

# Double-Row Ball Bearings Customised Ball Bearings





# Double-row ball bearings and customised ball bearings



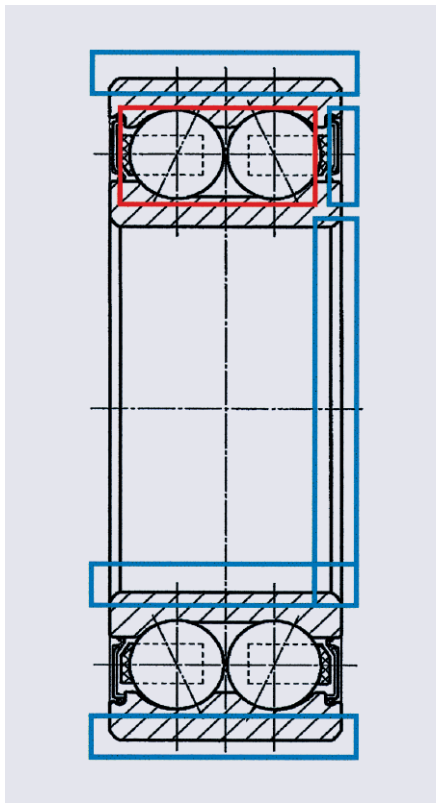
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## Flexible variation – solid precision

Everything is possible. NSK special bearings are manufactured according to your specific requirements. The only thing 'standard' with all our products is the NSK Quality.

**Internal design for load ratings:**  
DIN/ISO 76  
DIN/ISO 281



### OUTER RING ACCORDING TO CUSTOMER REQUIREMENTS

- Diameter
- Width
- With groove
- With bore/thread

#### Profile

- Spherical
- Gothic arch
- V-profile
- Groove turned or ground

### SEALS ACCORDING TO CUSTOMER REQUIREMENTS

#### Standard

- ZR/2ZR
- RSR/2RSR

#### Special solutions

- Multi-lipped
- Labyrinth seal
- Three-part sealing

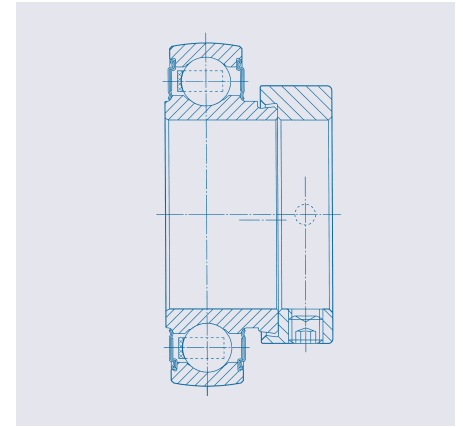
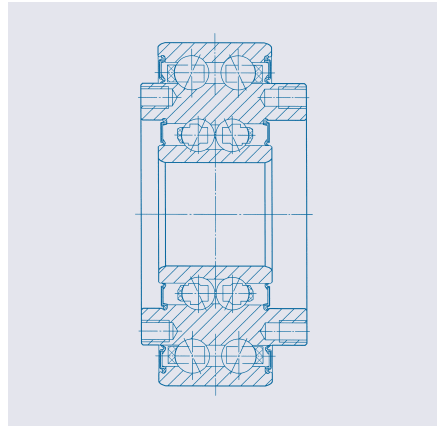
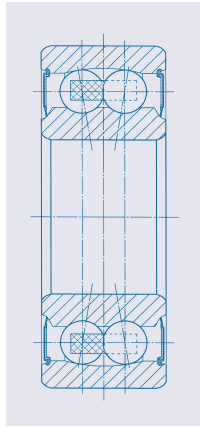
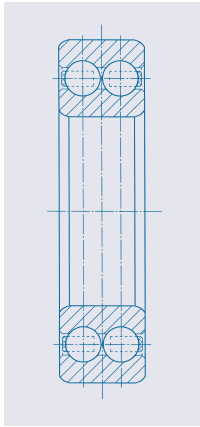
### INNER RING ACCORDING TO CUSTOMER REQUIREMENTS

#### Bore

- Diameter
- Cone
- Teeth
- Groove
- Thread

#### Width





### DOUBLE-ROW BALL BEARINGS

30 mm...180 mm external diameter  
(deep-groove, angular-contact and self-aligning ball bearings and various versions)

#### Deep-groove ball bearings in:

- WHEEL BEARINGS
- BELT-TENSIONERS
- FANS

#### Angular-contact ball bearings in:

- THE AUTOMOBILE INDUSTRY
- SHAFT ENCODERS
- GEARBOXES
- WOOD PROCESSING MACHINES
- COMPRESSORS
- MAST GUIDE ROLLERS
- PUMPS
- WHEEL BEARINGS
- BELT-TENSIONERS
- TACHOMETERS

#### Self-aligning ball bearings in:

- BLOWERS
- WOOD PROCESSING MACHINES
- AGRICULTURAL MACHINES
- EXTRACTION FANS
- TEXTILE MACHINES
- ROLLERS

### DOUBLE-ROW CUSTOMISED BALL BEARINGS

for applications such as the in-house design of double-row clutch-release bearings based on standard bearing or new designs:

- WIRE-STRAIGHTENING MACHINES
- ELECTROMAGNETIC CLUTCHES (FOR EXAMPLE)
- CONVEYOR EQUIPMENT
- LIFTING EQUIPMENT
- WOOD-PROCESSING MACHINES
- CHAIN PULLEYS
- PULLEYS
- PULLEYS FOR OVERHEAD CHAIN CONVEYORS
- LINEAR GUIDES
- ROPE PULLEYS
- ALL TYPES OF TENSION PULLEYS

### RADIAL INSERT BEARING WITH OUTER RING

for harvesting machines (special designs, suitable for applications where there is high exposure to contamination and for high-pressure cleaning)

- CONVEYOR BELTS
- HOUSED BEARING UNITS
- CHAIN CONVEYORS
- AGRICULTURAL MACHINES
- SUPPORT ROLLERS
- FANS





## Quality – made in Germany

Our products are manufactured in Germany to a high standard of quality and reliability, and our management system is certified in accordance with national and international standards. We take responsibility for our total process – when it comes to the environment, too: We take it for granted that raw materials and energy must be used efficiently and that waste must be reduced to the minimum.

Certification according to  
**ISO/TS 16949:2002** including  
**DIN EN ISO 9001:2000** and  
**DIN EN ISO 14001:2004**

Are you looking for something special? At NSK, you will find experts in all of our sales offices. When it comes to meeting your requirements – whether they are standard or special solutions - our staff are always at your service. The only thing we do not need to discuss is quality. With us, meeting the highest standards is the norm.



## Always at your service

### Europe

PETERLEE  
 COVENTRY  
 MAIDENHEAD  
 NEWARK  
 RATINGEN  
 STUTTGART  
 MUNDERKINGEN  
 PARIS  
 BARCELONA  
 TURIN  
 MILAN  
 WARSAW  
 KIELCE  
 WALBRZYCH  
 ISTANBUL

### Africa

JOHANNESBURG

### North America

MONTREAL  
 ANN ARBOR  
 FRANKLIN  
 PLAINFIELD  
 CLARINDA  
 MIAMI  
 SANTA FE SPRINGS  
 VANCOUVER

### South America

BUENOS AIRES  
 SUZANO  
 SAO PAULO  
 MEXICO CITY

### New Zealand Australia

AUCKLAND  
 SYDNEY  
 BRISBANE  
 MELBOURNE  
 ADELAIDE  
 PERTH

### Asia

HONG KONG  
 BEIJING  
 SHANGHAI  
 KUNSHAN  
 SEOUL  
 TOKYO  
 FUJISAWA  
 TAIPEH  
 MANILA  
 HANOI  
 BANGKOK  
 KUALA LUMPUR  
 SINGAPORE  
 JAKARTA



| BASIC TYPES       | OPEN | ZR | 2ZR | RSR | 2RSR | N<br>NR | K | TNG-CAGE | J-CAGE | C2<br>C3 |
|-------------------|------|----|-----|-----|------|---------|---|----------|--------|----------|
| 1201 – 1203       | ●    |    |     |     |      |         |   | ●        | ○      | ●        |
| 1204 – 1213       | ●    |    |     |     |      |         | ● | ●        | ○      | ●        |
| 1214              | ○    |    |     |     |      |         | ○ | ○        | ○      | ○        |
| 1215              | ●    |    |     |     |      |         | ● | ●        | ○      | ●        |
| 1302 – 1303       | ●    |    |     |     |      |         |   | ●        | ○      | ●        |
| 1304 – 1311       | ●    |    |     |     |      |         | ● | ●        | ○      | ●        |
| 1312              | ●    |    |     |     |      |         | ● |          | ●      | ●        |
| 2201 – 2203       | ●    |    |     |     | ●    |         |   | ●        | ○      | ●        |
| 2204 – 2213       | ●    |    |     |     | ●    |         | ● | ●        | ○      | ●        |
| 2302 – 2303       | ●    |    |     |     | ●    |         |   | ●        | ○      | ●        |
| 2304              | ●    |    |     |     |      |         | ● |          | ●      | ●        |
| 2304              | ●    |    |     |     | ●    |         |   | ●        |        | ●        |
| 2305 – 2313       | ●    |    |     |     | ●    |         | ● | ●        | ○      | ●        |
| 2314              | ●    |    |     |     |      |         | ● |          | ●      | ●        |
| 11204 – 11212     | ●    |    |     |     |      |         |   | ●        | ○      | ●        |
| 11305 – 11310     | ●    |    |     |     |      |         |   | ●        | ○      | ●        |
| 11504 – 11510     | ●    |    |     |     |      |         |   | ●        | ○      | ●        |
| 3200B – 3218B     | ●    | ●  | ●   | ●   | ●    | ●       |   | ●        |        | ●        |
| 3301B – 3315B     | ●    | ●  | ●   | ●   | ●    | ●       |   | ●        |        | ●        |
| 3200 – 3214       | ○    |    |     |     |      | ○       |   |          | ○      | ○        |
| 3302 – 3313       | ○    |    |     |     |      | ○       |   |          | ○      | ○        |
| 3314              | ●    |    |     |     |      | ●       |   |          | ●      | ●        |
| LB3200B – LB3207B |      |    | ●   |     | ●    |         |   | ●        |        |          |
| LZ3200B – LZ3207B |      |    | ●   |     | ●    |         |   | ●        |        |          |
| 4200 – 4218       | ●    |    |     |     |      |         |   | ●        | ○      | ●        |
| 4302 – 4315       | ●    |    |     |     |      |         |   | ●        | ○      | ●        |

● Special bearings on enquiry  
 ● Standard  
 ○ on enquiry

# Self-aligning ball bearings

Self-aligning ball bearings are double-row bearings with a spherical outer ring raceway. The bearings therefore facilitate angle adjustment and are suitable for compensating for angular misalignment.

Self-aligning ball bearings are manufactured with cylindrical and tapered bores. The bearings with tapered bore are predominantly fitted to shafts with adapter sleeves. The cages of these bearings are normally made of glass-fibre reinforced Polyamide 66. Bearings with these cages are marked with the designation "TNG". The cages of some of the small bearings are made of Polyamide 66 without glass-fibre reinforcement. These are marked with the designation "TN".

A very few bearings (Version J) are mass produced with cages made of pressed steel. The bearings which are normally fitted with plastic cages are also available on request with cages made of pressed steel "J".

Series 22.. and 23.. self-aligning bearings are also available sealed on both sides. These bearings are marked with the designation "2RS".

## Standards, dimensions

The external dimensions of self-aligning ball bearings are laid down in ISO R15 or DIN 630.

## Tolerances

The bearings are only manufactured to the standard tolerance P0.

## Bearing clearance

Self-aligning bearings with cylindrical bores are normally manufactured with standard radial clearance C0 and those with a tapered bore with radial clearance C3. Bearings with other clearances are available on enquiry.

The clearances can be found in the table below.

Radial bearing clearance of self-aligning ball bearings with cylindrical bore without load according to DIN 620, Part 4

| Rated size of bore (mm) | above | 6  | 10 | 14 | 18 | 24 | 30 | 40 | 50 |
|-------------------------|-------|----|----|----|----|----|----|----|----|
|                         | up to | 10 | 14 | 18 | 24 | 30 | 40 | 50 | 65 |
| C2                      | min.  | 2  | 2  | 3  | 4  | 5  | 6  | 6  | 7  |
|                         | max.  | 9  | 10 | 12 | 14 | 16 | 18 | 19 | 21 |
| C0 Standard             | min.  | 6  | 6  | 8  | 10 | 11 | 13 | 14 | 16 |
|                         | max.  | 17 | 19 | 21 | 23 | 24 | 29 | 31 | 36 |
| C3                      | min.  | 12 | 13 | 15 | 17 | 19 | 23 | 25 | 30 |
|                         | max.  | 25 | 26 | 28 | 30 | 35 | 40 | 44 | 50 |
| C4                      | min.  | 19 | 21 | 23 | 25 | 29 | 34 | 37 | 45 |
|                         | max.  | 33 | 35 | 37 | 39 | 46 | 53 | 57 | 69 |
| C5                      | min.  | 27 | 30 | 32 | 34 | 40 | 46 | 50 | 62 |
|                         | max.  | 42 | 48 | 50 | 52 | 58 | 66 | 71 | 88 |

Bearing clearances in µm



Radial bearing clearance of self-aligning ball bearings with tapered bore without load according to DIN 620, Part 4

| Rated size of bore (mm) | above | 18 | 24 | 30 | 40 | 50 |
|-------------------------|-------|----|----|----|----|----|
|                         | up to | 24 | 30 | 40 | 50 | 65 |
| C2                      | min.  | 7  | 9  | 12 | 14 | 18 |
|                         | max.  | 17 | 20 | 24 | 27 | 32 |
| C0                      | min.  | 13 | 15 | 19 | 22 | 27 |
|                         | max.  | 26 | 28 | 35 | 39 | 47 |
| C3 Standard             | min.  | 20 | 23 | 29 | 33 | 41 |
|                         | max.  | 33 | 39 | 46 | 52 | 61 |
| C4                      | min.  | 28 | 33 | 40 | 45 | 56 |
|                         | max.  | 42 | 50 | 59 | 65 | 80 |
| C5                      | min.  | 37 | 44 | 52 | 58 | 73 |
|                         | max.  | 55 | 62 | 72 | 79 | 99 |

Bearing clearances in  $\mu\text{m}$ 

**Seals** NSK manufactures Series 22.. and 23.. self-aligning ball bearings, not only open version but also with seals on both sides of the bearing. These seals are made of nitrile rubber and are reinforced with a steel disc embedded in the rubber. The seals are fixed in the outer ring and seal against the inner ring with a friction sealing lip.

Sealed self-aligning ball bearings are filled with enough grease at the factory to last the normal life span of the bearing. The bearings are therefore maintenance free. Note that sealed self-aligning bearings have a lower load-carrying capacity than open bearings of the same type. During installation, it is essential that they are not twisted, as otherwise the seals may be forced out of position.

**Angle adjustment facility** Self-aligning bearings facilitate angle adjustment. The permitted angle of tilt from the central position for Series 12.. and 22.. open bearings is  $2.5^\circ$  and for Series 13.. and 23.. is  $3^\circ$ . With sealed bearings, the permitted angle of tilt is  $1.5^\circ$ .

**Dynamic equivalent bearing load**  $P = F_r + Y_1 \cdot F_a$  [kN] for  $F_a/F_r \leq e$   
 $P = 0.65 \cdot F_r + Y_2 \cdot F_a$  [kN] for  $F_a/F_r > e$   
 The factors  $e$ ,  $Y_1$  and  $Y_2$  can be found in the bearing tables.

**Basic rating life**  $L_h = \frac{1,000,000}{n \cdot 60} \cdot \left(\frac{C}{P}\right)^3$  (Running hours)  
 $f_h = f_n \cdot \left(\frac{C}{P}\right)$  (Factors  $f_h$  and  $f_n$ , see tables on Page 39)

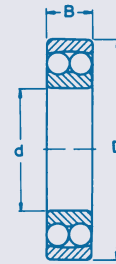
**Static equivalent bearing load**  $P_0 = F_r + Y_0 \cdot F_a$  [kN]  
 The factor  $Y_0$  can be found in the bearing tables.

