min ). The allowable speed of a bearing depends on the type of bearing, bearing dimensions, type of cage, load, lubricating conditions, and cooling conditions.

The allowable speeds listed in the bearing tables for grease and oil lubrication are for standard NIKO bearings under normal operating conditions, correctly installed, using the suitable lubricants with adequate supply and proper maintenance. Moreover, these values are based on normal load conditions ($P \leqslant 0.09C$, $Fa/Fr \leqslant 0.3$).

For bearings to be used under heavier than normal load conditions, the allowable speed values listed in the bearing tables must be multiplied by an adjustment factor. The adjustment factors $f_L$ and $f_C$ are given in Figs. 9.1 and 9.2.

Also, when radial bearings are mounted on vertical shafts, lubricant retentions and cage guidance are not favorable compared to horizontal shaft mounting.

Therefore, the allowable speed should be reduced to approximately 80% of the listed speed.

It is possible to operate precision bearings with high speed specification cages at speeds higher than those listed in the bearing tables , if special precautions are taken. These precautions should include the use of forced oil circulation methods such as oil jet or oil mist lubrication.

Under such high speed operating conditions, when special care is taken, the standard allowable speeds given in the bearing tables can be adjusted upward. The maximum speed adjustment values, /B, by which the bearing table speeds can be multiplied, are shown in Table 9.1. However, for any application requiring speeds in excess of the standard allowable speed, please consult NIKO Engineering.

**Fig.9.1 Value of adjustment factor FL depends on bearing load**

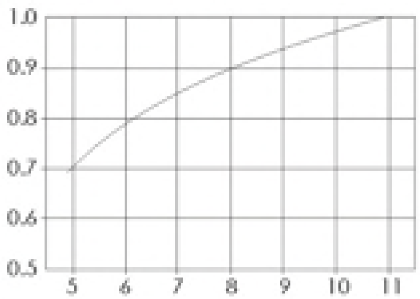



**Fig.9.2 Value of adjustment factor Fc depends on combined load**

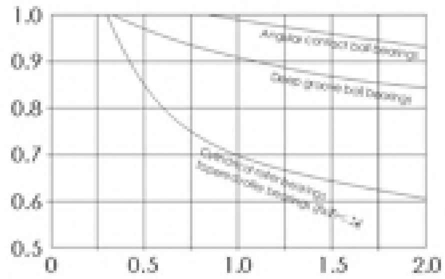


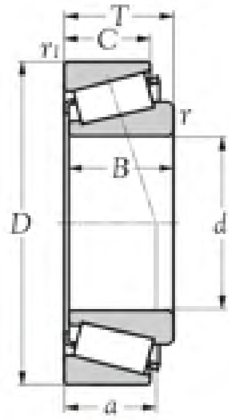

**Table 9.1 Adjustment factor, $f_B$, for allowable number of revolutions**

| Type of bearing | Adjustment factor $f_B$ |
|---|---|
| Deep groove ball bearings | 3.0 |
| Angular contact ball bearings | 2.0 |

# NOTE


# DIMENSION TABLES

## Taper Roller Bearing
## series 302



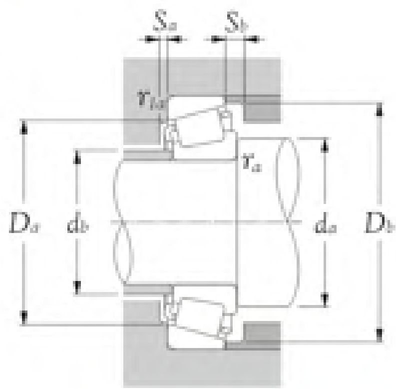

| Boundary dimensions mm | | | | | | | Basic load ratings dynamic N | static N | dynamic kgf | static kgf | Limiting speeds $min^{-1}$ | | Bearing numbers |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | D | T | B | C | $r_s$ min[1)] | $r_{1s}$ min[1)] | $C_r$ | $C_{or}$ | $C_r$ | $C_{or}$ | grease | oil | |
| 17 | 40 | 13.25 | 12 | 11 | 1.0 | 1.0 | 20,500 | 20,300 | 2,090 | 2,070 | 9,900 | 13,000 | 30203-A |
| 20 | 47 | 15.25 | 14 | 12 | 1.0 | 1.0 | 28,200 | 28,700 | 2,870 | 2,930 | 8,800 | 12,000 | 30204-A |
| 25 | 52 | 16.25 | 15 | 13 | 1.0 | 1.0 | 31,500 | 34,000 | 3,200 | 3,450 | 7,300 | 9,800 | 30205-A |
| 30 | 62 | 17.25 | 16 | 14 | 1.0 | 1.0 | 43,500 | 48,000 | 4,450 | 4,900 | 6,300 | 8,400 | 30206-A |
| 35 | 72 | 18.25 | 17 | 15 | 1.5 | 1.5 | 55,500 | 61,500 | 5,650 | 6,250 | 5,500 | 7,400 | 30207-A |
| 40 | 80 | 19.75 | 18 | 16 | 1.5 | 1.5 | 61,000 | 67,000 | 6,250 | 6,850 | 4,900 | 6,600 | 30208-A |
| 45 | 85 | 20.75 | 19 | 16 | 1.5 | 1.5 | 67,500 | 78,500 | 6,900 | 8,000 | 4,400 | 5,900 | 30209-A |
| 50 | 90 | 21.75 | 20 | 17 | 1.5 | 1.5 | 77,000 | 93,000 | 7,850 | 9,450 | 4,000 | 5,300 | 30210-A |
| 55 | 100 | 22.75 | 21 | 18 | 2.0 | 1.5 | 93,000 | 111,000 | 9,500 | 11,300 | 3,600 | 4,900 | 30211-A |
| 60 | 110 | 23.75 | 22 | 19 | 2.0 | 1.5 | 105,000 | 125,000 | 10,700 | 12,700 | 3,400 | 4,500 | 30212-A |
| 65 | 120 | 24.75 | 23 | 20 | 2.0 | 1.5 | 123,000 | 148,000 | 12,500 | 15,000 | 3,100 | 4,200 | 30213-A |
| 70 | 125 | 26.25 | 24 | 21 | 2.0 | 1.5 | 131,000 | 162,000 | 13,400 | 16,500 | 2,900 | 3,900 | 30214-A |
| 75 | 130 | 27.25 | 25 | 22 | 2.0 | 1.5 | 139,000 | 175,000 | 14,200 | 17,900 | 2,700 | 3,600 | 30215-A |
| 80 | 140 | 28.25 | 26 | 22 | 2.5 | 2.0 | 160,000 | 200,000 | 16,300 | 20,400 | 2,500 | 3,400 | 30216-A |
| 85 | 150 | 30.50 | 28 | 24 | 2.5 | 2.0 | 183,000 | 232,000 | 18,600 | 23,600 | 2,400 | 3,200 | 30217-A |
| 90 | 160 | 32.50 | 30 | 26 | 2.5 | 2.0 | 208,000 | 267,000 | 21,200 | 27,200 | 2,200 | 3,000 | 30218-A |
| 95 | 170 | 34.50 | 32 | 27 | 3.0 | 2.5 | 226,000 | 290,000 | 23,000 | 29,600 | 2,100 | 2,800 | 30219-A |
| 100 | 180 | 37.00 | 34 | 29 | 3.0 | 2.5 | 258,000 | 335,000 | 26,300 | 34,500 | 2,000 | 2,700 | 30220-A |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | Class 0 (JIS) | Nil |
| Polymid - | X | | |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## TAPER ROLLER BEARING
## SERIES 302




**Equivalent radial load dynamic**

$P_r = XF_r + YF_a$

| $\frac{F_a}{F_r} \leq e$ | | $\frac{F_a}{F_r} > e$ | |
|---|---|---|---|
| X | Y | X | Y |
| 1 | 0 | 0.4 | $Y_2$ |

**Static**

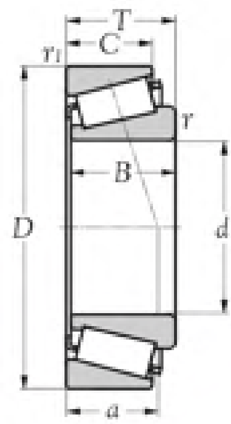
$P_r = 0.5F_r + Y_0F_a$

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

**For values of** $e, Y2$ **and** $Y_0$ **see the tabla below.**

| Abutment and fillet dimensions mm | | | | | | | | | Load center mm | Constant | Axial load factors | | Mass kg(s). |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $d_a$ min | $d_b$ max | $D_a$ max | $D_a$ min | $D_b$ min | $S_a$ min | $S_b$ min | $r_{as}$ max | $r_{bs}$ max | $a$ | $e$ | $Y_2$ | $Y_0$ | (approx.) |
| 22.5 | 23 | 34.5 | 33 | 37 | 2 | 2.0 | 1.0 | 1.0 | 9.5 | 0.35 | 1.74 | 0.96 | 0.080 |
| 25.5 | 27 | 41.5 | 40 | 44 | 2 | 3.0 | 1.0 | 1.0 | 11.5 | 0.35 | 1.74 | 0.96 | 0.127 |
| 30.5 | 31 | 46.5 | 44 | 48 | 2 | 3.0 | 1.0 | 1.0 | 12.5 | 0.37 | 1.60 | 0.88 | 0.154 |
| 35.5 | 37 | 56.5 | 53 | 57 | 2 | 3.0 | 1.0 | 1.0 | 13.5 | 0.37 | 1.60 | 0.88 | 0.241 |
| 43.5 | 44 | 63.5 | 62 | 67 | 3 | 3.0 | 1.5 | 1.5 | 15.0 | 0.37 | 1.60 | 0.88 | 0.344 |
| 48.5 | 49 | 71.5 | 69 | 75 | 3 | 3.5 | 1.5 | 1.5 | 16.5 | 0.37 | 1.60 | 0.88 | 0.435 |
| 53.5 | 54 | 76.5 | 74 | 80 | 3 | 4.5 | 1.5 | 1.5 | 18.0 | 0.40 | 1.48 | 0.81 | 0.495 |
| 58.5 | 58 | 81.5 | 79 | 85 | 3 | 4.5 | 1.5 | 1.5 | 19.5 | 0.42 | 1.43 | 0.79 | 0.563 |
| 65.0 | 64 | 91.5 | 88 | 94 | 4 | 4.5 | 2.0 | 1.5 | 21.0 | 0.40 | 1.48 | 0.81 | 0.740 |
| 70.0 | 70 | 101.5 | 96 | 103 | 4 | 4.5 | 2.0 | 1.5 | 22.0 | 0.40 | 1.48 | 0.81 | 0.949 |
| 75.0 | 77 | 111.5 | 106 | 113 | 4 | 4.5 | 2.0 | 1.5 | 23.5 | 0.40 | 1.48 | 0.81 | 1.180 |
| 80.0 | 81 | 116.5 | 110 | 118 | 4 | 5.0 | 2.0 | 1.5 | 25.5 | 0.42 | 1.43 | 0.79 | 1.260 |
| 85.0 | 85 | 121.5 | 115 | 124 | 4 | 5.0 | 2.0 | 1.5 | 27.0 | 0.44 | 1.38 | 0.76 | 1.410 |
| 92.0 | 91 | 130.0 | 124 | 132 | 4 | 6.0 | 2.0 | 2.0 | 27.5 | 0.42 | 1.43 | 0.79 | 1.720 |
| 97.0 | 97 | 140.0 | 132 | 141 | 5 | 6.5 | 2.0 | 2.0 | 30.0 | 0.42 | 1.43 | 0.79 | 2.140 |
| 102.0 | 103 | 150.0 | 140 | 150 | 5 | 6.5 | 2.0 | 2.0 | 32.0 | 0.42 | 1.43 | 0.79 | 2.660 |
| 109.0 | 110 | 158.0 | 149 | 159 | 5 | 7.5 | 2.5 | 2.0 | 34.0 | 0.42 | 1.43 | 0.79 | 3.070 |
| 114.0 | 116 | 168.0 | 157 | 168 | 5 | 8.0 | 2.5 | 2.0 | 36.0 | 0.42 | 1.43 | 0.79 | 3.780 |

## Taper Roller Bearing
### series 303



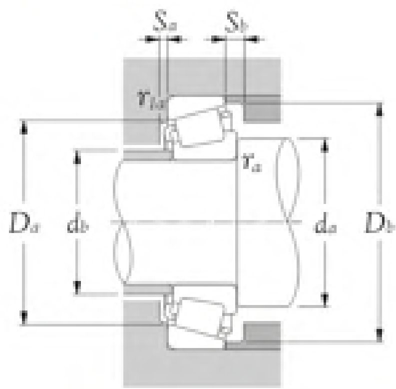

| Boundary dimensions mm | | | | | | | Basic load ratings dynamic N | static N | dynamic kgf | static kgf | Limiting speeds min$^{-1}$ | | Bearing numbers |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | D | T | B | C | $r_{1s}$ min[1] | $r_{2s}$ min[1] | Cr | Cor | Cr | Cor | grease | oil | |
| 17 | 47 | 15.25 | 14 | 12 | 1.0 | 1.0 | 28,900 | 26,300 | 2,940 | 2,680 | 9,000 | 12,000 | 30303 |
| 20 | 52 | 16.25 | 16 | 13 | 1.5 | 1.5 | 35,500 | 34,000 | 3,600 | 3,450 | 8,000 | 11,000 | 30304 |
| 25 | 62 | 18.25 | 17 | 15 | 1.5 | 1.5 | 48,500 | 47,500 | 4,950 | 4,850 | 6,700 | 8,900 | 30305 |
| 30 | 72 | 20.75 | 19 | 16 | 1.5 | 1.5 | 60,000 | 61,000 | 6,100 | 6,200 | 5,700 | 7,600 | 30306 |
| 35 | 80 | 22.75 | 21 | 18 | 2.0 | 1.5 | 75,000 | 77,000 | 7,650 | 7,900 | 5,000 | 6,600 | 30307 |
| 40 | 90 | 25.25 | 23 | 20 | 2.0 | 1.5 | 91,500 | 102,000 | 9,350 | 10,400 | 4,400 | 5,900 | 30308 |
| 45 | 100 | 27.25 | 25 | 22 | 2.0 | 1.5 | 111,000 | 126,000 | 11,300 | 12,800 | 4,000 | 5,300 | 30309 |
| 50 | 110 | 29.25 | 27 | 23 | 2.5 | 2.0 | 133,000 | 152,000 | 13,500 | 15,500 | 3,600 | 4,800 | 30310 |
| 55 | 120 | 31.50 | 29 | 25 | 2.5 | 2.0 | 155,000 | 179,000 | 15,800 | 18,300 | 3,300 | 4,400 | 30311 |
| 60 | 130 | 33.50 | 31 | 26 | 3.0 | 2.5 | 180,000 | 210,000 | 18,300 | 21,400 | 3,000 | 4,000 | 30312 |
| 65 | 140 | 36.00 | 33 | 28 | 3.0 | 2.5 | 203,000 | 238,000 | 20,700 | 24,300 | 2,800 | 3,700 | 30313 |
| 70 | 150 | 38.00 | 35 | 30 | 3.0 | 2.5 | 230,000 | 272,000 | 23,400 | 27,800 | 2,600 | 3,500 | 30314 |
| 75 | 160 | 40.00 | 37 | 31 | 3.0 | 2.5 | 255,000 | 305,000 | 26,000 | 31,000 | 2,400 | 3,200 | 30315 |
| 80 | 170 | 42.50 | 39 | 33 | 3.0 | 2.5 | 291,000 | 350,000 | 29,700 | 36,000 | 2,300 | 3,000 | 30316 |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | Class 0 (JIS) | Nil |
| Polymid - | X | | |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## Taper Roller Bearing
## series 303




**Equivalent radial load dynamic**

$P_r = XF_r + YF_a$

| $\frac{F_a}{F_r} \leq e$ | | $\frac{F_a}{F_r} > e$ | |
|---|---|---|---|
| X | Y | X | Y |
| 1 | 0 | 0.4 | $Y_2$ |

**Static**

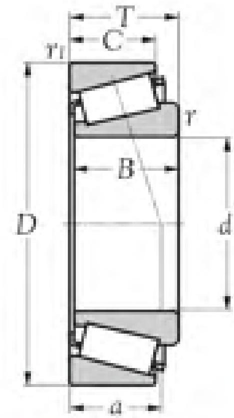
$P_r = 0.5F_r + Y_0F_a$

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

**For values of** $e, Y_2$ **and** $Y_0$ **see the tabla below.**

| Abutment and fillet dimensions mm | | | | | | | | | Load center mm | Constant | Axial load factors | | Mass kg(s). |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $d_a$ min | $d_b$ max | $D_a$ max | $D_a$ min | $D_b$ min | $S_a$ min | $S_b$ min | $r_{as}$ max | $r_{1as}$ max | $a$ | $e$ | $Y_2$ | $Y_0$ | (approx.) |
| 22.5 | 24.0 | 41.5 | 40.0 | 42.0 | 3 | 3.5 | 1.0 | 1.0 | 10.5 | 0.29 | 2.11 | 1.16 | 0.134 |
| 28.5 | 28.0 | 43.5 | 42.5 | 47.5 | 3 | 3.0 | 1.5 | 1.5 | 10.5 | 0.30 | 2.00 | 1.10 | 0.176 |
| 33.5 | 34.0 | 53.5 | 52.0 | 57.0 | 3 | 3.0 | 1.5 | 1.5 | 13.0 | 0.30 | 2.00 | 1.10 | 0.272 |
| 38.5 | 40.0 | 63.5 | 62.0 | 66.0 | 3 | 4.5 | 1.5 | 1.5 | 15.0 | 0.31 | 1.90 | 1.05 | 0.408 |
| 45.0 | 45.0 | 71.5 | 70.0 | 74.0 | 3 | 4.5 | 2.0 | 1.5 | 17.0 | 0.31 | 1.90 | 1.05 | 0.540 |
| 50.0 | 52.0 | 81.5 | 77.0 | 82.0 | 3 | 5.0 | 2.0 | 1.5 | 19.5 | 0.35 | 1.74 | 0.96 | 0.769 |
| 55.0 | 59.0 | 91.5 | 86.0 | 93.0 | 3 | 5.0 | 2.0 | 1.5 | 21.0 | 0.35 | 1.74 | 0.96 | 1.010 |
| 62.0 | 65.0 | 100.0 | 95.0 | 102.0 | 3 | 6.0 | 2.0 | 2.0 | 23.0 | 0.35 | 1.74 | 0.96 | 1.310 |
| 67.0 | 71.0 | 110.0 | 104.0 | 111.0 | 4 | 6.5 | 2.0 | 2.0 | 24.5 | 0.35 | 1.74 | 0.96 | 1.660 |
| 74.0 | 77.0 | 118.0 | 112.0 | 120.0 | 4 | 7.5 | 2.5 | 2.0 | 26.5 | 0.35 | 1.74 | 0.96 | 2.060 |
| 79.0 | 83.0 | 128.0 | 122.0 | 130.0 | 4 | 8.0 | 2.5 | 2.0 | 28.5 | 0.35 | 1.74 | 0.96 | 2.550 |
| 84.0 | 89.0 | 138.0 | 130.0 | 140.0 | 4 | 8.0 | 2.5 | 2.0 | 30.0 | 0.35 | 1.74 | 0.96 | 3.060 |
| 89.0 | 95.0 | 148.0 | 139.0 | 149.0 | 4 | 9.0 | 2.5 | 2.0 | 32.0 | 0.35 | 1.74 | 0.96 | 3.570 |
| 94.0 | 102.0 | 158.0 | 148.0 | 159.0 | 4 | 9.5 | 2.5 | 2.0 | 34.0 | 0.35 | 1.74 | 0.96 | 4.410 |

## Taper Roller Bearing
## series 320




| Boundary dimensions mm | | | | | | | Basic load ratings dynamic N | static N | dynamic kgf | static kgf | Limiting speeds $min^{-1}$ | | Bearing numbers |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | D | T | B | C | $r_s$ min[1] | $r_{1s}$ min[1] | $C_r$ | $C_{or}$ | $C_r$ | $C_{or}$ | grease | oil | |
| 20 | 42 | 15 | 15 | 12.0 | 0.6 | 0.6 | 24,900 | 27,900 | 2,540 | 2,840 | 9,500 | 13,000 | **32004 X** |
| 22 | 44 | 15 | 15 | 11.5 | 0.6 | 0.6 | 27,000 | 31,500 | 2,760 | 3,250 | 8,900 | 12,000 | **320/22 X** |
| 25 | 47 | 15 | 15 | 11.5 | 0.6 | 0.6 | 27,800 | 33,500 | 2,830 | 3,450 | 7,900 | 11,000 | **32005 X** |
| 28 | 52 | 16 | 16 | 12.0 | 1.0 | 1.0 | 33,000 | 40,500 | 3,400 | 4,150 | 7,300 | 9,700 | **320/28 X** |
| 30 | 55 | 17 | 17 | 13.0 | 1.0 | 1.0 | 37,500 | 46,000 | 3,800 | 4,700 | 6,900 | 9,200 | **32006 X** |
| 32 | 58 | 17 | 17 | 13.0 | 1.0 | 1.0 | 37,000 | 46,500 | 3,750 | 4,750 | 6,600 | 8,700 | **320/32 X** |
| 35 | 62 | 18 | 18 | 14.0 | 1.0 | 1.0 | 41,500 | 52,500 | 4,250 | 5,350 | 6,100 | 8,100 | **32007 X** |
| 40 | 68 | 19 | 19 | 14.5 | 1.0 | 1.0 | 50,000 | 65,500 | 5,100 | 6,650 | 5,300 | 7,100 | **32008 X** |
| 45 | 75 | 20 | 20 | 15.5 | 1.0 | 1.0 | 57,500 | 76,500 | 5,850 | 7,800 | 4,800 | 6,400 | **32009 X** |
| 50 | 80 | 20 | 20 | 15.5 | 1.0 | 1.0 | 62,500 | 88,000 | 6,400 | 9,000 | 4,400 | 5,800 | **32010 X** |
| 55 | 90 | 23 | 23 | 17.5 | 1.5 | 1.5 | 80,500 | 118,000 | 8,200 | 12,000 | 4,000 | 5,400 | **32011 X** |
| 60 | 95 | 23 | 23 | 17.5 | 1.5 | 1.5 | 82,000 | 123,000 | 8,350 | 12,500 | 3,700 | 4,900 | **32012 X** |
| 65 | 100 | 23 | 23 | 17.5 | 1.5 | 1.5 | 83,000 | 128,000 | 8,450 | 13,000 | 3,400 | 4,600 | **32013 X** |
| 70 | 110 | 25 | 25 | 19.0 | 1.5 | 1.5 | 105,000 | 160,000 | 10,700 | 16,400 | 3,200 | 4,200 | **32014 X** |
| 75 | 115 | 25 | 25 | 19.0 | 1.5 | 1.5 | 106,000 | 167,000 | 10,800 | 17,000 | 3,000 | 4,000 | **32015 X** |
| 80 | 125 | 29 | 29 | 22.0 | 1.5 | 1.5 | 139,000 | 216,000 | 14,200 | 22,000 | 2,800 | 3,700 | **32016 X** |
| 85 | 130 | 29 | 29 | 22.0 | 1.5 | 1.5 | 142,000 | 224,000 | 14,400 | 22,900 | 2,600 | 3,500 | **32017 X** |
| 90 | 140 | 32 | 32 | 24.0 | 2.0 | 1.5 | 168,000 | 270,000 | 17,200 | 27,600 | 2,500 | 3,300 | **32018 X** |
| 95 | 145 | 32 | 32 | 24.0 | 2.0 | 1.5 | 171,000 | 280,000 | 17,500 | 28,600 | 2,300 | 3,100 | **32019 X** |
| 100 | 150 | 32 | 32 | 24.0 | 2.0 | 1.5 | 170,000 | 281,000 | 17,300 | 28,600 | 2,200 | 3,000 | **32020 X** |
| 105 | 160 | 35 | 35 | 26.0 | 2.5 | 2.0 | 201,000 | 335,000 | 20,500 | 34,000 | 2,100 | 2,800 | **32021 X** |
| 110 | 170 | 38 | 38 | 29.0 | 2.5 | 2.0 | 236,000 | 390,000 | 24,000 | 39,500 | 2,000 | 2,700 | **32022 X** |
| 120 | 180 | 38 | 38 | 29.0 | 2.5 | 2.0 | 245,000 | 420,000 | 25,000 | 43,000 | 1,800 | 2,500 | **32024 X** |

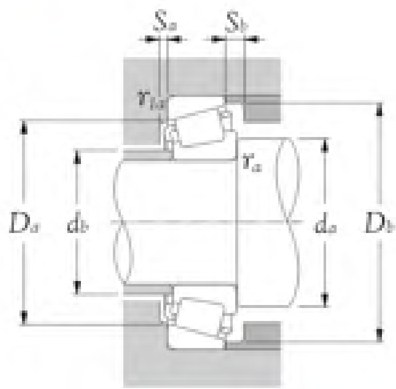
**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | ✓ | | |
| Polymid - | X | Class 0 (JIS) | Nil |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

# TAPER ROLLER BEARING

## SERIES 320




**Equivalent radial load**
**dynamic**

$P_r = XF_r + YF_a$

| $\frac{F_a}{F_r} \leq e$ | | $\frac{F_a}{F_r} > e$ | |
|---|---|---|---|
| X | Y | X | Y |
| 1 | 0 | 0.4 | $Y_2$ |

**Static**

$P_r = 0.5F_r + Y_0F_a$

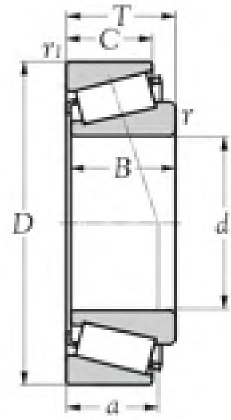
**When** $P_{or} < F_r$ **use** $P_{or} = F_r$

**For values of** $e$, $Y_2$ **and** $Y_0$ **see the tabla below.**

| Abutment and fillet dimensions mm | | | | | | | | | Load center mm | Constant | Axial load factors | | Mass kg(s). |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $d_a$ min | $d_b$ max | $D_a$ max | $D_a$ min | $D_b$ min | $S_a$ min | $S_b$ min | $r_{as}$ max | $r_{bs}$ max | $a$ | $e$ | $Y_2$ | $Y_0$ | (approx.) |
| 24.5 | 25 | 37.5 | 36 | 39 | 3 | 3.0 | 0.6 | 0.6 | 10.5 | 0.37 | 1.60 | 0.88 | 0.097 |
| 26.5 | 27 | 39.5 | 38 | 41 | 3 | 3.5 | 0.6 | 0.6 | 11.0 | 0.40 | 1.51 | 0.83 | 0.106 |
| 29.5 | 30 | 42.5 | 40 | 44 | 3 | 3.5 | 0.6 | 0.6 | 12.0 | 0.43 | 1.39 | 0.77 | 0.114 |
| 33.5 | 33 | 46.5 | 45 | 49 | 3 | 4.0 | 1.0 | 1.0 | 12.5 | 0.43 | 1.39 | 0.77 | 0.146 |
| 35.5 | 35 | 49.5 | 48 | 52 | 3 | 4.0 | 1.0 | 1.0 | 13.5 | 0.43 | 1.39 | 0.77 | 0.166 |
| 37.5 | 38 | 52.5 | 50 | 55 | 3 | 4.0 | 1.0 | 1.0 | 14.5 | 0.45 | 1.32 | 0.73 | 0.181 |
| 40.5 | 40 | 56.5 | 54 | 59 | 4 | 4.0 | 1.0 | 1.0 | 15.5 | 0.45 | 1.32 | 0.73 | 0.224 |
| 45.5 | 46 | 62.5 | 60 | 65 | 4 | 4.5 | 1.0 | 1.0 | 15.0 | 0.38 | 1.58 | 0.87 | 0.273 |
| 50.5 | 51 | 69.5 | 67 | 72 | 4 | 4.5 | 1.0 | 1.0 | 16.5 | 0.39 | 1.53 | 0.84 | 0.346 |
| 55.5 | 56 | 74.5 | 72 | 77 | 4 | 4.5 | 1.0 | 1.0 | 17.5 | 0.42 | 1.42 | 0.78 | 0.366 |
| 63.5 | 63 | 81.5 | 81 | 86 | 4 | 5.5 | 1.5 | 1.5 | 20.0 | 0.41 | 1.48 | 0.81 | 0.563 |
| 68.5 | 67 | 86.5 | 85 | 91 | 4 | 5.5 | 1.5 | 1.5 | 21.0 | 0.43 | 1.39 | 0.77 | 0.576 |
| 73.5 | 72 | 91.5 | 90 | 97 | 4 | 5.5 | 1.5 | 1.5 | 22.5 | 0.46 | 1.31 | 0.72 | 0.630 |
| 78.5 | 78 | 101.5 | 98 | 105 | 5 | 6.0 | 1.5 | 1.5 | 24.0 | 0.43 | 1.38 | 0.76 | 0.848 |
| 83.5 | 83 | 106.5 | 103 | 110 | 5 | 6.0 | 1.5 | 1.5 | 25.5 | 0.46 | 1.31 | 0.72 | 0.909 |
| 88.5 | 89 | 116.5 | 112 | 120 | 6 | 7.0 | 1.5 | 1.5 | 27.0 | 0.42 | 1.42 | 0.78 | 1.280 |
| 93.5 | 94 | 121.5 | 117 | 125 | 6 | 7.0 | 1.5 | 1.5 | 28.5 | 0.44 | 1.36 | 0.75 | 1.350 |
| 100.0 | 100 | 131.5 | 125 | 134 | 6 | 8.0 | 2.0 | 1.5 | 30.0 | 0.42 | 1.42 | 0.78 | 1.790 |
| 105.0 | 105 | 136.5 | 130 | 140 | 6 | 8.0 | 2.0 | 1.5 | 31.5 | 0.44 | 1.36 | 0.75 | 1.830 |
| 110.0 | 109 | 141.5 | 134 | 144 | 6 | 8.0 | 2.0 | 1.5 | 32.5 | 0.46 | 1.31 | 0.72 | 1.910 |
| 117.0 | 116 | 150.0 | 143 | 154 | 6 | 9.0 | 2.0 | 2.0 | 34.5 | 0.44 | 1.35 | 0.74 | 2.420 |
| 122.0 | 122 | 160.0 | 152 | 163 | 7 | 9.0 | 2.0 | 2.0 | 36.5 | 0.43 | 1.39 | 0.77 | 3.070 |
| 132.0 | 131 | 170.0 | 161 | 173 | 7 | 9.0 | 2.0 | 2.0 | 39.0 | 0.46 | 1.31 | 0.72 | 3.250 |

