

THE SPECIALIST  
FOR MOTION  
TECHNOLOGY

# NEEDLE BEARINGS





# PRODUCT OVERVIEW



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# PRODUCT OVERVIEW

## MEASUREMENT UNITS

| Unit                | S.I. System             |                   | Multiple or part              |        | Equivalent                   |
|---------------------|-------------------------|-------------------|-------------------------------|--------|------------------------------|
|                     | title                   | symbol            | title                         | symbol |                              |
| length              | metre                   | m                 | millimeter                    | mm     | 1 mm = 10 <sup>-3</sup> m    |
| time                | second                  | s                 | micron                        | µm     | 1 µm = 10 <sup>-6</sup> m    |
| speed               | metre per second        | m/s               | hour                          | h      | 1 h = 3600 s                 |
| acceleration        | metre per square second | m/s <sup>2</sup>  | minute                        | min    | 1 min = 60 s                 |
| speed (rotational)  | revolutions per minute  | min <sup>-1</sup> |                               |        |                              |
| mass                | kilogramme              | kg                | gram                          | g      | 1 g = 10 <sup>-3</sup> kg    |
| force               | newton                  | N                 | kilonewton                    |        | 1 N = 10 <sup>-3</sup> kN    |
| moment of force     | newton metre            | Nm                |                               |        |                              |
| stress              | pascal                  | Pa                | megapascal                    |        | 1 Mpa = 1N/mm <sup>2</sup>   |
| kinematic viscosity | square metre per second | m <sup>2</sup> /s | square millimeters per second |        | 1 mm <sup>2</sup> /s = 1 cSt |
| temperature         | degrees centigrade      | C°                |                               |        |                              |

### Comments

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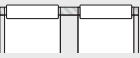























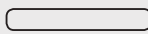
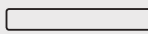
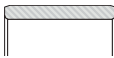
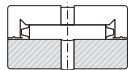
Information and advice contained herein may be insufficient given the conditions of specific applications.  
Consult our Technical Department..

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# PRODUCT OVERVIEW

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# PRODUCT OVERVIEW

## TECHNICAL FEATURES

### 1. GENERAL

The choice of a bearing depends on many factors that need to be examined in order to obtain the most successful results at the lowest cost. In most cases the selection should be made when the overall design of the machine has been decided.

Dimensional limits are then known, also the speeds and loads. At this stage the choice can be made from the many types of bearings offered from the standard ranges. The notes given in this section will generally permit one to select the most suitable bearing for each application.

As for all other types of bearing, the results obtained with needle bearing products depend to a large extent on the design and method of assembly, loading, and alignment between inner and outer rings.

Bearing alignment depends first of all on the geometry of the parts involved and secondly on the deflection of the shaft under load. The shaft diameter should therefore be sufficient to prevent large deflections. This is easier to achieve using needle bearings because they occupy a small radial area.

### 2. BEARING TYPE SELECTION

Bearing type selection is made after the general design concept of the mechanism has been established and the application requirements carefully evaluated.

The ability of a bearing to support radial or axial loads, tolerate misalignments, be suitable for high speeds or loads are the main criteria for guiding the selection in the correct way. To navigate the families of bearings in this catalogue an initial assessment can be made on the basis of the table below. Further details are specified in the relevant chapters.

|                        | Radial needle roller cage | Caged needle bushes | Full complement needle bushes | Caged needle bearings | Full complement needle bearings | Needle rollers | Thrust bearings | Combined bearings <sup>1)</sup> |
|------------------------|---------------------------|---------------------|-------------------------------|-----------------------|---------------------------------|----------------|-----------------|---------------------------------|
| Radial load            | High                      | Moderate            | High                          | High                  | Very high                       | Very high      | None            | High                            |
| Axial load             | None                      | None                | None                          | None                  | None                            | None           | Very high       | Very high                       |
| Speed                  | Very high                 | High                | Moderate                      | Very high             | Moderate                        | Moderate       | Moderate        | Moderate                        |
| Misalignment tolerance | Moderate                  | Moderate            | Low                           | Moderate              | Moderate                        | Very low       | Low             | Low                             |
| Grease life            | High                      | High                | Moderate                      | High                  | Moderate                        | Moderate       | Low             | Low                             |
| Friction               | Very low                  | Low                 | High                          | Very low              | High                            | High           | High            | Moderate                        |
| Precision              | Very high                 | Moderate            | Moderate                      | High                  | High                            | Very high      | High            | Very high                       |
| Cross section          | Very low                  | Low                 | Low                           | Moderate              | Moderate                        | Very low       | Moderate        | Moderate                        |
| Cost                   | Low                       | Low                 | Low                           | Moderate              | Moderate                        | Low            | High            | High                            |

*1) RAX 700 series not included*

### 3. CALCULATIONS FOR RADIAL AND THRUST BEARINGS

The details following enable one to evaluate lifetime of radial bearings and thrust bearings and also combined bearings which comprise a radial and a thrust component. These are calculated separately without transforming the axial load into an equivalent radial load.

The calculation for a radial or thrust bearing must take account of the following principal factors:

- Actual supported loads and possible shock loads
- Rotation speed
- Operating temperature
- Hardness of the bearing raceways

Other features such as lubrication, sealing and alignment must be considered in order to avoid introducing unfavourable factors.

The formulas for lifetime calculations here reported are considered valid under standard conditions, generally useful for first-sizing or product comparison. For further details on correction factors for bearing lifetime in applications, please refer to ISO281 standards and to Nadella Technical Service.

The life calculation of a radial bearing or a thrust bearing under rotation is established from the dynamic capacity C indicated in the tables of dimensions. The static capacity C<sub>0</sub> enables one to determine the maximum load under certain operating conditions (see table above).

## 3.1. BEARING LIFETIME

### 3.1.1 Dynamic capacity C

The dynamic capacity of a bearing is the constant radial load which it can support during one million revolutions before the first signs of fatigue appear on a ring or rolling element. For a thrust bearing, the capacity for one million revolutions assumes a constant axial load centred in line with the axis of rotation.

The dynamic capacity is a reference value only; the base value of one million revolutions has been chosen for ease of calculation. Since applied loading as great as the dynamic capacity tends to cause local plastic deformations of the rolling surfaces that may affect their operations.

The dynamic capacity C for bearings shown in the tables of dimensions has been established in conformance with the ISO Standard 281.

### 3.1.2 Nominal life $L_{10}$

The life of a (or thrust bearing) is the number of revolutions (or the number of hours at constant speed) that it will maintain before showing the first signs of material fatigue.

The relationship between the life in millions of revolutions  $L_{10}$ , the dynamic capacity C and the supported load P, is given by the formula:

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

in this expression p is equal to 10/3 for needle or roller bearings. In order to assess the importance of the influence of load on the life expectancy, one should note for example that, if the load on a bearing is doubled, its life is reduced by a factor of 10. The formula above is independent of speed of rotation which must not exceed the recommended limit in respect of the radial bearing or the thrust bearing used and the method of lubrication. If the speed of rotation n (r.p.m.) is constant, the life is given in hours by the function:

$$L_{10h} = \frac{L_{10} \times 10^6}{60 n}$$

The above formula will ensure that 90% of the bearings operating under the same conditions will attain at least the calculated  $L_{10}$  life, known as the nominal life (the figure 10 being the percentage of bearings which may not attain this life). The formulae are based on the use of standard quality bearing steel and assume a satisfactory method of lubrication. The formulas for life calculation are effective for an applied load smaller than 0.5 C.

### 3.1.3 Modified life $L_{na}$

In conditions different from the mentioned above, a modified life  $L_{na}$  can be determined (in millions of revolutions) following the general formula:

$$L_{na} = a_1 \cdot a_{ISO} \cdot L_{10}$$

in which  $a_1$  and  $a_{ISO}$  are correction factors linked respectively to reliability, contamination and lubrication.

#### Reliability correction factor $a_1$

A reliability factor in excess of 90% may be required in certain industries fields, such as aviation, for reasons of security and to reduce the risk of a very costly immobilisation. The table below indicates the values of the correction factor  $a_1$  as a function of reliability:

| Reliability<br>% | Factor<br>$a_1$ | Modified life<br>$L_{na1}$ |
|------------------|-----------------|----------------------------|
| 90               | 1               | $L_{10}$                   |
| 95               | 0,64            | $L_5$                      |
| 96               | 0,55            | $L_4$                      |
| 97               | 0,47            | $L_3$                      |
| 98               | 0,37            | $L_2$                      |
| 99               | 0,25            | $L_1$                      |
| 99,5             | 0,175           | $L_{0,5}$                  |
| 99,9             | 0,093           | $L_{0,1}$                  |

In order to select as an example a bearing of life  $L_4$  (reliability 96%) it is necessary to estimate life  $L_{10}$  with the formula  $L_{10} = (C/P)^{10/3}$  starting from the dynamic capacity C given in this catalogue:

$$L_4 = 0.55 \cdot L_{10}$$

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### Correction factor $a_{ISO}$

The factors that affect bearing life are numerous, and their analysis is not one in this catalogue. The effects of temperature, misalignment, bearing clearance, cleaning and lubrication conditions, which require a detailed discussion is beyond the scope of the product catalogue. For a more detailed discussion, please refer to Standards:

ISO 281:2007 introducing the coefficient  $a_{ISO}$  to take into account the effects of lubrication and cleanliness of the lubricant.

Nadella technical service is available for advice on the choices to be made in special cases.

### 3.1.4 Variable loads and speeds $a_{ISO}$

When the loads and speeds are variable, the life calculation can only be made by first establishing an assumed constant load and constant speed equivalent in their effect on the fatigue life.

This type of operating condition is frequently met and the possible variations although cyclical are numerous. One encounters this feature in particular, in variable speed drives on some supports, but constant on each support for an interval of time referring to the total operating time (example: change of speed). The equivalent load  $P$  and the equivalent speed  $n$  are obtained from the following formulas:

$$P = \sqrt[p]{\frac{m_1 n_1 P_1^p + m_2 n_2 P_2^p + \dots + m_n n_n P_n^p}{m_1 n_1 + m_2 n_2 + \dots + m_n n_n}}$$

$$n = m_1 n_1 + m_2 n_2 + \dots + m_n n_n$$

in which:

- $m_1, m_2, \dots, m_n$ : interval of operating time under constant load and speed (by definition:  $m_1 + m_2 + \dots + m_n = 1$ )
- $n_1, n_2, \dots, n_n$ : constant speed corresponding respectively to intervals of time  $m_1, m_2, \dots, m_n$
- $P_1, P_2, P_n$ : constant loads corresponding respectively to intervals of time  $m_1, m_2, \dots, m_n$

For needles and roller bearings and thrust bearings,  $p$  is equal to 10/3.

Whilst at constant speed, the load varies linearly during a given time, between a minimum  $P_{min}$  and a maximum  $P_{max}$ . the equivalent load is given by:

$$P = \frac{P_{min} + 2 P_{max}}{3}$$

### 3.1.5 Oscillating motion

In order to calculate the life during oscillating motion it is necessary to determine an equivalent speed  $n$  in revolutions per minute from the formula:

$$n = \frac{n_{osc} \alpha}{180}$$

$n_{osc}$ : interval of operating time under constant load and speed (by definition:  $m_1 + m_2 + \dots + m_n = 1$ )

$\alpha$ : constant speed corresponding respectively to intervals of time  $m_1, m_2, \dots, m_n$

However, this formula risks being in error and giving inaccurate lives for oscillations at small amplitudes. It is therefore recommended not to apply it for angles of oscillation below 15°.

When the angle of oscillation is very small fretting corrosion is likely to be produced and a suitable lubricant must be chosen in consequence. Experience confirms that full complement needle bearings provide better results under this phenomenon in view of their better load sharing capability.

### 3.1.6 Application criteria

The life calculation may be unreliable when values for speed and load reach the ultimate limits. A low speed and/or load can yield an extremely long calculated life but this will be limited in practice by other operating factors such as sealing, lubrication and maintenance, all of which have a decisive influence on the life of the product in such cases.



### 3.2. MINIMUM LOAD

Slippage can occur if loads are too light and, if accompanied by inadequate lubrication, cause damage to the bearings. The minimum load for bearings with cage must be

For radial bearings

- $F_{r \min} = 0,04C$  (C is the Dynamic Capacity for lifetime calculation)

For thrust bearings are correct the formulas

- Needle bearings  $F_{a \min} = 0,005 C_o$  (C<sub>o</sub> is the Static Capacity)
- Roller bearings  $F_{a \min} = 0,001 C_o$  (C<sub>o</sub> is the Static Capacity)

### 3.3. STATIC CAPACITY C<sub>o</sub> AND LIMIT LOAD P<sub>o</sub>

The static capacity C<sub>o</sub> given in the tables of dimensions has been established in conformance with ISO Specification 76. This takes into consideration the maximum admissible contact stress (Hertzian stress). The value currently being adopted is 4000 MPa.

Since permanent deformation is produced as readily in a bearing rotating as in one that is stationary, the static capacity C<sub>o</sub> determines the limit load P<sub>o</sub> which depends on the type of bearing and the operating conditions. When the limit load P<sub>o</sub> is given within the "min-max" range, the load applied may attain the indicated maximum provided it is applied continuously without sudden repeated variations. Alternatively, in the case of shock loads and vibrations, the load applied should not exceed the minimum value of limit load P<sub>o</sub>.

The relationship between the static capacity and the limit load defines the safety static factor f<sub>o</sub>:

$$f_o = C_o/P_o$$

The suggested values for the safety factor, depend on the type of application and product

Solid rail bearings

- $f_o = 1,5 \dots 2,5$  Important requirements for smoothness of function, silent operation or accuracy of rotation
- $f_o = 1 \dots 1,5$  General applications
- $f_o = 0,7 \dots 1$  Slow rotation or oscillatory motion

$$Z = \frac{\pi \cdot (F_w + \emptyset)}{\emptyset}$$

Drawn bearings

- $f_o > 4$  Important requirements for smoothness of function, silent operation or accuracy of rotation
- $f_o > 3$  General applications and oscillatory motion

$$Z = \frac{\pi \cdot (30 + 2,5)}{2,5}$$

Cam followers: the allowable load for cam followers depends on the static load of the bearing and from the strength of the stud and of the outer ring. Authorised values are listed in the tables of dimensions.

### 3.4. COEFFICIENT OF FRICTION

The resistance torque M of a bearing supporting a load P is given by the following relationships:

- Radial bearing:  $M = f \cdot P \cdot \frac{F_w}{2}$

(where F<sub>w</sub> is the diameter of the inner raceway of the bearing)

- Thrust bearing:  $M = f \cdot P \cdot \frac{d_m}{2}$  with  $d_m = \frac{E_b + E_a}{2}$

(where E<sub>b</sub> and E<sub>a</sub> are the internal and external raceway diameters given in table of dimensions).

The coefficient of friction f depends on a number of factors, amongst which are:

- Type of mechanism
- Applied load
- Speed of rotation
- Lubrication
- Surface finish and alignment of raceways

The mean values shown below are for oil lubrication

- $f = 0,002 \div 0,003$  for caged needle bearings
- $f = 0,003 \div 0,004$  for full complement bearings and needle thrust bearings
- $f = 0,004 \div 0,005$  for roller thrust bearings

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These coefficients are applicable for values of C/P between 2 and 6 approximaely. For values less than or in excess of these limits the coefficient of friction f can be increased by 10 to 50%. Under starting conditions from rest, the values of f may be up to 1.5 times higher than those shown above. To evaluate the losses of the entire bearing assembly, account must also be taken of the friction due to the seals which can be significant, especially during "running-in".

### 3.5. LIMITING SPEED

The tabular pages list the limiting speed values calculated under normal operating conditions, properly mounting tolerances and clearance, absence of misalignments, low loads. For speed calculated with oil lubrication it is considered a normal flow of lubricant. A bearing may operate at a speed higher than the listed limiting speed with use of a clean, with good quality oil and correct flow to remove the heat generated in the table. Consult Nadella Technical Service for further details.

In case of high speed and acceleration to avoid internal slippage between the rolling elements and the raceways the relationship between the applied load P and the base load of the bearing C must be at least  $P/C > 0.02$ .

The wheels are supplied normally lubricated with grease suitable for general use, so the limit speed given in the dimension tables take account of such lubrication. For wheels without seals, lubricated with oil, the indicated speed limit may be increased by about 30% for continuous rotation (about 50% for intermittent rotation).

## 4. MOUNTING

### 4.1. SHAFT FOR BEARINGS WITHOUT INNER RING

#### 4.1.1. Heat treatment of raceways

The minimum hardness of 58-64 HRC required to apply the calculations without reducing the basic capacities may be obtained with a through-hardened bearing steel or with a case-hardened and tempered steel. In the latter case, the hardened case must be homogeneous and regular over the entire surface of the raceway: the case depth is the thickness between the surface and the core having a hardness value of Vickers HV1 of 550 (see Standard NF A 04 202).

The minimum effective case depth of hardening depends on the applied load, the size of the rolling elements and the core strength of the steel used. To calculate the approximate case depth minimum depth can be used the following formula

$$\text{Minimum case depth} = (0,07 \div 0,12) \times Dw$$

Dw = diameter of the rolling element

In any case the minimum suggested case depth is of 0.4 mm.

The load capacities shown in the tables of dimensions apply to raceways with a hardness of between 58 and 64 HRC.

The dynamic and static capacities are reduced when hardness values are lower than 58 and 54 HRC respectively according to the following table:

|                                    |       |     |     |      |      |      |      |      |      |      |      |      |      |
|------------------------------------|-------|-----|-----|------|------|------|------|------|------|------|------|------|------|
| Hardness                           | HRC   | 60  | 58  | 56   | 54   | 52   | 50   | 48   | 45   | 40   | 35   | 30   | 25   |
|                                    | HV*   | 697 | 653 | 613  | 577  | 545  | 512  | 485  | 447  | 392  | 346  | 302  | 267  |
| Coefficients<br>for load reduction | Dyn.  | 1   | 1   | 0,93 | 0,84 | 0,73 | 0,63 | 0,52 | 0,43 | 0,31 | 0,23 | 0,15 | 0,11 |
|                                    | Stat. | 1   | 1   | 1    | 1    | 0,96 | 0,86 | 0,77 | 0,65 | 0,50 | 0,39 | 0,30 | 0,25 |

#### 4.1.2. Surface finish

The shafts or housing used directly as raceways for needles must have a surface finish acceptable for the operating conditions and the precision requirements:

- applications with high speeds and loads: Ra = 0,2 µm
- general applications: Ra = 0,35 µm

#### 4.1.3. Tolerances and form deviations

The suggested tolerances for the mean shaft diameter are indicated in the appropriate chapters specific for every product.

The suggested tolerance for deviation from the cylindrical raceways form (radial bearings).

- Variation of mean shaft diameter within the length of the bearing raceway should not exceed 0.008 mm or one-half the diameter tolerance. The profile should never be concave (the core diameter must protrude to the diameter at the ends)
- Deviation from circular form: the minimum between 0.0025 mm and one quarter of diameter tolerance

For thrust bearings and combined bearings refer to the specific chapter prescriptions.

#### 4.1.4. End chamfer

For the most effective assembly and preventing damage to the roller complements or needles, provide a chamfer to the ends of the raceway.

#### 4.1.5. Surface in contact with seals

The surface in contact with the sealing lips must be finished with plunge cut grinding. The propeller subsequent to the grinding process without centers can create a pumping effect of the lubricant through the seal.

### 4.2. SHAFT FOR BEARINGS WITH INNER RING

#### 4.2.1. Surface finish of the shaft

Maximum roughness suggested:  $R_a = 1,6 \mu\text{m}$

#### 4.2.2. Tolerances and form deviations

The suggested tolerances for the mean shaft diameter are indicated in the appropriate chapters specific for every product. The suggested tolerance for deviation from the cylindrical raceways form (radial bearings)

- Variation of mean shaft diameter within the length of the bearing raceway: one-half of the diameter tolerance
- Deviation from circular form: one-half of the diameter tolerance

#### 4.2.3. End chamfer

For the most effective assembly provide a chamfer to the ends of the shaft on which the inner ring must be inserted.

### 4.3. HOUSING FOR BEARINGS WITH OUTER RING

#### 4.3.1. Surface finish of the shaft

Maximum roughness suggested:  $R_a = 1,6 \mu\text{m}$

#### 4.3.2. Tolerances and form deviations

The suggested tolerances for the housing is indicated in the appropriate chapters specific for every product. The suggested tolerance for deviation of form is:

- Variation of mean housing diameter within the length in contact with needle: 0.013 mm
- Deviation from circular form: one-half of the diameter tolerance of the housing

#### 4.3.3. End chamfer

For the most effective assembly provide a chamfer to the ends of the shaft on which the inner ring must be inserted.

#### 4.3.4. Alignment between hole housing

When possible ream the housing of the same shaft with a single placement on the machine tool.

### 4.4. HOUSING FOR CAGES AND NEEDLES

Bearings are protected against oxidation with a corrosion protection, but normally supplied unlubricated. Please don't forget to lubricate them when mounting.

#### 4.4.1 Requirements for materials, processing and finishing

Observe the rules for the shafts, paragraph 4.1.

#### 4.4.2. Alignment between hole housing

When possible ream the housing of the same shaft with a single placement on the machine tool.

### 5. LUBRICATION

Bearings are protected against oxidation with a corrosion protection, but normally supplied unlubricated. Please don't forget to lubricate them when mounting.

# PRODUCT OVERVIEW

## TECHNICAL FEATURES

### 5.1. LUBRICANT FEATURES

Lubrication of a bearing provides a viscous film between the rolling elements in order to reduce heat and wear caused by friction. The lubricant can also assist in preventing corrosion and help to seal the bearing from the introduction of dirt and impurities; it reduces friction between the shaft and seals and lowers the noise level generated within the bearing.

Wherever the operating conditions permit, grease should be chosen in preference to oil, as it is more convenient to use and more economic. Furthermore, it acts as an efficient seal against the effects of dust and humidity. On account of its consistency, grease can improve the effectiveness of sealing rings and can be used on its own as a seal, when it is used to fill grooves or labyrinths provided for this purpose.

Alternatively, oil is necessary for high rotational speeds in excess of the limits advised for grease lubrication and in cases where there is a problem of heat dissipation. Oil can also remove moisture and impurities from the bearing and is usually easily controlled to monitor the state of lubrication. Oil lubrication is also necessary where it is used already in the function of the equipment, such as hydraulic motors and pumps, speed variators and gear boxes etc.

Oil and grease lubricants must be free of all impurities which could cause premature failure of the bearing and removal from service. Sand and metal particles are particularly injurious to bearings. Every precaution must be taken to assure the cleanliness of gear casings, pipes, grease nipples, couplings, as well as lubricant containers.

The efficiency of a lubricant decreases in service both by age and by the continuous mixing to which it is submitted. Therefore replenishment must take place at regular intervals, taking account of operating and environmental conditions (humidity, dirt, temperature) except for applications where the bearing has been lubricated for life with a suitable grease.

#### 5.1.1. Base oil

It is the main constituent of a lubricant, being it an oil (obtained by adding base oil to chemical additives) or a grease (which is obtained by adding the thickener to the oil). Technically base oils differ between them for their chemical/physical properties and for their ability to work in particular conditions such as high temperatures or low temperatures or even in oxidizing environments, and so on.

The following table shows the main base oils and their main physical features distinguishing its capabilities.

|                                   | Mineral oil | Ester based oil | Polyglycol oil | Silicone oil | Fluorocarbon oil |
|-----------------------------------|-------------|-----------------|----------------|--------------|------------------|
| Density [g/ml]                    | 0.9         | 0.9             | 0.9 - 1.1      | 0.9 - 1.05   | 1.9              |
| Viscosity index VI <sup>1)</sup>  | 100         | 150             | >200           | 200/500      | 50/150           |
| Pour Point [°C] <sup>2)</sup>     | -10/-40     | -30/-70         | -20/-50        | -30/80       | -30/-70          |
| Flash point [°C] <sup>3)</sup>    | 200/250     | 230/300         | 150/300        | 150/300      | No one           |
| Oxidation resistance              | Sufficient  | Good            | Good           | Excellent    | Excellent        |
| Temperature stability             | Sufficient  | Good            | Good           | Excellent    | Excellent        |
| Lubricating ability <sup>4)</sup> | Good        | Good            | Excellent      | Low          | Good             |
| Compatibility with seals          | Good        | Low             | Sufficient     | Good         | Good             |

1) The viscosity index represents the ability of the lubricant to maintain constant its viscosity with changes in temperature; An high value of index VI means good ability to maintain a constant viscosity (key parameter for oils).

2) The pour point is the lowest temperature at which the lubricant loses the ability to scroll (solidification), so it is an index for the utilization of the lubricant at low temperatures.

3) Minimum temperature at which the air / gas mixture above the lubricant will ignite if it gets too close to a heat source.

4) The lubricating ability indicates the ability of the lubricant to withstand large loads applied.

The mineral oils are used in most applications. Synthetic oils (such as esters, polyglycols, silicon) and finally the fluorocarbon that are special oils as chemically inert (due to the presence of fluoride) in the case of specific needs.

It is important to note the general rules on the viscosity of the oils:

- fluid oil = excellent refrigerant;
- thick oil = excellent lubricant;

Never use a lubricant with a viscosity greater than necessary.

## 5.1.2. Additives

The addition of additives to the base oil, allows to obtain an oil with performance features clearly higher than the base oil itself. The additives allow to reduce some negative sides of base oils, although a silicone oil (particularly weak to support applied loads) suitably additiveted (eg with EP additives) will never be as a synthetic oil or polyglycol.

The following table shows the main technological characteristics related with additives.

| Additives                | Features   |
|--------------------------|--|
| Anti-oxidants            | They slow down the oxidation that creates deposits on the surfaces in contact with detriment to the lubricating fluid that deteriorates                  |
| Anti-corrosion           | Slow chemical reactions with materials such as copper, aluminum and sulfur   |
| Anti-rust                | Slow down the chemical reactions with ferrous materials that give life to rust   |
| Anti-wear                | Slow down the wear phenomena of materials in contact with the lubricant  |
| EP                       | Extreme Pressure it allows to increase the ability of the lubricant to withstand the applied load thereby reducing the danger of seizure                 |
| Detergents               | Clean the metal surfaces from debris or oxidation products by emulsion   |
| Dispersants              | Maintain the oxidation and emulsion products in suspension, preventing their deposit on metal surfaces   |
| Pour Point               | Lower the flow temperature of a lubricant allowing its use at low temperatures   |
| Enhancers of VI          | Increase the viscosity index allowing to obtain a lubricant constant in a wide range of temperature. Used mainly to the extreme temperatures temperature |
| Anti-foaming             | Reduce the danger of the formation of foam in the lubricant  |
| Adhesiveness enhancers   | Increase the adhesion of the lubricant to the surface with which it is in contact  |
| Compatibility with seals | Good   |

## 5.1. GREASE LUBRICATION

Greases for bearings must possess high lubricity power, good mechanical stability, an effective oxidation resistance and good anti-rust features, especially for parts operating in humid environment or subjected to splashing water. Their consistency, generally of grade 1, 2 or 3 of the NLGI scale, must remain as stable as possible within the temperature limits allowed by their composition.

### 5.2.1. Main types of grease

The grease is a thick lubricant, it consists of the base oil, plus additives and a thickener which is very often composed of a soap.

Greases based on lithium soap are particularly suitable for the lubrication of needle and rollers bearings and thrust bearings. They can be used at operating temperatures between -30 and +120°C, and even up to 150°C if they are of good quality. They are generally fitted with anti-rust additives and offer a good protection against corrosion.

Greases based on sodium soap are suitable for the lubrication of the bearings up to approximately 100°C (minimum temperature -30°C) and ensure a good seal against dust. They can absorb small amounts of water without losing their lubricating properties, but high amounts of water will dissolve and cancel all their effectiveness.