**Basic static load rating**  $S_0 = \left(\frac{C_0}{P_0}\right)$

# Self-aligning ball bearings

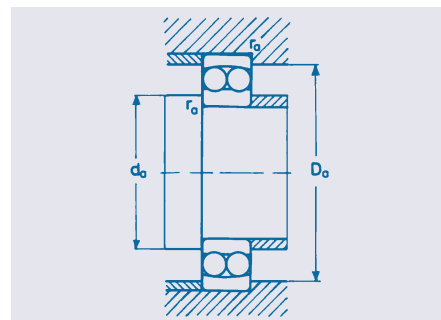
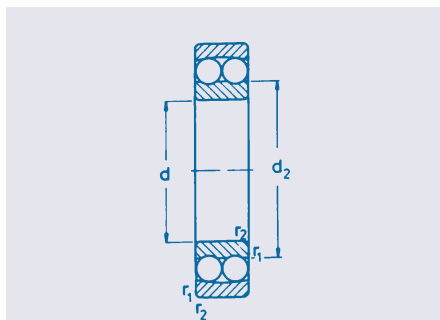
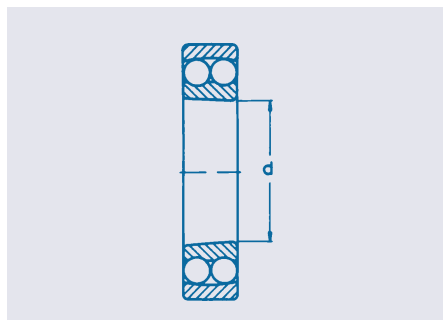
Cylindrical bore

Bore 10 – 35 mm



| Dimensions |    |    |                         | Abbreviation for |              | Load ratings |                         | Speed limits      |        |
|------------|----|----|-------------------------|------------------|--------------|--------------|-------------------------|-------------------|--------|
| d          | D  | B  | r <sub>1,2</sub><br>min | cylindrical bore | Tapered bore | dyn.<br>C    | stat.<br>C <sub>0</sub> | Grease            | Oil    |
| mm         |    |    |                         |                  |              | kN           |                         | min <sup>-1</sup> |        |
| 10         | 30 | 9  | 0.6                     | 1200TN           | —            | 5.50         | 1.53                    | 24,000            | 30,000 |
|            | 30 | 14 | 0.6                     | 2200TN           | —            | 7.20         | 2.04                    | 24,000            | 30,000 |
| 12         | 32 | 10 | 0.6                     | 1201TNG          | —            | 5.60         | 1.27                    | 24,000            | 30,000 |
|            | 32 | 14 | 0.6                     | 2201ETNG         | —            | 9.00         | 1.96                    | 20,000            | 26,000 |
|            | 37 | 12 | 1.0                     | 1301TN           | —            | 9.50         | 2.16                    | 18,000            | 22,000 |
| 15         | 35 | 11 | 0.6                     | 1202TNG          | —            | 7.50         | 1.76                    | 20,000            | 26,000 |
|            | 35 | 14 | 0.6                     | 2202ETNG         | —            | 9.15         | 2.08                    | 19,000            | 24,000 |
|            | 42 | 13 | 1.0                     | 1302TN           | —            | 9.50         | 2.28                    | 17,000            | 20,000 |
|            | 42 | 17 | 1.0                     | 2302ETNG         | —            | 12.00        | 2.90                    | 16,000            | 19,000 |
| 17         | 40 | 12 | 0.6                     | 1203TNG          | —            | 8.00         | 2.04                    | 18,000            | 22,000 |
|            | 40 | 16 | 0.6                     | 2203ETNG         | —            | 11.40        | 2.75                    | 16,000            | 19,000 |
|            | 47 | 14 | 1.0                     | 1303TN           | —            | 12.50        | 3.20                    | 15,000            | 18,000 |
|            | 47 | 19 | 1.0                     | 2303TN           | —            | 14.30        | 3.55                    | 14,000            | 17,000 |
| 20         | 47 | 14 | 1.0                     | 1204TNG          | 1204KTNGC3   | 10.00        | 2.65                    | 15,000            | 18,000 |
|            | 47 | 18 | 1.0                     | 2204ETNG         | 2204EKTNGC3  | 14.30        | 3.55                    | 14,000            | 17,000 |
|            | 52 | 15 | 1.1                     | 1304TNG          | 1304KTNGC3   | 12.50        | 3.35                    | 13,000            | 16,000 |
|            | 52 | 21 | 1.1                     | 2304J            | 2304KJC3     | 18.00        | 4.65                    | 13,000            | 16,000 |
| 25         | 52 | 15 | 1.0                     | 1205TNG          | 1205KTNGC3   | 12.20        | 3.35                    | 13,000            | 16,000 |
|            | 52 | 18 | 1.0                     | 2205ETNG         | 2205EKTNGC3  | 17.00        | 4.40                    | 12,000            | 15,000 |
|            | 62 | 17 | 1.1                     | 1305TNG          | 1305KTNGC3   | 18.00        | 5.00                    | 11,000            | 14,000 |
|            | 62 | 24 | 1.1                     | 2305TNG          | 2305KTNGC3   | 24.50        | 6.55                    | 10,000            | 13,000 |
| 30         | 62 | 16 | 1.0                     | 1206TNG          | 1206KTNGC3   | 15.60        | 4.65                    | 11,000            | 14,000 |
|            | 62 | 20 | 1.0                     | 2206ETNG         | 2206EKTNGC3  | 25.50        | 6.95                    | 9,500             | 12,000 |
|            | 72 | 19 | 1.1                     | 1306TNG          | 1306KTNGC3   | 21.20        | 6.30                    | 9,000             | 11,000 |
|            | 72 | 27 | 1.1                     | 2306TNG          | 2306KTNGC3   | 31.50        | 8.65                    | 8,500             | 10,000 |
| 35         | 72 | 17 | 1.1                     | 1207TNG          | 1207KTNGC3   | 16.00        | 5.20                    | 9,500             | 12,000 |
|            | 72 | 23 | 1.1                     | 2207ETNG         | 2207EKTNGC3  | 32.00        | 9.00                    | 8,000             | 9,500  |
|            | 80 | 21 | 1.5                     | 1307TNG          | 1307KTNGC3   | 25.00        | 8.00                    | 8,000             | 9,500  |
|            | 80 | 31 | 1.5                     | 2307TNG          | 2307KTNGC3   | 39.00        | 11.20                   | 7,500             | 9,000  |

Tapered bore (Taper 1:12)

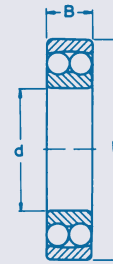


| Abutment dimensions |              |              | Factors |                         |                      |       | Weight    | Abbreviation |
|---------------------|--------------|--------------|---------|-------------------------|----------------------|-------|-----------|--------------|
| $d_a$<br>min        | $D_a$<br>max | $r_a$<br>max | e       | $Y_1$<br>$Fa/Fr \leq e$ | $Y_2$<br>$Fa/fr > e$ | $Y_0$ | $\approx$ |              |
| mm                  |              |              |         |                         |                      |       | kg        |              |
| 14.0                | 26.0         | 0.6          | 0.32    | 2.0                     | 3.00                 | 2.1   | 0.034     | 1200TN       |
| 14.0                | 26.0         | 0.6          | 0.66    | 1.0                     | 1.50                 | 1.0   | 0.047     | 2200TN       |
| 16.0                | 28.0         | 0.6          | 0.37    | 1.7                     | 2.60                 | 1.8   | 0.040     | 1201TNG      |
| 16.0                | 28.0         | 0.6          | 0.53    | 1.2                     | 1.85                 | 1.3   | 0.053     | 2201ETNG     |
| 17.0                | 32.0         | 1.0          | 0.35    | 1.8                     | 2.80                 | 1.9   | 0.067     | 1301TN       |
| 19.0                | 31.0         | 0.6          | 0.34    | 1.9                     | 2.90                 | 2.0   | 0.049     | 1202TNG      |
| 19.0                | 31.0         | 0.6          | 0.46    | 1.4                     | 2.10                 | 1.4   | 0.060     | 2202ETNG     |
| 20.0                | 37.0         | 1.0          | 0.35    | 1.8                     | 2.80                 | 1.9   | 0.094     | 1302TN       |
| 20.0                | 37.0         | 1.0          | 0.51    | 1.2                     | 1.90                 | 1.3   | 0.110     | 2302ETNG     |
| 21.0                | 36.0         | 0.6          | 0.33    | 1.9                     | 3.00                 | 2.0   | 0.073     | 1203TNG      |
| 21.0                | 36.0         | 0.6          | 0.46    | 1.4                     | 2.10                 | 1.4   | 0.088     | 2203ETNG     |
| 22.0                | 42.0         | 1.0          | 0.32    | 1.9                     | 3.00                 | 2.0   | 0.130     | 1303TN       |
| 22.0                | 42.0         | 1.0          | 0.53    | 1.2                     | 1.90                 | 1.3   | 0.160     | 2303TN       |
| 25.0                | 42.0         | 1.0          | 0.28    | 2.2                     | 3.50                 | 2.3   | 0.120     | 1204TNG      |
| 25.0                | 42.0         | 1.0          | 0.44    | 1.5                     | 2.20                 | 1.5   | 0.140     | 2204ETNG     |
| 26.5                | 45.5         | 1.0          | 0.29    | 2.2                     | 3.30                 | 2.3   | 0.160     | 1304TNG      |
| 26.5                | 45.5         | 1.0          | 0.51    | 1.2                     | 1.90                 | 1.3   | 0.210     | 2304J        |
| 30.0                | 47.0         | 1.0          | 0.27    | 2.4                     | 3.70                 | 2.5   | 0.140     | 1205TNG      |
| 30.0                | 47.0         | 1.0          | 0.35    | 1.8                     | 2.80                 | 1.9   | 0.160     | 2205ETNG     |
| 31.5                | 55.5         | 1.0          | 0.28    | 2.3                     | 3.50                 | 2.4   | 0.260     | 1305TNG      |
| 31.5                | 55.5         | 1.0          | 0.48    | 1.3                     | 2.00                 | 1.4   | 0.340     | 2305TTNG     |
| 35.0                | 57.0         | 1.0          | 0.25    | 2.5                     | 3.90                 | 2.7   | 0.220     | 1206TNG      |
| 35.0                | 57.0         | 1.0          | 0.30    | 2.1                     | 3.30                 | 2.2   | 0.260     | 2206ETNG     |
| 36.5                | 65.5         | 1.0          | 0.26    | 2.4                     | 3.70                 | 2.5   | 0.390     | 1306TNG      |
| 36.5                | 65.5         | 1.0          | 0.45    | 1.4                     | 2.20                 | 1.5   | 0.500     | 2306TNG      |
| 41.5                | 65.5         | 1.0          | 0.22    | 2.8                     | 4.30                 | 2.9   | 0.320     | 1207TNG      |
| 41.5                | 65.5         | 1.0          | 0.30    | 2.1                     | 3.30                 | 2.2   | 0.400     | 2207ETNG     |
| 43.0                | 72.0         | 1.5          | 0.26    | 2.5                     | 3.80                 | 2.6   | 0.510     | 1307TNG      |
| 43.0                | 72.0         | 1.5          | 0.47    | 1.4                     | 2.10                 | 1.4   | 0.680     | 2307TNG      |

# Self-aligning ball bearings

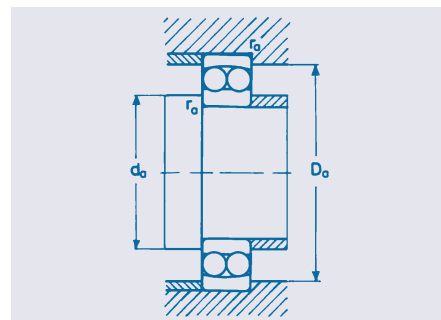
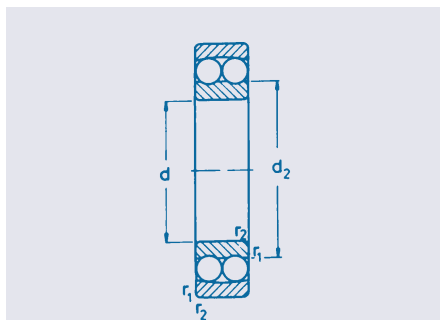
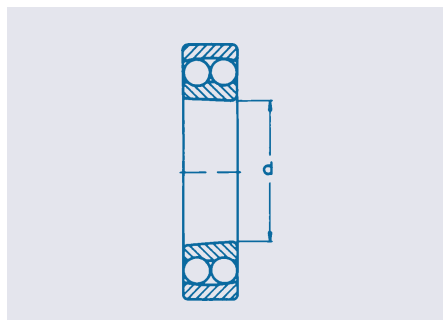
Cylindrical bore

Bore 40 – 75 mm



| Dimensions |     |    |                         | Abbreviation for |              | Load ratings |                         | Speed limits      |        |
|------------|-----|----|-------------------------|------------------|--------------|--------------|-------------------------|-------------------|--------|
| d          | D   | B  | r <sub>1,2</sub><br>min | cylindrical bore | Tapered bore | dyn.<br>C    | stat.<br>C <sub>0</sub> | Grease            | Oil    |
| mm         |     |    |                         |                  |              | kN           |                         | min <sup>-1</sup> |        |
| 40         | 80  | 18 | 1.1                     | 1208TNG          | 1208KTNGC3   | 19.30        | 6.55                    | 8,500             | 10,000 |
|            | 80  | 23 | 1.1                     | 2208ETNG         | 2208EKTNGC3  | 31.50        | 9.50                    | 7,500             | 9,000  |
|            | 90  | 23 | 1.5                     | 1308TNG          | 1308KTNGC3   | 29.00        | 9.65                    | 7,000             | 8,500  |
|            | 90  | 33 | 1.5                     | 2308TNG          | 2308KTNGC3   | 45.00        | 13.40                   | 6,700             | 8,000  |
| 45         | 85  | 19 | 1.1                     | 1209TNG          | 1209KTNGC3   | 22.00        | 7.35                    | 7,500             | 9,000  |
|            | 85  | 23 | 1.1                     | 2209ETNG         | 2209EKTNGC3  | 28.00        | 9.00                    | 7,000             | 8,500  |
|            | 100 | 25 | 1.5                     | 1309TNG          | 1309KTNGC3   | 38.00        | 12.90                   | 6,300             | 7,500  |
|            | 100 | 36 | 1.5                     | 2309TNG          | 2309KTNGC3   | 54.00        | 16.30                   | 6,000             | 7,000  |
| 50         | 90  | 20 | 1.1                     | 1210TNG          | 1210KTNGC3   | 22.80        | 8.15                    | 7,000             | 8,500  |
|            | 90  | 23 | 1.1                     | 2210ETNG         | 2210EKTNGC3  | 28.00        | 9.50                    | 6,700             | 8,000  |
|            | 110 | 27 | 2.0                     | 1310TNG          | 1310KTNGC3   | 41.50        | 14.30                   | 5,600             | 6,700  |
|            | 110 | 40 | 2.0                     | 2310TNG          | 2310KTNGC3   | 64.00        | 20.00                   | 5,300             | 6,300  |
| 55         | 100 | 21 | 1.5                     | 1211TNG          | 1211KTNGC3   | 27.00        | 10.00                   | 6,300             | 7,500  |
|            | 100 | 25 | 1.5                     | 2211ETNG         | 2211EKTNGC3  | 39.00        | 12.70                   | 5,600             | 6,700  |
|            | 120 | 29 | 2.0                     | 1311TNG          | 1311KTNGC3   | 51.00        | 18.00                   | 5,000             | 6,000  |
|            | 120 | 43 | 2.0                     | 2311TNG          | 2311KTNGC3   | 75.00        | 23.60                   | 4,800             | 5,600  |
| 60         | 110 | 22 | 1.5                     | 1212TNG          | 1212KTNGC3   | 30.00        | 11.60                   | 5,600             | 6,700  |
|            | 110 | 28 | 1.5                     | 2212ETNG         | 2212EKTNGC3  | 47.50        | 16.60                   | 5,300             | 6,300  |
|            | 130 | 31 | 2.0                     | 1312J            | 1312KJC3     | 57.50        | 20.80                   | 4,800             | 5,600  |
|            | 130 | 46 | 2.0                     | 2312J            | 2312KJC3     | 88.50        | 28.30                   | 4,300             | 5,300  |
| 65         | 120 | 23 | 1.5                     | 1213TNG          | 1213KTNGC3   | 31.00        | 12.50                   | 5,300             | 6,300  |
|            | 120 | 31 | 1.5                     | 2213ETNG         | 2213EKTNGC3  | 57.00        | 19.30                   | 4,500             | 5,300  |
|            | 140 | 33 | 2.1                     | 1313J            | 1313KTNGC3   | 62.50        | 22.90                   | 4,300             | 5,300  |
|            | 140 | 48 | 2.1                     | 2313J            | 2313KTNGC3   | 96.50        | 32.50                   | 4,000             | 4,800  |
| 70         | 125 | 24 | 1.5                     | 1214TNG          | —            | 34.50        | 13.70                   | 5,000             | 6,000  |
|            | 125 | 31 | 1.5                     | 2214J            | —            | 44.00        | 17.10                   | 4,500             | 5,600  |
|            | 150 | 35 | 2.1                     | 1314J            | —            | 67.50        | 25.10                   | 4,000             | 5,000  |
|            | 150 | 51 | 2.1                     | 2314J            | —            | 111.00       | 37.50                   | 3,600             | 4,300  |
| 75         | 130 | 25 | 1.5                     | 1215TNG          | 1215KTNGC3   | 39.00        | 15.60                   | 4,800             | 5,600  |
|            | 130 | 31 | 1.5                     | 2215J            | 2215KJC3     | 44.50        | 17.80                   | 4,300             | 5,300  |
|            | 160 | 37 | 2.1                     | 1315J            | 1315KJC3     | 80.00        | 30.00                   | 3,800             | 4,500  |
|            | 160 | 55 | 2.1                     | 2315J            | 2315KJC3     | 125.00       | 43.00                   | 3,400             | 4,300  |

Tapered bore (Taper 1:12)

