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## 7. SPHERICAL ROLLER BEARINGS

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### TECHNICAL DATA

## SPHERICAL ROLLER BEARINGS

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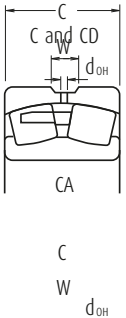
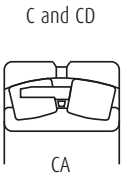
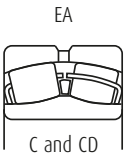
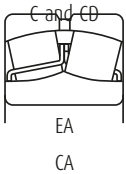
## DESIGNS, TYPES AND FEATURES

High load capacity designs EA, C, CD and CA, shown in the figures are available. Types EA, C and CD have pressed steel cages, and type CA has machined brass cage. The EA type bearings listed here are classified as NSKPS 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.

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



**Table 1 Dimensions of Oil Grooves and Holes**

Units : mm

| Nominal Outer Ring Width C |       | Oil Groove Width W | Hole Diameter $d_{OH}$ |
|----------------------------|-------|--------------------|------------------------|
| over                       | incl. |                    |                        |
| 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 Diameter 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               |



|                                | Table ..... | Pages          |
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### 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 (GREASE)

The limiting speeds (grease) 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 A098 for detailed information.

### PRECAUTIONS FOR USE OF SPHERICAL ROLLER BEARINGS

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.

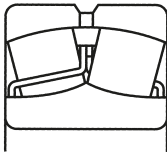
## TECHNICAL DATA

### Free Space of Spherical Roller Bearings

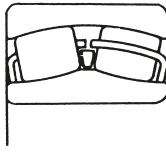
The spherical roller bearing has self-aligning ability and capacity to carry substantially large radial and bi-axial loads. For these reasons, this bearing is used widely in many applications. Application problems include a long span, which causes substantial deflection of the shaft, as well as installation errors and axial misalignment. These bearings may be exposed to a large radial or shock loads.

Grease lubrication is common for spherical roller bearings because it simplifies the seal construction around the housing and makes maintenance and inspection easier. In this case, it is important to select a grease appropriate to the operating conditions and to fill the bearing with the proper amount of grease considering the housing internal space.

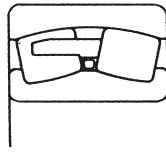
As a reference, the bearing free space for conventional types plus four other types (EA, C, CD, and CA) is shown in Table 1. Under general operating conditions, it is appropriate to pack a large quantity of grease into the bearing internal space and to pack grease into the housing internal space other than the bearing itself, to the extent of  $1/3$  to  $2/3$  that of the free space.



EA type



C, CD type



CA type

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Table 1 Free Space of Spherical Roller Bearing (EA, C, CD, and CA)

Units : cm<sup>3</sup>

| Bearing Bore No. | Bearing Free Space |       |       |       |       |
|------------------|--------------------|-------|-------|-------|-------|
|                  | Bearing Series     |       |       |       |       |
|                  | 230                | 231   | 222   | 232   | 223   |
| 11               | —                  | —     | 29    | —     | 78    |
| 12               | —                  | —     | 42    | —     | 96    |
| 13               | —                  | —     | 48    | —     | 113   |
| 14               | —                  | —     | 52    | —     | 139   |
| 15               | —                  | —     | 57    | —     | 170   |
| 16               | —                  | —     | 71    | —     | 206   |
| 17               | —                  | —     | 91    | —     | 234   |
| 18               | —                  | —     | 110   | 130   | 283   |
| 19               | —                  | —     | 135   | —     | 327   |
| 20               | —                  | —     | 169   | 203   | 410   |
| 22               | 100                | 150   | 242   | 294   | 560   |
| 24               | 109                | 228   | 297   | 340   | 700   |
| 26               | 161                | 240   | 365   | 405   | 955   |
| 28               | 170                | 292   | 400   | 530   | 1 230 |
| 30               | 209                | 465   | 505   | 680   | 1 430 |
| 32               | 254                | 575   | 680   | 850   | 1 710 |
| 34               | 355                | 610   | 785   | 1 090 | 2 070 |
| 36               | 465                | 785   | 810   | 1 120 | 2 460 |
| 38               | 565                | 970   | 1 160 | 1 340 | 2 830 |
| 40               | 715                | 1 160 | 1 400 | 1 640 | 2 900 |
| 44               | 940                | 1 500 | 1 880 | 2 270 | 3 750 |
| 48               | 1 030              | 1 900 | 2 550 | 3 550 | 4 700 |
| 52               | 1 530              | 2 940 | 3 300 | 4 750 | 5 900 |
| 56               | 1 820              | 3 150 | 3 400 | 4 950 | 7 250 |
| 60               | 2 200              | 4 050 | 4 300 | 6 200 | 8 750 |

**Remarks**

22211 to 22226, 22311 to 22324 are EA Type Bearings.  
 23122 to 23148, 23218 to 23244 are C Type Bearings.  
 23022 to 23036, 22228 to 22236 are CD Type Bearings.  
 23038 to 23060, 23152 to 23160, 22238 to 22260,  
 23248 to 23260, and 22326 to 22360 are CA Type Bearing.

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## Measurement of Bearing Clearance

For the bearing mounting, the measurement of internal bearing clearance is a most important task. Before handling the bearing and measuring the internal bearing clearance, be sure to wear thin rubber gloves. (If a bearing is touched by a bare hand, the touched part may rust.) When measuring the internal bearing clearance, pay careful attention so that the rollers are positioned correctly.

### 1. Measurement of Bearing Clearance

To measure only internal bearing clearance, set the bearing standing upright (vertically) on a flat surface, while holding its outer ring with one hand. While paying attention not to incline the inner and outer rings, stabilize the rollers by turning the inner ring to the right and left by about one half to one full rotation. Adjust rollers until one randomly chosen roller of the double rows is positioned to be exactly at the top. Now, the internal clearance is measured with a thickness gauge. The measurement position and measured point vary slightly depending on the size of the outer ring outside diameter.

#### 1.1 Bearing Outside Diameter Is Smaller Than 200 mm

Insert the thickness gauge between rollers of 2 rows which have a roller positioned exactly at the top of the bearing and outer ring. Now, measure the internal clearance ( $\Delta_{rl}$ ). (Fig. 1)

#### 1.2 Bearing Outside Diameter Is Larger Than 200 mm

Insert the thickness gauge between the rollers of the 2 rows, which each have been positioned to be exactly at the top, and outer ring and between 2 rows of bearing at symmetrical position relative to the bearing center, then measure the respective

internal clearance of the bearing. (Fig. 2). For the internal bearing clearance ( $\Delta_{rl}$ ), take that value measured between 2 rows of just top of bearing and outer ring as respectively  $\Delta_{rl1}$  and  $\Delta_{rl2}$  and that value measured just at top of the bearing as  $\Delta_{rl}$ .

$$\Delta_{rl} = 1/2 (\Delta_{rl1} + \Delta_{rl2})$$

Among internal clearances between 2 rows of rollers that are symmetrical relative to the bearing center and outer ring, take that measurement between 2 rows of rollers of left side respectively as  $\Delta_{rl1}$  and  $\Delta_{rl2}$ . The internal clearance on the left side of the bearing is  $\Delta_{rl}$ :

$$\Delta_{rl} = 1/2 (\Delta_{rl1} + \Delta_{rl2})$$

Take that measurement between 2 rows of rollers of right side respectively as  $\Delta_{rl1}$  and  $\Delta_{rl2}$ . The internal clearance of the right side of the bearing is  $\Delta_{rl}$ :

$$\Delta_{rl} = 1/2 (\Delta_{rl1} + \Delta_{rl2})$$

The internal bearing clearance ( $\Delta_{rl}$ ) is given by the following equation:

$$\Delta_{rl} = 1/2 (\Delta_{rl} + \Delta_{rl} + \Delta_{rl})$$

### 2. Measuring Bearing Clearance When Mounted on Shaft or Sleeve

Basically, the measurement of the clearance is taken when the outer ring of bearing hangs down from rollers. At first, while holding the bearing up-right, rotate the outer ring in the clockwise and counter-clockwise directions by one half to one full rotation until both rows have a randomly chosen roller positioned exactly at the bottom. The clearance is measured with a thickness gauge but diameter.

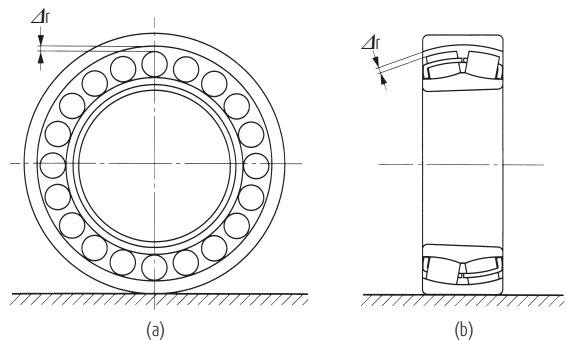


Fig. 1 Clearance Measurement Point (Bearing Outside Diameter: Less Than 200 mm)

the measurement point varies slightly depending on the size of the outer ring outside diameter.

## 2.1 Bearing Outside Diameter Is Smaller Than 200 mm

Insert the thickness gauge between rollers of 2 rows of just at the bottom of the bearing and outer ring and measure the internal clearance ( $\Delta_{IS}$ ). (Fig. 3)

## 2.2 Bearing Outside Diameter Is Larger Than 200 mm

Insert the thickness gauge between rollers of 2 rows that are positioned just at the bottom of bearing and outer ring and between 2 rows of bearing rollers symmetrical relative to the bearing center, then, measure the respective internal clearance of the bearing. (Fig. 3) For the internal bearing clearance ( $\Delta_I$ ), take the measurement when the roller is positioned exactly at the bottom, since the bearing has 2 rows, two values must be measured. The bearing internal clearance is  $\Delta_{IS1}$  and  $\Delta_{IS2}$  while that value measured at the exact bottom of the bearing is  $\Delta_{IS}$ .

$$\Delta_{IS} = 1/2 (\Delta_{IS1} + \Delta_{IS2})$$

Among internal clearances between 2 rows of rollers symmetrical relative to the bearing center and outer ring, take that value measured between 2 rows of rollers of left side respectively as  $\Delta_{IL1}$  and  $\Delta_{IL2}$  and the internal clearance of left side of bearing as  $\Delta_{IL}$ .

$$\Delta_{IL} = 1/2 (\Delta_{IL1} + \Delta_{IL2})$$

The internal clearances measured between 2 rows of rollers on the right side respectively as  $\Delta_{IR1}$  and  $\Delta_{IR2}$ . The internal clearance of right side of bearing is  $\Delta_{IR}$ .

$$\Delta_{IR} = 1/2 (\Delta_{IR1} + \Delta_{IR2})$$

The internal bearing clearance ( $\Delta_I$ ) is given by the following equation:

$$\Delta_I = 1/2 (\Delta_{IS} + \Delta_{IL} + \Delta_{IR})$$

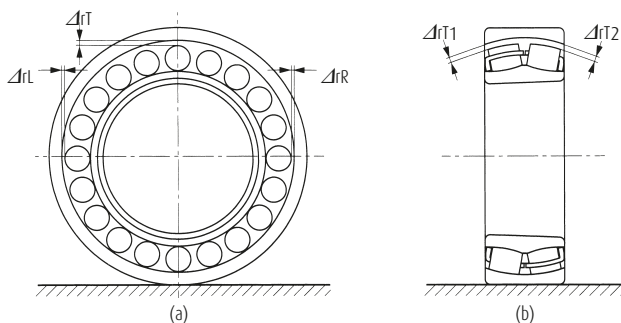


Fig. 2 Clearance Measurement Point (Bearing Outside Diameter: Larger Than 200 mm)

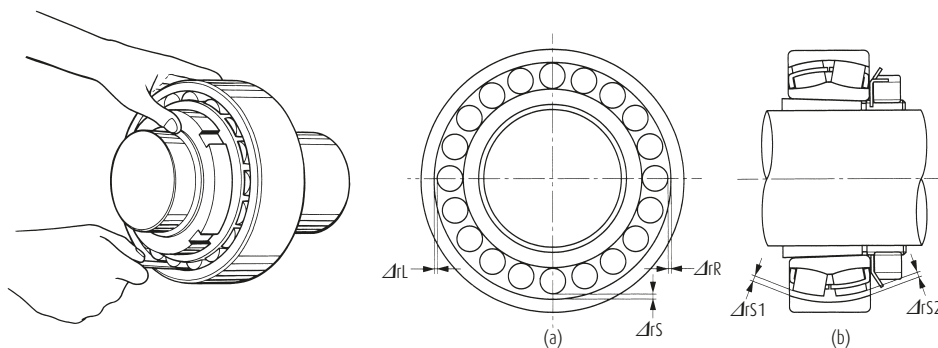


Fig. 3 Clearance Measurement Point

## 3. Temperature Equilibrium When Taking Measurements

To ensure accurate bearing measurement of the internal clearance or dimensions, the temperature of the measurement instrument and that of the components to be measured must be brought to the same temperature. Especially, if the bearing is mounted by using an oil heating tank or induction heater, then measure the internal clearance only after a complete cool down. For example, if a bearing is brought from the warehouse to the measurement place, the temperature of the stored bearing may still be high, thus, if the clearance or dimension were measured without confirming the bearing temperature, the measured value may be wrong.

For a large bearing with an outer ring outside diameter that is larger than 400 mm, if a clearance or dimension measurement is necessary, it is recommended to leave the unpacked bearing for about 24 hours on the surface plate, before making a clearance or dimension measurement. Put the end face of the bearing on a surface plate prior to measurement to ensure a measurement with both objects at the same temperature.

## 4. Clearance Adjustment When Mounting Bearing on a Tapered Shaft or Sleeve

Mount the bearing with its inner ring having a tapered bore to the tapered shaft or sleeve (adapter, removable sleeve). When pushing in the bearing to the tapered shaft or sleeve, the inner ring of bearing is widened resulting in increase of "interference" and reduction of internal clearance. It is important to give proper interference and internal clearance when mounting the bearing. Next, we show the reduction amount of the clearance to achieve the proper mounting.

(Mounting of spherical roller bearings having tapered bore Table 2)

When mounting a bearing, each time the bearing is pushed further onto the tapered shaft or sleeve, measure the variation of internal clearance and repeat the above procedure until the clearance reduction amount to the specified value listed in the Table 2 is attained. This procedure is called "Clearance adjustment" and when the clearance reduction amount is attained, the clearance necessary for bearing running is secured. The confirmation of the clearance reduction amount by measurement with a thickness gauge is very important. Depending on the method of clearance adjustment, the measured value obtained with the thickness gauge may not be correct. Therefore, the following corrective procedure must be executed.

### 1. In case to heat

When the temperatures of bearing and shaft are both at the same room temperature, measure again the clearance with the thickness gauge to confirm that the specified value is secured.

### 2. In case that a lock-washer is used as a turning stopper of the lock nut.

Prior to bending the tooth of the lock-washer into cutout of lock nut, measure again the clearance with the thickness gauge to confirm that the specified value is secured.

### 3. In case a hydraulic nut is used

After removal of the hydraulic nut, mount the lock nut and measure the clearance again to confirm that the specified value remains constant prior to stopping the turning.

### 4. In case an oil injection pump is used

Drop to zero the pressure of high pressure oil fed from the oil injection pump so that there is no pressure on bearing or sleeve fitted part. Next, measure the clearance with the thickness gauge to confirm that the specified value remains secured.

## Radial Internal Clearance and Clearance Reduction Amount of the Bearing to be Mounted

- › When radial internal clearance is CN clearance (normal clearance) Perform the clearance adjustment while aiming at a middle value between minimum and maximum clearance reduction amount.
- › When radial internal clearance is C3 or C4 clearance Perform the clearance adjustment aiming at the maximum clearance reduction amount.

## Internal Clearance Adjustment of Tapered-Bore Bearings

Perform the adjustment by measuring the clearance reduction amount with the thickness gauge.

1. For measurement position and measured point, refer to Section 2.(Page B280) of this manual.
2. To mount a bearing on a tapered shaft, perform each time when the bearing is pushed in by the lock nut, end plate, end cap or hydraulic nut.
3. When using an adapter sleeve, perform each time when the bearing is pushed in by the lock nut or hydraulic nut.
4. When using a removable sleeve, perform each time when the removable sleeve is pushed in by the lock nut or hydraulic nut.



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When measuring the clearance during those operations, as the outer ring of bearing is hanging down from of rollers, turn the outer ring to right and left by one half to one full rotation while keeping the bearing in its correct posture.

Position one randomly chosen roller from each row of rollers to the exact bottom position. Then, insert the thickness gauge to an appropriate place depending on size of the outer ring outside diameter to measure the internal clearance. For the clearance adjustment, the measured value of each clearance measurement shall be recorded.

**Table 2 Mounting of Spherical Roller Bearings with Tapered Bores**

Units : mm

| Bearing Bore Diameter d (mm) |       | Reduction in Radial Clearance |       | Axial Movement |      |            |      | Minimum Permissible Residual Clearance |       |       |
|------------------------------|-------|-------------------------------|-------|----------------|------|------------|------|----------------------------------------|-------|-------|
| over                         | incl. | min.                          | max.  | Taper 1:12     |      | Taper 1:30 |      |                                        |       |       |
|                              |       |                               |       | min.           | max. | min.       | max. | CN                                     | C3    | C4    |
| 30                           | 40    | 0.025                         | 0.030 | 0.40           | 0.45 | —          | —    | 0.010                                  | 0.025 | 0.035 |
| 40                           | 50    | 0.030                         | 0.035 | 0.45           | 0.55 | —          | —    | 0.015                                  | 0.030 | 0.045 |
| 50                           | 65    | 0.030                         | 0.035 | 0.45           | 0.55 | —          | —    | 0.025                                  | 0.035 | 0.060 |
| 65                           | 80    | 0.040                         | 0.045 | 0.60           | 0.70 | —          | —    | 0.030                                  | 0.040 | 0.075 |
| 80                           | 100   | 0.045                         | 0.055 | 0.70           | 0.85 | 1.75       | 2.15 | 0.035                                  | 0.050 | 0.085 |
| 100                          | 120   | 0.050                         | 0.060 | 0.75           | 0.90 | 1.9        | 2.25 | 0.045                                  | 0.065 | 0.110 |
| 120                          | 140   | 0.060                         | 0.070 | 0.90           | 1.1  | 2.25       | 2.75 | 0.055                                  | 0.080 | 0.130 |
| 140                          | 160   | 0.065                         | 0.080 | 1.0            | 1.3  | 2.5        | 3.25 | 0.060                                  | 0.100 | 0.150 |
| 160                          | 180   | 0.070                         | 0.090 | 1.1            | 1.4  | 2.75       | 3.5  | 0.070                                  | 0.110 | 0.170 |
| 180                          | 200   | 0.080                         | 0.100 | 1.3            | 1.6  | 3.25       | 4.0  | 0.070                                  | 0.110 | 0.190 |
| 200                          | 225   | 0.090                         | 0.110 | 1.4            | 1.7  | 3.5        | 4.25 | 0.080                                  | 0.130 | 0.210 |
| 225                          | 250   | 0.100                         | 0.120 | 1.6            | 1.9  | 4.0        | 4.75 | 0.090                                  | 0.140 | 0.230 |
| 250                          | 280   | 0.110                         | 0.140 | 1.7            | 2.2  | 4.25       | 5.5  | 0.100                                  | 0.150 | 0.250 |
| 280                          | 315   | 0.120                         | 0.150 | 1.9            | 2.4  | 4.75       | 6.0  | 0.110                                  | 0.160 | 0.280 |
| 315                          | 355   | 0.140                         | 0.170 | 2.2            | 2.7  | 5.5        | 6.75 | 0.120                                  | 0.180 | 0.300 |
| 355                          | 400   | 0.150                         | 0.190 | 2.4            | 3.0  | 6.0        | 7.5  | 0.130                                  | 0.200 | 0.330 |
| 400                          | 450   | 0.170                         | 0.210 | 2.7            | 3.3  | 6.75       | 8.25 | 0.140                                  | 0.220 | 0.360 |
| 450                          | 500   | 0.190                         | 0.240 | 3.0            | 3.7  | 7.5        | 9.25 | 0.160                                  | 0.240 | 0.390 |
| 500                          | 560   | 0.210                         | 0.270 | 3.4            | 4.3  | 8.5        | 11.0 | 0.170                                  | 0.270 | 0.410 |
| 560                          | 630   | 0.230                         | 0.300 | 3.7            | 4.8  | 9.25       | 12.0 | 0.200                                  | 0.310 | 0.460 |
| 630                          | 710   | 0.260                         | 0.330 | 4.2            | 5.3  | 10.5       | 13.0 | 0.220                                  | 0.330 | 0.520 |
| 710                          | 800   | 0.280                         | 0.370 | 4.5            | 5.9  | 11.5       | 15.0 | 0.240                                  | 0.390 | 0.590 |
| 800                          | 900   | 0.310                         | 0.410 | 5.0            | 6.6  | 12.5       | 16.5 | 0.280                                  | 0.430 | 0.660 |
| 900                          | 1 000 | 0.340                         | 0.460 | 5.5            | 7.4  | 14.0       | 18.5 | 0.310                                  | 0.470 | 0.730 |
| 1 000                        | 1 120 | 0.370                         | 0.500 | 5.9            | 8.0  | 15.0       | 20.0 | 0.360                                  | 0.530 | 0.800 |

**Remarks**

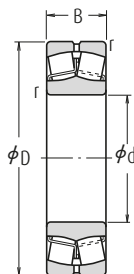
The values for reduction in radial internal clearance are for bearings with CN clearance.