Greases based on calcium soap are stable to water and can be used only up to 50 or 60°C. Their mechanical stability and their power anti-rust are weak. Their use as lubricants for bearings is therefore not recommended, but may be used in labyrinth seals. However, some grease calcium based, with increased mechanical stability and anti-rust power, can be used up to 100°C to lubricate bearings in a humid atmosphere.

|                   | Lithium soap | Sodium soap | Calcium soap | Polyurea  | Lithium aluminium complex soap |
|-------------------|--------------|-------------|--------------|-----------|--------------------------------|
| Temperature range | 120          | 110         | 60           | 160       | 160                            |
| Drop point        | 190          | 260         | 100          | 230       | 260                            |
| Water resistance  | Good         | Low         | Excellent    | Excellent | Good                           |
| EP capacity       | Good         | Good        | Good         | Low       | Excellent                      |

# PRODUCT OVERVIEW

## TECHNICAL FEATURES

### 5.2.2. Consistency

The parameter that determines the softness or hardness of the grease is the consistency, that is, the penetration of the lubricant. It is defined by the NLGI consistency scale of measurement, according to eight levels which corresponds to a range of values of the Worked Penetration, expressed in tenths of millimeter.

The following table shows the classes defined by the NLGI consistency.

| NLGI class | Worked Penetration | Texture                      |
|------------|--------------------|------------------------------|
| 000        | 445 - 475          | Liquid                       |
| 00         | 400 - 430          | Semi-liquid                  |
| 0          | 355 - 385          | Very very soft               |
| 1          | 310 - 340          | Very soft                    |
| 2          | 265 - 295          | Soft                         |
| 3          | 220 - 250          | Medium                       |
| 4          | 175 - 205          | Hard                         |
| 5          | 130 - 160          | Very hard                    |
| 6          | 85 - 115           | Extremely hard (as softwood) |

### 5.2.3. Special grease

Greases with **EP additives** (high pressure) can be useful when bearings or thrust bearings must work with heavy loads. These greases generally offer a good lubricating power and have good anti-rust properties even in the presence of moisture. EP additives are used in the case of bearings with high load and low rotation speed, insufficient to create a meatus of lubricant sufficient to separate the metal parts.

Greases for **low temperatures**. The starting torque at low temperatures can be problematic. Suitable acids are commercially available.

Greases for **high temperatures**. The stability and duration of the grease is strongly influenced by temperature. In general the standard greases can be used up to 120°C-150°C. Further should be provide specific products. For high temperatures can be used lubricating pastes.

|                       | Al Complex  | Ba Complex  | Ca Stearate | Ca 12Hydroxy | Ca Complex  | Ca Sulfonate | ClayNon-Soap | Li Stearate | Li 12 Hydroxy | Li Complex  | Polyurea    | Polyurea S S |
|-----------------------|-------------|-------------|-------------|--------------|-------------|--------------|--------------|-------------|---------------|-------------|-------------|--------------|
| Aluminum Complex      | Best Choice | Compatible  | Compatible  | Compatible   | Compatible  | Compatible   | Compatible   | Compatible  | Compatible    | Compatible  | Compatible  | Compatible   |
| Barium Complex        | Compatible  | Best Choice | Compatible  | Compatible   | Compatible  | Compatible   | Compatible   | Compatible  | Compatible    | Compatible  | Compatible  | Compatible   |
| Calcium Stearate      | Compatible  | Compatible  | Best Choice | Compatible   | Compatible  | Compatible   | Compatible   | Compatible  | Compatible    | Compatible  | Compatible  | Compatible   |
| Calcium 12 Hydroxy    | Compatible  | Compatible  | Compatible  | Best Choice  | Compatible  | Compatible   | Compatible   | Compatible  | Compatible    | Compatible  | Compatible  | Compatible   |
| Calcium Complex       | Compatible  | Compatible  | Compatible  | Compatible   | Best Choice | Compatible   | Compatible   | Compatible  | Compatible    | Compatible  | Compatible  | Compatible   |
| Calcium Sulfonate     | Compatible  | Compatible  | Compatible  | Compatible   | Compatible  | Best Choice  | Compatible   | Compatible  | Compatible    | Compatible  | Compatible  | Compatible   |
| Clay Non-Soap         | Compatible  | Compatible  | Compatible  | Compatible   | Compatible  | Compatible   | Best Choice  | Compatible  | Compatible    | Compatible  | Compatible  | Compatible   |
| Lithium Stearate      | Compatible  | Compatible  | Compatible  | Compatible   | Compatible  | Compatible   | Compatible   | Best Choice | Compatible    | Compatible  | Compatible  | Compatible   |
| Lithium 12 Hydroxy    | Compatible  | Compatible  | Compatible  | Compatible   | Compatible  | Compatible   | Compatible   | Compatible  | Best Choice   | Compatible  | Compatible  | Compatible   |
| Lithium Complex       | Compatible  | Compatible  | Compatible  | Compatible   | Compatible  | Compatible   | Compatible   | Compatible  | Compatible    | Best Choice | Compatible  | Compatible   |
| Polyurea Conventional | Compatible  | Compatible  | Compatible  | Compatible   | Compatible  | Compatible   | Compatible   | Compatible  | Compatible    | Compatible  | Best Choice | Compatible   |
| Polyurea Shear Stable | Compatible  | Compatible  | Compatible  | Compatible   | Compatible  | Compatible   | Compatible   | Compatible  | Compatible    | Compatible  | Compatible  | Best Choice  |

### 5.2.4. Compatibility of greases

Certain greases are incompatible with others and, if they are mixed, their function will be impaired.

With greases considered as compatible, account should be taken of the reduction in their consistency when mixed and the maximum permissible temperature should be reduced accordingly.

## 5.2.5. Application

Grease can be introduced into the bearings at the time of assembly, care being taken to distribute it around the crown of the needles (see below "Quantity of grease"). The free space found in the bearing which is filled with grease, constitutes a reservoir and a reinforced seal.

This method is possible if replenishments of grease are necessary at regular maintenance periods, during the course of which one can dismount the bearings, clean and examine them. Otherwise one has to use a hand pump which forces grease into the bearing by means of valves and replenishes the adjacent reservoir and also the channels and labyrinth seals. The entry passage for the grease must directly abut the bearing or be in close proximity to it, in order that new fresh grease pushes out the used grease through the seals. For this reason the lip of the sealing ring must be oriented towards the outside of the bearing for it to rise under the force of the grease being ejected. This method has the advantage of removing impurities which could be introduced into the seals, particularly in the case of a highly contaminated atmosphere.

With greases considered as compatible, account should be taken of the reduction in their consistency when mixed and the maximum permissible temperature should be reduced accordingly.

## 5.2.6. Quantity of grease

The amount of grease that should be contained in a bearing can be established by considering the relationship of the limiting speed permissible for the grease  $n_G$  to the speed of rotation  $n$ :

- $n_G/n < 1,25$  minimum quantity; bearing must be lubricated with a small quantity of grease and the adjacent parts packed with grease
- $1,25 < n_G/n < 5$  1/3 to 2/3 of the available volume
- $n_G/n > 5$  bearing must totally filled with grease

## 5.2.7. Re-lubrication

The frequency of grease re-lubrication depends on a number of factors, amongst which are the type of bearing and its dimensions, the speed and load, the temperature and ambient atmospheric conditions (humidity, acidity, pollution), the type of grease and sealing.

Only after controlled trials can the re-lubrication period be defined exactly and particular importance should be given to the effects of temperature, speed and humidity. Under normal conditions of function without unfavourable factors using an appropriate grease with a maximum temperature of 70°C, the re-lubrication interval  $T_G$  in hours can be determined approximately from the formula:

$$T_G = \frac{K \cdot 10^8}{n \cdot \sqrt{F_w} \cdot \sqrt[4]{\frac{n}{n_G}}}$$

in which:

- $n$ : speed of rotation
- $n_G$ : permissible speed limit for grease lubrication (see page 14)
- $F_w$ : diameter of inner raceway of bearing in mm
- $K$ : coefficient according to the type of bearing:  
 $K = 32$  for caged needle bearings  $K = 28$  for full complement needle bearings  $K = 15$  for needle or roller thrust bearings.

For the bearings below, the diameter  $F_w$  is replaced by the following dimensions, given in the table of dimensions:

Cam followers type FG and derivatives: dimension  $d_A$

Needle or roller thrust bearings: dimension  $E_b$

Cam followers type GC and derivatives: average dimension  $\frac{d+d_A}{2}$

If the operating temperature exceeds 70°C, the interval  $T_G$  determined from the formula above should, for each increase of 10°C, be reduced by 50%. However, this adjustment is not applicable beyond 115°C; for temperatures above this level trials should be made to determine the acceptable re-lubrication interval.

In the case of very slow speed rotation, which would give interval  $T_G$  in excess of 35000 hours corresponding to 8 years operation at a rate of 12 hours per day, it is recommended to limit the period to a maximum of 3 years. For oscillating motion, the speed to be considered is the equivalent speed given by the formula on page 11. For very small amplitudes of oscillation it is recommended to reduce by half the calculated re-lubrication period  $T_G$ .

## PRODUCT OVERVIEW TECHNICAL FEATURES

### 5.3. OIL LUBRICATION

#### 5.3.1. Viscosity

The essential characteristic of an oil is its basic kinematic viscosity in mm<sup>2</sup>/sec. at a reference temperature of 40°C according to ISO 3448.

The base viscosity V40 should be increased proportionately as the operating temperature increases but decreased as the speed increases, without however reaching a lower limit below which the film strength of the oil is impaired. For applications under moderate load without shocks up to about 1/5 of the dynamic capacity of the bearing, the viscosity VF at the operating temperature should not be lower than 12 mm<sup>2</sup>/sec.

For higher loads greater than 1/5 of the dynamic capacity the min. viscosity VF can be about 18 mm<sup>2</sup>/sec. The variation in viscosity of an oil as a function of temperature is reduced as the number measuring its index of viscosity is increased. A viscosity index of 85 to 95 is generally satisfactory for the lubrication of bearings.

Diagram 1 below gives the viscosity VF required at the operating temperature from the ratio nH/n (nH: permitted speed limit for oil lubrication - n: speed rotation) and of the applied load (ratio C/P).

For the viscosity VF required in operation and from operating temperature, diagram 2 gives the base viscosity V40 at the reference temperature of 40°C.

Example: A bearing supporting a load P>C/5 and having a speed limit for oil lubrication of 10000 r.p.m., must rotate at 2000 r.p.m. at temperature up to 60°C.

The ratio  $\frac{n_H}{n} = \frac{10.000}{2.000} = 5$  indicates a viscosity in operation VF = 60 mm<sup>2</sup>/sec. (diagram 1). For an operating temperature of 60°C, the horizontal

VF = 60 cuts the vertical of 60°C (diagram 2) in the 150 zone, which is therefore the base viscosity required at 40°C.

#### 5.3.2. Application of the lubricant

Oil must be supplied to the bearings regularly and in sufficient quantity but not abundantly, otherwise an abnormal increase in temperature can occur. According to the speed of rotation, the following general lubrication methods can be applied:

Lubrication by oil bath: is suitable for assemblies with the shaft horizontal and average speeds up to about half the values shown in the tables of dimensions. The level of oil in the bath at rest must reach the lowest point of the inner raceway of the bearing, though the movement of oil caused by the immersion of parts in the oil bath may be sufficient to feed bearings situated above this level, providing there are pipes and collectors to ensure sufficient oil reserve when starting.

Forced lubrication: the circuit is typically composed of the tank, the circulation pump, hoses and fittings, filter, possibly the radiator. Allows to effectively lubricate the bearings even in case of high speed, remove dirt and moisture from the bearing, if necessary to remove the heat generated in the bearing. For the thrust bearing, the arrival of the oil must be made, if possible, from the shaft to use the effect of centrifugation in the sense of movement.

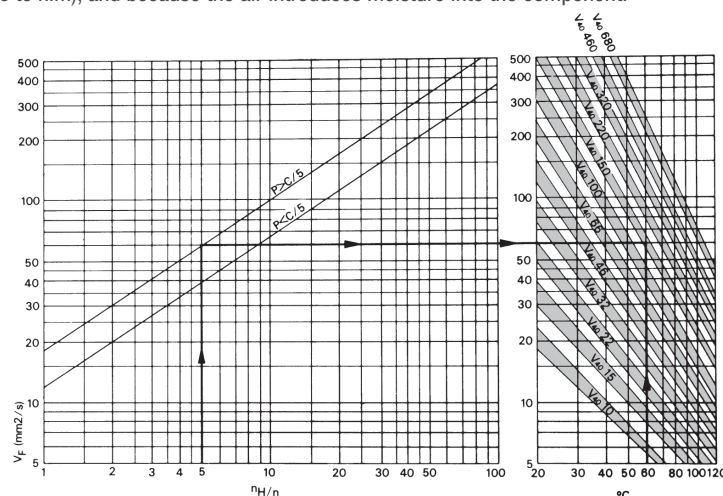
Oil mist lubrication: consists of applying to the bearings oil finely atomised in suspension in a current of clean compressed air. The pressure created within the bearing effectively protects it from the introduction of dust, humid vapours and noxious gases. This procedure, which allows a substantial flow from a small quantity of oil, is used particularly for ultra-high speed applications in excess of speed limits given in the tables of dimensions.

### 6. BEARINGS STORAGE

With the exception of cam followers which are delivered lubricated with grease, all other needle or roller bearing products are supplied without grease, though protected against oxydation by an oil film compatible with most greases and mineral oil lubricants. Bearings should be stocked in a clean dry environment and retained in their original wrapping until the last moment before assembly. Even when assembling the bearing, care should be taken to prevent contamination from dirt or metallic particles and humidity.

In case of doubt concerning cleanliness of the bearing, it may be necessary to wash it in filtered petroleum. In so doing the bearing must be rotated and then suitably drained and dried. Smear the bearing with a suitable oil or grease to protect it against oxydation at the time of assembly.

**Avoid the use of compressed air to clean or dry the bearing.** And to avoid the risk that a needle roller can be removed from its place and launched (danger for the operator and the people close to him), and because the air introduces moisture into the component.

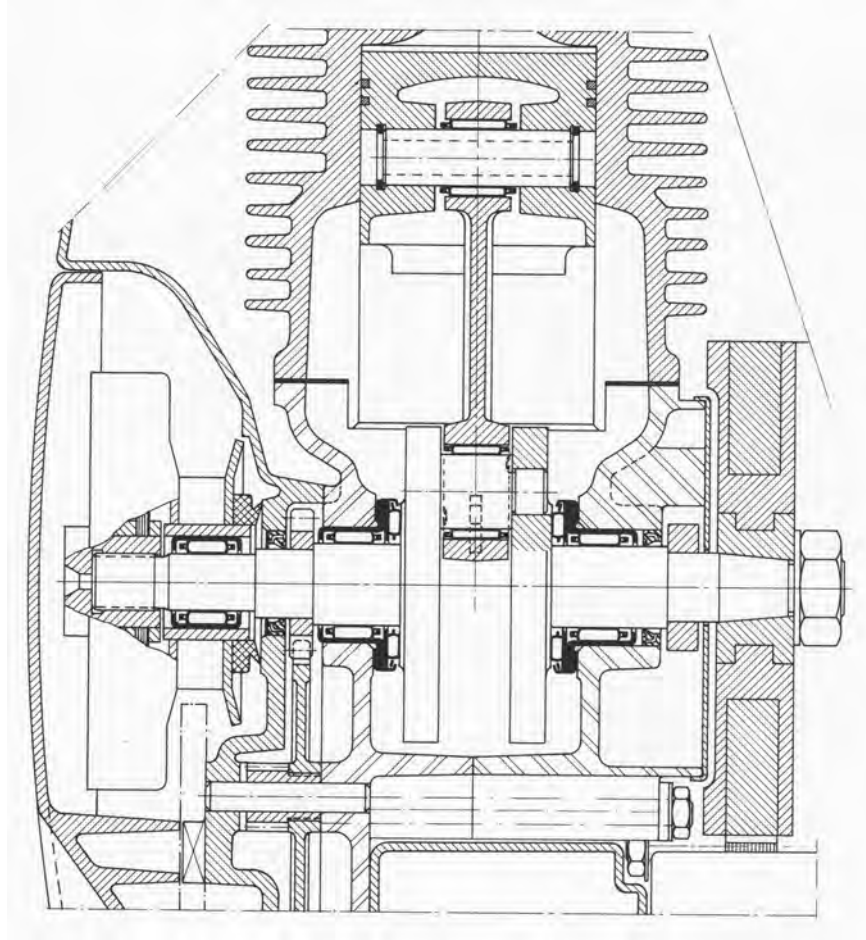




# PRODUCT OVERVIEW

## APPLICATIONS

### TWO STROKE ENGINE FOR PORTABLE SAW



The high speeds attained by these engines subject the connecting rod bearings to extremely arduous working conditions, made worse by doubtful lubrication and high operating temperatures. Needle cages provide the solution to these difficulties, by virtue of their small size and special manufacturing methods. In the big end of the connecting rod, the steel cage is specially treated and is centred on its outside diameter.

In the little end, on the other hand, the needle cage is centred internally on the gudgeon pin. The cage extends beyond the width of the rod, thereby allowing the maximum possible length of needle to be utilised with consequent reduction of unit load.

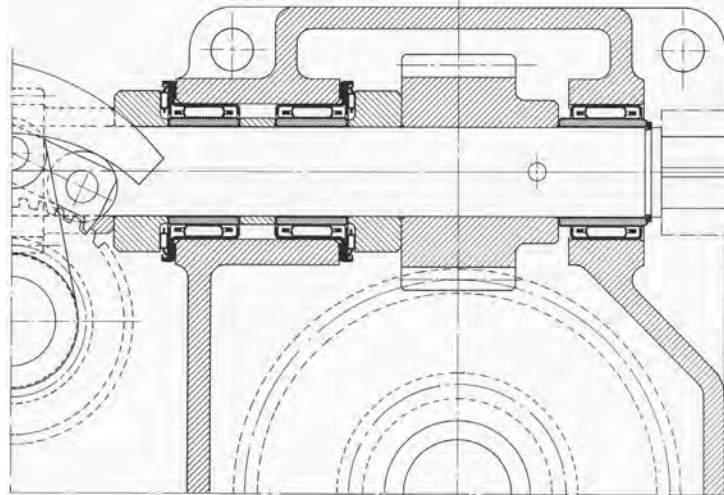
Lateral location of the rod is ensured by the crankshaft webs, giving adequate clearance between the little end and the internal bosses of the piston. The crankshaft runs in two RAX 714 combined bearings to carry the radial loads and provide axial location the least possible space. They are sealed by two DH lip seals. In the disengaged position, the pulley is supported by a HK 10 12 caged Needle Bushes. All faces and shafts acting as needle raceways are case hardened to 58 – 60 HRC.

# PRODUCT OVERVIEW

## APPLICATIONS

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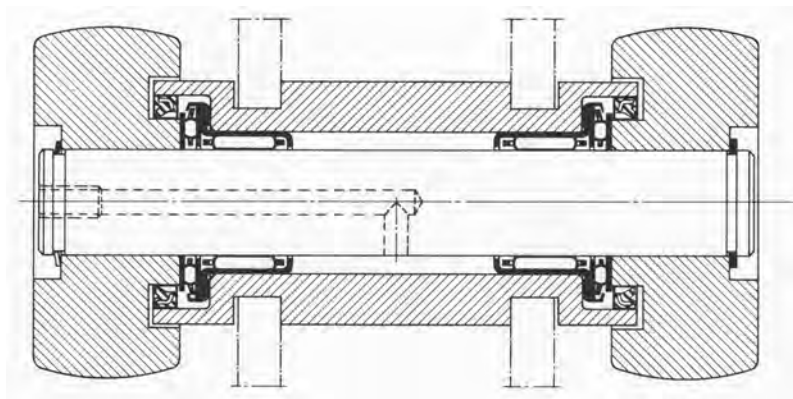
### OFFSET PRESS- PAPER FEEDING MECHANISM



The pinion shaft is supported at one end, by two RAX 730 thin wall combined bearings, which ensure lateral location in both directions. The other end of the shaft runs in a HK 30 20 caged needle bushes.

The use of inner race avoids the necessity for hardening the shaft journals. The use of inner race avoids the necessity for hardening the shaft journals.

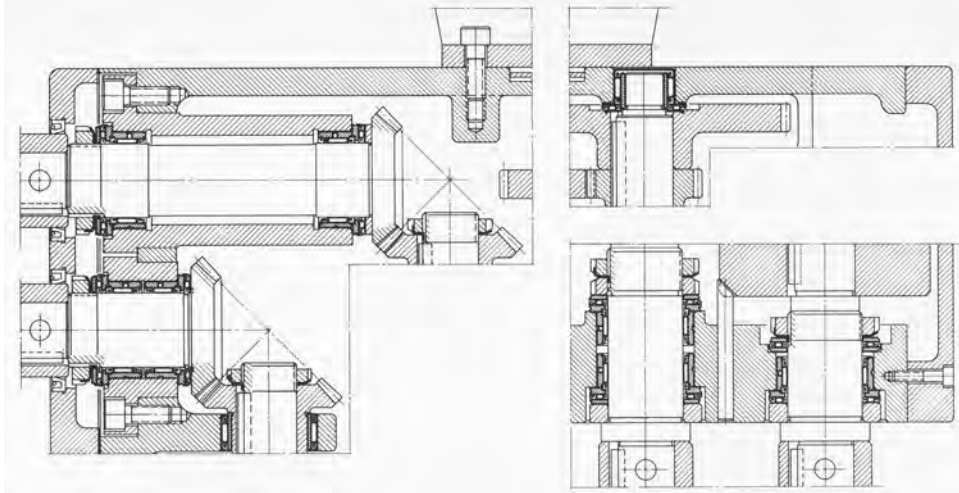
### FOLLOWERS FOR OVERHEAD CONVEYOR



The common spindle carrying the two rollers turns between two RAX 718 combined bearings (with thrust plates) which ensures lateral location in both directions. The bearing surfaces of the shaft are hardened to 58 HRC.

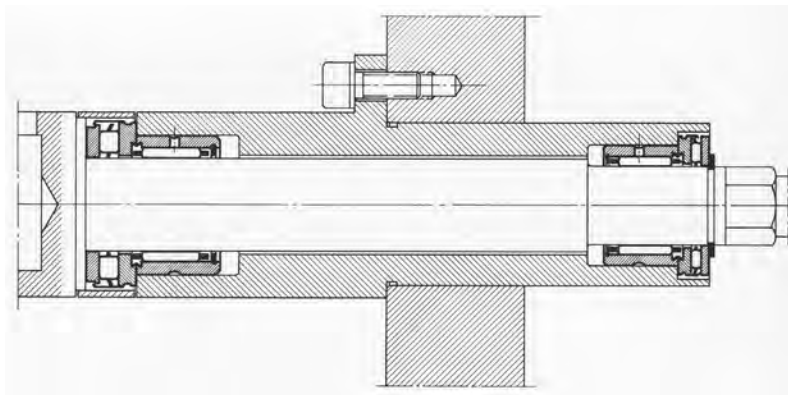
Lubrication is by grease introduced via a nipple on the end of the shaft. Sealing is effected by sealing rings type DH28x35x4.

## MILLER/BORER - GEAR BOX



This assembly is particularly interesting in the method of radial and axial location of gears and spindles, by means of two RAX 400 combined bearings mounted in opposition which, even though located in close proximity, ensure adequate support. Of equal interest is the RAX 700 thin wall combined bearing whose closed end ensures perfect shaft sealing.

## BORER SPINDLE



Case hardening the ends of the shaft to 60 HRC allows the use of bearings without inner rings. The front journal is a combined bearing with roller thrust and integral thrust washer. The inside diameter of the radial part of the bearing is held to tolerance F6, and the shaft to k5, giving the necessary low play for this precision application.

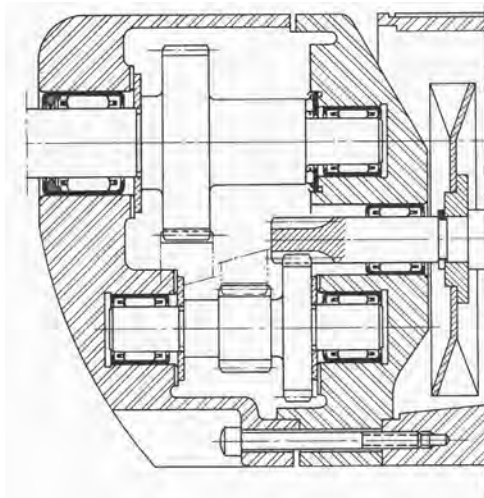
The thrust rollers of the combined bearing withstand the main axial loading. It is shielded from ingress of foreign bodies by the cover which retains the thrust washer and by a sleeve over the assembly. The rear housing incorporates an RAX 417 combined bearing (with thrust washer CP 2 17 30) on a k5 shaft. The needle thrust taking the axial loadings in the opposite direction to the main working load. A speed of 1 500 r.p.m. allows the use of grease for lubrication.

# PRODUCT OVERVIEW

## APPLICATIONS

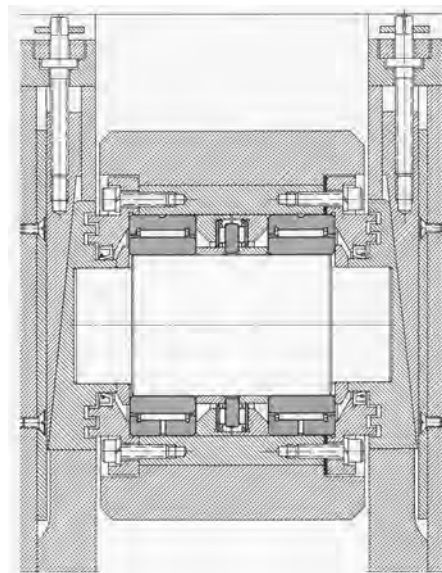
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### HAND DRILL



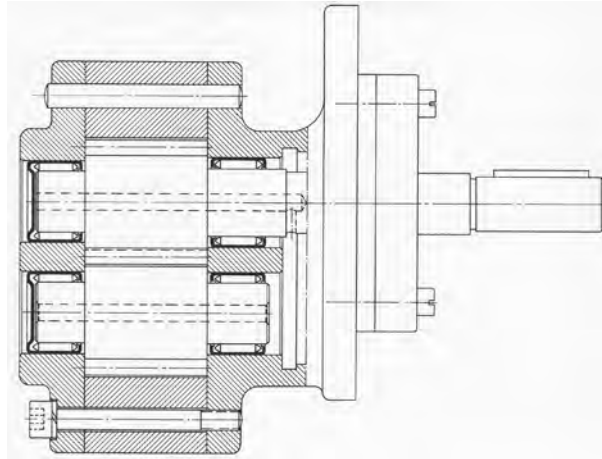
This example shows the use, on a hardened shaft, of type HK caged needle bushes, whose small radial thickness is particularly suitable for this type of application. The outer bearing of the output shaft is supported by a HK sealed, caged needle bush. Axial drilling loads are carried by a needle thrust bearing type AX.

### ROLLING MILL FOLLOWER



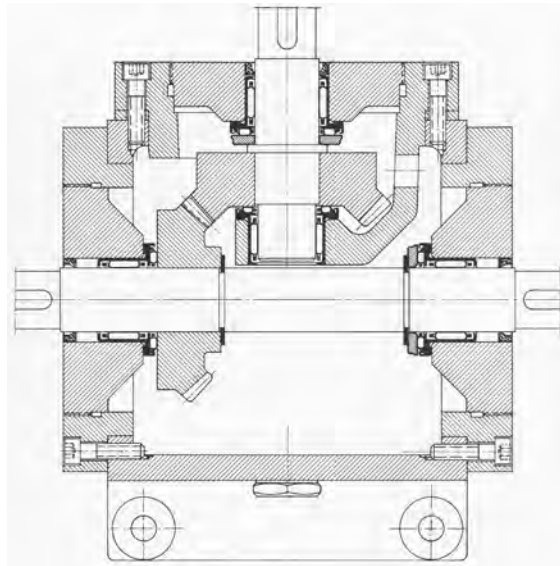
This roller guides hot rolled steel products whose temperature is around 100°C. A cooling spray limits the temperature of the roller to 50°C. Two NA 3 080 full complement bearing support the radial load which may be as high as 28 000 daN at a speed of 100 r.p.m. Axial location of the rollers is by two AX needle thrust bearings of 90 mm bore, mounted either side of a CPR intermediate plate. Lip seals and grease filled labyrinths effectively prevent the ingress of coolant into the bearing

## GEAR PUMP



The operating conditions of this gear pump allow the use of DL and DLF full complement needle bushes bearings on the pinion journals. The DLF closed end needle bushes ensure the sealing of the bores in the bottom plate. The trunnions, acting as raceways under the needles, are hardened to 58 HRC.