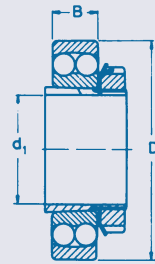


| Abutment dimensions |              |              | Factors |                         |                      |       | Weight    | Abbreviation |
|---------------------|--------------|--------------|---------|-------------------------|----------------------|-------|-----------|--------------|
| $d_a$<br>min        | $D_a$<br>max | $r_a$<br>max | e       | $Y_1$<br>$Fa/Fr \leq e$ | $Y_2$<br>$Fa/fr > e$ | $Y_0$ | $\approx$ |              |
| mm                  |              |              |         |                         |                      |       | kg        |              |
| 46.5                | 73.5         | 1.0          | 0.22    | 2.9                     | 4.5                  | 3.0   | 0.42      | 1208TNG      |
| 46.5                | 73.5         | 1.0          | 0.26    | 2.4                     | 3.8                  | 2.5   | 0.51      | 2208ETNG     |
| 48.0                | 82.0         | 1.5          | 0.25    | 2.5                     | 3.9                  | 2.6   | 0.72      | 1308TNG      |
| 48.0                | 82.0         | 1.5          | 0.43    | 1.5                     | 2.3                  | 1.5   | 0.93      | 1208TNG      |
| 51.5                | 78.5         | 1.0          | 0.21    | 3.0                     | 4.7                  | 3.2   | 0.47      | 1209TNG      |
| 51.5                | 78.5         | 1.0          | 0.26    | 2.4                     | 3.8                  | 2.5   | 0.55      | 2209ETNG     |
| 53.0                | 92.0         | 1.5          | 0.25    | 2.5                     | 3.9                  | 2.6   | 0.96      | 1309TNG      |
| 53.0                | 92.0         | 1.5          | 0.43    | 1.5                     | 2.3                  | 1.6   | 1.25      | 2309TNG      |
| 56.5                | 83.5         | 1.0          | 0.19    | 3.2                     | 4.9                  | 3.3   | 0.53      | 1210TNG      |
| 56.5                | 83.5         | 1.0          | 0.22    | 2.6                     | 4.1                  | 3.7   | 0.59      | 2210ETNG     |
| 59.0                | 101.0        | 2.0          | 0.24    | 2.6                     | 4.0                  | 2.7   | 1.20      | 1310TNG      |
| 59.0                | 101.0        | 2.0          | 0.43    | 1.5                     | 2.3                  | 1.5   | 1.65      | 2310TNG      |
| 63.0                | 92.0         | 1.5          | 0.19    | 3.3                     | 5.1                  | 3.5   | 0.71      | 1211TNG      |
| 63.0                | 92.0         | 1.5          | 0.22    | 2.9                     | 4.5                  | 2.1   | 0.81      | 2211ETNG     |
| 64.0                | 111.0        | 2.0          | 0.24    | 2.7                     | 4.1                  | 2.8   | 1.60      | 1311TNG      |
| 64.0                | 111.0        | 2.0          | 0.42    | 1.5                     | 2.3                  | 1.6   | 2.10      | 2311TNG      |
| 68.5                | 101.5        | 1.5          | 0.18    | 3.5                     | 5.4                  | 3.6   | 0.90      | 1212TNG      |
| 68.5                | 101.5        | 1.5          | 0.23    | 2.7                     | 4.2                  | 2.8   | 1.10      | 2212ETNG     |
| 72.0                | 118.0        | 2.0          | 0.23    | 2.8                     | 4.3                  | 2.9   | 1.95      | 1312TNG      |
| 72.0                | 118.0        | 2.0          | 0.40    | 1.6                     | 2.4                  | 1.7   | 2.60      | 2312TNG      |
| 73.0                | 112.0        | 1.5          | 0.18    | 3.6                     | 5.5                  | 3.7   | 1.15      | 1213TNG      |
| 73.0                | 112.0        | 1.5          | 0.23    | 2.8                     | 4.3                  | 2.9   | 1.45      | 2213ETNG     |
| 76.0                | 128.0        | 2.0          | 0.23    | 2.8                     | 4.3                  | 2.9   | 2.45      | 1313J        |
| 76.0                | 128.0        | 2.0          | 0.39    | 1.6                     | 2.5                  | 1.7   | 3.25      | 2313J        |
| 78.0                | 116.5        | 1.5          | 0.19    | 3.3                     | 5.1                  | 3.5   | 1.25      | 1214TNG      |
| 78.0                | 116.5        | 1.5          | 0.26    | 2.4                     | 3.7                  | 2.5   | 1.50      | 2214J        |
| 81.0                | 138.0        | 2.0          | 0.22    | 2.8                     | 4.4                  | 3.0   | 3.00      | 1314J        |
| 81.0                | 138.0        | 2.0          | 0.38    | 1.7                     | 2.6                  | 1.8   | 4.25      | 2314J        |
| 83.5                | 121.5        | 1.5          | 0.17    | 3.6                     | 5.6                  | 3.8   | 1.35      | 1215TNG      |
| 83.5                | 121.5        | 1.5          | 0.25    | 2.5                     | 3.9                  | 2.6   | 1.60      | 2215J        |
| 87.0                | 148.0        | 2.0          | 0.22    | 2.8                     | 4.4                  | 3.0   | 3.55      | 1315J        |
| 87.0                | 148.0        | 2.0          | 0.38    | 1.6                     | 2.6                  | 1.7   | 5.15      | 2315J        |

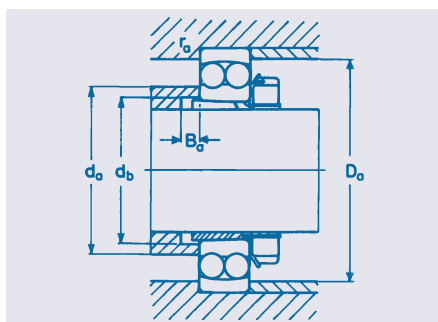
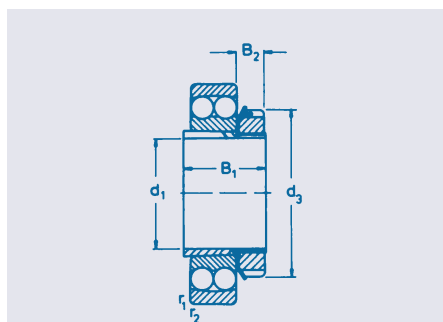


# Self-aligning ball bearings

With adapter sleeve  
Shaft 17 – 50 mm



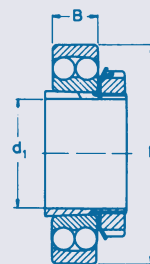
| Dimensions     |     |    |                  | Abbreviation |        | Load ratings |                | Speed limits      |        |
|----------------|-----|----|------------------|--------------|--------|--------------|----------------|-------------------|--------|
| d <sub>1</sub> | D   | B  | r <sub>1,2</sub> | Bearing      | Sleeve | dyn.         | stat.          | Grease            | Oil    |
| Shaft          |     |    | min              |              |        | C            | C <sub>0</sub> |                   |        |
| mm             |     |    |                  |              |        | kN           |                | min <sup>-1</sup> |        |
| 17             | 47  | 14 | 1.0              | 1204KTNGC3   | H204   | 10.00        | 2.65           | 15,000            | 18,000 |
|                | 47  | 18 | 1.0              | 2204EKTNGC3  | H304   | 14.30        | 3.55           | 14,000            | 17,000 |
|                | 52  | 15 | 1.1              | 1304KTNGC3   | H304   | 12.50        | 3.35           | 13,000            | 16,000 |
|                | 52  | 21 | 1.1              | 2304KJC3     | H2304  | 18.00        | 4.65           | 13,000            | 16,000 |
| 20             | 52  | 15 | 1.0              | 1205KTNGC3   | H205   | 12.20        | 3.35           | 13,000            | 16,000 |
|                | 52  | 18 | 1.0              | 2205EKTNGC3  | H305   | 17.00        | 4.40           | 12,000            | 15,000 |
|                | 62  | 17 | 1.1              | 1305KTNGC3   | H305   | 18.00        | 5.00           | 11,000            | 14,000 |
|                | 62  | 24 | 1.1              | 2305KTNGC3   | H2305  | 24.50        | 6.55           | 10,000            | 13,000 |
| 25             | 62  | 16 | 1.0              | 1206KTNGC3   | H206   | 15.60        | 4.65           | 11,000            | 14,000 |
|                | 62  | 20 | 1.0              | 2206EKTNGC3  | H306   | 25.50        | 6.95           | 9,500             | 12,000 |
|                | 72  | 19 | 1.1              | 1306KTNGC3   | H306   | 21.20        | 6.30           | 9,000             | 11,000 |
|                | 72  | 27 | 1.1              | 2306KTNGC3   | H2306  | 31.50        | 8.65           | 8,500             | 10,000 |
| 30             | 72  | 17 | 1.1              | 1207KTNGC3   | H207   | 16.00        | 5.20           | 9,500             | 12,000 |
|                | 72  | 23 | 1.1              | 2207EKTNGC3  | H307   | 32.00        | 9.00           | 8,000             | 9,500  |
|                | 80  | 21 | 1.5              | 1307KTNGC3   | H307   | 25.00        | 8.00           | 8,000             | 9,500  |
|                | 80  | 31 | 1.5              | 2307KTNGC3   | H2307  | 39.00        | 11.20          | 7,500             | 9,000  |
| 35             | 80  | 18 | 1.1              | 1208KTNGC3   | H208   | 19.30        | 6.55           | 8,500             | 10,000 |
|                | 80  | 23 | 1.1              | 2208EKTNGC3  | H308   | 31.50        | 9.50           | 7,500             | 9,000  |
|                | 90  | 23 | 1.5              | 1308KTNGC3   | H308   | 29.00        | 9.65           | 7,000             | 8,500  |
|                | 90  | 33 | 1.5              | 2308KTNGC3   | H2308  | 45.00        | 13.40          | 6,700             | 8,000  |
| 40             | 85  | 19 | 1.1              | 1209KTNGC3   | H209   | 22.00        | 7.35           | 7,500             | 9,000  |
|                | 85  | 23 | 1.1              | 2209EKTNGC3  | H309   | 28.00        | 9.00           | 7,000             | 8,500  |
|                | 100 | 25 | 1.5              | 1309KTNGC3   | H309   | 38.00        | 12.90          | 6,300             | 7,500  |
|                | 100 | 36 | 1.5              | 2309KTNGC3   | H2309  | 54.00        | 16.30          | 6,000             | 7,000  |
| 45             | 90  | 20 | 1.1              | 1210KTNGC3   | H210   | 22.90        | 8.15           | 7,000             | 8,500  |
|                | 90  | 23 | 1.1              | 2210EKTNGC3  | H310   | 28.00        | 9.50           | 6,700             | 8,000  |
|                | 110 | 27 | 2.0              | 1310KTNGC3   | H310   | 41.50        | 14.30          | 5,600             | 6,700  |
|                | 110 | 40 | 2.0              | 2310KTNGC3   | H2310  | 64.00        | 20.00          | 5,300             | 6,300  |
| 50             | 100 | 21 | 1.5              | 1211KTNGC3   | H211   | 27.00        | 10.00          | 6,300             | 7,500  |
|                | 100 | 25 | 1.5              | 2211EKTNGC3  | H311   | 39.00        | 12.70          | 5,600             | 6,700  |
|                | 120 | 29 | 2.0              | 1311KTNGC3   | H311   | 51.00        | 18.00          | 5,000             | 6,000  |
|                | 120 | 43 | 2.0              | 2311KTNGC3   | H2311  | 75.00        | 23.60          | 4,800             | 5,600  |



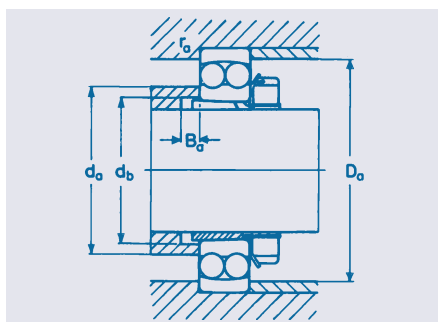
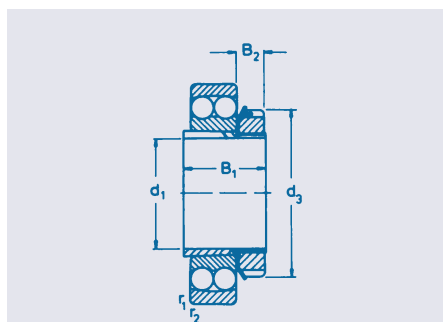
| Dimensions     |                |                | Abutment dimensions |                |                |                |                | Factors |                |                |                | Weight  |        | Abbreviation |
|----------------|----------------|----------------|---------------------|----------------|----------------|----------------|----------------|---------|----------------|----------------|----------------|---------|--------|--------------|
| d <sub>3</sub> | B <sub>1</sub> | B <sub>2</sub> | d <sub>a</sub>      | d <sub>b</sub> | D <sub>a</sub> | B <sub>a</sub> | r <sub>a</sub> | e       | Y <sub>1</sub> | Y <sub>2</sub> | Y <sub>0</sub> |         |        | ≈            |
|                |                |                | max                 | min            | max            | min            | max            |         | Fa/Fr ≤ e      | Fa/fr > e      |                | Bearing | Sleeve |              |
| mm             |                |                | mm                  |                |                |                |                |         |                |                |                | kg      |        |              |
| 32             | 24             | 7              | 27                  | 23             | 42.0           | 5              | 1.0            | 0.28    | 2.2            | 3.5            | 2.3            | 0.12    | 0.041  | 1204KTNGC3   |
| 32             | 28             | 7              | 27                  | 23             | 42.0           | 5              | 1.0            | 0.44    | 1.5            | 2.2            | 1.5            | 0.14    | 0.045  | 2204EKTNGC3  |
| 32             | 28             | 7              | 30                  | 23             | 45.5           | 8              | 1.0            | 0.29    | 2.2            | 3.3            | 2.3            | 0.16    | 0.045  | 1304KTNGC3   |
| 32             | 31             | 7              | 28                  | 24             | 45.5           | 5              | 1.0            | 0.51    | 1.2            | 1.9            | 1.3            | 0.21    | 0.049  | 2304KJC3     |
| 38             | 26             | 8              | 32                  | 28             | 47.0           | 5              | 1.0            | 0.27    | 2.4            | 3.7            | 2.5            | 0.14    | 0.070  | 1205KTNGC3   |
| 38             | 29             | 8              | 32                  | 28             | 47.0           | 5              | 1.0            | 0.35    | 1.8            | 2.8            | 1.9            | 0.16    | 0.075  | 2205EKTNGC3  |
| 38             | 29             | 8              | 35                  | 28             | 55.5           | 6              | 1.0            | 0.28    | 2.3            | 3.5            | 2.4            | 0.26    | 0.075  | 1305KTNGC3   |
| 38             | 35             | 8              | 34                  | 30             | 55.5           | 5              | 1.0            | 0.48    | 1.3            | 2.0            | 1.4            | 0.34    | 0.087  | 2305KTNGC3   |
| 45             | 27             | 8              | 38                  | 33             | 57.0           | 5              | 1.0            | 0.25    | 2.5            | 3.9            | 2.7            | 0.22    | 0.100  | 1206KTNGC3   |
| 45             | 31             | 8              | 39                  | 33             | 57.0           | 5              | 1.0            | 0.30    | 2.1            | 3.3            | 2.2            | 0.24    | 0.110  | 2206EKTNGC3  |
| 45             | 31             | 8              | 42                  | 33             | 65.5           | 6              | 1.0            | 0.26    | 2.4            | 3.7            | 2.5            | 0.38    | 0.110  | 1306KTNGC3   |
| 45             | 38             | 8              | 40                  | 35             | 65.5           | 5              | 1.0            | 0.45    | 1.4            | 2.2            | 1.5            | 0.49    | 0.130  | 2306KTNGC3   |
| 52             | 29             | 9              | 45                  | 38             | 65.5           | 5              | 1.0            | 0.22    | 2.8            | 4.3            | 2.9            | 0.32    | 0.130  | 1207KTNGC3   |
| 52             | 35             | 9              | 44                  | 39             | 65.5           | 5              | 1.0            | 0.30    | 2.1            | 3.3            | 2.2            | 0.40    | 0.140  | 2207EKTNGC3  |
| 52             | 35             | 9              | 49                  | 39             | 72.0           | 7              | 1.5            | 0.26    | 2.5            | 3.8            | 2.6            | 0.50    | 0.140  | 1307KTNGC3   |
| 52             | 43             | 9              | 45                  | 40             | 72.0           | 5              | 1.5            | 0.47    | 1.4            | 2.1            | 1.4            | 0.66    | 0.170  | 2307KTNGC3   |
| 58             | 31             | 10             | 52                  | 43             | 73.5           | 6              | 1.0            | 0.22    | 2.9            | 4.5            | 3.0            | 0.41    | 0.170  | 1208KTNGC3   |
| 58             | 36             | 10             | 50                  | 44             | 73.5           | 6              | 1.0            | 0.26    | 2.4            | 3.8            | 2.5            | 0.49    | 0.190  | 2208EKTNGC3  |
| 58             | 36             | 10             | 55                  | 44             | 82.0           | 6              | 1.5            | 0.25    | 2.5            | 3.9            | 2.6            | 0.70    | 0.190  | 1308KTNGC3   |
| 58             | 46             | 10             | 51                  | 45             | 82.0           | 6              | 1.5            | 0.43    | 1.5            | 2.3            | 1.5            | 0.90    | 0.220  | 2308KTNGC3   |
| 65             | 33             | 11             | 57                  | 48             | 78.5           | 6              | 1.0            | 0.21    | 3.0            | 4.7            | 3.2            | 0.46    | 0.230  | 1209KTNGC3   |
| 65             | 39             | 11             | 56                  | 50             | 78.5           | 8              | 1.0            | 0.26    | 2.4            | 3.8            | 2.5            | 0.53    | 0.250  | 2209EKTNGC3  |
| 65             | 39             | 11             | 61                  | 50             | 92.0           | 6              | 1.5            | 0.25    | 2.5            | 3.9            | 2.6            | 0.94    | 0.250  | 1309KTNGC3   |
| 65             | 50             | 11             | 57                  | 50             | 92.0           | 6              | 1.5            | 0.43    | 1.5            | 2.3            | 1.6            | 1.20    | 0.280  | 2309KTNGC3   |
| 70             | 35             | 12             | 62                  | 53             | 83.5           | 6              | 1.0            | 0.20    | 3.2            | 4.9            | 3.3            | 0.52    | 0.270  | 1210KTNGC3   |
| 70             | 42             | 12             | 61                  | 55             | 83.5           | 10             | 1.0            | 0.24    | 2.6            | 4.1            | 2.7            | 0.58    | 0.300  | 2210EKTNGC3  |
| 70             | 42             | 12             | 68                  | 55             | 101.0          | 6              | 2.0            | 0.24    | 2.6            | 4.0            | 2.7            | 1.20    | 0.300  | 1310KTNGC3   |
| 70             | 55             | 12             | 63                  | 56             | 101.0          | 6              | 2.0            | 0.43    | 1.5            | 2.3            | 1.5            | 1.60    | 0.360  | 2310KTNGC3   |
| 75             | 37             | 12             | 69                  | 60             | 92.0           | 7              | 1.5            | 0.19    | 3.3            | 5.1            | 3.5            | 0.69    | 0.310  | 1211KTNGC3   |
| 75             | 45             | 12             | 68                  | 60             | 92.0           | 11             | 1.5            | 0.22    | 2.9            | 4.5            | 2.1            | 0.79    | 0.390  | 2211EKTNGC3  |
| 75             | 45             | 12             | 74                  | 60             | 111.0          | 7              | 2.0            | 0.24    | 2.7            | 4.1            | 2.8            | 1.55    | 0.390  | 1311KTNGC3   |
| 75             | 59             | 12             | 69                  | 61             | 111.0          | 7              | 2.0            | 0.42    | 1.5            | 2.3            | 1.6            | 2.05    | 0.420  | 2311KTNGC3   |