# Taper Roller Bearing

## series 322



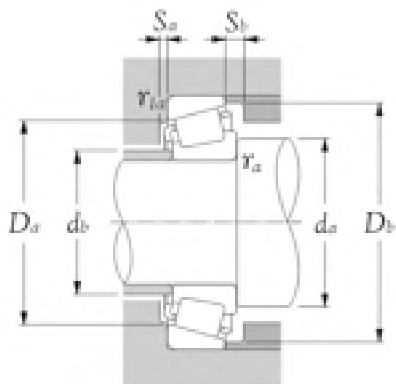

| Boundary dimensions mm | | | | | | | Basic load ratings dynamic N | static N | dynamic kgf | static kgf | Limiting speeds min⁻¹ | | Bearing numbers |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | D | T | B | C | $r_{s\,min}$[1] | $r_{1s\,min}$[1] | $C_r$ | $C_{or}$ | $C_r$ | $C_{or}$ | grease | oil | |
| 25 | 52 | 19.25 | 18 | 16 | 1.0 | 1.0 | 42,000 | 47,000 | 4,300 | 4,800 | 7,300 | 9,800 | 32205-A |
| 30 | 62 | 21.25 | 20 | 17 | 1.0 | 1.0 | 54,500 | 64,000 | 5,600 | 6,550 | 6,300 | 8,400 | 32206-A |
| 35 | 72 | 24.25 | 23 | 19 | 1.5 | 1.5 | 72,500 | 87,000 | 7,400 | 8,900 | 5,500 | 7,400 | 32207-A |
| 40 | 80 | 24.75 | 23 | 19 | 1.5 | 1.5 | 79,500 | 93,500 | 8,100 | 9,550 | 4,900 | 6,600 | 32208-A |
| 45 | 85 | 24.75 | 23 | 19 | 1.5 | 1.5 | 82,000 | 100,000 | 8,350 | 10,200 | 4,400 | 5,900 | 32209-A |
| 50 | 90 | 24.75 | 23 | 19 | 1.5 | 1.5 | 87,500 | 109,000 | 8,900 | 11,100 | 4,000 | 5,300 | 32210-A |
| 55 | 100 | 26.75 | 25 | 21 | 2.0 | 1.5 | 108,000 | 134,000 | 11,000 | 13,700 | 3,600 | 4,900 | 32211-A |
| 60 | 110 | 29.75 | 28 | 24 | 2.0 | 1.5 | 130,000 | 164,000 | 13,200 | 16,800 | 3,400 | 4,500 | 32212-A |
| 65 | 120 | 32.75 | 31 | 27 | 2.0 | 1.5 | 159,000 | 206,000 | 16,200 | 21,000 | 3,100 | 4,200 | 32213-A |
| 70 | 125 | 33.25 | 31 | 27 | 2.0 | 1.5 | 166,000 | 220,000 | 16,900 | 22,400 | 2,900 | 3,900 | 32214-A |
| 75 | 130 | 33.25 | 31 | 27 | 2.0 | 1.5 | 168,000 | 224,000 | 17,100 | 22,800 | 2,700 | 3,600 | 32215-A |
| 80 | 140 | 35.25 | 33 | 28 | 2.5 | 2.0 | 199,000 | 265,000 | 20,300 | 27,000 | 2,500 | 3,400 | 32216-A |
| 85 | 150 | 38.50 | 36 | 30 | 2.5 | 2.0 | 224,000 | 300,000 | 22,900 | 30,500 | 2,400 | 3,200 | 32217-A |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | Class 0 (JIS) | Nil |
| Polymid - | X | | |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## Taper Roller Bearing
## series 322



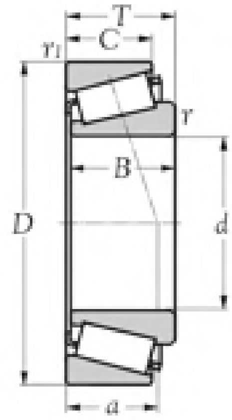

**Equivalent radial load dynamic**
$P_r = XF_r + YF_a$

| $\frac{F_a}{F_r} \leq e$ | | $\frac{F_a}{F_r} > e$ | |
|---|---|---|---|
| X | Y | X | Y |
| 1 | 0 | 0.4 | $Y_2$ |

**Static**
$P_r = 0.5F_r + Y_0F_a$
**When** $P_{or} < F_r$ **use** $P_{or} = F_r$
**For values of** $e$, $Y_2$ **and** $Y_0$ **see the tabla below.**

| Abutment and fillet dimensions mm | | | | | | | | | Load center mm | Constant | Axial load factors | | Mass kg(s). |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $d_a$ min | $d_b$ max | $D_a$ max | $D_a$ min | $D_b$ min | $S_a$ min | $S_b$ min | $r_{as}$ max | $r_{bs}$ max | $a$ | $e$ | $Y_2$ | $Y_0$ | (approx.) |
| 30.5 | 31 | 46.5 | 43 | 49.5 | 2.0 | 4.0 | 1.0 | 1.0 | 14.0 | 0.36 | 1.67 | 0.92 | 0.187 |
| 35.5 | 37 | 56.5 | 52 | 58.0 | 2.5 | 4.0 | 1.0 | 1.0 | 15.5 | 0.37 | 1.60 | 0.88 | 0.301 |
| 43.5 | 43 | 63.5 | 61 | 67.0 | 3.0 | 5.0 | 1.5 | 1.5 | 17.5 | 0.37 | 1.60 | 0.88 | 0.457 |
| 48.5 | 48 | 71.5 | 68 | 75.0 | 3.0 | 5.5 | 1.5 | 1.5 | 19.0 | 0.37 | 1.60 | 0.88 | 0.558 |
| 53.5 | 53 | 76.5 | 73 | 81.0 | 3.0 | 5.5 | 1.5 | 1.5 | 20.0 | 0.40 | 1.48 | 0.81 | 0.607 |
| 58.5 | 58 | 81.5 | 78 | 85.0 | 3.0 | 5.5 | 1.5 | 1.5 | 21.0 | 0.42 | 1.43 | 0.79 | 0.648 |
| 65.0 | 63 | 91.5 | 87 | 95.0 | 4.0 | 5.5 | 2.0 | 1.5 | 22.5 | 0.40 | 1.48 | 0.81 | 0.876 |
| 70.0 | 69 | 101.5 | 95 | 104.0 | 4.0 | 5.5 | 2.0 | 1.5 | 25.0 | 0.40 | 1.48 | 0.81 | 1.180 |
| 75.0 | 75 | 111.5 | 104 | 115.0 | 4.0 | 5.5 | 2.0 | 1.5 | 27.0 | 0.40 | 1.48 | 0.81 | 1.580 |
| 80.0 | 80 | 116.5 | 108 | 119.0 | 4.0 | 6.0 | 2.0 | 1.5 | 28.5 | 0.42 | 1.43 | 0.79 | 1.680 |
| 85.0 | 85 | 121.5 | 114 | 125.0 | 4.0 | 6.0 | 2.0 | 1.5 | 30.0 | 0.44 | 1.38 | 0.76 | 1.740 |
| 92.0 | 90 | 130.0 | 122 | 134.0 | 4.0 | 7.0 | 2.0 | 2.0 | 31.0 | 0.42 | 1.43 | 0.79 | 2.180 |
| 97.0 | 96 | 140.0 | 130 | 142.0 | 5.0 | 8.5 | 2.0 | 2.0 | 33.5 | 0.42 | 1.43 | 0.79 | 2.750 |

## Taper Roller Bearing
## series 323



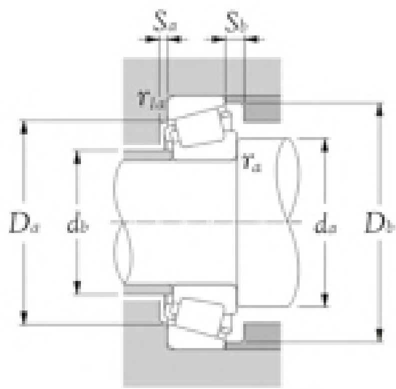

| Boundary dimensions mm | | | | | | | Basic load ratings dynamic N | static N | dynamic kgf | static kgf | Limiting speeds $min^{-1}$ | | Bearing numbers |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | D | T | B | C | $r_{s\,min}$[1] | $r_{1s\,min}$[1] | $C_r$ | $C_{or}$ | $C_r$ | $C_{or}$ | grease | oil | |
| 20 | 52 | 22.25 | 21 | 18 | 1.5 | 1.5 | 46,500 | 48,500 | 4,750 | 4,950 | 8,000 | 11,000 | **32304-A** |
| 25 | 62 | 25.25 | 24 | 20 | 1.5 | 1.5 | 61,500 | 64,500 | 6,250 | 6,600 | 6,700 | 8,900 | **32305-A** |
| 30 | 72 | 28.75 | 27 | 23 | 1.5 | 1.5 | 81,000 | 90,000 | 8,250 | 9,150 | 5,700 | 7,600 | **32306-A** |
| 35 | 80 | 32.75 | 31 | 25 | 2.0 | 1.5 | 101,000 | 115,000 | 10,300 | 11,700 | 5,000 | 6,600 | **32307-A** |
| 40 | 90 | 35.25 | 33 | 27 | 2.0 | 1.5 | 122,000 | 150,000 | 12,500 | 15,300 | 4,400 | 5,900 | **32308-A** |
| 45 | 100 | 38.25 | 36 | 30 | 2.0 | 1.5 | 154,000 | 191,000 | 15,700 | 19,500 | 4,000 | 5,300 | **32309-A** |
| 50 | 110 | 42.25 | 40 | 33 | 2.5 | 2.0 | 184,000 | 232,000 | 18,700 | 23,600 | 3,600 | 4,800 | **32310-A** |
| 55 | 120 | 45.50 | 43 | 35 | 2.5 | 2.0 | 215,000 | 275,000 | 21,900 | 28,000 | 3,300 | 4,400 | **32311-A** |
| 60 | 130 | 48.50 | 46 | 37 | 3.0 | 2.5 | 244,000 | 315,000 | 24,900 | 32,000 | 3,000 | 4,000 | **32312-A** |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | Class 0 (JIS) | Nil |
| Polymid - | X | | |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## TAPER ROLLER BEARING
## SERIES 323




**Equivalent radial load dynamic**

$P_r = XF_r + YF_a$

| $\frac{F_a}{F_r} \leq e$ | | $\frac{F_a}{F_r} > e$ | |
|---|---|---|---|
| X | Y | X | Y |
| 1 | 0 | 0.4 | $Y_2$ |

**Static**

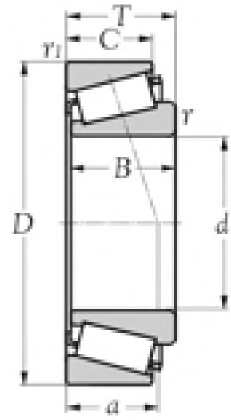
$P_r = 0.5F_r + Y_0F_a$

**When** $P_{0r} < F_r$ **use** $P_{0r} = F_r$

**For values of** $e, Y2$ **and** $Y_0$ **see the tabla below.**

| Abutment and fillet dimensions mm | | | | | | | | | Load center mm | Constant | Axial load factors | | Mass kg(s). |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $d_a$ min | $d_b$ max | $D_a$ max | $D_a$ min | $D_b$ min | $S_a$ min | $S_b$ min | $r_{as}$ max | $r_{bs}$ max | $a$ | $e$ | $Y_2$ | $Y_0$ | (approx.) |
| 28.5 | 27 | 43.5 | 43 | 47 | 3 | 4.0 | 1.5 | 1.5 | 14.0 | 0.30 | 2.00 | 1.10 | 0.245 |
| 33.5 | 32 | 53.5 | 52 | 57 | 3 | 5.0 | 1.5 | 1.5 | 16.0 | 0.30 | 2.00 | 1.10 | 0.381 |
| 38.5 | 38 | 63.5 | 59 | 66 | 3 | 5.5 | 1.5 | 1.5 | 18.5 | 0.31 | 1.90 | 1.05 | 0.583 |
| 45.0 | 43 | 71.5 | 66 | 74 | 3 | 7.5 | 2.0 | 1.5 | 20.5 | 0.31 | 1.90 | 1.05 | 0.787 |
| 50.0 | 50 | 81.5 | 73 | 82 | 3 | 8.0 | 2.0 | 1.5 | 23.0 | 0.35 | 1.74 | 0.96 | 1.080 |
| 55.0 | 56 | 91.5 | 82 | 93 | 3 | 8.0 | 2.0 | 1.5 | 25.5 | 0.35 | 1.74 | 0.96 | 1.460 |
| 62.0 | 62 | 100.0 | 90 | 102 | 3 | 9.0 | 2.0 | 2.0 | 28.5 | 0.35 | 1.74 | 0.96 | 1.920 |
| 67.0 | 68 | 110.0 | 99 | 111 | 4 | 10.5 | 2.0 | 2.0 | 30.5 | 0.35 | 1.74 | 0.96 | 2.440 |
| 74.0 | 74 | 118.0 | 107 | 120 | 4 | 11.5 | 2.5 | 2.0 | 32.0 | 0.35 | 1.74 | 0.96 | 3.020 |

## Taper Roller Bearing
## series 332



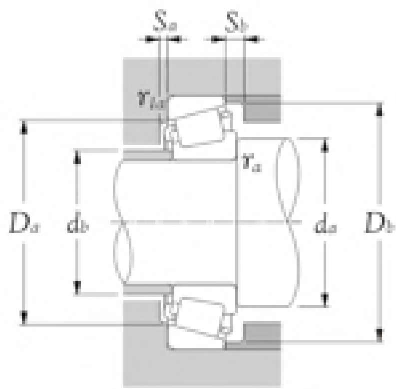

| Boundary dimensions mm | | | | | | | Basic load ratings dynamic N | static N | dynamic kgf | static kgf | Limiting speeds $min^{-1}$ | | Bearing numbers |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | D | T | B | C | $r_s$ min[1] | $r_{1s}$ min[1] | $C_r$ | $C_{or}$ | $C_r$ | $C_{or}$ | grease | oil | |
| 25 | 52 | 22 | 22 | 18.0 | 1.0 | 1.0 | 47,500 | 57,500 | 4,850 | 5,850 | 7,300 | 9,800 | **33205** |
| 30 | 62 | 25 | 25 | 19.5 | 1.0 | 1.0 | 65,000 | 77,000 | 6,600 | 7,850 | 6,300 | 8,400 | **33206** |
| 35 | 72 | 28 | 28 | 22.0 | 1.5 | 1.5 | 87,500 | 109,000 | 8,900 | 11,200 | 5,500 | 7,400 | **33207** |
| 40 | 80 | 32 | 32 | 25.0 | 1.5 | 1.5 | 103,000 | 132,000 | 10,500 | 13,400 | 4,900 | 6,600 | **33208** |
| 45 | 85 | 32 | 32 | 25.0 | 1.5 | 1.5 | 107,000 | 141,000 | 10,900 | 14,400 | 4,400 | 5,900 | **33209** |
| 50 | 90 | 32 | 32 | 24.5 | 1.5 | 1.5 | 115,000 | 158,000 | 11,700 | 16,100 | 4,000 | 5,300 | **33210** |
| 55 | 100 | 35 | 35 | 27.0 | 2.0 | 1.5 | 138,000 | 188,000 | 14,100 | 19,100 | 3,600 | 4,900 | **33211** |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | √ | Class 0 (JIS) | Nil |
| Polymid - | X | | |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire
NIKO web-site: Http://www.nipponkodobearings.com

# TAPER ROLLER BEARING
## SERIES 332




**Equivalent radial load**
**dynamic**

$P_r = XF_r + YF_a$

| $\frac{F_a}{F_r} \leq e$ | | $\frac{F_a}{F_r} > e$ | |
|---|---|---|---|
| X | Y | X | Y |
| 1 | 0 | 0.4 | $Y_2$ |

**Static**

$P_r = 0.5F_r + Y_0F_a$

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

**For values of** $e, Y_2$ **and** $Y_0$ **see the tabla below.**

| Abutment and fillet dimensions mm | | | | | | | | | Load center mm | Constant | Axial load factors | | Mass kg(s). |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $d_a$ min | $d_b$ max | $D_a$ max | $D_a$ min | $D_b$ min | $S_a$ min | $S_b$ min | $r_{as}$ max | $r_{bs}$ max | $a$ | $e$ | $Y_2$ | $Y_0$ | (approx.) |
| 30.5 | 30 | 46.5 | 43 | 49 | 4 | 4.0 | 1.0 | 1.0 | 14.0 | 0.35 | 1.71 | 0.94 | 0.217 |
| 35.5 | 36 | 56.5 | 53 | 59 | 5 | 5.5 | 1.0 | 1.0 | 16.0 | 0.34 | 1.76 | 0.97 | 0.344 |
| 43.5 | 42 | 63.5 | 61 | 68 | 5 | 6.0 | 1.5 | 1.5 | 18.5 | 0.35 | 1.70 | 0.93 | 0.531 |
| 48.5 | 47 | 71.5 | 67 | 76 | 5 | 7.0 | 1.5 | 1.5 | 21.0 | 0.36 | 1.68 | 0.92 | 0.728 |
| 53.5 | 52 | 76.5 | 72 | 81 | 5 | 7.0 | 1.5 | 1.5 | 22.0 | 0.39 | 1.56 | 0.86 | 0.783 |
| 58.5 | 57 | 81.5 | 77 | 87 | 5 | 7.5 | 1.5 | 1.5 | 23.5 | 0.41 | 1.45 | 0.80 | 0.852 |
| 65.0 | 62 | 91.5 | 85 | 96 | 6 | 8.0 | 2.0 | 1.5 | 25.5 | 0.40 | 1.50 | 0.83 | 1.150 |

## NOTE

# SPHERICAL ROLLER BEARINGS

# Technical Tables

## 1. Bearing materials

### 1.1 Raceway and rolling element materials

#### 1.1.1 High/mid carbon alloy steel
In general, steel varieties which can be hardened not just on the surface but also deep hardened by the so-called "through hardening method" are used for the raceways and rolling elements of bearings. Foremost among these is high carbon chromium bearing steel, which is widely used.

#### 1.1.2 Mid-carbon chromium steel
Mid-carbon chromium steel incorporating silicone and manganese, which gives it hardening properties comparable to high carbon chromium steel.

## 2. Cage

### 2.1 Cage materials
Bearing cage materials must have the strength to withstand rotational vibrations and shock loads. These materials must also have a low friction coefficient, be light weight, and be able to withstand bearing operation temperatures.

### 2.2 Pressed cages
For small and medium sized bearings, pressed cages of cold or hot rolled steel with a low carbon content of approx. 0.1% are used. However, depending on the application, austenitic stainless steel is also used.

### 2.3 Plastic cages
Injection molded plastic cages are now widely used: most are made from fiber glass reinforced heat resistant polyamide resin. Plastic cages are light weight, corrosion resistant and have excellent dampening and sliding properties. Heat resistant polyamide 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.

## 3. Bearing tolerances

### 3.1 Standard of tolerances
Taper roller bearings "tolerances" or dimensional accuracy and running accuracy, are regulated by ISO and JIS standards (rolling bearing tolerances). For dimensional accuracy, these standards prescribe the tolerances necessary when installing bearings on shafts or in housings. Running accuracy is defined as the allowable limits for bearing runout during operation.

**Table 3.1 Bearings types and applicable tolerance**

| Bearing type | Applicable standard | Applicable tolerance class | Applicable table |
|---|---|---|---|
| Spherical roller bearing | JIS B 1514 (ISO 492)<br>(NIKO standard) | class 0 | Table 3.2 |

**Table 3.2 Tolerance for radial bearings**
**Table 3.2.1 Inner rings**

| Nominal bore diameter $d$ mm | | Single plane mean bore diameter deviation $\Delta_{dmp}$ | | | | | | | | Single radial plane bore diameter variation $V_{dp}$ | | | | Mean single plane bore diameter variation $V_{dmp}$ | | | | Inner ring radial runout $K_{ia}$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | class 0 | | class 6 | | class 5 | | class 4 ❶ | | class 0 | class 6 | class 5 | class 4 | class 0 | class 6 | class 5 | class 4 | class 0 | class 6 | class 5 | class 4 |
| over | incl. | high | low | high | low | high | low | high | low | max. | | | | max. | | | | max. | | | |
| 18 | 30 | 0 | -10 | 0 | -8 | 0 | -6 | 0 | -5 | 13 | 10 | 6 | 5 | 8 | 6 | 3 | 2.5 | 13 | 8 | 4 | 3.0 |
| 30 | 50 | 0 | -12 | 0 | -10 | 0 | -8 | 0 | -6 | 15 | 13 | 8 | 6 | 9 | 8 | 4 | 3.0 | 15 | 10 | 5 | 4.0 |
| 50 | 80 | 0 | -15 | 0 | -12 | 0 | -9 | 0 | -7 | 19 | 15 | 9 | 7 | 11 | 9 | 5 | 3.5 | 20 | 10 | 5 | 4.0 |
| 80 | 120 | 0 | -20 | 0 | -15 | 0 | -10 | 0 | -8 | 25 | 19 | 10 | 8 | 15 | 11 | 5 | 4.0 | 25 | 13 | 6 | 5.0 |
| 120 | 150 | 0 | -25 | 0 | -18 | 0 | -13 | 0 | -10 | 31 | 23 | 13 | 10 | 19 | 14 | 7 | 5.0 | 30 | 18 | 8 | 6.0 |
| 150 | 180 | 0 | -25 | 0 | -18 | 0 | -13 | 0 | -10 | 31 | 23 | 13 | 10 | 19 | 14 | 7 | 5.0 | 30 | 18 | 8 | 6.0 |
| 180 | 250 | 0 | -30 | 0 | -22 | 0 | -15 | 0 | -12 | 38 | 28 | 15 | 12 | 23 | 17 | 8 | 6.0 | 40 | 20 | 10 | 8.0 |
| 250 | 315 | 0 | -35 | 0 | -25 | 0 | -18 | — | — | 44 | 31 | 18 | — | 26 | 19 | 9 | — | 50 | 25 | 13 | — |
| 315 | 400 | 0 | -40 | 0 | -30 | 0 | -23 | — | — | 50 | 38 | 23 | — | 30 | 23 | 12 | — | 60 | 30 | 15 | — |

Note: ❶ The dimensional difference $\Delta_{ds}$ of the bore diameter to be applied for class 4 is the same as the tolerance of dimensional difference $\Delta_{dmp}$ of the average bore diameter

(Unit: μm)

| Nominal bore diameter $d$ mm | | Face runout with bore $S_d$ | | | Inner ring axial runout (with side) $S_{ia}$ | | | Inner ring width deviation $\Delta_{Bs}$ | | | | Inner ring width variation $V_{Bs}$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | class 0 | class 6 | class 5 | class 0 | class 6 | class 5 | class 0,6 | | class 5,4 | | class 0 | class 6 | class 5 | class 4 |
| over | incl. | max. | | | max. | | | high | low | high | low | max. | | | |
| 18 | 30 | 8 | 4 | 1.5 | 8 | 4 | 2.5 | 0 | -120 | 0 | -120 | 20 | 20 | 5 | 2.5 |
| 30 | 50 | 8 | 4 | 1.5 | 8 | 4 | 2.5 | 0 | -120 | 0 | -120 | 20 | 20 | 5 | 3.0 |
| 50 | 80 | 8 | 5 | 1.5 | 8 | 5 | 2.5 | 0 | -150 | 0 | -150 | 25 | 25 | 6 | 4.0 |
| 80 | 120 | 9 | 5 | 2.5 | 9 | 5 | 2.5 | 0 | -200 | 0 | -200 | 25 | 25 | 7 | 4.0 |
| 120 | 150 | 10 | 6 | 2.5 | 10 | 7 | 2.5 | 0 | -250 | 0 | -250 | 30 | 30 | 8 | 5.0 |
| 150 | 180 | 10 | 6 | 4.0 | 10 | 7 | 5.0 | 0 | -250 | 0 | -250 | 30 | 30 | 8 | 5.0 |
| 180 | 250 | 11 | 7 | 5.0 | 13 | 8 | 5.0 | 0 | -300 | 0 | -300 | 30 | 30 | 10 | 6.0 |
| 250 | 315 | 13 | — | — | 15 | — | — | 0 | -350 | 0 | -350 | 35 | 35 | 13 | — |
| 315 | 400 | 15 | — | — | 20 | — | — | 0 | -400 | 0 | -400 | 40 | 40 | 15 | — |

Note: $\Delta_{dmp}$: deviation of the mean bore diameter from the nominal ($\Delta_{dmp} = d_{mp} - d$).
$V_{dp}$: bore diameter variation; difference between the largest and smallest single bore diameters in one plane.
$V_{dmp}$: mean bore diameter variation; difference between the largest and smallest mean bore diameters of one ring or washer.
$K_{ia}$: radial runout of assembled bearing inner ring and assembled bearing outer ring, respectively.
$S_d$: side face runout with reference to bore (of inner ring).
$S_{ia}$: side face runout of assembled bearing inner ring and assembled bearing outer ring, respectively.
$\Delta_{Bs}$: deviation of single inner ring width or single outer ring width from the nominal ($\Delta_{Bs} = B_s - B$ etc.)
$V_{Bs}$: ring width variation; difference between the largest and smallest single widths of inner ring and of outer ring, respectively.

**Table 3.2.2 Outer rings**

| Nominal outside diameter $D$ mm | | Single plane mean outside diameter deviation $\Delta D_{mp}$ | | | | | | | | Single radial plane outside diameter variation $V_{Dp}$ | | | | Mean single plane outside diameter variation $V_{Dmp}$ | | | | Outer ring radial runout $K_{ea}$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | class 0 | | class 6 | | class 5 | | class 4❷ | | class 0 | class 6 | class 5 | class 4 | class 0 | class 6 | class 5 | class 4 | class 0 | class 6 | class 5 | class 4 |
| over | incl. | high | low | high | low | high | low | high | low | max. | | | | max. | | | | max. | | | |
| 50 | 80 | 0 | -13 | 0 | -11 | 0 | -9 | 0 | -7 | 16 | 14 | 9 | 7 | 10 | 8 | 5 | 3.5 | 25 | 13 | 8 | 5 |
| 80 | 120 | 0 | -15 | 0 | -13 | 0 | -10 | 0 | -8 | 19 | 16 | 10 | 8 | 11 | 10 | 5 | 4.0 | 35 | 18 | 10 | 6 |
| 120 | 150 | 0 | -18 | 0 | -15 | 0 | -11 | 0 | -9 | 23 | 19 | 11 | 9 | 14 | 11 | 6 | 5.0 | 40 | 20 | 11 | 7 |
| 150 | 180 | 0 | -25 | 0 | -18 | 0 | -13 | 0 | -10 | 31 | 23 | 13 | 10 | 19 | 14 | 7 | 5.0 | 45 | 23 | 13 | 8 |
| 180 | 250 | 0 | -30 | 0 | -20 | 0 | -15 | 0 | -11 | 38 | 25 | 15 | 11 | 23 | 15 | 8 | 6.0 | 50 | 25 | 15 | 10 |
| 250 | 315 | 0 | -35 | 0 | -25 | 0 | -18 | 0 | -13 | 44 | 31 | 18 | 13 | 26 | 19 | 9 | 7.0 | 60 | 30 | 18 | 11 |
| 315 | 400 | 0 | -40 | 0 | -28 | 0 | -20 | 0 | -15 | 50 | 35 | 20 | 15 | 30 | 21 | 10 | 8.0 | 70 | 35 | 20 | 13 |
| 400 | 500 | 0 | -45 | 0 | -33 | 0 | -23 | — | — | 56 | 41 | 23 | — | 34 | 25 | 12 | — | 80 | 40 | 23 | — |
| 500 | 630 | 0 | -50 | 0 | -38 | 0 | -28 | — | — | 63 | 48 | 28 | — | 38 | 29 | 14 | — | 100 | 50 | 25 | — |

Note: ❷ The dimensional difference $\Delta Ds$ of the outer diameter to be applied for class 4 is the same as the tolerance of dimensional difference $\Delta Dmp$ of the average outer diameter.

(Unit: μm)

| Nominal outside diameter $D$ mm | | Outside surface inclination $S_D$ | | Outside ring axial runout $S_{ea}$ | | Outer ring width deviation $\Delta C_s$ | Outer ring width variation $V_{Cs}$ | | |
|---|---|---|---|---|---|---|---|---|---|
| | | class 5 | class 4 | class 5 | class 4 | | class 0,6 | class 5 | class 4 |
| over | incl. | max. | | max. | | all type | max. | | |
| 50 | 80 | 8 | 4 | 10 | 5 | Identical to $\Delta B_s$ of inner ring of same bearing | Identical to $\Delta Bs$ and Vbs of inner ring of same bearing | 6 | 3.0 |
| 80 | 120 | 9 | 5 | 11 | 6 | | | 8 | 4.0 |
| 120 | 150 | 10 | 5 | 13 | 7 | | | 8 | 5.0 |
| 150 | 180 | 10 | 5 | 14 | 8 | | | 8 | 5.0 |
| 180 | 250 | 11 | 7 | 15 | 10 | | | 10 | 7.0 |
| 250 | 315 | 13 | 8 | 18 | 10 | | | 11 | 7.0 |
| 315 | 400 | 13 | 10 | 20 | 13 | | | 13 | 8.0 |
| 400 | 500 | 15 | — | 23 | — | | | 15 | — |
| 500 | 630 | 18 | — | 25 | — | | | 18 | — |

Note: $\Delta Dmp$: deviation of the mean outside diameter from the nominal ($\Delta Dmp = Dmp - D$).

$Vdp$: outside diameter variation: difference between the largest and smallest single outside diameters in one plane.

$Vdmp$: mean bore diameter variation: difference between the largest and smallest mean bore diameters of one ring or washer.

$K_{ea}$: radial runout of assembled bearing inner ring and assembled bearing outer ring, respectively.

$S_D$: side face runout with reference to bore (of inner ring).

$S_{ea}$: side face runout of assembled bearing inner ring and assembled bearing outer ring, respectively.

$\Delta Cs$: deviation of single inner ring width or single outer ring width from the nominal ($\Delta Bs = Bs - B$ etc.)

$V_{cs}$: ring width variation: difference between the largest and smallest single widths of inner ring and of outer ring, respectively.

## 4. Bearing fits

### 4.1 Interference

For rolling bearings, inner and outer rings are fixed on the shaft or in the housing so that relative movement does not occur between fitted surfaces during operation or under load. This relative movement (referred to as "creep") between the fitted surfaces of the bearing and the shaft or housing can occur in a radial direction, an axial direction, or in the direction of rotation. To help prevent this creeping movement, bearing rings and the shaft or housing are installed with one of three interference fits, a "tight fit" (also called shrink fit), "transition fit," or "loose fit" (also called clearance fit), and the degree of interference between their fitted surfaces varies.

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

### 4.2 The necessity of a proper fit

In some cases, improper fit may lead to damage and shorten bearing life, therefore it is necessary to make a careful analysis in selecting a proper fit. Some of the negative conditions caused by improper fit are listed below.

