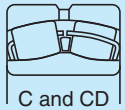
# SPHERICAL ROLLER BEARINGS

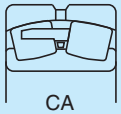
## SPHERICAL ROLLER BEARINGS

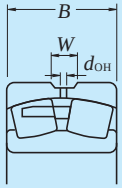
Cylindrical Bores, Tapered Bores
Bore Diameter 20 – 150mm ····· B184
Bore Diameter 160 – 560mm ····· B192
Bore Diameter 600 – 1400mm ····· B202






## DESIGN, TYPES, AND FEATURES

Shown in the figures, types EA, C, CD, CA, which are designed for high load capacity, are available. Types EA, C and CD have pressed steel cages, and type CA has machined brass cages. The EA type bearings listed here are classified as NSKHPS bearings, which offer particularly high load-carrying capacity, high limiting speeds, and are highly functional under high-temperature operating conditions of up to 200°C.

An oil groove and holes are provided in the outer ring to supply lubricant and the bearing numbers are suffixed with E4.

To use bearings with oil grooves and holes, it is recommended to provide an oil groove in the housing bore, since the depth of the groove in the bearing is limited. The number and dimensions of the oil groove and holes are shown in Tables 1 and 2.

When bearings with a hole for a locking pin to prevent outer ring rotation are required, please inform NSK.

**TOLERANCES AND RUNNING ACCURACY** ····· Table 8.2 (Pages A60 to A63)
**RECOMMENDED FITS** ····· Table 9.2 (Page A84)
Table 9.4 (Page A85)
**INTERNAL CLEARANCE** ····· Table 9.15 (Page A92)

## PERMISSIBLE MISALIGNMENT

The permissible misalignment of spherical roller bearings varies depending on the size and load, but it is approximately 0.018 to 0.045 radian (1° to 2.5°) with normal loads.

## LIMITING SPEEDS

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

**Table 1 Dimensions of Oil Grooves and Holes** Units : mm

| Nominal Width $B$ | | Oil Groove | Hole Diameter |
|---|---|---|---|
| over | incl. | Width $W$ | $d_{OH}$ |
| 18 | 30 | 5 | 2.5 |
| 30 | 40 | 6 | 3 |
| 40 | 50 | 7 | 4 |
| 50 | 65 | 8 | 5 |
| 65 | 80 | 10 | 6 |
| 80 | 100 | 12 | 8 |
| 100 | 120 | 15 | 10 |
| 120 | 160 | 20 | 12 |
| 160 | 200 | 25 | 15 |
| 200 | 250 | 30 | 20 |
| 250 | 315 | 35 | 20 |
| 315 | 400 | 40 | 25 |
| 400 | — | 40 | 25 |

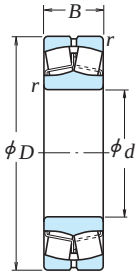
**Table 2 Number of Oil Holes**

| Nominal Outer Ring Dia $D$ (mm) | | Number of Holes |
|---|---|---|
| over | incl. | |
| — | 180 | 4 |
| 180 | 250 | 6 |
| 250 | 315 | 6 |
| 315 | 400 | 6 |
| 400 | 500 | 6 |
| 500 | 630 | 8 |
| 630 | 800 | 8 |
| 800 | 1000 | 8 |
| 1000 | 1250 | 8 |
| 1250 | 1600 | 8 |
| 1600 | 2000 | 8 |

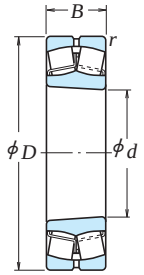
And if the load on spherical roller bearings becomes too small during operation or if the ratio of axial and radial loads is larger than the value of '$e$'(listed in the bearing tables), slippage occurs between the rollers and raceways, which may result in smearing. The higher the weight of the rollers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

If very small bearing loads are expected, please contact NSK for selection of an appropriate bearing.