For bearings with C3 or C4 Clearance, the maximum values listed should be used for the reduction in radial internal clearance.

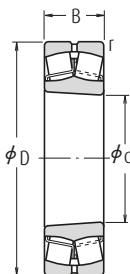
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Bore Diameter 20 – 55 mm



Cylindrical Bore  
EA



Tapered Bore  
EA



Without an Oil Groove or Holes  
CD

| Boundary Dimensions<br>(mm) |     |    |           | Basic Load Ratings<br>(N) |                 | Thermal<br>Reference Speed | Speeds<br>(min <sup>-1</sup> ) |        | Bearing               |
|-----------------------------|-----|----|-----------|---------------------------|-----------------|----------------------------|--------------------------------|--------|-----------------------|
| d                           | D   | B  | r<br>min. | C <sub>r</sub>            | C <sub>0r</sub> |                            | Limiting Speeds                |        | Cylindrical Bore      |
|                             |     |    |           |                           |                 |                            | Mechanical                     | Grease |                       |
| 20                          | 52  | 15 | 1.1       | 29 300                    | 26 900          | 10 000                     | —                              | 6 300  | 21304CDE4             |
| 25                          | 52  | 18 | 1.0       | 37 500                    | 37 000          | 10 000                     | —                              | 7 100  | 22205CE4              |
|                             | 62  | 17 | 1.1       | 43 000                    | 40 500          | 9 000                      | —                              | 5 300  | 21305CDE4             |
| 30                          | 62  | 20 | 1.0       | 50 000                    | 50 000          | 8 500                      | —                              | 6 000  | 22206CE4              |
|                             | 72  | 19 | 1.1       | 55 000                    | 54 000          | 7 500                      | —                              | 4 500  | 21306CDE4             |
| 35                          | 72  | 23 | 1.1       | 69 000                    | 71 000          | 7 500                      | —                              | 5 300  | 22207CE4              |
|                             | 80  | 21 | 1.5       | 71 500                    | 76 000          | 7 100                      | —                              | 4 000  | 21307CDE4             |
| 40                          | 80  | 23 | 1.1       | 113 000                   | 99 000          | 7 100                      | 12 000                         | 6 700  | 22208EA4 <sup>o</sup> |
|                             | 90  | 23 | 1.5       | 118 000                   | 111 000         | 6 700                      | 11 000                         | 6 000  | 21308EA4 <sup>o</sup> |
| 45                          | 90  | 33 | 1.5       | 170 000                   | 153 000         | 5 600                      | 9 000                          | 5 300  | 22308EA4 <sup>o</sup> |
|                             | 85  | 23 | 1.1       | 118 000                   | 111 000         | 6 300                      | 11 000                         | 6 000  | 22209EA4 <sup>o</sup> |
|                             | 100 | 25 | 1.5       | 149 000                   | 144 000         | 6 000                      | 9 000                          | 5 000  | 21309EA4 <sup>o</sup> |
| 50                          | 100 | 36 | 1.5       | 207 000                   | 195 000         | 5 000                      | 8 000                          | 4 500  | 22309EA4 <sup>o</sup> |
|                             | 90  | 23 | 1.1       | 124 000                   | 119 000         | 6 000                      | 9 500                          | 5 600  | 22210EA4 <sup>o</sup> |
|                             | 110 | 27 | 2.0       | 178 000                   | 174 000         | 5 300                      | 8 000                          | 4 500  | 21310EA4 <sup>o</sup> |
| 55                          | 110 | 40 | 2.0       | 246 000                   | 234 000         | 4 800                      | 7 100                          | 4 300  | 22310EA4 <sup>o</sup> |
|                             | 100 | 25 | 1.5       | 149 000                   | 144 000         | 5 300                      | 9 000                          | 5 300  | 22211EA4 <sup>o</sup> |
|                             | 120 | 29 | 2.0       | 178 000                   | 174 000         | 5 300                      | 8 000                          | 4 500  | 21311EA4 <sup>o</sup> |
|                             | 120 | 43 | 2.0       | 292 000                   | 292 000         | 4 300                      | 6 000                          | 3 800  | 22311EA4 <sup>o</sup> |

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

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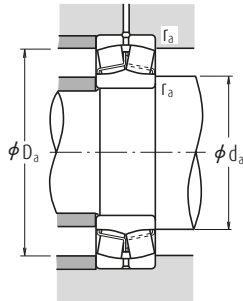
## Dynamic Equivalent Load $P = X F_r + Y F_a$

| $F_a/F_r \leq e$ |       | $F_a/F_r > e$ |       |
|------------------|-------|---------------|-------|
| 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.



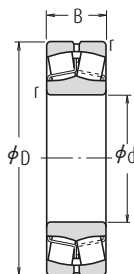
| Numbers          | Abutment and Fillet Dimensions<br>(mm) |      |       |      |       | Constant | Axial Load<br>Factors |       |       | Mass<br>(kg) |
|------------------|----------------------------------------|------|-------|------|-------|----------|-----------------------|-------|-------|--------------|
|                  | $d_a$                                  |      | $D_a$ |      | $r_a$ |          | $e$                   | $Y_2$ | $Y_3$ |              |
| Tapered Bore (1) | min.                                   | max. | max.  | min. | max.  |          |                       |       |       |              |
| 21304CDKE4       | 27                                     | 28   | 45    | 42   | 1.0   | 0.31     | 3.2                   | 2.1   | 2.1   | 0.17         |
| 22205CKE4        | 31                                     | 31   | 46    | 45   | 1.0   | 0.35     | 2.9                   | 1.9   | 1.9   | 0.17         |
| 21305CDKE4       | 32                                     | 34   | 55    | 51   | 1.0   | 0.29     | 3.4                   | 2.3   | 2.3   | 0.26         |
| 22206CKE4        | 36                                     | 37   | 56    | 54   | 1.0   | 0.33     | 3.1                   | 2.1   | 2.0   | 0.27         |
| 21306CDKE4       | 37                                     | 40   | 65    | 59   | 1.0   | 0.28     | 3.6                   | 2.4   | 2.3   | 0.39         |
| 22207CKE4        | 42                                     | 43   | 65    | 63   | 1.0   | 0.32     | 3.1                   | 2.1   | 2.0   | 0.42         |
| 21307CDKE4       | 44                                     | 47   | 71    | 67   | 1.5   | 0.28     | 3.6                   | 2.4   | 2.4   | 0.53         |
| 22208EAKE4*      | 47                                     | 49   | 73    | 70   | 1.0   | 0.28     | 3.6                   | 2.4   | 2.4   | 0.50         |
| 21308EAKE4*      | 49                                     | 54   | 81    | 75   | 1.5   | 0.25     | 3.9                   | 2.7   | 2.6   | 0.73         |
| 22208EAKE4*      | 49                                     | 52   | 81    | 77   | 1.5   | 0.35     | 2.8                   | 1.9   | 1.9   | 0.98         |
| 22209EAKE4*      | 52                                     | 54   | 78    | 75   | 1.0   | 0.25     | 3.9                   | 2.7   | 2.6   | 0.55         |
| 21309EAKE4*      | 54                                     | 65   | 91    | 89   | 1.5   | 0.23     | 4.3                   | 2.9   | 2.8   | 0.96         |
| 22209EAKE4*      | 54                                     | 59   | 91    | 86   | 1.5   | 0.34     | 2.9                   | 2.0   | 1.9   | 1.34         |
| 22210EAKE4*      | 57                                     | 60   | 83    | 81   | 1.0   | 0.24     | 4.3                   | 2.9   | 2.8   | 0.61         |
| 21310EAKE4*      | 60                                     | 72   | 100   | 98   | 2.0   | 0.23     | 4.4                   | 3.0   | 2.9   | 1.21         |
| 22210EAKE4*      | 60                                     | 64   | 100   | 93   | 2.0   | 0.35     | 2.8                   | 1.9   | 1.9   | 1.78         |
| 22211EAKE4*      | 64                                     | 65   | 91    | 89   | 1.5   | 0.23     | 4.3                   | 2.9   | 2.8   | 0.81         |
| 21311EAKE4*      | 65                                     | 72   | 110   | 98   | 2.0   | 0.23     | 4.4                   | 3.0   | 2.9   | 1.58         |
| 22311EAKE4*      | 65                                     | 73   | 110   | 103  | 2.0   | 0.34     | 2.9                   | 2.0   | 1.9   | 2.3          |

- Remarks**
- The bearings denoted by an asterisk (\*) are NSKHPS bearings and an oil groove and holes are standard for them.
  - When making a selection of the recommended fit (Tolerance of shaft) on Page A164, 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 ( $> 0.10C_r$ ).
  - For the dimensions of adapters and withdrawal sleeves, refer to Pages B376 - B377, and B384.

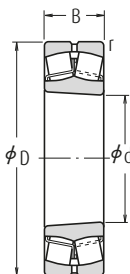
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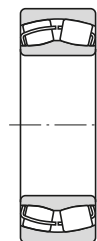
## Bore Diameter 60 - 90 mm



Cylindrical Bore  
EA



Tapered Bore  
EA



Without an Oil Groove or Holes  
CD

| Boundary Dimensions<br>(mm) |     |      |           | Basic Load Ratings<br>(N) |                 | Thermal<br>Reference Speed | Speeds<br>(min <sup>-1</sup> ) |        | Bearing          |
|-----------------------------|-----|------|-----------|---------------------------|-----------------|----------------------------|--------------------------------|--------|------------------|
| d                           | D   | B    | r<br>min. | C <sub>r</sub>            | C <sub>0r</sub> |                            | Limiting Speeds                |        | Cylindrical Bore |
|                             |     |      |           |                           |                 |                            | Mechanical                     | Grease |                  |
| 60                          | 95  | 26.0 | 1.1       | 98 500                    | 141 000         | 4 800                      | —                              | 3 600  | 23012CE4         |
|                             | 110 | 28.0 | 1.5       | 178 000                   | 174 000         | 5 300                      | 8 000                          | 4 800  | 22212EAE4*       |
|                             | 130 | 31.0 | 2.1       | 238 000                   | 244 000         | 4 800                      | 6 700                          | 3 800  | 21312EAE4*       |
|                             | 130 | 46.0 | 2.1       | 340 000                   | 340 000         | 4 000                      | 5 600                          | 3 600  | 22312EAE4*       |
| 65                          | 120 | 31.0 | 1.5       | 221 000                   | 230 000         | 4 800                      | 7 500                          | 4 300  | 22213EAE4*       |
|                             | 140 | 33.0 | 2.1       | 264 000                   | 275 000         | 4 500                      | 6 000                          | 3 600  | 21313EAE4*       |
|                             | 140 | 48.0 | 2.1       | 375 000                   | 380 000         | 3 800                      | 5 000                          | 3 200  | 22313EAE4*       |
| 70                          | 125 | 31.0 | 1.5       | 225 000                   | 232 000         | 4 500                      | 7 100                          | 4 000  | 22214EAE4*       |
|                             | 150 | 35.0 | 2.1       | 310 000                   | 325 000         | 4 300                      | 5 600                          | 3 200  | 21314EAE4*       |
|                             | 150 | 51.0 | 2.1       | 425 000                   | 435 000         | 3 600                      | 4 800                          | 3 000  | 22314EAE4*       |
| 75                          | 130 | 31.0 | 1.5       | 238 000                   | 244 000         | 4 300                      | 6 700                          | 4 000  | 22215EAE4*       |
|                             | 160 | 37.0 | 2.1       | 310 000                   | 325 000         | 4 000                      | 5 600                          | 3 200  | 21315EAE4*       |
|                             | 160 | 55.0 | 2.1       | 485 000                   | 505 000         | 3 400                      | 4 300                          | 2 800  | 22315EAE4*       |
| 80                          | 140 | 33.0 | 2.0       | 264 000                   | 275 000         | 4 000                      | 6 000                          | 3 600  | 22216EAE4*       |
|                             | 170 | 39.0 | 2.1       | 355 000                   | 375 000         | 3 800                      | 4 800                          | 3 000  | 21316EAE4*       |
|                             | 170 | 58.0 | 2.1       | 540 000                   | 565 000         | 3 200                      | 3 800                          | 2 600  | 22316EAE4*       |
| 85                          | 150 | 36.0 | 2.0       | 310 000                   | 325 000         | 4 000                      | 5 600                          | 3 400  | 22217EAE4*       |
|                             | 180 | 41.0 | 3.0       | 360 000                   | 395 000         | 3 800                      | 5 000                          | 3 000  | 21317EAE4*       |
|                             | 180 | 60.0 | 3.0       | 600 000                   | 630 000         | 3 000                      | 3 400                          | 2 400  | 22317EAE4*       |
| 90                          | 160 | 40.0 | 2.0       | 360 000                   | 395 000         | 3 800                      | 5 000                          | 3 200  | 22218EAE4*       |
|                             | 160 | 52.4 | 2.0       | 340 000                   | 490 000         | 2 800                      | —                              | 1 800  | 23218CE4         |
|                             | 190 | 43.0 | 3.0       | 415 000                   | 450 000         | 3 600                      | 4 500                          | 2 800  | 21318EAE4*       |
|                             | 190 | 64.0 | 3.0       | 665 000                   | 705 000         | 2 800                      | 3 000                          | 2 400  | 22318EAE4*       |

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

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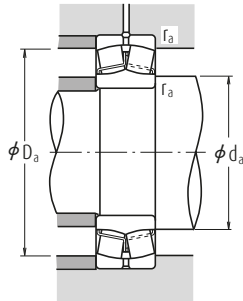
**Dynamic Equivalent Load**  $P = X F_r + Y F_a$ 

| $F_a/F_r \leq e$ |       | $F_a/F_r > e$ |       |
|------------------|-------|---------------|-------|
| 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<br><br>Tapered Bore (1) | Abutment and Fillet Dimensions (mm) |     |       |     |       | Constant<br><br>e | Axial Load Factors |       |       | Mass (kg)<br><br>approx. |
|---------------------------------|-------------------------------------|-----|-------|-----|-------|-------------------|--------------------|-------|-------|--------------------------|
|                                 | $d_a$                               |     | $D_a$ |     | $r_a$ |                   | $Y_2$              | $Y_3$ | $Y_0$ |                          |
| 23012CKE4                       | 67                                  | 68  | 88    | 85  | 1     | 0.26              | 3.9                | 2.6   | 2.5   | 0.68                     |
| 22212EAKE4*                     | 69                                  | 72  | 101   | 98  | 1.5   | 0.23              | 4.4                | 3.0   | 2.9   | 1.1                      |
| 21312EAKE4*                     | 72                                  | 87  | 118   | 117 | 2     | 0.22              | 4.5                | 3.0   | 3.0   | 1.98                     |
| 22312EAKE4*                     | 72                                  | 79  | 118   | 111 | 2     | 0.34              | 3.0                | 2.0   | 1.9   | 2.89                     |
| 22213EAKE4*                     | 74                                  | 80  | 111   | 107 | 1.5   | 0.24              | 4.2                | 2.8   | 2.7   | 1.51                     |
| 21313EAKE4*                     | 77                                  | 94  | 128   | 126 | 2     | 0.22              | 4.6                | 3.1   | 3.0   | 2.45                     |
| 22313EAKE4*                     | 77                                  | 84  | 128   | 119 | 2     | 0.33              | 3.0                | 2.0   | 2.0   | 3.52                     |
| 22214EAKE4*                     | 79                                  | 84  | 116   | 111 | 1.5   | 0.23              | 4.3                | 2.9   | 2.8   | 1.58                     |
| 21314EAKE4*                     | 82                                  | 101 | 138   | 135 | 2     | 0.22              | 4.6                | 3.1   | 3.0   | 3.0                      |
| 22314EAKE4*                     | 82                                  | 91  | 138   | 129 | 2     | 0.33              | 3.0                | 2.0   | 2.0   | 4.28                     |
| 22215EAKE4*                     | 84                                  | 87  | 121   | 117 | 1.5   | 0.22              | 4.5                | 3.0   | 3.0   | 1.64                     |
| 21315EAKE4*                     | 87                                  | 101 | 148   | 134 | 2     | 0.22              | 4.6                | 3.1   | 3.0   | 3.64                     |
| 22315EAKE4*                     | 87                                  | 97  | 148   | 137 | 2     | 0.33              | 3.0                | 2.0   | 2.0   | 5.26                     |
| 22216EAKE4*                     | 90                                  | 94  | 130   | 126 | 2     | 0.22              | 4.6                | 3.1   | 3.0   | 2.01                     |
| 21316EAKE4*                     | 92                                  | 109 | 158   | 146 | 2     | 0.23              | 4.4                | 3.0   | 2.9   | 4.32                     |
| 22316EAKE4*                     | 92                                  | 103 | 158   | 145 | 2     | 0.33              | 3.0                | 2.0   | 2.0   | 6.23                     |
| 22217EAKE4*                     | 95                                  | 101 | 140   | 135 | 2     | 0.22              | 4.6                | 3.1   | 3.0   | 2.54                     |
| 21317EAKE4*                     | 99                                  | 108 | 166   | 142 | 2.5   | 0.24              | 4.3                | 2.9   | 2.8   | 5.2                      |
| 22317EAKE4*                     | 99                                  | 110 | 166   | 155 | 2.5   | 0.33              | 3.1                | 2.1   | 2.0   | 7.23                     |
| 22218EAKE4*                     | 100                                 | 108 | 150   | 142 | 2     | 0.24              | 4.3                | 2.9   | 2.8   | 3.3                      |
| 23218CKE4                       | 100                                 | 105 | 150   | 138 | 2     | 0.32              | 3.2                | 2.1   | 2.1   | 4.51                     |
| 21318EAKE4*                     | 104                                 | 115 | 176   | 152 | 2.5   | 0.24              | 4.3                | 2.9   | 2.8   | 6.1                      |
| 22318EAKE4*                     | 104                                 | 115 | 176   | 163 | 2.5   | 0.33              | 3.1                | 2.1   | 2.0   | 8.56                     |

- Remarks**
- The bearings denoted by an asterisk (\*) are NSKHPS bearings and an oil groove and holes are standard for them.
  - When making a selection of the recommended fit (Tolerance of shaft) on Page A164, 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 ( $> 0.10C_r$ ).
  - For the dimensions of adapters and withdrawal sleeves, refer to Pages B376 – B379, and B384 – B385.

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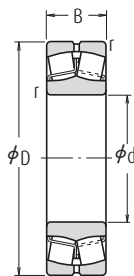
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# Spherical Roller Bearings

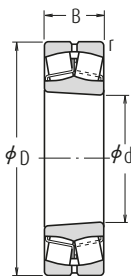


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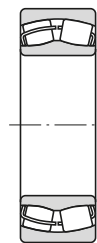
Bore Diameter 95 – 110 mm



Cylindrical Bore  
EA



Tapered Bore  
EA



Without an Oil Groove or Holes  
CD

| Boundary Dimensions<br>(mm) |     |      |           | Basic Load Ratings<br>(N) |                 | Thermal<br>Reference Speed | Speeds<br>(min <sup>-1</sup> ) |        | Bearing                    |
|-----------------------------|-----|------|-----------|---------------------------|-----------------|----------------------------|--------------------------------|--------|----------------------------|
| d                           | D   | B    | r<br>min. | C <sub>r</sub>            | C <sub>0r</sub> |                            | Limiting Speeds                |        | Cylindrical Bore           |
|                             |     |      |           |                           |                 |                            | Mechanical                     | Grease |                            |
| 95                          | 170 | 43.0 | 2.1       | 415 000                   | 450 000         | 3 800                      | 4 500                          | 3 000  | 22219EAE4 <sup>°</sup>     |
|                             | 170 | 55.6 | 2.1       | 370 000                   | 525 000         | 2 600                      | —                              | 1 700  | 23219CAME4                 |
|                             | 200 | 45.0 | 3.0       | 430 000                   | 435 000         | 3 600                      | —                              | 1 500  | 21319CAME4 <sup>°</sup>    |
|                             | 200 | 45.0 | 3.0       | 430 000                   | 435 000         | 3 600                      | —                              | 1 500  | 21319CE4                   |
|                             | 200 | 67.0 | 3.0       | 735 000                   | 780 000         | 2 600                      | 3 000                          | 2 200  | 22319EAE4 <sup>°</sup>     |
| 100                         | 150 | 37.0 | 1.5       | 212 000                   | 335 000         | 3 200                      | —                              | 2 200  | 23020CDE4                  |
|                             | 150 | 50.0 | 1.5       | 276 000                   | 470 000         | 2 800                      | —                              | 1 800  | 24020CE4                   |
|                             | 165 | 52.0 | 2.0       | 345 000                   | 530 000         | 2 800                      | —                              | 1 700  | 23120CE4                   |
|                             | 165 | 65.0 | 2.0       | 345 000                   | 535 000         | 2 400                      | —                              | 1 700  | 24120CAME4                 |
|                             | 180 | 46.0 | 2.1       | 455 000                   | 490 000         | 3 600                      | 4 300                          | 2 800  | 22220EAE4 <sup>°</sup>     |
|                             | 180 | 60.3 | 2.1       | 525 000                   | 605 000         | 2 800                      | 3 800                          | 1 600  | 23220CAME4 <sup>°</sup>    |
|                             | 180 | 60.3 | 2.1       | 525 000                   | 605 000         | 2 800                      | —                              | 1 600  | 23220CE4                   |
|                             | 215 | 47.0 | 3.0       | 495 000                   | 485 000         | 3 400                      | 4 500                          | 1 400  | 21320CAME4 <sup>°</sup>    |
|                             | 215 | 47.0 | 3.0       | 495 000                   | 485 000         | 3 400                      | —                              | 1 400  | 21320CE4                   |
|                             | 215 | 73.0 | 3.0       | 750 000                   | 785 000         | 2 600                      | 3 400                          | 1 700  | 22320CAME4(2) <sup>°</sup> |
| 110                         | 170 | 45.0 | 2.0       | 293 000                   | 465 000         | 3 200                      | —                              | 2 000  | 23022CDE4                  |
|                             | 170 | 60.0 | 2.0       | 380 000                   | 645 000         | 2 800                      | —                              | 1 600  | 24022CE4                   |
|                             | 180 | 56.0 | 2.0       | 480 000                   | 630 000         | 3 200                      | 4 000                          | 1 600  | 23122CAME4 <sup>°</sup>    |
|                             | 180 | 56.0 | 2.0       | 480 000                   | 630 000         | 3 200                      | —                              | 1 600  | 23122CE4                   |
|                             | 180 | 69.0 | 2.0       | 575 000                   | 750 000         | 2 200                      | 3 400                          | 1 600  | 24122CAME4 <sup>°</sup>    |
|                             | 180 | 69.0 | 2.0       | 575 000                   | 750 000         | 2 200                      | —                              | 1 600  | 24122CE4                   |
|                             | 200 | 53.0 | 2.1       | 605 000                   | 645 000         | 3 400                      | 3 400                          | 2 600  | 22222EAE4 <sup>°</sup>     |
|                             | 200 | 69.8 | 2.1       | 645 000                   | 760 000         | 2 600                      | 3 400                          | 1 500  | 23222CAME4 <sup>°</sup>    |
|                             | 200 | 69.8 | 2.1       | 645 000                   | 760 000         | 2 200                      | —                              | 1 500  | 23222CE4                   |
|                             | 240 | 50.0 | 3.0       | 450 000                   | 545 000         | 3 000                      | —                              | 1 300  | 21322CAE4                  |
|                             | 240 | 50.0 | 3.0       | 565 000                   | 545 000         | 3 000                      | 4 300                          | 1 300  | 21322CAME4 <sup>°</sup>    |
|                             | 240 | 80.0 | 3.0       | 1 030 000                 | 1 120 000       | 2 200                      | —                              | 1 500  | 22322EAE4 <sup>°</sup>     |
|                             | 240 | 80.0 | 3.0       | 925 000                   | 980 000         | 2 200                      | 3 000                          | 1 500  | 22322CAME4(2) <sup>°</sup> |

## Notes

- (1) The suffix K or K30 represents bearings with tapered bores (taper 1 : 12 or 1 : 30).
- (2) EA is also available. Load rating of EA is around 10% higher than CAM's, please consult NSK.