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

### 4.3 Fit selection

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

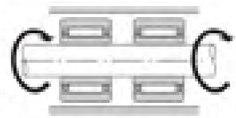
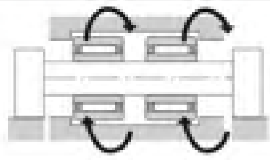
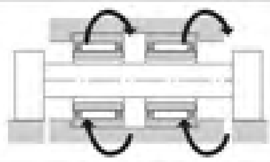
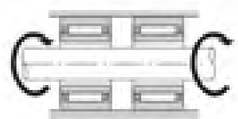
- Shaft and housing material, wall thickness, finished surface accuracy, etc.
- Machinery operating conditions ( nature and magnitude of load, rotational speed, temperature, etc. )

#### 4.3.1 "Tight fit," "transition fit," or "loose fit"

For raceways under rotating loads, a tight fit is necessary. (Refer to Table 4.1)
"Raceways under rotating loads" refers to raceways receiving loads rotating relative to their radial direction. For raceways under static loads, on the other hand, a loose fit is sufficient.
( Example ) Rotating inner ring load - the direction of the radial load on the inner ring is rotating relatively

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

**Table 4.1 Radial load and bearing**

| Illustration | Bearing rotation | | Ring load | Fit |
|---|---|---|---|---|
| Static load  |  | Inner ring: Rotating<br>Outer ring: Stationary | Rotating inner ring load | Inner ring: Tight fit |
| Imbalanced load  |  | Inner ring: Stationary<br>Outer ring: Rotating | Static outer ring load | Outer ring: Loose fit |
| Static load  |  | Inner ring: Stationary<br>Outer ring: Rotating | Static inner ring load | Inner ring: Loose fit |
| Imbalanced load  |  | Inner ring: Rotating<br>Outer ring: Stationary | Rotating outer ring load | Outer ring: Tight fit |

4.3.2 Recommended Fits

The system of limits and fits define the tolerances of the outside diameter of the shaft or the bore diameter of a housing ( the shaft or housing to which a metric bearing is installed). Bearing fit is governed by the selection of tolerances for the shaft outside diameter and housing bore diameter. Fig . 4.1 summarizes the interrelations between shaft outside diameter and bearing bore diameter, and between housing bore diameter and shaft outside diameter. Table 4.2 provides the recommended fits for common radial Spherical Roller Bearings (machined ring Spherical Roller Bearings with inner ring), relative to dimensions and loading conditions. Table 4.3 is a table of the numerical value of fits.

4.3.3 Interference minimum and maximum values

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

- In calculating the minimum required amount of interference keep in mind that:
  1) interference is reduced by radial loads
  2) interference is reduced by differences between bearing temperature and ambient temperature
- 3) interference is reduced by variation of fitted surfaces

Maximum interference should be no more than 1:1000 of the shaft diameter or outer diameter. Required interference calculations are shown below.

4.3.3.1 Fitted surface variation and required interference

Interference between fitted surfaces is reduced by roughness and other slight variations of these surfaces which are flattened in the fitting process. The degree of reduced interference depends upon the finish treatment of these surfaces, but in general it is necessary to assume the following interference reductions.

For ground shafts: 1.0 ~ 2.5 μm
For lathed shafts : 5.0 ~ 7.0 μm

4.3.3.2 Maximum interference

When bearing rings are installed with an interference fit, tension or compression stress may occur along their raceways. If interference is too great, this may cause damage to the rings and reduce bearing life . For these reasons , maximum interference should not exceed the previously mentioned ratio of 1:1,000 of the shaft or outside diameter.

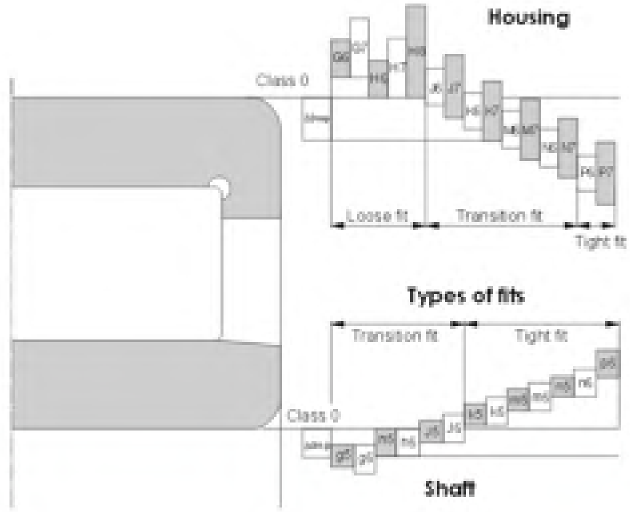



**Table 4.2 General standards for taper roller bearing fits**
**Table 4.2.1 Shaft fits**

| Nature of load | Fit | Load condition, magnitude | Shaft diameter mm over ~ incl | Tolerance class | Remarks |
|---|---|---|---|---|---|
| Indeterminate direction load Rotating inner ring load | Tight fit/ Transition fit | Light load ❶ | -<br>-<br>- | -<br>-<br>- | When greater accuracy is required m5 may be substituted for m6. |
| | | Normal load ❶ | ~ 40<br>40 ~ 65<br>65 ~ 100<br>100 ~ 140<br>140 ~ 280<br>280 ~ 500 | k5<br>m5<br>m6<br>n6<br>p6<br>r6 | |
| | | Heavy load ❶ or shock load | 50 ~ 100<br>100 ~ 140<br>140 ~ | n6<br>p6<br>r6 | When greater accuracy is required m5 may be substituted for m6. |
| Static inner ring load | Transition fit | Inner ring axial displacement possible | All shaft diameters | g6 | When greater accuracy is required use g5. For large bearings, f6 may be used. |
| | | Inner ring axial displacement unnecessary | | h6 | When greater accuracy is required use h5. |
| Centric axial load only | Transition fit | All loads | All shaft diameters | h9/IT5 | General: depending on the fit, shaft and inner rings are not fixed. |

❶ Standards for light loads, normal loads, and heavy loads
Light loads : equivalent radial load ≤ 0.06 $C_r$
Normal loads: 0.06 $C_r$ < equivalent radial load ≤ 0.12 $C_r$
Heavy loads : 0.12 $C_r$ < equivalent radial load

Note: All values and fits listed in the above tables are for solid steel shafts.

**Table 4.2.2 Housing fits (Housing of the drawn cup spherical roller bearings.)**

| Housing | Solid housing or split housing | | Split housing |
|---|---|---|---|
| Load condition, magnitude | Static outer load | All loads | H7 |
| | | with large temperature different | G7 |
| | Direction indeterminate load | Light to normal load | JS7 |
| Tolerance class | | Normal to heavy load | K7 |
| | | Heavy shock load | M7 |
| | Outer ring Rotating load | Light or variable load | M7 |
| | | Normal to heavy load | N7 |
| | | Heavy load (thin wall housing) or heavy shock load | P7 |

Note: All values add fits listed in the above tables are for cast iron or steel housings.
Select more tighten tolerance class for light weight alloy housings.

**Table 4.3 Numeric value table of fitting for radial bearing of class 0**

**Table 4.3.1 Fitting against shaft**

| Nominal bore diameter of bearing $d$ mm | | Single plane mean bore diameter deviation $\triangle dmp$ | | g5 | g6 | h5 | h6 | j5 | js5 | j6 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | bearing shaft | bearing shaft | bearing shaft | bearing shaft | bearing shaft | bearing shaft | bearing shaft |
| over | incl. | high | low | | | | | | | |
| 18 | 30 | 0 | -10 | 3T ~ 16L | 3T ~ 20L | 10T ~ 9L | 10T ~ 13L | 15T ~ 4L | 14.5T ~ 4.5L | 19T ~ 4L |
| 30 | 50 | 0 | -12 | 3T ~ 20L | 3T ~ 25L | 12T ~ 11L | 12T ~ 16L | 15T ~ 5L | 17.5T ~ 5.5L | 23T ~ 5L |
| 50 | 80 | 0 | -15 | 5T ~ 23L | 5T ~ 29L | 15T ~ 13L | 15T ~ 19L | 21T ~ 7L | 21.5T ~ 6.5L | 27T ~ 7L |
| 80 | 120 | 0 | -20 | 8T ~ 27L | 8T ~ 34L | 20T ~ 15L | 20T ~ 22L | 26T ~ 9L | 27.5T ~ 7.5L | 33T ~ 9L |
| 120 | 140 | | | | | | | | | |
| 140 | 160 | 0 | -25 | 11T ~ 32L | 11T ~ 39L | 25T ~ 18L | 25T ~ 25L | 32T ~ 11L | 34T ~ 9L | 39T ~ 11L |
| 160 | 180 | | | | | | | | | |
| 180 | 200 | | | | | | | | | |
| 200 | 225 | 0 | -30 | 15T ~ 35L | 15T ~ 44L | 30T ~ 20L | 30T ~ 29L | 37T ~ 13L | 40T ~ 10L | 46T ~ 13L |
| 225 | 250 | | | | | | | | | |
| 250 | 280 | | | | | | | | | |
| 280 | 315 | 0 | -35 | 18T ~ 40L | 18T ~ 49L | 35T ~ 23L | 35T ~ 32L | 42T ~ 16L | 46.5T ~ 11.5L | 51T ~ 16L |
| 315 | 355 | 0 | -40 | 22T ~ 43L | 22T ~ 54L | 40T ~ 25L | 40T ~ 36L | 47T ~ 18L | 52.5T ~ 12.5L | 58T ~ 18L |

**Table 4.3.2 FiTtting against housing**

| Nominal outside diameter of bearing $d$ mm | | Single plane mean outside diameter deviation $\triangle Dmp$ | | G7 | H6 | H7 | J6 | J7 | Js7 | K6 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | housing bearing | housing bearing | housing bearing | housing bearing | housing bearing | housing bearing | housing bearing |
| over | incl. | high | low | | | | | | | |
| 18 | 30 | 0 | -9 | 7L ~ 37L | 0 ~ 22L | 0 ~ 30L | 5T ~ 17L | 9T ~ 21L | 10.5T ~ 19.5L | 11T ~ 11L |
| 30 | 50 | 0 | -11 | 9L ~ 45L | 0 ~ 27L | 0 ~ 36L | 6T ~ 21L | 11T ~ 25L | 12.5T ~ 23.5L | 13T ~ 14L |
| 50 | 80 | 0 | -13 | 10L ~ 53L | 0 ~ 32L | 0 ~ 43L | 6T ~ 26L | 12T ~ 31L | 15T ~ 28L | 15T ~ 17L |
| 80 | 120 | 0 | -15 | 12L ~ 62L | 0 ~ 37L | 0 ~ 50L | 6T ~ 31L | 13T ~ 37L | 17.5T ~ 32.5L | 18T ~ 19L |
| 120 | 150 | 0 | -18 | 14L ~ 72L | 0 ~ 43L | 0 ~ 58L | 7T ~ 36L | 14T ~ 44L | 20T ~ 38L | 21T ~ 22L |
| 150 | 180 | 0 | -25 | 14L ~ 79L | 0 ~ 50L | 0 ~ 65L | 7T ~ 43L | 14T ~ 51L | 20T ~ 45L | 21T ~ 29L |
| 180 | 250 | 0 | -30 | 15L ~ 91L | 0 ~ 59L | 0 ~ 76L | 7T ~ 52L | 16T ~ 60L | 23T ~ 53L | 24T ~ 35L |
| 250 | 315 | 0 | -35 | 17L ~ 104L | 0 ~ 67L | 0 ~ 87L | 7T ~ 60L | 16T ~ 71L | 26T ~ 61L | 27T ~ 40L |
| 315 | 400 | 0 | -40 | 18L ~ 115L | 0 ~ 76L | 0 ~ 97L | 7T ~ 69L | 18T ~ 79L | 28.5T ~ 68.5L | 29T ~ 47L |

Note: T = tight, L = loose

(Unit: μm)

| js6 bearing shaft | k5 bearing shaft | k6 bearing shaft | m5 bearing shaft | m6 bearing shaft | n6 bearing shaft | p6 bearing shaft | r6 bearing shaft | Nominal bore diameter of bearing d mm over | incl |
|---|---|---|---|---|---|---|---|---|---|
| 16.5T ~ 6.5L | 21T ~ 2T | 25T ~ 2T | 27T ~ 8T | 31T ~ 8T | 38T ~ 15T | 45T ~ 22T | — | 18 | 30 |
| 20T ~ 8L | 25T ~ 2T | 30T ~ 2T | 32T ~ 9T | 37T ~ 9T | 45T ~ 17T | 54T ~ 26T | — | 30 | 50 |
| 24.5T ~ 9.5L | 30T ~ 2T | 36T ~ 2T | 39T ~ 11T | 45T ~ 11T | 54T ~ 20T | 66T ~ 32T | — | 50 | 80 |
| 31T ~ 11L | 38T ~ 3T | 45T ~ 2T | 48T ~ 13T | 55T ~ 13T | 65T ~ 23T | 79T ~ 37T | — | 80 | 120 |
| | | | | | | | 113T ~ 63T | 120 | 140 |
| 37.5T ~ 12.5L | 46T ~ 3T | 53T ~ 3T | 58T ~ 15T | 65T ~ 15T | 77T ~ 27T | 93T ~ 43T | 115T ~ 65T | 140 | 160 |
| | | | | | | | 118T ~ 68T | 160 | 180 |
| | | | | | | | 136T ~ 77T | 180 | 200 |
| 44.5T ~ 14.5L | 54T ~ 4T | 63T ~ 4T | 67T ~ 17T | 76T ~ 17T | 90T ~ 31T | 109T ~ 50T | 139T ~ 80T | 200 | 225 |
| | | | | | | | 143T ~ 84T | 225 | 250 |
| 51T ~ 16L | 62T ~ 4T | 71T ~ 4T | 78T ~ 20T | 87T ~ 20T | 101T ~ 34T | 123T ~ 56T | 161T ~ 94T | 250 | 280 |
| | | | | | | | 165T ~ 98T | 280 | 315 |
| 58T ~ 18L | 69T ~ 4T | 80T ~ 4T | 86T ~ 21T | 97T ~ 21T | 113T ~ 37T | 138T ~ 62T | 184T ~ 108T | 315 | 355 |

(Unit: μm)

| K7 housing bearing | M7 housing bearing | N7 housing bearing | P7 housing bearing | Nominal outside diameter of bearing d mm over | incl |
|---|---|---|---|---|---|
| 15T ~ 15L | 21T ~ 9L | 28T ~ 2L | 35T ~ 5L | 18 | 30 |
| 18T ~ 18L | 25T ~ 11L | 33T ~ 3L | 42T ~ 6L | 30 | 50 |
| 21T ~ 22L | 30T ~ 13L | 39T ~ 4L | 52T ~ 8L | 50 | 80 |
| 25T ~ 25L | 35T ~ 15L | 45T ~ 5L | 59T ~ 9L | 80 | 120 |
| 28T ~ 30L | 40T ~ 18L | 52T ~ 6L | 68T ~ 10L | 120 | 150 |
| 28T ~ 37L | 40T ~ 25L | 52T ~ 13L | 68T ~ 3L | 150 | 180 |
| 33T ~ 43L | 46T ~ 30L | 60T ~ 16L | 79T ~ 3L | 180 | 250 |
| 36T ~ 51L | 52T ~ 35L | 66T ~ 21L | 88T ~ 1L | 250 | 315 |
| 40T ~ 57L | 57T ~ 40L | 73T ~ 24L | 98T ~ 1L | 315 | 400 |

## 5. Bearing internal clearance

**Table 5.1 Radial internal clearance of Spherical Roller Bearings** (Unit: μm)

| Nominal bore diameter d (mm) | | Cylindrical bore | | | | | | | | | | Tapered bore | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | C2 | | CN | | C3 | | C4 | | C5 | | C2 | | CN | | C3 | | C4 | | C5 | |
| over | incl. | min. | max. | min. | max. | min. | max. | min. | max. | min. | max. | min. | max. | min. | max. | min. | max. | min. | max. | min. | max. |
| 14 | 18 | 10 | 20 | 20 | 35 | 35 | 45 | 45 | 60 | 60 | 75 | - | - | - | - | - | - | - | - | - | - |
| 18 | 24 | 10 | 20 | 20 | 35 | 35 | 45 | 45 | 60 | 60 | 75 | 15 | 25 | 25 | 35 | 35 | 45 | 45 | 60 | 60 | 75 |
| 24 | 30 | 15 | 25 | 25 | 40 | 40 | 55 | 55 | 75 | 75 | 95 | 20 | 30 | 30 | 40 | 40 | 55 | 55 | 75 | 75 | 95 |
| 30 | 40 | 15 | 30 | 30 | 45 | 45 | 60 | 60 | 80 | 80 | 100 | 25 | 35 | 35 | 50 | 50 | 65 | 65 | 85 | 85 | 105 |
| 40 | 50 | 20 | 35 | 35 | 55 | 55 | 75 | 75 | 100 | 100 | 125 | 30 | 45 | 45 | 60 | 60 | 80 | 80 | 100 | 100 | 130 |
| 50 | 65 | 20 | 40 | 40 | 65 | 65 | 90 | 90 | 120 | 120 | 150 | 40 | 55 | 55 | 75 | 75 | 95 | 95 | 120 | 120 | 160 |
| 65 | 80 | 30 | 50 | 50 | 80 | 80 | 110 | 110 | 145 | 145 | 180 | 50 | 70 | 70 | 95 | 95 | 120 | 120 | 150 | 150 | 200 |
| 80 | 100 | 35 | 60 | 60 | 100 | 100 | 135 | 135 | 180 | 180 | 225 | 55 | 80 | 80 | 110 | 110 | 140 | 140 | 180 | 180 | 230 |
| 100 | 120 | 40 | 75 | 75 | 120 | 120 | 160 | 160 | 210 | 210 | 260 | 65 | 100 | 100 | 135 | 135 | 170 | 170 | 220 | 220 | 280 |
| 120 | 140 | 50 | 95 | 95 | 145 | 145 | 190 | 190 | 240 | 240 | 300 | 80 | 120 | 120 | 160 | 160 | 200 | 200 | 260 | 260 | 330 |
| 140 | 160 | 60 | 110 | 110 | 170 | 170 | 220 | 220 | 280 | 280 | 350 | 90 | 130 | 130 | 180 | 180 | 230 | 230 | 300 | 300 | 380 |
| 160 | 180 | 65 | 120 | 120 | 180 | 180 | 240 | 240 | 310 | 310 | 390 | 100 | 140 | 140 | 200 | 200 | 260 | 260 | 340 | 340 | 430 |
| 180 | 200 | 70 | 130 | 130 | 200 | 200 | 260 | 260 | 340 | 340 | 430 | 110 | 160 | 160 | 220 | 220 | 290 | 290 | 370 | 370 | 470 |
| 200 | 225 | 80 | 140 | 140 | 220 | 220 | 290 | 290 | 380 | 380 | 470 | 120 | 180 | 180 | 250 | 250 | 320 | 320 | 410 | 410 | 520 |
| 225 | 250 | 90 | 150 | 150 | 240 | 240 | 320 | 320 | 420 | 420 | 520 | 140 | 200 | 200 | 270 | 270 | 350 | 350 | 450 | 450 | 570 |
| 250 | 280 | 100 | 170 | 170 | 260 | 260 | 350 | 350 | 460 | 460 | 570 | 150 | 220 | 220 | 300 | 300 | 390 | 390 | 490 | 490 | 620 |
| 280 | 315 | 110 | 190 | 190 | 280 | 280 | 370 | 370 | 500 | 500 | 630 | 170 | 240 | 240 | 330 | 330 | 430 | 430 | 540 | 540 | 680 |
| 315 | 355 | 120 | 200 | 200 | 310 | 310 | 410 | 410 | 550 | 550 | 690 | 190 | 270 | 270 | 360 | 360 | 470 | 470 | 590 | 590 | 740 |

## 6. Lubrication

6.1 Lubrication of rolling bearings

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) Friction and wear reduction
(2) Friction heat dissipation
(3) Prolonged bearing life
(4) Prevention of rust
(5) Protection against harmful elements

In order to achieve the above effects, the most effective lubrication method for the operating conditions must be selected. Also a good quality, reliable lubricant must be selected. In addition, an effectively designed sealing system that prevents the intrusion of damaging elements ( dust, water, etc. ) into the bearing interior, removes other impurities from the lubricant, and prevents lubricant from leaking to the outside, is also a requirement.

Almost all rolling bearings use either grease or oil lubrication methods, but in some special applicatic solid lubricant such as molybdenum disulfide or graphite may be used.

6.2 Grease lubrication

Grease type lubricants are relatively easy to handle require only the simplest sealing devicesfor these reasons, grease is the most widely used lubricant rolling bearings.

6.2.1 Types and characteristics of grease

Lubricating grease are composed of either a mineral base or a synthetic oil base. To this base a thicks other additives are added. The properties of all greases are mainly determined by the kind of base oil use the combination of thickening agent and various additives.

Standard greases and their characteristics are Table 6.2. As performance characteristics of even same type of grease will vary widely from brand, it is best to check the manufacturers' data when selecting a grease.

**Table 6.1 Grease varieties and characteristics**

| Grease name | Lithium grease | | | Sodium grease (Fiber grease) | Calcium compound base grease |
|---|---|---|---|---|---|
| Thickener | Li soap | | | Na soap | Ca+Na soap<br>Ca+Li soap |
| Base oil | Mineral oil | Diester oil | Silicone oil | Mineral oil | Mineral oil |
| Dropping poin ˚C | 170 ~ 190 | 170 ~ 190 | 200 ~ 250 | 150 ~ 180 | 150 ~ 180 |
| Operating temperature range ˚C | -30 ~ +130 | -50 ~ +130 | -50 ~ +160 | -20 ~ +130 | -20 ~ +120 |
| Mechanical stability | Excellent | Good | Good | Excellent ~ Good | Excellent ~ Good |
| Pressure resistance | Good | Good | poor | Good | Excellent ~ Good |
| Water resistance | Good | Good | Good | Good ~ poor | Good ~ poor |
| Applications | Widest range of applications.<br><br>Grease used in all types of rolling bearings. | Excellent low temperature and wear characteristics.<br><br>Suitable for small sized and miniature bearings. | Suitable for high and low temperatures.<br><br>Unsuitable for heavy load applications due to low oil film strength. | Some emulsification when water is introduced.<br><br>Excellent characteristics at relatively high temperatures. | Excellent pressure resistance and mechanical stability.<br><br>Suitable for bearings receiving shock loads. |

| Grease name | Aluminum grease | Non-soap base grease Thickener | |
|---|---|---|---|
| Thickener | Al soap | Bentone, silica gel, urea, carbon black, fluorine compounds, etc. | |
| Base oil | Mineral oil | Mineral oil | Synthetic oil |
| Dropping poin ˚C | 70 ~ 90 | 250 or above | 250 or above |
| Operating temperature range ˚C | -10 ~ +80 | -10 ~ +130 | -50 ~ +200 |
| Mechanical stability | Good ~ poor | Good | Good |
| Pressure resistance | Good | Good | Good |
| Water resistance | Good | Good | Good |
| Applications | Excellent viscosity characteristics.<br><br>Suitable for bearings subjected to vibrations. | 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.<br><br>Grease used in all types of rolling bearings. | |

## 7. Load rating and life

### 7.1 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, gnawing, rust, etc. However, these so called "causes" of bearing failure are usually themselves caused by improper installation, insufficient or improper lubrication, faulty sealing or inaccurate bearing selection. Since the above mentioned "causes" of bearing failure can be avoided by taking the proper precautions, and are not simply caused by material fatigue, they are considered separately from the flaking aspect.

### 7.2 Basic rated life and basic dynamic load rating

A group of seemingly identical bearings when subjected to identical load and operating conditions will exhibit a wide diversity in their durability. This " life " disparity can be accounted for by the difference in the fatigue of the bearing material itself. This disparity is considered statistically when calculating bearing life, and the basic rated life is defined as follows.

The basic rated 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 rated life (90% reliability) is expressed in the total number of hours of operation.

The basic dynamic load rating is an expression of the load capacity of a bearing based on a constant load which the bearing can sustain for one million revolutions (the basic life rating). For radial bearings this rating applies to pure radial loads, and for thrust bearings it refers to pure axial loads. The basic dynamic load ratings given in the bearing tables of this catalog are for bearings constructed of NIKO standard bearing materials, using standard manufacturing techniques. Please consult NIKO Engineering for basic load ratings of bearings constructed of special materials or using special manufacturing techniques.

The relationship between the basic rated life, the basic dynamic load rating and the bearing load is given in formula (7.1).

$L_{10} = \left(\frac{C}{P}\right)^{P}$ ............ Formula (7.1)

where,

$P = 10/3$ ············ For spherical roller bearings

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

C : Basic dynamic rating load, $N$

($C_r$: radial bearings, $C_a$: thrust bearings)

P : Equivalent dynamic load, $N$

($P_r$: radial bearings, $P_a$: thrust bearings)

The basic rating life can also be expressed in terms of hours of operation (revolution), and is calculated as shown in formula (7.2).

$L_{10h} = 500\ f_h{}^p$ ............. Formula (7.2)

$f_h = f_n \frac{C}{P}$ ................ Formula (7.3)

$f_n = \left(\frac{33.3}{n}\right)^{1/p}$ ............. Formula (7.4)

where,
$L_{10}$ : Basic rating life, h
$f_h$ : Life factor
$f_n$ : Speed factor
$n$ : Rotational speed, r/min

Roller bearings

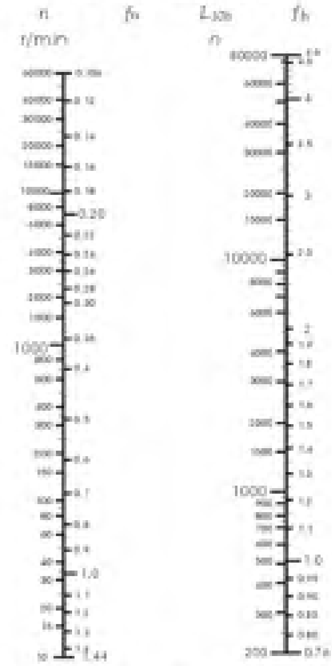



Fig. 7.1 Bearing life rating scale

Formula (7.2) can also be expressed as shown in formula (7.5).

$L_{10h} = \frac{10^6}{60n} \left(\frac{C}{P}\right)^p$ ..................... Formula (7.5)

The relationship between Rotational speed n and speed factor fn as well as the relation between the basic rating life $L10_h$ and the life factor fn is shown in Fig. 7.1. When several bearings are incorporated in machines or equipment as complete units, all the bearings in the unit are considered as a whole whencomputing bearing life (see formula 7.6). The total bearing life of the unit is a life rating based on the viable lifetime of the unit before even one of the bearings fails due to rolling contact fatigue.

$L = \frac{1}{\left(\frac{1}{L_1{}^e} + \frac{1}{L_2{}^e} + \dots \frac{1}{L_n{}^e}\right)^{1/e}}$ .............. Formula (7.6)

where,
e = 9/8.......................For roller bearings
L = Total basic rating life or entire unit, h
$L_1$, $L_2$...$L_n$ : Basic rating life or individual bearings, 1, 2,...n, h

7.3 Machine applications and requisite life
When selecting a bearing, it is essential that the requisite life of the bearing be established in relation to the operating conditions. The requisite life of the bearing Is usually determined by the type of machine in which the bearing will be used, and duration of service and operational reliability requirements. A general guide to these requisite life criteria is shown in Table 7.1. When determining bearing size, the fatigue life of the bearing is an important factor; however, besides bearing life, the strength and rigidity of the shaft and housing must also be taken into consideration.

7.4 Adjusted life rating factor
The basic bearing life rating ( 90% reliability factor) can be calculated through the formula mentioned earlier in Section 7.2. However, in some applications a bearing life factor of over 90% reliability may be required. To meet these requirements, bearing life can be lengthened by the use of specially improved bearing materials or special construction techniques. Moreover, according to elastohydrodynamic lubrication theory, it is clear that the bearing operating conditions (lubrication, temperature, speed, etc.) all exert an effect on bearing life.

$L_{na} = a_1 \cdot a_2 \cdot a_3\ (C/P)^p$.......... Formula (7.7)

where,
$L_{na}$ : Adjusted life rating in millions of revolutions ($10^6$)(adjusted for reliability, material and operating conditions)
$a_1$ : Reliability adjustment factor
$a_2$ : Material adjustment factor
$a_3$ : Operating condition adjustment factor

7.4.1 Life adjustment factor for reliability $a_1$
The values for the reliability adjustment factor as (for a reliability factor higher than 90%) can be found in Table 7.1.

**Table 7.1 Reliability adjustment factor values $a_1$**

| Reliability % | $L_n$ | Reliability factor $a_1$ |
|---|---|---|
| 90 | $L_{10}$ | 1.00 |
| 95 | $L_5$ | 0.62 |
| 96 | $L_4$ | 0.53 |
| 97 | $L_3$ | 0.44 |
| 98 | $L_2$ | 0.33 |
| 99 | $L_1$ | 0.21 |

7.4.2 Life adjustment factor for material $a_2$
The life of a bearing is affected by the material type and quality as well as the manufacturing process. In this regard, the life is adjusted by the use of an $a_2$ factor.

The basic dynamic load ratings listed in the catalog are based on NIKO's standard material and process, therefore, the adjustment factor $a_2 = 1$. When special materials or processes are used the adjustment factor can be larger than 1.

NIKO bearings can generally be used up to 120˚C . If bearings are operated at a higher temperature, the bearing must be specially heat treated (stabilized) so that inadmissible dimensional change does not occur due to changes in the micro-structure. This special heat treatment might cause the reduction of bearing life because of a hardness change.

7.4.3 Life adjustment factor $a_3$ for operating conditions
The operating conditions life adjustment factor $a_3$ is used to adjust for such conditions as lubrication, operating temperature, and other operation factors which have an effect on bearing life.

Generally speaking, when lubricating conditions are satisfactory, the $a_3$ factor has a value of one; and when lubricating conditions are exceptionally favorable, and all other operating conditions are normal, $a_3$ can have a value greater than one.

However, when lubricating conditions are particularly unfavorable and the oil film formation on the contact surfaces of the raceway and rolling elements is insufficient, the value of $a_3$ becomes less than one. This insufficient oil film formation can be caused, for example, by the lubricating oil viscosity being too low for the operating temperature (below 13 $mm^2/s$ for ball bearings; below 20 $mm^2/s$ for roller bearings); or by exceptionally low rotational speed (nr/min x $d_p$ mm less than 10,000). For bearings used under special operating conditions, please consult NIKO Engineering.

As the operating temperature of the bearing increases, the hardness of the bearing material decreases. Thus, the bearing life correspondingly decreases. The operating temperature adjustment values are shown in Fig. 7.2.

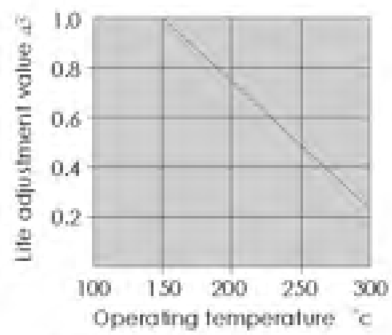



**Fig. 7.2 Life adjustment value for operating temperature**

7.5 Life of bearing with oscillating motion

The life of a radial bearing with oscillating motion can be calculated according to formula (7.8).