# Self-aligning ball bearings

With adapter sleeve  
Shaft 55 – 65 mm



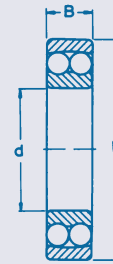
| Dimensions     |     |    |                  | Abbreviation |        | Load ratings |                | Speed limits      |       |
|----------------|-----|----|------------------|--------------|--------|--------------|----------------|-------------------|-------|
| d <sub>1</sub> | D   | B  | r <sub>1,2</sub> | Bearing      | Sleeve | dyn.         | stat.          | Grease            | Oil   |
| Shaft          |     |    | min              |              |        | C            | C <sub>0</sub> |                   |       |
| mm             |     |    |                  |              |        | kN           |                | min <sup>-1</sup> |       |
| 55             | 110 | 22 | 1.5              | 1212KTNGC3   | H212   | 30.0         | 11.6           | 5,600             | 6,700 |
|                | 110 | 28 | 1.5              | 2212EKTNGC3  | H312   | 47.5         | 16.6           | 5,300             | 6,300 |
|                | 130 | 31 | 2.0              | 1312KJC3     | H312   | 57.5         | 20.8           | 4,800             | 5,600 |
|                | 130 | 46 | 2.0              | 2312KJC3     | H2312  | 88.5         | 28.3           | 4,300             | 5,300 |
| 60             | 120 | 23 | 1.5              | 1213KTNGC3   | H213   | 31.0         | 12.5           | 5,300             | 6,300 |
|                | 120 | 31 | 1.5              | 2213EKTNGC3  | H313   | 57.0         | 19.3           | 4,500             | 5,300 |
|                | 140 | 33 | 2.1              | 1313KJC3     | H313   | 62.5         | 22.9           | 4,300             | 5,300 |
|                | 140 | 48 | 2.1              | 2313KJC3     | H2313  | 96.5         | 32.5           | 4,000             | 4,800 |
| 65             | 130 | 25 | 1.5              | 1215KTNGC3   | H215   | 39.0         | 15.6           | 4,800             | 5,600 |
|                | 130 | 31 | 1.5              | 2215KJC3     | H315   | 44.5         | 17.8           | 4,300             | 5,300 |
|                | 160 | 37 | 2.1              | 1315KJC3     | H315   | 80.0         | 30.0           | 3,800             | 4,500 |
|                | 160 | 55 | 2.1              | 2315KJC3     | H2315  | 125.0        | 43.0           | 3,400             | 4,300 |



| Dimensions |       |       | Abutment dimensions |              |              |              |              | Factors |                         |                      |       | Weight  |        | Abbreviation<br>≈ |
|------------|-------|-------|---------------------|--------------|--------------|--------------|--------------|---------|-------------------------|----------------------|-------|---------|--------|-------------------|
| $d_3$      | $B_1$ | $B_2$ | $d_a$<br>max        | $d_b$<br>min | $D_a$<br>max | $B_a$<br>min | $r_a$<br>max | $e$     | $Y_1$<br>$Fa/Fr \leq e$ | $Y_2$<br>$Fa/fr > e$ | $Y_0$ | Bearing | Sleeve |                   |
| mm         |       |       | mm                  |              |              |              |              |         |                         |                      |       | kg      |        |                   |
| 80         | 38    | 13    | 75                  | 64           | 102          | 7            | 1.5          | 0.18    | 3.5                     | 5.4                  | 3.6   | 0.90    | 0.35   | 1212KTNGC3        |
| 80         | 47    | 13    | 73                  | 65           | 102          | 9            | 1.5          | 0.23    | 2.7                     | 4.2                  | 2.8   | 1.10    | 0.39   | 2212EKTNGC3       |
| 80         | 47    | 13    | 83                  | 65           | 119          | 7            | 2.0          | 0.23    | 2.8                     | 4.3                  | 2.9   | 1.95    | 0.39   | 1312KJC3          |
| 80         | 62    | 13    | 74                  | 66           | 119          | 7            | 2.0          | 0.40    | 1.6                     | 2.4                  | 1.7   | 2.60    | 0.49   | 2312KJC3          |
| 85         | 40    | 14    | 83                  | 70           | 112          | 7            | 1.5          | 0.18    | 3.6                     | 5.5                  | 3.7   | 1.15    | 0.40   | 1213KTNGC3        |
| 85         | 50    | 14    | 79                  | 70           | 112          | 9            | 1.5          | 0.23    | 2.8                     | 4.3                  | 2.9   | 1.45    | 0.46   | 2213EKTNGC3       |
| 85         | 50    | 14    | 89                  | 70           | 129          | 7            | 2.0          | 0.23    | 2.8                     | 4.3                  | 2.9   | 2.45    | 0.46   | 1313KJC3          |
| 85         | 65    | 14    | 82                  | 72           | 129          | 7            | 2.0          | 0.39    | 1.6                     | 2.5                  | 1.7   | 3.25    | 0.55   | 2313KJC3          |
| 98         | 43    | 15    | 92                  | 80           | 122          | 7            | 1.5          | 0.17    | 3.6                     | 5.6                  | 3.8   | 1.35    | 0.71   | 1215KTNGC3        |
| 98         | 55    | 15    | 90                  | 80           | 122          | 13           | 1.5          | 0.25    | 2.5                     | 3.9                  | 2.6   | 1.60    | 0.83   | 2215KJC3          |
| 98         | 55    | 15    | 100                 | 80           | 149          | 7            | 2.0          | 0.22    | 2.8                     | 4.4                  | 3.0   | 3.55    | 0.83   | 1315KJC3          |
| 98         | 73    | 15    | 94                  | 82           | 149          | 7            | 2.0          | 0.38    | 1.6                     | 2.6                  | 1.7   | 5.15    | 1.05   | 2315KJC3          |

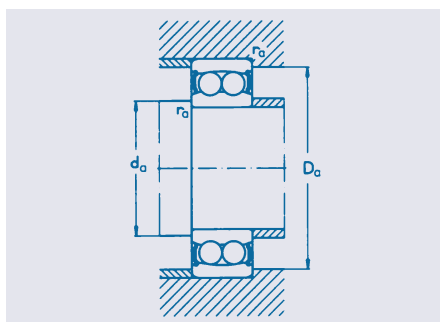
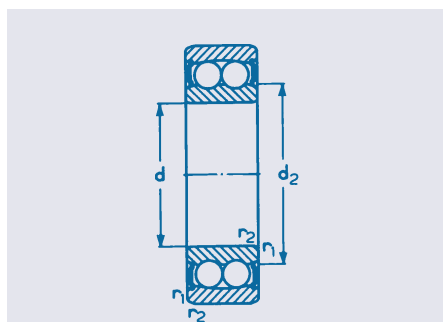
# Self-aligning ball bearings

Sealed on both sides  
Bore 12 – 65 mm



| Dimensions |     |    |           | Abbreviation |               | Load ratings |       | Speed limits      |
|------------|-----|----|-----------|--------------|---------------|--------------|-------|-------------------|
| $d_1$      | D   | B  | $r_{1,2}$ | Bearing      | Sleeve        | dyn.         | stat. | Grease            |
| Shaft      |     |    | min       |              |               | C            | $C_0$ |                   |
| mm         |     |    |           |              |               | kN           |       | min <sup>-1</sup> |
| 12         | 32  | 14 | 0.6       | 2201-2RSTNG  | —             | 5.60         | 1.27  | 16,000            |
| 15         | 35  | 14 | 0.6       | 2202-2RSTNG  | —             | 7.50         | 1.76  | 15,000            |
|            | 42  | 17 | 1.0       | 2302-2RSTN   | —             | 9.50         | 2.28  | 15,000            |
| 17         | 40  | 16 | 0.6       | 2203-2RSTNG  | —             | 8.00         | 2.04  | 14,000            |
|            | 47  | 19 | 1.0       | 2303-2RSTN   | —             | 12.50        | 3.20  | 11,000            |
| 20         | 47  | 18 | 1.0       | 2204-2RSTNG  | 2204K2RSTNGC3 | 10.00        | 2.65  | 11,000            |
|            | 52  | 21 | 1.1       | 2304-2RSTNG  | 2304K2RSTNGC3 | 12.50        | 3.35  | 10,000            |
| 25         | 52  | 18 | 1.0       | 2205-2RSTNG  | 2205K2RSTNGC3 | 12.20        | 3.35  | 9,500             |
|            | 62  | 24 | 1.1       | 2305-2RSTNG  | 2305K2RSTNGC3 | 18.00        | 5.00  | 8,000             |
| 30         | 62  | 20 | 1.0       | 2206-2RSTNG  | 2206K2RSTNGC3 | 15.60        | 4.65  | 8,000             |
|            | 72  | 27 | 1.1       | 2306-2RSTNG  | 2306K2RSTNGC3 | 21.20        | 6.30  | 6,700             |
| 35         | 72  | 23 | 1.1       | 2207-2RSTNG  | 2207K2RSTNGC3 | 16.00        | 5.20  | 7,000             |
|            | 80  | 31 | 1.5       | 2307-2RSTNG  | 2307K2RSTNGC3 | 25.00        | 8.00  | 6,000             |
| 40         | 80  | 23 | 1.1       | 2208-2RSTNG  | 2208K2RSTNGC3 | 19.30        | 6.55  | 6,300             |
|            | 90  | 33 | 1.5       | 2308-2RSTNG  | 2308K2RSTNGC3 | 29.00        | 9.65  | 5,300             |
| 45         | 85  | 23 | 1.1       | 2209-2RSTNG  | 2209K2RSTNGC3 | 22.00        | 7.35  | 5,600             |
|            | 100 | 36 | 1.5       | 2309-2RSTNG  | 2309K2RSTNGC3 | 38.00        | 12.90 | 4,800             |
| 50         | 90  | 23 | 1.1       | 2210-2RSTNG  | 2210K2RSTNGC3 | 22.80        | 8.15  | 5,300             |
|            | 100 | 40 | 2.0       | 2310-2RSTNG  | 2310K2RSTNGC3 | 41.50        | 14.30 | 4,300             |
| 55         | 100 | 25 | 1.5       | 2211-2RSTNG  | 2211K2RSTNGC3 | 27.00        | 10.00 | 4,800             |
|            | 120 | 43 | 2.0       | 2311-2RSTNG  | 2311K2RSTNGC3 | 51.00        | 18.00 | 3,800             |
| 60         | 110 | 28 | 1.5       | 2212-2RSTNG  | 2212K2RSTNGC3 | 30.00        | 11.60 | 4,300             |
| 65         | 120 | 31 | 1.5       | 2213-2RSTNG  | 2213K2RSTNGC3 | 31.00        | 12.40 | 4,000             |

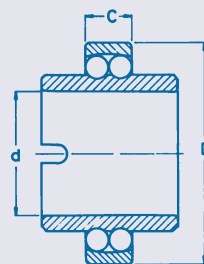




| Abutment dimensions |              |              | Factors |                         |                      |       | Weight    | Abbreviation |
|---------------------|--------------|--------------|---------|-------------------------|----------------------|-------|-----------|--------------|
| $d_a$<br>min        | $D_a$<br>max | $r_a$<br>max | e       | $Y_1$<br>$Fa/Fr \leq e$ | $Y_2$<br>$Fa/fr > e$ | $Y_0$ | $\approx$ |              |
| mm                  |              |              |         |                         |                      |       | kg        |              |
| 16.0                | 28.0         | 0.6          | 0.37    | 1.7                     | 2.6                  | 1.8   | 0.06      | 2201-2RSTNG  |
| 19.0                | 31.0         | 0.6          | 0.34    | 1.9                     | 2.9                  | 2.0   | 0.06      | 2202-2RSTNG  |
| 20.0                | 37.0         | 1.0          | 0.35    | 1.8                     | 2.8                  | 1.9   | 0.13      | 2302-2RSTN   |
| 21.0                | 36.0         | 0.6          | 0.33    | 1.9                     | 3.0                  | 2.0   | 0.10      | 2203-2RSTNG  |
| 22.0                | 42.0         | 1.0          | 0.32    | 1.9                     | 3.0                  | 2.0   | 0.18      | 2303-2RSTN   |
| 25.0                | 42.0         | 1.0          | 0.28    | 2.2                     | 3.5                  | 2.3   | 0.16      | 2204-2RSTNG  |
| 26.5                | 45.5         | 1.0          | 0.29    | 2.2                     | 3.3                  | 2.3   | 0.24      | 2304-2RSTNG  |
| 30.0                | 47.0         | 1.0          | 0.27    | 2.4                     | 3.7                  | 2.5   | 0.17      | 2205-2RSTNG  |
| 31.5                | 55.5         | 1.0          | 0.28    | 2.3                     | 3.5                  | 2.4   | 0.38      | 2305-2RSTNG  |
| 35.0                | 57.0         | 1.0          | 0.25    | 2.5                     | 3.9                  | 2.7   | 0.28      | 2206-2RSTNG  |
| 36.5                | 65.5         | 1.0          | 0.26    | 2.4                     | 3.7                  | 2.5   | 0.57      | 2306-2RSTNG  |
| 41.4                | 65.5         | 1.0          | 0.22    | 2.8                     | 4.3                  | 2.9   | 0.45      | 2207-2RSTNG  |
| 43.0                | 72.0         | 1.5          | 0.26    | 2.5                     | 3.8                  | 2.6   | 0.79      | 2307-2RSTNG  |
| 46.5                | 73.5         | 1.0          | 0.22    | 2.9                     | 4.5                  | 3.0   | 0.55      | 2208-2RSTNG  |
| 48.0                | 82.0         | 1.5          | 0.25    | 2.5                     | 3.9                  | 2.6   | 0.05      | 2308-2RSTNG  |
| 51.5                | 78.5         | 1.0          | 0.21    | 3.0                     | 4.7                  | 3.2   | 0.58      | 2209-2RSTNG  |
| 53.0                | 92.0         | 1.5          | 0.25    | 2.5                     | 3.9                  | 2.6   | 0.40      | 2309-2RSTNG  |
| 56.5                | 83.5         | 1.0          | 0.20    | 3.2                     | 4.9                  | 3.3   | 0.63      | 2210-2RSTNG  |
| 59.0                | 101.0        | 2.0          | 0.24    | 2.6                     | 4.0                  | 2.7   | 1.89      | 2310-2RSTNG  |
| 63.0                | 92.0         | 1.5          | 0.19    | 3.3                     | 5.1                  | 3.5   | 0.76      | 2211-2RSTNG  |
| 66.0                | 109.0        | 2.0          | 0.24    | 2.7                     | 4.1                  | 2.8   | 2.37      | 2311-2RSTNG  |
| 68.5                | 101.5        | 1.5          | 0.18    | 3.5                     | 5.4                  | 3.6   | 1.11      | 2212-2RSTNG  |
| 74.0                | 111.0        | 1.5          | 0.18    | 3.6                     | 5.5                  | 3.7   | 1.53      | 2213-2RSTNG  |