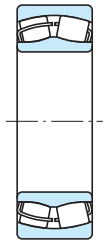
## Bore Diameter 120 – 150 mm




Cylindrical Bore



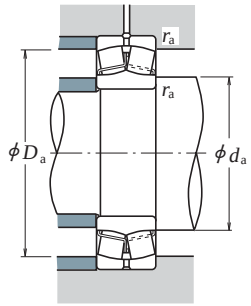

Tapered Bore



Without an Oil Groove or Holes

| Boundary Dimensions (mm) | | | | Basic Load Ratings (N) | | {kgf} | | Limiting Speeds ($min^{-1}$) | | Bearing |
|---|---|---|---|---|---|---|---|---|---|---|
| $d$ | $D$ | $B$ | $r$ min. | $C_r$ | $C_{0r}$ | $C_r$ | $C_{0r}$ | Grease | Oil | Cylindrical Bore |
| **120** | 180 | 46 | 2 | 315 000 | 525 000 | 32 000 | 53 500 | 1 800 | 2 200 | **23024CDE4** |
| | 180 | 60 | 2 | 395 000 | 705 000 | 40 500 | 72 000 | 1 500 | 2 000 | **24024CE4** |
| | 200 | 62 | 2 | 465 000 | 720 000 | 47 500 | 73 500 | 1 400 | 1 800 | **23124CE4** |
| | 200 | 80 | 2 | 575 000 | 950 000 | 58 500 | 96 500 | 1 400 | 1 800 | **24124CE4** |
| | 215 | 58 | 2.1 | 685 000 | 765 000 | 70 000 | 78 000 | 2 400 | 3 000 | ***22224EAE4** |
| | 215 | 76 | 2.1 | 630 000 | 970 000 | 64 500 | 99 000 | 1 300 | 1 700 | **23224CE4** |
| | 260 | 86 | 3 | 1190 000 | 1 320 000 | 122 000 | 134 000 | 1 700 | 2 200 | ***22324EAE4** |
| **130** | 200 | 52 | 2 | 400 000 | 655 000 | 40 500 | 67 000 | 1 700 | 2 000 | **23026CDE4** |
| | 200 | 69 | 2 | 495 000 | 865 000 | 50 500 | 88 000 | 1 400 | 1 800 | **24026CE4** |
| | 210 | 64 | 2 | 505 000 | 825 000 | 51 500 | 84 500 | 1 300 | 1 700 | **23126CE4** |
| | 210 | 80 | 2 | 590 000 | 1 010 000 | 60 000 | 103 000 | 1 300 | 1 700 | **24126CE4** |
| | 230 | 64 | 3 | 820 000 | 940 000 | 83 500 | 96 000 | 2 200 | 2 600 | ***22226EAE4** |
| | 230 | 80 | 3 | 700 000 | 1 080 000 | 71 500 | 110 000 | 1 200 | 1 600 | **23226CE4** |
| | 280 | 93 | 4 | 995 000 | 1 350 000 | 101 000 | 137 000 | 1 300 | 1 600 | **22326CE4** |
| **140** | 210 | 53 | 2 | 420 000 | 715 000 | 43 000 | 73 000 | 1 600 | 1 900 | **23028CDE4** |
| | 210 | 69 | 2 | 525 000 | 945 000 | 53 500 | 96 500 | 1 300 | 1 700 | **24028CE4** |
| | 225 | 68 | 2.1 | 580 000 | 945 000 | 59 000 | 96 500 | 1 200 | 1 600 | **23128CE4** |
| | 225 | 85 | 2.1 | 670 000 | 1 160 000 | 68 500 | 118 000 | 1 200 | 1 600 | **24128CE4** |
| | 250 | 68 | 3 | 645 000 | 930 000 | 65 500 | 95 000 | 1 400 | 1 700 | **22228CDE4** |
| | 250 | 88 | 3 | 835 000 | 1 300 000 | 85 000 | 133 000 | 1 100 | 1 500 | **23228CE4** |
| | 300 | 102 | 4 | 1 160 000 | 1 590 000 | 118 000 | 162 000 | 1 200 | 1 500 | **22328CE4** |
| **150** | 225 | 56 | 2.1 | 470 000 | 815 000 | 48 000 | 83 000 | 1 400 | 1 800 | **23030CDE4** |
| | 225 | 75 | 2.1 | 590 000 | 1 090 000 | 60 500 | 111 000 | 1 200 | 1 500 | **24030CE4** |
| | 250 | 80 | 2.1 | 725 000 | 1 180 000 | 74 000 | 121 000 | 1 100 | 1 400 | **23130CE4** |
| | 250 | 100 | 2.1 | 890 000 | 1 530 000 | 91 000 | 156 000 | 1 100 | 1 400 | **24130CE4** |
| | 270 | 73 | 3 | 765 000 | 1 120 000 | 78 000 | 114 000 | 1 300 | 1 600 | **22230CDE4** |
| | 270 | 96 | 3 | 975 000 | 1 560 000 | 99 500 | 159 000 | 1 100 | 1 400 | **23230CE4** |
| | 320 | 108 | 4 | 1 220 000 | 1 690 000 | 125 000 | 172 000 | 1 100 | 1 400 | **22330CAE4** |

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




**Dynamic Equivalent Load**

$P = XF_r + YF_a$

| $F_a/F_r \leqq e$ | | $F_a/F_r > e$ | |
|---|---|---|---|
| $X$ | $Y$ | $X$ | $Y$ |
| 1 | $Y_3$ | 0.67 | $Y_2$ |