$L_{osc} = \Omega L_{Rot}$ ............... Formula (7.8)

where,

$L_{osc}$ : life for oscillating bearing

$L_{Rot}$ : rating life at assumed number of rotations same as oscillation cycles

$\Omega$ : oscillation factor (Fig.7.3 indicates the relationship between half oscillation angle $\beta$ and $\Omega$).

Fig. 7.3 is valid only when the amplitude exceeds a certain degree (critical angle $2\beta c$). The critical angle is determined by the internal design of the bearing, in particular by the number of rolling elements in one row. Critical angle values are given in Table 7.3. When the magnitude of the oscillation is less than the critical angle, the life may be shorter than that calculated to be the value in Fig.7.3 It is safer to calculate life with the factor $\Omega$ corresponding to the critical angle. For the critical angle of an individual bearing, please consult NIKO Engineering. Where the amplitude of the oscillation $2\beta$ is small, it is difficult for a complete lubricant film to form on the contact surfaces of the rings and rolling elements, and fretting corrosion may occur. Therefore it is necessary to exercise extreme care in the selection of bearing type, lubrication and lubricant.

**Table 7.3 Critical angle**

| Number of rolling elements | Half critical angle $\beta c$ |
|---|---|
| 10 | 10° |
| 25 | 4° |
| 40 | 2.6° |

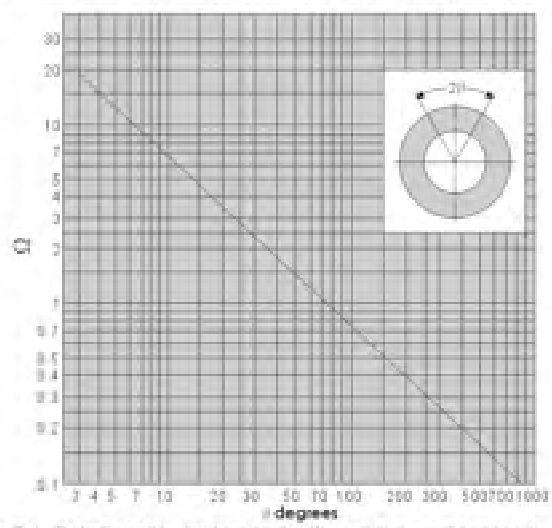



**Fig. 7.3 Relationship between half angle β and factor Ω**

7.6 Life of bearing with linear motion

With a linear motion bearing such as a linear ball bearing or linear flat roller bearing, the relation among the axial travel distance, bearing load, and load rating is expressed by formulas (7.9).

When the rolling elements are rollers:

$L = 100 \times (\frac{C_r}{P_r})^{\frac{10}{3}}$ ....................(7.9)

where,

L : Load rating km

Cr : Basic dynamic load rating [kgf]

Pr : Bearing load [kgf]

**Fig. 7.4 summarizes the relation between Cr/Pr and L.**

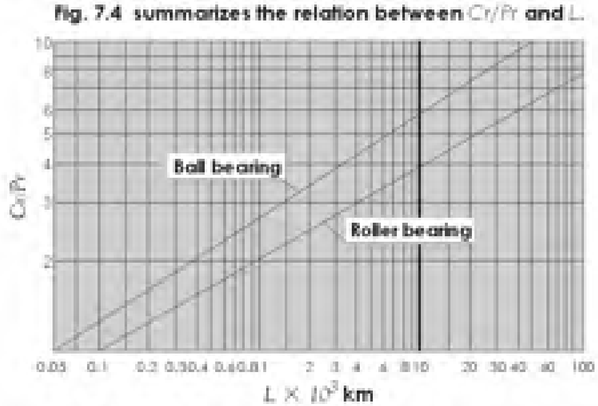



**Fig. 7.4 Life of bearing with axial motion**

If the cycle and travel distance within a particular travel motion remain constant, the rating life of the bearing can be determined by formulas (7.10) .

$$L_h = \frac{50X10^3}{10 \cdot S}\left(\frac{C_r}{P_r}\right)^{\frac{10}{3}} \text{.................. Formula (7.10)}$$

Where,
Lh : Travel life, h
S : Travel distance per minute, m/min.
$S = 2 \cdot L \cdot N$
L : Stroke length, m
n : Stroke cycle, N{kgf}

7.7 Basic static load rating
When stationary rolling bearings are subjected to static loads, they suffer from partial permanent deformation of the contact surfaces at the contact point between the rolling elements and the raceway. The amount of deformity increases as the load increases, and if this increase in load exceeds certain limits, the subsequent smooth operation of the bearings is impaired.

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

The basic rated static load 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 roller bearings 4,000 Mpa

7.8 Allowable static equivalent load
Generally the static equivalent load which can be permitted is limited by the basic static rated load as stated in Section 7.7. However, depending on requirements regarding friction and smooth operation, these limits may be greater or lesser than the basic static rated load.

In the following formula (7.11) and Table 7.4 the safety factor So can be determined considering the maximum static equivalent load.

So = Co / Po ...... Formula (7.11)

where,
So : Safety factor
Co : Basic static rated load, N
(radial bearings: Cor, thrust bearings: Coa )
Po max : Maximum static equivalent load, N
(radial: Por max, thrust: Coa max)

**Table 7.4 Minimum safety factor values $S_0$**

| Operating conditions | Roller bearings |
|---|---|
| High rotational accuracy demand | 3.0 |
| Normal rotating accuracy demand (Universal application) | 1.5 |
| Slight rotational accuracy deterioration permitted (Low speed, heavy loading, etc.) | 1.0 |

Note 1 : For drawn-cup spherical roller bearings, min. $S_0$ value=3.
2 : When vibration and/or shock loads are present, a load factor based on the shock load needs to be included in the $P_0$ max value.

## 8. Bearing handling

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

## 9. Allowable speed

As bearing speed increases, the temperature of the bearing also increases due to friction heat generated in the bearing interior. If the temperature continues to rise and exceeds certain limits, the efficiency of the lubricant start to fail down drastically, and the bearing can no longercontinue to operate in a stable manner. Therefore, the maximum speed at which it is possible for the bearing to continuously operate without the generation of excessive heat beyond specified limits, is called the allowable speed ( r/min ). The allowable speed of a bearing depends on the type of bearing, bearing dimensions, type of cage, load, lubricating conditions, and cooling conditions.

The allowable speeds listed in the bearing tables for grease and oil lubrication are for standard NIKO bearings under normal operating conditions, correctly installed, using the suitable lubricants with adequate supply and proper maintenance. Moreover, these values are based on normal load conditions ($P \leq 0.09C$, $Fa/Fr \leq 0.3$). For spherical bearings with contact seals (LLU type), the allowable speed is determined by the peripheral lip speed of the seal.

For bearings to be used under heavier than normal load conditions, the allowable speed values listed in the bearing tables must be multiplied by an adjustment factor. The adjustment factors $f_L$ and $f_C$ are given in Figs. 9.1 and 9.2.

Also, when radial bearings are mounted on vertical shafts, lubricant retentions and cage guidance are not favorable compared to horizontal shaft mounting.

Therefore, the allowable speed should be reduced to approximately 80% of the listed speed.

It is possible to operate precision bearings with high speed specification cages at speeds higher than those listed in the bearing tables , if special precautions are taken. These precautions should include the use of forced oil circulation methods such as oil jet or oil mist lubrication.

Under such high speed operating conditions, when special care is taken, the standard allowable speeds given in the bearing tables can be adjusted upward. The maximum speed adjustment values, /B, by which the bearing table speeds can be multiplied, are shown in Table 9.1. However, for any application requiring speeds in excess of the standard allowable speed, please consult NIKO Engineering.

**Fig.9.1 Value of adjustment factor FL depends on bearing load**

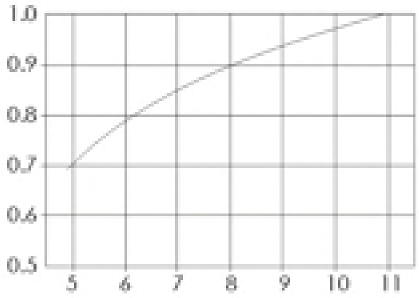



**Fig.9.2 Value of adjustment factor Fc depends on combined load**

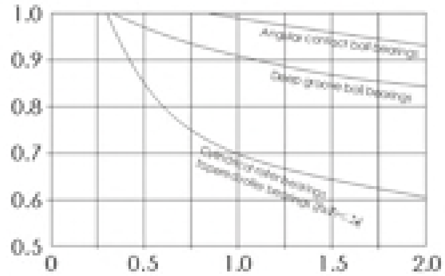
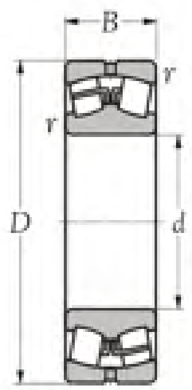



**Table 9.1 Adjustment factor, $f_B$, for allowable number of revolutions**

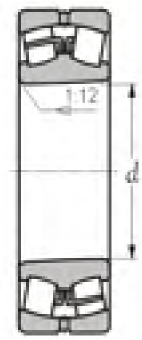
| Type of bearing | Adjustment factor $f_B$ |
|---|---|
| Spherical Roller Bearings | 3.0 |
| Spherical Roller Thrust Bearings | 2.0 |


# DIMENSION TABLES

## Spherical Roller Bearings
## series 213




Cylinrical bore




Tapered bore

| Boundary dimensions mm | | | | Basic load ratings dynamic N | static N | dynamic kgf | static kgf | Limiting speeds min⁻¹ | | Bearing numbers |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | $r_{s\ min}$ | $C_r$ | $C_{or}$ | $C_r$ | $C_{or}$ | grease | oil | |
| 20 | 52 | 15 | 1.1 | 41,000 | 33,000 | 4,182 | 3,366 | 9,700 | 15,000 | 21304 MB W33 |
| 20 | 52 | 15 | 1.1 | 41,000 | 33,000 | 4,182 | 3,366 | 9,700 | 15,000 | 21304 MB/K W33 |
| 25 | 62 | 17 | 1.1 | 53,000 | 43,500 | 5,406 | 4,437 | 8,400 | 13,000 | 21305 MB W33 |
| 25 | 62 | 17 | 1.1 | 53,000 | 43,500 | 5,406 | 4,437 | 8,400 | 13,000 | 21305 MB/K W33 |
| 30 | 72 | 19 | 1.1 | 72,000 | 63,000 | 7,344 | 6,426 | 7,300 | 11,000 | 21306 MB W33 |
| 30 | 72 | 19 | 1.1 | 72,000 | 63,000 | 7,344 | 6,426 | 7,300 | 11,000 | 21306 MB/K W33 |
| 35 | 80 | 21 | 1.5 | 83,000 | 74,000 | 8,466 | 7,548 | 6,800 | 9,500 | 21307 MB W33 |
| 35 | 80 | 21 | 1.5 | 83,000 | 74,000 | 8,466 | 7,548 | 6,800 | 9,500 | 21307 MB/K W33 |
| 40 | 90 | 23 | 1.5 | 88,000 | 90,000 | 8,950 | 9,150 | 4,900 | 6,400 | 21308 MB W33 |
| 40 | 90 | 23 | 1.5 | 88,000 | 90,000 | 8,950 | 9,150 | 4,900 | 6,400 | 21308 MB/K W33 |
| 45 | 100 | 25 | 1.5 | 102,000 | 106,000 | 10,400 | 10,800 | 4,400 | 5,700 | 21309 MB W33 |
| 45 | 100 | 25 | 1.5 | 102,000 | 106,000 | 10,400 | 10,800 | 4,400 | 5,700 | 21309 MB/K W33 |
| 50 | 110 | 27 | 2.0 | 118,000 | 127,000 | 12,000 | 12,900 | 4,000 | 5,200 | 21310 MB W33 |
| 50 | 110 | 27 | 2.0 | 118,000 | 127,000 | 12,000 | 12,900 | 4,000 | 5,200 | 21310 MB/K W33 |
| 55 | 120 | 29 | 2.0 | 145,000 | 163,000 | 14,800 | 16,600 | 3,700 | 4,800 | 21311 MB W33 |
| 55 | 120 | 29 | 2.0 | 145,000 | 163,000 | 14,800 | 16,600 | 3,700 | 4,800 | 21311 MB/K W33 |
| 60 | 130 | 31 | 2.1 | 167,000 | 191,000 | 17,100 | 19,500 | 3,400 | 4,400 | 21312 MB W33 |
| 60 | 130 | 31 | 2.1 | 167,000 | 191,000 | 17,100 | 19,500 | 3,400 | 4,400 | 21312 MB/K W33 |
| 65 | 140 | 33 | 2.1 | 194,000 | 228,000 | 19,800 | 23,200 | 3,100 | 4,000 | 21313 MB W33 |
| 65 | 140 | 33 | 2.1 | 194,000 | 228,000 | 19,800 | 23,200 | 3,100 | 4,000 | 21313 MB/K W33 |
| 70 | 150 | 35 | 2.1 | 220,000 | 262,000 | 22,400 | 26,800 | 2,900 | 3,800 | 21314 MB W33 |
| 70 | 150 | 35 | 2.1 | 220,000 | 262,000 | 22,400 | 26,800 | 2,900 | 3,800 | 21314 MB/K W33 |

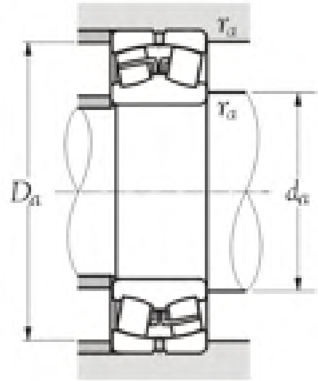
**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | X | Class 0 (JIS) | Nil |
| Polymid - | X | | |
| Brass - | MB | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

# Spherical Roller Bearings

## series 213




**Equivalent radial load**
**dynamic**

$P_r = XF_r + YF_a$

| $\frac{F_a}{F_r} \leq e$ | | $\frac{F_a}{F_r} > e$ | |
|---|---|---|---|
| X | Y | X | Y |
| 1 | $Y_1$ | 0.67 | $Y_2$ |

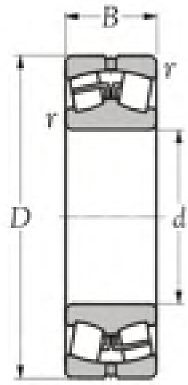
**Static**

$P_r = F_r + Y_0F_a$

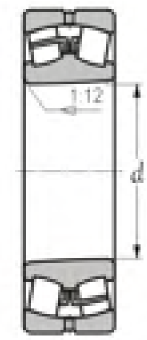
**For values of $e$, $Y2$ and $Y_0$ see the tabla below.**

| Abutments and fillet dimensions mm | | | Constant | Axial load factors | | | Mass (approx.) kg(s). | |
|---|---|---|---|---|---|---|---|---|
| $d_a$ min | $D_a$ max | $r_{as}$ max | $e$ | $Y_1$ | $Y_2$ | $Y_0$ | cylindrical bore | tapered bore |
| 27.0 | 45.0 | 1.0 | 0.30 | 2.25 | 3.34 | 2.20 | 0.160 | - |
| 27.0 | 45.0 | 1.0 | 0.30 | 2.25 | 3.34 | 2.20 | - | 0.155 |
| 32.0 | 55.0 | 1.0 | 0.28 | 2.43 | 3.61 | 2.37 | 0.254 | - |
| 32.0 | 55.0 | 1.0 | 0.28 | 2.43 | 3.61 | 2.37 | - | 0.247 |
| 37.0 | 65.0 | 1.0 | 0.27 | 2.49 | 3.71 | 2.43 | 0.386 | - |
| 37.0 | 65.0 | 1.0 | 0.27 | 2.49 | 3.71 | 2.43 | - | 0.375 |
| 44.0 | 71.0 | 1.5 | 0.26 | 2.55 | 3.80 | 2.50 | 0.503 | - |
| 44.0 | 71.0 | 1.5 | 0.26 | 2.55 | 3.80 | 2.50 | - | 0.488 |
| 48.5 | 81.5 | 1.5 | 0.26 | 2.55 | 3.80 | 2.50 | 0.705 | - |
| 48.5 | 81.5 | 1.5 | 0.26 | 2.55 | 3.80 | 2.50 | - | 0.694 |
| 53.5 | 91.5 | 1.5 | 0.26 | 2.60 | 3.87 | 2.54 | 0.927 | - |
| 53.5 | 91.5 | 1.5 | 0.26 | 2.60 | 3.87 | 2.54 | - | 0.912 |
| 60.0 | 100.0 | 2.0 | 0.26 | 2.64 | 3.93 | 2.58 | 1.210 | - |
| 60.0 | 100.0 | 2.0 | 0.26 | 2.64 | 3.93 | 2.58 | - | 1.190 |
| 65.0 | 110.0 | 2.0 | 0.25 | 2.69 | 4.01 | 2.63 | 1.710 | - |
| 65.0 | 110.0 | 2.0 | 0.25 | 2.69 | 4.01 | 2.63 | - | 1.690 |
| 72.0 | 118.0 | 2.0 | 0.25 | 2.69 | 4.00 | 2.63 | 2.100 | - |
| 72.0 | 118.0 | 2.0 | 0.25 | 2.69 | 4.00 | 2.63 | - | 2.070 |
| 77.0 | 128.0 | 2.0 | 0.25 | 2.69 | 4.00 | 2.63 | 2.550 | - |
| 77.0 | 128.0 | 2.0 | 0.25 | 2.69 | 4.00 | 2.63 | - | 2.510 |
| 82.0 | 138.0 | 2.0 | 0.25 | 2.69 | 4.00 | 2.63 | 3.180 | - |
| 82.0 | 138.0 | 2.0 | 0.25 | 2.69 | 4.00 | 2.63 | - | 3.140 |

## Spherical Roller Bearings
### series 213




Cylinrical bore




Tapered bore

| Boundary dimensions mm | | | | Basic load ratings dynamic (N) | static (N) | dynamic (kgf) | static (kgf) | Limiting speeds min⁻¹ | | Bearing numbers |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | $r_{s\,min}$ [1] | $C_r$ | $C_{or}$ | $C_r$ | $C_{or}$ | grease | oil | |
| 75 | 160 | 37 | 2.1 | 239,000 | 287,000 | 24,300 | 29,300 | 2,700 | 3,500 | **21315 MB W33** |
| 75 | 160 | 37 | 2.1 | 239,000 | 287,000 | 24,300 | 29,300 | 2,700 | 3,500 | **21315 MB/K W33** |
| 80 | 170 | 39 | 2.1 | 260,000 | 315,000 | 26,500 | 32,000 | 2,500 | 3,300 | **21316 MB W33** |
| 80 | 170 | 39 | 2.1 | 260,000 | 315,000 | 26,500 | 32,000 | 2,500 | 3,300 | **21316 MB/K W33** |
| 85 | 180 | 41 | 3.0 | 289,000 | 355,000 | 29,500 | 36,000 | 2,400 | 3,100 | **21317 MB W33** |
| 85 | 180 | 41 | 3.0 | 289,000 | 355,000 | 29,500 | 36,000 | 2,400 | 3,100 | **21317 MB/K W33** |
| 90 | 190 | 43 | 3.0 | 320,000 | 400,000 | 32,500 | 40,500 | 2,300 | 3,000 | **21318 MB W33** |
| 90 | 190 | 43 | 3.0 | 320,000 | 400,000 | 32,500 | 40,500 | 2,300 | 3,000 | **21318 MB/K W33** |
| 95 | 200 | 45 | 3.0 | 335,000 | 420,000 | 34,000 | 43,000 | 2,100 | 2,700 | **21319 MB W33** |
| 95 | 200 | 45 | 3.0 | 335,000 | 420,000 | 34,000 | 43,000 | 2,100 | 2,700 | **21319 MB/K W33** |
| 100 | 215 | 47 | 3.0 | 370,000 | 465,000 | 37,500 | 47,500 | 2,000 | 2,600 | **21320 MB W33** |
| 100 | 215 | 47 | 3.0 | 370,000 | 465,000 | 37,500 | 47,500 | 2,000 | 2,600 | **21320 MB/K W33** |
| 110 | 240 | 50 | 3.0 | 495,000 | 615,000 | 50,500 | 62,500 | 1,800 | 2,300 | **21322 MB W33** |
| 110 | 240 | 50 | 3.0 | 495,000 | 615,000 | 50,500 | 62,500 | 1,800 | 2,300 | **21322 MB/K W33** |

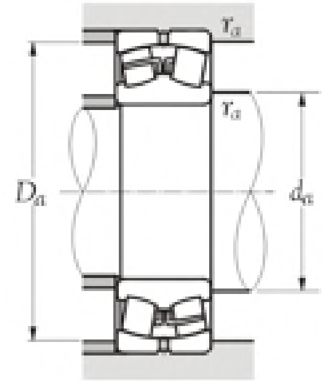
**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | X | Class 0 (JIS) | Nil |
| Polymid - | X | | |
| Brass - | MB | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

# Spherical Roller Bearings

## series 213




**Equivalent radial load**
**dynamic**
$P_r = XF_r + YF_a$

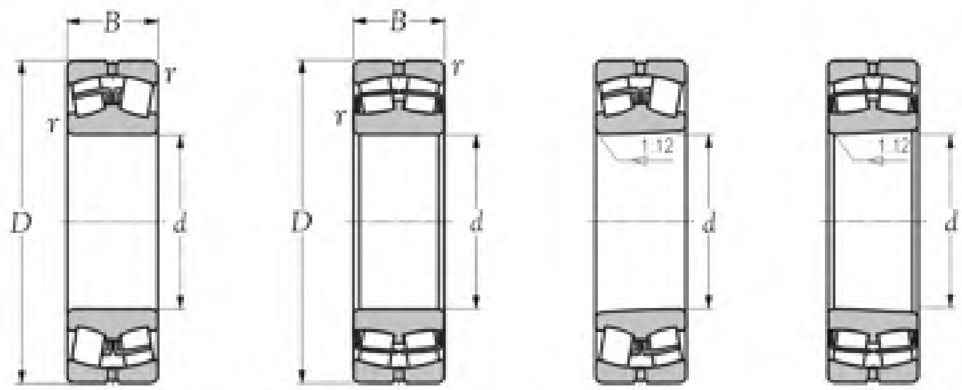
| $\frac{F_a}{F_r} \leq e$ | | $\frac{F_a}{F_r} > e$ | |
|---|---|---|---|
| X | Y | X | Y |
| 1 | $Y_1$ | 0.67 | $Y_2$ |

**Static**
$P_r = F_r + Y_0 F_a$
**For values of** $e$, $Y2$ **and** $Y_0$ **see the tabla below.**

| Abutments and fillet dimensions mm | | | Constant | Axial load factors | | | Mass (approx.) kgs. | |
|---|---|---|---|---|---|---|---|---|
| $d_a$ min | $D_a$ max | $r_{as}$ max | $e$ | $Y_1$ | $Y_2$ | $Y_0$ | cylindrical bore | tapered bore |
| 87 | 148 | 2.0 | 0.24 | 2.84 | 4.23 | 2.78 | 3.81 | - |
| 87 | 148 | 2.0 | 0.24 | 2.84 | 4.23 | 2.78 | - | 3.76 |
| 92 | 158 | 2.0 | 0.23 | 2.95 | 4.39 | 2.88 | 4.53 | - |
| 92 | 158 | 2.0 | 0.23 | 2.95 | 4.39 | 2.88 | - | 4.47 |
| 99 | 166 | 2.5 | 0.25 | 2.69 | 4.00 | 2.63 | 5.35 | - |
| 99 | 166 | 2.5 | 0.25 | 2.69 | 4.00 | 2.63 | - | 5.28 |
| 104 | 176 | 2.5 | 0.24 | 2.83 | 4.22 | 2.77 | 6.30 | - |
| 104 | 176 | 2.5 | 0.24 | 2.83 | 4.22 | 2.77 | - | 6.21 |
| 109 | 186 | 2.5 | 0.23 | 3.00 | 4.46 | 2.93 | 7.10 | - |
| 109 | 186 | 2.5 | 0.23 | 3.00 | 4.46 | 2.93 | - | 7.00 |
| 114 | 201 | 2.5 | 0.22 | 3.01 | 4.48 | 2.94 | 8.89 | - |
| 114 | 201 | 2.5 | 0.22 | 3.01 | 4.48 | 2.94 | - | 8.78 |
| 124 | 226 | 2.5 | 0.21 | 3.20 | 4.77 | 3.13 | 11.20 | - |
| 124 | 226 | 2.5 | 0.21 | 3.20 | 4.77 | 3.13 | - | 11.10 |

# Spherical Roller Bearings

## series 222




Cylinrical bore

Tapered bore

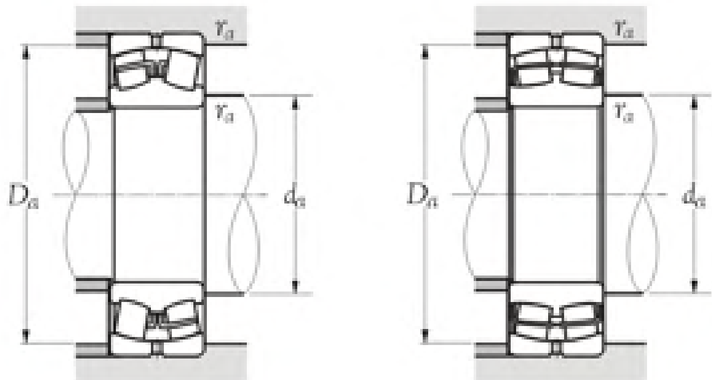
| Boundary dimensions mm | | | | Basic load ratings dynamic N | static N | dynamic kgf | static kgf | Limiting speeds min⁻¹ | | Bearing numbers |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | $r_{s\,min}$[1] | $C_r$ | $C_{0r}$ | $C_r$ | $C_{0r}$ | grease | oil | |
| 25 | 52 | 18 | 1.0 | 36,500 | 36,000 | 3,750 | 3,650 | 8,500 | 11,000 | 22205 MB W33 |
| 25 | 52 | 18 | 1.0 | 36,500 | 36,000 | 3,750 | 3,650 | 8,500 | 11,000 | 22205 MB/K W33 |
| 25 | 52 | 18 | 1.0 | 36,500 | 36,000 | 3,750 | 3,650 | 8,500 | 11,000 | 22205 CC W33 |
| 25 | 52 | 18 | 1.0 | 36,500 | 36,000 | 3,750 | 3,650 | 8,500 | 11,000 | 22205 CC/K W33 |
| 30 | 62 | 20 | 1.0 | 49,000 | 49,000 | 5,000 | 5,000 | 7,500 | 9,500 | 22206 MB W33 |
| 30 | 62 | 20 | 1.0 | 49,000 | 49,000 | 5,000 | 5,000 | 7,500 | 9,500 | 22206 MB/K W33 |
| 30 | 62 | 20 | 1.0 | 49,000 | 49,000 | 5,000 | 5,000 | 7,500 | 9,500 | 22206 CC W33 |
| 30 | 62 | 20 | 1.0 | 49,000 | 49,000 | 5,000 | 5,000 | 7,500 | 9,500 | 22206 CC/K W33 |
| 35 | 72 | 23 | 1.1 | 69,500 | 71,000 | 7,050 | 7,200 | 6,500 | 8,500 | 22207 MB W33 |
| 35 | 72 | 23 | 1.1 | 69,500 | 71,000 | 7,050 | 7,200 | 6,500 | 8,500 | 22207 MB/K W33 |
| 35 | 72 | 23 | 1.1 | 69,500 | 71,000 | 7,050 | 7,200 | 6,500 | 8,500 | 22207 CC W33 |
| 35 | 72 | 23 | 1.1 | 69,500 | 71,000 | 7,050 | 7,200 | 6,500 | 8,500 | 22207 CC/K W33 |
| 40 | 80 | 23 | 1.1 | 79,000 | 88,500 | 8,050 | 9,000 | 6,000 | 7,600 | 22208 MB W33 |
| 40 | 80 | 23 | 1.1 | 79,000 | 88,500 | 8,050 | 9,000 | 6,000 | 7,600 | 22208 MB/K W33 |
| 40 | 80 | 23 | 1.1 | 79,000 | 88,500 | 8,050 | 9,000 | 6,000 | 7,600 | 22208 CC W33 |
| 40 | 80 | 23 | 1.1 | 79,000 | 88,500 | 8,050 | 9,000 | 6,000 | 7,600 | 22208 CC/K W33 |
| 45 | 85 | 23 | 1.1 | 82,500 | 95,000 | 8,400 | 9,700 | 5,300 | 6,800 | 22209 MB W33 |
| 45 | 85 | 23 | 1.1 | 82,500 | 95,000 | 8,400 | 9,700 | 5,300 | 6,800 | 22209 MB/K W33 |
| 45 | 85 | 23 | 1.1 | 82,500 | 95,000 | 8,400 | 9,700 | 5,300 | 6,800 | 22209 CC W33 |
| 45 | 85 | 23 | 1.1 | 82,500 | 95,000 | 8,400 | 9,700 | 5,300 | 6,800 | 22209 CC/K W33 |
| 50 | 90 | 23 | 1.1 | 86,000 | 102,000 | 8,750 | 10,400 | 4,900 | 6,300 | 22210 MB W33 |
| 50 | 90 | 23 | 1.1 | 86,000 | 102,000 | 8,750 | 10,400 | 4,900 | 6,300 | 22210 MB/K W33 |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | CC | Class 0 (JIS) | Nil |
| Polymid - | X | | |
| Brass - | MB | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## Spherical Roller Bearings
## series 222



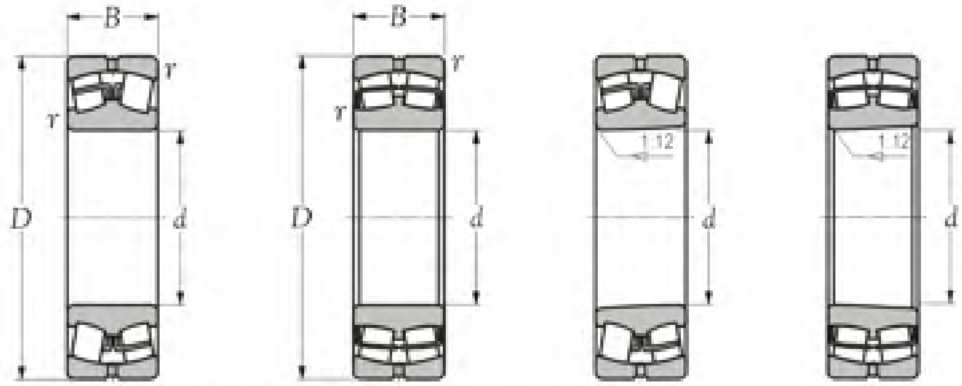

**Equivalent radial load**
**dynamic**
$P_r = XF_r + YF_a$

| $\frac{F_a}{F_r} \leq e$ | | $\frac{F_a}{F_r} > e$ | |
|---|---|---|---|
| X | Y | X | Y |
| 1 | $Y_1$ | 0.67 | $Y_2$ |