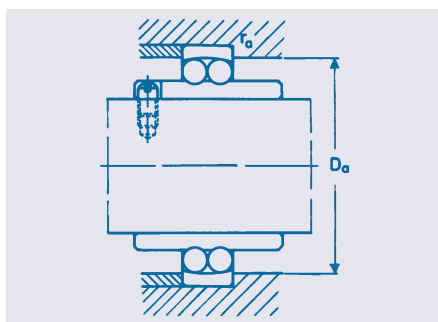
# Self-aligning ball bearings

With extended inner ring  
Bore 20 – 60 mm



| Dimensions |     |    |                         | Abbreviation | Load ratings |                         | Speed limits<br>Grease |
|------------|-----|----|-------------------------|--------------|--------------|-------------------------|------------------------|
| d          | D   | C  | r <sub>1,2</sub><br>min |              | dyn.<br>C    | stat.<br>C <sub>0</sub> |                        |
| mm         |     |    |                         |              | kN           |                         | min <sup>-1</sup>      |
| 20         | 47  | 14 | 1.0                     | 11204TNG     | 10.0         | 2.65                    | 9,000                  |
|            | 52  | 15 | 1.0                     | 11304TNG     | 12.5         | 3.20                    | 8,500                  |
| 25         | 52  | 15 | 1.0                     | 11205TNG     | 12.2         | 3.35                    | 8,000                  |
|            | 62  | 17 | 1.0                     | 11305TNG     | 18.0         | 5.00                    | 6,700                  |
| 30         | 62  | 16 | 1.0                     | 11206TNG     | 15.6         | 4.65                    | 6,700                  |
|            | 72  | 19 | 1.0                     | 11306TNG     | 21.2         | 6.30                    | 5,600                  |
| 35         | 72  | 17 | 1.1                     | 11207TNG     | 16.0         | 5.20                    | 5,600                  |
|            | 80  | 21 | 1.1                     | 11307TNG     | 25.0         | 8.00                    | 5,000                  |
| 40         | 80  | 18 | 1.1                     | 11208TNG     | 19.3         | 6.55                    | 5,000                  |
|            | 90  | 23 | 1.1                     | 11308TNG     | 29.0         | 9.65                    | 4,500                  |
| 45         | 85  | 19 | 1.1                     | 11209TNG     | 22.0         | 7.35                    | 4,500                  |
|            | 100 | 25 | 1.1                     | 11309TNG     | 38.0         | 12.90                   | 3,800                  |
| 50         | 90  | 20 | 1.1                     | 11210TNG     | 22.8         | 8.15                    | 4,300                  |
|            | 110 | 27 | 1.1                     | 11310TNG     | 41.5         | 14.30                   | 3,600                  |
| 55         | 100 | 21 | 1.5                     | 11211TNG     | 27.0         | 10.00                   | 4,000                  |
| 60         | 110 | 22 | 1.5                     | 11212TNG     | 30.0         | 11.60                   | 3,600                  |

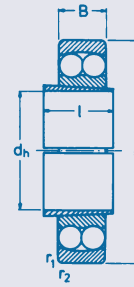
The bore tolerances do not comply with DIN 620. The bore tolerance corresponds to the tolerance zone J7.



| Dimensions |    | Abutment dimensions |              | Factors |                         |                      |       | Weight    | Abbreviation |
|------------|----|---------------------|--------------|---------|-------------------------|----------------------|-------|-----------|--------------|
| $d_2$      | B  | $D_a$<br>max        | $r_a$<br>max | e       | $Y_1$<br>Fa/Fr $\leq$ e | $Y_2$<br>Fa/fr $>$ e | $Y_0$ | $\approx$ |              |
| mm         |    |                     |              |         |                         |                      |       | kg        |              |
| 29.2       | 40 | 42.0                | 1.0          | 0.28    | 2.2                     | 3.5                  | 2.3   | 0.18      | 11204TNG     |
| 31.5       | 44 | 45.5                | 1.0          | 0.29    | 2.2                     | 3.3                  | 2.3   | 0.28      | 11304TNG     |
| 33.3       | 44 | 47.0                | 1.0          | 0.27    | 2.4                     | 3.7                  | 2.5   | 0.22      | 11205TNG     |
| 38.0       | 48 | 55.5                | 1.0          | 0.28    | 2.3                     | 3.5                  | 2.4   | 0.43      | 11305TNG     |
| 40.1       | 48 | 57.0                | 1.0          | 0.25    | 2.5                     | 3.9                  | 2.7   | 0.35      | 11206TNG     |
| 45.0       | 52 | 65.5                | 1.0          | 0.26    | 2.4                     | 3.7                  | 2.5   | 0.64      | 11306TNG     |
| 47.7       | 52 | 65.5                | 1.0          | 0.22    | 2.8                     | 4.3                  | 2.9   | 0.54      | 11207TNG     |
| 51.7       | 56 | 72.0                | 1.0          | 0.26    | 2.5                     | 3.8                  | 2.6   | 0.85      | 11307TNG     |
| 54.0       | 56 | 73.5                | 1.0          | 0.22    | 2.9                     | 4.5                  | 3.0   | 0.72      | 11208TNG     |
| 57.7       | 58 | 82.0                | 1.0          | 0.25    | 2.5                     | 3.9                  | 2.6   | 1.12      | 11308TNG     |
| 57.7       | 58 | 78.5                | 1.0          | 0.21    | 3.0                     | 4.7                  | 3.2   | 0.77      | 11209TNG     |
| 63.9       | 60 | 92.0                | 1.0          | 0.25    | 2.5                     | 3.9                  | 2.6   | 1.43      | 11309TNG     |
| 62.7       | 58 | 83.5                | 1.0          | 0.20    | 3.2                     | 4.9                  | 3.3   | 0.85      | 11210TNG     |
| 70.3       | 62 | 83.5                | 1.0          | 0.24    | 2.6                     | 4.0                  | 2.7   | 1.82      | 11310TNG     |
| 70.3       | 60 | 92.0                | 1.5          | 0.19    | 3.3                     | 5.1                  | 3.5   | 1.17      | 11211TNG     |
| 78.0       | 62 | 102.0               | 1.5          | 0.18    | 3.5                     | 5.4                  | 3.6   | 1.50      | 11212TNG     |

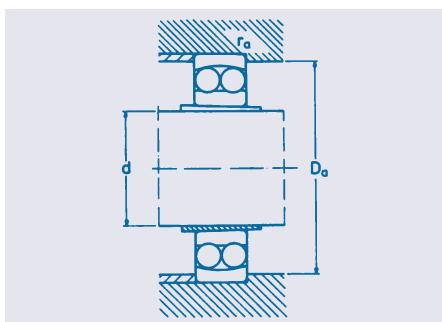
# Self-aligning ball bearings

Sleeve  
Shaft 20 – 50 mm



| Dimensions |                |    |    |    |                         | Abbreviation | Load ratings |                         | Speed limits      |        |
|------------|----------------|----|----|----|-------------------------|--------------|--------------|-------------------------|-------------------|--------|
| Shaft<br>d | d <sub>h</sub> | D  | B  | l  | r <sub>1,2</sub><br>min |              | dyn.<br>C    | stat.<br>C <sub>0</sub> | Grease            | Oil    |
| mm         |                |    |    |    |                         |              | kN           |                         | min <sup>-1</sup> |        |
| 20         | 20             | 47 | 14 | 23 | 1.0                     | 11504TNGC3   | 10.0         | 2.65                    | 15,000            | 18,000 |
| 25         | 25             | 52 | 15 | 25 | 1.0                     | 11505TNGC3   | 12.2         | 3.35                    | 13,000            | 16,000 |
| 30         | 30             | 62 | 16 | 25 | 1.0                     | 11506TNGC3   | 15.6         | 4.65                    | 11,000            | 14,000 |
| 35         | 35             | 72 | 17 | 26 | 1.1                     | 11507TNGC3   | 16.0         | 5.20                    | 9,500             | 12,000 |
| 40         | 40             | 80 | 18 | 27 | 1.1                     | 11508TNGC3   | 19.3         | 6.55                    | 8,500             | 10,000 |
| 45         | 45             | 85 | 19 | 28 | 1.1                     | 11509TNGC3   | 22.0         | 7.35                    | 7,500             | 9,000  |
| 50         | 50             | 90 | 20 | 30 | 1.1                     | 11510TNGC3   | 22.8         | 8.15                    | 7,000             | 8,500  |

The bore of the inner ring and its 1:15 taper do not comply with DIN 616.



| Abutment dimensions |              | Factors |                         |                      |       | Weight    | Abbreviation |
|---------------------|--------------|---------|-------------------------|----------------------|-------|-----------|--------------|
| $D_a$<br>max        | $r_a$<br>max | e       | $Y_1$<br>$Fa/Fr \leq e$ | $Y_2$<br>$Fa/fr > e$ | $Y_0$ | $\approx$ |              |
| mm                  |              |         |                         |                      |       | kg        |              |
| 41.0                | 1.0          | 0.28    | 2.2                     | 3.5                  | 2.3   | 0.120     | 11504TNGC3   |
| 46.5                | 1.0          | 0.27    | 2.4                     | 3.7                  | 2.5   | 0.144     | 11505TNGC3   |
| 56.5                | 1.0          | 0.25    | 2.5                     | 3.9                  | 2.7   | 0.227     | 11506TNGC3   |
| 65.0                | 1.0          | 0.22    | 2.8                     | 4.3                  | 2.9   | 0.335     | 11507TNGC3   |
| 73.0                | 1.0          | 0.22    | 2.9                     | 4.5                  | 3.0   | 0.435     | 11508TNGC3   |
| 78.0                | 1.0          | 0.21    | 3.0                     | 4.7                  | 3.2   | 0.480     | 11509TNGC3   |
| 83.0                | 1.0          | 0.20    | 3.2                     | 4.9                  | 3.3   | 0.540     | 11510TNGC3   |



# Deep-groove ball bearings

## Double-row

The structure and operation of double-row deep-groove ball bearings correspond to that of a pair of single-row deep-groove ball bearings. They should not be used where compensation for angular misalignment is required.

### Standards, dimensions

DIN 625 double-row deep-groove ball bearings

### Tolerances

The tolerances are stipulated in DIN 620. Double-row deep-groove ball bearings are only manufactured to standard tolerance P0.

### Bearing clearance

The bearing clearance groups are stipulated in DIN 620 Part 4 or ISO 5753 (see table).

Double-row deep-groove ball bearings are normally supplied with the standard clearance C0 "Normal". Other clearance groups are available on enquiry.

Radial bearing clearance of single and double row deep-groove ball bearings

| Rated size<br>of bore<br>d (mm) |       | Radial clearance in $\mu\text{m}$ |     |                |     |     |     |     |     |     |     |
|---------------------------------|-------|-----------------------------------|-----|----------------|-----|-----|-----|-----|-----|-----|-----|
|                                 |       | C2                                |     | C0<br>Standard |     | C3  |     | C4  |     | C5  |     |
| above                           | up to | min                               | max | min            | max | min | max | min | max | min | max |
| –                               | 10    | 0                                 | 7   | 2              | 13  | 8   | 23  | 14  | 29  | 20  | 37  |
| 10                              | 18    | 0                                 | 9   | 3              | 18  | 11  | 25  | 18  | 33  | 25  | 45  |
| 18                              | 24    | 0                                 | 10  | 5              | 20  | 13  | 28  | 20  | 36  | 28  | 48  |
| 24                              | 30    | 1                                 | 11  | 5              | 20  | 13  | 28  | 23  | 41  | 30  | 53  |
| 30                              | 40    | 1                                 | 11  | 6              | 20  | 15  | 33  | 28  | 46  | 40  | 64  |
| 40                              | 50    | 1                                 | 11  | 6              | 23  | 18  | 36  | 30  | 51  | 45  | 73  |
| 50                              | 65    | 1                                 | 15  | 8              | 28  | 23  | 43  | 38  | 61  | 55  | 90  |
| 65                              | 80    | 1                                 | 15  | 10             | 30  | 25  | 51  | 46  | 71  | 65  | 105 |
| 80                              | 100   | 1                                 | 18  | 12             | 36  | 30  | 58  | 53  | 84  | 75  | 120 |
| 100                             | 120   | 2                                 | 20  | 15             | 41  | 36  | 66  | 61  | 97  | 90  | 140 |
| 120                             | 140   | 2                                 | 23  | 18             | 48  | 41  | 81  | 71  | 114 | 105 | 160 |
| 140                             | 160   | 2                                 | 23  | 18             | 53  | 46  | 91  | 81  | 130 | 120 | 180 |
| 160                             | 180   | 2                                 | 25  | 20             | 61  | 53  | 102 | 91  | 147 | 135 | 200 |
| 180                             | 200   | 2                                 | 30  | 25             | 71  | 63  | 117 | 107 | 163 | 150 | 230 |
| 200                             | 225   | 4                                 | 32  | 28             | 82  | 73  | 132 | 120 | 187 | –   | –   |
| 225                             | 250   | 4                                 | 36  | 31             | 92  | 87  | 152 | 140 | 217 | –   | –   |
| 250                             | 280   | 4                                 | 39  | 36             | 97  | 97  | 162 | 152 | 237 | –   | –   |
| 280                             | 315   | 8                                 | 45  | 42             | 110 | 110 | 180 | 175 | 260 | –   | –   |
| 315                             | 355   | 8                                 | 50  | 50             | 120 | 120 | 200 | 200 | 290 | –   | –   |
| 355                             | 400   | 8                                 | 60  | 60             | 140 | 140 | 230 | 230 | 330 | –   | –   |

**Cages**

Double-row, deep-groove ball bearings are normally manufactured with snap cages made of glass-fibre reinforced Polyamide 66 and in a few cases, they are also provided with solid brass cages.

M solid cage made of brass, guided in the outer ring

TNG snap cage made of glass-fibre reinforced Polyamide 66

Bearings with cages made of glass-fibre reinforced polyamide are suitable for operating temperatures up to +120°C.

**Weights**

The weights shown in the dimension tables apply to the open version of the deep-groove ball bearings.

**Angular adjustment facility**

Because of their internal structure, double-row deep-groove ball bearings do not facilitate angular adjustment. When using these bearings, they must not be out of alignment.

**Dynamic equivalent bearing load**

$P = F_r + F_a$  (Double-row deep-groove ball bearings)

With double-row deep-groove ball bearings, it is essential that  $F_a \leq 0.3 \cdot F_r$

**Basic rating life**

$$L_h = \frac{1,000,000}{n \cdot 60} \cdot \left(\frac{C}{P}\right)^3 \quad (\text{Running hours})$$

$$f_h = f_n \cdot \frac{C}{P} \quad (\text{Factors } f_h \text{ and } f_n, \text{ see tables on Page 23})$$

**Static equivalent bearing load**

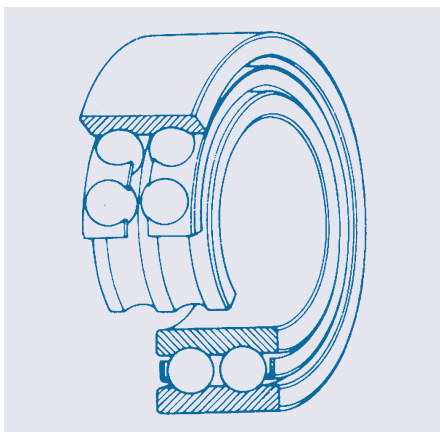
$P_0 = 0.6 \cdot F_r + 0.5 \cdot F_a$  (Single- and double-rowed deep-groove ball bearings)

If  $P_0 \approx F_r$ , then calculation must be with  $P_0 = F_r$ .

With double-row deep-groove ball bearings, it is essential that  $F_a \leq 0.3 \cdot F_r$ .