## RIGHT-ANGLE GEAR BOX



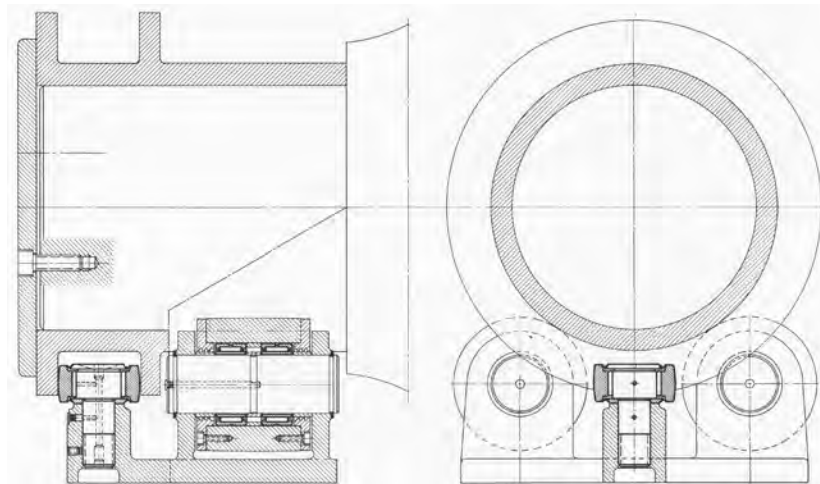
The driving shaft runs in two combined bearings types RAX 718 and RAX 720 with separate thrust plates. The driven shaft is mounted on two RAX 720 combined bearings of which one only has a separate thrust plate. The shaft journals and gear faces serving as bearing raceways are hardened to 58 HRC. The sealing of all shafts is ensured by type DH 20 26 sealing rings.

# PRODUCT OVERVIEW

## APPLICATIONS

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### DRUM SUPPORT ROLLERS

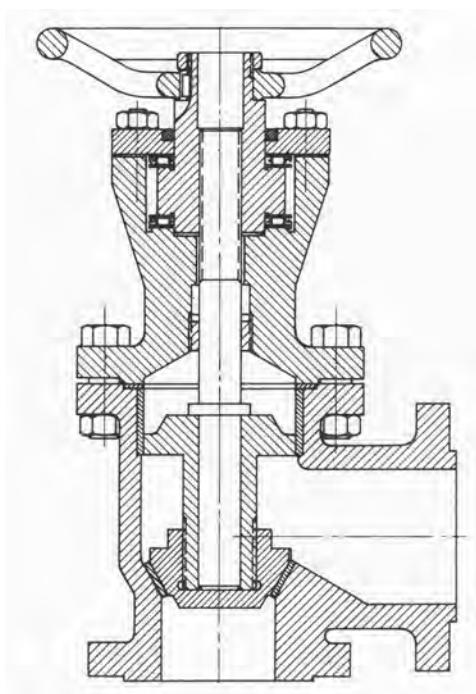


These rollers are each fitted with two NK 42/20 caged needle bearings with inner rings. A SW sealed cam follower with stud mounted vertically between the flanges of the sleeve, ensures lateral location of the cylinder in both directions.

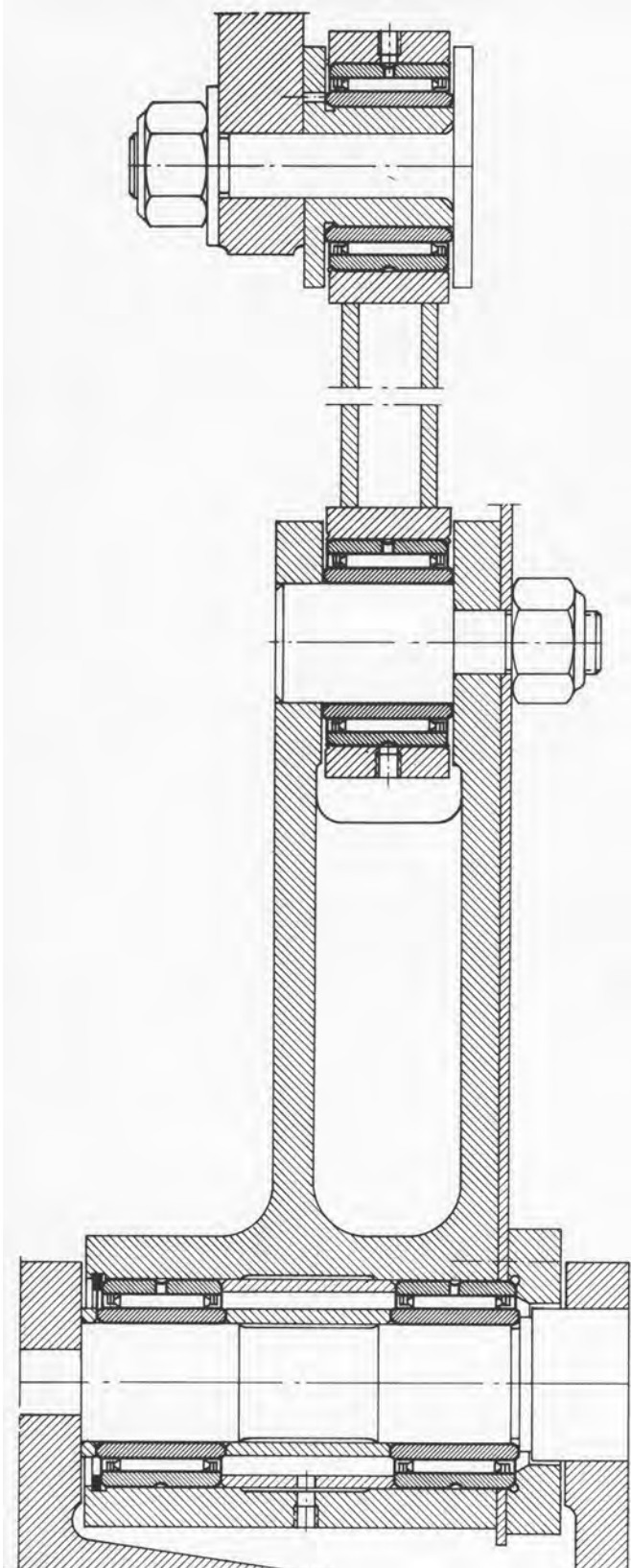
This arrangement offers the following advantages:

- The bearings are determined by the load to be carried rather than by the diameter of the trunnion. It is clearly preferable to use four small bearings, rather than one of unnecessarily large diameter.
- When the drum is heated internally, only a small amount of heat is transferred to the bearings via the outside diameter and the bearings do not have to have specially increased play to allow for expansion of the inner rings, as would be the case with a large bearing mounted on the trunnion.
- Finally the coefficient of friction is much reduced and less power is required to turn the cylinder.

### HAND OPERATED VALVE



Threaded spindle support mounted between two needle thrust bearings, i.e. AX 45 65 (with matching thrust races) ensures low frictional characteristics and easy manual operation.

**"RAPIER" WEAVING MACHINE**

On this type of weaving machine, the shuttles are replaced by "spears" or "rapiers" whose function is to project the weft thread through the warp threads to produce larger widths of cloth. The fore and aft operation of these "rapiers" is by means of a system of connecting rods whose arms are fitted with NA 22 030 full complement needle bearings (with inner races) which fully cater for the shock loadings occasioned by reversals of directions, either rotationally or under oscillating movement.





# 2

## **RADIAL NEEDLE ROLLER AND CAGE ASSEMBLIES**

PAGE 28

2.1 TECHNICAL FEATURES

PAGE 30

2.2 SINGLE-ROW, DOUBLE-ROW ASSEMBLIES

# RADIAL NEEDLE ROLLER AND CAGE ASSEMBLIES

## TECHNICAL FEATURES



Radial needle roller and cage assemblies have a steel cage that provides both inward and outward retention for the needle rollers. The designs provide maximum cage strength consistent with the inherent high load ratings of needle roller bearings.

Accurate guidance of the needle rollers by the cage bars allows for operation at high speeds. Needle roller and cage assemblies have either one or two rows of needle rollers.

Also listed are needle roller and cage assemblies using molded, one-piece glass-reinforced engineered polymer cages (suffix TN). These operate well at temperatures up to 120° C over extended periods. However, care should be exercised when these assemblies are lubricated with

oils containing additives as service life may be reduced if the operating temperature exceeds 100° C. At such high temperatures oil can deteriorate with time and it is suggested that oil change intervals are observed.

Needle rollers with relieved ends used in these assemblies are made of high-carbon chrome steel, through-hardened, ground and lapped to close tolerances for diameter and roundness.

Reference standards are:

- ISO 3030 - needle roller bearings - radial needle roller and cage assemblies - boundary dimensions and tolerances.
- DIN 5405 Section 1 - rolling bearings - needle roller bearings - radial needle roller and cage assemblies.
- ANSI/ABMA 18.1- needle roller bearings – radial, metric design.

### DIMENSIONAL ACCURACY

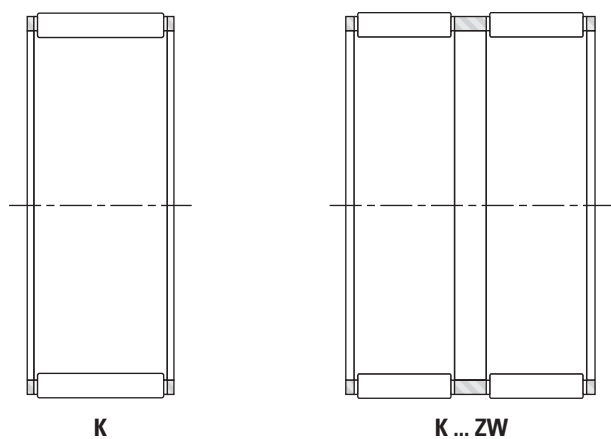
#### Needle roller groups

Radial needle roller and cage assemblies are supplied with needle roller complements subdivided into groups.

The groups are decided by Nadella if not differently decided during the order and with Grade G2 specified in ISO 3096 standard (see needle rollers, page 195).

The needle roller and cage assemblies of one shipment usually contain needle rollers with group limits of between 0 ... to -2, and -5 ... -7 μm. For needle roller and cage assemblies with needle rollers of different group limits contact Technical Service Nadella.

### TYPES OF RADIAL NEEDLE ROLLER AND CAGE ASSEMBLIES



### SUFFIXES

|      |   |
|------|---|
| TN   | molded cage of reinforced engineered polymer              |
| ZW   | double-row  |
| TNZW | molded cage of reinforced engineered polymer - double-row |
| H    | hardened steel cage                                       |
| F    | machined cage   |
| FH   | machined cage, case hardened                              |
| FV   | machined cage, hardened and tempered                      |

## MOUNTING DIMENSIONS

### Design of raceways

Radial needle roller and cage assemblies use the housing bore as the outer raceway and the shaft as the inner raceway. To realize full bearing load rating and life, the housing bore and the shaft raceways must have the correct geometric and metallurgical characteristics. The housing should be of sufficient cross section to maintain adequate roundness and running clearance under load. Additional design details for housings and shafts used as outer and inner raceways can be found in the “MOUNTING” section of this catalogue. The only limit to precision of the radial clearance of a mounted assembly is the capability of the user to hold close tolerances on the inner and outer raceways. The suggested shaft tolerances are based on housing bore tolerance G6 and apply to metric series radial needle roller and cage assemblies with needle rollers of group limits between 0.000 and -0.007.

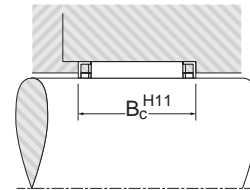
### Suggested shaft tolerances for housing bores machined to G6

| Nominal shaft diameter in mm | ≤80            | ≤80 |
|------------------------------|----------------|-----|
| Radial clearance             | Soft tolerance |     |
| Smaller than normal          | j5             | h5  |
| Normal                       | h5             | g5  |
| Large than normal            | g5             | f6  |

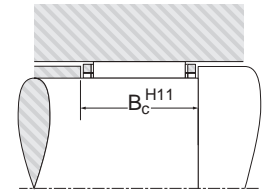
### Axial guidance requirements

Radial needle roller and cage assembly must be axially guided by shoulders or other suitable means. The end guiding surfaces should be hardened to minimize wear and must provide sufficient axial clearance to prevent end-locking of the assembly. Length tolerance H11 is suggested on dimension BC. If end guidance is provided by a housing shoulder at one end and by a shaft shoulder at the other end, the shaft must be axially positioned to prevent end-locking of needle roller and cage assembly.

The housing and shaft shoulder heights should be 70 percent to 90 percent of the needle roller diameter to provide proper axial guidance.



Guidance in the housing



Guidance in the shaft

### Mounting in sets

Radial needle roller and cage assemblies that are mounted side by side must have needle rollers of the same group limits to ensure uniform load distribution.

## LUBRICATION

Oil is the preferred lubricant for most applications. In critical applications involving high speeds, ample oil flow must be provided. Where assemblies are subjected to high centrifugal forces – such as in epicyclic gearing, or inertia forces, as in the small end of a connecting rod – the contact pressure between the cage and the raceway guiding surface becomes critical.

The allowable contact pressure depends on a combination of the induced force and the relative velocity between the cage and raceway and the rate of lubricant flow.

Consult the Nadella Technical Service when cages will be subjected to high induced forces.

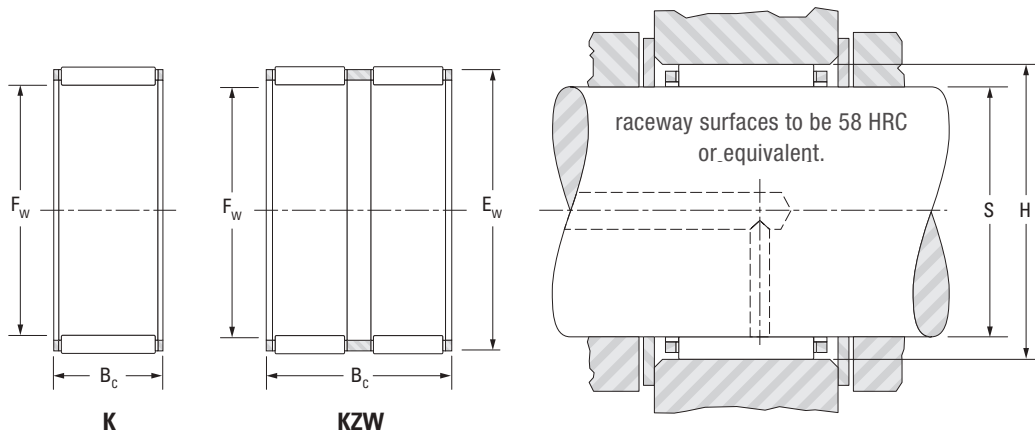
## SPECIAL DESIGNS

Radial needle roller and cage assemblies made to special dimensions or configurations – such as those which are split to assemble around a one-piece crankshaft – can be made available on special order.

Special coated or plated cages to enhance life, under conditions of marginal lubrication and high induced forces, also can be made available.

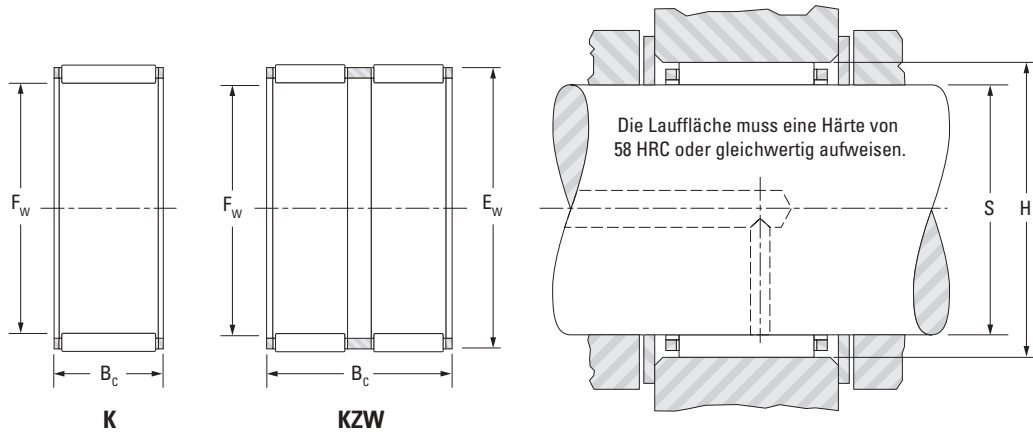
# RADIAL NEEDLE ROLLER AND CAGE ASSEMBLIES

## SINGLE-ROW, DOUBLE-ROW ASSEMBLIES



| Shaft mm | Designation | F <sub>w</sub> mm | E <sub>w</sub> mm | B <sub>c</sub> -0.20 -0.55 mm | Load ratings kN |                       | Speed rating min <sup>-1</sup> |       | Mounting dimensions |         |         |         | Wt. kg |
|----------|-------------|-------------------|-------------------|-------------------------------|-----------------|-----------------------|--------------------------------|-------|---------------------|---------|---------|---------|--------|
|          |             |                   |                   |                               | Dynamic C       | Static C <sub>0</sub> | Grease                         | Oil   | S                   |         | H       |         |        |
|          |             |                   |                   |                               |                 |                       |                                |       | Max. mm             | Min. mm | Max. mm | Min. mm |        |
|          |             |                   |                   |                               |                 |                       |                                |       |                     |         |         |         |        |
| 4        | K4x7x7TN    | 4                 | 7                 | 7                             | 1.83            | 1.32                  | 34000                          | 52000 | 4.000               | 3.995   | 7.014   | 7.005   | 0.0005 |
|          | K5x8x8TN    | 5                 | 8                 | 8                             | 2.18            | 1.71                  | 31000                          | 47000 | 5.000               | 4.995   | 8.014   | 8.005   | 0.0007 |
| 5        | K5x8x10TN   | 5                 | 8                 | 10                            | 3.04            | 2.63                  | 31000                          | 47000 | 5.000               | 4.995   | 8.014   | 8.005   | 0.0008 |
|          | K5x9x13TN   | 5                 | 9                 | 13                            | 4.29            | 3.55                  | 26000                          | 40000 | 5.000               | 4.995   | 8.014   | 9.005   | 0.002  |
| 6        | K6x9x8H     | 6                 | 9                 | 8                             | 3.19            | 2.90                  | 29000                          | 44000 | 6.000               | 5.995   | 9.014   | 9.005   | 0.0008 |
|          | K6x9x8TN    | 6                 | 9                 | 8                             | 2.47            | 2.07                  | 29000                          | 44000 | 6.000               | 5.995   | 9.014   | 9.005   | 0.001  |
|          | K6x9x10TN   | 6                 | 9                 | 10                            | 3.07            | 2.74                  | 29000                          | 44000 | 6.000               | 5.995   | 9.014   | 9.005   | 0.001  |
| 7        | K7x10x8TN   | 7                 | 10                | 8                             | 2.74            | 2.44                  | 28000                          | 42000 | 7.000               | 6.994   | 10.014  | 10.005  | 0.001  |
|          | K7x10x10TN  | 7                 | 10                | 10                            | 3.40            | 3.22                  | 28000                          | 42000 | 7.000               | 6.994   | 10.014  | 10.005  | 0.001  |
|          | K7x11x15TN  | 7                 | 11                | 15                            | 6.44            | 6.24                  | 23000                          | 35000 | 7.000               | 6.994   | 11.017  | 11.006  | 0.003  |
| 8        | K8x11x8FV   | 8                 | 11                | 8                             | 3.23            | 3.11                  | 26000                          | 41000 | 8.000               | 7.994   | 11.017  | 11.006  | 0.002  |
|          | K8x11x8TN   | 8                 | 11                | 8                             | 2.34            | 2.05                  | 26000                          | 41000 | 8.000               | 7.994   | 11.017  | 11.006  | 0.001  |
|          | K8x11x10H   | 8                 | 11                | 10                            | 4.57            | 4.89                  | 26000                          | 41000 | 8.000               | 7.994   | 11.017  | 11.006  | 0.002  |
|          | K8x11x10FV  | 8                 | 11                | 10                            | 4.01            | 4.11                  | 26000                          | 41000 | 8.000               | 7.994   | 11.017  | 11.006  | 0.002  |
|          | K8x11x10TN  | 8                 | 11                | 10                            | 3.84            | 3.91                  | 26000                          | 41000 | 8.000               | 7.994   | 11.017  | 11.006  | 0.001  |
|          | K8x11x13TN  | 8                 | 11                | 13                            | 5.18            | 5.75                  | 26000                          | 41000 | 8.000               | 7.994   | 11.017  | 11.006  | 0.002  |
| 9        | K8x11x13H   | 8                 | 11                | 13                            | 5.22            | 5.78                  | 26000                          | 41000 | 8.000               | 7.994   | 11.017  | 11.006  | 0.003  |
|          | K9x12x10FH  | 9                 | 12                | 10                            | 4.27            | 4.60                  | 26000                          | 40000 | 9.000               | 8.994   | 12.017  | 12.006  | 0.003  |
|          | K9x12x10FV  | 9                 | 12                | 10                            | 4.27            | 4.60                  | 26000                          | 40000 | 9.000               | 8.994   | 12.017  | 12.006  | 0.002  |
|          | K9x12x13FH  | 9                 | 12                | 13                            | 5.57            | 6.47                  | 26000                          | 40000 | 9.000               | 8.994   | 12.017  | 12.006  | 0.003  |
|          | K9x12x13FV  | 9                 | 12                | 13                            | 5.57            | 6.47                  | 26000                          | 40000 | 9.000               | 8.994   | 12.017  | 12.006  | 0.003  |
| 10       | K9x13x8H    | 9                 | 13                | 8                             | 3.96            | 3.50                  | 21000                          | 32000 | 9.000               | 8.994   | 13.017  | 13.006  | 0.003  |
|          | K10x13x10H  | 10                | 13                | 10                            | 5.40            | 6.43                  | 25000                          | 39000 | 10.000              | 9.994   | 13.017  | 13.006  | 0.002  |
|          | K10x13x10TN | 10                | 13                | 10                            | 4.29            | 4.77                  | 25000                          | 39000 | 10.000              | 9.994   | 13.017  | 13.006  | 0.002  |
|          | K10x13x13   | 10                | 13                | 13                            | 5.90            | 7.16                  | 25000                          | 39000 | 10.000              | 9.994   | 13.017  | 13.006  | 0.003  |
|          | K10x13x16   | 10                | 13                | 16                            | 7.43            | 9.64                  | 25000                          | 39000 | 10.000              | 9.994   | 13.017  | 13.006  | 0.004  |
|          | K10x14x10H  | 10                | 14                | 10                            | 6.12            | 6.29                  | 20000                          | 31000 | 10.000              | 9.994   | 14.017  | 14.006  | 0.003  |
|          | K10x14x13H  | 10                | 14                | 13                            | 7.88            | 8.71                  | 20000                          | 31000 | 10.000              | 9.994   | 14.017  | 14.006  | 0.004  |
| 10       | K10x16x12F  | 10                | 16                | 12                            | 8.39            | 7.47                  | 15000                          | 24000 | 10.000              | 9.994   | 16.017  | 16.006  | 0.006  |
|          | K10x16x12TN | 10                | 16                | 12                            | 7.50            | 6.40                  | 15000                          | 24000 | 10.000              | 9.994   | 16.017  | 16.006  | 0.005  |

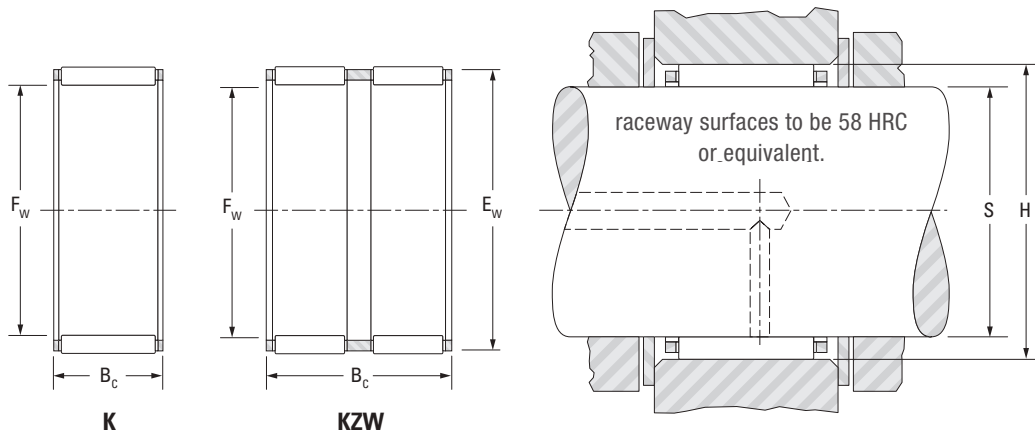
# 2.2



| Shaft<br>mm | Designation | F <sub>w</sub><br>mm | E <sub>w</sub><br>mm | B <sub>c</sub><br>-0.20<br>-0.55<br>mm | Load ratings kN |                          | Speed rating<br>min <sup>-1</sup> |       | Mounting dimensions |            |            |            | Wt.<br>kg |
|-------------|-------------|----------------------|----------------------|--|-----------------|--------------------------|-----------------------------------|-------|---------------------|------------|------------|------------|-----------|
|             |             |                      |                      |  | Dynamic<br>C    | Static<br>C <sub>0</sub> | Grease                            | Oil   | S                   |            | H          |            |           |
|             |             |                      |                      |  |                 |                          |                                   |       | Max.<br>mm          | Min.<br>mm | Max.<br>mm | Min.<br>mm |           |
|             |             |                      |                      |  |                 |                          |                                   |       |                     |            |            |            |           |
| 12          | K12x15x10H  | 12                   | 15                   | 10                                     | 5.85            | 7.51                     | 24000                             | 37000 | 12.000              | 11.992     | 15.017     | 15.006     | 0.003     |
|             | K12x15x13H  | 12                   | 15                   | 13                                     | 6.78            | 9.03                     | 24000                             | 37000 | 12.000              | 11.992     | 15.017     | 15.006     | 0.004     |
|             | K12x16x13H  | 12                   | 16                   | 13                                     | 7.49            | 8.51                     | 19000                             | 30000 | 12.000              | 11.992     | 16.017     | 16.006     | 0.006     |
|             | K12x17x13   | 12                   | 17                   | 13                                     | 8.93            | 9.29                     | 16000                             | 25000 | 12.000              | 11.992     | 17.017     | 17.006     | 0.008     |
|             | K12x18x12H  | 12                   | 18                   | 12                                     | 9.76            | 9.40                     | 14000                             | 22000 | 12.000              | 11.992     | 18.017     | 18.006     | 0.009     |
| 13          | K13x17x10   | 13                   | 17                   | 10                                     | 7.22            | 8.33                     | 19000                             | 29000 | 13.000              | 12.992     | 17.017     | 17.006     | 0.004     |
|             | K13x18x15F  | 13                   | 18                   | 15                                     | 10.8            | 12.1                     | 16000                             | 25000 | 13.000              | 12.992     | 18.017     | 18.006     | 0.008     |
| 14          | K14x18x8    | 14                   | 18                   | 8                                      | 5.39            | 5.82                     | 19000                             | 29000 | 14.000              | 13.992     | 18.017     | 18.006     | 0.004     |
|             | K14x18x10   | 14                   | 18                   | 10                                     | 7.17            | 8.41                     | 19000                             | 29000 | 14.000              | 13.992     | 18.017     | 18.006     | 0.005     |
|             | K14x18x13   | 14                   | 18                   | 13                                     | 9.73            | 12.5                     | 19000                             | 29000 | 14.000              | 13.992     | 18.017     | 18.006     | 0.006     |
|             | K14x18x15   | 14                   | 18                   | 15                                     | 10.5            | 13.8                     | 19000                             | 29000 | 14.000              | 13.992     | 18.017     | 18.006     | 0.007     |
|             | K14x18x17H  | 14                   | 18                   | 17                                     | 12.4            | 17.1                     | 19000                             | 29000 | 14.000              | 13.992     | 18.017     | 18.006     | 0.008     |
|             | K14x19x13H  | 14                   | 19                   | 13                                     | 10.2            | 11.4                     | 16000                             | 24000 | 14.000              | 13.992     | 19.020     | 19.007     | 0.008     |
|             | K14x19x18F  | 14                   | 19                   | 18                                     | 13.2            | 16.0                     | 16000                             | 24000 | 14.000              | 13.992     | 19.020     | 19.007     | 0.011     |
|             | K14x20x12   | 14                   | 20                   | 12                                     | 10.5            | 10.6                     | 14000                             | 21000 | 14.000              | 13.992     | 20.020     | 20.007     | 0.009     |
| 15          | K15x18x14T  | 15                   | 18                   | 14                                     | 7.92            | 11.9                     | 13000                             | 23000 | 15.000              | 14.992     | 18.017     | 18.006     | 0.003     |
|             | K15x18x16F  | 15                   | 18                   | 16                                     | 8.36            | 12.6                     | 13000                             | 23000 | 15.000              | 14.992     | 18.017     | 18.006     | 0.005     |
|             | K15x18x17   | 15                   | 18                   | 17                                     | 8.08            | 12.1                     | 23000                             | 36000 | 15.000              | 14.992     | 18.017     | 18.006     | 0.005     |
|             | K15x19x10   | 15                   | 19                   | 10                                     | 7.87            | 9.69                     | 18000                             | 28000 | 15.000              | 14.992     | 19.020     | 19.007     | 0.005     |
|             | K15x19x13   | 15                   | 19                   | 13                                     | 9.66            | 12.6                     | 18000                             | 28000 | 15.000              | 14.992     | 19.020     | 19.007     | 0.007     |
|             | K15x19x17H  | 15                   | 19                   | 17                                     | 12.3            | 17.2                     | 18000                             | 28000 | 15.000              | 14.992     | 19.020     | 19.007     | 0.009     |
|             | K15x19x22ZW | 15                   | 19                   | 22                                     | 12.2            | 17.0                     | 18000                             | 28000 | 15.000              | 14.992     | 19.020     | 19.007     | 0.010     |
|             | K15x20x13H  | 15                   | 20                   | 13                                     | 9.93            | 11.3                     | 16000                             | 24000 | 15.000              | 14.992     | 20.020     | 20.007     | 0.008     |
|             | K15x21x15   | 15                   | 21                   | 15                                     | 13.4            | 14.8                     | 14000                             | 21000 | 15.000              | 14.992     | 21.020     | 21.007     | 0.013     |
|             | K15x21x21H  | 15                   | 21                   | 21                                     | 18.0            | 21.7                     | 14000                             | 21000 | 15.000              | 14.992     | 21.020     | 21.007     | 0.018     |