**Static**
$P_r = F_r + Y_0F_a$
**For values of $e$, $Y2$ and $Y_0$ see the tabla below.**

| Abutments and fillet dimensions | | | Constant | Axial load factors | | | Mass (approx.) | |
|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | kg. | |
| $d_a$ min | $D_a$ max | $r_{as}$ max | $e$ | $Y_1$ | $Y_2$ | $Y_0$ | cylindrical bore | tapered bore |
| 31 | 46 | 1 | 0.35 | 1.92 | 2.86 | 1.88 | 0.186 | - |
| 31 | 46 | 1 | 0.35 | 1.92 | 2.86 | 1.88 | - | 0.182 |
| 31 | 46 | 1 | 0.35 | 1.92 | 2.86 | 1.88 | 0.186 | - |
| 31 | 46 | 1 | 0.35 | 1.92 | 2.86 | 1.88 | - | 0.182 |
| 36 | 56 | 1 | 0.33 | 2.07 | 3.09 | 2.03 | 0.287 | - |
| 36 | 56 | 1 | 0.33 | 2.07 | 3.09 | 2.03 | - | 0.282 |
| 36 | 56 | 1 | 0.33 | 2.07 | 3.09 | 2.03 | 0.287 | - |
| 36 | 56 | 1 | 0.33 | 2.07 | 3.09 | 2.03 | - | 0.282 |
| 42 | 65 | 1 | 0.32 | 2.09 | 3.11 | 2.04 | 0.446 | - |
| 42 | 65 | 1 | 0.32 | 2.09 | 3.11 | 2.04 | - | 0.437 |
| 42 | 65 | 1 | 0.32 | 2.09 | 3.11 | 2.04 | 0.446 | - |
| 42 | 65 | 1 | 0.32 | 2.09 | 3.11 | 2.04 | - | 0.437 |
| 47 | 73 | 1 | 0.29 | 2.35 | 3.50 | 2.30 | 0.526 | - |
| 47 | 73 | 1 | 0.29 | 2.35 | 3.50 | 2.30 | - | 0.515 |
| 47 | 73 | 1 | 0.29 | 2.35 | 3.50 | 2.30 | 0.526 | - |
| 47 | 73 | 1 | 0.29 | 2.35 | 3.50 | 2.30 | - | 0.515 |
| 52 | 78 | 1 | 0.27 | 2.50 | 3.72 | 2.44 | 0.584 | - |
| 52 | 78 | 1 | 0.27 | 2.50 | 3.72 | 2.44 | - | 0.572 |
| 52 | 78 | 1 | 0.27 | 2.50 | 3.72 | 2.44 | 0.584 | - |
| 52 | 78 | 1 | 0.27 | 2.50 | 3.72 | 2.44 | - | 0.572 |
| 57 | 83 | 1 | 0.25 | 2.69 | 4.01 | 2.63 | 0.630 | - |
| 57 | 83 | 1 | 0.25 | 2.69 | 4.01 | 2.63 | - | 0.616 |

## Spherical Roller Bearings
## series 222




Cylinrical bore

Tapered bore

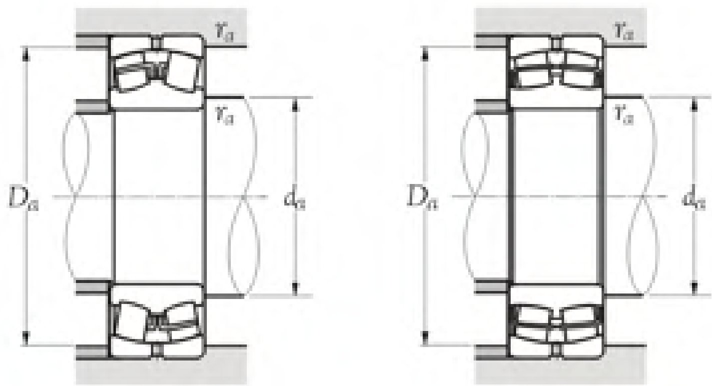
| Boundary dimensions mm | | | | Basic load ratings dynamic N | static N | dynamic kgf | static kgf | Limiting speeds $min^{-1}$ | | Bearing numbers |
|---|---|---|---|---|---|---|---|---|---|---|
| $d$ | $D$ | $B$ | $r_{s\,min}$[1] | $C_r$ | $C_{0r}$ | $C_r$ | $C_{0r}$ | grease | oil | |
| 50 | 90 | 23 | 1.1 | 86,000 | 102,000 | 8,750 | 10,400 | 4,900 | 6,300 | 22210 CC W33 |
| 50 | 90 | 23 | 1.1 | 86,000 | 102,000 | 8,750 | 10,400 | 4,900 | 6,300 | 22210 CC/K W33 |
| 55 | 100 | 25 | 1.5 | 93,500 | 110,000 | 9,500 | 11,200 | 4,500 | 5,800 | 22211 MB W33 |
| 55 | 100 | 25 | 1.5 | 93,500 | 110,000 | 9,500 | 11,200 | 4,500 | 5,800 | 22211 MB/K W33 |
| 55 | 100 | 25 | 1.5 | 93,500 | 110,000 | 9,500 | 11,200 | 4,500 | 5,800 | 22211 CC W33 |
| 55 | 100 | 25 | 1.5 | 93,500 | 110,000 | 9,500 | 11,200 | 4,500 | 5,800 | 22211 CC/K W33 |
| 60 | 110 | 28 | 1.5 | 115,000 | 147,000 | 11,700 | 15,000 | 4,100 | 5,300 | 22212 MB W33 |
| 60 | 110 | 28 | 1.5 | 115,000 | 147,000 | 11,700 | 15,000 | 4,100 | 5,300 | 22212 MB/K W33 |
| 60 | 110 | 28 | 1.5 | 115,000 | 147,000 | 11,700 | 15,000 | 4,100 | 5,300 | 22212 CC W33 |
| 60 | 110 | 28 | 1.5 | 115,000 | 147,000 | 11,700 | 15,000 | 4,100 | 5,300 | 22212 CC/K W33 |
| 65 | 120 | 31 | 1.5 | 143,000 | 179,000 | 14,600 | 18,300 | 3,900 | 5,000 | 22213 MB W33 |
| 65 | 120 | 31 | 1.5 | 143,000 | 179,000 | 14,600 | 18,300 | 3,900 | 5,000 | 22213 MB/K W33 |
| 65 | 120 | 31 | 1.5 | 143,000 | 179,000 | 14,600 | 18,300 | 3,900 | 5,000 | 22213 CC W33 |
| 65 | 120 | 31 | 1.5 | 143,000 | 179,000 | 14,600 | 18,300 | 3,900 | 5,000 | 22213 CC/K W33 |
| 70 | 125 | 31 | 1.5 | 154,000 | 201,000 | 15,700 | 20,500 | 3,500 | 4,600 | 22214 MB W33 |
| 70 | 125 | 31 | 1.5 | 154,000 | 201,000 | 15,700 | 20,500 | 3,500 | 4,600 | 22214 MB/K W33 |
| 70 | 125 | 31 | 1.5 | 154,000 | 201,000 | 15,700 | 20,500 | 3,500 | 4,600 | 22214 CC W33 |
| 70 | 125 | 31 | 1.5 | 154,000 | 201,000 | 15,700 | 20,500 | 3,500 | 4,600 | 22214 CC/K W33 |
| 75 | 130 | 31 | 1.5 | 166,000 | 223,000 | 16,900 | 22,800 | 3,200 | 4,200 | 22215 MB W33 |
| 75 | 130 | 31 | 1.5 | 166,000 | 223,000 | 16,900 | 22,800 | 3,200 | 4,200 | 22215 MB/K W33 |
| 75 | 130 | 31 | 1.5 | 166,000 | 223,000 | 16,900 | 22,800 | 3,200 | 4,200 | 22215 CC W33 |
| 75 | 130 | 31 | 1.5 | 166,000 | 223,000 | 16,900 | 22,800 | 3,200 | 4,200 | 22215 CC/K W33 |

**Technical supplement**

| Cages | Precision | Grease |
|---|---|---|
| Steel - CC<br>Polymid - X<br>Brass - MB | Class 0 (JIS) | Nil |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## Spherical Roller Bearings
## series 222




**Equivalent radial load dynamic**

$P_r = XF_r + YF_a$

| $\frac{F_a}{F_r} \leq e$ | | $\frac{F_a}{F_r} > e$ | |
|---|---|---|---|
| X | Y | X | Y |
| 1 | $Y_1$ | 0.67 | $Y_2$ |

**Static**

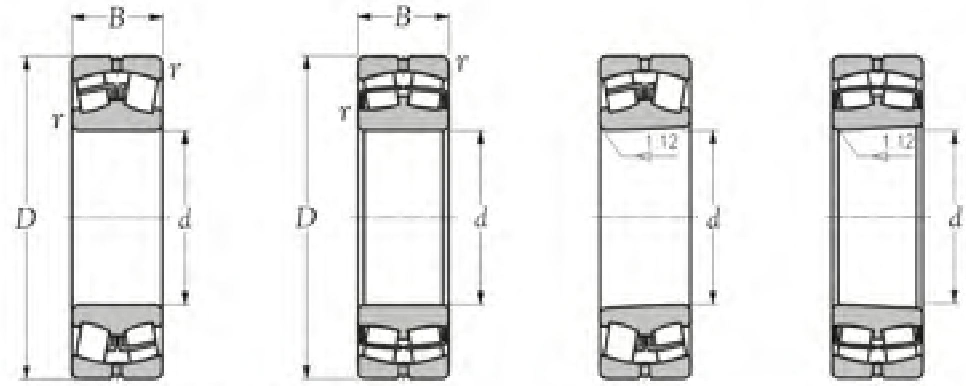
$P_r = F_r + Y_0 F_a$

**For values of $e$, $Y_2$ and $Y_0$ see the tabla below.**

| Abutments and fillet dimensions mm | | | Constant | Axial load factors | | | Mass (approx.) kg(s). | |
|---|---|---|---|---|---|---|---|---|
| $d_a$ min | $D_a$ max | $r_{as}$ max | $e$ | $Y_1$ | $Y_2$ | $Y_0$ | cylindrical bore | tapered bore |
| 57.0 | 83.0 | 1.0 | 0.25 | 2.69 | 4.01 | 2.63 | 0.63 | - |
| 57.0 | 83.0 | 1.0 | 0.25 | 2.69 | 4.01 | 2.63 | - | 0.616 |
| 63.5 | 91.5 | 1.5 | 0.28 | 2.42 | 3.61 | 2.37 | 0.85 | - |
| 63.5 | 91.5 | 1.5 | 0.28 | 2.42 | 3.61 | 2.37 | - | 0.832 |
| 63.5 | 91.5 | 1.5 | 0.28 | 2.42 | 3.61 | 2.37 | 0.85 | - |
| 63.5 | 91.5 | 1.5 | 0.28 | 2.42 | 3.61 | 2.37 | - | 0.832 |
| 68.5 | 101.5 | 1.5 | 0.27 | 2.49 | 3.71 | 2.44 | 1.15 | - |
| 68.5 | 101.5 | 1.5 | 0.27 | 2.49 | 3.71 | 2.44 | - | 1.130 |
| 68.5 | 101.5 | 1.5 | 0.27 | 2.49 | 3.71 | 2.44 | 1.15 | - |
| 68.5 | 101.5 | 1.5 | 0.27 | 2.49 | 3.71 | 2.44 | - | 1.130 |
| 73.5 | 111.5 | 1.5 | 0.28 | 2.42 | 3.60 | 2.37 | 1.50 | - |
| 73.5 | 111.5 | 1.5 | 0.28 | 2.42 | 3.60 | 2.37 | - | 1.470 |
| 73.5 | 111.5 | 1.5 | 0.28 | 2.42 | 3.60 | 2.37 | 1.50 | - |
| 73.5 | 111.5 | 1.5 | 0.28 | 2.42 | 3.60 | 2.37 | - | 1.470 |
| 78.5 | 116.5 | 1.5 | 0.26 | 2.55 | 3.80 | 2.50 | 1.55 | - |
| 78.5 | 116.5 | 1.5 | 0.26 | 2.55 | 3.80 | 2.50 | - | 1.520 |
| 78.5 | 116.5 | 1.5 | 0.26 | 2.55 | 3.80 | 2.50 | 1.55 | - |
| 78.5 | 116.5 | 1.5 | 0.26 | 2.55 | 3.80 | 2.50 | - | 1.520 |
| 83.5 | 121.5 | 1.5 | 0.24 | 2.81 | 4.19 | 2.75 | 1.65 | - |
| 83.5 | 121.5 | 1.5 | 0.24 | 2.81 | 4.19 | 2.75 | - | 1.610 |
| 83.5 | 121.5 | 1.5 | 0.24 | 2.81 | 4.19 | 2.75 | 1.65 | - |
| 83.5 | 121.5 | 1.5 | 0.24 | 2.81 | 4.19 | 2.75 | - | 1.610 |

## Spherical Roller Bearings

### series 222




Cylinrical bore

Tapered bore

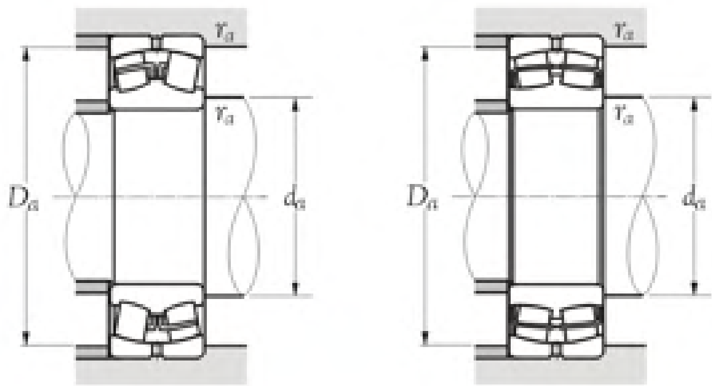
| Boundary dimensions mm | | | | Basic load ratings dynamic N | static N | dynamic kgf | static kgf | Limiting speeds min⁻¹ | | Bearing numbers |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | rs min | Cr | Cor | Cr | Cor | grease | oil | |
| 80 | 140 | 33 | 2.0 | 179,000 | 239,000 | 18,300 | 24,400 | 3,100 | 4,000 | 22216 MB W33 |
| 80 | 140 | 33 | 2.0 | 179,000 | 239,000 | 18,300 | 24,400 | 3,100 | 4,000 | 22216 MB/K W33 |
| 80 | 140 | 33 | 2.0 | 179,000 | 239,000 | 18,300 | 24,400 | 3,100 | 4,000 | 22216 CC W33 |
| 80 | 140 | 33 | 2.0 | 179,000 | 239,000 | 18,300 | 24,400 | 3,100 | 4,000 | 22216 CC/K W33 |
| 85 | 150 | 36 | 2.0 | 206,000 | 272,000 | 21,000 | 27,800 | 2,900 | 3,800 | 22217 MB W33 |
| 85 | 150 | 36 | 2.0 | 206,000 | 272,000 | 21,000 | 27,800 | 2,900 | 3,800 | 22217 MB/K W33 |
| 85 | 150 | 36 | 2.0 | 206,000 | 272,000 | 21,000 | 27,800 | 2,900 | 3,800 | 22217 CC W33 |
| 85 | 150 | 36 | 2.0 | 206,000 | 272,000 | 21,000 | 27,800 | 2,900 | 3,800 | 22217 CC/K W33 |
| 90 | 160 | 40 | 2.0 | 256,000 | 345,000 | 26,200 | 35,000 | 2,700 | 3,500 | 22218 MB W33 |
| 90 | 160 | 40 | 2.0 | 256,000 | 345,000 | 26,200 | 35,000 | 2,700 | 3,500 | 22218 MB/K W33 |
| 90 | 160 | 40 | 2.0 | 256,000 | 345,000 | 26,200 | 35,000 | 2,700 | 3,500 | 22218 CC W33 |
| 90 | 160 | 40 | 2.0 | 256,000 | 345,000 | 26,200 | 35,000 | 2,700 | 3,500 | 22218 CC/K W33 |
| 95 | 170 | 43 | 2.1 | 294,000 | 390,000 | 30,000 | 39,500 | 2,500 | 3,300 | 22219 MB W33 |
| 95 | 170 | 43 | 2.1 | 294,000 | 390,000 | 30,000 | 39,500 | 2,500 | 3,300 | 22219 MB/K W33 |
| 100 | 180 | 46 | 2.1 | 315,000 | 415,000 | 32,000 | 42,500 | 2,400 | 3,200 | 22220 MB W33 |
| 100 | 180 | 46 | 2.1 | 315,000 | 415,000 | 32,000 | 42,500 | 2,400 | 3,200 | 22220 MB/K W33 |
| 110 | 200 | 53 | 2.1 | 410,000 | 570,000 | 42,000 | 58,000 | 2,200 | 2,800 | 22222 MB W33 |
| 110 | 200 | 53 | 2.1 | 410,000 | 570,000 | 42,000 | 58,000 | 2,200 | 2,800 | 22222 MB/K W33 |
| 120 | 215 | 58 | 2.1 | 485,000 | 700,000 | 49,500 | 71,500 | 2,000 | 2,600 | 22224 MB W33 |
| 120 | 215 | 58 | 2.1 | 485,000 | 700,000 | 49,500 | 71,500 | 2,000 | 2,600 | 22224 MB/K W33 |
| 130 | 230 | 64 | 3.0 | 570,000 | 790,000 | 58,000 | 80,500 | 1,800 | 2,400 | 22226 MB W33 |
| 130 | 230 | 64 | 3.0 | 570,000 | 790,000 | 58,000 | 80,500 | 1,800 | 2,400 | 22226 MB/K W33 |

**Technical supplement**

| Cages | Precision | Grease |
|---|---|---|
| Steel - CC | | |
| Polymid - X | Class 0 (JIS) | Nil |
| Brass - MB | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## Spherical Roller Bearings
### series 222



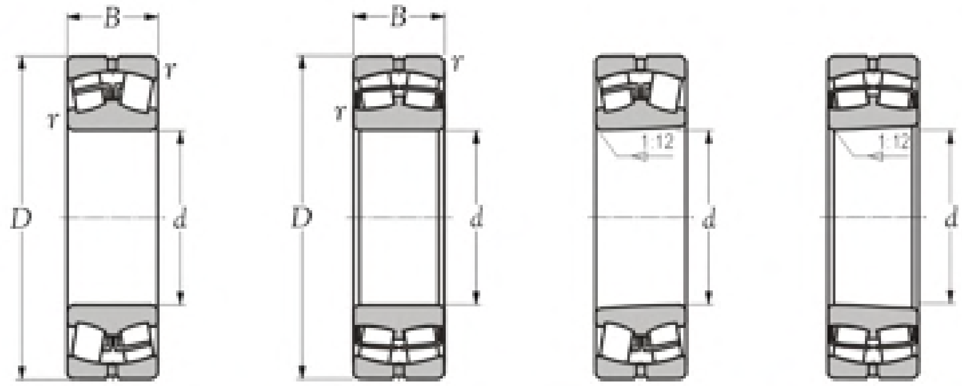

**Equivalent radial load**
**dynamic**
$P_r = XF_r + YF_a$

| $\frac{F_a}{F_r} \leq e$ | | $\frac{F_a}{F_r} > e$ | |
|---|---|---|---|
| X | Y | X | Y |
| 1 | $Y_1$ | 0.67 | $Y_2$ |

**Static**
$P_r = F_r + Y_0 F_a$
**For values of** $e$, $Y_2$ **and** $Y_0$ **see the tabla below.**

| Abutments and fillet dimensions mm | | | Constant | Axial load factors | | | Mass (approx.) kgs. | |
|---|---|---|---|---|---|---|---|---|
| $d_a$ min | $D_a$ max | $r_{as}$ max | $e$ | $Y_1$ | $Y_2$ | $Y_0$ | cylindrical bore | tapered bore |
| 90 | 130 | 2.0 | 0.26 | 2.64 | 3.93 | 2.58 | 2.15 | - |
| 90 | 130 | 2.0 | 0.26 | 2.64 | 3.93 | 2.58 | - | 2.11 |
| 90 | 130 | 2.0 | 0.26 | 2.64 | 3.93 | 2.58 | 2.15 | - |
| 90 | 130 | 2.0 | 0.26 | 2.64 | 3.93 | 2.58 | - | 2.11 |
| 95 | 140 | 2.0 | 0.26 | 2.60 | 3.88 | 2.55 | 2.66 | - |
| 95 | 140 | 2.0 | 0.26 | 2.60 | 3.88 | 2.55 | - | 2.61 |
| 95 | 140 | 2.0 | 0.26 | 2.60 | 3.88 | 2.55 | 2.66 | - |
| 95 | 140 | 2.0 | 0.26 | 2.60 | 3.88 | 2.55 | - | 2.61 |
| 100 | 150 | 2.0 | 0.26 | 2.55 | 3.80 | 2.49 | 3.50 | - |
| 100 | 150 | 2.0 | 0.26 | 2.55 | 3.80 | 2.49 | - | 3.42 |
| 100 | 150 | 2.0 | 0.26 | 2.55 | 3.80 | 2.49 | 3.50 | - |
| 100 | 150 | 2.0 | 0.26 | 2.55 | 3.80 | 2.49 | - | 3.42 |
| 107 | 158 | 2.0 | 0.26 | 2.63 | 3.92 | 2.57 | 4.20 | - |
| 107 | 158 | 2.0 | 0.26 | 2.63 | 3.92 | 2.57 | - | 2.80 |
| 112 | 168 | 2.0 | 0.26 | 2.55 | 3.80 | 2.49 | 4.95 | - |
| 112 | 168 | 2.0 | 0.26 | 2.55 | 3.80 | 2.49 | - | 4.84 |
| 122 | 188 | 2.0 | 0.27 | 2.51 | 3.74 | 2.46 | 7.20 | - |
| 122 | 188 | 2.0 | 0.27 | 2.51 | 3.74 | 2.46 | - | 7.04 |
| 132 | 203 | 2.0 | 0.27 | 2.47 | 3.68 | 2.42 | 9.10 | - |
| 132 | 203 | 2.0 | 0.27 | 2.47 | 3.68 | 2.42 | - | 8.89 |
| 144 | 216 | 2.5 | 0.28 | 2.39 | 3.56 | 2.33 | 11.20 | - |
| 144 | 216 | 2.5 | 0.28 | 2.39 | 3.56 | 2.33 | - | 10.90 |

## Spherical Roller Bearings
### series 222




Cylinrical bore          Tapered bore

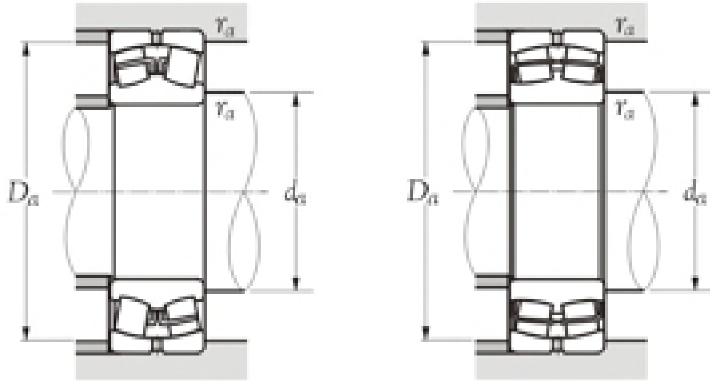
| Boundary dimensions mm | | | | Basic load ratings dynamic N | static N | dynamic kgf | static kgf | Limiting speeds min⁻¹ | | Bearing numbers |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | rs min[1] | Cr | Cor | Cr | Cor | grease | oil | |
| 140 | 250 | 68 | 3.0 | 685,000 | 975,000 | 70,000 | 99,500 | 1,700 | 2,200 | **22228 MB W33** |
| 140 | 250 | 68 | 3.0 | 685,000 | 975,000 | 70,000 | 99,500 | 1,700 | 2,200 | **22228 MB/K W33** |
| 150 | 270 | 73 | 3.0 | 775,000 | 1,160,000 | 79,000 | 119,000 | 1,600 | 2,000 | **22230 MB W33** |
| 150 | 270 | 73 | 3.0 | 775,000 | 1,160,000 | 79,000 | 119,000 | 1,600 | 2,000 | **22230 MB/K W33** |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | CC | | |
| Polymid - | X | Class 0 (JIS) | Nil |
| Brass - | MB | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## Spherical Roller Bearings
## series 222




**Equivalent radial load dynamic**

$P_r = XF_r + YF_a$

| $\frac{F_a}{F_r} \leq e$ | | $\frac{F_a}{F_r} > e$ | |
|---|---|---|---|
| X | Y | X | Y |
| 1 | $Y_1$ | 0.67 | $Y_2$ |

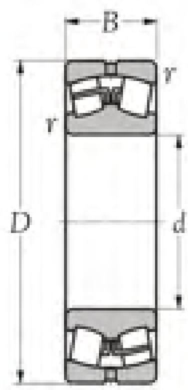
**Static**

$P_r = F_r + Y_0 F_a$

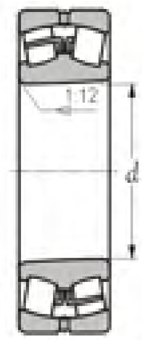
**For values of** $e$, $Y2$ **and** $Y_0$ **see the tabla below.**

| Abutments and fillet dimensions mm | | | Constant | Axial load factors | | | Mass (approx.) kgs. | |
|---|---|---|---|---|---|---|---|---|
| $d_a$ min | $D_a$ max | $r_{as}$ max | $e$ | $Y_1$ | $Y_2$ | $Y_0$ | cylindrical bore | tapered bore |
| 154 | 236 | 2.5 | 0.28 | 2.39 | 3.55 | 2.33 | 14.00 | - |
| 154 | 236 | 2.5 | 0.28 | 2.39 | 3.55 | 2.33 | - | 2.11 |
| 164 | 256 | 2.5 | 0.27 | 2.46 | 3.66 | 2.40 | 18.10 | - |
| 164 | 256 | 2.5 | 0.27 | 2.46 | 3.66 | 2.40 | - | 2.11 |

## Spherical Roller Bearings
## series 223




Cylinrical bore




Tapered bore

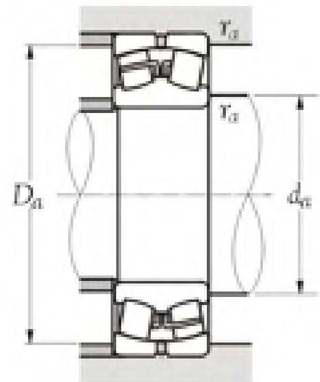
| Boundary dimensions mm | | | | Basic load ratings dynamic N | static N | dynamic kgf | static kgf | Limiting speeds $min^{-1}$ | | Bearing numbers |
|---|---|---|---|---|---|---|---|---|---|---|
| $d$ | $D$ | $B$ | $r_{s\ min}$ | $C_r$ | $C_{or}$ | $C_r$ | $C_{or}$ | grease | oil | |
| 40 | 90 | 33 | 1.5 | 121,000 | 128,000 | 12,300 | 13,000 | 4,500 | 5,900 | 22308 MB W33 |
| 40 | 90 | 33 | 1.5 | 121,000 | 128,000 | 12,300 | 13,000 | 4,500 | 5,900 | 22308 MB/K W33 |
| 45 | 100 | 36 | 1.5 | 148,000 | 167,000 | 15,100 | 17,000 | 4,100 | 5,300 | 22309 MB W33 |
| 45 | 100 | 36 | 1.5 | 148,000 | 167,000 | 15,100 | 17,000 | 4,100 | 5,300 | 22309 MB/K W33 |
| 50 | 110 | 40 | 2.0 | 186,000 | 212,000 | 19,000 | 21,600 | 3,700 | 4,800 | 22310 MB W33 |
| 50 | 110 | 40 | 2.0 | 186,000 | 212,000 | 19,000 | 21,600 | 3,700 | 4,800 | 22310 MB/K W33 |
| 55 | 120 | 43 | 2.0 | 204,000 | 234,000 | 20,800 | 23,900 | 3,400 | 4,400 | 22311 MB W33 |
| 55 | 120 | 43 | 2.0 | 204,000 | 234,000 | 20,800 | 23,900 | 3,400 | 4,400 | 22311 MB/K W33 |
| 60 | 130 | 46 | 2.1 | 238,000 | 273,000 | 24,300 | 27,800 | 3,100 | 4,000 | 22312 MB W33 |
| 60 | 130 | 46 | 2.1 | 238,000 | 273,000 | 24,300 | 27,800 | 3,100 | 4,000 | 22312 MB/K W33 |
| 65 | 140 | 48 | 2.1 | 265,000 | 320,000 | 27,100 | 32,500 | 2,800 | 3,700 | 22313 MB W33 |
| 65 | 140 | 48 | 2.1 | 265,000 | 320,000 | 27,100 | 32,500 | 2,800 | 3,700 | 22313 MB/K W33 |
| 70 | 150 | 51 | 2.1 | 325,000 | 380,000 | 33,000 | 39,000 | 2,700 | 3,500 | 22314 MB W33 |
| 70 | 150 | 51 | 2.1 | 325,000 | 380,000 | 33,000 | 39,000 | 2,700 | 3,500 | 22314 MB/K W33 |
| 75 | 160 | 55 | 2.1 | 330,000 | 410,000 | 33,500 | 42,000 | 2,500 | 3,200 | 22315 MB W33 |
| 75 | 160 | 55 | 2.1 | 330,000 | 410,000 | 33,500 | 42,000 | 2,500 | 3,200 | 22315 MB/K W33 |
| 80 | 170 | 58 | 2.1 | 385,000 | 470,000 | 39,500 | 48,000 | 2,300 | 3,000 | 22316 MB W33 |
| 80 | 170 | 58 | 2.1 | 385,000 | 470,000 | 39,500 | 48,000 | 2,300 | 3,000 | 22316 MB/K W33 |
| 85 | 180 | 60 | 3.0 | 415,000 | 510,000 | 42,500 | 52,000 | 2,200 | 2,900 | 22317 MB W33 |
| 85 | 180 | 60 | 3.0 | 415,000 | 510,000 | 42,500 | 52,000 | 2,200 | 2,900 | 22317 MB/K W33 |
| 90 | 190 | 64 | 3.0 | 480,000 | 590,000 | 49,000 | 60,000 | 2,100 | 2,700 | 22318 MB W33 |
| 90 | 190 | 64 | 3.0 | 480,000 | 590,000 | 49,000 | 60,000 | 2,100 | 2,700 | 22318 MB/K W33 |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | X | | |
| Polymid - | X | Class 0 (JIS) | Nil |
| Brass - | MB | | |

Remark: If you have more inquiry of technical, please inquire
NIKO web-site: Http://www.nipponkodobearings.com