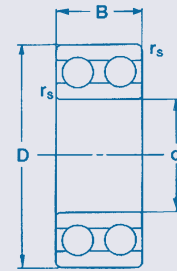
**Basic static load rating**

$$s_0 = \frac{C_0}{P_0}$$

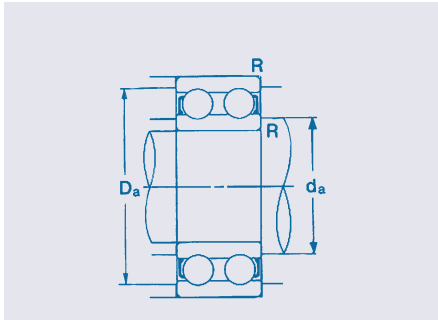


# Deep-groove ball bearings

Double-row  
Bore 10 – 90 mm



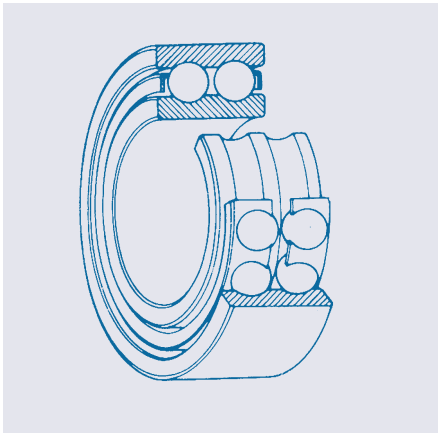
| Dimensions |     |    |                       | Abbreviation | Load ratings |                         | Speed limits      |        |
|------------|-----|----|-----------------------|--------------|--------------|-------------------------|-------------------|--------|
| d          | D   | B  | r <sub>s</sub><br>min |              | dyn.<br>C    | stat.<br>C <sub>0</sub> | Grease            | Oil    |
| mm         |     |    |                       | kN           |              |                         | min <sup>-1</sup> |        |
| 10         | 30  | 14 | 0.6                   | 4200BTNG     | 9.15         | 5.2                     | 18,000            | 24,000 |
| 12         | 32  | 14 | 0.6                   | 4201BTNG     | 9.30         | 5.5                     | 16,000            | 20,000 |
| 15         | 35  | 14 | 0.6                   | 4202BTNG     | 10.4         | 6.7                     | 14,000            | 18,000 |
|            | 42  | 17 | 1.0                   | 4302BTNG     | 14.6         | 9.2                     | 13,000            | 17,000 |
| 17         | 40  | 16 | 0.6                   | 4203BTNG     | 14.6         | 9.5                     | 13,000            | 18,000 |
|            | 47  | 19 | 1.0                   | 4303BTNG     | 19.6         | 13.2                    | 11,000            | 17,000 |
| 20         | 47  | 18 | 1.0                   | 4204BTNG     | 18.0         | 12.7                    | 10,000            | 14,000 |
|            | 52  | 21 | 1.1                   | 4304BTNG     | 23.2         | 16.0                    | 9,500             | 13,000 |
| 25         | 52  | 18 | 1.0                   | 4205BTNG     | 19.3         | 14.6                    | 9,000             | 12,000 |
|            | 62  | 24 | 1.1                   | 4305BTNG     | 31.5         | 22.4                    | 8,000             | 10,000 |
| 30         | 62  | 20 | 1.0                   | 4206BTNG     | 26.0         | 20.8                    | 7,500             | 9,500  |
|            | 72  | 27 | 1.1                   | 4306BTNG     | 40.0         | 30.5                    | 6,700             | 8,500  |
| 35         | 72  | 23 | 1.1                   | 4207BTNG     | 32.0         | 26.0                    | 6,700             | 8,500  |
|            | 80  | 31 | 1.5                   | 4307BTNG     | 51.0         | 38.0                    | 6,300             | 8,000  |
| 40         | 80  | 23 | 1.1                   | 4208BTNG     | 34.0         | 30.0                    | 6,000             | 7,500  |
|            | 90  | 33 | 1.5                   | 4308BTNG     | 63.0         | 48.0                    | 5,600             | 7,000  |
| 45         | 85  | 23 | 1.1                   | 4209BTNG     | 36.0         | 33.5                    | 5,600             | 7,000  |
|            | 100 | 36 | 1.5                   | 4309BTNG     | 72.0         | 60.0                    | 4,800             | 6,000  |
| 50         | 90  | 23 | 1.1                   | 4210BTNG     | 37.5         | 36.5                    | 5,000             | 6,300  |
|            | 110 | 40 | 2.0                   | 4310BTNG     | 90.0         | 75.0                    | 4,300             | 5,300  |
| 55         | 100 | 25 | 1.5                   | 4211BTNG     | 43.0         | 43.0                    | 4,500             | 5,600  |
|            | 120 | 43 | 2.0                   | 4311BTNG     | 104.0        | 90.0                    | 4,000             | 5,000  |
| 60         | 110 | 28 | 1.5                   | 4212BTNG     | 57.0         | 58.5                    | 4,000             | 5,000  |
|            | 130 | 46 | 2.1                   | 4312BTNG     | 120.0        | 106.0                   | 3,600             | 4,500  |
| 65         | 120 | 31 | 1.5                   | 4213BTNG     | 67.0         | 67.0                    | 3,800             | 4,800  |
|            | 140 | 48 | 2.1                   | 4313BTNG     | 129.0        | 98.0                    | 3,600             | 4,500  |
| 70         | 125 | 31 | 1.5                   | 4214BTNG     | 69.5         | 73.5                    | 3,600             | 4,500  |
|            | 150 | 51 | 2.1                   | 4314BTNG     | 146.0        | 114.0                   | 3,200             | 4,000  |
| 75         | 130 | 31 | 1.5                   | 4215BTNG     | 73.5         | 80.0                    | 3,400             | 4,300  |
|            | 160 | 55 | 2.1                   | 4315BTNG     | 170.0        | 134.0                   | 3,000             | 3,800  |
| 80         | 140 | 33 | 2.0                   | 4216BTNG     | 80.0         | 90.0                    | 3,200             | 4,000  |
| 85         | 150 | 36 | 2.0                   | 4217BTNG     | 93.0         | 106.0                   | 3,000             | 3,800  |



| Abutment dimensions |              |            | Weight | Abbreviation |
|---------------------|--------------|------------|--------|--------------|
| $d_a$<br>min        | $D_a$<br>max | $R$<br>min | ≈      |              |
| mm                  |              |            | kg     |              |
| 14.0                | 26.0         | 0.6        | 0.049  | 4200BTNG     |
| 16.0                | 28.0         | 0.6        | 0.053  | 4201BTNG     |
| 19.0                | 31.0         | 0.6        | 0.059  | 4202BTNG     |
| 20.0                | 37.0         | 1.0        | 0.120  | 4302BTNG     |
| 21.0                | 36.0         | 1.0        | 0.090  | 4203BTNG     |
| 22.0                | 42.0         | 1.0        | 0.16   | 4303BTNG     |
| 25.0                | 42.0         | 1.0        | 0.14   | 4204BTNG     |
| 26.5                | 45.5         | 1.0        | 0.21   | 4304BTNG     |
| 30.0                | 47.0         | 1.0        | 0.16   | 4205BTNG     |
| 31.5                | 55.5         | 1.0        | 0.34   | 4305BTNG     |
| 35.0                | 57.0         | 1.0        | 0.26   | 4206BTNG     |
| 36.5                | 65.5         | 1.0        | 0.50   | 4306BTNG     |
| 41.5                | 65.5         | 1.0        | 0.40   | 4207BTNG     |
| 43.0                | 72.0         | 1.5        | 0.69   | 4307BTNG     |
| 46.5                | 73.5         | 1.0        | 0.50   | 4208BTNG     |
| 48.0                | 82.0         | 1.5        | 0.95   | 4308BTNG     |
| 51.5                | 78.5         | 1.0        | 0.54   | 4209BTNG     |
| 53.0                | 92.0         | 1.5        | 1.25   | 4309BTNG     |
| 56.5                | 83.5         | 1.0        | 0.58   | 4210BTNG     |
| 59.0                | 101.0        | 2.0        | 1.70   | 4310BTNG     |
| 63.0                | 92.0         | 1.5        | 0.80   | 4211BTNG     |
| 64.0                | 111.0        | 2.0        | 2.15   | 4311BTNG     |
| 68.0                | 102.0        | 1.5        | 1.10   | 4212BTNG     |
| 71.0                | 119.0        | 2.0        | 2.65   | 4312BTNG     |
| 73.0                | 112.0        | 1.5        | 1.45   | 4213BTNG     |
| 76.0                | 129.0        | 2.0        | 3.25   | 4313BTNG     |
| 78.0                | 117.0        | 1.5        | 1.50   | 4214BTNG     |
| 81.0                | 139.0        | 2.0        | 3.95   | 4314BTNG     |
| 83.0                | 122.0        | 1.5        | 1.60   | 4215BTNG     |
| 86.0                | 149.0        | 2.0        | 5.38   | 4315BTNG     |
| 89.0                | 131.0        | 2.0        | 2.00   | 4216BTNG     |
| 94.0                | 141.0        | 2.0        | 2.55   | 4217BTNG     |
| 99.0                | 151.0        | 2.0        | 3.20   | 4218BTNG     |

# Angular-contact ball bearings

## Double-row



The structure and operation of double-row, angular-contact ball bearings correspond to that of a pair of back-to-back mounted single-row angular-contact ball bearings. They absorb radial and axial forces in both directions. The tilting moments can also be transferred. NSK supplies double-row angular-contact ball bearings with two different contact angles. The Series 32..J and 33..J bearings have a contact angle of 32° and are fitted with a cage made of sheet steel. These bearings have filling slots on one side. The bearings must therefore be installed so that most of the axial force is transferred by the side without the slots.

The Series 32.. and 33.. bearings with the suffix "BTNG" have a contact angle of 25° and are provided with a cage made of glass-fibre reinforced Polyamide 66. These bearings do not have filling slots and can therefore transfer axial forces in both directions.

As well as the open version, NSK supplies double-row angular-contact ball bearings with the suffix "BTNG" also with shield or seals on one or both sides of the bearing. All Series 32..BTNG and 33..BTNG bearings are supplied with grease as standard. The version with the cage made of sheet-steel must be used for operating temperatures above 120°C.

### Standards, dimensions

The external dimensions of double-row angular-contact ball bearings comply with DIN 628.

### Tolerances

The bearings are only manufactured to standard tolerance P0.

### Angular adjustment facility

Double-row angular-contact ball bearings do not facilitate angular adjustment.

### Bearing clearance

The axial clearance of double-row angular-contact ball bearings is specified. The bearings are mass produced with axial clearance C0 "Normal". Other clearance groups are available on enquiry. The axial clearances can be found in the table below.

The radial clearance of Version "BTNG" is approx. 45 % of its axial clearance. The radial clearance of Version "J" is approx. 60 % of its axial clearance.

Axial bearing clearance of double-row angular-contact ball bearings without load

| Rated size of bore (mm) | above | 6  | 10 | 18 | 24 | 30 | 40 | 50 | 65 | 80  |
|-------------------------|-------|----|----|----|----|----|----|----|----|-----|
|                         | up to | 10 | 18 | 24 | 30 | 40 | 50 | 65 | 80 | 100 |
| C2                      | min.  | 1  | 1  | 2  | 2  | 2  | 2  | 3  | 3  | 3   |
|                         | max.  | 11 | 12 | 14 | 15 | 16 | 18 | 22 | 24 | 26  |
| C0 Standard             | min.  | 5  | 6  | 7  | 8  | 9  | 11 | 13 | 15 | 16  |
|                         | max.  | 21 | 23 | 25 | 27 | 29 | 33 | 36 | 40 | 46  |
| C3                      | min.  | 12 | 13 | 16 | 18 | 21 | 23 | 26 | 30 | 35  |
|                         | max.  | 28 | 31 | 34 | 37 | 40 | 44 | 48 | 54 | 63  |
| C4                      | min.  | 25 | 27 | 28 | 30 | 33 | 36 | 40 | 46 | 55  |
|                         | max.  | 45 | 47 | 48 | 50 | 54 | 58 | 63 | 71 | 83  |

Bearing clearances in µm



# Angular-contact ball bearings

## Double-row

**Seals** As well as the open version, NSK manufactures double-row angular-contact ball bearings with the suffix "BTNG" also with shield or seals on one or both sides of the bearing.

**Shields ZR** Shields ZR are sheet-steel discs which are fixed inside the bearing outer ring forming a small gap for the bearing inner ring. The bearings are available with one shield on one side of the bearing "ZR" or shields on both sides of the bearing "2ZR".

**Seals RSR** Seals RSR consist of nitrile rubber and are reinforced with a steel disc embedded in the rubber. The seals are fixed in the outer ring and seal against the inner ring with a friction sealing lip. The bearings are available with one seal on one side of the bearing "RSR" or seals on both sides of the bearing "2RSR".

**Lubrication** With double-row angular-contact ball bearings, the gap between the cage and the rings is relatively small. When lubricating with grease, it is therefore not easy for the user to introduce the grease which is required for the initial lubrication. For this reason, NSK also supplies non-sealed double-row angular-contact ball bearings pre-filled with grease at the factory. The grease which is supplied is a high-quality lithium-based grease with a temperature range of  $-30\text{ }^{\circ}\text{C}$  to  $+120\text{ }^{\circ}\text{C}$ . The grease used by NSK is compatible with all other mineral-oil-based greases.

There is no problem using oil lubrication on bearings which have been lubricated with grease by NSK, providing that the oil used is mineral-oil based. A special version of the bearing is necessary for use with synthetic oils or greases. In these cases, please consult NSK.

### Dynamic equivalent bearing load

With Series 32..BTNG and 33..BTNG:

$$P = F_r + 0.92 \cdot F_a \quad [\text{kN}] \text{ where } F_a/F_r \leq 0.68$$

$$P = 0.67 \cdot F_r + 1.41 \cdot F_a \quad [\text{kN}] \text{ where } F_a/F_r > 0.68$$

With Series 32..J and 33..J:

$$P = F_r + 0.73 \cdot F_a \quad [\text{kN}] \text{ where } F_a/F_r \leq 0.86$$

$$P = 0.62 \cdot F_r + 1.17 \cdot F_a \quad [\text{kN}] \text{ where } F_a/F_r > 0.86$$

### Basic rating life

$$L_h = \frac{1,000,000}{n \cdot 60} \cdot \left(\frac{C}{P}\right)^3 \quad (\text{Running hours})$$

$$f_h = f_n \cdot \frac{C}{P} \quad (\text{Factors } f_h \text{ and } f_n, \text{ see tables on Page 39})$$

### Static equivalent bearing load

With Series 32..BTNG and 33..BTNG:

$$P_0 = F_r + 0.76 \cdot F_a \quad [\text{kN}]$$

With Series 32..J and 33..J:

$$P_0 = F_r + 0.63 \cdot F_a \quad [\text{kN}]$$

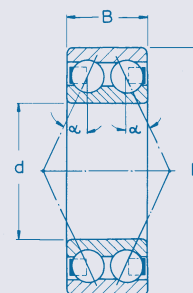
### Basic static load rating

$$S_0 = \frac{C_0}{P_0}$$

# Angular-contact ball bearings

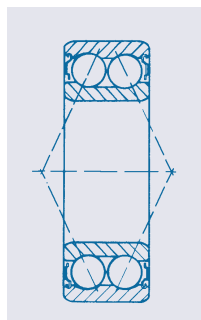
Double-row  
Bore 10 – 75 mm

Open

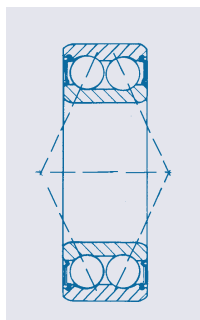


| Dimensions |     |      |                         | Abbreviation |                 |               | Load ratings |                         | Speed limits      |       |
|------------|-----|------|-------------------------|--------------|-----------------|---------------|--------------|-------------------------|-------------------|-------|
| d          | D   | B    | r <sub>1.2</sub><br>min | open         | with<br>shields | with<br>seals | dyn.<br>C    | stat.<br>C <sub>0</sub> | Grease            | Oil   |
| mm         |     |      |                         |              |                 |               | kN           |                         | min <sup>-1</sup> |       |
| 10         | 30  | 14.0 | 0.6                     | 3200BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 7.80         | 4.55                    | 16000             | 22000 |
| 12         | 32  | 15.9 | 0.6                     | 3201BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 10.60        | 5.85                    | 15000             | 20000 |
|            | 37  | 19.0 | 1.0                     | 3301BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 14.50        | 8.20                    | 10500             | 11500 |
| 15         | 35  | 15.9 | 0.6                     | 3202BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 11.80        | 7.10                    | 14000             | 19000 |
|            | 42  | 19.0 | 1.0                     | 3302BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 16.30        | 10.00                   | 11000             | 16000 |
| 17         | 40  | 17.5 | 0.6                     | 3203BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 14.60        | 9.00                    | 12000             | 17000 |
|            | 47  | 22.2 | 1.0                     | 3303BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 20.80        | 12.50                   | 10000             | 15000 |
| 20         | 47  | 20.6 | 1.0                     | 3204BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 19.60        | 12.50                   | 10000             | 15000 |
|            | 52  | 22.2 | 1.1                     | 3304BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 23.20        | 15.00                   | 9000              | 13000 |
| 25         | 52  | 20.6 | 1.0                     | 3205BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 21.20        | 14.60                   | 8500              | 12000 |
|            | 62  | 25.4 | 1.1                     | 3305BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 30.00        | 20.00                   | 7500              | 10000 |
| 30         | 62  | 23.8 | 1.0                     | 3206BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 30.00        | 21.20                   | 7000              | 9500  |
|            | 72  | 30.2 | 1.1                     | 3306BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 41.50        | 28.50                   | 6300              | 8500  |
| 35         | 72  | 27.0 | 1.1                     | 3207BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 39.00        | 28.50                   | 6300              | 8500  |
|            | 80  | 34.9 | 1.5                     | 3307BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 51.00        | 34.50                   | 5600              | 7500  |
| 40         | 80  | 30.2 | 1.1                     | 3208BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 48.00        | 36.50                   | 5600              | 7500  |
|            | 90  | 36.5 | 1.5                     | 3308BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 62.00        | 45.00                   | 5000              | 6700  |
| 45         | 85  | 30.2 | 1.1                     | 3209BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 48.00        | 37.50                   | 5000              | 6700  |
|            | 100 | 39.7 | 1.5                     | 3309BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 68.00        | 51.00                   | 4500              | 6000  |
| 50         | 90  | 30.2 | 1.1                     | 3210BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 51.00        | 42.50                   | 4800              | 6300  |
|            | 110 | 44.4 | 2.0                     | 3310BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 81.00        | 62.00                   | 4000              | 5300  |
| 55         | 100 | 33.3 | 1.5                     | 3211BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 58.50        | 49.00                   | 4300              | 5600  |
|            | 120 | 49.2 | 2.0                     | 3311BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 102.00       | 78.00                   | 3800              | 5000  |
| 60         | 110 | 36.5 | 1.5                     | 3212BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 72.00        | 61.00                   | 3800              | 5000  |
|            | 130 | 54.0 | 2.1                     | 3312BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 125.00       | 98.00                   | 3400              | 4500  |
| 65         | 120 | 38.1 | 1.5                     | 3213BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 80.00        | 73.50                   | 3400              | 4500  |
|            | 140 | 58.7 | 2.1                     | 3313BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 150.00       | 118.00                  | 3200              | 4300  |
| 70         | 125 | 39.7 | 1.5                     | 3214BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 83.00        | 76.50                   | 3400              | 4500  |
|            | 150 | 63.5 | 2.1                     | 3314BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 171.50       | 138.20                  | 3000              | 4000  |
| 75         | 130 | 41.3 | 1.5                     | 3215BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 91.50        | 85.00                   | 3200              | 4300  |
|            | 160 | 63.5 | 2.1                     | 3315BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 173.40       | 145.30                  | 2800              | 3800  |