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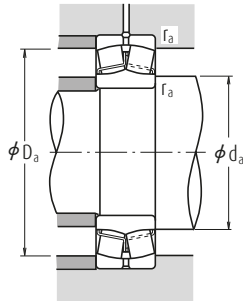
## Dynamic Equivalent Load $P = X F_r + Y_0 F_a$

| $F_a/F_r \leq e$ |       | $F_a/F_r > e$ |       |
|------------------|-------|---------------|-------|
| 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<br><br>Tapered Bore (1) | Abutment and Fillet Dimensions (mm) |      |      |      |      | Constant<br><br>e | Axial Load Factors |       |       | Mass (kg)<br><br>approx. |
|---------------------------------|-------------------------------------|------|------|------|------|-------------------|--------------------|-------|-------|--------------------------|
|                                 | min.                                | max. | max. | min. | max. |                   | $Y_2$              | $Y_3$ | $Y_0$ |                          |
| 22219EAKE4*                     | 107                                 | 115  | 158  | 152  | 2    | 0.24              | 4.3                | 2.9   | 2.8   | 4.04                     |
| 23219CAME4                      | 107                                 | —    | 158  | 146  | 2    | 0.32              | 3.1                | 2.1   | 2.0   | 5.33                     |
| 21319CAME4*                     | 109                                 | 127  | 186  | 172  | 2.5  | 0.22              | 4.6                | 3.1   | 3.0   | 6.92                     |
| 21319CKE4                       | 109                                 | 127  | 186  | 172  | 2.5  | 0.22              | 4.6                | 3.1   | 3.0   | 6.92                     |
| 22319EAKE4*                     | 109                                 | 121  | 186  | 172  | 2.5  | 0.33              | 3.1                | 2.1   | 2.0   | 9.91                     |
| 23020CDKE4                      | 109                                 | 112  | 141  | 136  | 1.5  | 0.22              | 4.6                | 3.1   | 3.0   | 2.31                     |
| 24020CK30E4                     | 109                                 | 110  | 141  | 132  | 1.5  | 0.30              | 3.4                | 2.3   | 2.2   | 3.08                     |
| 23120CKE4                       | 110                                 | 113  | 155  | 144  | 2    | 0.30              | 3.4                | 2.3   | 2.2   | 4.38                     |
| 24120CAMK30E4                   | 110                                 | —    | 155  | 143  | 2    | 0.35              | 2.9                | 1.9   | 1.9   | 5.42                     |
| 22220EAKE4*                     | 112                                 | 119  | 168  | 160  | 2    | 0.24              | 4.3                | 2.9   | 2.8   | 4.84                     |
| 23220CAMKE4*                    | 112                                 | 118  | 168  | 155  | 2    | 0.32              | 3.2                | 2.1   | 2.1   | 6.6                      |
| 23220CKE4                       | 112                                 | 118  | 168  | 155  | 2    | 0.32              | 3.2                | 2.1   | 2.1   | 6.6                      |
| 21320CAMKE4*                    | 114                                 | 133  | 201  | 184  | 2.5  | 0.21              | 4.7                | 3.2   | 3.1   | 8.46                     |
| 21320CKE4                       | 114                                 | 133  | 201  | 184  | 2.5  | 0.21              | 4.7                | 3.2   | 3.1   | 8.46                     |
| 22320CAMKE4(2)*                 | 114                                 | 130  | 201  | 184  | 2.5  | 0.33              | 3.0                | 2.0   | 2.0   | 12.7                     |
| 23022CDKE4                      | 120                                 | 124  | 160  | 153  | 2    | 0.24              | 4.2                | 2.8   | 2.8   | 3.76                     |
| 24022CK30E4                     | 120                                 | 121  | 160  | 148  | 2    | 0.32              | 3.1                | 2.1   | 2.1   | 4.96                     |
| 23122CAMKE4*                    | 120                                 | 127  | 170  | 158  | 2    | 0.28              | 3.5                | 2.4   | 2.3   | 5.7                      |
| 23122CKE4                       | 120                                 | 127  | 170  | 158  | 2    | 0.29              | 3.6                | 2.4   | 2.3   | 5.8                      |
| 24122CAMK30E4*                  | 120                                 | 123  | 170  | 154  | 2    | 0.36              | 2.8                | 1.9   | 1.8   | 6.84                     |
| 24122CK30E4                     | 120                                 | 123  | 170  | 154  | 2    | 0.37              | 2.9                | 1.9   | 1.8   | 6.85                     |
| 22222EAKE4*                     | 122                                 | 129  | 188  | 178  | 2    | 0.25              | 4.0                | 2.7   | 2.6   | 6.99                     |
| 23222CAMKE4*                    | 122                                 | 130  | 188  | 170  | 2    | 0.34              | 3.0                | 2.0   | 1.9   | 9.54                     |
| 23222CKE4                       | 122                                 | 130  | 188  | 170  | 2    | 0.35              | 3.1                | 2.1   | 1.10  | 9.55                     |
| 21322CAKE4                      | 124                                 | —    | 226  | 206  | 2.5  | 0.22              | 4.6                | 3.1   | 3.0   | 11.2                     |
| 21322CAMKE4*                    | 124                                 | —    | 226  | 206  | 2.5  | 0.22              | 4.6                | 3.1   | 3.0   | 11.2                     |
| 22322EAKE4*                     | 124                                 | 145  | 226  | 206  | 2.5  | 0.33              | 3.1                | 2.1   | 2.0   | 17.6                     |
| 22322CAMKE4 (2)*                | 124                                 | 145  | 226  | 206  | 2.5  | 0.33              | 3.1                | 2.1   | 2.0   | 17.6                     |

- Remarks**
- The bearings denoted by an asterisk (\*) are NSKHPs bearings and an oil groove and holes are standard for them.
  - When making a selection of the recommended fit (Tolerance of Shaft) on Page A164, 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 ( $> 0.10C_r$ ).
  - For the dimensions of adapters and withdrawal sleeves, refer to Pages **B379** and **B385**.

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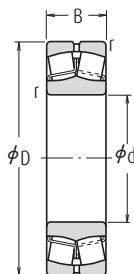
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# Spherical Roller Bearings

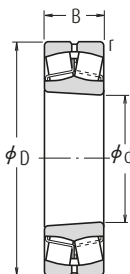


ТехноВита

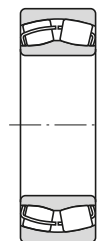
Bore Diameter 120 – 130 mm



Cylindrical Bore  
EA



Tapered Bore  
EA



Without an Oil Groove or Holes  
CD

| Boundary Dimensions<br>(mm) |     |      |           | Basic Load Ratings<br>(N) |                 | Thermal<br>Reference Speed | Speeds<br>(min <sup>-1</sup> ) |        | Bearing         |
|-----------------------------|-----|------|-----------|---------------------------|-----------------|----------------------------|--------------------------------|--------|-----------------|
| d                           | D   | B    | r<br>min. | C <sub>r</sub>            | C <sub>0r</sub> |                            | Limiting Speeds                |        |                 |
|                             |     |      |           |                           |                 |                            | Mechanical                     | Grease |                 |
| 120                         | 180 | 46.0 | 2.0       | 395 000                   | 525 000         | 3 200                      | 4 500                          | 1 800  | 23024CAME4 *    |
|                             | 180 | 46.0 | 2.0       | 395 000                   | 525 000         | 3 200                      | —                              | 1 800  | 23024CDE4       |
|                             | 180 | 60.0 | 2.0       | 480 000                   | 680 000         | 2 600                      | 3 600                          | 1 500  | 24024CAME4 *    |
|                             | 180 | 60.0 | 2.0       | 480 000                   | 680 000         | 2 600                      | —                              | 1 500  | 24024CE4        |
|                             | 200 | 62.0 | 2.0       | 580 000                   | 720 000         | 2 800                      | 3 600                          | 1 400  | 23124CAME4 *    |
|                             | 200 | 62.0 | 2.0       | 580 000                   | 720 000         | 2 800                      | —                              | 1 400  | 23124CE4        |
|                             | 200 | 80.0 | 2.0       | 695 000                   | 905 000         | 2 000                      | 3 000                          | 1 400  | 24124CAME4 *    |
|                             | 200 | 80.0 | 2.0       | 695 000                   | 905 000         | 2 000                      | —                              | 1 400  | 24124CE4        |
|                             | 215 | 58.0 | 2.1       | 685 000                   | 765 000         | 3 200                      | 3 000                          | 2 400  | 22224EAE4 *     |
|                             | 215 | 76.0 | 2.1       | 790 000                   | 970 000         | 2 200                      | 3 000                          | 1 300  | 23224CAME4      |
|                             | 215 | 76.0 | 2.1       | 790 000                   | 970 000         | 2 000                      | —                              | 1 300  | 23224CE4        |
|                             | 260 | 86.0 | 3.0       | 1 190 000                 | 1 320 000       | —                          | —                              | —      | 22324EAE4*      |
|                             | 260 | 86.0 | 3.0       | 1 060 000                 | 1 120 000       | 1 900                      | 2 800                          | 1 400  | 22324CAME4(2) * |
|                             | 130 | 200  | 52.0      | 2.0                       | 500 000         | 655 000                    | 3 000                          | 3 800  | 1 700           |
| 200                         |     | 52.0 | 2.0       | 500 000                   | 655 000         | 3 000                      | —                              | 1 700  | 23026CDE4       |
| 200                         |     | 69.0 | 2.0       | 620 000                   | 865 000         | 2 200                      | 3 200                          | 1 400  | 24026CAME4      |
| 200                         |     | 69.0 | 2.0       | 620 000                   | 865 000         | 2 200                      | —                              | 1 400  | 24026CE4        |
| 210                         |     | 64.0 | 2.0       | 630 000                   | 825 000         | 2 200                      | 3 400                          | 1 300  | 23126CAME4 *    |
| 210                         |     | 64.0 | 2.0       | 630 000                   | 825 000         | 2 600                      | —                              | 1 300  | 23126CE4        |
| 210                         |     | 80.0 | 2.0       | 735 000                   | 1 010 000       | 1 800                      | 2 800                          | 1 300  | 24126CAME4 *    |
| 210                         |     | 80.0 | 2.0       | 735 000                   | 1 010 000       | 1 800                      | —                              | 1 300  | 24126CE4        |
| 230                         |     | 64.0 | 3.0       | 820 000                   | 940 000         | 2 800                      | 2 600                          | 2 200  | 22226EAE4 *     |
| 230                         |     | 80.0 | 3.0       | 875 000                   | 1 080 000       | 2 000                      | 2 800                          | 1 200  | 23226CAME4 *    |
| 230                         |     | 80.0 | 3.0       | 875 000                   | 1 080 000       | 2 000                      | —                              | 1 200  | 23226CE4        |
| 280                         |     | 93.0 | 4.0       | 1 240 000                 | 1 350 000       | 1 800                      | 2 600                          | 1 300  | 22326CAME4 *    |
| 280                         |     | 93.0 | 4.0       | 1 240 000                 | 1 350 000       | 1 800                      | —                              | 1 300  | 22326CE4        |

## Notes

- (1) The suffix K or K30 represents bearings with tapered bores (taper 1 : 12 or 1 : 30).
- (2) EA is also available. Load rating of EA is around 10% higher than CAM's, please consult NSK.

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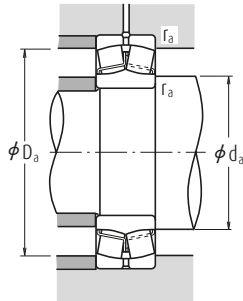
**Dynamic Equivalent Load**  $P = X F_r + Y_0 F_a$ 

| $F_a/F_r \leq e$ |       | $F_a/F_r > e$ |       |
|------------------|-------|---------------|-------|
| 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.



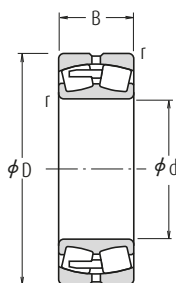
| Numbers<br><br>Tapered Bore (1) | Abutment and Fillet Dimensions (mm) |     |       |     |       | Constant<br><br>e | Axial Load Factors |       |       | Mass (kg)<br><br>approx. |
|---------------------------------|-------------------------------------|-----|-------|-----|-------|-------------------|--------------------|-------|-------|--------------------------|
|                                 | $d_a$                               |     | $D_a$ |     | $r_a$ |                   | $Y_2$              | $Y_3$ | $Y_0$ |                          |
| 23024CAMKE4 *                   | 130                                 | 134 | 170   | 163 | 2     | 0.22              | 4.5                | 3.0   | 2.9   | 4.11                     |
| 23024CDKE4                      | 130                                 | 134 | 170   | 163 | 2     | 0.22              | 4.5                | 3.0   | 2.9   | 4.11                     |
| 24024CAMK30E4 *                 | 130                                 | 131 | 170   | 158 | 2     | 0.32              | 3.2                | 2.1   | 2.1   | 5.33                     |
| 24024CK30E4                     | 130                                 | 131 | 170   | 158 | 2     | 0.32              | 3.2                | 2.1   | 2.1   | 5.33                     |
| 23124CAMKE4 *                   | 130                                 | 138 | 190   | 175 | 2     | 0.29              | 3.5                | 2.4   | 2.3   | 7.85                     |
| 23124CKE4                       | 130                                 | 138 | 190   | 175 | 2     | 0.29              | 3.5                | 2.4   | 2.3   | 7.85                     |
| 24124CAMK30E4 *                 | 130                                 | 136 | 190   | 171 | 2     | 0.37              | 2.7                | 1.8   | 1.8   | 10                       |
| 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                      |
| 23224CAMKE4 *                   | 132                                 | 140 | 203   | 182 | 2     | 0.34              | 2.9                | 2.0   | 1.9   | 12.1                     |
| 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                     |
| 22324CAMKE4(2) *                | 134                                 | 157 | 246   | 222 | 2.5   | 0.32              | 3.1                | 2.1   | 2.0   | 22.2                     |
| 23026CAMKE4 *                   | 140                                 | 147 | 190   | 180 | 2     | 0.23              | 4.3                | 2.9   | 2.8   | 5.98                     |
| 23026CDKE4                      | 140                                 | 147 | 190   | 180 | 2     | 0.23              | 4.3                | 2.9   | 2.8   | 5.98                     |
| 24026CAMK30E4 *                 | 140                                 | 143 | 190   | 175 | 2     | 0.31              | 3.2                | 2.2   | 2.1   | 7.84                     |
| 24026CK30E4                     | 140                                 | 143 | 190   | 175 | 2     | 0.31              | 3.2                | 2.2   | 2.1   | 7.84                     |
| 23126CAMKE4 *                   | 140                                 | 149 | 200   | 184 | 2     | 0.28              | 3.6                | 2.4   | 2.4   | 8.69                     |
| 23126CKE4                       | 140                                 | 149 | 200   | 184 | 2     | 0.28              | 3.6                | 2.4   | 2.4   | 8.69                     |
| 24126CAMK30E4 *                 | 140                                 | 146 | 200   | 180 | 2     | 0.35              | 2.9                | 1.9   | 1.9   | 10.7                     |
| 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                       |
| 23226CAMKE4 *                   | 144                                 | 150 | 216   | 196 | 2.5   | 0.34              | 2.9                | 2.0   | 1.9   | 14.3                     |
| 23226CKE4                       | 144                                 | 150 | 216   | 196 | 2.5   | 0.34              | 2.9                | 2.0   | 1.9   | 14.3                     |
| 22326CAMKE4 *                   | 148                                 | 166 | 262   | 236 | 3     | 0.34              | 2.9                | 2.0   | 1.9   | 28.1                     |
| 22326CKE4                       | 148                                 | 166 | 262   | 236 | 3     | 0.34              | 2.9                | 2.0   | 1.9   | 28.1                     |

- Remarks**
- The bearings denoted by an asterisk (\*) are NSKHPs bearings and an oil groove and holes are standard for them.
  - When making a selection of the recommended fit (Tolerance of Shaft) on Page A164, 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 ( $> 0.10C_r$ ).
  - For the dimensions of adapters and withdrawal sleeves, refer to Pages **B380** and **B385**.

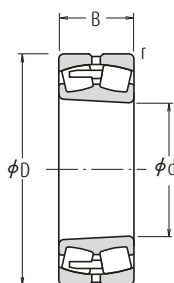
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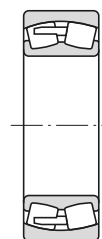
## Bore Diameter 140 – 150 mm



Cylindrical Bore  
CA



Tapered Bore  
CA



Without an Oil Groove or Holes  
CA

| Boundary Dimensions<br>(mm) |     |     |           | Basic Load Ratings<br>(N) |                 | Thermal<br>Reference Speed | Speeds<br>(min <sup>-1</sup> ) |        | Bearing          |
|-----------------------------|-----|-----|-----------|---------------------------|-----------------|----------------------------|--------------------------------|--------|------------------|
| d                           | D   | B   | r<br>min. | C <sub>r</sub>            | C <sub>0r</sub> |                            | Limiting Speeds                |        | Cylindrical Bore |
|                             |     |     |           |                           |                 |                            | Mechanical                     | Grease |                  |
| 140                         | 210 | 53  | 2         | 525 000                   | 715 000         | 2 800                      | 3 800                          | 1 600  | 23028CAME4 *     |
|                             | 210 | 53  | 2         | 420 000                   | 715 000         | 2 800                      | —                              | 1 600  | 23028CDE4        |
|                             | 210 | 69  | 2         | 635 000                   | 905 000         | 2 200                      | 3 000                          | 1 300  | 24028CAME4 *     |
|                             | 210 | 69  | 2         | 525 000                   | 945 000         | 2 200                      | —                              | 1 300  | 24028CE4         |
|                             | 225 | 68  | 2.1       | 725 000                   | 945 000         | 2 400                      | 3 200                          | 1 200  | 23128CAME4 *     |
|                             | 225 | 68  | 2.1       | 580 000                   | 945 000         | 2 400                      | —                              | 1 200  | 23128CE4         |
|                             | 225 | 85  | 2.1       | 835 000                   | 1 160 000       | 1 600                      | 2 600                          | 1 200  | 24128CAME4 *     |
|                             | 225 | 85  | 2.1       | 670 000                   | 1 160 000       | 1 600                      | —                              | 1 200  | 24128CE4         |
|                             | 250 | 68  | 3         | 835 000                   | 945 000         | 2 600                      | 3 200                          | 1 400  | 22228CAME4 *     |
|                             | 250 | 68  | 3         | 645 000                   | 930 000         | 2 600                      | —                              | 1 400  | 22228CDE4        |
|                             | 250 | 88  | 3         | 1 040 000                 | 1 300 000       | 1 800                      | 2 600                          | 1 100  | 23228CAME4 *     |
|                             | 250 | 88  | 3         | 835 000                   | 1 300 000       | 1 800                      | —                              | 1 100  | 23228CE4         |
|                             | 300 | 102 | 4         | 1 450 000                 | 1 590 000       | 1 700                      | 2 400                          | 1 200  | 22328CAME4 *     |
|                             | 300 | 102 | 4         | 1 160 000                 | 1 590 000       | 1 700                      | —                              | 1 200  | 22328CE4         |
| 150                         | 225 | 56  | 2.1       | 590 000                   | 815 000         | 2 600                      | 3 600                          | 1 400  | 23030CAME4 *     |
|                             | 225 | 56  | 2.1       | 470 000                   | 815 000         | 2 600                      | —                              | 1 400  | 23030CDE4        |
|                             | 225 | 75  | 2.1       | 740 000                   | 1 090 000       | 1 900                      | 3 000                          | 1 200  | 24030CAME4 *     |
|                             | 225 | 75  | 2.1       | 590 000                   | 1 090 000       | 1 900                      | —                              | 1 200  | 24030CE4         |
|                             | 250 | 80  | 2.1       | 905 000                   | 1 180 000       | 2 200                      | 2 800                          | 1 100  | 23130CAME4 *     |
|                             | 250 | 80  | 2.1       | 725 000                   | 1 180 000       | 2 200                      | —                              | 1 100  | 23130CE4         |
|                             | 250 | 100 | 2.1       | 1 070 000                 | 1 450 000       | 1 400                      | 2 400                          | 1 100  | 24130CAME4 *     |
|                             | 250 | 100 | 2.1       | 890 000                   | 1 530 000       | 1 400                      | —                              | 1 100  | 24130CE4         |
|                             | 270 | 73  | 3         | 955 000                   | 1 120 000       | 2 400                      | 3 000                          | 1 300  | 22230CAME4 *     |
|                             | 270 | 73  | 3         | 765 000                   | 1 120 000       | 2 400                      | —                              | 1 300  | 22230CDE4        |
|                             | 270 | 96  | 3         | 1 220 000                 | 1 560 000       | 1 700                      | 2 400                          | 1 100  | 23230CAME4 *     |
|                             | 270 | 96  | 3         | 975 000                   | 1 560 000       | 1 700                      | —                              | 1 100  | 23230CE4         |
|                             | 320 | 108 | 4         | 1 530 000                 | 1 690 000       | 1 600                      | 2 200                          | 1 100  | 22330CAME4 *     |

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

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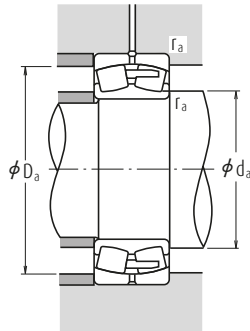
## Dynamic Equivalent Load $P = X F_r + Y F_a$

| $F_a/F_r \leq e$ |       | $F_a/F_r > e$ |       |
|------------------|-------|---------------|-------|
| 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.