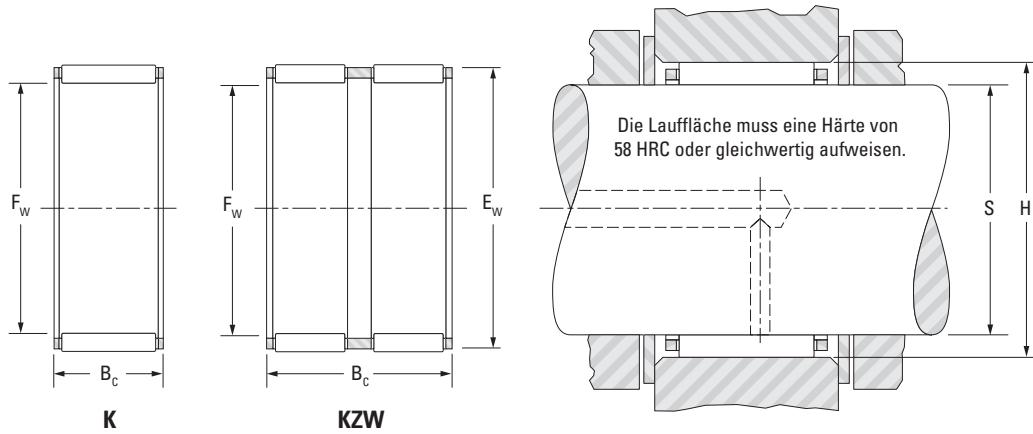
# RADIAL NEEDLE ROLLER AND CAGE ASSEMBLIES

## SINGLE-ROW, DOUBLE-ROW ASSEMBLIES



| Shaft mm | Designation | F <sub>w</sub> mm | E <sub>w</sub> mm | B <sub>c</sub> -0.20 -0.55 mm | Load ratings kN |                       | Speed rating min <sup>-1</sup> |       | S                   |         | H       |         | Wt. kg |
|----------|-------------|-------------------|-------------------|-------------------------------|-----------------|-----------------------|--------------------------------|-------|---------------------|---------|---------|---------|--------|
|          |             |                   |                   |                               | Dynamic C       | Static C <sub>0</sub> | Grease                         | Oil   | Mounting dimensions |         |         |         |        |
|          |             |                   |                   |                               |                 |                       |                                |       | Max. mm             | Min. mm | Max. mm | Min. mm |        |
|          |             |                   |                   |                               |                 |                       |                                |       |                     |         |         |         |        |
| 16       | K16x20x8F   | 16                | 20                | 8                             | 6.37            | 7.51                  | 18000                          | 28000 | 16.000              | 15.992  | 20.020  | 20.007  | 0.005  |
|          | K16x20x10H  | 16                | 20                | 10                            | 7.82            | 9.76                  | 18000                          | 28000 | 16.000              | 15.992  | 20.020  | 20.007  | 0.006  |
|          | K16x20x13   | 16                | 20                | 13                            | 10.1            | 13.5                  | 18000                          | 28000 | 16.000              | 15.992  | 20.020  | 20.007  | 0.007  |
|          | K16x20x14   | 16                | 20                | 14                            | 10.8            | 14.08                 | 18000                          | 28000 | 16.000              | 15.992  | 20.020  | 20.007  | 0.007  |
|          | K16x20x17H  | 16                | 20                | 17                            | 12.9            | 18.5                  | 18000                          | 28000 | 16.000              | 15.992  | 20.020  | 20.007  | 0.008  |
|          | K16x20x20   | 16                | 20                | 20                            | 13.4            | 19.5                  | 18000                          | 28000 | 16.000              | 15.992  | 20.020  | 20.007  | 0.011  |
|          | K16x22x12   | 16                | 22                | 12                            | 11.2            | 11.9                  | 19000                          | 29000 | 16.000              | 15.992  | 22.020  | 22.007  | 0.010  |
|          | K16x22x16H  | 16                | 22                | 16                            | 14.9            | 17.2                  | 19000                          | 29000 | 16.000              | 15.992  | 22.020  | 22.007  | 0.014  |
|          | K16x22x20   | 16                | 22                | 20                            | 18.6            | 22.9                  | 19000                          | 29000 | 16.000              | 15.992  | 22.020  | 22.007  | 0.017  |
|          | K16x24x20   | 16                | 24                | 20                            | 20.2            | 21.4                  | 20000                          | 30000 | 16.000              | 15.992  | 24.020  | 24.007  | 0.025  |
| 17       | K17x20x10   | 17                | 20                | 10                            | 5.96            | 8.53                  | 16000                          | 25000 | 17.000              | 16.992  | 20.020  | 20.007  | 0.004  |
|          | K17x21x10   | 17                | 21                | 10                            | 8.12            | 10.4                  | 17000                          | 26000 | 17.000              | 16.992  | 21.020  | 21.007  | 0.006  |
|          | K17x21x13H  | 17                | 21                | 12.8                          | 10.5            | 14.5                  | 17000                          | 26000 | 17.000              | 16.992  | 21.020  | 21.007  | 0.008  |
|          | K17x21x15   | 17                | 21                | 15                            | 11.4            | 16.1                  | 17000                          | 26000 | 17.000              | 16.992  | 21.020  | 21.007  | 0.008  |
|          | K17x21x17H  | 17                | 21                | 17                            | 13.4            | 19.8                  | 17000                          | 26000 | 17.000              | 16.992  | 21.020  | 21.007  | 0.011  |
|          | K17x22x20FH | 17                | 22                | 20                            | 17.0            | 23.3                  | 17000                          | 27000 | 17.000              | 16.992  | 22.020  | 22.007  | 0.015  |
|          | K17x23x15F  | 17                | 23                | 15                            | 14.1            | 16.3                  | 18000                          | 27000 | 17.000              | 16.992  | 23.020  | 23.007  | 0.010  |
| 18       | K18x22x8F   | 18                | 22                | 8                             | 6.32            | 7.70                  | 16000                          | 24000 | 18.000              | 17.992  | 22.020  | 22.007  | 0.005  |
|          | K18x22x10H  | 18                | 22                | 10                            | 8.41            | 11.1                  | 16000                          | 24000 | 18.000              | 17.992  | 22.020  | 22.007  | 0.006  |
|          | K18x22x13H  | 18                | 22                | 13                            | 10.8            | 15.4                  | 16000                          | 24000 | 18.000              | 17.992  | 22.020  | 22.007  | 0.008  |
|          | K18x22x14   | 18                | 22                | 14                            | 11.6            | 16.8                  | 16000                          | 24000 | 18.000              | 17.992  | 22.020  | 22.007  | 0.009  |
|          | K18x22x14FV | 18                | 22                | 14                            | 11.3            | 16.3                  | 16000                          | 24000 | 18.000              | 17.992  | 22.020  | 22.007  | 0.009  |
|          | K18x22x17H  | 18                | 22                | 17                            | 13.3            | 19.9                  | 16000                          | 24000 | 18.000              | 17.992  | 22.020  | 22.007  | 0.009  |
|          | K18x22x20F  | 18                | 22                | 20                            | 15.0            | 23.4                  | 16000                          | 24000 | 18.000              | 17.992  | 22.020  | 22.007  | 0.011  |
|          | K18x24x12   | 18                | 22                | 12                            | 11.8            | 13.1                  | 17000                          | 25000 | 18.000              | 17.992  | 24.020  | 24.007  | 0.011  |
|          | K18x24x20H  | 18                | 24                | 20                            | 19.4            | 24.9                  | 16000                          | 25000 | 18.000              | 17.992  | 24.020  | 24.007  | 0.019  |
|          | K18x25x22H  | 18                | 25                | 22                            | 23.3            | 28.6                  | 17000                          | 26000 | 18.000              | 17.992  | 25.020  | 25.007  | 0.025  |
|          | K18x26x12FV | 18                | 26                | 12                            | 13.8            | 13.5                  | 11000                          | 17000 | 18.000              | 17.992  | 26.020  | 26.007  | 0.020  |
|          | K18x26x20F  | 18                | 26                | 20                            | 21.7            | 24.1                  | 17000                          | 26000 | 18.000              | 17.992  | 26.020  | 26.007  | 0.027  |

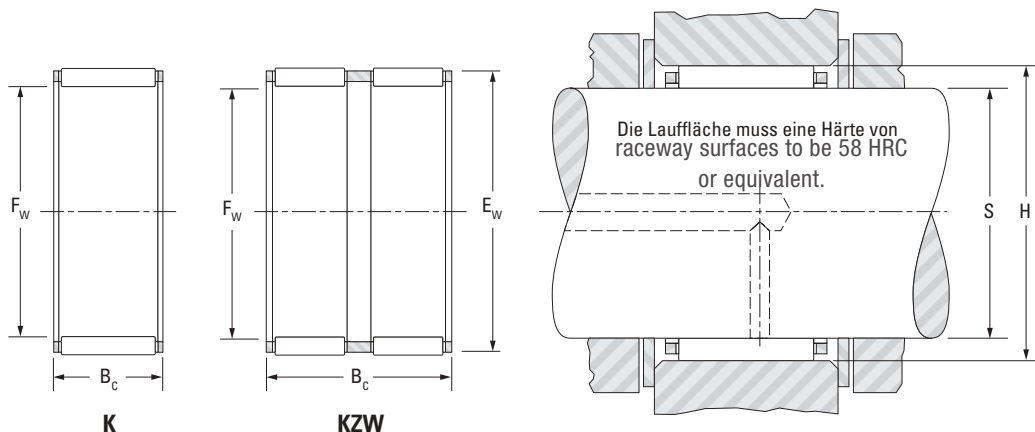
# 2.2



| Shaft mm | Designation | F <sub>w</sub> mm | E <sub>w</sub> mm | B <sub>c</sub> -0.20 -0.55 mm | Load ratings kN |                       | Speed rating min <sup>-1</sup> |       | Mounting dimensions |         |         |         | Wt. kg |
|----------|-------------|-------------------|-------------------|-------------------------------|-----------------|-----------------------|--------------------------------|-------|---------------------|---------|---------|---------|--------|
|          |             |                   |                   |                               | Dynamic C       | Static C <sub>0</sub> | Grease                         | Oil   | S                   |         | H       |         |        |
|          |             |                   |                   |                               |                 |                       |                                |       | Max. mm             | Min. mm | Max. mm | Min. mm |        |
|          |             |                   |                   |                               |                 |                       |                                |       |                     |         |         |         |        |
| 19       | K19x23x13   | 19                | 23                | 13                            | 10.8            | 15.5                  | 15000                          | 23000 | 19.000              | 18.991  | 23.020  | 23.007  | 0.008  |
|          | K19x23x17   | 19                | 23                | 17                            | 13.4            | 20.6                  | 15000                          | 23000 | 19.000              | 18.991  | 23.020  | 23.007  | 0.011  |
| 20       | K20x24x8F   | 20                | 24                | 8                             | 7.31            | 9.60                  | 14000                          | 22000 | 20.000              | 19.991  | 24.020  | 24.007  | 0.005  |
|          | K20x24x10H  | 20                | 24                | 10                            | 8.97            | 12.5                  | 14000                          | 22000 | 20.000              | 19.991  | 24.020  | 24.007  | 0.0%   |
|          | K20x24x12   | 20                | 24                | 12                            | 10.7            | 15.7                  | 14000                          | 22000 | 20.000              | 19.991  | 24.020  | 24.007  | 0.008  |
|          | K20x24x13H  | 20                | 24                | 13                            | 11.5            | 17.3                  | 14000                          | 22000 | 20.000              | 19.991  | 24.020  | 24.007  | 0.009  |
|          | K20x24x14   | 20                | 24                | 14                            | 12.4            | 18.9                  | 14000                          | 22000 | 20.000              | 19.991  | 24.020  | 24.007  | 0.009  |
|          | K20x24x17H  | 20                | 24                | 17                            | 14.8            | 23.7                  | 14000                          | 22000 | 20.000              | 19.991  | 24.020  | 24.007  | 0.011  |
|          | K20x26x12   | 20                | 26                | 12                            | 13.0            | 15.3                  | 15000                          | 23000 | 20.000              | 19.991  | 26.020  | 26.007  | 0.012  |
|          | K20x26)x13H | 20                | 26                | 13                            | 13.4            | 15.9                  | 15000                          | 23000 | 20.000              | 19.991  | 26.020  | 26.007  | 0.014  |
|          | K20x26x17H  | 20                | 26                | 17                            | 19.3            | 25.5                  | 15000                          | 23000 | 20.000              | 19.991  | 26.020  | 26.007  | 0.017  |
|          | K20x26x20   | 20                | 26                | 20                            | 20.3            | 27.2                  | 15000                          | 23000 | 20.000              | 19.991  | 26.020  | 26.007  | 0.020  |
|          | K20x28x20H  | 20                | 28                | 20                            | 24.6            | 29.0                  | 15000                          | 23000 | 20.000              | 19.991  | 28.020  | 28.007  | 0.028  |
|          | K20x28x25H  | 20                | 28                | 25                            | 29.7            | 37.0                  | 15000                          | 23000 | 20.000              | 19.991  | 28.020  | 28.007  | 0.036  |
|          | K20x30x30H  | 20                | 30                | 30                            | 38.9            | 45.8                  | 16000                          | 24000 | 20.000              | 19.991  | 30.020  | 30.007  | 0.055  |
|          | K20x32x36H  | 20                | 32                | 36                            | 49.9            | 57.0                  | 16000                          | 25000 | 20.000              | 19.991  | 32.025  | 32.009  | 0.082  |
| 21       | K21x25x17H  | 21                | 25                | 17                            | 14.3            | 23.1                  | 14000                          | 21000 | 21.000              | 20.991  | 25.020  | 25.007  | 0.013  |
| 22       | K22x26x10H  | 22                | 26                | 10                            | 9.81            | 14.5                  | 13000                          | 20000 | 22.000              | 21.991  | 26.020  | 26.007  | 0.007  |
|          | K22x26x13H  | 22                | 26                | 13                            | 11.8            | 18.3                  | 13000                          | 20000 | 22.000              | 21.991  | 26.020  | 26.007  | 0.012  |
|          | K22x26x17H  | 22                | 26                | 17                            | 15.6            | 26.3                  | 13000                          | 20000 | 22.000              | 21.991  | 26.020  | 26.007  | 0.012  |
|          | K22x26x18H  | 22                | 26                | 18                            | 15.3            | 25.5                  | 13000                          | 20000 | 22.000              | 21.991  | 26.020  | 26.007  | 0.017  |
|          | K22x28x13   | 22                | 28                | 13                            | 13.9            | 17.1                  | 13000                          | 20000 | 22.000              | 21.991  | 28.020  | 28.007  | 0.015  |
|          | K22x28x17H  | 22                | 28                | 17                            | 18.2            | 24.2                  | 13000                          | 20000 | 22.000              | 21.991  | 28.020  | 28.007  | 0.020  |
|          | K22x30x15H  | 22                | 30                | 15                            | 19.7            | 22.3                  | 14000                          | 21000 | 22.000              | 21.991  | 30.020  | 30.007  | 0.023  |
|          | K22x30x20FV | 22                | 30                | 20                            | 24.4            | 29.4                  | 14000                          | 21000 | 22.000              | 21.991  | 30.020  | 30.007  | 0.031  |
|          | K22x32x24F  | 22                | 32                | 24                            | 33.1            | 37.9                  | 14000                          | 22000 | 22.000              | 21.991  | 32.025  | 32.009  | 0.046  |
|          | K22x32x30H  | 22                | 32                | 30                            | 41.8            | 51.3                  | 14000                          | 22000 | 22.000              | 21.991  | 32.025  | 32.009  | 0.057  |

# RADIAL NEEDLE ROLLER AND CAGE ASSEMBLIES

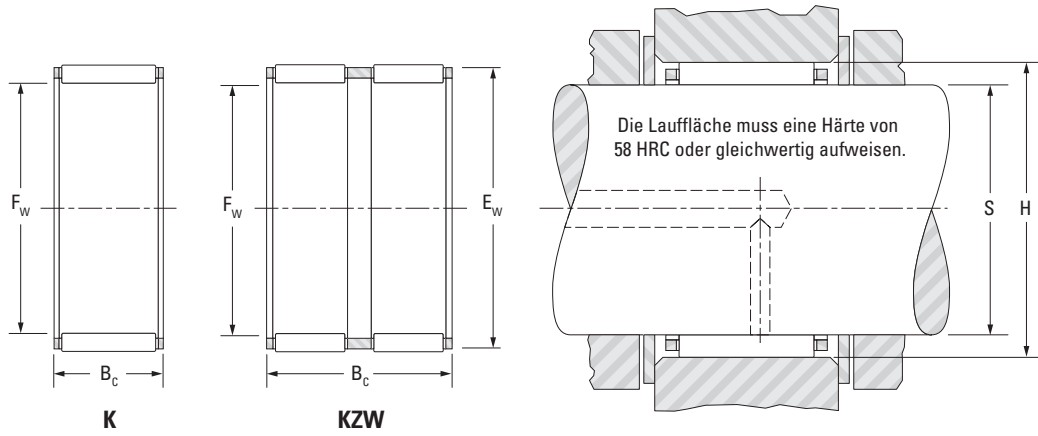
## SINGLE-ROW, DOUBLE-ROW ASSEMBLIES



| Shaft mm | Designation  | F <sub>w</sub> mm | E <sub>w</sub> mm | B <sub>c</sub><br>-0.20<br>-0.55<br>mm | Load ratings kN |        | Speed rating min <sup>-1</sup> |       | S                   |                | H       |         | Wt. kg |
|----------|--------------|-------------------|-------------------|--|-----------------|--------|--------------------------------|-------|---------------------|----------------|---------|---------|--------|
|          |              |                   |                   |  | Dynamic         | Static | Grease                         | Oil   | Mounting dimensions |                |         |         |        |
|          |              |                   |                   |  |                 |        |                                |       | C                   | C <sub>0</sub> | Max. mm | Min. mm |        |
|          |              |                   |                   |  |                 |        |                                |       |                     |                |         |         |        |
| 23       | K23x28x24F   | 23                | 28                | 24                                     | 22.4            | 36.2   | 12000                          | 19000 | 23.000              | 22.991         | 28.020  | 28.007  | 0.023  |
|          | K23x35x16H   | 23                | 35                | 16                                     | 25.9            | 25.1   | 14000                          | 21000 | 23.000              | 22.991         | 35.025  | 35.009  | 0.040  |
|          | K24x28x10H   | 24                | 28                | 10                                     | 9.67            | 14.6   | 12000                          | 18000 | 24.000              | 23.991         | 28.020  | 28.007  | 0.027  |
|          | K24x28x13H   | 24                | 28                | 13                                     | 12.5            | 20.2   | 12000                          | 18000 | 24.000              | 23.991         | 28.020  | 28.007  | 0.010  |
| 24       | K24x28x16F   | 24                | 28                | 16                                     | 12.6            | 20.4   | 12000                          | 18000 | 24.000              | 23.991         | 28.020  | 28.007  | 0.012  |
|          | K24x28x17H   | 24                | 28                | 17                                     | 15.4            | 26.4   | 12000                          | 18000 | 24.000              | 23.991         | 28.020  | 28.007  | 0.013  |
|          | K24x30x10TN  | 24                | 30                | 10                                     | 11.3            | 13.5   | 12000                          | 19000 | 24.000              | 23.991         | 30.020  | 30.007  | 0.008  |
|          | K24x30x17H   | 24                | 30                | 17                                     | 19.8            | 27.7   | 12000                          | 19000 | 24.000              | 23.991         | 30.020  | 30.007  | 0.020  |
|          | K24x30x22    | 24                | 30                | 22                                     | 25.0            | 37.3   | 12000                          | 19000 | 24.000              | 23.991         | 30.020  | 30.007  | 0.024  |
|          | K24x36x23H   | 24                | 36                | 23                                     | 37.1            | 40.1   | 13000                          | 20000 | 24.000              | 23.991         | 36.025  | 36.009  | 0.070  |
|          | K25x29x10H   | 25                | 29                | 10                                     | 9.61            | 14.6   | 11000                          | 17000 | 25.000              | 24.991         | 29.020  | 29.007  | 0.008  |
|          | K25x29x13H   | 25                | 29                | 13                                     | 12.8            | 21.1   | 11000                          | 17000 | 25.000              | 24.991         | 29.020  | 29.007  | 0.010  |
| 25       | K25x29x17H   | 25                | 29                | 17                                     | 15.1            | 26.2   | 11000                          | 17000 | 25.000              | 24.991         | 29.020  | 29.007  | 0.016  |
|          | K25x30x13    | 25                | 30                | 13                                     | 14.6            | 21.4   | 11000                          | 17000 | 25.000              | 24.991         | 30.020  | 30.007  | 0.012  |
|          | K25x30x17H   | 25                | 30                | 17                                     | 18.8            | 29.8   | 11000                          | 17000 | 25.000              | 24.991         | 30.020  | 30.007  | 0.016  |
|          | K25x30x18    | 25                | 30                | 18                                     | 20.6            | 33.4   | 11000                          | 17000 | 25.000              | 24.991         | 30.020  | 30.007  | 0.017  |
|          | K25x30x20H   | 25                | 30                | 20                                     | 21.9            | 36.1   | 11000                          | 17000 | 25.000              | 24.991         | 30.020  | 30.007  | 0.019  |
|          | K25x30x24H   | 25                | 30                | 24                                     | 24.8            | 42.4   | 11000                          | 17000 | 25.000              | 24.991         | 30.020  | 30.007  | 0.024  |
|          | K25x30x26ZW  | 25                | 30                | 26                                     | 23.0            | 38.6   | 11000                          | 17000 | 25.000              | 24.991         | 30.020  | 30.007  | 0.027  |
|          | K25x31x14H   | 25                | 31                | 14                                     | 16.8            | 22.7   | 12000                          | 18000 | 25.000              | 24.991         | 31.025  | 31.009  | 0.017  |
|          | K25x31x17H   | 25                | 31                | 17                                     | 19.7            | 27.8   | 12000                          | 18000 | 25.000              | 24.991         | 31.025  | 31.009  | 0.020  |
|          | K25x31x21H   | 25                | 31                | 21                                     | 25.1            | 38.0   | 12000                          | 18000 | 25.000              | 24.991         | 31.025  | 31.009  | 0.026  |
|          | K25x31x24H   | 25                | 31                | 24                                     | 25.3            | 38.5   | 12000                          | 18000 | 25.000              | 24.991         | 31.025  | 31.009  | 0.031  |
|          | K25x32x16    | 25                | 32                | 16                                     | 19.8            | 25.3   | 12000                          | 18000 | 25.000              | 24.991         | 32.025  | 32.009  | 0.027  |
|          | K25x33x20H   | 25                | 33                | 20                                     | 28.8            | 37.6   | 12000                          | 18000 | 25.000              | 24.991         | 33.025  | 33.009  | 0.035  |
|          | K25x33x24H   | 25                | 33                | 24                                     | 32.3            | 43.5   | 12000                          | 18000 | 25.000              | 24.991         | 33.025  | 33.009  | 0.038  |
|          | K25x33x25H   | 25                | 33                | 25                                     | 33.0            | 44.6   | 12000                          | 18000 | 25.000              | 24.991         | 33.025  | 33.009  | 0.041  |
|          | K25x35x23,7H | 25                | 35                | 23.7                                   | 35.9            | 42.3   | 12000                          | 19000 | 25.000              | 24.991         | 35.025  | 35.009  | 0.050  |
|          | K25x35x25H   | 25                | 35                | 25                                     | 37.8            | 46.2   | 12000                          | 19000 | 25.000              | 24.991         | 35.025  | 35.009  | 0.054  |
|          | K25x35x30H   | 25                | 35                | 30                                     | 44.6            | 57.2   | 12000                          | 19000 | 25.000              | 24.991         | 35.025  | 35.009  | 0.060  |
|          | K25x35x36H   | 25                | 35                | 36                                     | 52.4            | 70.4   | 12000                          | 19000 | 25.000              | 24.991         | 35.025  | 35.009  | 0.074  |
|          | K25x37x20H   | 25                | 37                | 20                                     | 32.5            | 34.1   | 12000                          | 19000 | 25.000              | 24.991         | 37.025  | 37.009  | 0.055  |