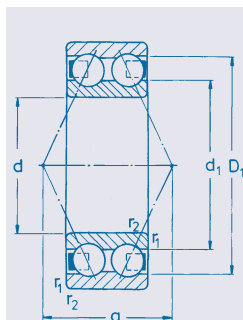
2ZR



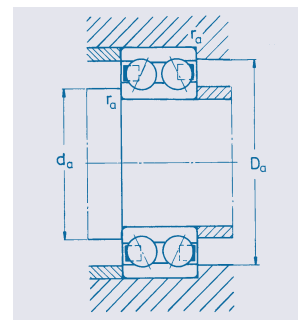
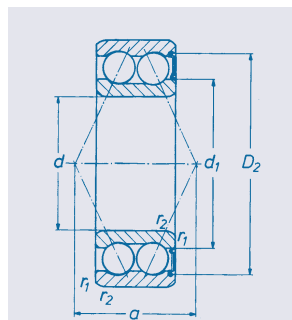
2RSR



Open



2ZR, 2RSR

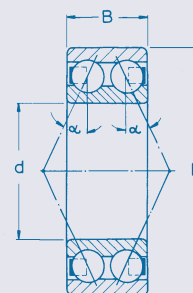


| Dimensions |            |      | Abutment dimensions |       |       | Weight    | Abbreviation |
|------------|------------|------|---------------------|-------|-------|-----------|--------------|
| $d_1$      | $D_1, D_2$ | $a$  | $d_a$               | $D_a$ | $r_a$ | $\approx$ |              |
| $\approx$  | $\approx$  |      | min                 | max   | max   |           |              |
| mm         |            |      |                     |       |       | kg        |              |
| 17.9       | 23.9       | 15.1 | 15                  | 25    | 0.6   | 0.043     | 3200BTNG     |
| 18.3       | 25.7       | 16.6 | 17                  | 27    | 0.6   | 0.051     | 3201BTNG     |
| 21.1       | 30.4       | 19.4 | 19                  | 32    | 1.0   | 0.090     | 3301BTNG     |
| 21.0       | 29.3       | 18.0 | 20                  | 30    | 0.6   | 0.058     | 3202BTNG     |
| 25.6       | 34.2       | 21.2 | 21                  | 36    | 1.0   | 0.112     | 3302BTNG     |
| 24.0       | 33.1       | 20.5 | 22                  | 35    | 0.6   | 0.085     | 3203BTNG     |
| 26.2       | 37.7       | 24.0 | 23                  | 41    | 1.0   | 0.161     | 3303BTNG     |
| 28.9       | 38.7       | 24.2 | 26                  | 41    | 1.0   | 0.139     | 3204BTNG     |
| 31.2       | 42.6       | 26.4 | 27                  | 45    | 1.0   | 0.197     | 3304BTNG     |
| 33.9       | 43.7       | 26.5 | 31                  | 46    | 1.0   | 0.159     | 3205BTNG     |
| 37.1       | 50.0       | 30.7 | 32                  | 55    | 1.0   | 0.316     | 3305BTNG     |
| 40.0       | 52.7       | 31.4 | 36                  | 56    | 1.0   | 0.265     | 3206BTNG     |
| 44.0       | 59.0       | 36.2 | 37                  | 65    | 1.0   | 0.496     | 3306BTNG     |
| 47.2       | 60.4       | 36.6 | 42                  | 65    | 1.0   | 0.412     | 3207BTNG     |
| 49.2       | 65.4       | 41.5 | 44                  | 71    | 1.5   | 0.664     | 3307BTNG     |
| 52.9       | 67.9       | 40.9 | 47                  | 73    | 1.0   | 0.550     | 3208BTNG     |
| 55.4       | 74.3       | 46.1 | 49                  | 81    | 1.5   | 0.905     | 3308BTNG     |
| 57.1       | 72.6       | 43.2 | 52                  | 78    | 1.0   | 0.583     | 3209BTNG     |
| 62.2       | 81.6       | 50.0 | 54                  | 91    | 1.5   | 1.210     | 3309BTNG     |
| 61.9       | 78.1       | 45.5 | 57                  | 83    | 1.0   | 0.632     | 3210BTNG     |
| 68.2       | 89.6       | 54.9 | 60                  | 100   | 2.0   | 1.600     | 3310BTNG     |
| 68.6       | 85.3       | 49.9 | 64                  | 91    | 1.5   | 0.876     | 3211BTNG     |
| 75.2       | 98.4       | 61.2 | 65                  | 110   | 2.0   | 2.110     | 3311BTNG     |
| 75.7       | 94.3       | 55.1 | 69                  | 101   | 1.5   | 1.180     | 3212BTNG     |
| 81.2       | 108.7      | 67.3 | 72                  | 118   | 2.0   | 2.700     | 3312BTNG     |
| 84.5       | 103.5      | 59.8 | 74                  | 111   | 1.5   | 1.520     | 3213BTNG     |
| 88.2       | 118.0      | 73.3 | 77                  | 128   | 2.0   | 3.390     | 3313BTNG     |
| 86.7       | 106.2      | 61.6 | 79                  | 116   | 1.5   | 1.640     | 3214BTNG     |
| 94.7       | 125.0      | 80.8 | 84                  | 135   | 2.1   | 4.900     | 3314BTNG     |
| 92.4       | 112.6      | 65.0 | 89                  | 116.6 | 1.5   | 1.910     | 3215BTNG     |
| 101.4      | 133.0      | 83.8 | 90                  | 143.0 | 2.1   | 5.700     | 3315BTNG     |

# Angular-contact ball bearings

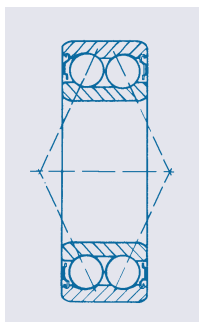
Double-row  
Bore 80 – 90 mm

Open

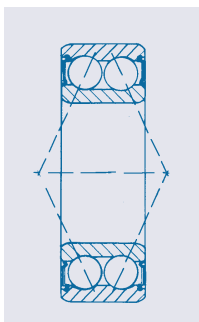


| Dimensions |     |      |                         | Abbreviation |                 |               | Load ratings |                         | Speed limits      |      |
|------------|-----|------|-------------------------|--------------|-----------------|---------------|--------------|-------------------------|-------------------|------|
| d          | D   | B    | r <sub>1.2</sub><br>min | open         | with<br>shields | with<br>seals | dyn.<br>C    | stat.<br>C <sub>0</sub> | Grease            | Oil  |
| mm         |     |      |                         |              |                 |               | kN           |                         | min <sup>-1</sup> |      |
| 80         | 140 | 44.4 | 2.0                     | 3216BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 98.0         | 93.0                    | 3000              | 4000 |
| 85         | 150 | 49.2 | 2.0                     | 3217BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 116.0        | 110.0                   | 2800              | 3800 |
| 90         | 160 | 52.4 | 2.0                     | 3218BTNG     | ..B2ZRTNG       | ..B2RSRTNG    | 124.6        | 120.3                   | 2600              | 3600 |

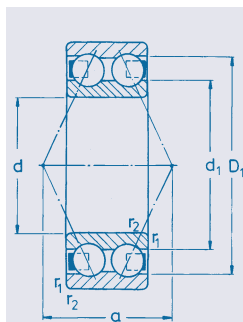
2ZR



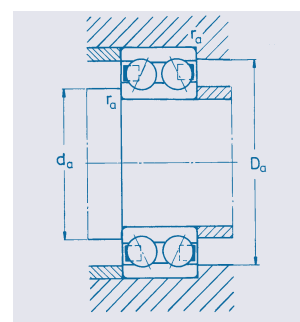
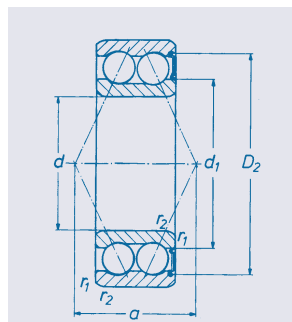
2RSR



Open



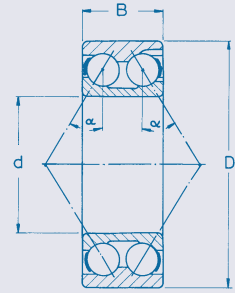
2ZR, 2RSR



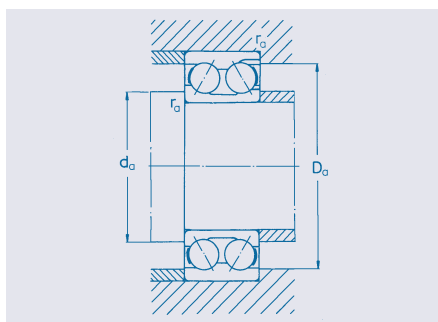
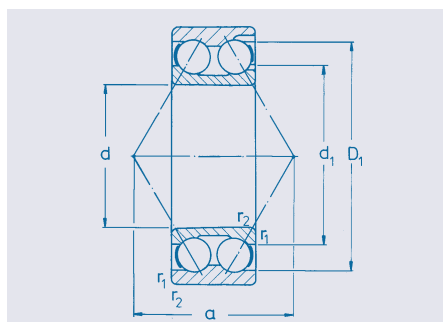
| Dimensions |            |      | Abutment dimensions |       |       | Weight    | Abbreviation |
|------------|------------|------|---------------------|-------|-------|-----------|--------------|
| $d_1$      | $D_1, D_2$ | $a$  | $d_a$               | $D_a$ | $r_a$ | $\approx$ |              |
| $\approx$  | $\approx$  |      | min                 | max   | max   |           |              |
| mm         |            |      |                     |       |       | kg        |              |
| 98.5       | 120.3      | 69.0 | 91                  | 129   | 2.0   | 2.450     | 3216BTNG     |
| 106.4      | 128.5      | 74.6 | 100                 | 135   | 2.0   | 3.300     | 3217BTNG     |
| 113.2      | 136.6      | 78.9 | 109                 | 141   | 2.1   | 4.170     | 3218BTNG     |

# Angular-contact ball bearings

Double-row, with filling slot  
Bore 10 – 70 mm



| Main dimensions |     |      |                         | Abbreviation | Load ratings |                         | Speed limits          |       |
|-----------------|-----|------|-------------------------|--------------|--------------|-------------------------|-----------------------|-------|
| d               | D   | B    | r <sub>1.2</sub><br>min |              | dyn.<br>C    | stat.<br>C <sub>0</sub> | Lubrication<br>Grease | Oil   |
| mm              |     |      |                         |              | kN           |                         | min <sup>-1</sup>     |       |
| 10              | 30  | 14.0 | 0.6                     | 3200J        | 8.0          | 5.9                     | 17000                 | 24000 |
| 12              | 32  | 15.9 | 0.6                     | 3201J        | 9.5          | 7.1                     | 15000                 | 20000 |
| 15              | 35  | 15.9 | 0.6                     | 3202J        | 10.8         | 9.0                     | 13000                 | 18000 |
|                 | 42  | 19.0 | 1.0                     | 3302J        | 14.5         | 12.3                    | 12000                 | 17000 |
| 17              | 40  | 17.5 | 0.6                     | 3203J        | 12.6         | 10.8                    | 12000                 | 17000 |
|                 | 47  | 22.2 | 1.0                     | 3303J        | 20.7         | 16.7                    | 10000                 | 15000 |
| 20              | 47  | 20.6 | 1.0                     | 3204J        | 17.2         | 15.3                    | 10000                 | 15000 |
|                 | 52  | 22.2 | 1.1                     | 3304J        | 20.8         | 18.5                    | 9500                  | 14000 |
| 25              | 52  | 20.6 | 1.0                     | 3205J        | 19.0         | 18.5                    | 8500                  | 12000 |
|                 | 62  | 25.4 | 1.1                     | 3305J        | 28.9         | 26.7                    | 7500                  | 10000 |
| 30              | 62  | 23.8 | 1.0                     | 3206J        | 27.2         | 27.3                    | 7000                  | 9500  |
|                 | 72  | 30.2 | 1.1                     | 3306J        | 38.1         | 36.5                    | 6300                  | 8500  |
| 35              | 72  | 27.0 | 1.1                     | 3207J        | 36.8         | 38.0                    | 6300                  | 8500  |
|                 | 80  | 34.9 | 1.5                     | 3307J        | 48.5         | 47.5                    | 5600                  | 7500  |
| 40              | 80  | 30.2 | 1.1                     | 3208J        | 42.0         | 44.8                    | 5600                  | 7500  |
|                 | 90  | 36.5 | 1.5                     | 3308J        | 59.8         | 64.8                    | 4800                  | 6300  |
| 45              | 85  | 30.2 | 1.1                     | 3209J        | 45.4         | 52.1                    | 5000                  | 6700  |
|                 | 100 | 39.7 | 1.5                     | 3309J        | 73.1         | 80.9                    | 4300                  | 5600  |
| 50              | 90  | 30.2 | 1.1                     | 3210J        | 48.2         | 56.0                    | 4800                  | 6300  |
|                 | 110 | 44.4 | 2.0                     | 3310J        | 87.6         | 98.3                    | 4000                  | 5300  |
| 55              | 100 | 33.3 | 1.5                     | 3211J        | 55.7         | 69.9                    | 4300                  | 5600  |
|                 | 120 | 49.2 | 2.0                     | 3311J        | 100.5        | 115.3                   | 3600                  | 4800  |
| 60              | 110 | 36.5 | 1.5                     | 3212J        | 71.4         | 86.1                    | 3800                  | 5000  |
|                 | 130 | 54.0 | 2.1                     | 3312J        | 116.1        | 135.3                   | 3400                  | 4500  |
| 65              | 120 | 38.1 | 1.5                     | 3213J        | 76.4         | 98.4                    | 3600                  | 4800  |
|                 | 140 | 58.7 | 2.1                     | 3313J        | 133.7        | 156.4                   | 3200                  | 4300  |
| 70              | 125 | 39.7 | 1.5                     | 3214J        | 84.2         | 109.5                   | 3200                  | 4300  |
|                 | 150 | 63.5 | 2.1                     | 3314J        | 146.9        | 175.5                   | 2800                  | 3800  |



| Dimensions |           |     | Abutment dimensions |       |       | Weight    | Abbreviation |
|------------|-----------|-----|---------------------|-------|-------|-----------|--------------|
| $d_1$      | $D_1$     | $a$ | $d_a$               | $D_a$ | $r_a$ | $\approx$ |              |
| $\approx$  | $\approx$ |     | min                 | max   | max   |           |              |
| mm         |           |     |                     |       |       | kg        |              |
| 17.2       | 24.4      | 20  | 14                  | 26    | 0.6   | 0.052     | 3200J        |
| 19.3       | 26.9      | 22  | 16                  | 28    | 0.6   | 0.063     | 3201J        |
| 22.6       | 30.4      | 24  | 19                  | 31    | 0.6   | 0.072     | 3202J        |
| 24.9       | 34.4      | 27  | 21                  | 36    | 1.0   | 0.132     | 3302J        |
| 25.5       | 33.8      | 27  | 21                  | 36    | 0.6   | 0.103     | 3203J        |
| 27.6       | 40.0      | 31  | 23                  | 41    | 1.0   | 0.192     | 3303J        |
| 29.5       | 40.5      | 32  | 26                  | 41    | 1.0   | 0.168     | 3204J        |
| 32.0       | 43.0      | 34  | 27                  | 45    | 1.0   | 0.230     | 3304J        |
| 34.6       | 45.1      | 35  | 31                  | 46    | 1.0   | 0.194     | 3205J        |
| 38.5       | 52.5      | 40  | 32                  | 55    | 1.0   | 0.369     | 3305J        |
| 41.2       | 54.0      | 41  | 36                  | 56    | 1.0   | 0.316     | 3206J        |
| 45.4       | 61.3      | 47  | 37                  | 65    | 1.0   | 0.585     | 3306J        |
| 47.8       | 63.3      | 47  | 42                  | 65    | 1.0   | 0.484     | 3207J        |
| 50.8       | 69.2      | 54  | 44                  | 71    | 1.5   | 0.816     | 3307J        |
| 54.0       | 70.4      | 53  | 47                  | 73    | 1.0   | 0.654     | 3208J        |
| 59.4       | 80.1      | 59  | 49                  | 81    | 1.5   | 1.070     | 3308J        |
| 59.8       | 76.4      | 56  | 52                  | 78    | 1.0   | 0.709     | 3209J        |
| 66.2       | 89.1      | 64  | 54                  | 91    | 1.5   | 1.400     | 3309J        |
| 63.7       | 80.8      | 59  | 57                  | 83    | 1.0   | 0.764     | 3210J        |
| 72.5       | 96.4      | 73  | 60                  | 100   | 2.0   | 1.950     | 3310J        |
| 72.0       | 89.7      | 64  | 64                  | 91    | 1.5   | 1.050     | 3211J        |
| 80.2       | 106.4     | 80  | 65                  | 110   | 2.0   | 2.550     | 3311J        |
| 78.2       | 98.3      | 71  | 69                  | 101   | 1.5   | 1.400     | 3212J        |
| 86.2       | 115.0     | 86  | 72                  | 118   | 2.0   | 3.250     | 3312J        |
| 84.7       | 105.8     | 76  | 74                  | 111   | 1.5   | 1.750     | 3213J        |
| 92.5       | 123.0     | 94  | 77                  | 128   | 2.0   | 4,100     | 3313J        |
| 88.7       | 111.5     | 81  | 79                  | 116   | 1.5   | 1.900     | 3214J        |
| 98.5       | 131.0     | 101 | 82                  | 138   | 2.0   | 5.050     | 3314J        |



# Pulleys

Pulleys are developments of double-row angular-contact ball bearings with a reinforced outer ring. The outer ring can be either of cylindrical or spherical design. The inner ring of these bearings is provided with lubrication holes. The bearings have no filling slot and absorb radial and axial forces in both directions. The contact angle of these bearings is 25°. The bearing cage is made of glass-fibre reinforced Polyamide 66. Pulleys are supplied with seals or shields on both sides. They are normally supplied filled with grease at the factory. Special pulleys with galvanised bearing inner and outer rings are also available on enquiry.