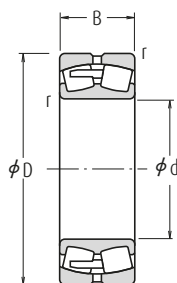
| Numbers<br><br>Tapered Bore (!) | Abutment and Fillet Dimensions (mm) |                     |      |                     |                     | Constant<br><br>e | Axial Load Factors |                |                | Mass (kg)<br><br>approx. |
|---------------------------------|-------------------------------------|---------------------|------|---------------------|---------------------|-------------------|--------------------|----------------|----------------|--------------------------|
|                                 | min.                                | d <sub>a</sub> max. | max. | D <sub>a</sub> min. | r <sub>a</sub> max. |                   | Y <sub>2</sub>     | Y <sub>3</sub> | Y <sub>0</sub> |                          |
| 23028CAMKE4 *                   | 150                                 | 157                 | 200  | 190                 | 2                   | 0.22              | 4.5                | 3.0            | 2.9            | 6.49                     |
| 23028CDKE4                      | 150                                 | 157                 | 200  | 190                 | 2                   | 0.22              | 4.5                | 3.0            | 2.9            | 6.49                     |
| 24028CAMK30E4 *                 | 150                                 | 154                 | 200  | 186                 | 2                   | 0.29              | 3.4                | 2.3            | 2.2            | 8.37                     |
| 24028CK30E4                     | 150                                 | 154                 | 200  | 186                 | 2                   | 0.29              | 3.4                | 2.3            | 2.2            | 8.37                     |
| 23128CAMKE4 *                   | 152                                 | 158                 | 213  | 198                 | 2                   | 0.28              | 3.6                | 2.4            | 2.3            | 10.5                     |
| 23128CKE4                       | 152                                 | 158                 | 213  | 198                 | 2                   | 0.28              | 3.6                | 2.4            | 2.3            | 10.5                     |
| 24128CAMK30E4 *                 | 152                                 | 156                 | 213  | 193                 | 2                   | 0.35              | 2.9                | 1.9            | 1.9            | 13                       |
| 24128CK30E4                     | 152                                 | 156                 | 213  | 193                 | 2                   | 0.35              | 2.9                | 1.9            | 1.9            | 13                       |
| 22228CAMKE4 *                   | 154                                 | 167                 | 236  | 219                 | 2.5                 | 0.25              | 4.0                | 2.7            | 2.6            | 14.5                     |
| 22228CDKE4                      | 154                                 | 167                 | 236  | 219                 | 2.5                 | 0.25              | 4.0                | 2.7            | 2.6            | 14.5                     |
| 23228CAMKE4 *                   | 154                                 | 163                 | 236  | 213                 | 2.5                 | 0.35              | 2.9                | 1.9            | 1.9            | 18.8                     |
| 23228CKE4                       | 154                                 | 163                 | 236  | 213                 | 2.5                 | 0.35              | 2.9                | 1.9            | 1.9            | 18.8                     |
| 22328CAMKE4 *                   | 158                                 | 177                 | 282  | 253                 | 3                   | 0.35              | 2.9                | 1.9            | 1.9            | 35.4                     |
| 22328CKE4                       | 158                                 | 177                 | 282  | 253                 | 3                   | 0.35              | 2.9                | 1.9            | 1.9            | 35.4                     |
| 23030CAMKE4 *                   | 162                                 | 168                 | 213  | 203                 | 2                   | 0.22              | 4.6                | 3.1            | 3.0            | 7.9                      |
| 23030CDKE4                      | 162                                 | 168                 | 213  | 203                 | 2                   | 0.22              | 4.6                | 3.1            | 3.0            | 7.9                      |
| 24030CAMK30E4 *                 | 162                                 | 165                 | 213  | 198                 | 2                   | 0.30              | 3.4                | 2.3            | 2.2            | 10.5                     |
| 24030CK30E4                     | 162                                 | 165                 | 213  | 198                 | 2                   | 0.30              | 3.4                | 2.3            | 2.2            | 10.5                     |
| 23130CAMKE4 *                   | 162                                 | 174                 | 238  | 218                 | 2                   | 0.30              | 3.4                | 2.3            | 2.2            | 15.8                     |
| 23130CKE4                       | 162                                 | 174                 | 238  | 218                 | 2                   | 0.30              | 3.4                | 2.3            | 2.2            | 15.8                     |
| 24130CAMK30E4 *                 | 162                                 | 169                 | 238  | 212                 | 2                   | 0.38              | 2.6                | 1.8            | 1.7            | 19.8                     |
| 24130CK30E4                     | 162                                 | 169                 | 238  | 212                 | 2                   | 0.38              | 2.6                | 1.8            | 1.7            | 19.8                     |
| 22230CAMKE4 *                   | 164                                 | 179                 | 256  | 236                 | 2.5                 | 0.26              | 3.9                | 2.6            | 2.5            | 18.4                     |
| 22230CDKE4                      | 164                                 | 179                 | 256  | 236                 | 2.5                 | 0.26              | 3.9                | 2.6            | 2.5            | 18.4                     |
| 23230CAMKE4 *                   | 164                                 | 176                 | 256  | 230                 | 2.5                 | 0.35              | 2.9                | 1.9            | 1.9            | 24.2                     |
| 23230CKE4                       | 164                                 | 176                 | 256  | 230                 | 2.5                 | 0.35              | 2.9                | 1.9            | 1.9            | 24.2                     |
| 22330CAMKE4 *                   | 164                                 | —                   | 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 A164, 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 **B380** and **B386**.

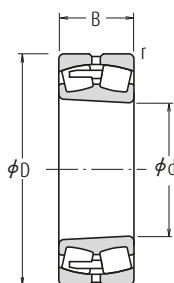
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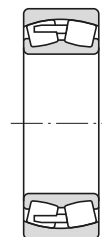
## Bore Diameter 160 – 170 mm



Cylindrical Bore  
CA



Tapered Bore  
CA



Without an Oil Groove and Holes  
CA

| Boundary Dimensions<br>(mm) |     |     |           | Basic Load Ratings<br>(N) |                 | Thermal<br>Reference Speed | Speeds<br>(min <sup>-1</sup> ) |              | Bearing          |
|-----------------------------|-----|-----|-----------|---------------------------|-----------------|----------------------------|--------------------------------|--------------|------------------|
| d                           | D   | B   | r<br>min. | C <sub>r</sub>            | C <sub>0r</sub> |                            | Limiting Speeds                |              | Cylindrical Bore |
|                             |     |     |           |                           |                 |                            | Mechanical                     | Grease       |                  |
| 160                         | 220 | 45  | 2         | 450 000                   | 675 000         | 3 000                      | 3 200                          | 1 400        | 23932CAME4 *     |
|                             | 220 | 45  | 2         | 360 000                   | 675 000         | 3 000                      | —                              | 1 400        | 23932CAE4        |
|                             | 240 | 60  | 2.1       | 675 000                   | 955 000         | 2 400                      | 3 200                          | 1 300        | 23032CAME4 *     |
|                             | 240 | 60  | 2.1       | 540 000                   | 955 000         | 2 400                      | —                              | 1 300        | 23032CDE4        |
|                             | 240 | 80  | 2.1       | 845 000                   | 1 260 000       | 1 800                      | 2 800                          | 1 100        | 24032CAME4 *     |
|                             | 240 | 80  | 2.1       | 680 000                   | 1 260 000       | 1 800                      | —                              | 1 100        | 24032CE4         |
|                             | 270 | 86  | 2.1       | 1 070 000                 | 1 400 000       | 2 000                      | 2 600                          | 1 000        | 23132CAME4 *     |
|                             | 270 | 86  | 2.1       | 855 000                   | 1 400 000       | 2 000                      | —                              | 1 000        | 23132CE4         |
|                             | 270 | 109 | 2.1       | 1 240 000                 | 1 670 000       | 1 300                      | 2 200                          | 1 000        | 24132CAME4 *     |
|                             | 270 | 109 | 2.1       | 1 040 000                 | 1 760 000       | 1 300                      | —                              | 1 000        | 24132CE4         |
|                             | 290 | 80  | 3         | 1 140 000                 | 1 320 000       | 2 200                      | 2 800                          | 1 200        | 22232CAME4 *     |
|                             | 290 | 80  | 3         | 910 000                   | 1 320 000       | 2 200                      | —                              | 1 200        | 22232CDE4        |
|                             | 290 | 104 | 3         | 1 370 000                 | 1 770 000       | 1 500                      | 2 200                          | 1 000        | 23232CAME4 *     |
|                             | 290 | 104 | 3         | 1 100 000                 | 1 770 000       | 1 500                      | —                              | 1 000        | 23232CE4         |
| 340                         | 114 | 4   | 1 700 000 | 1 900 000                 | 1 400           | 2 200                      | 1 100                          | 22332CAME4 * |                  |
| 170                         | 230 | 45  | 2         | 450 000                   | 680 000         | 3 000                      | 3 600                          | 1 400        | 23934CAME4 *     |
|                             | 260 | 67  | 2.1       | 795 000                   | 1 090 000       | 2 200                      | 3 000                          | 1 200        | 23034CAME4 *     |
|                             | 260 | 67  | 2.1       | 640 000                   | 1 090 000       | 2 200                      | —                              | 1 200        | 23034CDE4        |
|                             | 260 | 90  | 2.1       | 1 030 000                 | 1 520 000       | 1 600                      | 2 400                          | 1 000        | 24034CAME4 *     |
|                             | 260 | 90  | 2.1       | 825 000                   | 1 520 000       | 1 600                      | —                              | 1 000        | 24034CE4         |
|                             | 280 | 88  | 2.1       | 1 180 000                 | 1 570 000       | 1 800                      | 2 600                          | 1 000        | 23134CAME4 *     |
|                             | 280 | 88  | 2.1       | 940 000                   | 1 570 000       | 1 800                      | —                              | 1 000        | 23134CE4         |
|                             | 280 | 109 | 2.1       | 1 280 000                 | 1 770 000       | 1 200                      | 2 200                          | 1 000        | 24134CAME4 *     |
|                             | 280 | 109 | 2.1       | 1 080 000                 | 1 860 000       | 1 200                      | —                              | 1 000        | 24134CE4         |
|                             | 310 | 86  | 4         | 1 240 000                 | 1 500 000       | 2 000                      | 2 600                          | 1 100        | 22234CAME4 *     |
|                             | 310 | 86  | 4         | 990 000                   | 1 500 000       | 2 000                      | —                              | 1 100        | 22234CDE4        |
|                             | 310 | 110 | 4         | 1 500 000                 | 1 910 000       | 1 400                      | 2 200                          | 900          | 23234CAME4 *     |
|                             | 310 | 110 | 4         | 1 200 000                 | 1 910 000       | 1 400                      | —                              | 900          | 23234CE4         |
|                             | 360 | 120 | 4         | 1 970 000                 | 2 110 000       | 1 300                      | 2 000                          | 1 000        | 22334CAME4 *     |

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

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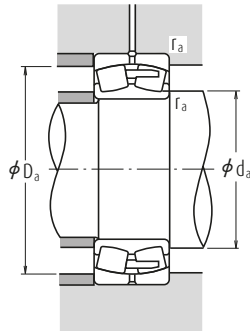
**Dynamic Equivalent Load**  $P = X F_r + Y F_a$ 

| $F_a/F_r \leq e$ |       | $F_a/F_r > e$ |       |
|------------------|-------|---------------|-------|
| 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.



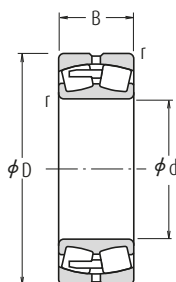
| Numbers<br><br>Tapered Bore (1) | Abutment and Fillet Dimensions (mm) |                     |                     |      |                     | Constant<br><br>e | Axial Load Factors |                |                | Mass (kg)<br><br>approx. |
|---------------------------------|-------------------------------------|---------------------|---------------------|------|---------------------|-------------------|--------------------|----------------|----------------|--------------------------|
|                                 | min.                                | d <sub>a</sub> max. | D <sub>a</sub> max. | min. | r <sub>a</sub> max. |                   | Y <sub>2</sub>     | Y <sub>3</sub> | Y <sub>0</sub> |                          |
| 23932CAMKE4 *                   | 170                                 | —                   | 210                 | 203  | 2                   | 0.18              | 5.6                | 3.8            | 3.7            | 4.97                     |
| 23932CAKE4                      | 170                                 | —                   | 210                 | 203  | 2                   | 0.18              | 5.6                | 3.8            | 3.7            | 4.97                     |
| 23032CAMKE4 *                   | 172                                 | 179                 | 228                 | 216  | 2                   | 0.22              | 4.5                | 3.0            | 2.9            | 9.66                     |
| 23032CDKE4                      | 172                                 | 179                 | 228                 | 216  | 2                   | 0.22              | 4.5                | 3.0            | 2.9            | 9.66                     |
| 24032CAMK30E4 *                 | 172                                 | 177                 | 228                 | 212  | 2                   | 0.30              | 3.4                | 2.3            | 2.2            | 12.7                     |
| 24032CK30E4                     | 172                                 | 177                 | 228                 | 212  | 2                   | 0.30              | 3.4                | 2.3            | 2.2            | 12.7                     |
| 23132CAMKE4 *                   | 172                                 | 185                 | 258                 | 234  | 2                   | 0.30              | 3.4                | 2.3            | 2.2            | 20.3                     |
| 23132CKE4                       | 172                                 | 185                 | 258                 | 234  | 2                   | 0.30              | 3.4                | 2.3            | 2.2            | 20.3                     |
| 24132CAMK30E4 *                 | 172                                 | 179                 | 258                 | 229  | 2                   | 0.39              | 2.6                | 1.7            | 1.7            | 25.4                     |
| 24132CK30E4                     | 172                                 | 179                 | 258                 | 229  | 2                   | 0.39              | 2.6                | 1.7            | 1.7            | 25.4                     |
| 22232CAMKE4 *                   | 174                                 | 190                 | 276                 | 255  | 2.5                 | 0.26              | 3.8                | 2.6            | 2.5            | 23.1                     |
| 22232CDKE4                      | 174                                 | 190                 | 276                 | 255  | 2.5                 | 0.26              | 3.8                | 2.6            | 2.5            | 23.1                     |
| 23232CAMKE4 *                   | 174                                 | 189                 | 276                 | 245  | 2.5                 | 0.34              | 2.9                | 2.0            | 1.9            | 30.5                     |
| 23232CKE4                       | 174                                 | 189                 | 276                 | 245  | 2.5                 | 0.34              | 2.9                | 2.0            | 1.9            | 30.5                     |
| 22332CAMKE4 *                   | 178                                 | —                   | 322                 | 287  | 3                   | 0.35              | 2.9                | 1.9            | 1.9            | 49.3                     |
| 23934CAMKE4 *                   | 180                                 | —                   | 220                 | 213  | 2                   | 0.17              | 5.8                | 3.9            | 3.8            | 5.38                     |
| 23034CAMKE4 *                   | 182                                 | 191                 | 248                 | 233  | 2                   | 0.23              | 4.3                | 2.9            | 2.8            | 13                       |
| 23034CDKE4                      | 182                                 | 191                 | 248                 | 233  | 2                   | 0.23              | 4.3                | 2.9            | 2.8            | 13                       |
| 24034CAMK30E4 *                 | 182                                 | 188                 | 248                 | 228  | 2                   | 0.31              | 3.2                | 2.2            | 2.1            | 17.3                     |
| 24034CK30E4                     | 182                                 | 188                 | 248                 | 228  | 2                   | 0.31              | 3.2                | 2.2            | 2.1            | 17.3                     |
| 23134CAMKE4 *                   | 182                                 | 194                 | 268                 | 245  | 2                   | 0.29              | 3.5                | 2.3            | 2.3            | 21.8                     |
| 23134CKE4                       | 182                                 | 194                 | 268                 | 245  | 2                   | 0.29              | 3.5                | 2.3            | 2.3            | 21.8                     |
| 24134CAMK30E4 *                 | 182                                 | 190                 | 268                 | 239  | 2                   | 0.37              | 2.7                | 1.8            | 1.8            | 26.6                     |
| 24134CK30E4                     | 182                                 | 190                 | 268                 | 239  | 2                   | 0.37              | 2.7                | 1.8            | 1.8            | 26.6                     |
| 22234CAMKE4 *                   | 188                                 | 206                 | 292                 | 270  | 3                   | 0.26              | 3.8                | 2.6            | 2.5            | 28.8                     |
| 22234CDKE4                      | 188                                 | 206                 | 292                 | 270  | 3                   | 0.26              | 3.8                | 2.6            | 2.5            | 28.8                     |
| 23234CAMKE4 *                   | 188                                 | 201                 | 292                 | 261  | 3                   | 0.34              | 2.9                | 2.0            | 1.9            | 36.4                     |
| 23234CKE4                       | 188                                 | 201                 | 292                 | 261  | 3                   | 0.34              | 2.9                | 2.0            | 1.9            | 36.4                     |
| 22334CAMKE4 *                   | 188                                 | —                   | 342                 | 304  | 3                   | 0.35              | 2.9                | 1.9            | 1.9            | 57.9                     |

- Remarks**
- The bearings denoted by an asterisk (\*) are NSKHPS bearings and an oil groove and holes are standard for them.
  - When making a selection of the recommended fit (Tolerance of shaft) on Page A164, in case of NSKHPS bearings, the conditions are different.  
The segmentations are: Light Loads ( $\leq 0.05C_0$ ); Normal Loads ( $0.05$  to  $0.10C_0$ ); and Heavy Loads ( $> 0.10C_0$ ).
  - For the dimensions of adapters and withdrawal sleeves, refer to Pages B380 and B386.