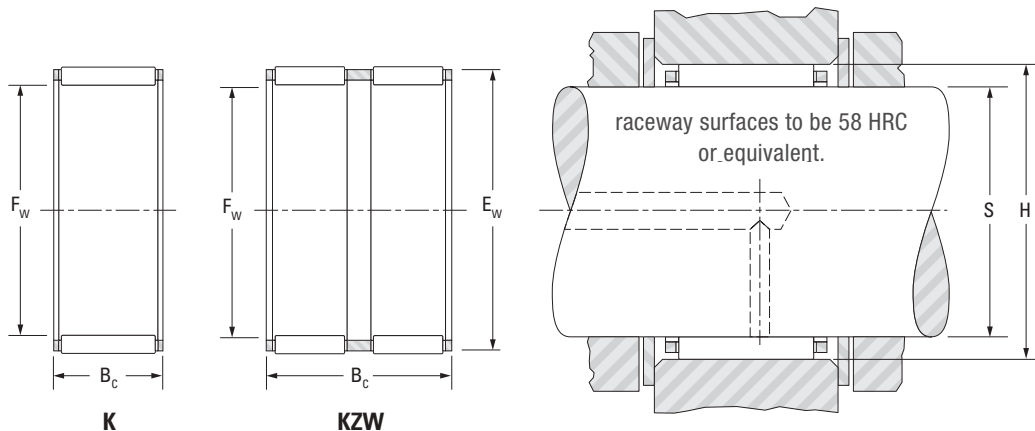
# 2.2



| Shaft mm  | Designation  | F <sub>w</sub> mm | E <sub>w</sub> mm | B <sub>c</sub> -0.20 -0.55 mm | Load ratings kN |                | Speed rating min <sup>-1</sup> |       | S                   |         | H       |         | Wt. kg |
|-----------|--------------|-------------------|-------------------|-------------------------------|-----------------|----------------|--------------------------------|-------|---------------------|---------|---------|---------|--------|
|           |              |                   |                   |                               | Dynamic         | Static         | Grease                         | Oil   | Mounting dimensions |         |         |         |        |
|           |              |                   |                   |                               |                 |                |                                |       | Max. mm             | Min. mm | Max. mm | Min. mm |        |
|           |              |                   |                   |                               | C               | C <sub>0</sub> |                                |       |                     |         |         |         |        |
| 26        | K26x30x10F   | 26                | 30                | 10                            | 9.46            | 14.5           | 11000                          | 16000 | 26.000              | 25.991  | 30.020  | 30.007  | 0.007  |
|           | K26x30x13    | 26                | 30                | 13                            | 12.3            | 20.4           | 10000                          | 16000 | 26.000              | 25.991  | 30.007  | 0.011   | 0.011  |
|           | K26x30x17    | 26                | 30                | 17                            | 15.0            | 26.3           | 10000                          | 16000 | 26.000              | 25.991  | 30.007  | 0.014   | 0.014  |
|           | K26x30x22ZW  | 26                | 30                | 22                            | 16.7            | 30.2           | 10000                          | 16000 | 26.000              | 25.991  | 30.007  | 0.018   | 0.018  |
| 28        | K28x32x21F   | 28                | 32                | 21                            | 18.7            | 35.7           | 9900                           | 15000 | 28.000              | 27.991  | 32.009  | 0.018   | 0.018  |
|           | K28x33x13F   | 28                | 33                | 13                            | 14.1            | 21.4           | 10000                          | 15000 | 28.000              | 27.991  | 33.009  | 0.015   | 0.015  |
|           | K28x33x17H   | 28                | 33                | 17                            | 19.8            | 33.0           | 10000                          | 15000 | 28.000              | 27.991  | 33.009  | 0.018   | 0.015  |
|           | K28x33x27    | 28                | 33                | 27                            | 29.0            | 53.8           | 10000                          | 15000 | 28.000              | 27.991  | 33.009  | 0.027   | 0.018  |
|           | K28x34x17    | 28                | 34                | 17                            | 21.1            | 31.5           | 10000                          | 16000 | 28.000              | 27.991  | 34.009  | 0.022   | 0.027  |
|           | K28x34x20H   | 28                | 34                | 20                            | 24.4            | 37.8           | 10000                          | 16000 | 28.000              | 27.991  | 34.009  | 0.025   | 0.027  |
|           | K28x35x15H   | 28                | 35                | 15                            | 19.5            | 25.6           | 10000                          | 16000 | 28.000              | 27.991  | 35.009  | 0.025   | 0.025  |
|           | K28x35x16H   | 28                | 35                | 16                            | 21.5            | 29.1           | 10000                          | 16000 | 28.000              | 27.991  | 35.009  | 0.026   | 0.025  |
|           | K28x35x27H   | 28                | 35                | 27                            | 35.2            | 54.7           | 10000                          | 16000 | 28.000              | 27.991  | 35.009  | 0.042   | 0.042  |
|           | K28x36x20FV  | 28                | 36                | 20                            | 27.8            | 37.0           | 10000                          | 16000 | 28.000              | 27.991  | 36.009  | 0.039   | 0.039  |
|           | K28x38x25,5  | 28                | 38                | 25                            | 40.9            | 52.7           | 11000                          | 16000 | 28.000              | 27.991  | 38.009  | 0.059   | 0.059  |
|           | K28x40x18H   | 28                | 40                | 18                            | 33.6            | 36.5           | 11000                          | 17000 | 28.000              | 27.991  | 40.009  | 0.060   | 0.060  |
|           | K28x40x25H   | 28                | 40                | 25                            | 45.5            | 54.0           | 11000                          | 17000 | 28.000              | 27.991  | 40.009  | 0.072   | 0.072  |
|           | K28x40x30H   | 28                | 40                | 30                            | 54.3            | 67.8           | 11000                          | 17000 | 28.000              | 27.991  | 40.009  | 0.100   | 0.100  |
|           | K28x41x25H   | 28                | 41                | 25                            | 49.2            | 57.1           | 11000                          | 17000 | 28.000              | 27.991  | 41.009  | 0.082   | 0.082  |
|           | 29           | K29x34x27F        | 29                | 34                            | 27              | 28.9           | 54.0                           | 9700  | 15000               | 29.000  | 28.991  | 34.009  | 0.033  |
| K30x34x13 |              | 30                | 34                | 13                            | 13.5            | 24.1           | 9200                           | 14000 | 30.000              | 29.991  | 34.009  | 0.011   | 0.011  |
| 30        | K30x35x13H   | 30                | 35                | 13                            | 15.6            | 24.9           | 9300                           | 14000 | 30.000              | 29.991  | 35.009  | 0.017   | 0.017  |
|           | K30x35x17H   | 30                | 35                | 17                            | 20.2            | 34.6           | 9300                           | 14000 | 30.000              | 29.991  | 35.009  | 0.022   | 0.022  |
|           | K30x35x20H   | 30                | 35                | 20                            | 23.5            | 41.9           | 9300                           | 14000 | 30.000              | 29.991  | 35.009  | 0.023   | 0.023  |
|           | K30x35x23F   | 30                | 35                | 22.8                          | 25.6            | 46.8           | 9300                           | 14000 | 30.000              | 29.991  | 35.009  | 0.028   | 0.028  |
|           | K30x35x27H   | 30                | 35                | 27                            | 30.6            | 59.0           | 9300                           | 14000 | 30.000              | 29.991  | 35.009  | 0.032   | 0.032  |
|           | K30x35x27HZW | 30                | 35                | 27                            | 19.9            | 33.6           | 9300                           | 14000 | 30.000              | 29.991  | 35.009  | 0.033   | 0.033  |
|           | K30x36x14    | 30                | 36                | 14                            | 18.0            | 26.2           | 9500                           | 15000 | 30.000              | 29.991  | 36.009  | 0.020   | 0.020  |

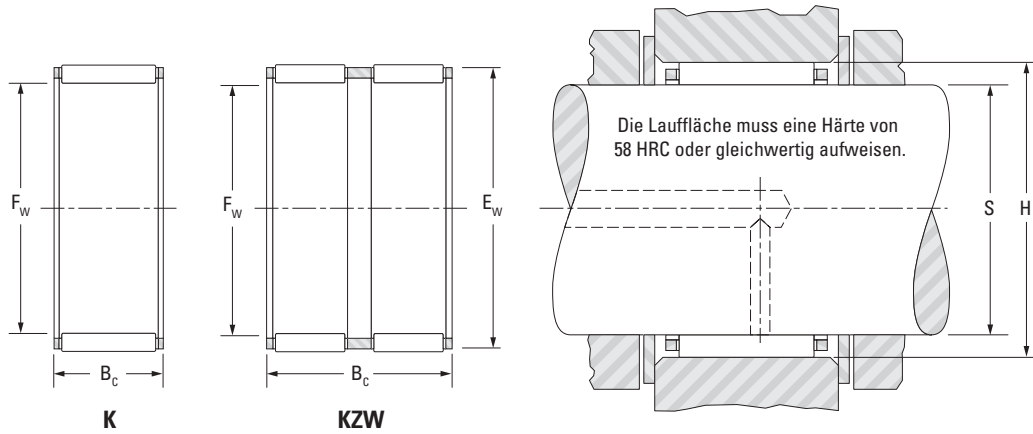
# RADIAL NEEDLE ROLLER AND CAGE ASSEMBLIES

## SINGLE-ROW, DOUBLE-ROW ASSEMBLIES



| Shaft mm    | Designation | F <sub>w</sub> mm | E <sub>w</sub> mm | B <sub>c</sub> -0.20 -0.55 mm | Load ratings kN |                       | Speed rating min <sup>-1</sup> |        | Mounting dimensions |         |         |         | Wt. kg |       |
|-------------|-------------|-------------------|-------------------|-------------------------------|-----------------|-----------------------|--------------------------------|--------|---------------------|---------|---------|---------|--------|-------|
|             |             |                   |                   |                               | Dynamic C       | Static C <sub>0</sub> | Grease                         | Oil    | S                   |         | H       |         |        |       |
|             |             |                   |                   |                               |                 |                       |                                |        | Max. mm             | Min. mm | Max. mm | Min. mm |        |       |
|             |             |                   |                   |                               |                 |                       |                                |        |                     |         |         |         |        |       |
| 30          | K30x37(18)  | 30                | 37                | 17.8                          | 24.3            | 34.8                  | 9600                           | 15000  | 30.000              | 29.991  | 37.025  | 37.009  |        |       |
|             | K30x40x30H  | 30                | 40                | 30                            | 49.2            | 67.8                  | 9900                           | 15000  | 30.000              | 29.991  | 40.025  | 40.009  | 0.077  |       |
|             | K30x42x30H  | 30                | 42                | 30                            | 54.2            | 68.6                  | 10000                          | 16000  | 30.000              | 29.991  | 42.025  | 42.009  | 0.096  |       |
|             | K30x44x26H  | 30                | 44                | 26                            | 52.4            | 59.9                  | 10000                          | 16000  | 30.000              | 29.991  | 44.025  | 44.009  | 0.095  |       |
| 32          | K32x36x15F  | 32                | 36                | 15                            | 11.6            | 20.2                  | 8600                           | 13000  | 32.000              | 31.989  | 36.025  | 36.009  | 0.015  |       |
|             | K32x37x13   | 32                | 37                | 13                            | 15.2            | 24.4                  | 8700                           | 13000  | 32.000              | 31.989  | 37.025  | 37.009  | 0.018  |       |
|             | K32x37x17H  | 32                | 37                | 17                            | 20.0            | 34.8                  | 8700                           | 13000  | 32.000              | 31.989  | 37.025  | 37.009  | 0.020  |       |
|             | K32x37x27   | 32                | 37                | 27                            | 29.3            | 56.8                  | 8700                           | 13000  | 32.000              | 31.989  | 37.025  | 37.009  | 0.035  |       |
|             | K32x38x20H  | 32                | 38                | 20                            | 27.3            | 45.7                  | 8800                           | 14000  | 32.000              | 31.989  | 38.025  | 38.009  | 0.030  |       |
|             | K32x38x26H  | 32                | 38                | 26                            | 33.2            | 58.8                  | 8800                           | 14000  | 32.000              | 31.989  | 38.025  | 38.009  | 0.037  |       |
|             | K32x39x16H  | 32                | 39                | 16                            | 23.0            | 33.0                  | 8900                           | 14000  | 32.000              | 31.989  | 39.025  | 39.009  | 0.030  |       |
|             | K32x39x18H  | 32                | 39                | 18                            | 25.8            | 38.2                  | 8900                           | 14000  | 32.000              | 31.989  | 39.025  | 39.009  | 0.033  |       |
|             | K32x40x25H  | 32                | 40                | 25                            | 37.9            | 57.2                  | 9000                           | 14000  | 32.000              | 31.989  | 40.025  | 40.009  | 0.052  |       |
|             | K32x40x36H  | 32                | 40                | 36                            | 52.3            | 86.4                  | 9000                           | 14.000 | 32.000              | 31.989  | 40.025  | 40.009  | 0.080  |       |
|             | K32x42x42H  | 32                | 42                | 42                            | 69.2            | 108                   | 9200                           | 14.000 | 32.000              | 31.989  | 42.025  | 42.009  | 0.110  |       |
|             | K32x46x18H  | 32                | 46                | 18                            | 39.2            | 41.9                  | 9600                           | 15000  | 32.000              | 31.989  | 46.025  | 46.009  | 0.075  |       |
|             | K32x46x32H  | 32                | 46                | 32                            | 67.0            | 83.4                  | 9600                           | 15.000 | 32.000              | 31.989  | 46.025  | 46.009  | 0.140  |       |
|             | K32x46x40H  | 32                | 46                | 40                            | 81.7            | 108                   | 9600                           | 15.000 | 32.000              | 31.989  | 46.025  | 46.009  | 0.158  |       |
|             | 33          | K33x51x23H        | 33                | 51                            | 23              | 55.9                  | 57.6                           | 9600   | 15.000              | 33.000  | 32.989  | 51.029  | 51.010 | 0.140 |
|             | 34          | K34x38x11         | 34                | 38                            | 11              | 12.2                  | 21.9                           | 8100   | 12.000              | 34.000  | 33.989  | 38.025  | 38.009 | 0.011 |
| K34x44x26FH |             | 34                | 44                | 26                            | 42.9            | 58.9                  | 8600                           | 13.000 | 34.000              | 33.989  | 44.025  | 44.009  | 0.080  |       |
| 35          | K35x40x13H  | 35                | 40                | 13                            | 16.2            | 27.2                  | 7900                           | 12.000 | 35.000              | 34.989  | 40.025  | 40.009  | 0.018  |       |
|             | K35x40x17H  | 35                | 40                | 17                            | 22.1            | 40.8                  | 7900                           | 12.000 | 35.000              | 34.989  | 40.025  | 40.009  | 0.025  |       |
|             | K35x40x19F  | 35                | 40                | 19                            | 23.2            | 43.2                  | 7900                           | 12.000 | 35.000              | 34.989  | 40.025  | 40.009  | 0.025  |       |
|             | K35x40x19H  | 35                | 40                | 19                            | 23.2            | 43.2                  | 7900                           | 12.000 | 35.000              | 34.989  | 40.025  | 40.009  | 0.025  |       |
|             | K35x40x25H  | 35                | 40                | 25                            | 28.4            | 56.2                  | 7900                           | 12.000 | 35.000              | 34.989  | 40.025  | 40.009  | 0.035  |       |
|             | K35x40x27H  | 35                | 40                | 27                            | 29.8            | 59.6                  | 7900                           | 12.000 | 35.000              | 34.989  | 40.025  | 40.009  | 0.037  |       |
|             | K35x42x16H  | 35                | 42                | 16                            | 24.5            | 36.8                  | 8100                           | 12.000 | 35.000              | 34.989  | 42.025  | 42.009  | 0.032  |       |
|             | K35x42x18   | 35                | 42                | 18                            | 27.5            | 42.6                  | 8100                           | 12.000 | 35.000              | 34.989  | 42.025  | 42.009  | 0.035  |       |

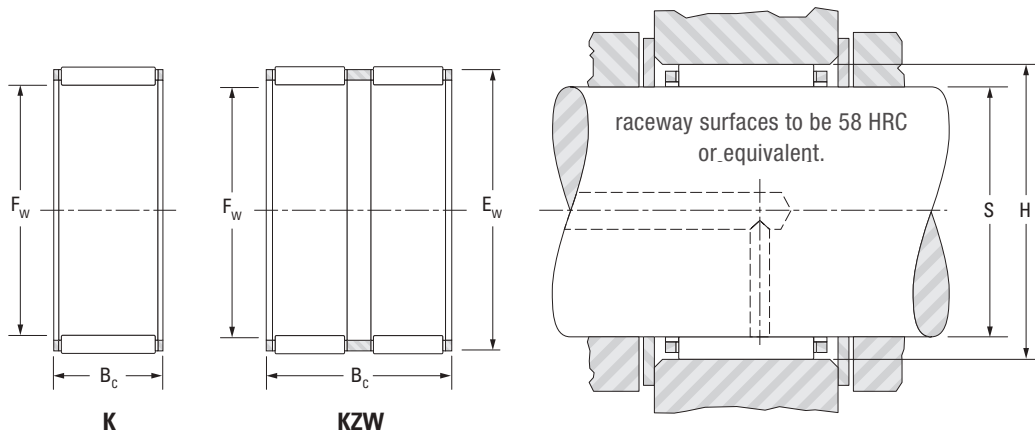
# 2.2



| Shaft mm | Designation  | F <sub>w</sub> mm | E <sub>w</sub> mm | B <sub>c</sub> -0.20 -0.55 mm | Load ratings kN  |                       | Speed rating min <sup>-1</sup> |        | Mounting dimensions |         |         |         | Wt. kg |
|----------|--------------|-------------------|-------------------|-------------------------------|--|-----------------------|--------------------------------|--------|---------------------|---------|---------|---------|--------|
|          |              |                   |                   |                               | Dynamic C  | Static C <sub>0</sub> | Grease                         | Oil    | S                   |         | H       |         |        |
|          |              |                   |                   |                               |  |                       |                                |        | Max. mm             | Min. mm | Max. mm | Min. mm |        |
|          |              |                   |                   |                               | Die Lauffläche muss eine Härte von 58 HRC oder gleichwertig aufweisen. |                       |                                |        |                     |         |         |         |        |
| 35       | K35x42x20H   | 35                | 42                | 20                            | 30.4   | 48.5                  | 8.100                          | 12.000 | 35.000              | 34.989  | 42.025  | 42.009  | 0.037  |
|          | K35x42x30FH  | 35                | 42                | 30                            | 40.5   | 70.0                  | 8.100                          | 12.000 | 35.000              | 34.989  | 42.025  | 42.009  | 0.061  |
|          | K35x45x20FH  | 35                | 45                | 20                            | 36.5   | 49.9                  | 8.400                          | 13.000 | 35.000              | 34.989  | 45.025  | 45.009  | 0.059  |
|          | K35x45x30F   | 35                | 45                | 30                            | 51.2   | 74.5                  | 8400                           | 13000  | 35.000              | 34.989  | 45.025  | 45.009  | 0.100  |
|          | K35x45x35H   | 35                | 45                | 35                            | 62.1   | 95.5                  | 8.400                          | 13.000 | 35.000              | 34.989  | 45.025  | 45.009  | 0.085  |
|          | K35x45x41    | 35                | 45                | 41                            | 70.8   | 113                   | 8.400                          | 13.000 | 35.000              | 34.989  | 45.025  | 45.009  | 0.120  |
|          | K35x45x49H   | 35                | 45                | 49                            | 82.5   | 138                   | 8.400                          | 13.000 | 35.000              | 34.989  | 45.025  | 45.009  | 0.143  |
|          | K35x45x49H2W | 35                | 45                | 49                            | 71.8   | 115                   | 8.400                          | 13.000 | 35.000              | 34.989  | 45.025  | 45.009  | 0.143  |
| 36       | K35x50x40F   | 35                | 50                | 40                            | 79.7   | 102                   | 8.700                          | 13.000 | 35.000              | 34.989  | 50.025  | 50.009  | 0.200  |
|          | K36x40x29TN  | 36                | 40                | 29                            | 21.2   | 45.2                  | 7.600                          | 12.000 | 36.000              | 35.989  | 40.025  | 40.009  | 0.029  |
| 37       | K36x42x16    | 36                | 42                | 16                            | 22.8   | 37.7                  | 7.800                          | 12.000 | 36.000              | 35.989  | 42.025  | 42.009  | 0.027  |
|          | K37x42x13H   | 37                | 42                | 13                            | 16.9   | 29.4                  | 7.500                          | 11.000 | 37.000              | 36.989  | 42.025  | 42.009  | 0.017  |
|          | K37x42x17H   | 37                | 42                | 17                            | 21.9   | 41.0                  | 7.500                          | 11.000 | 37.000              | 36.989  | 42.025  | 42.009  | 0.025  |
|          | K37x42x27F   | 37                | 42                | 27                            | 32.1   | 66.9                  | 7.500                          | 11.000 | 37.000              | 36.989  | 42.025  | 42.009  | 0.039  |
| 38       | K37x44x19H   | 37                | 44                | 19                            | 29.7   | 48.0                  | 7.600                          | 12.000 | 37.000              | 36.989  | 44.025  | 44.009  | 0.039  |
|          | K38x41x9TN   | 38                | 41                | 9                             | 5.93   | 11.0                  | 7.100                          | 11.000 | 38.000              | 37.989  | 41.025  | 41.009  | 0.004  |
|          | K38x43x17H   | 38                | 43                | 17                            | 21.8   | 41.0                  | 7.300                          | 11.000 | 38.000              | 37.989  | 43.025  | 43.009  | 0.032  |
|          | K38x43x27    | 38                | 43                | 27                            | 31.9   | 67.0                  | 7.300                          | 11.000 | 38.000              | 37.989  | 43.025  | 43.009  | 0.041  |
|          | K38x46x20H   | 38                | 46                | 19.8                          | 33.3   | 51.0                  | 7.500                          | 12.000 | 38.000              | 37.989  | 46.025  | 46.009  | 0.055  |
|          | K38x46x32H   | 38                | 46                | 32                            | 55.2   | 98.1                  | 7.500                          | 12.000 | 38.000              | 37.989  | 46.025  | 46.009  | 0.090  |
|          | K38x50x25    | 38                | 50                | 25                            | 53.0   | 70.8                  | 7.800                          | 12.000 | 38.000              | 37.989  | 50.025  | 50.009  | 0.100  |
|          | K38x50x33H   | 38                | 50                | 33                            | 68.3   | 98.2                  | 7.800                          | 12.000 | 38.000              | 37.989  | 50.025  | 50.009  | 0.126  |
| 40       | K38x50x40FH  | 38                | 50                | 40                            | 76.2   | 113                   | 7.800                          | 12.000 | 38.000              | 37.989  | 50.025  | 50.009  | 0.170  |
|          | K40x45x13H   | 40                | 45                | 13                            | 17.6   | 31.7                  | 6.900                          | 11.000 | 40.000              | 39.989  | 45.025  | 45.009  | 0.022  |
|          | K40x45x18H   | 40                | 45                | 18                            | 25.1   | 50.4                  | 6.900                          | 11.000 | 40.000              | 39.989  | 45.025  | 45.009  | 0.031  |
|          | K40x45x21H   | 40                | 45                | 21                            | 23.3   | 45.2                  | 6.900                          | 11.000 | 40.000              | 39.989  | 45.025  | 45.009  | 0.033  |
|          | K40x45x27H   | 40                | 45                | 27                            | 32.7   | 70.2                  | 6.900                          | 11.000 | 40.000              | 39.989  | 45.025  | 45.009  | 0.040  |
|          | K40x45x27TN  | 40                | 45                | 27                            | 33.3   | 72.1                  | 6.900                          | 11.000 | 40.000              | 39.989  | 45.025  | 45.009  | 0.030  |
|          | K40x45x29H   | 40                | 45                | 29                            | 34.7   | 75.9                  | 6.900                          | 11.000 | 40.000              | 39.989  | 45.025  | 45.009  | 0.050  |

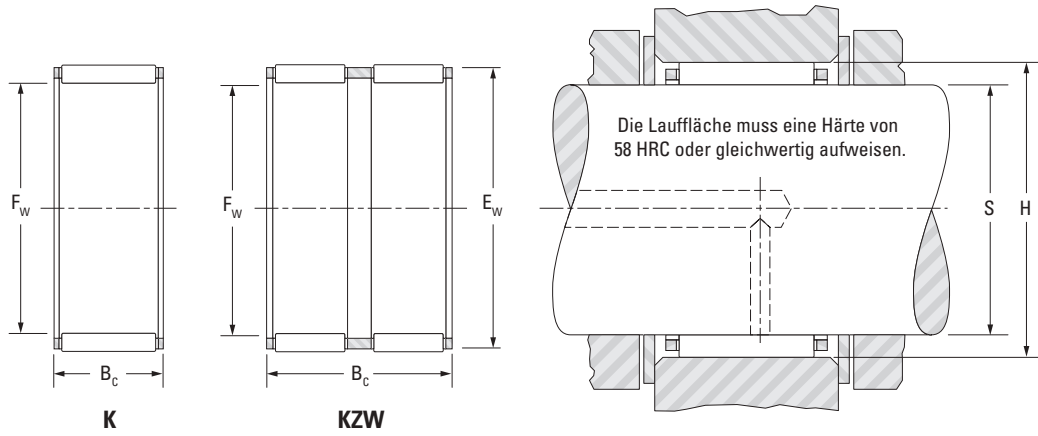
# RADIAL NEEDLE ROLLER AND CAGE ASSEMBLIES