## Spherical Roller Bearings
## series 223



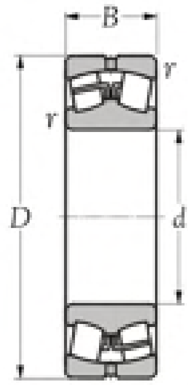

**Equivalent radial load**
**dynamic**
$P_r = XF_r + YF_a$

| $\frac{F_a}{F_r} \leq e$ | | $\frac{F_a}{F_r} > e$ | |
|---|---|---|---|
| X | Y | X | Y |
| 1 | $Y_1$ | 0.67 | $Y_2$ |

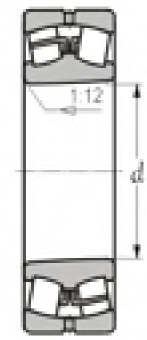
**Static**
$P_r = F_r + Y_0 F_a$
**For values of $e$, $Y_2$ and $Y_0$ see the tabla below.**

| Abutments and fillet dimensions mm | | | Constant | Axial load factors | | | Mass (approx.) kg(s). | |
|---|---|---|---|---|---|---|---|---|
| $d_a$ min | $D_a$ max | $r_{as}$ max | $e$ | $Y_1$ | $Y_2$ | $Y_0$ | cylindrical bore | tapered bore |
| 48.5 | 81.5 | 1.5 | 0.38 | 1.76 | 2.62 | 1.72 | 0.97 | - |
| 48.5 | 81.5 | 1.5 | 0.38 | 1.76 | 2.62 | 1.72 | - | 0.95 |
| 53.5 | 91.5 | 1.5 | 0.36 | 1.86 | 2.77 | 1.82 | 1.33 | - |
| 53.5 | 91.5 | 1.5 | 0.36 | 1.86 | 2.77 | 1.82 | - | 1.30 |
| 60.0 | 100.0 | 2.0 | 0.37 | 1.80 | 2.69 | 1.76 | 1.79 | - |
| 60.0 | 100.0 | 2.0 | 0.37 | 1.80 | 2.69 | 1.76 | - | 1.75 |
| 65.0 | 110.0 | 2.0 | 0.40 | 1.68 | 2.50 | 1.64 | 2.30 | - |
| 65.0 | 110.0 | 2.0 | 0.40 | 1.68 | 2.50 | 1.64 | - | 2.25 |
| 72.0 | 118.0 | 2.0 | 0.42 | 1.62 | 2.42 | 1.59 | 2.90 | - |
| 72.0 | 118.0 | 2.0 | 0.42 | 1.62 | 2.42 | 1.59 | - | 2.83 |
| 77.0 | 128.0 | 2.0 | 0.38 | 1.79 | 2.67 | 1.75 | 3.45 | - |
| 77.0 | 128.0 | 2.0 | 0.38 | 1.79 | 2.67 | 1.75 | - | 3.37 |
| 82.0 | 138.0 | 2.0 | 0.37 | 1.81 | 2.70 | 1.77 | 4.22 | - |
| 82.0 | 138.0 | 2.0 | 0.37 | 1.81 | 2.70 | 1.77 | - | 4.12 |
| 87.0 | 148.0 | 2.0 | 0.37 | 1.80 | 2.69 | 1.76 | 5.25 | - |
| 87.0 | 148.0 | 2.0 | 0.37 | 1.80 | 2.69 | 1.76 | - | 5.13 |
| 92.0 | 158.0 | 2.0 | 0.37 | 1.80 | 2.69 | 1.76 | 6.05 | - |
| 92.0 | 158.0 | 2.0 | 0.37 | 1.80 | 2.69 | 1.76 | - | 5.91 |
| 99.0 | 166.0 | 2.5 | 0.37 | 1.82 | 2.71 | 1.78 | 7.10 | - |
| 99.0 | 166.0 | 2.5 | 0.37 | 1.82 | 2.71 | 1.78 | - | 6.94 |
| 104.0 | 176.0 | 2.5 | 0.37 | 1.80 | 2.69 | 1.76 | 8.35 | - |
| 104.0 | 176.0 | 2.5 | 0.37 | 1.80 | 2.69 | 1.76 | - | 8.16 |

## Spherical Roller Bearings
## series 223




Cylinrical bore




Tapered bore

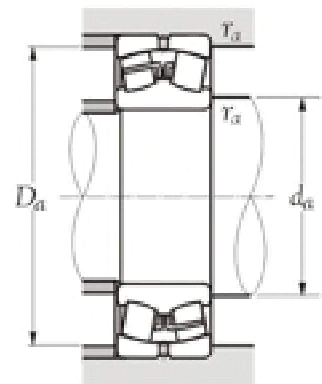
| Boundary dimensions mm | | | | Basic load ratings dynamic N | static N | dynamic kgf | static kgf | Limiting speeds min-1 | | Bearing numbers |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | $r_{s\,min}$[1)] | $C_r$ | $C_{or}$ | $C_r$ | $C_{or}$ | grease | oil | |
| 95 | 200 | 67 | 3 | 500,000 | 615,000 | 51,000 | 63,000 | 1,900 | 2,500 | **22319 MB W33** |
| 95 | 200 | 67 | 3 | 500,000 | 615,000 | 51,000 | 63,000 | 1,900 | 2,500 | **22319 MB/K W33** |
| 100 | 215 | 73 | 3 | 605,000 | 755,000 | 61,500 | 77,000 | 1,800 | 2,400 | **22320 MB W33** |
| 100 | 215 | 73 | 3 | 605,000 | 755,000 | 61,500 | 77,000 | 1,800 | 2,400 | **22320 MB/K W33** |
| 110 | 240 | 80 | 3 | 745,000 | 930,000 | 76,000 | 95,000 | 1,700 | 2,200 | **22322 MB W33** |
| 110 | 240 | 80 | 3 | 745,000 | 930,000 | 76,000 | 95,000 | 1,700 | 2,200 | **22322 MB/K W33** |
| 120 | 260 | 86 | 3 | 880,000 | 1,120,000 | 89,500 | 114,000 | 1,500 | 2,000 | **22324 MB W33** |
| 120 | 260 | 86 | 3 | 880,000 | 1,120,000 | 89,500 | 114,000 | 1,500 | 2,000 | **22324 MB/K W33** |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | X | Class 0 (JIS) | Nil |
| Polymid - | X | | |
| Brass - | MB | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## Spherical Roller Bearings
## series 223



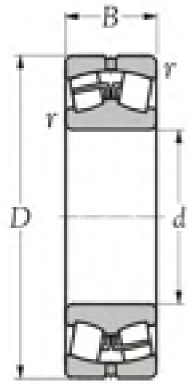

**Equivalent radial load**
**dynamic**
$P_r = XF_r + YF_a$

| $\frac{F_a}{F_r} \leq e$ | | $\frac{F_a}{F_r} > e$ | |
|---|---|---|---|
| X | Y | X | Y |
| 1 | $Y_1$ | 0.67 | $Y_2$ |

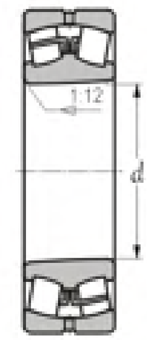
**Static**
$P_r = F_r + Y_0F_a$
**For values of** $e$, $Y_2$ **and** $Y_0$ **see the tabla below.**

| Abutments and fillet dimensions mm | | | Constant | Axial load factors | | | Mass (approx.) kgs. | |
|---|---|---|---|---|---|---|---|---|
| $d_a$ min | $D_a$ max | $r_{as}$ max | $e$ | $Y_1$ | $Y_2$ | $Y_0$ | cylindrical bore | tapered bore |
| 109 | 186 | 2.5 | 0.37 | 1.80 | 2.69 | 1.76 | 9.76 | - |
| 109 | 186 | 2.5 | 0.37 | 1.80 | 2.69 | 1.76 | - | 9.54 |
| 114 | 201 | 2.5 | 0.37 | 1.80 | 2.69 | 1.76 | 12.40 | - |
| 114 | 201 | 2.5 | 0.37 | 1.80 | 2.69 | 1.76 | - | 12.10 |
| 124 | 226 | 2.5 | 0.36 | 1.87 | 2.79 | 1.83 | 17.10 | - |
| 124 | 226 | 2.5 | 0.36 | 1.87 | 2.79 | 1.83 | - | 16.70 |
| 134 | 246 | 2.5 | 0.37 | 1.80 | 2.69 | 1.76 | 21.50 | - |
| 134 | 246 | 2.5 | 0.37 | 1.80 | 2.69 | 1.76 | - | 21.00 |

## Spherical Roller Bearings
## series 230




Cylinrical bore




Tapered bore

| Boundary dimensions mm | | | | Basic load ratings dynamic N | static N | dynamic kgf | static kgf | Limiting speeds min⁻¹ | | Bearing numbers |
|---|---|---|---|---|---|---|---|---|---|---|
| $d$ | $D$ | $B$ | $r_{s\,min}$ 1) | $C_r$ | $C_{or}$ | $C_r$ | $C_{or}$ | grease | oil | |
| 110 | 170 | 45 | 2.0 | 282,000 | 455,000 | 28,800 | 46,500 | 2,200 | 2,800 | 23022 MB W33 |
| 110 | 170 | 45 | 2.0 | 282,000 | 455,000 | 28,800 | 46,500 | 2,200 | 2,800 | 23022 MB/K W33 |
| 120 | 180 | 46 | 2.0 | 296,000 | 495,000 | 30,000 | 50,500 | 2,000 | 2,600 | 23024 MB W33 |
| 120 | 180 | 46 | 2.0 | 296,000 | 495,000 | 30,000 | 50,500 | 2,000 | 2,600 | 23024 MB/K W33 |
| 130 | 200 | 52 | 2.0 | 375,000 | 620,000 | 38,500 | 63,500 | 1,800 | 2,300 | 23026 MB W33 |
| 130 | 200 | 52 | 2.0 | 375,000 | 620,000 | 38,500 | 63,500 | 1,800 | 2,300 | 23026 MB/K W33 |
| 140 | 210 | 53 | 2.0 | 405,000 | 690,000 | 41,000 | 70,500 | 1,700 | 2,200 | 23028 MB W33 |
| 140 | 210 | 53 | 2.0 | 405,000 | 690,000 | 41,000 | 70,500 | 1,700 | 2,200 | 23028 MB/K W33 |
| 150 | 225 | 56 | 2.1 | 445,000 | 775,000 | 45,500 | 79,000 | 1,500 | 2,000 | 23030 MB W33 |
| 150 | 225 | 56 | 2.1 | 445,000 | 775,000 | 45,500 | 79,000 | 1,500 | 2,000 | 23030 MB/K W33 |
| 160 | 240 | 60 | 2.1 | 505,000 | 885,000 | 51,500 | 90,000 | 1,500 | 1,900 | 23032 MB W33 |
| 160 | 240 | 60 | 2.1 | 505,000 | 885,000 | 51,500 | 90,000 | 1,500 | 1,900 | 23032 MB/K W33 |

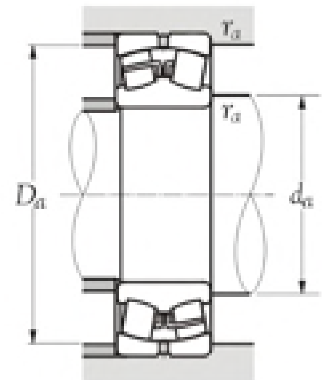
**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | X | | |
| Polymid - | X | Class 0 (JIS) | Nil |
| Brass - | MB | | |

Remark: If you have more inquiry of technical, please inquire
NIKO web-site: Http://www.nipponkodobearings.com

SPHERICAL ROLLER BEARINGS

SERIES **230**




**Equivalent radial load**
**dynamic**

$P_r = XF_r + YF_a$

| $\frac{F_a}{F_r} \leq e$ | | $\frac{F_a}{F_r} > e$ | |
|---|---|---|---|
| X | Y | X | Y |
| 1 | $Y_1$ | 0.67 | $Y_2$ |

**Static**

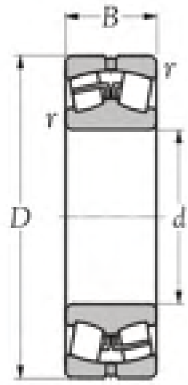
$P_r = F_r + Y_0 F_a$

**For values of** $e$, $Y2$ **and** $Y_0$ **see the tabla below.**

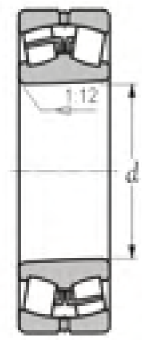
| Abutments and fillet dimensions mm | | | Constant | Axial load factors | | | Mass (approx.) kgs. | |
|---|---|---|---|---|---|---|---|---|
| $d_a$ min | $D_a$ max | $r_{as}$ max | $e$ | $Y_1$ | $Y_2$ | $Y_0$ | cylindrical bore | tapered bore |
| 120 | 160 | 2 | 0.26 | 2.59 | 3.85 | 2.53 | 3.71 | - |
| 120 | 160 | 2 | 0.26 | 2.59 | 3.85 | 2.53 | - | 3.58 |
| 130 | 170 | 2 | 0.25 | 2.69 | 4.01 | 2.63 | 4.05 | - |
| 130 | 170 | 2 | 0.25 | 2.69 | 4.01 | 2.63 | - | 3.90 |
| 140 | 190 | 2 | 0.26 | 2.63 | 3.92 | 2.57 | 5.90 | - |
| 140 | 190 | 2 | 0.26 | 2.63 | 3.92 | 2.57 | - | 5.69 |
| 150 | 200 | 2 | 0.25 | 2.73 | 4.06 | 2.67 | 6.35 | - |
| 150 | 200 | 2 | 0.25 | 2.73 | 4.06 | 2.67 | - | 6.12 |
| 162 | 213 | 2 | 0.24 | 2.76 | 4.11 | 2.70 | 7.73 | - |
| 162 | 213 | 2 | 0.24 | 2.76 | 4.11 | 2.70 | - | 7.45 |
| 172 | 228 | 2 | 0.25 | 2.74 | 4.09 | 2.68 | 9.42 | - |
| 172 | 228 | 2 | 0.25 | 2.74 | 4.09 | 2.68 | - | 9.09 |

# Spherical Roller Bearings

## series 231



Cylinrical bore



Tapered bore

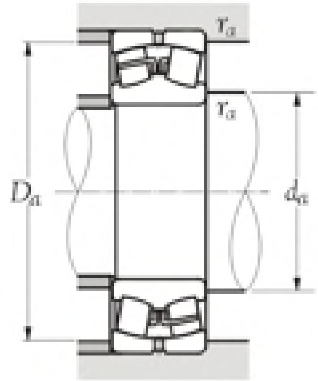
| Boundary dimensions mm | | | | Basic load ratings dynamic N | static N | dynamic kgf | static kgf | Limiting speeds min⁻¹ | | Bearing numbers |
|---|---|---|---|---|---|---|---|---|---|---|
| $d$ | $D$ | $B$ | $r_{s\,min}$ [1)] | $C_r$ | $C_{or}$ | $C_r$ | $C_{or}$ | grease | oil | |
| 100 | 165 | 52 | 2.0 | 310,000 | 470,000 | 31,500 | 47,500 | 2,000 | 2,600 | **23120 MB W33** |
| 100 | 165 | 52 | 2.0 | 310,000 | 470,000 | 31,500 | 47,500 | 2,000 | 2,600 | **23120 MB/K W33** |
| 110 | 180 | 56 | 2.0 | 370,000 | 580,000 | 37,500 | 59,500 | 1,800 | 2,400 | **23122 MB W33** |
| 110 | 180 | 56 | 2.0 | 370,000 | 580,000 | 37,500 | 59,500 | 1,800 | 2,400 | **23122 MB/K W33** |
| 120 | 200 | 62 | 2.0 | 455,000 | 705,000 | 46,500 | 71,500 | 1,600 | 2,100 | **23124 MB W33** |
| 120 | 200 | 62 | 2.0 | 455,000 | 705,000 | 46,500 | 71,500 | 1,600 | 2,100 | **23124 MB/K W33** |
| 130 | 210 | 64 | 2.0 | 495,000 | 795,000 | 50,500 | 81,000 | 1,500 | 2,000 | **23126 MB W33** |
| 130 | 210 | 64 | 2.0 | 495,000 | 795,000 | 50,500 | 81,000 | 1,500 | 2,000 | **23126 MB/K W33** |
| 140 | 225 | 68 | 2.1 | 540,000 | 895,000 | 55,000 | 91,000 | 1,400 | 1,800 | **23128 MB W33** |
| 140 | 225 | 68 | 2.1 | 540,000 | 895,000 | 55,000 | 91,000 | 1,400 | 1,800 | **23128 MB/K W33** |
| 150 | 250 | 80 | 2.1 | 730,000 | 1,190,000 | 74,500 | 121,000 | 1,300 | 1,700 | **23130 MB W33** |
| 150 | 250 | 80 | 2.1 | 730,000 | 1,190,000 | 74,500 | 121,000 | 1,300 | 1,700 | **23130 MB/K W33** |
| 160 | 270 | 86 | 2.1 | 840,000 | 1,370,000 | 85,500 | 140,000 | 1,200 | 1,600 | **23132 MB W33** |
| 160 | 270 | 86 | 2.1 | 840,000 | 1,370,000 | 85,500 | 140,000 | 1,200 | 1,600 | **23132 MB/K W33** |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | X | | |
| Polymid - | X | Class 0 (JIS) | Nil |
| Brass - | MB | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## Spherical Roller Bearings
## series 231




**Equivalent radial load dynamic**

$P_r = XF_r + YF_a$

| $\frac{F_a}{F_r} \leq e$ | | $\frac{F_a}{F_r} > e$ | |
|---|---|---|---|
| X | Y | X | Y |
| 1 | $Y_1$ | 0.67 | $Y_2$ |

**Static**

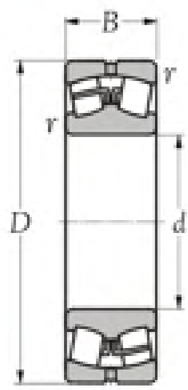
$P_r = F_r + Y_0 F_a$

**For values of $e$, $Y2$ and $Y_0$ see the tabla below.**

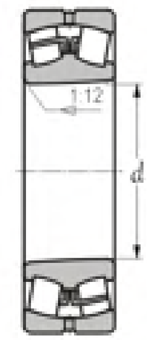
| Abutments and fillet dimensions mm | | | Constant | Axial load factors | | | Mass (approx.) kgs. | |
|---|---|---|---|---|---|---|---|---|
| $d_a$ min | $D_a$ max | $r_{as}$ max | $e$ | $Y_1$ | $Y_2$ | $Y_0$ | cylindrical bore | tapered bore |
| 110 | 155 | 2 | 0.32 | 2.12 | 3.15 | 2.07 | 4.30 | - |
| 110 | 155 | 2 | 0.32 | 2.12 | 3.15 | 2.07 | - | 4.16 |
| 120 | 170 | 2 | 0.31 | 2.17 | 3.24 | 2.13 | 5.40 | - |
| 120 | 170 | 2 | 0.31 | 2.17 | 3.24 | 2.13 | - | 5.22 |
| 130 | 190 | 2 | 0.31 | 2.17 | 3.24 | 2.13 | 7.70 | - |
| 130 | 190 | 2 | 0.31 | 2.17 | 3.24 | 2.13 | - | 7.46 |
| 140 | 200 | 2 | 0.30 | 2.23 | 3.32 | 2.18 | 8.47 | - |
| 140 | 200 | 2 | 0.30 | 2.23 | 3.32 | 2.18 | - | 8.20 |
| 152 | 213 | 2 | 0.30 | 2.25 | 3.35 | 2.20 | 10.20 | - |
| 152 | 213 | 2 | 0.30 | 2.25 | 3.35 | 2.20 | - | 9.86 |
| 162 | 238 | 2 | 0.32 | 2.11 | 3.15 | 2.06 | 15.60 | - |
| 162 | 238 | 2 | 0.32 | 2.11 | 3.15 | 2.06 | - | 15.10 |
| 172 | 258 | 2 | 0.32 | 2.11 | 3.15 | 2.07 | 19.80 | - |
| 172 | 258 | 2 | 0.32 | 2.11 | 3.15 | 2.07 | - | 19.20 |

# Spherical Roller Bearings

## series 232




Cylinrical bore




Tapered bore

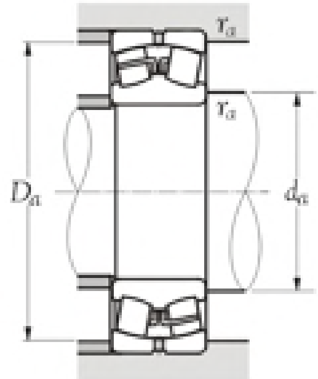
| Boundary dimensions mm | | | | Basic load ratings | | | | Limiting speeds $min^{-1}$ | | Bearing numbers |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | dynamic N | static N | dynamic kgf | static kgf | | | |
| d | D | B | $r_{s\,min}$ [1] | $C_r$ | $C_{or}$ | $C_r$ | $C_{or}$ | grease | oil | |
| 90 | 160 | 52.4 | 2.0 | 315,000 | 455,000 | 32,500 | 46,500 | 2,200 | 2,800 | 23218 MB W33 |
| 90 | 160 | 52.4 | 2.0 | 315,000 | 455,000 | 32,500 | 46,500 | 2,200 | 2,800 | 23218 MB/K W33 |
| 100 | 180 | 60.3 | 2.1 | 405,000 | 580,000 | 41,500 | 59,000 | 1,900 | 2,500 | 23220 MB W33 |
| 100 | 180 | 60.3 | 2.1 | 405,000 | 580,000 | 41,500 | 59,000 | 1,900 | 2,500 | 23220 MB/K W33 |
| 110 | 200 | 69.8 | 2.1 | 515,000 | 760,000 | 52,500 | 77,500 | 1,700 | 2,200 | 23222 MB W33 |
| 110 | 200 | 69.8 | 2.1 | 515,000 | 760,000 | 52,500 | 77,500 | 1,700 | 2,200 | 23222 MB/K W33 |
| 120 | 215 | 76.0 | 2.1 | 585,000 | 880,000 | 59,500 | 89,500 | 1,500 | 2,000 | 23224 MB W33 |
| 120 | 215 | 76.0 | 2.1 | 585,000 | 880,000 | 59,500 | 89,500 | 1,500 | 2,000 | 23224 MB/K W33 |
| 130 | 230 | 80.0 | 3.0 | 685,000 | 1060,000 | 70,000 | 108,000 | 1,500 | 1,900 | 23226 MB W33 |
| 130 | 230 | 80.0 | 3.0 | 685,000 | 1060,000 | 70,000 | 108,000 | 1,500 | 1,900 | 23226 MB/K W33 |
| 140 | 250 | 88.0 | 3.0 | 805,000 | 1270,000 | 82,000 | 129,000 | 1,300 | 1,700 | 23228 MB W33 |
| 140 | 250 | 88.0 | 3.0 | 805,000 | 1270,000 | 82,000 | 129,000 | 1,300 | 1,700 | 23228 MB/K W33 |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | X | Class 0 (JIS) | Nil |
| Polymid - | X | | |
| Brass - | MB | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

# Spherical Roller Bearings
## series 232



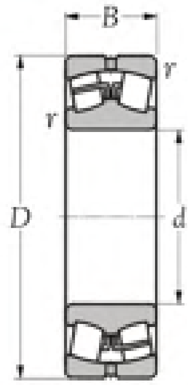

**Equivalent radial load**
**dynamic**
$P_r = XF_r + YF_a$

| $\frac{F_a}{F_r} \leq e$ | | $\frac{F_a}{F_r} > e$ | |
|---|---|---|---|
| X | Y | X | Y |
| 1 | $Y_1$ | 0.67 | $Y_2$ |

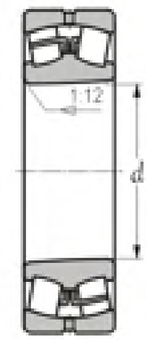
**Static**
$P_r = F_r + Y_0 F_a$
**For values of** $e$, $Y2$ **and** $Y_0$ **see the tabla below.**

| Abutments and fillet dimensions mm | | | Constant | Axial load factors | | | Mass (approx.) kgs. | |
|---|---|---|---|---|---|---|---|---|
| $d_a$ min | $D_a$ max | $r_{as}$ max | $e$ | $Y_1$ | $Y_2$ | $Y_0$ | cylindrical bore | tapered bore |
| 100 | 150 | 2.0 | 0.33 | 2.04 | 3.03 | 1.99 | 4.45 | - |
| 100 | 150 | 2.0 | 0.33 | 2.04 | 3.03 | 1.99 | - | 4.32 |
| 112 | 168 | 2.0 | 0.34 | 1.98 | 2.94 | 1.93 | 6.47 | - |
| 112 | 168 | 2.0 | 0.34 | 1.98 | 2.94 | 1.93 | - | 6.28 |
| 122 | 188 | 2.0 | 0.35 | 1.91 | 2.84 | 1.86 | 9.71 | - |
| 122 | 188 | 2.0 | 0.35 | 1.91 | 2.84 | 1.86 | - | 9.43 |
| 132 | 203 | 2.0 | 0.36 | 1.89 | 2.82 | 1.85 | 12.10 | - |
| 132 | 203 | 2.0 | 0.36 | 1.89 | 2.82 | 1.85 | - | 11.70 |
| 144 | 216 | 2.5 | 0.35 | 1.92 | 2.86 | 1.88 | 14.30 | - |
| 144 | 216 | 2.5 | 0.35 | 1.92 | 2.86 | 1.88 | - | 13.90 |
| 154 | 236 | 2.5 | 0.36 | 1.90 | 2.83 | 1.86 | 18.80 | - |
| 154 | 236 | 2.5 | 0.36 | 1.90 | 2.83 | 1.86 | - | 18.20 |

## Spherical Roller Bearings
## series 240




Cylinrical bore




Tapered bore

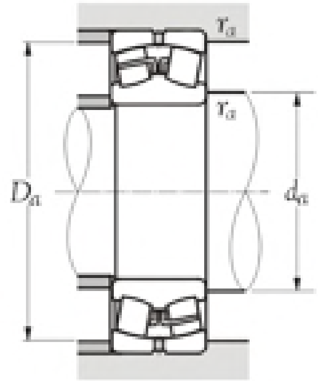
| Boundary dimensions mm | | | | Basic load ratings dynamic N | static N | dynamic kgf | static kgf | Limiting speeds min⁻¹ | | Bearing numbers |
|---|---|---|---|---|---|---|---|---|---|---|
| $d$ | $D$ | $B$ | $r_s$ min[1)] | $C_r$ | $C_{0r}$ | $C_r$ | $C_{0r}$ | grease | oil | |
| 110 | 170 | 60 | 1.2 | 415,000 | 620,000 | 42,330 | 63,240 | 2,400 | 3,600 | **24022 MB W33** |
| 110 | 170 | 60 | 1.2 | 415,000 | 620,000 | 42,330 | 63,240 | 2,400 | 3,600 | **24022 MB/K W33** |
| 120 | 180 | 60 | 2.0 | 390,000 | 670,000 | 39,500 | 68,500 | 1,800 | 2,300 | **24024 MB W33** |
| 120 | 180 | 60 | 2.0 | 390,000 | 670,000 | 39,500 | 68,500 | 1,800 | 2,300 | **24024 MB/K W33** |
| 130 | 200 | 69 | 2.0 | 505,000 | 895,000 | 51,500 | 91,000 | 1,600 | 2,100 | **24026 MB W33** |
| 130 | 200 | 69 | 2.0 | 505,000 | 895,000 | 51,500 | 91,000 | 1,600 | 2,100 | **24026 MB/K W33** |
| 140 | 210 | 69 | 2.0 | 510,000 | 945,000 | 52,000 | 96,500 | 1,500 | 1,900 | **24028 MB W33** |
| 140 | 210 | 69 | 2.0 | 510,000 | 945,000 | 52,000 | 96,500 | 1,500 | 1,900 | **24028 MB/K W33** |
| 150 | 225 | 75 | 2.1 | 585,000 | 1,060,000 | 59,500 | 108,000 | 1,400 | 1,800 | **24030 MB W33** |
| 150 | 225 | 75 | 2.1 | 585,000 | 1,060,000 | 59,500 | 108,000 | 1,400 | 1,800 | **24030 MB/K W33** |
| 160 | 240 | 80 | 2.1 | 650,000 | 1,200,000 | 66,500 | 122,000 | 1,300 | 1,700 | **24032 MB W33** |
| 160 | 240 | 80 | 2.1 | 650,000 | 1,200,000 | 66,500 | 122,000 | 1,300 | 1,700 | **24032 MB/K W33** |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | X | Class 0 (JIS) | Nil |
| Polymid - | X | | |
| Brass - | MB | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

SPHERICAL ROLLER BEARINGS
SERIES 240




**Equivalent radial load dynamic**

$P_r = XF_r + YF_a$

| $\frac{F_a}{F_r} \leq e$ | | $\frac{F_a}{F_r} > e$ | |
|---|---|---|---|
| X | Y | X | Y |
| 1 | $Y_1$ | 0.67 | $Y_2$ |

**Static**

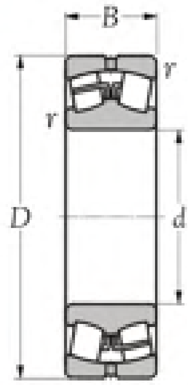
$P_r = F_r + Y_0 F_a$

**For values of $e$, $Y2$ and $Y_0$ see the tabla below.**

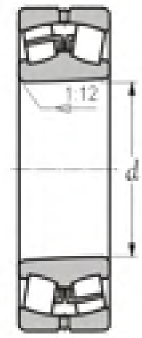
| Abutments and fillet dimensions mm | | | Constant | Axial load factors | | | Mass (approx.) kgs. | |
|---|---|---|---|---|---|---|---|---|
| $d_a$ min | $D_a$ max | $r_{as}$ max | $e$ | $Y_1$ | $Y_2$ | $Y_0$ | cylindrical bore | tapered bore |
| 119 | 161 | 2 | 0.33 | 2.00 | 3.00 | 2.00 | 5.00 | - |
| 119 | 161 | 2 | 0.33 | 2.00 | 3.00 | 2.00 | - | 4.90 |
| 130 | 170 | 2 | 0.33 | 2.06 | 3.07 | 2.02 | 5.48 | - |
| 130 | 170 | 2 | 0.33 | 2.06 | 3.07 | 2.02 | - | 5.39 |
| 140 | 190 | 2 | 0.34 | 1.98 | 2.95 | 1.94 | 8.08 | - |
| 140 | 190 | 2 | 0.34 | 1.98 | 2.95 | 1.94 | - | 7.95 |
| 150 | 200 | 2 | 0.32 | 2.09 | 3.12 | 2.05 | 8.57 | - |
| 150 | 200 | 2 | 0.32 | 2.09 | 3.12 | 2.05 | - | 8.43 |
| 162 | 213 | 2 | 0.33 | 2.06 | 3.07 | 2.02 | 10.70 | - |
| 162 | 213 | 2 | 0.33 | 2.06 | 3.07 | 2.02 | - | 10.50 |
| 172 | 228 | 2 | 0.32 | 2.10 | 3.13 | 2.06 | 13.00 | - |
| 172 | 228 | 2 | 0.32 | 2.10 | 3.13 | 2.06 | - | 12.80 |