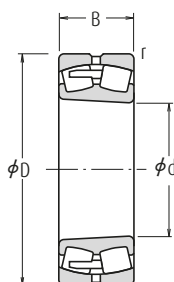
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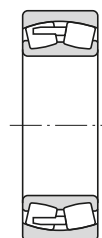
## Bore Diameter 180 – 190 mm



Cylindrical Bore  
CA



Tapered Bore  
CA



Without an Oil Groove and Holes  
CA

| Boundary Dimensions<br>(mm) |     |     |           | Basic Load Ratings<br>(N) |                 | Thermal<br>Reference Speed | Speeds<br>(min <sup>-1</sup> ) |        | Bearing          |
|-----------------------------|-----|-----|-----------|---------------------------|-----------------|----------------------------|--------------------------------|--------|------------------|
| d                           | D   | B   | r<br>min. | C <sub>r</sub>            | C <sub>0r</sub> |                            | Limiting Speeds                |        | Cylindrical Bore |
|                             |     |     |           |                           |                 |                            | Mechanical                     | Grease |                  |
| 180                         | 250 | 52  | 2         | 470 000                   | 890 000         | 2 600                      | —                              | 1 200  | 23936CAE4        |
|                             | 250 | 52  | 2         | 590 000                   | 890 000         | 2 600                      | 3 000                          | 1 200  | 23936CAME4 *     |
|                             | 280 | 74  | 2.1       | 935 000                   | 1 270 000       | 2 000                      | 2 800                          | 1 200  | 23036CAME4 *     |
|                             | 280 | 74  | 2.1       | 750 000                   | 1 270 000       | 2 000                      | —                              | 1 200  | 23036CDE4        |
|                             | 280 | 100 | 2.1       | 1 210 000                 | 1 750 000       | 1 500                      | 2 200                          | 950    | 24036CAME4 *     |
|                             | 280 | 100 | 2.1       | 965 000                   | 1 750 000       | 1 500                      | —                              | 950    | 24036CE4         |
|                             | 300 | 96  | 3         | 1 320 000                 | 1 760 000       | 1 700                      | 2 200                          | 900    | 23136CAME4 *     |
|                             | 300 | 96  | 3         | 1 050 000                 | 1 760 000       | 1 700                      | —                              | 900    | 23136CE4         |
|                             | 300 | 118 | 3         | 1 490 000                 | 2 040 000       | 1 100                      | 2 000                          | 900    | 24136CAME4 *     |
|                             | 300 | 118 | 3         | 1 190 000                 | 2 040 000       | 1 100                      | —                              | 900    | 24136CE4         |
|                             | 320 | 86  | 4         | 1 280 000                 | 1 540 000       | 2 000                      | 2 600                          | 1 100  | 22236CAME4 *     |
|                             | 320 | 86  | 4         | 1 020 000                 | 1 540 000       | 2 000                      | —                              | 1 100  | 22236CDE4        |
|                             | 320 | 112 | 4         | 1 620 000                 | 2 110 000       | 1 300                      | 2 000                          | 850    | 23236CAME4 *     |
|                             | 320 | 112 | 4         | 1 300 000                 | 2 110 000       | 1 300                      | —                              | 850    | 23236CE4         |
|                             | 380 | 126 | 4         | 2 170 000                 | 2 340 000       | 1 200                      | 2 000                          | 950    | 22336CAME4 *     |
| 190                         | 260 | 52  | 2         | 575 000                   | 875 000         | 2 600                      | 3 000                          | 1 200  | 23938CAME4 *     |
|                             | 290 | 75  | 2.1       | 970 000                   | 1 350 000       | 2 000                      | 2 600                          | 1 100  | 23038CAME4 *     |
|                             | 290 | 100 | 2.1       | 1 220 000                 | 1 840 000       | 1 400                      | 2 200                          | 900    | 24038CAME4 *     |
|                             | 290 | 100 | 2.1       | 975 000                   | 1 840 000       | 1 400                      | —                              | 900    | 24038CE4         |
|                             | 320 | 104 | 3         | 1 480 000                 | 2 020 000       | 1 600                      | 2 200                          | 850    | 23138CAME4 *     |
|                             | 320 | 104 | 3         | 1 190 000                 | 2 020 000       | 1 600                      | —                              | 850    | 23138CE4         |
|                             | 320 | 128 | 3         | 1 710 000                 | 2 330 000       | 1 000                      | 1 900                          | 850    | 24138CAME4 *     |
|                             | 320 | 128 | 3         | 1 370 000                 | 2 330 000       | 1 000                      | —                              | 850    | 24138CE4         |
|                             | 340 | 92  | 4         | 1 420 000                 | 1 730 000       | 1 800                      | 2 400                          | 1 000  | 22238CAME4 *     |
|                             | 340 | 120 | 4         | 1 800 000                 | 2 350 000       | 1 200                      | 1 900                          | 800    | 23238CAME4 *     |
|                             | 340 | 120 | 4         | 1 440 000                 | 2 350 000       | 1 200                      | —                              | 800    | 23238CE4         |
|                             | 400 | 132 | 5         | 2 370 000                 | 2 590 000       | 1 200                      | 1 900                          | 900    | 22338CAME4 *     |

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

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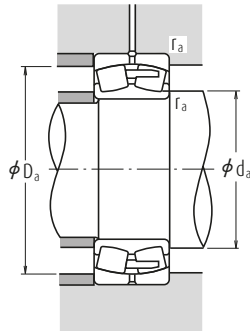
**Dynamic Equivalent Load**  $P = X F_r + Y F_a$ 

| $F_a/F_r \leq e$ |       | $F_a/F_r > e$ |       |
|------------------|-------|---------------|-------|
| 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.



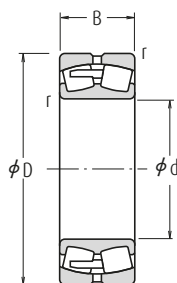
| Numbers<br><br>Tapered Bore (1) | Abutment and Fillet Dimensions (mm) |                     |                     |      |                     | Constant<br><br>e | Axial Load Factors |                |                | Mass (kg)<br><br>approx. |
|---------------------------------|-------------------------------------|---------------------|---------------------|------|---------------------|-------------------|--------------------|----------------|----------------|--------------------------|
|                                 | min.                                | d <sub>a</sub> max. | D <sub>a</sub> max. | min. | r <sub>a</sub> max. |                   | Y <sub>2</sub>     | Y <sub>3</sub> | Y <sub>0</sub> |                          |
| 23936CAKE4                      | 190                                 | —                   | 240                 | 230  | 2                   | 0.18              | 5.5                | 3.7            | 3.6            | 7.64                     |
| 23936CAMKE4*                    | 190                                 | —                   | 240                 | 230  | 2                   | 0.18              | 5.5                | 3.7            | 3.6            | 7.64                     |
| 23036CAMKE4*                    | 192                                 | 202                 | 268                 | 249  | 2                   | 0.24              | 4.2                | 2.8            | 2.8            | 17.1                     |
| 23036CDKE4                      | 192                                 | 202                 | 268                 | 249  | 2                   | 0.24              | 4.2                | 2.8            | 2.8            | 17.1                     |
| 24036CAMK30E4*                  | 192                                 | 200                 | 268                 | 245  | 2                   | 0.32              | 3.1                | 2.1            | 2.0            | 22.7                     |
| 24036CK30E4                     | 192                                 | 200                 | 268                 | 245  | 2                   | 0.32              | 3.1                | 2.1            | 2.0            | 22.7                     |
| 23136CAMKE4*                    | 194                                 | 206                 | 286                 | 260  | 2.5                 | 0.30              | 3.4                | 2.3            | 2.2            | 27.5                     |
| 23136CKE4                       | 194                                 | 206                 | 286                 | 260  | 2.5                 | 0.30              | 3.4                | 2.3            | 2.2            | 27.5                     |
| 24136CAMK30E4*                  | 194                                 | 202                 | 286                 | 255  | 2.5                 | 0.37              | 2.7                | 1.8            | 1.8            | 33.1                     |
| 24136CK30E4                     | 194                                 | 202                 | 286                 | 255  | 2.5                 | 0.37              | 2.7                | 1.8            | 1.8            | 33.1                     |
| 22236CAMKE4*                    | 198                                 | 212                 | 302                 | 278  | 3                   | 0.26              | 3.9                | 2.6            | 2.6            | 30.2                     |
| 22236CDKE4                      | 198                                 | 212                 | 302                 | 278  | 3                   | 0.26              | 3.9                | 2.6            | 2.6            | 30.2                     |
| 23236CAMKE4*                    | 198                                 | 211                 | 302                 | 274  | 3                   | 0.33              | 3.0                | 2.0            | 2.0            | 38.9                     |
| 23236CKE4                       | 198                                 | 211                 | 302                 | 274  | 3                   | 0.33              | 3.0                | 2.0            | 2.0            | 38.9                     |
| 22336CAMKE4*                    | 198                                 | —                   | 362                 | 322  | 3                   | 0.34              | 2.9                | 2.0            | 1.9            | 67                       |
| 23938CAMKE4*                    | 200                                 | —                   | 250                 | 240  | 2                   | 0.18              | 5.7                | 3.8            | 3.7            | 8.03                     |
| 23038CAMKE4*                    | 202                                 | —                   | 278                 | 261  | 2                   | 0.24              | 4.2                | 2.8            | 2.8            | 17.6                     |
| 24038CAMK30E4*                  | 202                                 | 210                 | 278                 | 253  | 2                   | 0.31              | 3.2                | 2.2            | 2.1            | 24                       |
| 24038CK30E4                     | 202                                 | 210                 | 278                 | 253  | 2                   | 0.31              | 3.2                | 2.2            | 2.1            | 24                       |
| 23138CAMKE4*                    | 204                                 | 219                 | 306                 | 276  | 2.5                 | 0.31              | 3.3                | 2.2            | 2.2            | 34.5                     |
| 23138CKE4                       | 204                                 | 219                 | 306                 | 276  | 2.5                 | 0.31              | 3.3                | 2.2            | 2.2            | 34.5                     |
| 24138CAMK30E4*                  | 204                                 | 211                 | 306                 | 269  | 2.5                 | 0.40              | 2.5                | 1.7            | 1.6            | 41.5                     |
| 24138CK30E4                     | 204                                 | 211                 | 306                 | 269  | 2.5                 | 0.40              | 2.5                | 1.7            | 1.6            | 41.5                     |
| 22238CAMKE4*                    | 208                                 | —                   | 322                 | 296  | 3                   | 0.26              | 3.8                | 2.6            | 2.5            | 35.5                     |
| 23238CAMKE4*                    | 208                                 | 222                 | 322                 | 288  | 3                   | 0.35              | 2.9                | 1.9            | 1.9            | 47.6                     |
| 23238CKE4                       | 208                                 | 222                 | 322                 | 288  | 3                   | 0.35              | 2.9                | 1.9            | 1.9            | 47.6                     |
| 22338CAMKE4*                    | 212                                 | —                   | 378                 | 338  | 4                   | 0.34              | 2.9                | 2.0            | 1.9            | 77.6                     |

- 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 A164, 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<sub>r</sub>); and Heavy Loads ( $> 0.10C_r$ ).
  3. For the dimensions of adapters and withdrawal sleeves, refer to Pages **B381**, and **B386 – B387**.

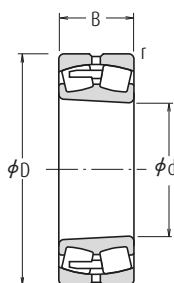
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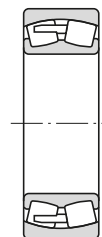
## Bore Diameter 200 – 220 mm



Cylindrical Bore  
CA



Tapered Bore  
CA



Without an Oil Groove and Holes  
CA

| Boundary Dimensions<br>(mm) |     |     |           | Basic Load Ratings<br>(N) |                 | Thermal<br>Reference Speed | Speeds<br>(min <sup>-1</sup> ) |              | Bearing          |
|-----------------------------|-----|-----|-----------|---------------------------|-----------------|----------------------------|--------------------------------|--------------|------------------|
| d                           | D   | B   | r<br>min. | C <sub>r</sub>            | C <sub>0r</sub> |                            | Limiting Speeds                |              | Cylindrical Bore |
|                             |     |     |           |                           |                 |                            | Mechanical                     | Grease       |                  |
| 200                         | 280 | 60  | 2.1       | 570 000                   | 1 060 000       | —                          | —                              | —            | 23940CAE4        |
|                             | 280 | 60  | 2.1       | 710 000                   | 1 060 000       | 2 400                      | 2 600                          | 1 100        | 23940CAME4 *     |
|                             | 310 | 82  | 2.1       | 1 180 000                 | 1 700 000       | 1 800                      | 2 400                          | 1 000        | 23040CAME4 *     |
|                             | 310 | 109 | 2.1       | 1 420 000                 | 2 120 000       | 1 300                      | 2 000                          | 850          | 24040CAME4 *     |
|                             | 310 | 109 | 2.1       | 1 140 000                 | 2 120 000       | 1 300                      | —                              | 850          | 24040CE4         |
|                             | 340 | 112 | 3         | 1 700 000                 | 2 330 000       | 1 500                      | 2 000                          | 800          | 23140CAME4 *     |
|                             | 340 | 112 | 3         | 1 360 000                 | 2 330 000       | 1 500                      | —                              | 800          | 23140CE4         |
|                             | 340 | 140 | 3         | 1 960 000                 | 2 660 000       | 950                        | 1 800                          | 800          | 24140CAME4 *     |
|                             | 340 | 140 | 3         | 1 570 000                 | 2 670 000       | 950                        | —                              | 800          | 24140CE4         |
|                             | 360 | 98  | 4         | 1 620 000                 | 2 010 000       | 1 700                      | 2 200                          | 950          | 22240CAME4 *     |
|                             | 360 | 128 | 4         | 2 070 000                 | 2 750 000       | 1 100                      | 1 800                          | 750          | 23240CAME4 *     |
|                             | 360 | 128 | 4         | 1 660 000                 | 2 750 000       | 1 100                      | —                              | 750          | 23240CE4         |
| 220                         | 420 | 138 | 5         | 2 500 000                 | 2 990 000       | 1 000                      | 1 700                          | 850          | 22340CAME4 *     |
|                             | 300 | 60  | 2.1       | 785 000                   | 1 240 000       | 2 200                      | 2 600                          | 1 000        | 23944CAME4 *     |
|                             | 340 | 90  | 3         | 1 360 000                 | 1 980 000       | 1 600                      | 2 200                          | 950          | 23044CAME4 *     |
|                             | 340 | 118 | 3         | 1 640 000                 | 2 490 000       | 1 200                      | 1 900                          | 750          | 24044CAME4 *     |
|                             | 340 | 118 | 3         | 1 360 000                 | 2 600 000       | 1 200                      | —                              | 750          | 24044CE4         |
|                             | 370 | 120 | 4         | 1 960 000                 | 2 710 000       | 1 300                      | 1 800                          | 710          | 23144CAME4 *     |
|                             | 370 | 120 | 4         | 1 570 000                 | 2 710 000       | 1 300                      | —                              | 710          | 23144CE4         |
|                             | 370 | 150 | 4         | 2 250 000                 | 3 200 000       | 850                        | 1 600                          | 710          | 24144CAME4 *     |
|                             | 370 | 150 | 4         | 1 800 000                 | 3 200 000       | 850                        | —                              | 710          | 24144CE4         |
|                             | 400 | 108 | 4         | 1 960 000                 | 2 430 000       | 1 500                      | 2 000                          | 850          | 22244CAME4 *     |
|                             | 400 | 144 | 4         | 2 520 000                 | 3 400 000       | 1 000                      | 1 600                          | 670          | 23244CAME4 *     |
|                             | 400 | 144 | 4         | 2 020 000                 | 3 400 000       | 850                        | —                              | 670          | 23244CE4         |
| 460                         | 145 | 5   | 2 940 000 | 3 400 000                 | 950             | 1 600                      | 750                            | 22344CAME4 * |                  |

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

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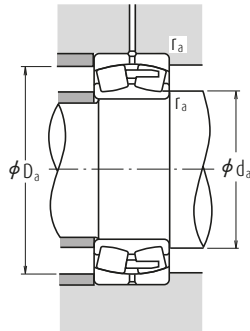
## Dynamic Equivalent Load $P = X F_r + Y F_a$

| $F_a/F_r \leq e$ |       | $F_a/F_r > e$ |       |
|------------------|-------|---------------|-------|
| 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<br>(mm) |      |       |       |      | Constant | Axial Load<br>Factors |       |       | Mass<br>(kg) |
|------------------|----------------------------------------|------|-------|-------|------|----------|-----------------------|-------|-------|--------------|
|                  | $d_a$                                  |      | $D_a$ | $r_a$ |      |          | $e$                   | $Y_2$ | $Y_3$ |              |
| Tapered Bore (1) | min.                                   | max. | max.  | min.  | max. | e        | $Y_2$                 | $Y_3$ | $Y_0$ | approx.      |
| 23940CAKE4       | 212                                    | —    | 268   | 258   | 2    | 0.20     | 5.1                   | 3.4   | 3.3   | 11           |
| 23940CAMKE4*     | 212                                    | —    | 268   | 258   | 2    | 0.20     | 5.1                   | 3.4   | 3.3   | 11           |
| 23040CAMKE4*     | 212                                    | —    | 268   | 279   | 2    | 0.25     | 4.0                   | 2.7   | 2.6   | 22.6         |
| 24040CAMK30E4*   | 212                                    | 223  | 298   | 271   | 2    | 0.32     | 3.1                   | 2.1   | 2.0   | 30.4         |
| 24040CK30E4      | 212                                    | 223  | 298   | 271   | 2    | 0.32     | 3.1                   | 2.1   | 2.0   | 30.4         |
| 23140CAMKE4*     | 214                                    | 232  | 326   | 293   | 2.5  | 0.31     | 3.2                   | 2.2   | 2.1   | 42.7         |
| 23140CKE4        | 214                                    | 232  | 326   | 293   | 2.5  | 0.31     | 3.2                   | 2.2   | 2.1   | 42.7         |
| 24140CAMK30E4*   | 214                                    | 226  | 326   | 290   | 2.5  | 0.39     | 2.6                   | 1.8   | 1.7   | 51.3         |
| 24140CK30E4      | 214                                    | 226  | 326   | 290   | 2.5  | 0.39     | 2.6                   | 1.8   | 1.7   | 51.3         |
| 22240CAMKE4*     | 218                                    | —    | 342   | 315   | 3    | 0.26     | 3.8                   | 2.6   | 2.5   | 42.6         |
| 23240CAMKE4*     | 218                                    | 237  | 342   | 307   | 3    | 0.34     | 2.9                   | 2.0   | 1.9   | 57.1         |
| 23240CKE4        | 222                                    | 237  | 342   | 307   | 3    | 0.34     | 2.9                   | 2.0   | 1.9   | 57.1         |
| 22340CAMKE4*     | 232                                    | —    | 398   | 352   | 4    | 0.34     | 2.9                   | 2.0   | 1.9   | 92.6         |
| 23944CAMKE4*     | 234                                    | —    | 288   | 278   | 2    | 0.18     | 5.7                   | 3.8   | 3.7   | 12.2         |
| 23044CAMKE4*     | 234                                    | —    | 326   | 302   | 2.5  | 0.24     | 4.1                   | 2.8   | 2.7   | 29.7         |
| 24044CAMK30E4*   | 234                                    | 244  | 326   | 296   | 2.5  | 0.31     | 3.2                   | 2.1   | 2.1   | 40.5         |
| 24044CK30E4      | 238                                    | 244  | 326   | 296   | 2.5  | 0.31     | 3.2                   | 2.1   | 2.1   | 40.5         |
| 23144CAMKE4*     | 238                                    | 254  | 352   | 320   | 3    | 0.30     | 3.3                   | 2.2   | 2.2   | 53           |
| 23144CKE4        | 238                                    | 254  | 352   | 320   | 3    | 0.30     | 3.3                   | 2.2   | 2.2   | 53           |
| 24144CAMK30E4*   | 238                                    | 248  | 352   | 313   | 3    | 0.39     | 2.6                   | 1.7   | 1.7   | 66.7         |
| 24144CK30E4      | 238                                    | 248  | 352   | 313   | 3    | 0.39     | 2.6                   | 1.7   | 1.7   | 66.7         |
| 22244CAMKE4*     | 238                                    | —    | 382   | 348   | 3    | 0.27     | 3.7                   | 2.5   | 2.4   | 59           |
| 23244CAMKE4*     | 238                                    | 260  | 382   | 337   | 3    | 0.35     | 2.9                   | 1.9   | 1.9   | 80.4         |
| 23244CKE4        | 238                                    | 260  | 382   | 337   | 3    | 0.35     | 2.9                   | 1.9   | 1.9   | 80.4         |
| 22344CAMKE4*     | 242                                    | —    | 438   | 391   | 4    | 0.33     | 3.0                   | 2.0   | 2.0   | 116          |

- Remarks**
- The bearings denoted by an asterisk (\*) are NSKHPS bearings and an oil groove and holes are standard for them.
  - When making a selection of the recommended fit (Tolerance of shaft) on Page A164, 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 ( $> 0.10C_r$ ).
  - For the dimensions of adapters and withdrawal sleeves, refer to Pages **B381** and **B387**.