## SINGLE-ROW, DOUBLE-ROW ASSEMBLIES



| Shaft mm   | Designation    | F <sub>w</sub> mm | E <sub>w</sub> mm | B <sub>c</sub> -0.20 -0.55 mm | Load ratings kN                              |                       | Speed rating min <sup>-1</sup> |        | Mounting dimensions |         |         |         | Wt. kg |
|------------|----------------|-------------------|-------------------|-------------------------------|--|-----------------------|--------------------------------|--------|---------------------|---------|---------|---------|--------|
|            |                |                   |                   |                               | Dynamic C                                    | Static C <sub>0</sub> | Grease                         | Oil    | S                   |         | H       |         |        |
|            |                |                   |                   |                               |  |                       |                                |        | Max. mm             | Min. mm | Max. mm | Min. mm |        |
|            |                |                   |                   |                               | raceway surfaces to be 58 HRC or equivalent. |                       |                                |        |                     |         |         |         |        |
| 40         | K40x46x17      | 40                | 46                | 17                            | 25.2   | 44.0                  | 7000                           | 11000  | 40.000              | 39.989  | 46.025  | 46.009  | 0.033  |
|            | K40x47x18      | 40                | 47                | 18                            | 28.0   | 45.6                  | 7000                           | 11000  | 40.000              | 39.989  | 47.025  | 47.009  | 0.041  |
|            | K40x47x20      | 40                | 47                | 20                            | 31.1   | 52.1                  | 7000                           | 11000  | 40.000              | 39.989  | 47.025  | 47.009  | 0.042  |
|            | K40x48x20FV1   | 40                | 4 B               | 20                            | 35.5   | 56.3                  | 7100                           | 11000  | 40.000              | 39.989  | 48.025  | 48.009  | 0.052  |
|            | K40x48x20H     | 40                | 48                | 20                            | 35.5   | 56.3                  | 7100                           | 11000  | 40.000              | 39.989  | 48.025  | 48.009  | 0.050  |
|            | K40x48x35H     | 40                | 48                | 35                            | 57.3   | 104                   | 7100                           | 11000  | 40.000              | 39.989  | 48.025  | 48.009  | 0.098  |
|            | K40x50x27H     | 40                | 50                | 27                            | 53.0   | 81.0                  | 7200                           | 11000  | 40.000              | 39.989  | 50.025  | 50.009  | 0.084  |
|            | K40x55x45H     | 40                | 55                | 45                            | 103  | 146                   | 7500                           | 12000  | 40.000              | 39.989  | 55.029  | 55.010  | 0.221  |
| K40x56x26H | 40             | 56                | 26                | 63.7                          | 75.7   | 7600                  | 12000                          | 40.000 | 39.989              | 56.029  | 56.010  | 0.0138  |        |
| 41         | K41x48x31HZW   | 41                | 48                | 31                            | 38.0   | 68.1                  | 6800                           | 11000  | 41.000              | 40.989  | 48.025  | 48.009  | 0.067  |
| 42         | K42x47x13H     | 42                | 47                | 13                            | 18.7   | 34.9                  | 6500                           | 10000  | 42.000              | 41.989  | 47.025  | 47.009  | 0.027  |
|            | K42x47x17H     | 42                | 47                | 17                            | 22.8   | 45.2                  | 6500                           | 10000  | 42.000              | 41.989  | 47.025  | 47.009  | 0.028  |
|            | K42x47x27H     | 42                | 47                | 27                            | 33.8   | 74.7                  | 6500                           | 10000  | 42.000              | 41.989  | 47.225  | 47.009  | 0.041  |
|            | K42x48x24F     | 42                | 48                | 24                            | 33.1   | 63.9                  | 6600                           | 10000  | 42.000              | 41.989  | 48.025  | 48.009  | 0.046  |
|            | K42x50x13H     | 42                | 50                | 13                            | 20.9   | 28.9                  | 6700                           | 10000  | 42.000              | 41.989  | 50.325  | 50.009  | 0.035  |
|            | K42x50x20H     | 42                | 50                | 20                            | 35.2   | 56.6                  | 6700                           | 10000  | 42.000              | 41.989  | 50.225  | 50.009  | 0.054  |
|            | K42x50x30H     | 42                | 50                | 30                            | 51.3   | 91.9                  | 6700                           | 10000  | 42.000              | 41.989  | 50.025  | 50.009  | 0.080  |
| 43         | K43x48x17FH    | 43                | 48                | 17                            | 23.0   | 45.8                  | 6400                           | 9800   | 43.000              | 42.989  | 48.025  | 48.009  | 0.036  |
|            | K43x48x27H     | 43                | 48                | 27                            | 34.8   | 78.0                  | 6400                           | 9800   | 43.000              | 42.989  | 48.025  | 48.009  | 0.050  |
| 44         | K44x50x22H     | 44                | 50                | 22                            | 31.6   | 60.6                  | 6400                           | 9900   | 44.000              | 43.989  | 50.025  | 50.009  | 0.046  |
|            | K44x50x30,5HZW | 44                | 50                | 30                            | 35.5   | 70.5                  | 6400                           | 9900   | 44.000              | 43.989  | 50.325  | 50.009  | 0.068  |
| 45         | K45x50x13H     | 45                | 50                | 13                            | 18.4   | 35.1                  | 6100                           | 9400   | 45.000              | 44.989  | 50.025  | 50.009  | 0.022  |
|            | K45x50x15H     | 45                | 50                | 15                            | 19.4   | 37.3                  | 6100                           | 9400   | 45.000              | 44.989  | 50.025  | 50.009  | 0.028  |
|            | K45x50x17H     | 45                | 50                | 17                            | 24.9   | 51.8                  | 6100                           | 9400   | 45.000              | 44.989  | 50.025  | 50.009  | 0.030  |
|            | K45x50x20F     | 45                | 50                | 20                            | 27.0   | 57.4                  | 6100                           | 9400   | 45.000              | 44.989  | 50.025  | 50.009  | 0.040  |
|            | K45x50x21CH    | 45                | 50                | 21                            | 24.6   | 50.4                  | 6100                           | 9400   | 45.000              | 44.989  | 50.025  | 50.009  | 0.036  |
|            | K45x50x27FH    | 45                | 50                | 27                            | 34.2   | 77.4                  | 6100                           | 9400   | 45.000              | 44.989  | 50.025  | 50.009  | 0.043  |
|            | K45x50x27      | 45                | 50                | 27                            | 31.8   | 70.7                  | 6100                           | 9400   | 45.000              | 44.989  | 50.025  | 50.009  | 0.048  |
|            | K45x52x18H     | 45                | 52                | 18                            | 30.1   | 52.0                  | 6200                           | 9500   | 45.000              | 44.989  | 52.029  | 52.010  | 0.045  |

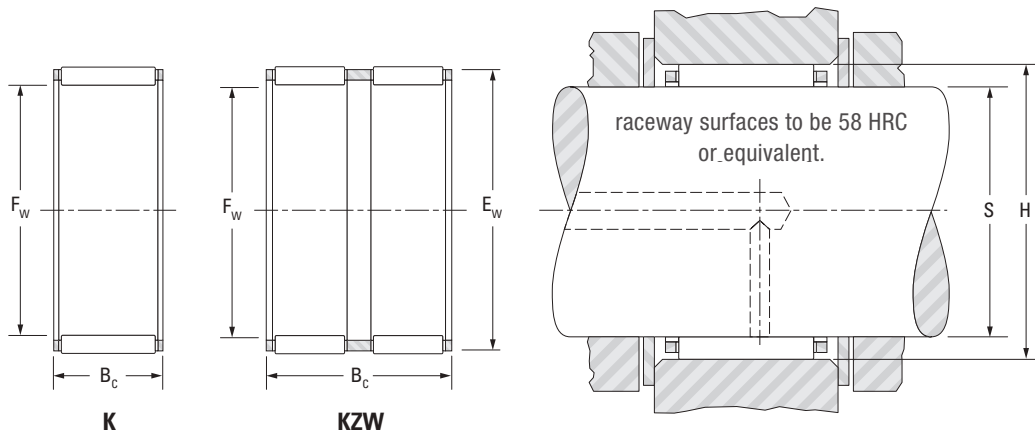
# 2.2



| Shaft mm   | Designation  | F <sub>w</sub> mm | E <sub>w</sub> mm | B <sub>c</sub> -0.20 -0.55 mm | Load ratings kN |                       | Speed rating min <sup>-1</sup> |        | S                   |         | H       |         | Wt. kg |
|------------|--------------|-------------------|-------------------|-------------------------------|-----------------|-----------------------|--------------------------------|--------|---------------------|---------|---------|---------|--------|
|            |              |                   |                   |                               | Dynamic C       | Static C <sub>0</sub> | Grease                         | Oil    | Mounting dimensions |         |         |         |        |
|            |              |                   |                   |                               |                 |                       |                                |        | Max. mm             | Min. mm | Max. mm | Min. mm |        |
|            |              |                   |                   |                               |                 |                       |                                |        |                     |         |         |         |        |
| 45         | K45x52x21F   | 45                | 52                | 21                            | 35.0            | 63.2                  | 6200                           | 9500   | 45.000              | 44.989  | 52.029  | 52.010  | 0.055  |
|            | K45x53x20H   | 45                | 53                | 20                            | 36.0            | 59.5                  | 6200                           | 9600   | 45.000              | 44.989  | 53.029  | 53.010  | 0.054  |
|            | K45x53x25H   | 45                | 53                | 24.8                          | 45.9            | 81.5                  | 6200                           | 9600   | 45.000              | 44.989  | 53.029  | 53.010  | 0.072  |
|            | K45x53x25F   | 45                | 53                | 25                            | 42.5            | 73.7                  | 6200                           | 9600   | 45.000              | 44.989  | 53.029  | 53.010  | 0.075  |
|            | K45x53x28H   | 45                | 53                | 28                            | 49.3            | 89.2                  | 6200                           | 9600   | 45.000              | 44.989  | 53.029  | 53.010  | 0.078  |
|            | K45x55x20H   | 45                | 55                | 20                            | 42.0            | 62.2                  | 6400                           | 9800   | 45.000              | 44.989  | 55.029  | 55.010  | 0.074  |
|            | K45x59x18H   | 45                | 59                | 18                            | 47.8            | 58.9                  | 6600                           | 10000  | 45.000              | 44.989  | 59.029  | 59.010  | 0.107  |
|            | K45x59x18TN  | 45                | 59                | 18                            | 45.7            | 55.4                  | 6600                           | 10000  | 45.000              | 44.989  | 59.029  | 59.010  | 0.097  |
|            | K45x59x36H   | 45                | 59                | 36                            | 82.4            | 118                   | 6600                           | 10000  | 45.000              | 44.989  | 59.029  | 59.010  | 0.181  |
|            | K45x60x30H   | 45                | 60                | 30                            | 75.5            | 101                   | 6600                           | 10000  | 45.000              | 44.989  | 60.029  | 60.010  | 0.171  |
| K45x60x45H | 45           | 60                | 45                | 108                           | 160             | 6600                  | 10000                          | 45.000 | 44.989              | 60.029  | 60.010  | 0.280   |        |
| 46         | K46x53x36HZW | 46                | 53                | 36                            | 48.6            | 96.7                  | 6100                           | 9300   | 46.000              | 45.989  | 53.029  | 53.010  | 0.100  |
| 47         | K47x52x15FH  | 47                | 52                | 15                            | 20.1            | 39.8                  | 5800                           | 8900   | 47.000              | 46.989  | 52.029  | 52.010  | 0.030  |
|            | K47x52x17H   | 47                | 52                | 17                            | 24.2            | 50.4                  | 5800                           | 8900   | 47.000              | 46.989  | 52.029  | 52.010  | 0.032  |
|            | K47x52x27H   | 47                | 52                | 27                            | 36.6            | 85.9                  | 5800                           | 8900   | 47.000              | 46.989  | 52.029  | 52.010  | 0.045  |
|            | K47x55x28FV1 | 47                | 55                | 28                            | 48.9            | 89.5                  | 6000                           | 9200   | 47.000              | 46.989  | 55.029  | 55.010  | 0.092  |
| 48         | K48x53x17H   | 48                | 53                | 17                            | 25.7            | 54.9                  | 5700                           | 8700   | 48.000              | 47.989  | 53.029  | 53.010  | 0.032  |
|            | K48x54x19H   | 48                | 54                | 19                            | 30.9            | 61.2                  | 5700                           | 8800   | 48.000              | 47.989  | 54.029  | 54.010  | 0.042  |
| 49         | K49x55x32HZW | 49                | 55                | 32                            | 40.2            | 86.4                  | 5600                           | 8600   | 49.000              | 48.989  | 55.029  | 55.010  | 0.080  |
|            | K49x65x38H   | 49                | 65                | 38                            | 100             | 142                   | 6100                           | 9300   | 49.000              | 48.989  | 65.029  | 65.010  | 0.244  |
| 50         | K50x55x17H   | 50                | 55                | 17                            | 25.5            | 55.0                  | 5400                           | 8400   | 50.000              | 49.989  | 55.029  | 55.010  | 0.032  |
|            | K50x55x20H   | 50                | 55                | 20                            | 30.2            | 68.5                  | 5400                           | 8400   | 50.000              | 49.989  | 55.029  | 55.010  | 0.038  |
|            | K50x55x30    | 50                | 55                | 30                            | 38.2            | 92.4                  | 5400                           | 8400   | 50.000              | 49.989  | 55.029  | 55.010  | 0.057  |
|            | K50x55x30FV1 | 50                | 55                | 30                            | 38.2            | 92.4                  | 5400                           | 8400   | 50.000              | 49.989  | 55.029  | 55.010  | 0.057  |
|            | K50x56x23    | 50                | 56                | 23                            | 35.5            | 74.1                  | 5500                           | 8500   | 50.000              | 49.989  | 56.029  | 56.010  | 0.051  |
|            | K50x57x18FH  | 50                | 57                | 18                            | 31.3            | 56.4                  | 5500                           | 8500   | 50.000              | 49.989  | 57.029  | 57.010  | 0.050  |
|            | K50x58x20H   | 50                | 58                | 20                            | 38.8            | 67.8                  | 5600                           | 8600   | 50.000              | 49.989  | 58.029  | 58.010  | 0.065  |
|            | K50x58x25H   | 50                | 58                | 25                            | 46.5            | 85.6                  | 5600                           | 8600   | 50.000              | 49.989  | 58.029  | 58.010  | 0.081  |

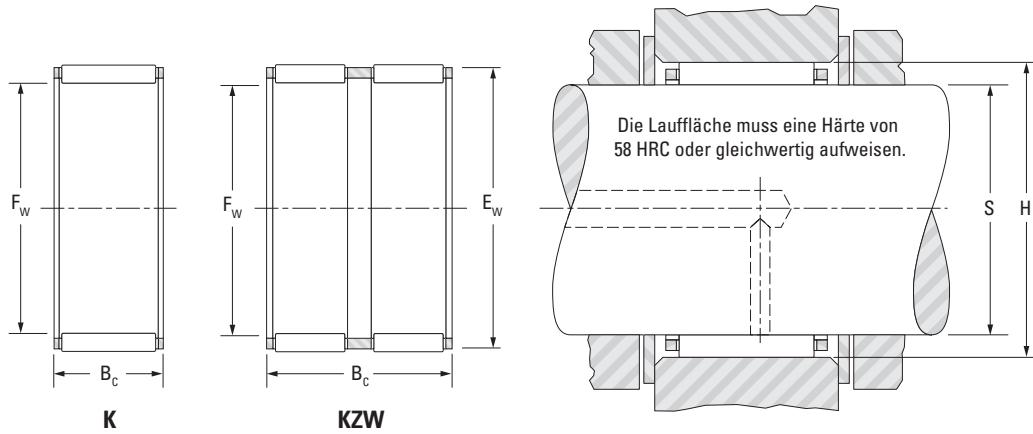
# RADIAL NEEDLE ROLLER AND CAGE ASSEMBLIES

## SINGLE-ROW, DOUBLE-ROW ASSEMBLIES



| Shaft mm    | Designation | F <sub>w</sub> mm | E <sub>w</sub> mm | B <sub>c</sub> -0.20 -0.55 mm | Load ratings kN |                       | Speed rating min <sup>-1</sup> |        | S                   |         | H       |         | Wt. kg |
|-------------|-------------|-------------------|-------------------|-------------------------------|-----------------|-----------------------|--------------------------------|--------|---------------------|---------|---------|---------|--------|
|             |             |                   |                   |                               | Dynamic C       | Static C <sub>0</sub> | Grease                         | Oil    | Mounting dimensions |         |         |         |        |
|             |             |                   |                   |                               |                 |                       |                                |        | Max. mm             | Min. mm | Max. mm | Min. mm |        |
|             |             |                   |                   |                               |                 |                       |                                |        |                     |         |         |         |        |
| 50          | K50x58x35H  | 50                | 58                | 35                            | 64.9            | 131                   | 5600                           | 8600   | 50.000              | 49.989  | 58.029  | 58.010  | 0.105  |
|             | K50x62x30H  | 50                | 62                | 30                            | 64.6            | 98.1                  | 5800                           | 8900   | 50.000              | 49.989  | 62.029  | 62.010  | 0.136  |
|             | K50x55x30   | 50                | 55                | 30                            | 38.2            | 92.4                  | 5400                           | 8400   | 50.000              | 49.989  | 55.029  | 55.010  | 0.057  |
|             | K50x66x30H  | 50                | 66                | 30                            | 80.9            | 109                   | 5900                           | 9100   | 50.000              | 49.989  | 66.029  | 66.010  | 0.192  |
|             | K50x70x32H  | 50                | 70                | 32                            | 103             | 129                   | 6100                           | 9300   | 50.000              | 49.989  | 70.029  | 70.010  | 0.224  |
| 52          | K52x57x12   | 52                | 57                | 12                            | 18.4            | 36.7                  | 5200                           | 8000   | 52.000              | 51.987  | 57.029  | 57.010  | 0.022  |
|             | K52x57x17H  | 52                | 57                | 17                            | 21.4            | 44.3                  | 5200                           | 8000   | 52.000              | 51.987  | 57.029  | 57.010  | 0.035  |
|             | K52x60x24   | 52                | 60                | 24                            | 47.1            | 88.3                  | 5400                           | 8200   | 52.000              | 51.987  | 60.029  | 60.010  | 0.078  |
| 55          | K55x60x17   | 55                | 60                | 17                            | 26.0            | 58.3                  | 4900                           | 7600   | 55.000              | 54.987  | 60.029  | 60.010  | 0.037  |
|             | K55x60x20H  | 55                | 60                | 20                            | 30.7            | 72.4                  | 4900                           | 7600   | 55.000              | 54.987  | 60.029  | 60.010  | 0.042  |
|             | K55x60x27H  | 55                | 60                | 27                            | 40.1            | 102                   | 4900                           | 7600   | 55.000              | 54.987  | 60.029  | 60.010  | 0.055  |
|             | K55x60x30FH | 55                | 60                | 30                            | 40.6            | 103                   | 4900                           | 7600   | 55.000              | 54.987  | 60.029  | 60.010  | 0.068  |
|             | K55x61x26H  | 55                | 61                | 26                            | 44.3            | 102                   | 5000                           | 7600   | 55.000              | 54.987  | 61.029  | 61.010  | 0.063  |
|             | K55x62x18H  | 55                | 62                | 18                            | 33.2            | 62.8                  | 5000                           | 7700   | 55.000              | 54.987  | 62.029  | 62.010  | 0.055  |
|             | K55x63x15F  | 55                | 63                | 15                            | 30.5            | 51.5                  | 5000                           | 7800   | 55.000              | 54.987  | 63.029  | 63.010  | 0.054  |
|             | K55x63x20   | 55                | 63                | 20                            | 40.3            | 73.5                  | 5000                           | 7800   | 55.000              | 54.987  | 63.029  | 63.010  | 0.072  |
|             | K55x63x25   | 55                | 63                | 25                            | 49.8            | 96.5                  | 5000                           | 7800   | 55.000              | 54.987  | 63.029  | 63.010  | 0.080  |
|             | K55x63x32   | 55                | 63                | 32                            | 62.3            | 129                   | 5000                           | 7800   | 55.000              | 54.987  | 63.029  | 63.010  | 0.108  |
| 58          | K58x63x17F  | 58                | 63                | 17                            | 27.0            | 62.6                  | 4700                           | 7200   | 58.000              | 57.987  | 63.029  | 63.010  | 0.037  |
|             | K58x64x19H  | 58                | 64                | 19                            | 32.9            | 70.6                  | 4700                           | 7200   | 58.000              | 57.987  | 64.029  | 64.010  | 0.037  |
|             | K58x65x18H  | 58                | 65                | 18                            | 34.3            | 67.1                  | 4700                           | 7300   | 58.000              | 57.987  | 65.029  | 65.010  | 0.058  |
| 60          | K60x65x20H  | 60                | 65                | 20                            | 31.9            | 78.1                  | 4500                           | 6900   | 60.000              | 59.987  | 65.029  | 65.010  | 0.046  |
|             | K60x65x27FH | 60                | 65                | 26.8                          | 39.5            | 103                   | 4500                           | 6900   | 60.000              | 59.987  | 65.029  | 65.010  | 0.059  |
|             | K60x65x30FH | 60                | 65                | 29.8                          | 42.9            | 114                   | 4500                           | 6900   | 60.000              | 59.987  | 65.029  | 65.010  | 0.085  |
|             | K60x65x30   | 60                | 65                | 30                            | 42.9            | 114                   | 4500                           | 6900   | 60.000              | 59.987  | 65.029  | 65.010  | 0.070  |
|             | K60x68x17F  | 60                | 68                | 17                            | 34.2            | 61.4                  | 4600                           | 7100   | 60.000              | 59.987  | 68.029  | 68.010  | 0.066  |
|             | K60x68x20H  | 60                | 68                | 20                            | 41.8            | 79.2                  | 4600                           | 7100   | 60.000              | 59.987  | 68.029  | 68.010  | 0.066  |
|             | K60x68x23H  | 60                | 68                | 23                            | 49.0            | 97.2                  | 4600                           | 7100   | 60.000              | 59.987  | 68.029  | 68.010  | 0.089  |
|             | K60x68x25   | 60                | 68                | 25                            | 51.6            | 104                   | 4600                           | 7100   | 60.000              | 59.987  | 68.029  | 68.010  | 0.091  |
| K60x68x30ZW | 60          | 68                | 30                | 46.4                          | 90.1            | 4600                  | 7100                           | 60.000 | 59.987              | 68.029  | 68.010  | 0.119   |        |

# 2.2

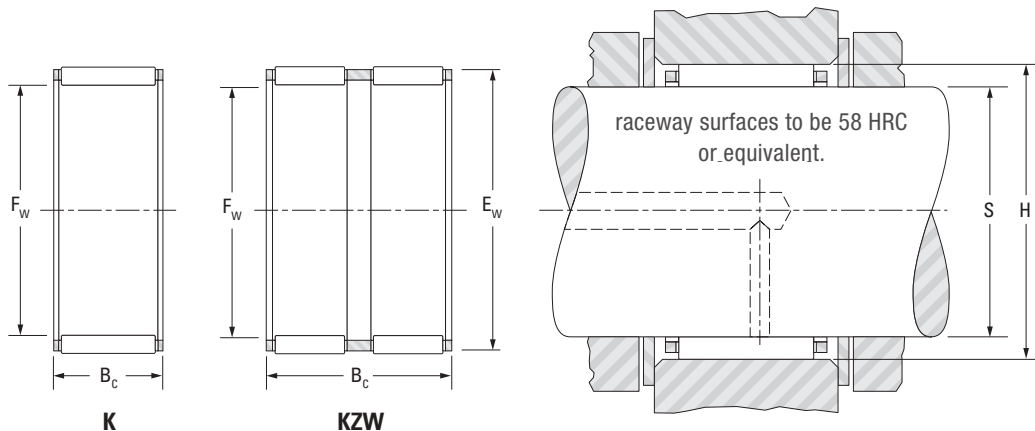


| Shaft mm | Designation  | F <sub>w</sub> mm | E <sub>w</sub> mm | B <sub>c</sub> -0.20 -0.55 mm | Load ratings kN |                       | Speed rating min <sup>-1</sup> |      | S                   |         | H       |         | Wt. kg |
|----------|--------------|-------------------|-------------------|-------------------------------|-----------------|-----------------------|--------------------------------|------|---------------------|---------|---------|---------|--------|
|          |              |                   |                   |                               | Dynamic C       | Static C <sub>0</sub> | Grease                         | Oil  | Mounting dimensions |         |         |         |        |
|          |              |                   |                   |                               |                 |                       |                                |      | Max. mm             | Min. mm | Max. mm | Min. mm |        |
|          |              |                   |                   |                               | 63              | K63x71 x20            | 63                             | 71   | 20                  | 41.4    | 79.4    | 4400    |        |
| 64       | K64x70x16    | 64                | 70                | 16                            | 26.4            | 55.1                  | 4200                           | 6500 | 64.000              | 63.987  | 70.029  | 70.010  | 0.049  |
| 65       | K65x70x20CH  | 65                | 70                | 20                            | 28.6            | 69.2                  | 4100                           | 6400 | 65.000              | 64.987  | 70.029  | 70.010  | 0.050  |
|          | K65x70x30    | 65                | 70                | 30                            | 44.4            | 123                   | 4100                           | 6400 | 65.000              | 64.987  | 70.029  | 70.010  | 0.075  |
|          | K65x73x23H   | 65                | 73                | 23                            | 48.2            | 97.7                  | 4200                           | 6500 | 65.000              | 64.987  | 73.029  | 73.010  | 0.091  |
|          | K65x73x30H   | 65                | 73                | 30                            | 60.1            | 129                   | 4200                           | 6500 | 65.000              | 64.987  | 73.029  | 73.010  | 0.116  |
| 68       | K68x74x20FH  | 68                | 74                | 20                            | 37.5            | 88.1                  | 4000                           | 6100 | 68.000              | 67.987  | 74.029  | 74.010  | 0.062  |
|          | K68x74x28CH  | 68                | 74                | 28                            | 44.8            | 110                   | 4000                           | 6100 | 68.000              | 67.987  | 74.029  | 74.010  | 0.082  |
|          | K68x4x30H    | 68                | 74                | 30                            | 47.6            | 119                   | 4000                           | 6100 | 68.000              | 67.987  | 74.029  | 74.010  | 0.098  |
|          | K68x74x35HZW | 68                | 74                | 35                            | 45.1            | 111                   | 4000                           | 6100 | 68.000              | 67.987  | 74.029  | 74.010  | 0.120  |
|          | K68x76x20    | 68                | 76                | 20                            | 43.8            | 87.8                  | 4000                           | 6200 | 68.000              | 67.987  | 76.029  | 76.010  | 0.086  |
|          | K68x82x38,5H | 68                | 82                | 38.5                          | 117             | 209                   | 4200                           | 6400 | 68.000              | 67.987  | 82.034  | 82.012  | 0.320  |
| 70       | K70x76x20    | 70                | 76                | 20                            | 36.1            | 84.7                  | 3900                           | 5900 | 70.000              | 69.987  | 76.029  | 76.010  | 0.065  |
|          | K70x76x30    | 70                | 76                | 30                            | 51.6            | 134.0                 | 3900                           | 5900 | 70.000              | 69.987  | 76.029  | 76.010  | 0.097  |
|          | K70x78x20H   | 70                | 78                | 20                            | 43.6            | 87.9                  | 3900                           | 6000 | 70.000              | 69.987  | 78.029  | 78.010  | 0.090  |
|          | K70x78x23F   | 70                | 78                | 23                            | 49.8            | 104.0                 | 3900                           | 6000 | 70.000              | 69.987  | 78.029  | 78.010  | 0.115  |
|          | K70x78x25F   | 70                | 78                | 24.8                          | 49.8            | 104.0                 | 3900                           | 6000 | 70.000              | 69.987  | 78.029  | 78.010  | 0.115  |
|          | K70x78x30H   | 70                | 78                | 30                            | 62.2            | 139.0                 | 3900                           | 6000 | 70.000              | 69.987  | 78.029  | 78.010  | 0.140  |
|          | K70x78x46ZW  | 70                | 78                | 46                            | 78.4            | 187.0                 | 3900                           | 6000 | 70.000              | 69.987  | 78.029  | 78.010  | 0.188  |
|          | K70x85x40F   | 70                | 85                | 40                            | 118             | 203                   | 4100                           | 6300 | 70.000              | 69.987  | 85.034  | 85.012  | 0.338  |
| 72       | K72x80x20    | 72                | 80                | 20                            | 44.4            | 90.7                  | 3800                           | 5800 | 72.000              | 71.987  | 80.029  | 80.010  | 0.084  |
| 73       | K73x79x20    | 73                | 79                | 20                            | 37.0            | 88.7                  | 3700                           | 5700 | 73.000              | 72.987  | 79.029  | 79.010  | 0.068  |
| 75       | K75x81x20F   | 75                | 81                | 20                            | 37.4            | 90.7                  | 3600                           | 5500 | 75.000              | 74.987  | 81.034  | 81.012  | 0.075  |
|          | K75x83x23    | 75                | 83                | 23                            | 52.5            | 114.0                 | 3600                           | 5600 | 75.000              | 74.987  | 83.034  | 83.012  | 0.104  |
|          | K75x83x30    | 75                | 83                | 30                            | 60.9            | 138                   | 3600                           | 5600 | 75.000              | 74.987  | 83.034  | 83.012  | 0.141  |
|          | K75x83x30FH  | 75                | 83                | 30                            | 60.9            | 138                   | 3600                           | 5600 | 75.000              | 74.987  | 83.034  | 83.012  | 0.141  |
| 80       | K80x86x20H   | 80                | 86                | 20                            | 38.6            | 96.7                  | 3400                           | 5200 | 80.000              | 79.987  | 86.034  | 86.012  | 0.072  |
|          | K80x88x25FV1 | 80                | 88                | 25                            | 54.0            | 121                   | 3400                           | 5200 | 80.000              | 79.987  | 88.034  | 88.012  | 0.134  |
|          | K80x88x30    | 80                | 88                | 30                            | 67.5            | 161                   | 3400                           | 5200 | 80.000              | 79.987  | 88.034  | 88.012  | 0.153  |

# 2.2

## RADIAL NEEDLE ROLLER AND CAGE ASSEMBLIES

### SINGLE-ROW, DOUBLE-ROW ASSEMBLIES



| Shaft mm | Designation  | F <sub>w</sub> mm | E <sub>w</sub> mm | B <sub>c</sub> -0.20 -0.55 mm | Load ratings kN |        | Speed rating min <sup>-1</sup> |      | S                   |                | H       |         | Wt. kg |
|----------|--------------|-------------------|-------------------|-------------------------------|-----------------|--------|--------------------------------|------|---------------------|----------------|---------|---------|--------|
|          |              |                   |                   |                               | Dynamic         | Static | Grease                         | Oil  | Mounting dimensions |                |         |         |        |
|          |              |                   |                   |                               |                 |        |                                |      | C                   | C <sub>0</sub> | Max. mm | Min. mm |        |
|          |              |                   |                   |                               |                 |        |                                |      |                     |                |         |         |        |
| 85       | K85x92x20H   | 85                | 92                | 20                            | 39.9            | 91.7   | 3200                           | 4900 | 84.988              | 84.973         | 92.034  | 92.012  | 0.085  |
|          | K85x93x25F   | 85                | 93                | 25                            | 58.8            | 138    | 3200                           | 4900 | 84.988              | 84.973         | 93.034  | 93.012  | 0.000  |
|          | K85x93x30H   | 85                | 93                | 30                            | 31024"          | 3200   | 4900                           | 4900 | 84.988              | 84.973         | 93.034  | 93.012  | 0.166  |
| 90       | K90x97x20    | 90                | 97                | 20                            | 46.3            | 114    | 3000                           | 4600 | 89.988              | 89.973         | 97.034  | 97.012  | 0.095  |
|          | K90x98x25F   | 90                | 98                | 25                            | 54.8            | 128    | 3000                           | 4600 | 89.988              | 89.973         | 98.034  | 98.012  | 0.134  |
|          | K90x98x30    | 90                | 98                | 30                            | 63.6            | 155    | 3000                           | 4600 | 89.988              | 89.973         | 98.034  | 98.012  | 0.168  |
| 95       | K95x103x20   | 95                | 103               | 20                            | 49.3            | 114    | 2800                           | 4400 | 94.988              | 94.973         | 103.034 | 103.012 | 0.130  |
|          | K95x103x30F  | 95                | 103               | 30                            | 71.0            | 183    | 2800                           | 4400 | 94.988              | 94.973         | 103.034 | 103.012 | 0.180  |
| 100      | K100x108x30  | 100               | 108               | 30                            | 72.4            | 191    | 2700                           | 4200 | 99.988              | 99.973         | 108.034 | 108.012 | 0.210  |
| 110      | K101x118x24  | 110               | 118               | 24                            | 64.0            | 168    | 2400                           | 3800 | 109.988             | 109.973        | 118.034 | 108.012 | 0.165  |
|          | K110x118x30H | 110               | 118               | 30                            | 75.3            | 207    | 2400                           | 3800 | 109.988             | 109.973        | 118.034 | 108.012 | 0.200  |





# 3

## NEEDLE BUSHES

|         |  |
|---------|--|
| PAGE 46 | 3.1 TECHNICAL FEATURES                       |
| PAGE 51 | 3.2 NEEDLE BUSHES, FULL COMPLEMENT, RETAINED |
| PAGE 54 | 3.3 CAGED NEEDLE BUSHES                      |
| PAGE 58 | 3.4 CAGED NEEDLE BUSHES WITH SEAL            |
| PAGE 60 | 3.5 INTERNAL RINGS FOR NEEDLE BUSHES         |

# NEEDLE BUSHES

## TECHNICAL FEATURES



Needle bushes consist of a thin, heat treated outer ring formed from accurately controlled sheet steel encasing a set of needles. Bushes may have a full complement of needles retained in the outer ring by their ends or by grease; others have the needles retained in a cage which is prevented from moving laterally in the outer ring. These bearings which occupy very little radial space are particularly economical to use and possess a high load capacity, relative to their size. They should be selected in preference to other bearings when conditions of mounting and operation permit.