## Spherical Roller Bearings

### series 241




Cylinrical bore




Tapered bore

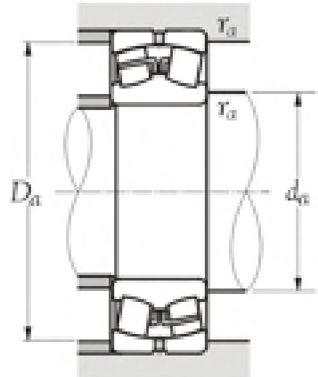
| Boundary dimensions mm | | | | Basic load ratings dynamic N | static N | dynamic kgf | static kgf | Limiting speeds min⁻¹ | | Bearing numbers |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | $r_{s\,min}$[1] | $C_r$ | $C_{0r}$ | $C_r$ | $C_{0r}$ | grease | oil | |
| 110 | 180 | 69 | 2.0 | 450,000 | 755,000 | 46,000 | 77,000 | 1,800 | 2,400 | 24122 MB W33 |
| 110 | 180 | 69 | 2.0 | 450,000 | 755,000 | 46,000 | 77,000 | 1,800 | 2,400 | 24122 MB/K W33 |
| 120 | 200 | 80 | 2.0 | 575,000 | 945,000 | 58,500 | 96,500 | 1,600 | 2,100 | 24124 MB W33 |
| 120 | 200 | 80 | 2.0 | 575,000 | 945,000 | 58,500 | 96,500 | 1,600 | 2,100 | 24124 MB/K W33 |
| 130 | 210 | 80 | 2.0 | 585,000 | 995,000 | 60,000 | 102,000 | 1,500 | 2,000 | 24126 MB W33 |
| 130 | 210 | 80 | 2.0 | 585,000 | 995,000 | 60,000 | 102,000 | 1,500 | 2,000 | 24126 MB/K W33 |
| 140 | 225 | 85 | 2.1 | 670,000 | 1,150,000 | 68,500 | 117,000 | 1,400 | 1,800 | 24128 MB W33 |
| 140 | 225 | 85 | 2.1 | 670,000 | 1,150,000 | 68,500 | 117,000 | 1,400 | 1,800 | 24128 MB/K W33 |
| 150 | 250 | 100 | 2.1 | 885,000 | 1,520,000 | 90,500 | 155,000 | 1,300 | 1,700 | 24130 MB W33 |
| 150 | 250 | 100 | 2.1 | 885,000 | 1,520,000 | 90,500 | 155,000 | 1,300 | 1,700 | 24130 MB/K W33 |
| 160 | 270 | 109 | 2.1 | 1,040,000 | 1,780,000 | 106,000 | 181,000 | 1,200 | 1,600 | 24132 MB W33 |
| 160 | 270 | 109 | 2.1 | 1,040,000 | 1,780,000 | 106,000 | 181,000 | 1,200 | 1,600 | 24132 MB/K W33 |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | X | Class 0 (JIS) | Nil |
| Polymid - | X | | |
| Brass - | MB | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## Spherical Roller Bearings
## series 241




**Equivalent radial load**
**dynamic**
$P_r = XF_r + YF_a$

| $\frac{F_a}{F_r} \leq e$ | | $\frac{F_a}{F_r} > e$ | |
|---|---|---|---|
| X | Y | X | Y |
| 1 | $Y_1$ | 0.67 | $Y_2$ |

**Static**
$P_r = F_r + Y_0F_a$
**For values of** $e$, $Y2$ **and** $Y_0$ **see the tabla below.**

| **Abutments and fillet dimensions** mm | | | **Constant** | **Axial load factors** | | | **Mass** (approx.) kgs. | |
|---|---|---|---|---|---|---|---|---|
| $d_a$ min | $D_a$ max | $r_{as}$ max | $e$ | $Y_1$ | $Y_2$ | $Y_0$ | cylindrical bore | tapered bore |
| 120 | 170 | 2 | 0.38 | 1.76 | 2.63 | 1.73 | 7.07 | - |
| 120 | 170 | 2 | 0.38 | 1.76 | 2.63 | 1.73 | - | 6.96 |
| 130 | 190 | 2 | 0.40 | 1.68 | 2.50 | 1.64 | 10.30 | - |
| 130 | 190 | 2 | 0.40 | 1.68 | 2.50 | 1.64 | - | 10.10 |
| 140 | 200 | 2 | 0.38 | 1.78 | 2.65 | 1.74 | 11.00 | - |
| 140 | 200 | 2 | 0.38 | 1.78 | 2.65 | 1.74 | - | 10.80 |
| 152 | 213 | 2 | 0.38 | 1.80 | 2.68 | 1.76 | 13.30 | - |
| 152 | 213 | 2 | 0.38 | 1.80 | 2.68 | 1.76 | - | 13.10 |
| 162 | 238 | 2 | 0.40 | 1.69 | 2.51 | 1.65 | 20.20 | - |
| 162 | 238 | 2 | 0.40 | 1.69 | 2.51 | 1.65 | - | 20.00 |
| 172 | 258 | 2 | 0.40 | 1.67 | 2.48 | 1.63 | 26.00 | - |
| 172 | 258 | 2 | 0.40 | 1.67 | 2.48 | 1.63 | - | 25.60 |

# NOTE

# ROD ENDS

## 1. Bearing materials

Standard material for spherical bearing rod ends, stainless steel spherical bearing rod ends, winding shape ball joint rod ends, straight ball joint rod ends are mostly classified into balls, outer rings, races and bearing body structures. Details please refer to Table 1.1.

Table 1.1

| Series / Classification | Lubricant type Series BNM/BNF | Maintenance free Series BM/BF | Maintenance free Series BNM..K/BNF..K | Maintenance free Series DMSS/DFSS | Maintenance free Series RBL/RBI |
|---|---|---|---|---|---|
| Balls | Chromium steel, 100Cr6 (HRc 58~64), hard chrome plated | Chromium steel, 100Cr6 (HRc 58~64), hard chrome plated | Chromium steel, 100Cr6 (HRc 58~64), hard chrome plated | Stainless steel 440, hardened | Chromium steel, 100Cr6 (HRc 58~64), hard chrome plated |
| Outer rings | — | — | Brass(H62) | Brass(H62) | — |
| Races | Brass(H62) | PTFE | PTFE | PTFE | Brass(H62) |
| Body | Low carbon steel, Nickel plated | Low carbon steel, Nickel plated | Low carbon steel, Nickel plated | Stainless steel 440, hardened | Low carbon steel, Nickel plated |

## 2. Tolerances for spherical bearing rod ends

### 2.1 Thread of stretching rod

Metric thread: Female 6H and Male 6g.

### 2.2 Tolerances in details

Table 2.1 Inner ring for BNM, BNF, DM, DF, RBL, RBI, DMSS and DFSS series

(Unit : μm)

| *d* mm | | △*dmp* | | △*Bs* | |
|---|---|---|---|---|---|
| over | incl. | max. | min. | max. | min. |
| - | 6 | +12 | 0 | 0 | -100 |
| 6 | 10 | +15 | 0 | 0 | -100 |
| 10 | 18 | +18 | 0 | 0 | -100 |
| 18 | 30 | +21 | 0 | 0 | -100 |

Table 2.2 Inner ring for BNM..K and BNF..K series

(Unit : μm)

| $d$ mm | | $\triangle dmp$ | | $\triangle Bs$ | |
|---|---|---|---|---|---|
| over | incl. | max. | min. | max. | min. |
| - | 6 | +12 | 0 | 0 | -150 |
| 6 | 10 | +15 | 0 | 0 | -150 |
| 10 | 12 | +18 | 0 | 0 | -150 |
| 12 | 18 | +18 | 0 | 0 | -200 |
| 18 | 30 | +21 | 0 | 0 | -200 |

Table 2.3 Outer ring for BNM, BNF, DM, DF, RBL, RBI, DMSS, DFSS, BNM..K and BNF..K series

(Unit : μm)

| $d$ mm | | $\triangle dmp$ | | $\triangle Cs$ | |
|---|---|---|---|---|---|
| over | incl. | max. | min. | max. | min. |
| 10 | 18 | 0 | -11 | +100 | -100 |
| 18 | 30 | 0 | -13 | +100 | -100 |
| 30 | 50 | 0 | -16 | +100 | -100 |
| 50 | 60 | 0 | -19 | +100 | -100 |

Table 2.4 Center height deviation for BNM, BNF, DM, DF, RBL, RBI, DMSS, DFSS, BNM..K and BNF..K series

| $d$ mm | | $\triangle hs$ mm | | $\triangle his$ mm | |
|---|---|---|---|---|---|
| over | incl. | max. | min. | max. | min. |
| - | 6 | +1.20 | +0.80 | +0.65 | -1.05 |
| 6 | 20 | +0.80 | -1.20 | +0.80 | -1.20 |
| 20 | 30 | +1.00 | -1.70 | +1.00 | -1.70 |
| 30 | 45 | +1.40 | -2.10 | +1.40 | -2.10 |
| 45 | 60 | +1.80 | -2.70 | +1.80 | -2.70 |
| 60 | 80 | +2.25 | -3.40 | +2.25 | -3.40 |

## 3. Fits of Spherical Bearing Rod Ends

Fitted with Rod Ends.

**Table 3.1 For shaft**

| With indeterminate loads | Normal conditions |
|---|---|
| n6, p6 | h6, h7 |

**Table 3.2 For thread**

| Male thread | Female thread |
|---|---|
| 6g | 6h |

**Table 3.3 Roughness of fitting surface** (Unit : μm)

| Fitting surface<br>Bearing bore diameter "d" or outer diameter "D"<br>Nominal bore diameter (mm) over | incl. | Shaft surface<br>Ra≤ | Bore surface of housing<br>Ra≤ | Side of shaft shoulder, washer, housing bore shoulder<br>Ra≤ |
|---|---|---|---|---|
| - | 80 | 1.25 | 1.60 | 2.00 |
| 80 | 150 | 2.00 | 2.50 | 2.50 |

To look into the table with "d " for shaft, to look into the table with "D " for housing.

**Table 3.4 Shape and position tolerance of fitting surface** (Unit : μm)

| d or D mm | | Cylindricity | | Side beat of round circuity | | Parallelism of two sides of washer |
|---|---|---|---|---|---|---|
| | | Housing bore | Shaft diameter | Housing bore shoulder | Shaft shoulder | |
| over | incl. | max. | max. | max. | max. | max. |
| - | 6 | 4 | - | 8 | - | 12 |
| 6 | 10 | 4 | 4 | 9 | 9 | 15 |
| 10 | 18 | 5 | 5 | 10 | 10 | 18 |
| 18 | 30 | 6 | 6 | 11 | 11 | 21 |
| 30 | 50 | 7 | 7 | 13 | 13 | 25 |
| 50 | 80 | 8 | 8 | 16 | 16 | 30 |
| 80 | 120 | 10 | 10 | 19 | 19 | 35 |
| 120 | 150 | 12 | 12 | 22 | 22 | 40 |

## 4. Radial Internal Clearance for Spherical Bearing Rod Ends

### 4.1 Maintenance-free type

**Table 4.1 Radial internal clearance for BNM..K, BNF..K, DM, DF, RBL, RBI, DMSS and DFSS series.**

(Unit : μm)

| d mm | | Group | |
|---|---|---|---|
| over | incl. | min. | max. |
| - | 12 | 32 | 68 |
| 12 | 20 | 40 | 82 |
| 20 | 30 | 50 | 100 |

### 4.2 Lubricant type

**Table 4.2 Radial internal clearance for BNM and BNF series.**

(Unit : μm)

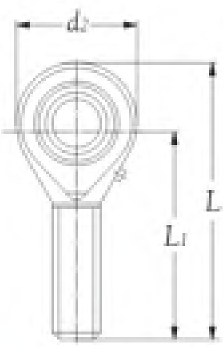
| d mm | | Group | |
|---|---|---|---|
| over | incl. | min. | max. |
| - | 30 | 0 | 35 |

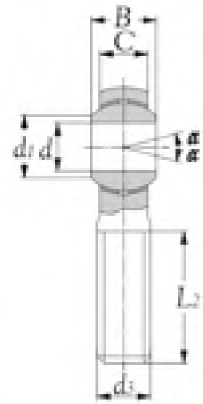
# NOTE


# DIMENSION TABLES

## Spherical Bearing Rod Ends (Lubricant Type)

## series BNM.., BNML..




| Boundary dimensions mm | | | Nominal dimensions mm | | | | | | | Load ratings dynamic static N | | Bearing numbers | Mass kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | d2 | B | C1 | d3 | L1 | L2 | L | d1 | α° ≈ | Cd | Cs | | (approx.) |
| 5 | 16 | 8 | 6.00 | M5 x 0.80 | 33 | 20 | 41 | 7.7 | 13 | 3300 | 3900 | **BNM5** | 0.0125 |
| 6 | 18 | 9 | 6.75 | M6 x 1.00 | 36 | 22 | 45 | 9.0 | 13 | 4300 | 5300 | **BNM6** | 0.0190 |
| 8 | 22 | 12 | 9.00 | M8 x 1.25 | 42 | 25 | 53 | 10.4 | 13 | 6800 | 8500 | **BNM8** | 0.0320 |
| 10 | 26 | 14 | 10.50 | M10 x 1.50 | 48 | 29 | 61 | 12.9 | 13 | 10000 | 11000 | **BNM10** | 0.0540 |
| 12 | 30 | 16 | 12.00 | M12 x 1.75 | 54 | 33 | 69 | 15.4 | 13 | 13000 | 14000 | **BNM12** | 0.0850 |
| 14 | 34 | 19 | 13.50 | M14 x 2.00 | 60 | 36 | 77 | 16.9 | 13 | 17000 | 20000 | **BNM14** | 0.1260 |
| 16 | 38 | 21 | 15.00 | M16 x 2.00 | 66 | 40 | 85 | 19.4 | 13 | 21000 | 25000 | **BNM16** | 0.1850 |
| 18 | 42 | 23 | 16.50 | M18 x 1.50 | 72 | 44 | 93 | 21.9 | 13 | 26000 | 30000 | **BNM18** | 0.2600 |
| 20 | 46 | 25 | 18.00 | M20 x 1.50 | 78 | 47 | 101 | 24.4 | 13 | 31000 | 35000 | **BNM20** | 0.3400 |
| 22 | 50 | 28 | 20.00 | M22 x 1.50 | 84 | 51 | 109 | 25.8 | 13 | 38000 | 43000 | **BNM22** | 0.4350 |
| 25 | 60 | 31 | 22.00 | M24 x 2.00 | 94 | 57 | 124 | 29.6 | 13 | 47000 | 65000 | **BNM25** | 0.6500 |
| 30 | 70 | 37 | 25.00 | M30 x 2.00 | 110 | 66 | 145 | 34.8 | 13 | 63000 | 86000 | **BNM30** | 1.0700 |

Note: 1) Suffix "L" means with left hand thread.
2) We could supply the above models in two sorts, one is produced by forging, the another by machining. So, please let us know which of them is what you needed before you ordering.
3) We supply this series of rod end bearings strictly in accordance with the above specifications, any changes are on special order.

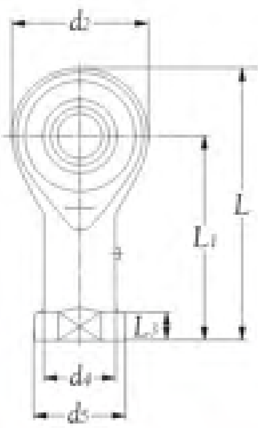
**Technical supplement**

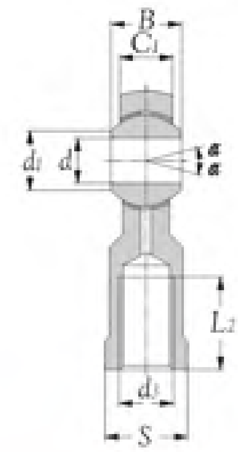
| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | X | | |
| Polymid - | X | Class 0 (JIS) | Nil |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## Spherical Bearing Rod Ends (Lubricant Type)

## series BNF.., BNFL..




| Boundary dimensions mm | | | Nominal dimensions mm | | | | | | | | | | | Load ratings dynamic N | static | Bearing numbers | Mass kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $d$ | $d_2$ | $B$ | $C_1$ | $S$ | $d_3$ | $d_4$ | $d_5$ | $L_1$ | $L_2$ | $L$ | $L_3$ | $d_1$ | $\alpha$ ≈ | $C_d$ | $C_s$ | | (approx.) |
| 5 | 16 | 8 | 6.00 | 9 | M5 x 0.80 | 9.0 | 11 | 27 | 14 | 35 | 4.0 | 7.7 | 13 | 3300 | 3900 | BNF5 | 0.016 |
| 6 | 18 | 9 | 6.75 | 11 | M6 x 1.00 | 10.0 | 13 | 30 | 14 | 39 | 5.0 | 9.0 | 13 | 4300 | 5300 | BNF6 | 0.026 |
| 8 | 22 | 12 | 9.00 | 14 | M8 x 1.25 | 12.5 | 16 | 36 | 17 | 47 | 5.0 | 10.4 | 13 | 6800 | 8500 | BNF8 | 0.044 |
| 10 | 26 | 14 | 10.50 | 17 | M10 x 1.50 | 15.0 | 19 | 43 | 21 | 56 | 6.5 | 12.9 | 13 | 10000 | 11000 | BNF10 | 0.072 |
| 10 | 26 | 14 | 10.50 | 17 | M10 x 1.25 | 15.0 | 19 | 43 | 21 | 56 | 6.5 | 12.9 | 13 | 10000 | 11000 | BNF10.1 | 0.072 |
| 12 | 30 | 16 | 12.00 | 19 | M12 x 1.75 | 17.5 | 22 | 50 | 24 | 65 | 6.5 | 15.4 | 13 | 13000 | 14000 | BNF12 | 0.108 |
| 12 | 30 | 16 | 12.00 | 19 | M12 x 1.25 | 17.5 | 22 | 50 | 24 | 65 | 6.5 | 15.4 | 13 | 13000 | 14000 | BNF12.1 | 0.108 |
| 14 | 34 | 19 | 13.50 | 22 | M14 x 2.00 | 20.0 | 25 | 57 | 27 | 74 | 8.0 | 16.9 | 13 | 17000 | 20000 | BNF14 | 0.161 |
| 16 | 38 | 21 | 15.00 | 22 | M16 x 2.00 | 22.0 | 27 | 64 | 33 | 83 | 8.0 | 19.4 | 13 | 21000 | 25000 | BNF16 | 0.225 |
| 16 | 38 | 21 | 15.00 | 22 | M16 x 1.50 | 22.0 | 27 | 64 | 33 | 83 | 8.0 | 19.4 | 13 | 21000 | 25000 | BNF16.1 | 0.225 |
| 18 | 42 | 23 | 16.50 | 27 | M18 x 1.50 | 25.0 | 31 | 71 | 36 | 92 | 10.0 | 21.9 | 13 | 26000 | 30000 | BNF18 | 0.295 |
| 20 | 46 | 25 | 18.00 | 30 | M20 x 1.50 | 27.5 | 34 | 77 | 40 | 100 | 10.0 | 24.4 | 13 | 31000 | 35000 | BNF20 | 0.382 |
| 22 | 50 | 28 | 20.00 | 32 | M22 x 1.50 | 30.0 | 37 | 84 | 43 | 109 | 12.0 | 25.8 | 13 | 38000 | 43000 | BNF22 | 0.488 |
| 25 | 60 | 31 | 22.00 | 36 | M24 x 2.00 | 33.5 | 42 | 94 | 48 | 124 | 12.0 | 29.6 | 13 | 47000 | 65000 | BNF25 | 0.749 |
| 30 | 70 | 37 | 25.00 | 41 | M30 x 2.00 | 40.0 | 50 | 110 | 56 | 145 | 15.0 | 34.8 | 13 | 63000 | 86000 | BNF30 | 1.130 |
| 30 | 70 | 37 | 25.00 | 41 | M27 x 2.00 | 40.0 | 50 | 110 | 56 | 145 | 15.0 | 34.8 | 13 | 63000 | 86000 | BNF30.1 | 1.130 |

Note: 1) Suffix "L" means with left hand thread.
2) We could supply the above models in two sorts, one is produced by forging, the another by machining. So, please let us know which of them is what you needed before you ordering.
3) We supply this series of rod end bearings strictly in accordance with the above specifications, any changes are on special order.

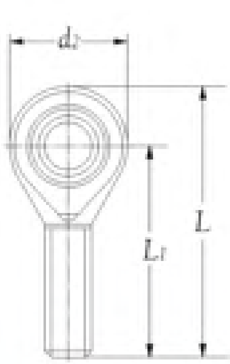
**Technical supplement**

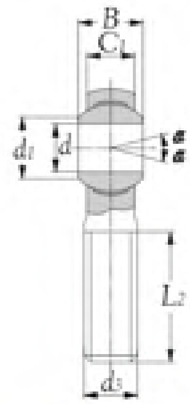
| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | X | | |
| Polymid - | X | Class 0 (JIS) | Nil |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## SPHERICAL BEARING ROD ENDS (MAINTENANCE-FREE TYPE)

## SERIES DM.., DML..




| Boundary dimensions mm | | | Nominal dimensions mm | | | | | | | Load ratings dynamic static N | | Bearing numbers | Mass kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $d$ | $d_2$ | $B$ | $C_1$ | $d_3$ | $L_1$ | $L_2$ | $L$ | $d_1$ | $\alpha°$ ≈ | $C_d$ | $C_s$ | | (approx.) |
| 5 | 16 | 8 | 6.00 | M5 x 0.80 | 33 | 20 | 41 | 7.7 | 13 | 3300 | 3900 | **DM5** | 0.013 |
| 6 | 18 | 9 | 6.75 | M6 x 1.00 | 36 | 22 | 45 | 9.0 | 13 | 4300 | 5300 | **DM6** | 0.019 |
| 8 | 22 | 12 | 9.00 | M8 x 1.25 | 42 | 25 | 53 | 10.4 | 13 | 6800 | 8500 | **DM8** | 0.032 |
| 10 | 26 | 14 | 10.50 | M10 x 1.50 | 48 | 29 | 61 | 12.9 | 13 | 10000 | 11000 | **DM10** | 0.054 |
| 12 | 30 | 16 | 12.00 | M12 x 1.75 | 54 | 33 | 69 | 15.4 | 13 | 13000 | 14000 | **DM12** | 0.085 |
| 14 | 34 | 19 | 13.50 | M14 x 2.00 | 60 | 36 | 77 | 16.9 | 13 | 17000 | 20000 | **DM14** | 0.126 |
| 16 | 38 | 21 | 15.00 | M16 x 2.00 | 66 | 40 | 85 | 19.4 | 13 | 21000 | 25000 | **DM16** | 0.185 |
| 18 | 42 | 23 | 16.50 | M18 x 1.50 | 72 | 44 | 93 | 21.9 | 13 | 26000 | 30000 | **DM18** | 0.260 |
| 20 | 46 | 25 | 18.00 | M20 x 1.50 | 78 | 47 | 101 | 24.4 | 13 | 31000 | 35000 | **DM20** | 0.340 |
| 22 | 50 | 28 | 20.00 | M22 x 1.50 | 84 | 51 | 109 | 25.8 | 13 | 38000 | 43000 | **DM22** | 0.435 |
| 25 | 60 | 31 | 22.00 | M24 x 2.00 | 94 | 57 | 124 | 29.6 | 13 | 47000 | 65000 | **DM25** | 0.650 |
| 30 | 70 | 37 | 25.00 | M30 x 2.00 | 110 | 66 | 145 | 34.8 | 13 | 63000 | 86000 | **DM30** | 1.070 |

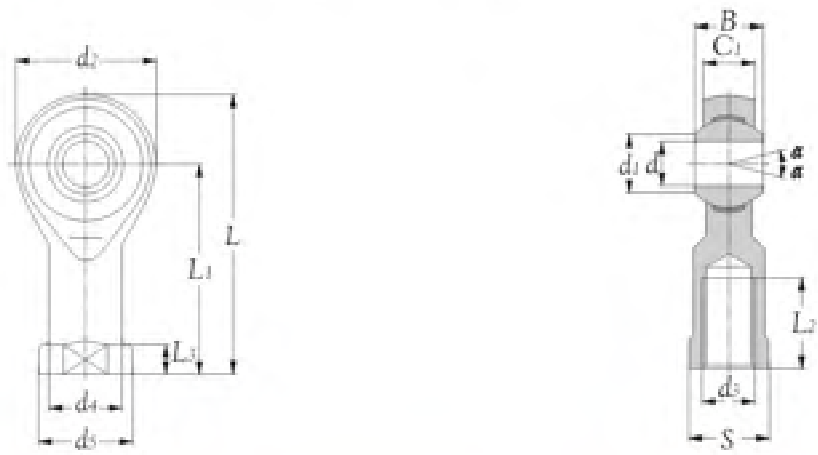
Note: 1) Suffix "L" means with left hand thread.
2) We could supply the above models in two sorts, one is produced by forging, the another by machining. So, please let us know which of them is what you needed before you ordering.
3) We supply this series of rod end bearings strictly in accordance with the above specifications, any changes are on special order.

**Technical supplement**

| Cages | Precision | Grease |
|---|---|---|
| Steel - X | | |
| Polymid - X | Class 0 (JIS) | Nil |
| Brass - X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## SPHERICAL BEARING ROD ENDS (MAINTENANCE-FREE TYPE)
### SERIES DF.., DFL..




| Boundary dimensions mm | | | Nominal dimensions mm | | | | | | | | | | α° ≈ | Load ratings N dynamic | static | Bearing numbers | Mass kg (approx.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | d2 | B | C1 | S | d3 | d4 | d5 | L1 | L2 | L | L3 | d1 | | Cd | Co | | |
| 5 | 16 | 8 | 6.00 | 9 | M5 x 0.80 | 9.0 | 11 | 27 | 14 | 35 | 4.0 | 7.7 | 13 | 3300 | 3900 | DF5 | 0.016 |
| 6 | 18 | 9 | 6.75 | 11 | M6 x 1.00 | 10.0 | 13 | 30 | 14 | 39 | 5.0 | 9.0 | 13 | 4300 | 5300 | DF6 | 0.026 |
| 8 | 22 | 12 | 9.00 | 14 | M8 x 1.25 | 12.5 | 16 | 36 | 17 | 47 | 5.0 | 10.4 | 13 | 6800 | 8500 | DF8 | 0.044 |
| 10 | 26 | 14 | 10.50 | 17 | M10 x 1.50 | 15.0 | 19 | 43 | 21 | 56 | 6.5 | 12.9 | 13 | 10000 | 11000 | DF10 | 0.072 |
| 10 | 26 | 14 | 10.50 | 17 | M10 x 1.25 | 15.0 | 19 | 43 | 21 | 56 | 6.5 | 12.9 | 13 | 10000 | 11000 | DF10.1 | 0.072 |
| 12 | 30 | 16 | 12.00 | 19 | M12 x 1.75 | 17.5 | 22 | 50 | 24 | 65 | 6.5 | 15.4 | 13 | 13000 | 14000 | DF12 | 0.108 |
| 12 | 30 | 16 | 12.00 | 19 | M12 x 1.25 | 17.5 | 22 | 50 | 24 | 65 | 6.5 | 15.4 | 13 | 13000 | 14000 | DF12.1 | 0.108 |
| 14 | 34 | 19 | 13.50 | 22 | M14 x 2.00 | 20.0 | 25 | 57 | 27 | 74 | 8.0 | 16.9 | 13 | 17000 | 20000 | DF14 | 0.161 |
| 16 | 38 | 21 | 15.00 | 22 | M16 x 2.00 | 22.0 | 27 | 64 | 33 | 83 | 8.0 | 19.4 | 13 | 21000 | 25000 | DF16 | 0.225 |
| 16 | 38 | 21 | 15.00 | 22 | M16 x 1.50 | 22.0 | 27 | 64 | 33 | 83 | 8.0 | 19.4 | 13 | 21000 | 25000 | DF16.1 | 0.225 |
| 18 | 42 | 23 | 16.50 | 27 | M18 x 1.50 | 25.0 | 31 | 71 | 36 | 92 | 10.0 | 21.9 | 13 | 26000 | 30000 | DF18 | 0.295 |
| 20 | 46 | 25 | 18.00 | 30 | M20 x 1.50 | 27.5 | 34 | 77 | 40 | 100 | 10.0 | 24.4 | 13 | 31000 | 35000 | DF20 | 0.382 |
| 22 | 50 | 28 | 20.00 | 32 | M22 x 1.50 | 30.0 | 37 | 84 | 43 | 109 | 12.0 | 25.8 | 13 | 38000 | 43000 | DF22 | 0.488 |
| 25 | 60 | 31 | 22.00 | 36 | M24 x 2.00 | 33.5 | 42 | 94 | 48 | 124 | 12.0 | 29.6 | 13 | 47000 | 65000 | DF25 | 0.749 |
| 30 | 70 | 37 | 25.00 | 41 | M30 x 2.00 | 40.0 | 50 | 110 | 56 | 145 | 15.0 | 34.8 | 13 | 63000 | 86000 | DF30 | 1.130 |

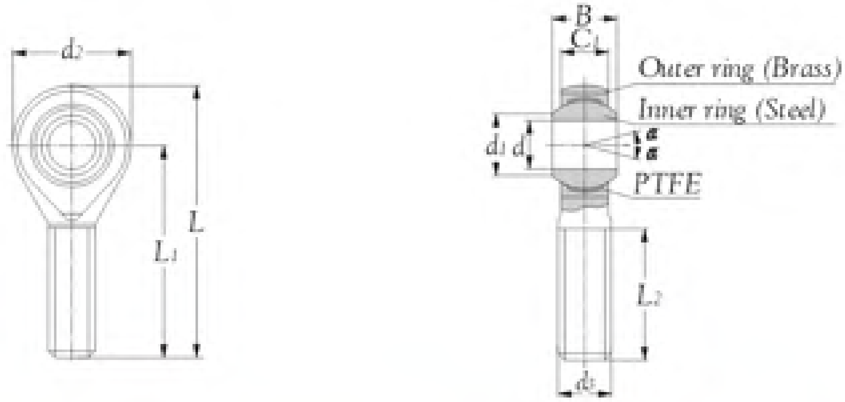
Note: 1) Suffix "L" means with left hand thread.
2) We could supply the above models in two sorts, one is produced by forging, the another by machining, So, please let us know which of them is what you needed before you ordering.
3) We supply this series of rod end bearings strictly in accordance with the above specifications, any changes are on special order.