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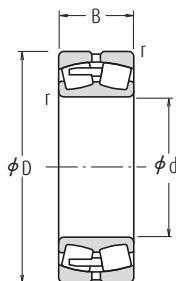
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# Spherical Roller Bearings

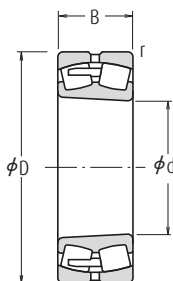


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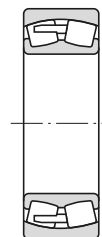
Bore Diameter 240 – 280 mm



Cylindrical Bore  
CA



Tapered Bore  
CA



Without an Oil Groove and Holes  
CA

| Boundary Dimensions<br>(mm) |     |     |           | Basic Load Ratings<br>(N) |                 | Thermal<br>Reference Speed | Speeds<br>(min <sup>-1</sup> ) |        | Bearing                 |
|-----------------------------|-----|-----|-----------|---------------------------|-----------------|----------------------------|--------------------------------|--------|-------------------------|
| d                           | D   | B   | r<br>min. | C <sub>r</sub>            | C <sub>0r</sub> |                            | Limiting Speeds                |        | Cylindrical Bore        |
|                             |     |     |           |                           |                 |                            | Mechanical                     | Grease |                         |
| 240                         | 320 | 60  | 2.1       | 635 000                   | 1 300 000       | 1 900                      | 2 600                          | 950    | 23948CAE4               |
|                             | 320 | 60  | 2.1       | 795 000                   | 1 300 000       | 1 900                      | 2 600                          | 950    | 23948CAME4 <sup>®</sup> |
|                             | 360 | 92  | 3         | 1 450 000                 | 2 140 000       | 1 500                      | 2 200                          | 850    | 23048CAME4 <sup>®</sup> |
|                             | 360 | 118 | 3         | 1 730 000                 | 2 730 000       | 1 100                      | 1 800                          | 710    | 24048CAME4 <sup>®</sup> |
|                             | 360 | 118 | 3         | 1 390 000                 | 2 730 000       | 1 100                      | —                              | 710    | 24048CE4                |
|                             | 400 | 128 | 4         | 2 230 000                 | 3 100 000       | 1 200                      | 1 700                          | 670    | 23148CAME4 <sup>®</sup> |
|                             | 400 | 128 | 4         | 1 790 000                 | 3 100 000       | 1 200                      | —                              | 670    | 23148CE4                |
|                             | 400 | 160 | 4         | 2 660 000                 | 3 800 000       | 750                        | 1 500                          | 670    | 24148CAME4 <sup>®</sup> |
|                             | 400 | 160 | 4         | 2 130 000                 | 3 800 000       | 750                        | —                              | 670    | 24148CE4                |
|                             | 440 | 120 | 4         | 2 340 000                 | 2 890 000       | 1 400                      | 1 800                          | 750    | 22248CAME4 <sup>®</sup> |
|                             | 440 | 160 | 4         | 3 050 000                 | 4 050 000       | 850                        | 1 500                          | 630    | 23248CAME4 <sup>®</sup> |
|                             | 500 | 155 | 5         | 3 250 000                 | 3 800 000       | 850                        | 1 500                          | 670    | 22348CAME4 <sup>®</sup> |
| 260                         | 360 | 75  | 2.1       | 1 170 000                 | 1 870 000       | 1 800                      | 2 200                          | 850    | 23952CAME4 <sup>®</sup> |
|                             | 400 | 104 | 4         | 1 780 000                 | 2 580 000       | 1 300                      | 1 900                          | 800    | 23052CAME4 <sup>®</sup> |
|                             | 400 | 140 | 4         | 2 270 000                 | 3 500 000       | 950                        | 1 600                          | 630    | 24052CAME4 <sup>®</sup> |
|                             | 440 | 144 | 4         | 2 700 000                 | 3 750 000       | 1 100                      | 1 500                          | 600    | 23152CAME4 <sup>®</sup> |
|                             | 440 | 180 | 4         | 3 200 000                 | 4 700 000       | 630                        | 1 300                          | 600    | 24152CAME4 <sup>®</sup> |
|                             | 480 | 130 | 5         | 2 720 000                 | 3 400 000       | 1 200                      | 1 700                          | 670    | 22252CAME4 <sup>®</sup> |
|                             | 480 | 174 | 5         | 3 400 000                 | 4 550 000       | 800                        | 1 400                          | 560    | 23252CAME4 <sup>®</sup> |
|                             | 540 | 165 | 6         | 3 900 000                 | 4 600 000       | 750                        | 1 400                          | 630    | 22352CAME4 <sup>®</sup> |
| 280                         | 380 | 75  | 2.1       | 1 160 000                 | 1 950 000       | 1 600                      | 2 000                          | 800    | 23956CAME4 <sup>®</sup> |
|                             | 420 | 106 | 4         | 1 930 000                 | 2 950 000       | 1 200                      | 1 800                          | 710    | 23056CAME4 <sup>®</sup> |
|                             | 420 | 140 | 4         | 2 350 000                 | 3 800 000       | 850                        | 1 500                          | 600    | 24056CAME4 <sup>®</sup> |
|                             | 460 | 146 | 5         | 2 790 000                 | 4 000 000       | 1 000                      | 1 500                          | 560    | 23156CAME4 <sup>®</sup> |
|                             | 460 | 180 | 5         | 3 300 000                 | 5 000 000       | 600                        | 1 300                          | 560    | 24156CAME4 <sup>®</sup> |
|                             | 500 | 130 | 5         | 2 850 000                 | 3 650 000       | 1 100                      | 1 600                          | 630    | 22256CAME4 <sup>®</sup> |
|                             | 500 | 176 | 5         | 3 600 000                 | 4 900 000       | 750                        | 1 300                          | 530    | 23256CAME4 <sup>®</sup> |
|                             | 580 | 175 | 6         | 4 350 000                 | 5 150 000       | 710                        | 1 300                          | 560    | 22356CAME4 <sup>®</sup> |

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

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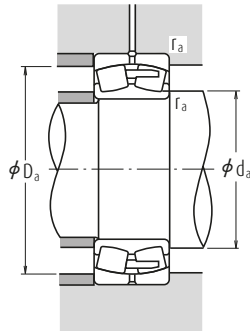
## Dynamic Equivalent Load $P = X F_r + Y F_a$

| $F_a/F_r \leq e$ |       | $F_a/F_r > e$ |       |
|------------------|-------|---------------|-------|
| 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<br>(mm) |                        |                        |      |                        | Constant | Axial Load Factors |                |                | Mass<br>(kg) |
|----------------|----------------------------------------|------------------------|------------------------|------|------------------------|----------|--------------------|----------------|----------------|--------------|
|                | Tapered Bore (1)                       |                        |                        |      |                        |          |                    |                |                |              |
|                | min.                                   | d <sub>a</sub><br>max. | D <sub>a</sub><br>max. | min. | r <sub>a</sub><br>max. | e        | Y <sub>2</sub>     | Y <sub>3</sub> | Y <sub>0</sub> | approx.      |
| 23948CAKE4     | 252                                    | —                      | 308                    | 298  | 2                      | 0.17     | 6.0                | 4.0            | 3.9            | 13.3         |
| 23948CAMKE4*   | 253                                    | —                      | 308                    | 298  | 2                      | 0.18     | 6.1                | 4.1            | 3.10           | 13.4         |
| 23048CAMKE4*   | 254                                    | —                      | 346                    | 324  | 2.5                    | 0.24     | 4.2                | 2.8            | 2.7            | 32.6         |
| 24048CAMK30E4* | 254                                    | 265                    | 346                    | 317  | 2.5                    | 0.29     | 3.4                | 2.3            | 2.2            | 43.4         |
| 24048CK30E4    | 254                                    | 265                    | 346                    | 317  | 2.5                    | 0.29     | 3.4                | 2.3            | 2.2            | 43.4         |
| 23148CAMKE4*   | 258                                    | 275                    | 382                    | 347  | 3                      | 0.30     | 3.3                | 2.2            | 2.2            | 66.9         |
| 23148CKE4      | 258                                    | 275                    | 382                    | 347  | 3                      | 0.30     | 3.3                | 2.2            | 2.2            | 66.9         |
| 24148CAMK30E4* | 258                                    | 268                    | 382                    | 341  | 3                      | 0.38     | 2.7                | 1.8            | 1.8            | 79.5         |
| 24148CK30E4    | 258                                    | 268                    | 382                    | 341  | 3                      | 0.38     | 2.7                | 1.8            | 1.8            | 79.5         |
| 22248CAMKE4*   | 258                                    | —                      | 422                    | 383  | 3                      | 0.27     | 3.7                | 2.5            | 2.4            | 80.2         |
| 23248CAMKE4*   | 258                                    | —                      | 422                    | 372  | 3                      | 0.37     | 2.7                | 1.8            | 1.8            | 106          |
| 22348CAMKE4*   | 262                                    | —                      | 478                    | 423  | 4                      | 0.32     | 3.2                | 2.1            | 2.1            | 147          |
| 23952CAMKE4*   | 272                                    | —                      | 348                    | 333  | 2                      | 0.19     | 5.4                | 3.6            | 3.5            | 23           |
| 23052CAMKE4*   | 278                                    | —                      | 382                    | 356  | 3                      | 0.25     | 4.1                | 2.7            | 2.7            | 46.6         |
| 24052CAMK30E4* | 278                                    | —                      | 382                    | 348  | 3                      | 0.32     | 3.1                | 2.1            | 2.1            | 62.6         |
| 23152CAMKE4*   | 278                                    | —                      | 422                    | 380  | 3                      | 0.32     | 3.2                | 2.1            | 2.1            | 88.2         |
| 24152CAMK30E4* | 278                                    | —                      | 422                    | 371  | 3                      | 0.39     | 2.6                | 1.7            | 1.7            | 109          |
| 22252CAMKE4*   | 282                                    | —                      | 458                    | 418  | 4                      | 0.27     | 3.7                | 2.5            | 2.5            | 104          |
| 23252CAMKE4*   | 282                                    | —                      | 458                    | 406  | 4                      | 0.37     | 2.7                | 1.8            | 1.8            | 137          |
| 22352CAMKE4*   | 288                                    | —                      | 512                    | 462  | 5                      | 0.32     | 3.2                | 2.1            | 2.1            | 180          |
| 23956CAMKE4*   | 292                                    | —                      | 368                    | 351  | 2                      | 0.18     | 5.7                | 3.9            | 3.8            | 24.5         |
| 23056CAMKE4*   | 298                                    | —                      | 402                    | 377  | 3                      | 0.24     | 4.2                | 2.8            | 2.7            | 50.5         |
| 24056CAMK30E4* | 298                                    | —                      | 402                    | 369  | 3                      | 0.31     | 3.3                | 2.2            | 2.2            | 66.4         |
| 23156CAMKE4*   | 302                                    | —                      | 438                    | 400  | 4                      | 0.30     | 3.3                | 2.2            | 2.2            | 94.3         |
| 24156CAMK30E4* | 302                                    | —                      | 438                    | 392  | 4                      | 0.37     | 2.7                | 1.8            | 1.8            | 115          |
| 22256CAMKE4*   | 302                                    | —                      | 478                    | 439  | 4                      | 0.25     | 4.0                | 2.7            | 2.6            | 110          |
| 23256CAMKE4*   | 302                                    | —                      | 478                    | 425  | 4                      | 0.35     | 2.9                | 1.9            | 1.9            | 147          |
| 22356CAMKE4*   | 308                                    | —                      | 552                    | 496  | 5                      | 0.31     | 3.2                | 2.1            | 2.1            | 221          |

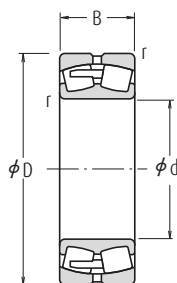
- Remarks**
- The bearings denoted by an asterisk (\*) are NSKHPS bearings and an oil groove and holes are standard for them.
  - When making a selection of the recommended fit (Tolerance of shaft) on Page A164, in case of NSKHPS bearings, the conditions are different.  
The segmentations are: Light Loads ( $\leq 0.05C_r$ ); Normal Loads ( $0.05$  to  $0.10C_r$ ); and Heavy Loads ( $> 0.10C_r$ ).
  - For the dimensions of adapters and withdrawal sleeves, refer to Pages **B381**, **B382** and **B387** – **B388**.

# Spherical Roller Bearings

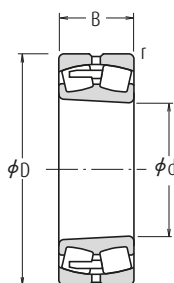


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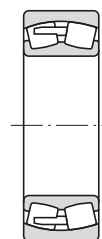
Bore Diameter 300 – 380 mm



Cylindrical Bore  
CA



Tapered Bore  
CA



Without an Oil Groove and Holes  
CA

| Boundary Dimensions<br>(mm) |     |     |           | Basic Load Ratings<br>(N) |                 | Thermal<br>Reference Speed | Speeds<br>(min <sup>-1</sup> ) |        | Bearing          |
|-----------------------------|-----|-----|-----------|---------------------------|-----------------|----------------------------|--------------------------------|--------|------------------|
| d                           | D   | B   | r<br>min. | C <sub>r</sub>            | C <sub>0r</sub> |                            | Limiting Speeds                |        | Cylindrical Bore |
|                             |     |     |           |                           |                 |                            | Mechanical                     | Grease |                  |
| 300                         | 420 | 90  | 3         | 1 540 000                 | 2 490 000       | 1 500                      | 1 800                          | 710    | 23960CAME4°      |
|                             | 460 | 118 | 4         | 2 400 000                 | 3 700 000       | 1 100                      | 1 600                          | 670    | 23060CAME4°      |
|                             | 460 | 160 | 4         | 2 890 000                 | 4 600 000       | 800                        | 1 400                          | 530    | 24060CAME4°      |
|                             | 500 | 160 | 5         | 3 350 000                 | 4 800 000       | 900                        | 1 400                          | 500    | 23160CAME4°      |
|                             | 500 | 200 | 5         | 3 900 000                 | 5 800 000       | 530                        | 1 200                          | 500    | 24160CAME4°      |
|                             | 540 | 140 | 5         | 3 250 000                 | 4 250 000       | 1 000                      | 1 500                          | 600    | 22260CAME4°      |
|                             | 540 | 192 | 5         | 4 250 000                 | 5 900 000       | 670                        | 1 200                          | 480    | 23260CAME4°      |
|                             | 540 | 192 | 5         | 4 250 000                 | 5 900 000       | 670                        | 1 200                          | 480    | 23260CAME4°      |
| 320                         | 440 | 90  | 3         | 1 620 000                 | 2 750 000       | 1 400                      | 1 700                          | 670    | 23964CAME4°      |
|                             | 480 | 121 | 4         | 2 450 000                 | 3 850 000       | 1 000                      | 1 600                          | 630    | 23064CAME4°      |
|                             | 480 | 160 | 4         | 3 050 000                 | 5 050 000       | 710                        | 1 300                          | 500    | 24064CAME4°      |
|                             | 540 | 176 | 5         | 3 850 000                 | 5 500 000       | 800                        | 1 300                          | 480    | 23164CAME4°      |
|                             | 540 | 218 | 5         | 4 400 000                 | 6 650 000       | 500                        | 1 100                          | 480    | 24164CAME4°      |
|                             | 580 | 150 | 5         | 3 750 000                 | 4 850 000       | 950                        | 1 400                          | 530    | 22264CAME4°      |
|                             | 580 | 208 | 5         | 4 850 000                 | 6 900 000       | 600                        | 1 100                          | 450    | 23264CAME4°      |
|                             | 580 | 208 | 5         | 4 850 000                 | 6 900 000       | 600                        | 1 100                          | 450    | 23264CAME4°      |
| 340                         | 460 | 90  | 3         | 1 670 000                 | 2 840 000       | 1 300                      | 1 700                          | 630    | 23968CAME4°      |
|                             | 520 | 133 | 5         | 2 850 000                 | 4 400 000       | 950                        | 1 500                          | 560    | 23068CAME4°      |
|                             | 520 | 180 | 5         | 3 650 000                 | 6 050 000       | 670                        | 1 200                          | 480    | 24068CAME4°      |
|                             | 580 | 190 | 5         | 4 500 000                 | 6 600 000       | 710                        | 1 200                          | 430    | 23168CAME4°      |
|                             | 580 | 243 | 5         | 5 300 000                 | 7 900 000       | 450                        | 1 000                          | 430    | 24168CAME4°      |
|                             | 620 | 224 | 6         | 4 400 000                 | 7 800 000       | 480                        | —                              | 400    | 23268CAME4°      |
|                             | 480 | 90  | 3         | 1 730 000                 | 3 050 000       | 1 200                      | 1 700                          | 600    | 23972CAME4°      |
|                             | 540 | 134 | 5         | 2 990 000                 | 4 700 000       | 900                        | 1 400                          | 530    | 23072CAME4°      |
| 360                         | 540 | 180 | 5         | 3 650 000                 | 6 100 000       | 630                        | 1 200                          | 450    | 24072CAME4°      |
|                             | 600 | 192 | 5         | 4 800 000                 | 7 100 000       | 670                        | 1 100                          | 400    | 23172CAME4°      |
|                             | 600 | 243 | 5         | 5 250 000                 | 8 000 000       | 430                        | 1 000                          | 400    | 24172CAME4°      |
|                             | 600 | 232 | 6         | 4 800 000                 | 8 550 000       | 450                        | —                              | 380    | 23272CAME4°      |
|                             | 520 | 106 | 4         | 2 340 000                 | 4 100 000       | 1 100                      | 1 500                          | 530    | 23976CAME4°      |
|                             | 560 | 135 | 5         | 3 150 000                 | 5 100 000       | 850                        | 1 400                          | 530    | 23076CAME4°      |
|                             | 560 | 180 | 5         | 3 850 000                 | 6 600 000       | 600                        | 1 200                          | 430    | 24076CAME4°      |
|                             | 620 | 194 | 5         | 4 000 000                 | 7 600 000       | 530                        | —                              | 400    | 23176CAME4°      |
| 380                         | 620 | 243 | 5         | 4 350 000                 | 8 450 000       | 360                        | —                              | 400    | 24176CAME4°      |
|                             | 680 | 240 | 6         | 5 150 000                 | 9 200 000       | 430                        | —                              | 360    | 23276CAME4°      |

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

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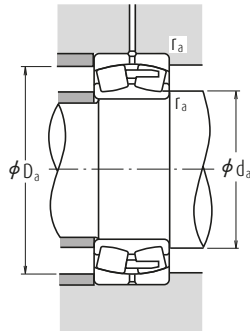
**Dynamic Equivalent Load**  $P = X F_r + Y F_a$ 

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

**Static Equivalent Load**

$$P_0 = F_r + Y_0 F_a$$

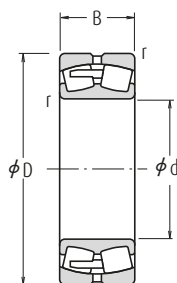
The values of  $e$ ,  $Y_2$ ,  $Y_3$  and  $Y_0$  are given in the table below.



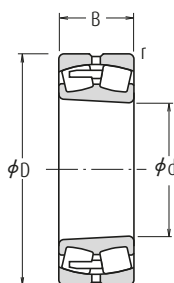
| Numbers<br><br>Tapered Bore (!) | Abutment and Fillet Dimensions (mm) |                     |                     |      |                     | Constant<br><br>e | Axial Load Factors |                |                | Mass (kg)<br><br>approx. |
|---------------------------------|-------------------------------------|---------------------|---------------------|------|---------------------|-------------------|--------------------|----------------|----------------|--------------------------|
|                                 | min.                                | d <sub>a</sub> max. | D <sub>a</sub> max. | min. | r <sub>a</sub> max. |                   | Y <sub>2</sub>     | Y <sub>3</sub> | Y <sub>0</sub> |                          |
| 23960CAMKE4*                    | 314                                 |                     | 406                 | 386  | 2.5                 | 0.19              | 5.2                | 3.5            | 3.4            | 38.2                     |
| 23060CAMKE4*                    | 318                                 |                     | 442                 | 413  | 3                   | 0.24              | 4.2                | 2.8            | 2.7            | 70.5                     |
| 24060CAMK30E4*                  | 318                                 |                     | 442                 | 400  | 3                   | 0.32              | 3.1                | 2.1            | 2.0            | 93.6                     |
| 23160CAMKE4*                    | 322                                 |                     | 478                 | 433  | 4                   | 0.31              | 3.3                | 2.2            | 2.2            | 125                      |
| 24160CAMK30E4*                  | 322                                 |                     | 478                 | 423  | 4                   | 0.38              | 2.6                | 1.8            | 1.7            | 152                      |
| 22260CAMKE4*                    | 322                                 |                     | 518                 | 473  | 4                   | 0.25              | 4.0                | 2.7            | 2.6            | 139                      |
| 23260CAMKE4*                    | 322                                 |                     | 518                 | 458  | 4                   | 0.35              | 2.9                | 1.9            | 1.9            | 189                      |
| 23964CAMKE4*                    | 334                                 |                     | 426                 | 406  | 2.5                 | 0.18              | 5.5                | 3.7            | 3.6            | 40.6                     |
| 23064CAMKE4*                    | 338                                 |                     | 462                 | 432  | 3                   | 0.24              | 4.2                | 2.8            | 2.8            | 75.6                     |
| 24064CAMK30E4*                  | 338                                 |                     | 462                 | 422  | 3                   | 0.31              | 3.3                | 2.2            | 2.2            | 99.7                     |
| 23164CAMKE4*                    | 342                                 |                     | 518                 | 466  | 4                   | 0.31              | 3.2                | 2.1            | 2.1            | 162                      |
| 24164CAMK30E4*                  | 342                                 |                     | 518                 | 456  | 4                   | 0.39              | 2.6                | 1.7            | 1.7            | 196                      |
| 22264CAMKE4*                    | 342                                 |                     | 558                 | 508  | 4                   | 0.26              | 3.9                | 2.6            | 2.6            | 174                      |
| 23264CAMKE4*                    | 342                                 |                     | 558                 | 488  | 4                   | 0.36              | 2.8                | 1.9            | 1.8            | 239                      |
| 23968CAMKE4*                    | 354                                 |                     | 446                 | 427  | 2.5                 | 0.18              | 5.7                | 3.8            | 3.7            | 42.4                     |
| 23068CAMKE4*                    | 362                                 |                     | 498                 | 465  | 4                   | 0.24              | 4.2                | 2.8            | 2.8            | 101                      |
| 24068CAMK30E4*                  | 362                                 |                     | 498                 | 454  | 4                   | 0.32              | 3.2                | 2.1            | 2.1            | 135                      |
| 23168CAMKE4*                    | 362                                 |                     | 558                 | 499  | 4                   | 0.31              | 3.2                | 2.1            | 2.1            | 206                      |
| 24168CAMK30E4*                  | 362                                 |                     | 558                 | 489  | 4                   | 0.40              | 2.5                | 1.7            | 1.7            | 257                      |
| 23268CAMKE4                     | 368                                 |                     | 592                 | 521  | 5                   | 0.36              | 2.8                | 1.9            | 1.8            | 295                      |
| 23972CAMKE4*                    | 374                                 |                     | 466                 | 447  | 2.5                 | 0.17              | 6.0                | 4.1            | 4.0            | 44.7                     |
| 23072CAMKE4*                    | 382                                 |                     | 518                 | 485  | 4                   | 0.24              | 4.2                | 2.8            | 2.8            | 106                      |
| 24072CAMK30E4*                  | 382                                 |                     | 518                 | 476  | 4                   | 0.32              | 3.2                | 2.1            | 2.1            | 139                      |
| 23172CAMKE4*                    | 382                                 |                     | 578                 | 520  | 4                   | 0.31              | 3.2                | 2.2            | 2.1            | 217                      |
| 24172CAMK30E4*                  | 382                                 |                     | 578                 | 507  | 4                   | 0.40              | 2.5                | 1.7            | 1.7            | 264                      |
| 23272CAMKE4                     | 388                                 |                     | 622                 | 549  | 5                   | 0.36              | 2.8                | 1.9            | 1.8            | 342                      |
| 23976CAMKE4*                    | 398                                 |                     | 502                 | 482  | 3                   | 0.18              | 5.5                | 3.7            | 3.6            | 65.4                     |
| 23076CAMKE4*                    | 402                                 |                     | 538                 | 506  | 4                   | 0.22              | 4.5                | 3.0            | 3.0            | 113                      |
| 24076CAMK30E4*                  | 402                                 |                     | 538                 | 496  | 4                   | 0.29              | 3.4                | 2.3            | 2.3            | 148                      |
| 23176CAMKE4                     | 402                                 |                     | 598                 | 540  | 4                   | 0.30              | 3.3                | 2.2            | 2.2            | 229                      |
| 24176CAMK30E4                   | 402                                 |                     | 598                 | 529  | 4                   | 0.38              | 2.6                | 1.8            | 1.7            | 275                      |
| 23276CAMKE4                     | 408                                 |                     | 652                 | 578  | 5                   | 0.35              | 2.9                | 1.9            | 1.9            | 372                      |

- Remarks**
- The bearings denoted by an asterisk (\*) are NSKHPS bearings and an oil groove and holes are standard for them.
  - When making a selection of the recommended fit (Tolerance of shaft) on Page A164, 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 ( $> 0.10C_r$ ).
  - For the dimensions of adapters and withdrawal sleeves, refer to Pages **B382** and **B388**.