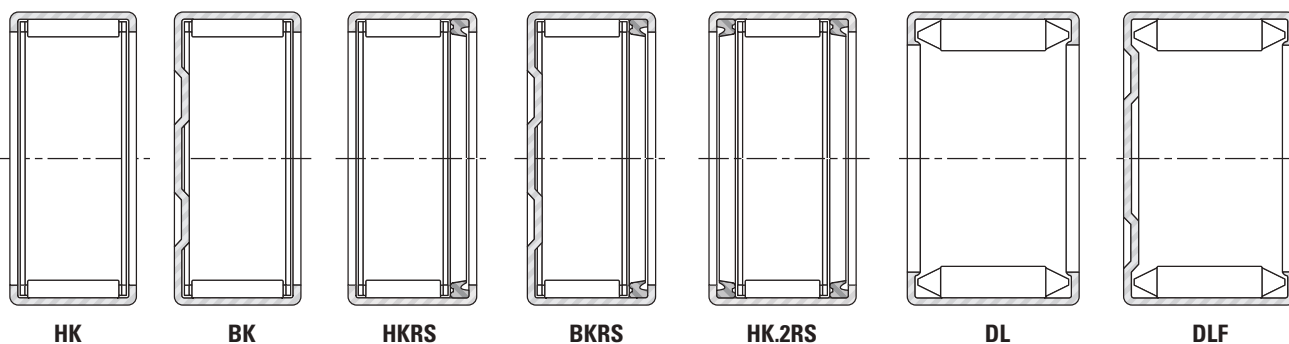
When needle bushes are used without an inner ring and the needles rotate on a shaft of suitable hardness, they occupy minimum space and therefore provide a very satisfactory solution.

Maximum load capacity is obtained with a shaft hardness under the needles of at least 58 HRC. A lower hardness is acceptable if loads and required life permit.

Hardened inner rings can be supplied for most Nadella needle bushes. They remove the necessity to harden the shaft and enable the bearings to accept full load capacity.

All needle bushes are normally supplied unlubricated (except where a special grease has been requested). However, they are coated with a thin film of grease to prevent corrosion.

### TYPES OF NEEDLE BUSHES



| Full complements needle bushes |            | Caged needle bushes |            |                   |                       |
|--------------------------------|------------|---------------------|------------|-------------------|-----------------------|
| Retained needles               |            | open                | closed end | open with seals   | closed end with seals |
| open                           | closed end |                     |            |                   |                       |
| DL                             | DLF        | HK                  | BK         | HK..RS<br>HK..2RS | BK..RS                |

| Suffixes |                   |
|----------|-------------------|
| AS1      | lubrication hole  |
| RS       | seal on one side  |
| .2RS     | seal on each side |

## CONSTRUCTION

The outer ring, in the form of a cup, is accurately drawn and no subsequent machining is performed. Needle bushes of series **HK** and **DL** have open ends. The **HK** series also are available with one seal, **HKRS**, and with two seals, **HK.2RS**. The stamped lip of a needle bush of series **HKRS** is at the seal end.

Needle bushes of series **BK** and **DLF** are closed at one end. They are used for shaft-end mounting. The open end is typically not sealed.

Needle bushes may be made available on request with a lubricating hole, indicated by suffix **AS1**.

The one-piece steel cage used in most cases of needle bushes is designed to provide rigidity and minimize wear. This cage design separates the needle roller guiding and retention functions.

### Caged needle bushes incorporating seals

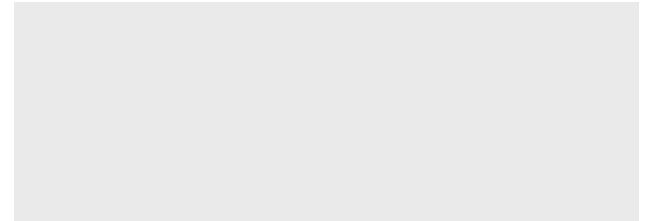
Caged needle bushes type **HK...RS** and **HK...2RS** have a seal incorporated on the inside of the face marked with the bearing part number. To this face should be applied the force necessary for installation or two seals version **2RS**. Thus, after fitting, the seal will normally be situated towards the outside of the bearing to prevent loss of lubricant and the entry of dirt, etc. (fig. 4).

If sealing is also necessary on the opposite side, a separate sealing ring type **DH** (see page 189), of the same internal and external diameters as the needle bush may be used or, if available, a needle bush **HK...2RS**. The bearing seal which is made of synthetic rubber permits operation up to 120°C (minimum running temperature -20°C).

The shaft to be introduced into the needle bush on assembly must be chamfered at its end or at its shoulder (fig. 4). When carrying out this operation the surface passing through the seal must be greased, in order to avoid damages.

## INNER RINGS

Inner rings for needle bushes are normally supplied without oil hole and have a cylindrical needle track. In those infrequent cases where lubrication is provided through the shaft, inner rings can be supplied on request with an oil hole (series **JR...JS1**).



### JR JR...JS1

Inner rings series **JRZ...JS1** are without installation chamfers, allowing for maximum possible raceway contact. See section "Inner rings" on pag. 68 for further details.

## LOAD RATING FACTORS

### Dynamic loads

Needle bushes can accommodate only radial loads.

$P$  = The maximum dynamic radial load that may be applied to a needle bush based on the dynamic load rating  $C$ , given in the bearing tables. This load should be  $\leq C/3$ .

### Static loads

$$f_0 = \frac{C_0}{P_0}$$

$f_0$  = static load safety factor

$C_0$  = basic static load rating (kN)

$P_0$  = maximum applied static load (kN)

To ensure satisfactory operation of needle bushes, under all types of conditio

# NEEDLE BUSHES

## TECHNICAL FEATURES

### INSTALLATION

Radial needle roller and cage assemblies use the housing bore as t For needle bushes one must accept that the thin outer ring is interference fitted to the housing bore and will correspond closely to the shape of the housing.

A housing with localised imperfections and thickness variations may cause deformation of the bush, which is detrimental to smooth operation. Best results are obtained with a geometrically uniform shape and even load distribution.

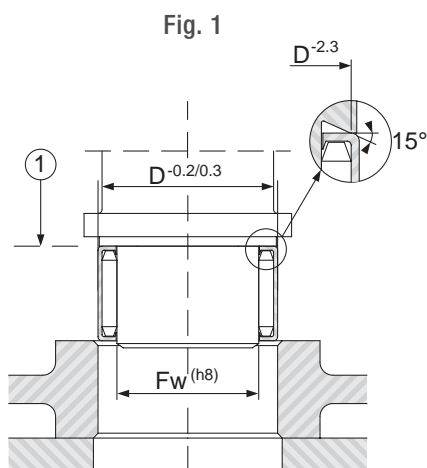
A mounting with interference of needle bushes in the housing obviates any lateral sealing device. The side of the bush not marked must remain moved away from any shoulder, seal, cover, spacer or edge of another bush. If for machining required there is a housing with shoulders, the latter must be sufficiently moved away from the bush to avoid deforming the edge during mounting.

The force required to insert the needle bush must be applied without shock to the side marked with the bearing part number.

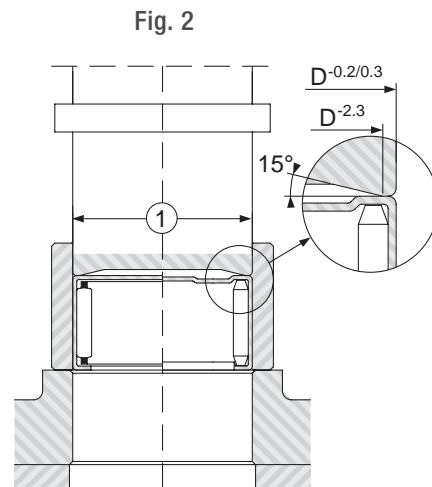
Thus it is advisable to use a small press fitted with a suitable mandrel to apply uniform force to the bush centred in the housing (fig. 1).

The axial movement of the mandrel should be limited by a shoulder coming against the face of the housing.

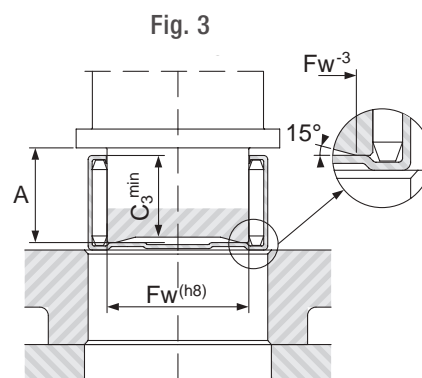
Bushes having one closed end should preferably have the open end presented to the housing bore (fig. 2). If this is not possible, the force may be applied to the inside face of the closed end in the case of bushes type DLF (fig. 3) (this must not be done in the case of bushes type BK).



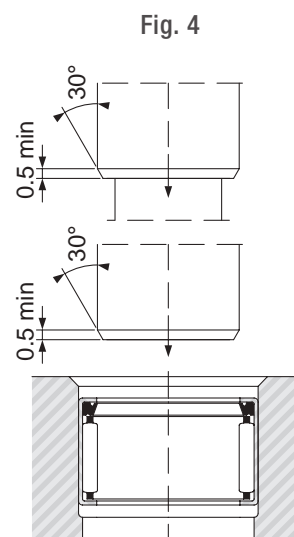
(1) Marked face



(1) Bore of ring  $D + 0.3$  mm



$$A \text{ min} = C3 \text{ min} + 1 \text{ mm}$$



## RADIAL PLAY

The fit of a bush in its housing determines to a large extent the dimension under the needles after fitting and consequently the radial play during operation.

The recommended shaft and housing tolerances give a radial play the limits of which are suitable for most normal applications. To obtain a closer clearance, it is possible to match the shaft diameters with the diameters under the needles of the bushes after the latter have been fitted into their housings.

The possible differences in the rigidity of housings and the variations of clamping force resulting from the tolerance build up do not permit one to establish a range of dimensions under the needles for every application.

The radial play limits should also take into account the tolerance of the shaft used directly as a raceway or the outer diameter of the inner ring after it has been fitted on to the shaft.

It is suggested that when inner rings are used with needle bushes, they should be mounted with a loose transition fit on the shaft using g6 (g5) shaft diameter tolerance.

The inner ring should be end-clamped against a shoulder. If a tight transition fit must be used [shaft diameter tolerance h6 (h5)] to keep the inner ring from rotating relative to the shaft, the inner ring outer diameter, as mounted, must not exceed the raceway diameter required by the needle bush for the particular application.

In case the outer diameter of the inner ring, when mounted on the shaft, exceeds the required raceway diameter for the matching needle bush, it should be ground to proper diameter while mounted on the shaft.

| Types of bush        | Operating conditions   | Shaft tolerance, needle bushes without inner ring (recommended internal radial play). | Shaft tolerance, needle bushes with inner ring (recommended internal radial play). | Housing tolerance (recommended internal radial play) |
|----------------------|--|---|--|--|
| HK, BK, HKRS, HK.2RS | One piece heavy section steel or cast iron housing                                 | h5 (h6)   | h6 (h5)  | N6 (N7)  |
| DL, DLF              | One piece heavy section steel or cast iron housing                                 | h5 (h6)   | h6 (h5)  | H6 (H7)  |
| HK, BK, HKRS, HK.2RS | Housing material of low rigidity (Non-ferrous metal (1) or thin casings in steel). | h5 (h6)   | h6 (h5)  | R6 (R7)  |
| DL, DLF              | Housing material of low rigidity (Non-ferrous metal (1) or thin casings in steel). | h5 (h6)   | h6 (h5)  | M6 (M7)  |
| HK, BK, HKRS, HK.2RS | Outer ring rotation (one piece heavy section steel or cast iron housing).          | f5 (f6)   | g6 (g5)  | R6 (R7)  |
| DL, DLF              | Outer ring rotation (one piece heavy section steel or cast iron housing).          | f5 (f6)   | g6 (g5)  | M6 (M7)  |
| HK, BK, HKRS, HK.2RS | Oscillating motion   | j5 (j6)   | h6 (h5)  | (2)  |
| DL, DLF              | Oscillating motion   | j5 (j6)   | h6 (h5)  | (2)  |

(1) If a housing of non-ferrous metal reaches temperatures considerably higher (or lower) than 20°C, account should be taken of the difference in expansion (or contraction) of the bush and suitable adjustments to the fits should be made. The cylindrical tolerance defined as the difference in radii of two coaxial cylinders (Standard ISO 1101) must normally be less than a quarter of the machining tolerance on the defined diameter. However, for precision applications or high speeds, it is recommended that the cylindrical tolerance is reduced to one eighth of the machining tolerance.

(2) The tolerance depends on the shape of the housing.

## NEEDLE BUSHES TECHNICAL FEATURES

### INSPECTION OF NEEDLE BUSHES

Although the bush is accurately drawn from strip steel, because of its fairly thin section, it may go out-of-round during heat treatment. When the bearing is pressed into a true round housing, or ring gage of correct size and wall thickness, it becomes round and is sized properly.

For this reason, it is incorrect to inspect an unmounted drawn cup bearing by measuring the outer diameter.

The correct method for inspecting the needle bush size is to:

1. Press the needle bush into a ring gage of proper size.
2. Plug the needle bush bore with the appropriate "GO" and "NO GO" gages, or measure it with a tapered arbor (lathe mandrel).

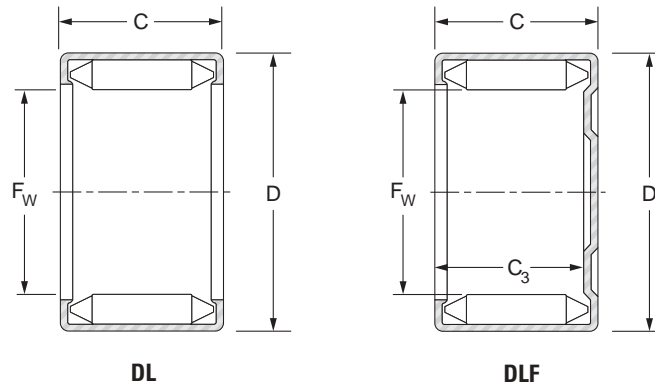
The "GO" gage size is the minimum needle roller complement bore diameter. The "NO GO" gage size is larger than the maximum needle roller complement bore diameter.

| FULL COMPLEMENT NEEDLE BUSHES<br>Type DL, DLF |            |  |        |
|---|------------|--|--------|
| Nominal bore diameter                         | Ring Gage* | Needle roller complement bore diameter |        |
|   |            | Max.                                   | Min.   |
| mm  | mm         | mm                                     | mm     |
| 5.000   | 9.000      | 5.036                                  | 5.009  |
| 6.000   | 12.000     | 6.034                                  | 6.009  |
| 8.000   | 14.000     | 8.034                                  | 8.009  |
| 9.000   | 14.000     | 9.034                                  | 9.009  |
| 10.000  | 16.000     | 10.034                                 | 10.009 |
| 12.000  | 18.000     | 12.035                                 | 12.009 |
| 13.000  | 19.000     | 13.035                                 | 13.009 |
| 14.000  | 23.000     | 14.035                                 | 14.009 |
| 15.000  | 24.000     | 15.035                                 | 15.009 |
| 16.000  | 26.000     | 16.035                                 | 16.009 |
| 17.000  | 23.000     | 17.035                                 | 17.009 |
| 18.000  | 24.000     | 18.035                                 | 18.009 |
| 20.000  | 26.000     | 20.035                                 | 20.009 |
| 22.000  | 28.000     | 22.035                                 | 22.009 |
| 25.000  | 33.000     | 25.041                                 | 25.015 |
| 28.000  | 36.000     | 28.041                                 | 28.015 |
| 30.000  | 38.000     | 30.041                                 | 30.015 |
| 35.000  | 33.000     | 35.041                                 | 35.015 |
| 40.000  | 48.000     | 40.041                                 | 40.015 |
| 44.000  | 52.000     | 44.041                                 | 44.015 |
| 45.000  | 52.000     | 45.041                                 | 45.015 |
| 47.000  | 55.000     | 47.041                                 | 47.015 |
| 50.000  | 58.000     | 50.041                                 | 50.015 |
| 55.000  | 63.000     | 55.041                                 | 55.015 |

| CAGED NEEDLE BUSHES<br>Type HK, BK, HK...RS, BK...RS, HK...2RS |            |  |        |
|--|------------|--|--------|
| Nominal bore diameter  | Ring Gage* | Needle roller complement bore diameter |        |
|  |            | Max.                                   | Min.   |
| mm   | mm         | mm                                     | mm     |
| 3.000  | 6.484      | 3.024                                  | 3.006  |
| 4.000  | 7.984      | 4.028                                  | 4.010  |
| 5.000  | 8.984      | 5.028                                  | 5.010  |
| 6.000  | 9.984      | 6.028                                  | 6.010  |
| 7.000  | 10.980     | 7.031                                  | 7.013  |
| 8.000  | 11.980     | 8.031                                  | 8.013  |
| 9.000  | 12.980     | 9.031                                  | 9.013  |
| 10.000   | 13.980     | 10.031                                 | 10.013 |
| 12.000   | 15.980     | 12.034                                 | 12.016 |
| 13.000   | 17.980     | 13.034                                 | 13.016 |
| 14.000   | 19.976     | 14.034                                 | 14.016 |
| 15.000   | 20.976     | 15.034                                 | 15.016 |
| 16.000   | 21.976     | 16.034                                 | 16.016 |
| 17.000   | 22.976     | 17.034                                 | 17.016 |
| 18.000   | 23.976     | 18.034                                 | 18.016 |
| 20.000   | 25.976     | 20.041                                 | 20.020 |
| 22.000   | 27.976     | 22.041                                 | 22.020 |
| 25.000   | 31.972     | 25.041                                 | 25.020 |
| 28.000   | 34.972     | 28.041                                 | 28.020 |
| 30.000   | 36.972     | 30.041                                 | 30.020 |
| 35.000   | 41.972     | 35.050                                 | 35.020 |
| 40.000   | 46.972     | 40.050                                 | 40.025 |
| 45.000   | 51.967     | 45.050                                 | 45.025 |
| 50.000   | 57.967     | 50.050                                 | 50.025 |
| 60.000   | 67.967     | 60.060                                 | 60.030 |

# 3.2

## NEEDLE BUSHES, FULL COMPLEMENT, RETAINED OPEN SERIES DL | CLOSED END SERIES DLF

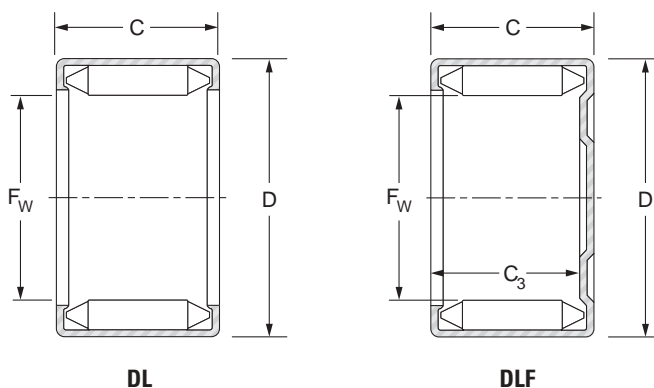


| Shaft mm | Designation | F <sub>w</sub> mm | D mm | C mm | C <sub>3</sub> min mm | Load Ratings kN |                | Speed Limit min <sup>-1</sup> |       | Weight. kg | Internal Ring |
|----------|-------------|-------------------|------|------|-----------------------|-----------------|----------------|-------------------------------|-------|------------|---------------|
|          |             |                   |      |      |                       | Dynamic         | Static         | Grease                        | Oil   |            |               |
|          |             |                   |      |      |                       | C               | C <sub>0</sub> |                               |       |            |               |
| 6        | DL 6 10     | 6                 | 12   | 10   | -                     | 2.90            | 3.80           | 33000                         | 50000 | 0.004      | -             |
|          | DLF 6 10    | 6                 | 12   | 10   | 7.7                   | 2.90            | 3.80           | 33000                         | 50000 | 0.004      | -             |
| 8        | DL 8 10     | 8                 | 14   | 10   | -                     | 4.50            | 6.50           | 24000                         | 37500 | 0.005      | -             |
|          | DLF 8 10    | 8                 | 14   | 10   | 7.7                   | 4.50            | 6.50           | 24000                         | 37500 | 0.006      | -             |
| 10       | DL 10 12    | 10                | 16   | 12   | -                     | 7.00            | 10.9           | 20000                         | 30000 | 0.008      | -             |
|          | DLF 10 12   | 10                | 16   | 12   | 9.7                   | 7.00            | 10.9           | 20000                         | 30000 | 0.009      | -             |
| 12       | DL 12 10    | 12                | 18   | 10   | -                     | 6.00            | 9.7            | 16000                         | 25000 | 0.008      | JR8x12x10.5   |
|          | DLF 12 10   | 12                | 18   | 10   | 7.7                   | 6.00            | 9.7            | 16000                         | 25000 | 0.008      | JR8x12x12.5   |
|          | DL 12 12    | 12                | 18   | 12   | -                     | 7.00            | 11.5           | 16000                         | 25000 | 0.009      | JR8x12x12.5   |
|          | DLF 12 12   | 12                | 18   | 12   | 9.7                   | 7.00            | 11.5           | 16000                         | 25000 | 0.010      | JR8x12x12.5   |
| 13       | DL 13 12    | 13                | 19   | 12   | -                     | 8.50            | 14.2           | 15000                         | 23000 | 0.010      | JR10x13x2.5   |
|          | DLF 13 12   | 13                | 19   | 12   | 9.7                   | 8.50            | 14.2           | 15000                         | 23000 | 0.011      | JR10x13x12.5  |
| 14       | DL 14 12    | 14                | 20   | 12   | -                     | 7.90            | 13.5           | 14000                         | 21500 | 0.011      | JR10x14x12.5  |
|          | DLF 14 12   | 14                | 20   | 12   | 9.7                   | 7.90            | 13.5           | 14000                         | 21500 | 0.012      | JR10x14x12.5  |
| 15       | DL 15 12    | 15                | 21   | 12   | -                     | 9.40            | 16.4           | 13000                         | 20000 | 0.011      | JR12x15x12.5  |
|          | DLF 15 12   | 15                | 21   | 12   | 9.7                   | 9.40            | 16.4           | 13000                         | 20000 | 0.012      | JR12x15x12.5  |
| 16       | DL 16 12    | 16                | 22   | 12   | -                     | 8.70            | 15.5           | 12000                         | 18500 | 0.012      | JR12x16x12.5  |
|          | DLF 16 12   | 16                | 22   | 12   | 9.7                   | 8.70            | 15.5           | 12000                         | 18500 | 0.013      | JR12x16x12.5  |
| 17       | DL 17 12    | 17                | 23   | 12   | -                     | 9.00            | 16.2           | 11000                         | 17500 | 0.013      | JR13x17x12.5  |
|          | DLF 17 12   | 17                | 23   | 12   | 9.7                   | 9.00            | 16.2           | 11000                         | 17500 | 0.014      | JR13x17x12.5  |
| 18       | DL 18 12    | 18                | 24   | 12   | -                     | 10.7            | 19.5           | 11000                         | 16500 | 0.014      | JR13x18x12.5  |
|          | DLF 18 12   | 18                | 24   | 12   | 9.7                   | 10.7            | 19.5           | 11000                         | 16500 | 0.016      | JR13x18x12.5  |
|          | DL 18 16    | 18                | 24   | 16   | -                     | 16.0            | 29.5           | 11000                         | 16500 | 0.019      | JR15x18x16.5  |
|          | DLF 18 16   | 18                | 24   | 16   | 13.7                  | 16.0            | 29.5           | 11000                         | 16500 | 0.021      | JR15x18x16.5  |



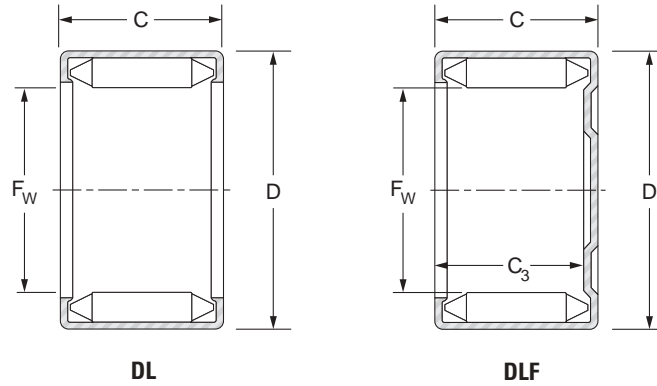
# NEEDLE BUSHES, FULL COMPLEMENT, RETAINED