**Tolerances** The bearings are only manufactured to the standard tolerance P0.

**Angular adjustment facility** Double-row pulleys do not facilitate angular adjustment.

**Bearing clearance** With double-row pulleys, the axial bearing clearance is specified. The bearings are normally supplied with axial clearance C0 "Normal". The axial clearances can be found in the table below.

The radial clearances are approx. 45 % of the axial clearances.

Axial clearance of double-row pulleys without load

| Rated size of bore (mm) | above | 6  | 10 | 18 | 24 | 30 | 40 | 50 | 65 |
|-------------------------|-------|----|----|----|----|----|----|----|----|
|                         | up to | 10 | 18 | 24 | 30 | 40 | 50 | 65 | 80 |
|                         |       |    |    |    |    |    |    |    |    |
| C0 Standard             | min.  | 5  | 6  | 7  | 8  | 9  | 11 | 13 | 15 |
|                         | max.  | 21 | 23 | 25 | 27 | 29 | 33 | 36 | 40 |

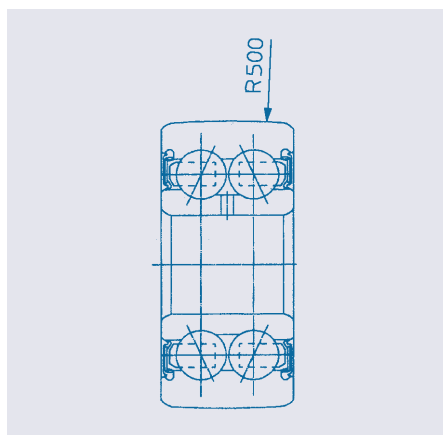
Bearing clearances in µm

**Cages** Double-row pulleys are fitted with cages made of glass-fibre reinforced Polyamide 66.

**Seals** NSK manufactures pulleys with seals and shields on both sides of the bearing.

**Shields ZR** Shields are sheet-steel discs which are fixed inside the bearing outer ring forming a small gap for the bearing inner ring. The bearings are available with shields on both sides "2ZR".

**Seals RSR** Seals RSR consist of nitrile rubber and are reinforced with a steel disc embedded in the rubber. The seals are fixed in the outer ring and seal against the inner ring with a friction sealing lip. The bearings are available with seals on both sides of the bearing "2RSR".



### Lubrication

NSK supplies pulleys filled with grease at the factory. This is a high-quality lithiumbased grease with an admissible temperature range of  $-30\text{ }^{\circ}\text{C}$  to  $+110\text{ }^{\circ}\text{C}$ . The grease used by NSK is compatible with all other mineral-oil-based greases. The inner rings of the pulleys are provided with a lubrication hole so that bearings can be re-lubricated. With Version 2RSR, the grease must be pressed in slowly to avoid damaging the seals.

### Bearing load capacity

If the pulley is supported by a flat contact surface, only a small surface area of the outer ring of the pulleys comes into contact with the rolling plane. The elastic deformation of the outer ring reduces the load-bearing capacity of the pulley. In this case, the values specified in the "Pulley load ratings" table must be used in the calculation.

On the other hand, when installing the pulley in a housing bore, the "Bearing load ratings" apply which are also listed.

### Suffixes

|      |  |
|------|--|
| LZ   | Pulley with cylindrical outer ring (prefix)      |
| LB   | Pulley with spherical outer ring (prefix)        |
| B    | $25^{\circ}$ Contact angle                       |
| S    | Lubrication hole in inner ring                   |
| TNG  | Cage made of glass-fibre reinforced Polyamide 66 |
| 2ZR  | Shields on both sides                            |
| 2RSR | Seals on both sides                              |

### Dynamic equivalent bearing load

$$P = F_r + 0.92 \cdot F_a \quad [\text{kN}] \quad \text{where } F_a/F_r \leq 0.68$$

$$P = 0.67 \cdot F_r + 1.41 \cdot F_a \quad [\text{kN}] \quad \text{where } F_a/F_r > 0.68$$

### Basic rating life

$$L_n = \frac{1,000,000}{n \cdot 60} \cdot \left(\frac{C}{P}\right)^3 \quad (\text{Running hours})$$

$$f_h = f_n \cdot \frac{C}{P} \quad (\text{Factors } f_h \text{ and } f_n \text{ see Table Page 39})$$

### Static equivalent bearing load

$$P_0 = F_r + 0.76 \cdot F_a \quad [\text{kN}]$$

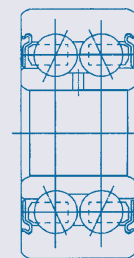
### Basic static load rating

$$s_0 = \frac{C_0}{P_0}$$

# Pulleys

LZ..2ZR

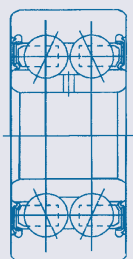
Pulleys  
Bore 10 – 35 mm



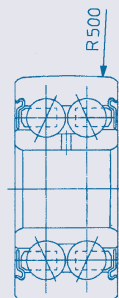
| Dimensions |    |      |                | Abbreviation                     |                                    | Load ratings [kN] |                         |           |                         | Speed limits      | Weight |
|------------|----|------|----------------|----------------------------------|------------------------------------|-------------------|-------------------------|-----------|-------------------------|-------------------|--------|
| d          | D* | B    | r <sub>s</sub> | Shields                          | Seals                              | Bearing Pulley    |                         |           |                         | ≈                 |        |
|            |    |      |                |                                  |                                    | dyn.<br>C         | stat.<br>C <sub>0</sub> | dyn.<br>C | stat.<br>C <sub>0</sub> |                   |        |
| mm         |    |      | min            |                                  |                                    |                   |                         |           |                         | min <sup>-1</sup> | kg     |
| 10         | 32 | 14.0 | 0.6            | LZ3200B2ZRSTNG<br>LB3200B2ZRSTNG | LZ3200B2RSRSTNG<br>LB3200B2RSRSTNG | 7.8               | 4.55                    | 7.45      | 4.15                    | 16000             | 0.061  |
| 12         | 35 | 15.9 | 0.6            | LZ3201B2ZRSTNG<br>LB3201B2ZRSTNG | LZ3201B2RSRSTNG<br>LB3201B2RSRSTNG | 10.6              | 5.85                    | 9.95      | 5.20                    | 15000             | 0.079  |
| 15         | 40 | 15.9 | 0.6            | LZ3202B2ZRSTNG<br>LB3202B2ZRSTNG | LZ3202B2RSRSTNG<br>LB3202B2RSRSTNG | 11.8              | 7.10                    | 11.00     | 6.45                    | 13000             | 0.100  |
| 17         | 47 | 17.5 | 0.6            | LZ3203B2ZRSTNG<br>LB3203B2ZRSTNG | LZ3203B2RSRSTNG<br>LB3203B2RSRSTNG | 14.6              | 9.00                    | 13.80     | 8.30                    | 10000             | 0.165  |
| 20         | 52 | 20.6 | 1.0            | LZ3204B2ZRSTNG<br>LB3204B2ZRSTNG | LZ3204B2RSRSTNG<br>LB3204B2RSRSTNG | 19.6              | 12.50                   | 18.30     | 11.00                   | 9000              | 0.210  |
| 25         | 62 | 20.6 | 1.0            | LZ3205B2ZRSTNG<br>LB3205B2ZRSTNG | LZ3205B2RSRSTNG<br>LB3205B2RSRSTNG | 21.2              | 14.60                   | 19.90     | 13.40                   | 8000              | 0.330  |
| 30         | 72 | 23.8 | 1.0            | LZ3206B2ZRSTNG<br>LB3206B2ZRSTNG | LZ3206B2RSRSTNG<br>LB3206B2RSRSTNG | 30.0              | 21.20                   | 27.90     | 18.60                   | 7100              | 0.500  |
| 35         | 80 | 27.0 | 1.1            | LZ3207B2ZRSTNG<br>LB3207B2ZRSTNG | LZ3207B2RSRSTNG<br>LB3207B2RSRSTNG | 39.0              | 28.50                   | 36.2      | 25.0                    | 6300              | 0.660  |

\* with spherical outer ring D 0.05 mm

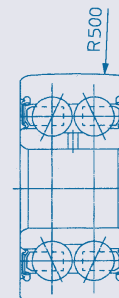
LZ..2RSR



LB..2ZR



LB..2RSR



# Life factors $f_h$ and speed factors $f_n$ for ball bearings

$f_h$  values for ball bearings  $f_h = \sqrt[3]{\frac{L_h}{500}}$

| $L_h$<br>(h) | $f_h$ | $L_h$<br>(h) | $f_h$ | $L_h$<br>(h) | $f_h$ | $L_h$<br>(h) | $f_h$ | $L_h$<br>(h) | $f_h$ |
|--------------|-------|--------------|-------|--------------|-------|--------------|-------|--------------|-------|
| 100          | 0.585 | 400          | 0.928 | 1,500        | 1.440 | 5,000        | 2.150 | 20,000       | 3.420 |
| 110          | 0.604 | 420          | 0.944 | 1,600        | 1.470 | 5,500        | 2.220 | 22,000       | 3.530 |
| 120          | 0.621 | 440          | 0.958 | 1,700        | 1.500 | 6,000        | 2.290 | 24,000       | 3.630 |
| 130          | 0.638 | 460          | 0.973 | 1,800        | 1.530 | 6,500        | 2.350 | 26,000       | 3.730 |
| 140          | 0.654 | 480          | 0.986 | 1,900        | 1.560 | 7,000        | 2.410 | 28,000       | 3.830 |
| 150          | 0.669 | 500          | 1.000 | 2,000        | 1.590 | 7,500        | 2.470 | 30,000       | 3.910 |
| 160          | 0.684 | 550          | 1.030 | 2,200        | 1.640 | 8,000        | 2.520 | 35,000       | 4.120 |
| 170          | 0.698 | 600          | 1.060 | 2,400        | 1.690 | 8,500        | 2.570 | 40,000       | 4.310 |
| 180          | 0.711 | 650          | 1.090 | 2,600        | 1.730 | 9,000        | 2.620 | 45,000       | 4.480 |
| 190          | 0.724 | 700          | 1.120 | 2,800        | 1.780 | 9,500        | 2.670 | 50,000       | 4.640 |
| 200          | 0.737 | 750          | 1.140 | 3,000        | 1.820 | 10,000       | 2.710 | 55,000       | 4.790 |
| 220          | 0.761 | 800          | 1.170 | 3,200        | 1.860 | 11,000       | 2.800 | 60,000       | 4.930 |
| 240          | 0.783 | 850          | 0.190 | 3,400        | 1.890 | 12,000       | 2.880 | 65,000       | 5.070 |
| 260          | 0.804 | 900          | 1.220 | 3,600        | 1.930 | 13,000       | 2.960 | 70,000       | 5.190 |
| 280          | 0.824 | 950          | 1.240 | 3,800        | 1.970 | 14,000       | 3.040 | 75,000       | 5.310 |
| 300          | 0.843 | 1,000        | 1.260 | 4,000        | 2.000 | 15,000       | 3.110 | 80,000       | 5.430 |
| 320          | 0.862 | 1,100        | 1.300 | 4,200        | 2.030 | 16,000       | 3.170 | 85,000       | 5.540 |
| 340          | 0.879 | 1,200        | 1.340 | 4,400        | 2.060 | 17,000       | 3.240 | 90,000       | 5.650 |
| 360          | 0.896 | 1,300        | 1.380 | 4,600        | 2.100 | 18,000       | 3.300 | 95,000       | 5.750 |
| 380          | 0.913 | 1,400        | 1.410 | 4,800        | 2.130 | 19,000       | 3.360 | 100,000      | 5.850 |

$f_n$  - values for ball bearings  $f_n = \sqrt[3]{\frac{33^{1/3}}{n}}$

| $n$<br>(min <sup>-1</sup> ) | $f_n$ | $n$<br>(min <sup>-1</sup> ) | $f_n$ | $n$<br>(min <sup>-1</sup> ) | $f_n$ | $n$<br>(min <sup>-1</sup> ) | $f_n$ | $n$<br>(min <sup>-1</sup> ) | $f_n$  |
|-----------------------------|-------|-----------------------------|-------|-----------------------------|-------|-----------------------------|-------|-----------------------------|--------|
| 10                          | 1.490 | 50                          | 0.874 | 300                         | 0.481 | 1,500                       | 0.281 | 7,500                       | 0.1640 |
| 11                          | 1.450 | 55                          | 0.846 | 320                         | 0.471 | 1,600                       | 0.275 | 8,000                       | 0.1610 |
| 12                          | 1.410 | 60                          | 0.822 | 340                         | 0.461 | 1,700                       | 0.270 | 8,500                       | 0.1580 |
| 13                          | 1.370 | 65                          | 0.800 | 360                         | 0.452 | 1,800                       | 0.265 | 9,000                       | 0.1550 |
| 14                          | 1.340 | 70                          | 0.781 | 380                         | 0.444 | 1,900                       | 0.260 | 9,500                       | 0.1520 |
| 15                          | 1.300 | 75                          | 0.763 | 400                         | 0.437 | 2,000                       | 0.255 | 10,000                      | 0.1490 |
| 16                          | 1.280 | 80                          | 0.747 | 420                         | 0.430 | 2,200                       | 0.247 | 11,000                      | 0.1450 |
| 17                          | 1.250 | 85                          | 0.732 | 440                         | 0.423 | 2,400                       | 0.240 | 12,000                      | 0.1410 |
| 18                          | 1.230 | 90                          | 0.718 | 460                         | 0.417 | 2,600                       | 0.234 | 13,000                      | 0.1370 |
| 19                          | 1.210 | 95                          | 0.705 | 480                         | 0.411 | 2,800                       | 0.228 | 14,000                      | 0.1340 |
| 20                          | 1.190 | 100                         | 0.693 | 500                         | 0.405 | 3,000                       | 0.223 | 16,000                      | 0.1280 |
| 22                          | 1.150 | 110                         | 0.672 | 550                         | 0.393 | 3,200                       | 0.218 | 18,000                      | 0.1230 |
| 24                          | 1.120 | 120                         | 0.652 | 600                         | 0.382 | 3,400                       | 0.214 | 20,000                      | 0.1190 |
| 26                          | 1.090 | 130                         | 0.635 | 650                         | 0.372 | 3,600                       | 0.210 | 22,000                      | 0.1150 |
| 28                          | 1.060 | 140                         | 0.620 | 700                         | 0.362 | 3,800                       | 0.206 | 24,000                      | 0.1120 |
| 30                          | 1.040 | 150                         | 0.606 | 750                         | 0.354 | 4,000                       | 0.203 | 26,000                      | 0.1090 |
| 32                          | 1.010 | 160                         | 0.593 | 800                         | 0.347 | 4,200                       | 0.199 | 28,000                      | 0.1060 |
| 34                          | 0.993 | 170                         | 0.581 | 850                         | 0.340 | 4,400                       | 0.196 | 30,000                      | 0.1040 |
| 36                          | 0.975 | 180                         | 0.570 | 900                         | 0.333 | 4,600                       | 0.194 | 32,000                      | 0.1010 |
| 38                          | 0.957 | 190                         | 0.560 | 950                         | 0.327 | 4,800                       | 0.191 | 34,000                      | 0.0993 |
| 40                          | 0.941 | 200                         | 0.550 | 1,000                       | 0.322 | 5,000                       | 0.188 | 36,000                      | 0.0975 |
| 42                          | 0.926 | 220                         | 0.533 | 1,100                       | 0.312 | 5,500                       | 0.182 | 38,000                      | 0.0957 |
| 44                          | 0.912 | 240                         | 0.518 | 1,200                       | 0.303 | 6,000                       | 0.177 | 40,000                      | 0.0941 |
| 46                          | 0.898 | 260                         | 0.504 | 1,300                       | 0.295 | 6,500                       | 0.172 | 45,000                      | 0.0905 |
| 48                          | 0.886 | 280                         | 0.492 | 1,400                       | 0.288 | 7,000                       | 0.168 | 50,000                      | 0.0875 |



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