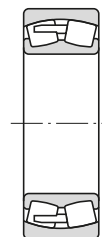
## Bore Diameter 400 – 460 mm



Cylindrical Bore  
CA



Tapered Bore  
CA



Without an Oil Groove and Holes  
CA

| Boundary Dimensions<br>(mm) |     |     |           | Basic Load Ratings<br>(N) |                 | Thermal<br>Reference Speed | Speeds<br>(min <sup>-1</sup> ) |        | Bearing          |
|-----------------------------|-----|-----|-----------|---------------------------|-----------------|----------------------------|--------------------------------|--------|------------------|
| d                           | D   | B   | r<br>min. | C <sub>r</sub>            | C <sub>0r</sub> |                            | Limiting Speeds                |        | Cylindrical Bore |
|                             |     |     |           |                           |                 |                            | Mechanical                     | Grease |                  |
| 400                         | 540 | 106 | 4         | 2 370 000                 | 4 250 000       | 1 000                      | 1 400                          | 530    | 23980CAME4*      |
|                             | 600 | 148 | 5         | 3 700 000                 | 5 900 000       | 800                        | 1 300                          | 480    | 23080CAME4*      |
|                             | 600 | 200 | 5         | 4 500 000                 | 7 600 000       | 550                        | 1 100                          | 400    | 24080CAME4*      |
|                             | 650 | 200 | 6         | 4 150 000                 | 7 900 000       | 500                        | —                              | 380    | 23180CAME4       |
|                             | 650 | 250 | 6         | 4 950 000                 | 10 100 000      | 320                        | —                              | 380    | 24180CAME4       |
| 420                         | 720 | 256 | 6         | 5 800 000                 | 10 400 000      | 380                        | —                              | 340    | 23280CAME4       |
|                             | 560 | 106 | 4         | 2 340 000                 | 4 250 000       | 1 000                      | 1 400                          | 500    | 23984CAME4*      |
|                             | 620 | 150 | 5         | 2 910 000                 | 5 850 000       | 670                        | —                              | 450    | 23084CAME4       |
|                             | 620 | 200 | 5         | 3 750 000                 | 8 100 000       | 480                        | —                              | 380    | 24084CAME4       |
|                             | 700 | 224 | 6         | 5 000 000                 | 9 400 000       | 480                        | —                              | 340    | 23184CAME4       |
| 440                         | 700 | 280 | 6         | 6 000 000                 | 12 000 000      | 280                        | —                              | 340    | 24184CAME4       |
|                             | 760 | 272 | 7.5       | 6 450 000                 | 11 700 000      | 360                        | —                              | 320    | 23284CAME4       |
|                             | 600 | 118 | 4         | 2 190 000                 | 4 800 000       | 630                        | —                              | 450    | 23988CAME4       |
|                             | 650 | 157 | 6         | 3 150 000                 | 6 350 000       | 630                        | —                              | 430    | 23088CAME4       |
|                             | 650 | 212 | 6         | 4 150 000                 | 9 100 000       | 450                        | —                              | 360    | 24088CAME4       |
| 460                         | 720 | 226 | 6         | 5 300 000                 | 10 300 000      | 430                        | —                              | 320    | 23188CAME4       |
|                             | 720 | 280 | 6         | 6 000 000                 | 12 100 000      | 280                        | —                              | 320    | 24188CAME4       |
|                             | 790 | 280 | 7.5       | 6 900 000                 | 12 800 000      | 340                        | —                              | 300    | 23288CAME4       |
|                             | 620 | 118 | 4         | 2 220 000                 | 4 950 000       | 600                        | —                              | 430    | 23992CAME4       |
|                             | 680 | 163 | 6         | 3 450 000                 | 7 100 000       | 600                        | —                              | 400    | 23092CAME4       |
| 460                         | 680 | 218 | 6         | 4 500 000                 | 9 950 000       | 430                        | —                              | 340    | 24092CAME4       |
|                             | 760 | 240 | 7.5       | 5 700 000                 | 10 900 000      | 430                        | —                              | 300    | 23192CAME4       |
|                             | 760 | 300 | 7.5       | 6 300 000                 | 12 400 000      | 280                        | —                              | 300    | 24192CAME4       |
|                             | 830 | 296 | 7.5       | 7 350 000                 | 13 700 000      | 320                        | —                              | 280    | 23292CAME4       |

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

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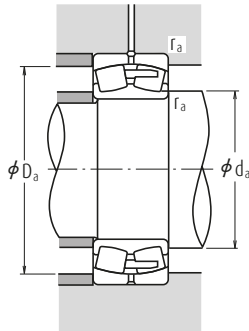
## Dynamic Equivalent Load $P = X F_r + Y F_a$

| $F_a/F_r \leq e$ |       | $F_a/F_r > e$ |       |
|------------------|-------|---------------|-------|
| 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.



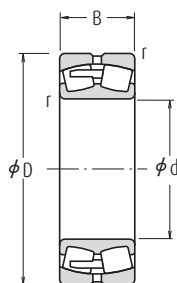
| Numbers<br><br>Tapered Bore (1) | Abutment and Fillet Dimensions (mm) |                     |                     |      |                     | Constant<br><br>e | Axial Load Factors |                |                | Mass (kg)<br><br>approx. |
|---------------------------------|-------------------------------------|---------------------|---------------------|------|---------------------|-------------------|--------------------|----------------|----------------|--------------------------|
|                                 | min.                                | d <sub>a</sub> max. | D <sub>a</sub> max. | min. | r <sub>a</sub> max. |                   | Y <sub>2</sub>     | Y <sub>3</sub> | Y <sub>0</sub> |                          |
| 23980CAMKE4*                    | 418                                 |                     | 522                 | 501  | 3                   | 0.18              | 5.7                | 3.9            | 3.8            | 69.1                     |
| 23080CAMKE4*                    | 422                                 |                     | 578                 | 540  | 4                   | 0.23              | 4.4                | 3.0            | 2.9            | 146                      |
| 24080CAMK30E4*                  | 422                                 |                     | 578                 | 527  | 4                   | 0.31              | 3.3                | 2.2            | 2.2            | 193                      |
| 23180CAMKE4                     | 428                                 |                     | 622                 | 569  | 5                   | 0.29              | 3.4                | 2.3            | 2.3            | 257                      |
| 24180CAMK30E4                   | 428                                 |                     | 622                 | 551  | 5                   | 0.37              | 2.7                | 1.8            | 1.8            | 316                      |
| 23280CAMKE4                     | 428                                 |                     | 692                 | 610  | 5                   | 0.36              | 2.8                | 1.9            | 1.9            | 449                      |
| 23984CAMKE4*                    | 438                                 |                     | 542                 | 521  | 3                   | 0.17              | 6.0                | 4.0            | 3.9            | 71.6                     |
| 23084CAMKE4                     | 442                                 |                     | 598                 | 562  | 4                   | 0.23              | 4.3                | 2.9            | 2.8            | 151                      |
| 24084CAMK30E4                   | 442                                 |                     | 598                 | 549  | 4                   | 0.31              | 3.2                | 2.2            | 2.1            | 199                      |
| 23184CAMKE4                     | 448                                 |                     | 672                 | 607  | 5                   | 0.31              | 3.3                | 2.2            | 2.2            | 341                      |
| 24184CAMK30E4                   | 448                                 |                     | 672                 | 598  | 5                   | 0.38              | 2.6                | 1.8            | 1.7            | 421                      |
| 23284CAMKE4                     | 456                                 |                     | 724                 | 644  | 6                   | 0.35              | 2.9                | 1.9            | 1.9            | 534                      |
| 23988CAMKE4                     | 458                                 |                     | 582                 | 555  | 3                   | 0.18              | 5.7                | 3.9            | 3.8            | 96.3                     |
| 23088CAMKE4                     | 468                                 |                     | 622                 | 587  | 5                   | 0.23              | 4.3                | 2.9            | 2.8            | 173                      |
| 24088CAMK30E4                   | 468                                 |                     | 622                 | 576  | 5                   | 0.31              | 3.2                | 2.1            | 2.1            | 237                      |
| 23188CAMKE4                     | 468                                 |                     | 692                 | 627  | 5                   | 0.3               | 3.3                | 2.2            | 2.2            | 360                      |
| 24188CAMK30E4                   | 468                                 |                     | 692                 | 617  | 5                   | 0.37              | 2.7                | 1.8            | 1.8            | 433                      |
| 23288CAMKE4                     | 476                                 |                     | 754                 | 669  | 6                   | 0.35              | 2.9                | 1.9            | 1.9            | 594                      |
| 23992CAMKE4                     | 478                                 |                     | 602                 | 575  | 3                   | 0.17              | 5.9                | 4.0            | 3.9            | 100                      |
| 23092CAMKE4                     | 488                                 |                     | 652                 | 615  | 5                   | 0.22              | 4.6                | 3.1            | 3.0            | 201                      |
| 24092CAMK30E4                   | 488                                 |                     | 652                 | 604  | 5                   | 0.29              | 3.4                | 2.3            | 2.3            | 266                      |
| 23192CAMKE4                     | 496                                 |                     | 724                 | 661  | 6                   | 0.31              | 3.3                | 2.2            | 2.2            | 423                      |
| 24192CAMK30E4                   | 496                                 |                     | 724                 | 646  | 6                   | 0.39              | 2.6                | 1.7            | 1.7            | 512                      |
| 23292CAMKE4                     | 496                                 |                     | 794                 | 702  | 6                   | 0.36              | 2.8                | 1.9            | 1.8            | 691                      |

- 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 A164, in case of NSKHPs bearings, the conditions are different.  
The segmentations are: Light Loads ( $\leq 0.05C_r$ ); Normal Loads (0.05 to 0.10 $C_r$ ); and Heavy Loads ( $> 0.10C_r$ ).
  3. For the dimensions of adapters and withdrawal sleeves, refer to Pages **B382 - B383** and **B389**.

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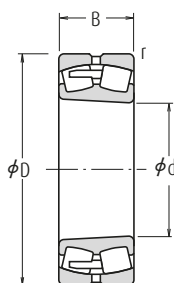
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## Bore Diameter 480 – 560 mm



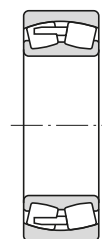
Cylindrical Bore

CA



Tapered Bore

CA



Without an Oil Groove and Holes

CA

| Boundary Dimensions<br>(mm) |       |     |           | Basic Load Ratings<br>(N) |                 | Thermal<br>Reference Speed | Speeds<br>(min <sup>-1</sup> ) |        | Bearing          |
|-----------------------------|-------|-----|-----------|---------------------------|-----------------|----------------------------|--------------------------------|--------|------------------|
| d                           | D     | B   | r<br>min. | C <sub>r</sub>            | C <sub>0r</sub> |                            | Limiting Speeds                |        | Cylindrical Bore |
|                             |       |     |           |                           |                 |                            | Mechanical                     | Grease |                  |
| 480                         | 650   | 128 | 5         | 2 580 000                 | 5 850 000       | 560                        | —                              | 400    | 23996CAME4       |
|                             | 700   | 165 | 6         | 3 800 000                 | 7 950 000       | 560                        | —                              | 400    | 23096CAME4       |
|                             | 700   | 218 | 6         | 4 600 000                 | 10 200 000      | 400                        | —                              | 320    | 24096CAME4       |
|                             | 790   | 248 | 7.5       | 6 050 000                 | 11 700 000      | 400                        | —                              | 300    | 23196CAME4       |
|                             | 790   | 308 | 7.5       | 7 150 000                 | 14 600 000      | 240                        | —                              | 300    | 24196CAME4       |
| 500                         | 870   | 310 | 7.5       | 7 850 000                 | 14 400 000      | 300                        | —                              | 260    | 23296CAME4       |
|                             | 670   | 128 | 5         | 2 460 000                 | 5 550 000       | 560                        | —                              | 400    | 239/500CAME4     |
|                             | 720   | 167 | 6         | 3 750 000                 | 8 100 000       | 530                        | —                              | 380    | 230/500CAME4     |
|                             | 720   | 218 | 6         | 4 450 000                 | 9 900 000       | 400                        | —                              | 300    | 240/500CAME4     |
|                             | 830   | 264 | 7.5       | 6 850 000                 | 13 400 000      | 360                        | —                              | 280    | 231/500CAME4     |
| 530                         | 830   | 325 | 7.5       | 8 000 000                 | 16 000 000      | 220                        | —                              | 280    | 241/500CAME4     |
|                             | 920   | 336 | 7.5       | 9 000 000                 | 16 600 000      | 280                        | —                              | 260    | 232/500CAME4     |
|                             | 710   | 136 | 5         | 2 930 000                 | 6 800 000       | 500                        | —                              | 360    | 239/530CAME4     |
|                             | 780   | 185 | 6         | 4 440 000                 | 9 200 000       | 500                        | —                              | 340    | 230/530CAME4     |
|                             | 780   | 250 | 6         | 5 400 000                 | 11 800 000      | 360                        | —                              | 280    | 240/530CAME4     |
| 560                         | 870   | 272 | 7.5       | 7 150 000                 | 14 100 000      | 340                        | —                              | 260    | 231/530CAME4     |
|                             | 870   | 335 | 7.5       | 8 500 000                 | 17 500 000      | 200                        | —                              | 260    | 241/530CAME4     |
|                             | 980   | 355 | 9.5       | 10 100 000                | 18 800 000      | 260                        | —                              | 240    | 232/530CAME4     |
|                             | 750   | 140 | 5         | 3 100 000                 | 7 250 000       | 480                        | —                              | 340    | 239/560CAME4     |
|                             | 820   | 195 | 6         | 5 000 000                 | 10 700 000      | 450                        | —                              | 320    | 230/560CAME4     |
| 560                         | 820   | 258 | 6         | 5 950 000                 | 13 300 000      | 340                        | —                              | 260    | 240/560CAME4     |
|                             | 920   | 280 | 7.5       | 7 850 000                 | 15 500 000      | 320                        | —                              | 240    | 231/560CAME4     |
|                             | 920   | 355 | 7.5       | 9 400 000                 | 19 600 000      | 190                        | —                              | 240    | 241/560CAME4     |
|                             | 1 030 | 365 | 9.5       | 10 900 000                | 20 500 000      | 240                        | —                              | 220    | 232/560CAME4     |

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

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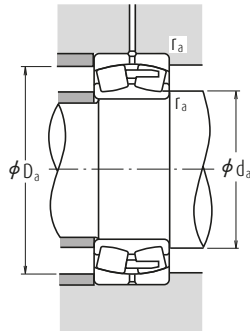
## Dynamic Equivalent Load $P = X F_r + Y F_a$

| $F_a/F_r \leq e$ |       | $F_a/F_r > e$ |       |
|------------------|-------|---------------|-------|
| 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.



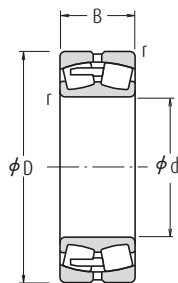
| Numbers          | Abutment and Fillet Dimensions<br>(mm) |      |       |      |       | Constant | Axial Load<br>Factors |       |       | Mass<br>(kg) |
|------------------|----------------------------------------|------|-------|------|-------|----------|-----------------------|-------|-------|--------------|
|                  | $d_a$                                  |      | $D_a$ |      | $r_a$ |          | $e$                   | $Y_2$ | $Y_3$ |              |
| Tapered Bore (1) | min.                                   | max. | max.  | min. | max.  |          |                       |       |       | approx.      |
| 23996CAMKE4      | 502                                    |      | 628   | 602  | 4     | 0.18     | 5.7                   | 3.8   | 3.7   | 121          |
| 23096CAMKE4      | 508                                    |      | 672   | 633  | 5     | 0.22     | 4.6                   | 3.1   | 3.0   | 211          |
| 24096CAMK30E4    | 508                                    |      | 672   | 625  | 5     | 0.30     | 3.4                   | 2.3   | 2.2   | 270          |
| 23196CAMKE4      | 516                                    |      | 754   | 688  | 6     | 0.31     | 3.3                   | 2.2   | 2.2   | 475          |
| 24196CAMK30E4    | 516                                    |      | 754   | 670  | 6     | 0.39     | 2.6                   | 1.7   | 1.7   | 567          |
| 23296CAMKE4      | 516                                    |      | 834   | 733  | 6     | 0.36     | 2.8                   | 1.9   | 1.8   | 795          |
| 239/500CAMKE4    | 522                                    |      | 648   | 622  | 4     | 0.17     | 6.0                   | 4.0   | 3.9   | 124          |
| 230/500CAMKE4    | 528                                    |      | 692   | 655  | 5     | 0.21     | 4.8                   | 3.2   | 3.1   | 220          |
| 240/500CAMK30E4  | 528                                    |      | 692   | 643  | 5     | 0.30     | 3.4                   | 2.3   | 2.2   | 276          |
| 231/500CAMKE4    | 536                                    |      | 794   | 720  | 6     | 0.31     | 3.2                   | 2.2   | 2.1   | 567          |
| 241/500CAMK30E4  | 536                                    |      | 794   | 703  | 6     | 0.39     | 2.6                   | 1.7   | 1.7   | 666          |
| 232/500CAMKE4    | 536                                    |      | 884   | 773  | 6     | 0.38     | 2.7                   | 1.8   | 1.8   | 969          |
| 239/530CAMKE4    | 552                                    |      | 688   | 659  | 4     | 0.17     | 6.0                   | 4.0   | 3.9   | 149          |
| 230/530CAMKE4    | 558                                    |      | 752   | 706  | 5     | 0.22     | 4.6                   | 3.1   | 3.0   | 298          |
| 240/530CAMK30E4  | 558                                    |      | 752   | 690  | 5     | 0.31     | 3.3                   | 2.2   | 2.2   | 390          |
| 231/530CAMKE4    | 566                                    |      | 834   | 758  | 6     | 0.30     | 3.3                   | 2.2   | 2.2   | 628          |
| 241/530CAMK30E4  | 566                                    |      | 834   | 740  | 6     | 0.38     | 2.6                   | 1.8   | 1.7   | 773          |
| 232/530CAMKE4    | 574                                    |      | 936   | 824  | 8     | 0.38     | 2.7                   | 1.8   | 1.7   | 1 170        |
| 239/560CAMKE4    | 582                                    |      | 728   | 697  | 4     | 0.16     | 6.1                   | 4.1   | 4.0   | 172          |
| 230/560CAMKE4    | 588                                    |      | 792   | 742  | 5     | 0.22     | 4.5                   | 3.0   | 2.9   | 344          |
| 240/560CAMK30E4  | 588                                    |      | 792   | 729  | 5     | 0.30     | 3.3                   | 2.2   | 2.2   | 440          |
| 231/560CAMKE4    | 596                                    |      | 884   | 804  | 6     | 0.30     | 3.4                   | 2.3   | 2.2   | 727          |
| 241/560CAMK30E4  | 596                                    |      | 884   | 782  | 6     | 0.39     | 2.6                   | 1.8   | 1.7   | 886          |
| 232/560CAMKE4    | 604                                    |      | 986   | 870  | 8     | 0.36     | 2.8                   | 1.9   | 1.8   | 1 320        |