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | X | | |
| Polymid - | X | Class 0 (JIS) | Nil |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## Spherical Bearing Rod Ends (Maintenance-Free Type)
## series BNM..K, BNML..K




| Boundary dimensions mm | | | Nominal dimensions mm | | | | | | α° ≈ | Load ratings N | | Bearing numbers | Mass kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | dynamic | static | | |
| d | d2 | B | C1 | d3 | L1 | L2 | L | d1 | | Cd | Cs | | (approx.) |
| 5 | 18 | 8 | 6.00 | M5 x 0.80 | 33 | 19 | 42 | 7.7 | 4 | 4000 | 7500 | BNM5K | 0.013 |
| 6 | 20 | 9 | 6.75 | M6 x 1.00 | 36 | 22 | 46 | 8.9 | 9 | 4400 | 9300 | BNM6K | 0.020 |
| 8 | 24 | 12 | 9.00 | M8 x 1.25 | 42 | 25 | 54 | 10.4 | 13 | 8000 | 16700 | BNM8K | 0.033 |
| 10 | 28 | 14 | 10.50 | M10 x 1.50 | 48 | 29 | 62 | 12.9 | 13 | 12900 | 23400 | BNM10K | 0.056 |
| 12 | 32 | 16 | 12.00 | M12 x 1.75 | 54 | 33 | 70 | 15.4 | 13 | 17000 | 32000 | BNM12K | 0.087 |
| 14 | 36 | 19 | 13.50 | M14 x 2.00 | 60 | 38 | 78 | 16.8 | 13 | 24000 | 41900 | BNM14K | 0.129 |
| 16 | 42 | 21 | 15.00 | M16 x 2.00 | 66 | 40 | 87 | 19.3 | 13 | 28500 | 52700 | BNM16K | 0.189 |
| 18 | 46 | 23 | 16.50 | M18 x 1.50 | 72 | 44 | 95 | 21.8 | 13 | 35000 | 63800 | BNM18K | 0.267 |
| 20 | 50 | 25 | 18.00 | M20 x 1.50 | 78 | 47 | 103 | 24.3 | 13 | 40000 | 78100 | BNM20K | 0.348 |
| 22 | 54 | 28 | 20.00 | M22 x 1.50 | 84 | 51 | 111 | 25.8 | 13 | 52000 | 97200 | BNM22K | 0.443 |
| 25 | 60 | 31 | 22.00 | M24 x 2.00 | 94 | 58 | 124 | 29.6 | 13 | 60000 | 122100 | BNM25K | 0.600 |
| 30 | 70 | 37 | 25.00 | M30 x 2.00 | 110 | 71 | 145 | 34.8 | 13 | 81000 | 168400 | BNM30K | 1.030 |

Note: 1) Suffix "L" means with left hand thread.
2) We could supply the above models in two sorts, one is produced by forging, the another by machining. So, please let us know which of them is what you needed before you ordering.
3) We supply this series of rod end bearings strictly in accordance with the above specifications, any changes are on special order.

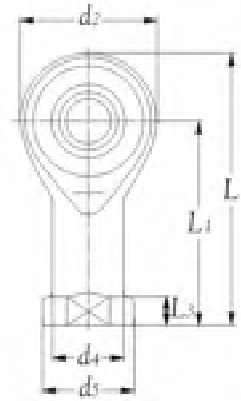
**Technical supplement**

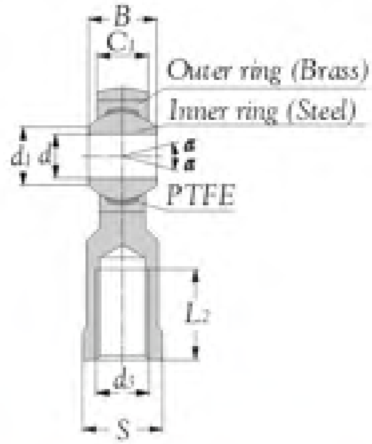
| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | X | Class 0 (JIS) | Nil |
| Polymid - | X | | |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## Spherical Bearing Rod Ends (Maintenance-Free Type)

## series BNF..K, BNFL..K




| Boundary dimensions mm | | | Nominal dimensions mm | | | | | | | | | | | Load ratings dynamic N | static | Bearing numbers | Mass kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_2$ | B | $C_1$ | S | $d_3$ | $d_4$ | $d_5$ | $L_1$ | $L_2$ | L | $L_3$ | $d_1$ | α° ≈ | $C_d$ | $C_s$ | | (approx.) |
| 5 | 18 | 8 | 6.00 | 9 | M5 x 0.80 | 9.0 | 11 | 27 | 10 | 36 | 4.5 | 7.7 | 13 | 6000 | 7500 | BNF5K | 0.018 |
| 6 | 20 | 9 | 6.75 | 11 | M6 x 1.00 | 10.0 | 13 | 30 | 12 | 40 | 5.0 | 8.9 | 13 | 7200 | 9300 | BNF6K | 0.027 |
| 8 | 24 | 12 | 9.00 | 13 | M8 x 1.25 | 12.5 | 16 | 36 | 16 | 48 | 5.0 | 10.4 | 13 | 11600 | 16700 | BNF8K | 0.046 |
| 10 | 28 | 14 | 10.50 | 17 | M10 x 1.50 | 15.0 | 19 | 43 | 20 | 57 | 6.5 | 12.9 | 13 | 14500 | 23400 | BNF10K | 0.076 |
| 10 | 28 | 14 | 10.50 | 17 | M10 x 1.25 | 15.0 | 19 | 43 | 20 | 57 | 6.5 | 12.9 | 13 | 14500 | 23400 | BNF10.1K | 0.076 |
| 12 | 32 | 16 | 12.00 | 19 | M12 x 1.75 | 17.5 | 22 | 50 | 22 | 66 | 6.5 | 15.4 | 13 | 17000 | 32000 | BNF12K | 0.115 |
| 12 | 32 | 16 | 12.00 | 19 | M12 x 1.25 | 17.5 | 22 | 50 | 22 | 66 | 6.5 | 15.4 | 13 | 17000 | 32000 | BNF12.1K | 0.115 |
| 14 | 36 | 19 | 13.50 | 22 | M14 x 2.00 | 20.0 | 25 | 57 | 25 | 75 | 8.0 | 16.8 | 13 | 24000 | 41900 | BNF14K | 0.170 |
| 16 | 42 | 21 | 15.00 | 22 | M16 x 2.00 | 22.0 | 27 | 64 | 28 | 85 | 8.0 | 19.3 | 13 | 28500 | 52700 | BNF16K | 0.230 |
| 16 | 42 | 21 | 15.00 | 22 | M16 x 1.50 | 22.0 | 27 | 64 | 28 | 85 | 8.0 | 19.3 | 13 | 28500 | 52700 | BNF16.1K | 0.230 |
| 18 | 46 | 23 | 16.50 | 27 | M18 x 1.50 | 25.0 | 31 | 71 | 32 | 94 | 10.0 | 21.8 | 13 | 35000 | 63800 | BNF18K | 0.320 |
| 20 | 50 | 25 | 18.00 | 32 | M20 x 1.50 | 27.5 | 34 | 77 | 33 | 102 | 10.0 | 24.3 | 13 | 40000 | 78100 | BNF20K | 0.415 |
| 22 | 54 | 28 | 20.00 | 32 | M22 x 1.50 | 30.0 | 37 | 84 | 37 | 111 | 10.0 | 25.8 | 13 | 52000 | 97200 | BNF22K | 0.540 |
| 25 | 60 | 31 | 22.00 | 36 | M24 x 2.00 | 33.5 | 42 | 94 | 42 | 124 | 12.0 | 29.6 | 13 | 60000 | 122100 | BNF25K | 0.750 |
| 30 | 70 | 37 | 25.00 | 41 | M30 x 2.00 | 40.0 | 51 | 110 | 51 | 145 | 15.0 | 34.8 | 13 | 81000 | 168400 | BNF30K | 1.130 |

Note: 1) Suffix "L" means with left hand thread.
2) We could supply the above models in two sorts, one is produced by forging, the another by machining. So, please let us know which of them is what you needed before you ordering.
3) We supply this series of rod end bearings strictly in accordance with the above specifications, any changes are on special order.

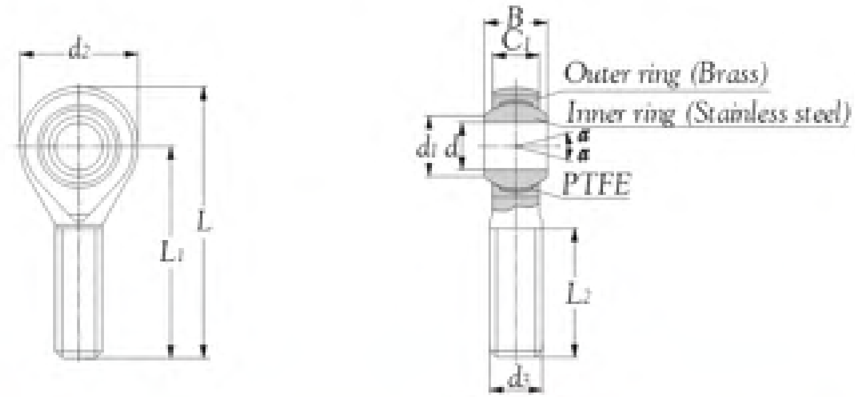
**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | X | | |
| Polymid - | X | Class 0 (JIS) | Nil |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire
NIKO web-site: Http://www.nipponkodobearings.com

## Stainless Steel Spherical Bearing Rod Ends (Maintenance-Free Type)

### series DMSS.., DMSSL..




| Boundary dimensions mm | | | Nominal dimensions mm | | | | | | | Load ratings N | | Bearing numbers | Mass kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | dynamic | static | | |
| d | d2 | B | C1 | d3 | L1 | L2 | L | d1 | α° ≈ | Cd | Cs | | (approx.) |
| 5 | 16 | 8 | 6.00 | M5 x 0.80 | 33 | 20 | 41 | 7.7 | 13 | 3300 | 3900 | DMSS5 | 0.013 |
| 6 | 18 | 9 | 6.75 | M6 x 1.00 | 36 | 22 | 45 | 9.0 | 13 | 4300 | 5300 | DMSS6 | 0.019 |
| 8 | 22 | 12 | 9.00 | M8 x 1.25 | 42 | 25 | 53 | 10.4 | 13 | 6800 | 8500 | DMSS8 | 0.032 |
| 10 | 26 | 14 | 10.50 | M10 x 1.50 | 48 | 29 | 61 | 12.9 | 13 | 10000 | 11000 | DMSS10 | 0.054 |
| 12 | 30 | 16 | 12.00 | M12 x 1.75 | 54 | 33 | 69 | 15.4 | 13 | 13000 | 14000 | DMSS12 | 0.085 |
| 14 | 34 | 19 | 13.50 | M14 x 2.00 | 60 | 36 | 77 | 16.9 | 13 | 17000 | 20000 | DMSS14 | 0.126 |
| 16 | 38 | 21 | 15.00 | M16 x 2.00 | 66 | 40 | 85 | 19.4 | 13 | 21000 | 25000 | DMSS16 | 0.185 |
| 18 | 42 | 23 | 16.50 | M18 x 1.50 | 72 | 44 | 93 | 21.9 | 13 | 26000 | 30000 | DMSS18 | 0.260 |
| 20 | 46 | 25 | 18.00 | M20 x 1.50 | 78 | 47 | 101 | 24.4 | 13 | 31000 | 35000 | DMSS20 | 0.340 |
| 22 | 50 | 28 | 20.00 | M22 x 1.50 | 84 | 51 | 109 | 25.8 | 13 | 38000 | 43000 | DMSS22 | 0.435 |
| 25 | 60 | 31 | 22.00 | M24 x 2.00 | 94 | 57 | 124 | 29.6 | 13 | 47000 | 65000 | DMSS25 | 0.650 |
| 30 | 70 | 37 | 25.00 | M30 x 2.00 | 110 | 66 | 145 | 34.8 | 13 | 63000 | 86000 | DMSS30 | 1.070 |

Note: 1) Suffix "L" means with left hand thread.
2) We could supply the above models in two sorts, one is produced by forging, the another by machining. So, please let us know which of them is what you needed before you ordering.
3) We supply this series of rod end bearings strictly in accordance with the above specifications, any changes are on special order.

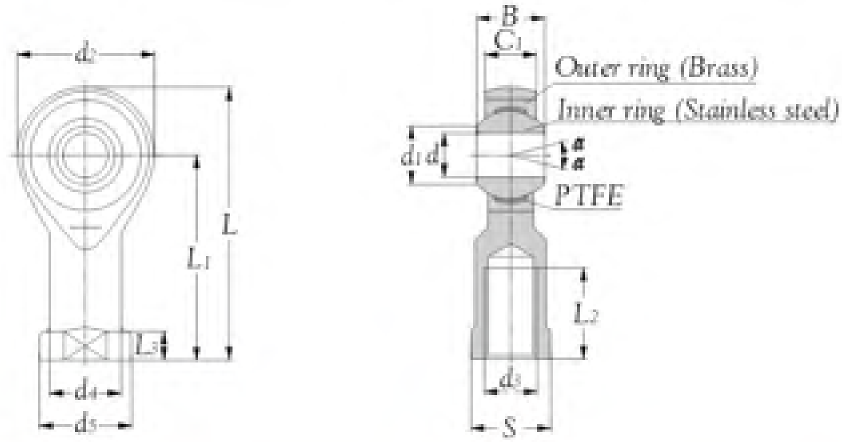
**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | X | | |
| Polymid - | X | Class 0 (JIS) | Nil |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## Stainless Steel Spherical Bearing Rod Ends (Maintenance-Free Type)

**SERIES DFSS.., DFSSL..**




| Boundary dimensions mm | | | Nominal dimensions mm | | | | | | | | | | α° | Load ratings N dynamic | static | Bearing numbers | Mass kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_2$ | B | $C_1$ | S | $d_3$ | $d_4$ | $d_5$ | $L_1$ | $L_2$ | L | $L_3$ | $d_1$ | ≈ | $C_d$ | $C_s$ | | (approx.) |
| 5 | 16 | 8 | 6.00 | 9 | M5 x 0.80 | 9.0 | 11 | 27 | 14 | 35 | 4.0 | 7.7 | 13 | 3300 | 3900 | DFSS5 | 0.016 |
| 6 | 18 | 9 | 6.75 | 11 | M6 x 1.00 | 10.0 | 13 | 30 | 14 | 39 | 5.0 | 9.0 | 13 | 4300 | 5300 | DFSS6 | 0.026 |
| 8 | 22 | 12 | 9.00 | 14 | M8 x 1.25 | 12.5 | 16 | 36 | 17 | 47 | 5.0 | 10.4 | 13 | 6800 | 8500 | DFSS8 | 0.044 |
| 10 | 26 | 14 | 10.50 | 17 | M10 x 1.50 | 15.0 | 19 | 43 | 21 | 56 | 6.5 | 12.9 | 13 | 10000 | 11000 | DFSS10 | 0.072 |
| 10 | 26 | 14 | 10.50 | 17 | M10 x 1.25 | 15.0 | 19 | 43 | 21 | 56 | 6.5 | 12.9 | 13 | 10000 | 11000 | DFSS10.1 | 0.072 |
| 12 | 30 | 16 | 12.00 | 19 | M12 x 1.75 | 17.5 | 22 | 50 | 24 | 65 | 6.5 | 15.4 | 13 | 13000 | 14000 | DFSS12 | 0.108 |
| 12 | 30 | 16 | 12.00 | 19 | M12 x 1.25 | 17.5 | 22 | 50 | 24 | 65 | 6.5 | 15.4 | 13 | 13000 | 14000 | DFSS12.1 | 0.108 |
| 14 | 34 | 19 | 13.50 | 22 | M14 x 2.00 | 20.0 | 25 | 57 | 27 | 74 | 8.0 | 16.9 | 13 | 17000 | 20000 | DFSS14 | 0.161 |
| 16 | 38 | 21 | 15.00 | 22 | M16 x 2.00 | 22.0 | 27 | 64 | 33 | 83 | 8.0 | 19.4 | 13 | 21000 | 25000 | DFSS16 | 0.225 |
| 16 | 38 | 21 | 15.00 | 22 | M16 x 1.50 | 22.0 | 27 | 64 | 33 | 83 | 8.0 | 19.4 | 13 | 21000 | 25000 | DFSS16.1 | 0.225 |
| 18 | 42 | 23 | 16.50 | 27 | M18 x 1.50 | 25.0 | 31 | 71 | 36 | 92 | 10.0 | 21.9 | 13 | 26000 | 30000 | DFSS18 | 0.295 |
| 20 | 46 | 25 | 18.00 | 30 | M20 x 1.50 | 27.5 | 34 | 77 | 40 | 100 | 10.0 | 24.4 | 13 | 31000 | 35000 | DFSS20 | 0.382 |
| 22 | 50 | 28 | 20.00 | 32 | M22 x 1.50 | 30.0 | 37 | 84 | 43 | 109 | 12.0 | 25.8 | 13 | 38000 | 43000 | DFSS22 | 0.488 |
| 25 | 60 | 31 | 22.00 | 36 | M24 x 2.00 | 33.5 | 42 | 94 | 48 | 124 | 12.0 | 29.6 | 13 | 47000 | 65000 | DFSS25 | 0.749 |
| 30 | 70 | 37 | 25.00 | 41 | M30 x 2.00 | 40.0 | 50 | 110 | 56 | 145 | 15.0 | 34.8 | 13 | 63000 | 86000 | DFSS30 | 1.130 |

Note: 1) Suffix "L" means with left hand thread.
2) We could supply the above models in two sorts, one is produced by forging, the another by machining. So, please let us know which of them is what you needed before you ordering.
3) We supply this series of rod end bearings strictly in accordance with the above specifications, any changes are on special order.

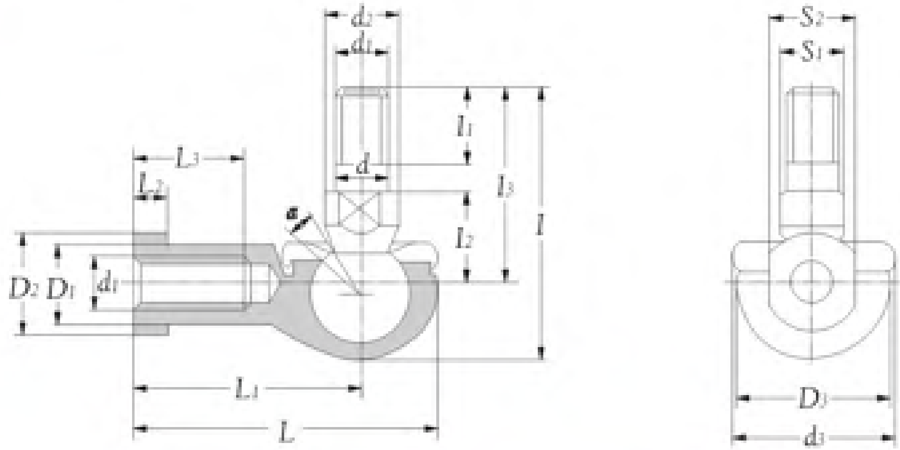
**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | X | Class 0 (JIS) | Nil |
| Polymid - | X | | |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire NIKO web-site: Http://www.nipponkodobearings.com

## Winding Shape Ball Joint RodEnd

**series RBL...**



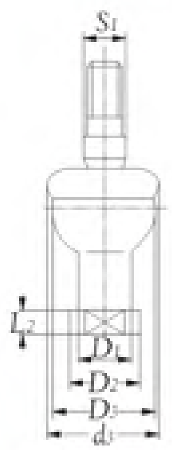

| Nominal dimensions mm | | | | | | | | | | | | | | | | | | Load ratings dynamic N | Bearing numbers | Mass kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $d$ | $d_1$ | $d_2$ min | $d_3$ max | $l$ min | $l_1$ max | $l_2$ | $l_3$ max | $S_1$ | $L$ max | $L_1$ | $L_2$ max | $L_3$ min | $D_1$ max | $D_2$ max | $D_3$ max | $S_2$ | $\alpha°$ ≈ | $C_d$ | | (approx.) |
| 5 | M5x0.80 | 9 | 19 | 29.0 | 8 | 10.0 | 21 | 7 | 35 | 27 | 4.0 | 14 | 9.0 | 11 | 16 | 9 | 25 | 2200 | RBL5 | 0.026 |
| 6 | M6x1.00 | 10 | 20 | 35.5 | 11 | 11.0 | 26 | 8 | 40 | 30 | 5.0 | 14 | 10.0 | 13 | 19 | 11 | 25 | 3500 | RBL6 | 0.039 |
| 8 | M8x1.25 | 12 | 24 | 42.5 | 12 | 14.0 | 31 | 10 | 48 | 36 | 5.0 | 17 | 12.5 | 16 | 23 | 14 | 25 | 6600 | RBL8 | 0.068 |
| 10 | M10x1.25 | 14 | 30 | 50.5 | 15 | 17.0 | 37 | 11 | 57 | 43 | 6.5 | 21 | 15.0 | 19 | 27 | 17 | 25 | 10000 | RBL10 | 0.112 |
| 10 | M10x1.50 | 14 | 30 | 56.5 | 21 | 17.0 | 43 | 11 | 57 | 43 | 6.5 | 21 | 15.0 | 19 | 27 | 17 | 25 | 10000 | RBL10B | 0.112 |
| 12 | M12x1.25 | 17 | 32 | 57.5 | 17 | 19.0 | 42 | 15 | 66 | 50 | 6.5 | 25 | 17.5 | 22 | 31 | 19 | 25 | 16000 | RBL12 | 0.164 |
| 12 | M12x1.75 | 17 | 32 | 64.5 | 24 | 19.0 | 49 | 15 | 66 | 50 | 6.5 | 25 | 17.5 | 22 | 31 | 19 | 25 | 16000 | RBL12B | 0.164 |
| 14 | M14x1.50 | 19 | 38 | 73.5 | 22 | 21.5 | 56 | 17 | 75 | 57 | 8.0 | 26 | 20.0 | 25 | 35 | 22 | 25 | 19000 | RBL14 | 0.254 |
| 14 | M14x2.00 | 19 | 38 | 79.5 | 28 | 21.5 | 62 | 17 | 75 | 57 | 8.0 | 26 | 20.0 | 25 | 35 | 22 | 25 | 19000 | RBL14B | 0.254 |
| 16 | M16x1.50 | 22 | 44 | 79.5 | 23 | 23.5 | 60 | 19 | 84 | 64 | 8.0 | 32 | 22.0 | 27 | 39 | 22 | 20 | 26000 | RBL16 | 0.336 |
| 16 | M16x2.00 | 22 | 44 | 85.5 | 29 | 23.5 | 66 | 19 | 84 | 64 | 8.0 | 32 | 22.0 | 27 | 39 | 22 | 20 | 26000 | RBL16B | 0.336 |
| 18 | M18x1.50 | 23 | 45 | 90.0 | 25 | 26.5 | 68 | 20 | 93 | 71 | 10.0 | 34 | 25.0 | 31 | 44 | 27 | 20 | 33000 | RBL18 | 0.464 |
| 20 | M20x1.50 | 27 | 50 | 90.0 | 25 | 27.0 | 68 | 24 | 99 | 77 | 10.0 | 35 | 27.5 | 34 | 44 | 30 | 20 | 45000 | RBL20 | 0.538 |
| 22 | M22x1.50 | 27 | 52 | 95.0 | 26 | 28.0 | 70 | 24 | 100 | 84 | 12.0 | 41 | 30.0 | 37 | 50 | 32 | 16 | 48000 | RBL22 | 0.713 |

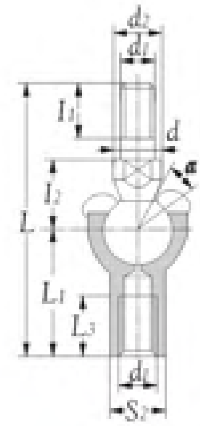
**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | X | Class 0 (JIS) | Nil |
| Polymid - | X | | |
| Brass - | X | | |

Remark: If you have more inquiry of technical, please inquire
NIKO web-site: Http://www.nipponkodobearings.com

## STRAIGHT BALL JOINT ROD ENDS
SERIES **RBI...**




| Nominal dimensions mm | | | | | | | | | | | | | | | | Load ratings dynamic N | Bearing numbers | Mass kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | d1 | d2 min | d3 max | l1 min | l2 | S1 | L max | L1 | L2 max | L3 min | D1 max | D2 max | D3 max | S2 | α° ≈ | Cd | | (approx.) |
| 5 | M5 x 0.80 | 9 | 20 | 8 | 11.0 | 7 | 46.0 | 24 | 4.0 | 12 | 9.0 | 11 | 17 | 9 | 15.0 | 2800 | RBI5 | 0.025 |
| 6 | M6 x 1.00 | 10 | 20 | 11 | 12.2 | 8 | 55.2 | 28 | 5.0 | 15 | 10.0 | 13 | 20 | 11 | 15.0 | 3700 | RBI6 | 0.041 |
| 8 | M8 x 1.25 | 12 | 24 | 12 | 16.0 | 10 | 65.0 | 32 | 5.0 | 16 | 12.5 | 16 | 24 | 14 | 15.0 | 5800 | RBI8 | 0.075 |
| 10 | M10 x 1.25 | 14 | 30 | 15 | 19.5 | 11 | 74.5 | 35 | 6.5 | 18 | 15.0 | 19 | 28 | 17 | 15.0 | 8400 | RBI10 | 0.120 |
| 10 | M10 x 1.50 | 14 | 30 | 21 | 19.5 | 11 | 80.5 | 35 | 6.5 | 18 | 15.0 | 19 | 28 | 17 | 15.0 | 8400 | RBI10B | 0.120 |
| 12 | M12 x 1.25 | 17 | 32 | 17 | 21.0 | 15 | 84.0 | 40 | 6.5 | 20 | 17.5 | 22 | 32 | 19 | 15.0 | 11000 | RBI12 | 0.180 |
| 12 | M12 x 1.75 | 17 | 32 | 24 | 21.0 | 15 | 91.0 | 40 | 6.5 | 20 | 17.5 | 22 | 32 | 19 | 15.0 | 11000 | RBI12B | 0.180 |
| 14 | M14 x 1.50 | 19 | 38 | 22 | 23.5 | 17 | 103.0 | 45 | 8.0 | 25 | 20.0 | 25 | 36 | 22 | 11.0 | 15000 | RBI14 | 0.270 |
| 14 | M14 x 2.00 | 19 | 38 | 28 | 23.5 | 17 | 109.0 | 45 | 8.0 | 25 | 20.0 | 25 | 36 | 22 | 11.0 | 15000 | RBI14B | 0.270 |
| 16 | M16 x 1.50 | 22 | 44 | 23 | 25.5 | 19 | 112.0 | 50 | 8.0 | 27 | 22.0 | 27 | 40 | 22 | 11.0 | 15000 | RBI16 | 0.360 |
| 16 | M16 x 2.00 | 22 | 44 | 29 | 25.5 | 19 | 118.0 | 50 | 8.0 | 27 | 22.0 | 27 | 40 | 22 | 11.0 | 15000 | RBI16B | 0.360 |
| 18 | M18 x 1.50 | 23 | 45 | 25 | 31.0 | 20 | 130.0 | 58 | 10.0 | 31 | 25.0 | 31 | 45 | 27 | 11.0 | 19000 | RBI18 | 0.540 |
| 20 | M20 x 1.50 | 27 | 50 | 25 | 29.0 | 24 | 133.0 | 63 | 10.0 | 34 | 27.5 | 34 | 45 | 30 | 7.5 | 19000 | RBI20 | 0.570 |
| 22 | M22 x 1.50 | 27 | 52 | 26 | 33.0 | 24 | 145.0 | 70 | 12.0 | 37 | 30.0 | 37 | 50 | 32 | 7.5 | 23000 | RBI22 | 0.760 |

**Technical supplement**

| Cages | | Precision | Grease |
|---|---|---|---|
| Steel - | X | | |
| Polymid - | X | Class 0 (JIS) | Nil |
| Brass - | X | | |

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# NOTE

NIKO®

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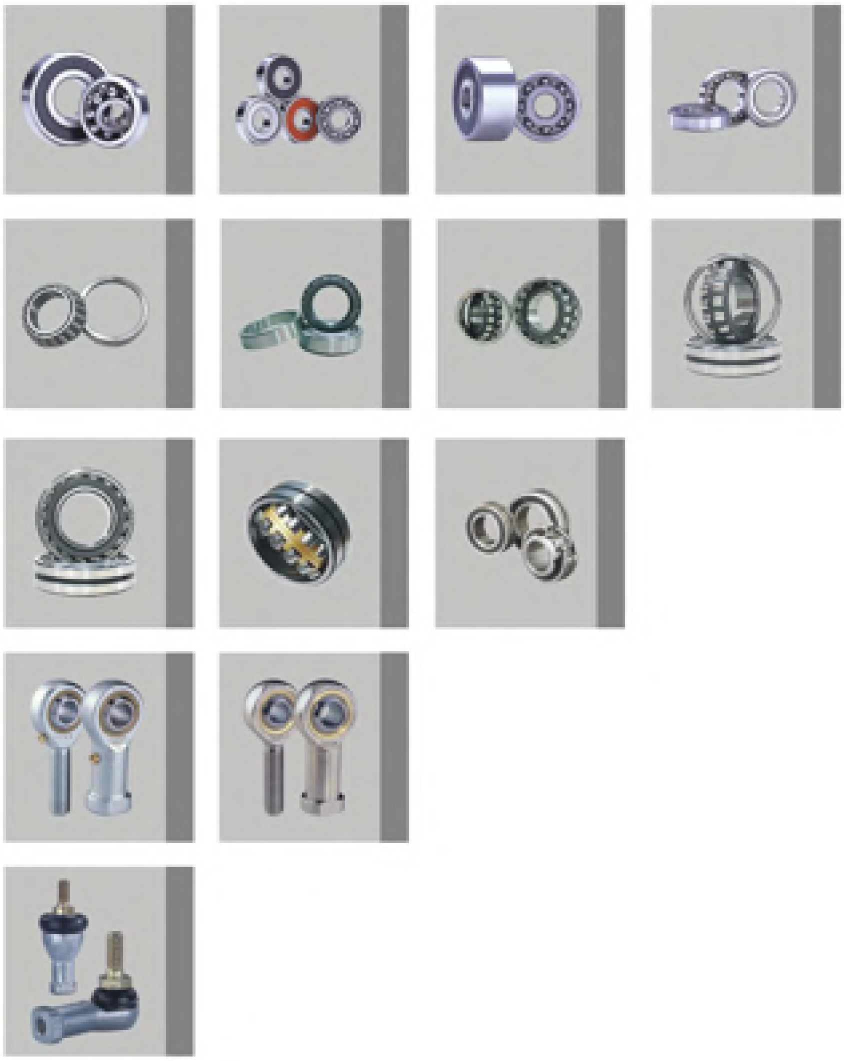
AUTOMATION TECHNOLOGY

# Ball and Roller Bearings 2012

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