**Static Equivalent Load**

$P_0 = F_r + Y_0 F_a$

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

| Numbers | Abutment and Fillet Dimensions (mm) | | | | | Constant | Axial Load Factors | | | Mass (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| Tapered Bore(1) | $d_a$ min. | $d_a$ max. | $D_a$ max. | $D_a$ min. | $r_a$ max. | $e$ | $Y_2$ | $Y_3$ | $Y_0$ | approx. |
| **23024CDKE4** | 130 | 134 | 170 | 163 | 2 | 0.22 | 4.5 | 3.0 | 2.9 | 4.11 |
| **24024CK30E4** | 130 | 131 | 170 | 158 | 2 | 0.32 | 3.2 | 2.1 | 2.1 | 5.33 |
| **23124CKE4** | 130 | 138 | 190 | 175 | 2 | 0.29 | 3.5 | 2.4 | 2.3 | 7.85 |
| **24124CK30E4** | 130 | 136 | 190 | 171 | 2 | 0.37 | 2.7 | 1.8 | 1.8 | 10 |
| ***22224EAKE4** | 132 | 142 | 203 | 190 | 2 | 0.25 | 3.9 | 2.7 | 2.6 | 8.8 |
| **23224CKE4** | 132 | 140 | 203 | 182 | 2 | 0.34 | 2.9 | 2.0 | 1.9 | 12.1 |
| ***22324EAKE4** | 134 | 157 | 246 | 222 | 2.5 | 0.32 | 3.1 | 2.1 | 2.0 | 22.2 |
| **23026CDKE4** | 140 | 147 | 190 | 180 | 2 | 0.23 | 4.3 | 2.9 | 2.8 | 5.98 |
| **24026CK30E4** | 140 | 143 | 190 | 175 | 2 | 0.31 | 3.2 | 2.2 | 2.1 | 7.84 |
| **23126CKE4** | 140 | 149 | 200 | 184 | 2 | 0.28 | 3.6 | 2.4 | 2.4 | 8.69 |
| **24126CK30E4** | 140 | 146 | 200 | 180 | 2 | 0.35 | 2.9 | 1.9 | 1.9 | 10.7 |
| ***22226EAKE4** | 144 | 152 | 216 | 204 | 2.5 | 0.26 | 3.8 | 2.6 | 2.5 | 11 |
| **23226CKE4** | 144 | 150 | 216 | 196 | 2.5 | 0.34 | 2.9 | 2.0 | 1.9 | 14.3 |
| **22326CKE4** | 148 | 166 | 262 | 236 | 3 | 0.34 | 2.9 | 2.0 | 1.9 | 28.1 |
| **23028CDKE4** | 150 | 157 | 200 | 190 | 2 | 0.22 | 4.5 | 3.0 | 2.9 | 6.49 |
| **24028CK30E4** | 150 | 154 | 200 | 186 | 2 | 0.29 | 3.4 | 2.3 | 2.2 | 8.37 |
| **23128CKE4** | 152 | 158 | 213 | 198 | 2 | 0.28 | 3.6 | 2.4 | 2.3 | 10.5 |
| **24128CK30E4** | 152 | 156 | 213 | 193 | 2 | 0.35 | 2.9 | 1.9 | 1.9 | 13 |
| **22228CDKE4** | 154 | 167 | 236 | 219 | 2.5 | 0.25 | 4.0 | 2.7 | 2.6 | 14.5 |
| **23228CKE4** | 154 | 163 | 236 | 213 | 2.5 | 0.35 | 2.9 | 1.9 | 1.9 | 18.8 |
| **22328CKE4** | 158 | 177 | 282 | 253 | 3 | 0.35 | 2.9 | 1.9 | 1.9 | 35.4 |
| **23030CDKE4** | 162 | 168 | 213 | 203 | 2 | 0.22 | 4.6 | 3.1 | 3.0 | 7.9 |
| **24030CK30E4** | 162 | 165 | 213 | 198 | 2 | 0.30 | 3.4 | 2.3 | 2.2 | 10.5 |
| **23130CKE4** | 162 | 174 | 238 | 218 | 2 | 0.30 | 3.4 | 2.3 | 2.2 | 15.8 |
| **24130CK30E4** | 162 | 169 | 238 | 212 | 2 | 0.38 | 2.6 | 1.8 | 1.7 | 19.8 |
| **22230CDKE4** | 164 | 179 | 256 | 236 | 2.5 | 0.26 | 3.9 | 2.6 | 2.5 | 18.4 |
| **23230CKE4** | 164 | 176 | 256 | 230 | 2.5 | 0.35 | 2.9 | 1.9 | 1.9 | 24.2 |
| **22330CAKE4** | 168 | — | 302 | 270 | 3 | 0.35 | 2.9 | 1.9 | 1.9 | 41.5 |

**Remarks**
1. The bearings denoted by an asterisk (*) are NSKHPS bearings and an oil groove and holes are standard for them.
2. When making a selection of the recommended fit (Tolerance of Shaft) on Page A84 of the NSK Rolling Bearings catalog, in case of NSKHPS bearings, the conditions are different.
   The segmentations are: Light Loads ($\leq 0.05C_r$); Normal Loads (0.05 to $0.10C_r$); and Heavy Loads ($>0.10C_r$).
3. For the dimensions of adapters and withdrawal sleeves, refer to Pages **B361** – **B362**, and **B367** – **B368**.