**Remark** For the dimensions of adapters ( $d=470$  mm) and withdrawal sleeves, refer to Pages B383 and B389.

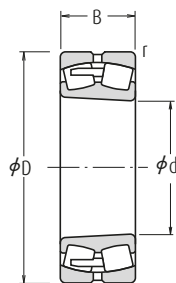
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## Bore Diameter 600 – 750 mm



Cylindrical Bore  
CA



Tapered Bore  
CA

| Boundary Dimensions<br>(mm) |       |     |           | Basic Load Ratings<br>(N) |                 | Thermal<br>Reference Speed | Speeds<br>(min <sup>-1</sup> ) |        | Bearing      |
|-----------------------------|-------|-----|-----------|---------------------------|-----------------|----------------------------|--------------------------------|--------|--------------|
| d                           | D     | B   | r<br>min. | C <sub>r</sub>            | C <sub>0r</sub> |                            | Limiting Speeds                |        |              |
|                             |       |     |           |                           |                 |                            | Mechanical                     | Grease |              |
| 600                         | 800   | 150 | 5         | 3 450 000                 | 8 100 000       | 450                        | —                              | 320    | 239/600CAME4 |
|                             | 870   | 200 | 6         | 5 450 000                 | 12 200 000      | 400                        | —                              | 300    | 230/600CAME4 |
|                             | 870   | 272 | 6         | 6 600 000                 | 15 100 000      | 300                        | —                              | 240    | 240/600CAME4 |
|                             | 980   | 300 | 7.5       | 8 750 000                 | 17 500 000      | 280                        | —                              | 220    | 231/600CAME4 |
|                             | 980   | 375 | 7.5       | 10 400 000                | 21 900 000      | 170                        | —                              | 220    | 241/600CAME4 |
| 630                         | 1 090 | 388 | 9.5       | 12 700 000                | 24 900 000      | 200                        | —                              | 200    | 232/600CAME4 |
|                             | 850   | 165 | 6         | 4 000 000                 | 9 350 000       | 400                        | —                              | 300    | 239/630CAME4 |
|                             | 920   | 212 | 7.5       | 5 900 000                 | 12 700 000      | 400                        | —                              | 280    | 230/630CAME4 |
|                             | 920   | 290 | 7.5       | 7 550 000                 | 17 700 000      | 280                        | —                              | 220    | 240/630CAME4 |
|                             | 1 030 | 315 | 7.5       | 9 600 000                 | 19 400 000      | 260                        | —                              | 200    | 231/630CAME4 |
| 670                         | 1 030 | 400 | 7.5       | 11 300 000                | 23 900 000      | 160                        | —                              | 200    | 241/630CAME4 |
|                             | 1 150 | 412 | 12        | 13 400 000                | 25 600 000      | 200                        | —                              | 180    | 232/630CAME4 |
|                             | 900   | 170 | 6         | 4 350 000                 | 10 300 000      | 380                        | —                              | 260    | 239/670CAME4 |
|                             | 980   | 230 | 7.5       | 6 850 000                 | 15 000 000      | 360                        | —                              | 240    | 230/670CAME4 |
|                             | 980   | 308 | 7.5       | 8 450 000                 | 19 500 000      | 260                        | —                              | 200    | 240/670CAME4 |
| 710                         | 1 090 | 336 | 7.5       | 10 600 000                | 21 600 000      | 240                        | —                              | 190    | 231/670CAME4 |
|                             | 1 090 | 412 | 7.5       | 12 400 000                | 26 500 000      | 150                        | —                              | 190    | 241/670CAME4 |
|                             | 1 220 | 438 | 12        | 14 900 000                | 28 700 000      | 180                        | —                              | 170    | 232/670CAME4 |
|                             | 950   | 180 | 6         | 4 800 000                 | 11 700 000      | 360                        | —                              | 240    | 239/710CAME4 |
|                             | 1 030 | 236 | 7.5       | 7 100 000                 | 15 800 000      | 340                        | —                              | 240    | 230/710CAME4 |
| 750                         | 1 030 | 315 | 7.5       | 8 850 000                 | 20 700 000      | 240                        | —                              | 190    | 240/710CAME4 |
|                             | 1 150 | 438 | 9.5       | 13 900 000                | 30 500 000      | 130                        | —                              | 170    | 241/710CAME4 |
|                             | 1 280 | 450 | 12        | 15 700 000                | 30 500 000      | 170                        | —                              | 160    | 232/710CAME4 |
|                             | 1 000 | 185 | 6         | 5 250 000                 | 12 800 000      | 320                        | —                              | 220    | 239/750CAME4 |
|                             | 1 090 | 250 | 7.5       | 7 750 000                 | 17 200 000      | 320                        | —                              | 220    | 230/750CAME4 |
|                             | 1 090 | 335 | 7.5       | 10 100 000                | 24 000 000      | 220                        | —                              | 180    | 240/750CAME4 |
|                             | 1 360 | 475 | 15        | 17 700 000                | 35 500 000      | 150                        | —                              | 140    | 232/750CAME4 |

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

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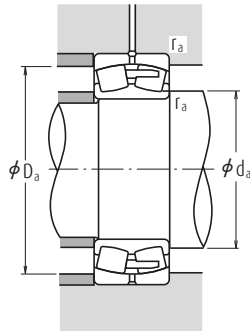
## Dynamic Equivalent Load $P = X F_r + Y F_a$

| $F_a/F_r \leq e$ |       | $F_a/F_r > e$ |       |
|------------------|-------|---------------|-------|
| 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.

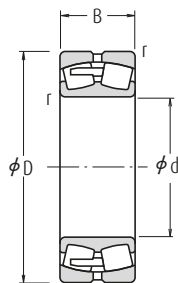


| Numbers         | Abutment and Fillet Dimensions<br>(mm) |      |       |       |       | Constant | Axial Load<br>Factors |       |       | Mass<br>(kg) |
|-----------------|----------------------------------------|------|-------|-------|-------|----------|-----------------------|-------|-------|--------------|
|                 | Tapered Bore (1)                       |      | $d_a$ |       | $r_a$ |          | $e$                   | $Y_2$ | $Y_3$ |              |
|                 | min.                                   | max. | max.  | min.  | max.  |          |                       |       |       |              |
| 239/600CAMKE4   | 622                                    |      | 778   | 745   | 4     | 0.17     | 5.9                   | 3.9   | 3.9   | 205          |
| 230/600CAMKE4   | 628                                    |      | 842   | 794   | 5     | 0.21     | 4.8                   | 3.3   | 3.2   | 389          |
| 240/600CAMK30E4 | 628                                    |      | 842   | 772   | 5     | 0.30     | 3.3                   | 2.2   | 2.2   | 529          |
| 231/600CAMKE4   | 636                                    |      | 944   | 856   | 6     | 0.30     | 3.4                   | 2.3   | 2.2   | 898          |
| 241/600CAMK30E4 | 636                                    |      | 944   | 836   | 6     | 0.39     | 2.6                   | 1.8   | 1.7   | 1 050        |
| 232/600CAMKE4   | 644                                    |      | 1 046 | 923   | 8     | 0.36     | 2.8                   | 1.9   | 1.8   | 1 590        |
| 239/630CAMKE4   | 658                                    |      | 822   | 786   | 5     | 0.18     | 5.6                   | 3.8   | 3.7   | 259          |
| 230/630CAMKE4   | 666                                    |      | 884   | 835   | 6     | 0.22     | 4.7                   | 3.1   | 3.1   | 468          |
| 240/630CAMK30E4 | 666                                    |      | 884   | 815   | 6     | 0.30     | 3.3                   | 2.2   | 2.2   | 637          |
| 231/630CAMKE4   | 666                                    |      | 994   | 900   | 6     | 0.30     | 3.4                   | 2.3   | 2.2   | 1 040        |
| 241/630CAMK30E4 | 666                                    |      | 994   | 876   | 6     | 0.38     | 2.7                   | 1.8   | 1.7   | 1 250        |
| 232/630CAMKE4   | 684                                    |      | 1 096 | 970   | 10    | 0.36     | 2.8                   | 1.9   | 1.8   | 1 850        |
| 239/670CAMKE4   | 698                                    |      | 872   | 836   | 5     | 0.17     | 5.8                   | 3.9   | 3.8   | 300          |
| 230/670CAMKE4   | 706                                    |      | 944   | 891   | 6     | 0.22     | 4.7                   | 3.1   | 3.1   | 571          |
| 240/670CAMK30E4 | 706                                    |      | 944   | 868   | 6     | 0.30     | 3.3                   | 2.2   | 2.2   | 773          |
| 231/670CAMKE4   | 706                                    |      | 1 054 | 952   | 6     | 0.30     | 3.3                   | 2.2   | 2.2   | 1 230        |
| 241/670CAMK30E4 | 706                                    |      | 1 054 | 934   | 6     | 0.37     | 2.7                   | 1.8   | 1.8   | 1 440        |
| 232/670CAMKE4   | 724                                    |      | 1 166 | 1 024 | 10    | 0.37     | 2.7                   | 1.8   | 1.8   | 2 210        |
| 239/710CAMKE4   | 738                                    |      | 922   | 883   | 5     | 0.17     | 5.8                   | 3.9   | 3.8   | 352          |
| 230/710CAMKE4   | 746                                    |      | 994   | 936   | 6     | 0.22     | 4.6                   | 3.1   | 3.0   | 647          |
| 240/710CAMK30E4 | 746                                    |      | 994   | 916   | 6     | 0.29     | 3.4                   | 2.3   | 2.2   | 861          |
| 241/710CAMK30E4 | 754                                    |      | 1 106 | 981   | 8     | 0.38     | 2.6                   | 1.8   | 1.7   | 1 730        |
| 232/710CAMKE4   | 764                                    |      | 1 226 | 1 080 | 10    | 0.36     | 2.8                   | 1.9   | 1.8   | 2 470        |
| 239/750CAMKE4   | 778                                    |      | 972   | 931   | 5     | 0.17     | 6.0                   | 4.1   | 4.0   | 398          |
| 230/750CAMKE4   | 786                                    |      | 1 054 | 990   | 6     | 0.22     | 4.6                   | 3.1   | 3.0   | 768          |
| 240/750CAMK30E4 | 786                                    |      | 1 054 | 969   | 6     | 0.29     | 3.4                   | 2.3   | 2.2   | 1 030        |
| 232/750CAMKE4   | 814                                    |      | 1 296 | 1 148 | 12    | 0.36     | 2.8                   | 1.9   | 1.8   | 2 980        |

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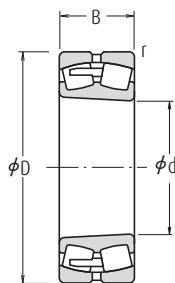
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## Bore Diameter 800 – 1400 mm



Cylindrical Bore

CA



Tapered Bore

CA

| Boundary Dimensions<br>(mm) |       |     |           | Basic Load Ratings<br>(N) |                 | Thermal<br>Reference Speed | Speeds<br>(min <sup>-1</sup> ) |        | Bearing          |
|-----------------------------|-------|-----|-----------|---------------------------|-----------------|----------------------------|--------------------------------|--------|------------------|
| d                           | D     | B   | r<br>min. | C <sub>r</sub>            | C <sub>0r</sub> |                            | Limiting Speeds                |        | Cylindrical Bore |
|                             |       |     |           |                           |                 |                            | Mechanical                     | Grease |                  |
| 800                         | 1 060 | 195 | 6         | 5 600 000                 | 13 700 000      | 300                        | —                              | 220    | 239/800CAME4     |
|                             | 1 150 | 258 | 7.5       | 8 350 000                 | 19 100 000      | 300                        | —                              | 200    | 230/800CAME4     |
|                             | 1 150 | 345 | 7.5       | 10 900 000                | 26 300 000      | 200                        | —                              | 160    | 240/800CAME4     |
|                             | 1 280 | 375 | 9.5       | 13 800 000                | 29 200 000      | 190                        | —                              | 150    | 231/800CAME4     |
|                             | 1 420 | 488 | 15        | 20 300 000                | 41 000 000      | 130                        | —                              | 130    | 232/800CAME4     |
| 850                         | 1 120 | 200 | 6         | 6 100 000                 | 15 200 000      | 280                        | —                              | 190    | 239/850CAME4     |
|                             | 1 220 | 272 | 7.5       | 9 300 000                 | 21 400 000      | 280                        | —                              | 180    | 230/850CAME4     |
|                             | 1 220 | 365 | 7.5       | 11 600 000                | 28 300 000      | 190                        | —                              | 150    | 240/850CAME4     |
|                             | 1 500 | 515 | 15        | 22 300 000                | 45 500 000      | 120                        | —                              | 120    | 232/850CAME4     |
|                             | 1 180 | 206 | 6         | 6 660 000                 | 16 700 000      | 260                        | —                              | 180    | 239/900CAME4     |
| 900                         | 1 280 | 280 | 7.5       | 9 850 000                 | 22 800 000      | 260                        | —                              | 160    | 230/900CAME4     |
|                             | 1 280 | 375 | 7.5       | 12 800 000                | 31 500 000      | 170                        | —                              | 140    | 240/900CAME4     |
|                             | 1 580 | 515 | 15        | 23 400 000                | 47 500 000      | 120                        | —                              | 110    | 232/900CAME4     |
|                             | 1 250 | 224 | 7.5       | 7 600 000                 | 19 900 000      | 240                        | —                              | 160    | 239/950CAME4     |
|                             | 1 360 | 300 | 7.5       | 11 300 000                | 26 500 000      | 240                        | —                              | 150    | 230/950CAME4     |
| 950                         | 1 360 | 412 | 7.5       | 14 500 000                | 36 500 000      | 160                        | —                              | 120    | 240/950CAME4     |
|                             | 1 660 | 530 | 15        | 24 700 000                | 50 500 000      | 110                        | —                              | 100    | 232/950CAME4     |
|                             | 1 320 | 236 | 7.5       | 8 200 000                 | 21 700 000      | 220                        | —                              | 150    | 239/1000CAME4    |
|                             | 1 420 | 308 | 7.5       | 11 900 000                | 28 100 000      | 220                        | —                              | 140    | 230/1000CAME4    |
|                             | 1 420 | 412 | 7.5       | 15 300 000                | 38 500 000      | 150                        | —                              | 110    | 240/1000CAME4    |
| 1 060                       | 1 400 | 250 | 7.5       | 9 300 000                 | 24 400 000      | 200                        | —                              | 130    | 239/1060CAME4    |
|                             | 1 500 | 325 | 9.5       | 13 000 000                | 31 500 000      | 200                        | —                              | 120    | 230/1060CAME4    |
|                             | 1 500 | 438 | 9.5       | 16 800 000                | 43 000 000      | 140                        | —                              | 100    | 240/1060CAME4    |
|                             | 1 580 | 345 | 9.5       | 15 400 000                | 38 000 000      | 180                        | —                              | 110    | 230/1120CAME4    |
|                             | 1 580 | 462 | 9.5       | 18 700 000                | 49 500 000      | 120                        | —                              | 95     | 240/1120CAME4    |
| 1 180                       | 1 660 | 475 | 9.5       | 20 200 000                | 52 500 000      | 120                        | —                              | 85     | 240/1180CAME4    |
|                             | 1 750 | 500 | 9.5       | 21 000 000                | 59 500 000      | 110                        | —                              | 75     | 240/1250CAME4    |
| 1 320                       | 1 850 | 530 | 12        | 22 600 000                | 63 500 000      | 100                        | —                              | 67     | 240/1320CAME4    |
| 1 400                       | 1 950 | 545 | 12        | 24 500 000                | 65 000 000      | 95                         | —                              | 60     | 240/1400CAME4    |

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

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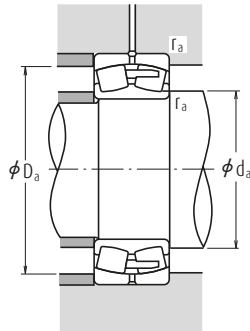
## Dynamic Equivalent Load $P = X F_r + Y F_a$

| $F_a/F_r \leq e$ |       | $F_a/F_r > e$ |       |
|------------------|-------|---------------|-------|
| 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<br>(mm) |      |                |       |                | Constant | Axial Load<br>Factors |                |                | Mass<br>(kg) |
|-------------------|----------------------------------------|------|----------------|-------|----------------|----------|-----------------------|----------------|----------------|--------------|
|                   | d <sub>a</sub>                         |      | D <sub>a</sub> |       | r <sub>a</sub> |          | Y <sub>2</sub>        | Y <sub>3</sub> | Y <sub>0</sub> |              |
| Tapered Bore (1°) | min.                                   | max. | max.           | min.  | max.           | e        |                       |                |                | approx.      |
| 239/800CAMKE4     | 828                                    |      | 1 032          | 987   | 5              | 0.17     | 6.0                   | 4.0            | 3.9            | 462          |
| 230/800CAMKE4     | 836                                    |      | 1 114          | 1 045 | 6              | 0.21     | 4.7                   | 3.2            | 3.1            | 870          |
| 240/800CAMK30E4   | 836                                    |      | 1 114          | 1 029 | 6              | 0.27     | 3.7                   | 2.5            | 2.5            | 1 130        |
| 231/800CAMKE4     | 844                                    |      | 1 236          | 1 127 | 8              | 0.28     | 3.6                   | 2.4            | 2.3            | 1 870        |
| 232/800CAMKE4     | 864                                    |      | 1 356          | 1 208 | 12             | 0.35     | 2.8                   | 1.9            | 1.9            | 3 250        |
| 239/850CAMKE4     | 878                                    |      | 1 092          | 1 046 | 5              | 0.16     | 6.2                   | 4.2            | 4.1            | 523          |
| 230/850CAMKE4     | 886                                    |      | 1 184          | 1 109 | 6              | 0.21     | 4.8                   | 3.2            | 3.1            | 1 020        |
| 240/850CAMK30E4   | 886                                    |      | 1 184          | 1 093 | 6              | 0.28     | 3.6                   | 2.4            | 2.4            | 1 350        |
| 232/850CAMKE4     | 914                                    |      | 1 436          | 1 274 | 12             | 0.35     | 2.8                   | 1.9            | 1.9            | 3 890        |
| 239/900CAMKE4     | 928                                    |      | 1 152          | 1 103 | 5              | 0.16     | 6.4                   | 4.3            | 4.2            | 591          |
| 230/900CAMKE4     | 936                                    |      | 1 244          | 1 169 | 6              | 0.20     | 4.9                   | 3.3            | 3.2            | 1 160        |
| 240/900CAMK30E4   | 936                                    |      | 1 244          | 1 147 | 6              | 0.28     | 3.6                   | 2.4            | 2.4            | 1 520        |
| 232/900CAMKE4     | 964                                    |      | 1 516          | 1 354 | 12             | 0.33     | 3.0                   | 2.0            | 2.0            | 4 300        |
| 239/950CAMKE4     | 986                                    |      | 1 214          | 1 169 | 6              | 0.16     | 6.3                   | 4.2            | 4.1            | 732          |
| 230/950CAMKE4     | 986                                    |      | 1 324          | 1 241 | 6              | 0.21     | 4.8                   | 3.2            | 3.2            | 1 400        |
| 240/950CAMK30E4   | 986                                    |      | 1 324          | 1 219 | 6              | 0.28     | 3.6                   | 2.4            | 2.3            | 1 880        |
| 232/950CAMKE4     | 1 014                                  |      | 1 596          | 1 428 | 12             | 0.32     | 3.1                   | 2.1            | 2.1            | 4 800        |
| 239/1000CAMKE4    | 1 036                                  |      | 1 284          | 1 229 | 6              | 0.16     | 6.4                   | 4.3            | 4.2            | 881          |
| 230/1000CAMKE4    | 1 036                                  |      | 1 384          | 1 298 | 6              | 0.20     | 4.9                   | 3.3            | 3.2            | 1 560        |
| 240/1000CAMK30E4  | 1 036                                  |      | 1 384          | 1 275 | 6              | 0.27     | 3.7                   | 2.5            | 2.4            | 2 010        |
| 239/1060CAMKE4    | 1 096                                  |      | 1 384          | 1 302 | 6              | 0.16     | 6.1                   | 4.1            | 4.0            | 1 030        |
| 230/1060CAMKE4    | 1 104                                  |      | 1 456          | 1 368 | 8              | 0.21     | 4.9                   | 3.3            | 3.2            | 1 790        |
| 240/1060CAMK30E4  | 1 104                                  |      | 1 456          | 1 346 | 8              | 0.28     | 3.6                   | 2.4            | 2.4            | 2 410        |
| 230/1120CAMKE4    | 1 164                                  |      | 1 536          | 1 444 | 8              | 0.20     | 5.0                   | 3.4            | 3.3            | 2 120        |
| 240/1120CAMK30E4  | 1 164                                  |      | 1 536          | 1 421 | 8              | 0.27     | 3.7                   | 2.5            | 2.5            | 2 790        |
| 240/1180CAMK30E4  | 1 224                                  |      | 1 616          | 1 494 | 8              | 0.27     | 3.7                   | 2.5            | 2.4            | 3 180        |
| 240/1250CAMK30E4  | 1 294                                  |      | 1 706          | 1 579 | 8              | 0.25     | 4.0                   | 2.7            | 2.6            | 3 700        |
| 240/1320CAMK30E4  | 1 374                                  |      | 1 796          | 1 656 | 10             | 0.26     | 3.9                   | 2.6            | 2.6            | 4 400        |
| 240/1400CAMK30E4  | 1 454                                  |      | 1 896          | 1 767 | 10             | 0.25     | 4.0                   | 2.7            | 2.6            | 4 900        |

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