## OPEN SERIES DL | CLOSED END SERIES DLF



| Shaft mm | Designation | F <sub>w</sub> mm | D mm | C mm | C <sub>3</sub> min. mm | Load Ratings kN |                | Speed Limit min <sup>-1</sup> |       | Weight. kg | Internal Ring |
|----------|-------------|-------------------|------|------|------------------------|-----------------|----------------|-------------------------------|-------|------------|---------------|
|          |             |                   |      |      |                        | Dynamic         | Static         |                               |       |            |               |
|          |             |                   |      |      |                        | C               | C <sub>0</sub> | Grease                        | Oil   |            |               |
| 20       | DL 20 12    | 20                | 26   | 12   | -                      | 10.2            | 19.5           | 10000                         | 15000 | 0.015      | JR15x20x12    |
|          | DLF 20 12   | 20                | 26   | 12   | 9.7                    | 10.2            | 19.5           | 10000                         | 15000 | 0.017      | JR15x20x12    |
|          | DL 20 16    | 20                | 26   | 16   | -                      | 16.0            | 30.5           | 10000                         | 15000 | 0.020      | JR17x20x16    |
|          | DLF 20 16   | 20                | 26   | 16   | 13.7                   | 16.0            | 30.5           | 10000                         | 15000 | 0.022      | JB17x20x16    |
| 22       | DL 22 16    | 22                | 28   | 16   | -                      | 17.0            | 33.0           | 8800                          | 13500 | 0.022      | JR17x22x16    |
|          | DLF 22 16   | 22                | 28   | 16   | 13.7                   | 17.0            | 33.0           | 8800                          | 13500 | 0.025      | JR17x22x16    |
| 25       | DL 25 16    | 25                | 33   | 16   | -                      | 16.0            | 32.5           | 7800                          | 12000 | 0.035      | JR20x25x17    |
|          | DLF 25 16   | 25                | 33   | 16   | 13.7                   | 16.0            | 32.5           | 7800                          | 12000 | 0.039      | JR20x25x17    |
|          | DL 25 20    | 25                | 33   | 20   | -                      | 22.8            | 46.0           | 7800                          | 12000 | 0.043      | JR20x25x20.5  |
|          | DLF 25 20   | 25                | 33   | 20   | 17.7                   | 22.8            | 46.0           | 7800                          | 12000 | 0.047      | JR20x25x20.5  |
| 28       | DL 28 20    | 28                | 36   | 20   | -                      | 24.5            | 52.0           | 7200                          | 11000 | 0.047      | JR22x28x20.5  |
|          | DLF 28 20   | 28                | 36   | 20   | 17.7                   | 24.5            | 52.0           | 7200                          | 11000 | 0.051      | JR22x28x20.5  |
| 30       | DL 30 16    | 30                | 38   | 16   | -                      | 21.7            | 46.5           | 6500                          | 10000 | 0.040      | JR25x30x17    |
|          | DLF 30 16   | 30                | 38   | 16   | 13.7                   | 21.7            | 46.5           | 6500                          | 10000 | 0.045      | JR25x30x17    |
|          | DL 30 20    | 30                | 38   | 20   | -                      | 26.0            | 56.0           | 6500                          | 10000 | 0.050      | JR25x30x20.5  |
|          | DLF 30 20   | 30                | 38   | 20   | 17.7                   | 26.0            | 56.0           | 6500                          | 10000 | 0.055      | JR25x30x20.5  |
|          | DL 30 25    | 30                | 38   | 25   | -                      | 35.5            | 76.0           | 6500                          | 10000 | 0.063      | JR25x30x26    |
|          | DLF 30 25   | 30                | 38   | 25   | 22.7                   | 35.5            | 76.0           | 6500                          | 10000 | 0.068      | JR25x30x26    |
| 35       | DL 35 16    | 35                | 43   | 16   | -                      | 24.0            | 54.0           | 5500                          | 8500  | 0.046      | JR30x35x17    |
|          | DLF 35 16   | 35                | 43   | 16   | 13.7                   | 24.0            | 54.0           | 5500                          | 8500  | 0.053      | JR30x35x17    |
|          | DL 35 20    | 35                | 43   | 20   | -                      | 29.0            | 65.0           | 5500                          | 8500  | 0.057      | JR30x35x20.5  |
|          | DLF 35 20   | 35                | 43   | 20   | 17.7                   | 29.0            | 65.0           | 5500                          | 8500  | 0.064      | JR30x35x20.5  |
| 40       | DL 40 16    | 40                | 48   | 16   | -                      | 26.5            | 62.0           | 4900                          | 7500  | 0.051      | JR35x40x17    |
|          | DLF 40 16   | 40                | 48   | 16   | 13.7                   | 26.5            | 62.0           | 4900                          | 7500  | 0.061      | JR35x40x17    |
|          | DL 40 20    | 40                | 48   | 20   | -                      | 36.0            | 84.0           | 4900                          | 7500  | 0.064      | JR35x40x20.5  |
|          | DLF 40 20   | 40                | 48   | 20   | 17.7                   | 36.0            | 84.0           | 4900                          | 7500  | 0.074      | JR35x40x20.5  |

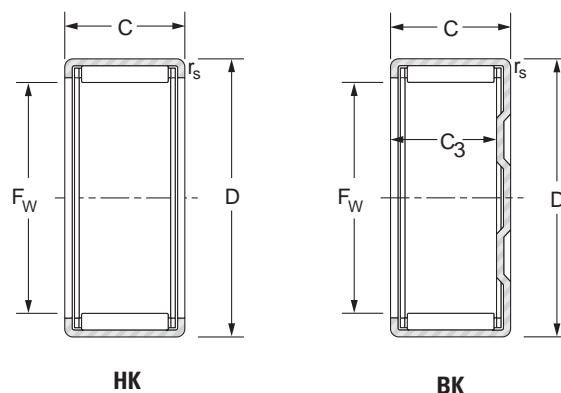
# 3.2



| Shaft mm | Designation | F <sub>w</sub> mm | D mm | C mm | C <sub>3 min</sub> mm | Load Ratings kN |                | Speed Limit min <sup>-1</sup> |      | Weight. kg | Internal Ring |
|----------|-------------|-------------------|------|------|-----------------------|-----------------|----------------|-------------------------------|------|------------|---------------|
|          |             |                   |      |      |                       | Dynamic         | Static         | Grease                        | Oil  |            |               |
|          |             |                   |      |      |                       | C               | C <sub>0</sub> |                               |      |            |               |
| 44       | DL 44 16    | 44                | 52   | 16   | -                     | 23.80           | 57.00          | 4400                          | 6800 | 0.056      | -             |
|          | DLF 44 16   | 44                | 52   | 16   | 13.7                  | 23.80           | 57.00          | 4400                          | 6800 | 0.066      | -             |
| 47       | DL47 16     | 47                | 55   | 16   | -                     | 25.00           | 61.00          | 4200                          | 6400 | 0.060      | -             |
|          | DLF 4716    | 47                | 55   | 16   | 13.7                  | 25.00           | 61.00          | 4200                          | 6400 | 0.071      | -             |
| 50       | DL 501 2    | 50                | 58   | 12   | -                     | 20.00           | 50.00          | 3900                          | 6000 | 0.047      | -             |
|          | DLF 5012    | 50                | 58   | 12   | 9.7                   | 20.00           | 50.00          | 3900                          | 6000 | 0.061      | -             |
|          | DL 50 18    | 50                | 58   | 18   | -                     | 36.50           | 92.00          | 3900                          | 6000 | 0.071      | -             |
|          | DLF 50 18   | 50                | 58   | 18   | 15.7                  | 36.50           | 92.00          | 3900                          | 6000 | 0.085      | -             |
|          | DL 50 20    | 50                | 58   | 20   | -                     | 37.00           | 93.00          | 3900                          | 6000 | 0.077      | JR45x50x20    |
|          | DLF 50 20   | 50                | 58   | 20   | 17.7                  | 37.00           | 93.00          | 3900                          | 6000 | 0.091      | JR45x50x20    |
| 55       | DL 55 20    | 55                | 63   | 20   | -                     | 39.5            | 102.0          | 3600                          | 5500 | 0.086      | JR50x55x20    |
|          | DLF 55 20   | 55                | 63   | 20   | 17.7                  | 39.5            | 102.0          | 3600                          | 5500 | 0.102      | JR50x55x20    |

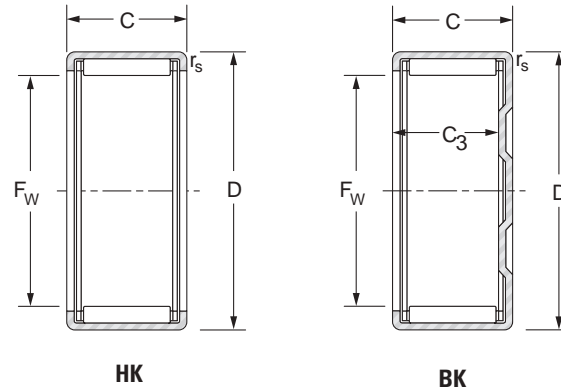
# CAGED NEEDLE BUSHES

## OPEN SERIES HK | CLOSED END SERIES BK



| Shaft mm | Designation | F <sub>w</sub> mm | D mm | C mm | C <sub>3</sub> min·mm | r <sub>s</sub> min·mm | Load ratings kN |                | Speed limit min <sup>-1</sup> |       | Weight. kg | Internal Ring |
|----------|-------------|-------------------|------|------|-----------------------|-----------------------|-----------------|----------------|-------------------------------|-------|------------|---------------|
|          |             |                   |      |      |                       |                       | Dynamic         | Static         | Grease                        | Oil   |            |               |
|          |             |                   |      |      |                       |                       | C               | C <sub>0</sub> |                               |       |            |               |
| 3        | BK0306      | 3                 | 6.5  | 6    | 5.2                   | 0.30                  | 1.20            | 0.78           | 30000                         | 46000 | 0.001      | -             |
|          | HK0306      | 3                 | 6.5  | 6    | -                     | 0.30                  | 1.60            | 1.14           | 30000                         | 46000 | 0.001      | -             |
| 4        | BK0408      | 4                 | 8    | 8    | 6.4                   | 0.40                  | 1.83            | 1.32           | 25000                         | 39000 | 0.002      | -             |
|          | HK0408      | 4                 | 8    | 8    | -                     | 0.40                  | 1.88            | 1.38           | 25000                         | 39000 | 0.002      | -             |
| 5        | BK0509      | 5                 | 9    | 9    | 7.4                   | 0.40                  | 2.52            | 2.07           | 23000                         | 36000 | 0.002      | -             |
|          | HK0509      | 5                 | 9    | 9    | -                     | 0.40                  | 2.52            | 2.07           | 23000                         | 36000 | 0.002      | -             |
| 6        | BK0608      | 6                 | 10   | 8    | 6.4                   | 0.40                  | 2.34            | 1.95           | 22000                         | 33000 | 0.002      | -             |
|          | HK0608      | 6                 | 10   | 8    | -                     | 0.40                  | 2.34            | 1.95           | 22000                         | 33000 | 0.002      | -             |
|          | BK0609      | 6                 | 10   | 9    | 7.4                   | 0.40                  | 3.14            | 2.85           | 22000                         | 33000 | 0.003      | -             |
|          | HK0609      | 6                 | 10   | 9    | -                     | 0.40                  | 3.14            | 2.85           | 22000                         | 33000 | 0.002      | -             |
| 7        | BK0709      | 7                 | 11   | 9    | 7.4                   | 0.40                  | 3.24            | 3.10           | 21000                         | 32000 | 0.003      | -             |
|          | HK0709      | 7                 | 11   | 9    | -                     | 0.40                  | 3.23            | 3.05           | 21000                         | 32000 | 0.003      | -             |
| 8        | BK0808      | 8                 | 12   | 8    | 6.4                   | 0.40                  | 2.90            | 2.73           | 20000                         | 31000 | 0.003      | -             |
|          | HK0808      | 8                 | 12   | 8    | -                     | 0.40                  | 2.90            | 2.73           | 20000                         | 31000 | 0.003      | -             |
|          | BK0810      | 8                 | 12   | 10   | 8.4                   | 0.40                  | 3.93            | 4.14           | 20000                         | 31000 | 0.004      | JR5x8x12      |
|          | HK0810      | 8                 | 12   | 10   | -                     | 0.40                  | 3.95            | 4.07           | 20000                         | 31000 | 0.004      | JR5x8x12      |
| 9        | BK0910      | 9                 | 13   | 10   | 8.4                   | 0.40                  | 4.57            | 5.07           | 19000                         | 30000 | 0.004      | JR6x9x12      |
|          | HK0910      | 9                 | 13   | 10   | -                     | 0.40                  | 4.57            | 5.07           | 19000                         | 30000 | 0.004      | JR6x9(12)     |
|          | BK0912      | 9                 | 13   | 12   | 10.4                  | 0.40                  | 5.65            | 6.65           | 19000                         | 30000 | 0.005      | JR6x9x12      |
|          | HK0912      | 9                 | 13   | 12   | -                     | 0.40                  | 5.65            | 6.65           | 19000                         | 30000 | 0.005      | JR6x9x12      |
| 10       | BK1010      | 10                | 14   | 10   | 8.4                   | 0.40                  | 4.78            | 5.51           | 19000                         | 29000 | 0.004      | JR7x10x10.5   |
|          | HK1010      | 10                | 14   | 10   | -                     | 0.40                  | 4.78            | 5.51           | 19000                         | 29000 | 0.004      | JR7x10x10.5   |
|          | BK1012      | 10                | 14   | 12   | 10.4                  | 0.40                  | 5.90            | 7.23           | 19000                         | 29000 | 0.006      | JR7x10x12     |
|          | HK1012      | 10                | 14   | 12   | -                     | 0.40                  | 5.90            | 7.23           | 19000                         | 29000 | 0.005      | JR7x10x12     |
|          | BK1015      | 10                | 14   | 15   | 13.4                  | 0.40                  | 7.49            | 9.81           | 19000                         | 29000 | 0.006      | JR7x10x16     |
|          | HK1015      | 10                | 14   | 15   | -                     | 0.40                  | 7.49            | 9.81           | 19000                         | 29000 | 0.006      | JR7x10x16     |

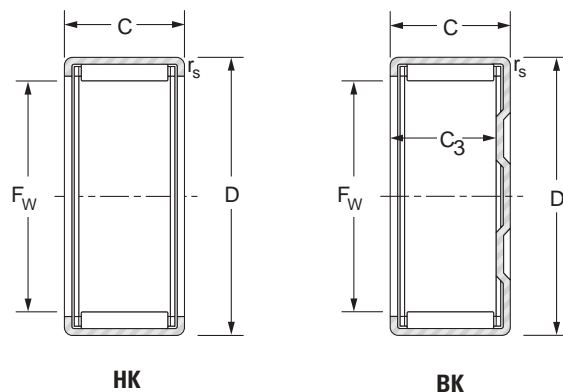
# 3.3



| Shaft mm | Designation | F <sub>w</sub> mm | D mm | C mm | C <sub>3</sub> min·mm | r <sub>s</sub> min·mm | Load ratings kN |                | Speed limit min <sup>-1</sup> |       | Weight. kg | Internal Ring |
|----------|-------------|-------------------|------|------|-----------------------|-----------------------|-----------------|----------------|-------------------------------|-------|------------|---------------|
|          |             |                   |      |      |                       |                       | Dynamic         | Static         | Grease                        | Oil   |            |               |
|          |             |                   |      |      |                       |                       | C               | C <sub>0</sub> |                               |       |            |               |
| 12       | BK1210      | 12                | 16   | 10   | 8.4                   | 0.4                   | 4.96            | 6.08           | 18000                         | 28000 | 0.006      | JR8x12x10.5   |
|          | HK1210      | 12                | 16   | 10   | -                     | 0.4                   | 4.96            | 6.08           | 18000                         | 28000 | 0.006      | JR8x12x10.5   |
|          | BK1212      | 12                | 18   | 12   | 9.3                   | 1                     | 6.61            | 7.29           | 14000                         | 22000 | 0.012      | JR8x12x12.5   |
|          | HK1212      | 12                | 18   | 12   | -                     | 1                     | 6.61            | 7.29           | 14000                         | 22000 | 0.01       | JR8x12x12.5   |
| 13       | BK1312      | 13                | 19   | 12   | 9.3                   | 1                     | 6.92            | 7.89           | 14000                         | 22000 | 0.012      | JR10x13x12.5  |
|          | HK1312      | 13                | 19   | 12   | -                     | 1                     | 6.92            | 7.89           | 14000                         | 22000 | 0.01       | JR10x13x12.5  |
| 14       | BK1412      | 14                | 20   | 12   | 9.3                   | 1                     | 7.21            | 8.50           | 14000                         | 21000 | 0.014      | JR10x14x12    |
|          | HK1412      | 14                | 20   | 12   | -                     | 1                     | 7.21            | 8.50           | 14000                         | 21000 | 0.011      | JR10x14x12    |
| 15       | BK1512      | 15                | 21   | 12   | 9.3                   | 1                     | 7.16            | 8.57           | 14000                         | 21000 | 0.015      | JR12x15x12.5  |
|          | HK1512      | 15                | 21   | 12   | -                     | 1                     | 7.49            | 9.11           | 14000                         | 21000 | 0.012      | JR12x15x12.5  |
|          | BK1516      | 15                | 21   | 16   | 13.3                  | 1                     | 10.70           | 14.4           | 14000                         | 21000 | 0.019      | JR12x15x16.5  |
|          | HK1516      | 15                | 21   | 16   | -                     | 1                     | 10.70           | 14.4           | 14000                         | 21000 | 0.018      | JR12x15x16.5  |
|          | BK1522      | 15                | 21   | 22   | 19.3                  | 1                     | 13.50           | 19.4           | 14000                         | 21000 | 0.022      | JR12x15x22.5  |
|          | HK1522      | 15                | 21   | 22   | -                     | 1                     | 13.50           | 19.4           | 14000                         | 21000 | 0.024      | JR12x15x22.5  |
| 16       | BK1612      | 16                | 22   | 12   | 9.3                   | 1                     | 7.76            | 9.72           | 14000                         | 21000 | 0.016      | JR12x16x12    |
|          | HK1612      | 16                | 22   | 12   | -                     | 1                     | 7.76            | 9.72           | 14000                         | 21000 | 0.012      | JR12x16x12    |
|          | BK1616      | 16                | 22   | 16   | 13.3                  | 1                     | 11.1            | 15.3           | 14000                         | 21000 | 0.02       | JR12x16x16    |
|          | HK1616      | 16                | 22   | 16   | -                     | 1                     | 11.1            | 15.3           | 14000                         | 21000 | 0.016      | JR12x16x16    |
|          | BK1622      | 16                | 22   | 22   | 19.3                  | 1                     | 13.4            | 19.5           | 14000                         | 21000 | 0.028      | JR12x16x22    |
|          | HK1622      | 16                | 22   | 22   | -                     | 1                     | 13.4            | 19.5           | 14000                         | 21000 | 0.022      | JR12x16x22    |
| 17       | BK1712      | 17                | 23   | 12   | 9.3                   | 1                     | 8.12            | 10.4           | 13000                         | 20000 | 0.018      | -             |
|          | HK1712      | 17                | 23   | 12   | -                     | 1                     | 8.12            | 10.4           | 13000                         | 20000 | 0.013      | -             |
| 18       | BK1812      | 18                | 24   | 12   | 9.3                   | 1                     | 8.41            | 11.11          | 12000                         | 18000 | 0.017      | -             |
|          | HK1812      | 18                | 24   | 12   | -                     | 1                     | 8.41            | 11.11          | 12000                         | 18000 | 0.015      | -             |
|          | BK1816      | 18                | 24   | 16   | 13.3                  | 1                     | 11.6            | 16.8           | 12000                         | 18000 | 0.022      | JR15x18x16.5  |
|          | HK1816      | 18                | 24   | 16   | -                     | 1                     | 11.6            | 16.8           | 12000                         | 18000 | 0.018      | JR15x18x16.5  |

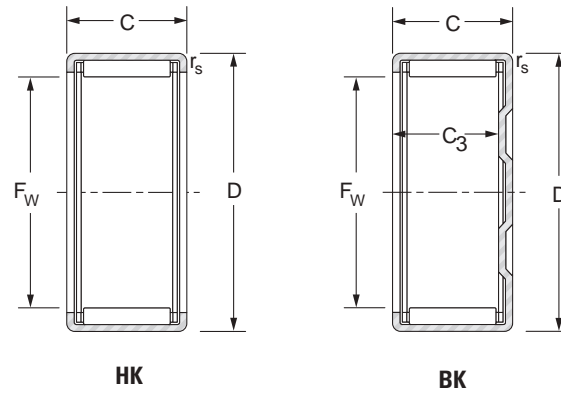
# CAGED NEEDLE BUSHES

## OPEN SERIES HK | CLOSED END SERIES BK



| Shaft mm | Designation | F <sub>w</sub> mm | D mm | C mm | C <sub>3</sub> min·mm | r <sub>s</sub> min·mm | Load ratings kN |                | Speed limit min <sup>-1</sup> |       | Weight. kg   | Internal Ring |
|----------|-------------|-------------------|------|------|-----------------------|-----------------------|-----------------|----------------|-------------------------------|-------|--------------|---------------|
|          |             |                   |      |      |                       |                       | Dynamic         | Static         | Grease                        | Oil   |              |               |
|          |             |                   |      |      |                       |                       | C               | C <sub>0</sub> |                               |       |              |               |
| 20       | BK2012      | 20                | 26   | 12   | 9.3                   | 1                     | 8.97            | 12.5           | 11000                         | 16000 | 0.017        | JR15x20x12    |
|          | HK2012      | 20                | 26   | 12   | -                     | 1                     | 8.97            | 12.5           | 11000                         | 16000 | 0.015        | JR15x20)(12   |
|          | BK2016      | 20                | 26   | 16   | 13.3                  | 1                     | 12.40           | 18.90          | 11000                         | 16000 | 0.024        | JR17x20x16.5  |
|          | HK2016      | 20                | 26   | 16   | -                     | -                     | 12.40           | 18.90          | 11000                         | 16000 | 0.022        | JRI 7x20x16.5 |
|          | BK2020      | 20                | 26   | 20   | 17.3                  | -                     | 15.50           | 25.30          | 11000                         | 16000 | 0.027        | JR17x20x20.5  |
|          | HK2020      | 20                | 26   | 20   | -                     | -                     | 15.90           | 26.20          | 11000                         | 16000 | 0.025        | JR17x20x20.5  |
|          | BK2030      | 20                | 26   | 30   | 27.3                  | 1                     | 21.20           | 37.80          | 11000                         | 16000 | 0.043        | JR17x20x30.5  |
| HK2030   | 20          | 26                | 30   | -    | 1                     | 21.20                 | 37.80           | 11000          | 16000                         | 0.041 | JR17x20x30.5 |               |
| 22       | BK2210      | 22                | 28   | 10   | 9.3                   | 1                     | 7.06            | 9.49           | 9600                          | 15000 | 0.013        | -             |
|          | HK2210      | 22                | 28   | 10   | -                     | 1                     | 7.06            | 9.49           | 9600                          | 15000 | 0.013        | -             |
|          | BK2212      | 22                | 28   | 12   | 9.3                   | 1                     | 9.81            | 14.50          | 9600                          | 15000 | 0.02         | JR17x22x13    |
|          | HK2212      | 22                | 28   | 12   | -                     | 1                     | 9.81            | 14.50          | 9600                          | 15000 | 0.015        | JR17x22x13    |
|          | BK2216      | 22                | 28   | 16   | 13.3                  | 1                     | 13.10           | 20.90          | 9600                          | 15000 | 0.027        | JR17x22x16    |
|          | HK2216      | 22                | 28   | 16   | -                     | 1                     | 13.10           | 20.90          | 9600                          | 15000 | 0.022        | JR17x22x16    |
|          | BK2220      | 22                | 28   | 20   | 17.3                  | 1                     | 15.30           | 25.50          | 9600                          | 15000 | 0.028        | JR17x22x23    |
| HK2220   | 22          | 28                | 20   | -    | 1                     | 15.30                 | 25.50           | 9600           | 15000                         | 0.026 | JR17x22x23   |               |
| 25       | BK2512      | 25                | 32   | 12   | 9.3                   | 1                     | 10.90           | 14.70          | 8500                          | 13000 | 0.025        | -             |
|          | HK2512      | 25                | 32   | 12   | -                     | 1                     | 10.90           | 14.70          | 8500                          | 13000 | 0.021        | -             |
|          | BK2516      | 25                | 32   | 16   | 13.3                  | 1                     | 15.60           | 23.50          | 8500                          | 13000 | 0.031        | JR20x25x17    |
|          | HK2516      | 25                | 32   | 16   | -                     | 1                     | 15.60           | 23.50          | 8500                          | 13000 | 0.028        | JR20x25x17    |
|          | BK2520      | 25                | 32   | 20   | 17.3                  | -                     | 20.60           | 33.40          | 8500                          | 13000 | 0.043        | JR20x25x20.5  |
|          | HK2520      | 25                | 32   | 20   | -                     | 1                     | 20.60           | 33.40          | 8500                          | 13000 | 0.040        | JR20x25x20.5  |
|          | BK2526      | 25                | 32   | 26   | 23.3                  | 1                     | 25.70           | 44.40          | 8500                          | 13000 | 0.051        | JR20x25x26.5  |
|          | HK2526      | 25                | 32   | 26   | -                     | 1                     | 25.70           | 44.40          | 8500                          | 13000 | 0.046        | JR20x25x26.5  |
| 28       | BK2538      | 25                | 32   | 38   | 35.3                  | 1                     | 35.30           | 66.90          | 8500                          | 13000 | 0.077        | JR20x25x38.5  |
|          | HK2538      | 25                | 32   | 38   | -                     | 1                     | 35.30           | 66.90          | 8500                          | 13000 | 0.068        | JR20x25x38.5  |
|          | BK2816      | 28                | 35   | 16   | 13.3                  | 1                     | 15.9            | 24.9           | 7500                          | 12000 | 0.038        | JR22x28x17    |
|          | HK2816      | 28                | 35   | 16   | -                     | 1                     | 15.9            | 24.9           | 7500                          | 12000 | 0.032        | JR22x28x17    |
| 28       | BK2820      | 28                | 35   | 20   | 17.3                  | 1                     | 20.9            | 35.3           | 7500                          | 12000 | 0.047        | JR22x28x20.5  |
|          | HK2820      | 28                | 35   | 20   | -                     | 1                     | 20.9            | 35.3           | 7500                          | 12000 | 0.040        | JR22x28x20.5  |

# 3.3



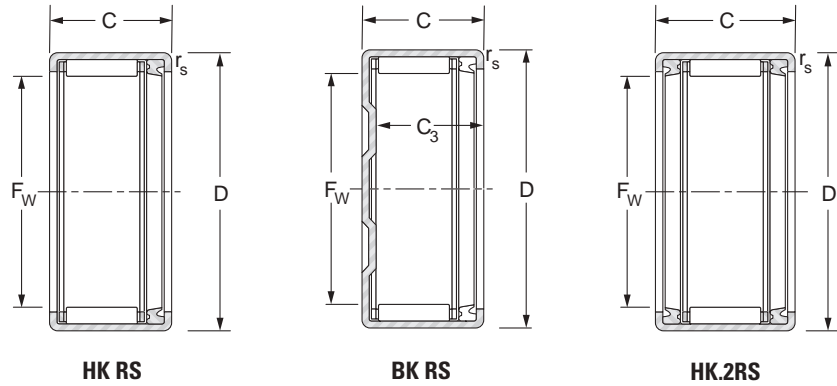
HK

BK

| Shaft mm | Designation | F <sub>w</sub> mm | D mm | C mm | C <sub>3</sub> min. mm | r <sub>s</sub> min. mm | Load ratings kN |                | Speed limit min <sup>-1</sup> |       | Weight. kg   | Internal Ring |
|----------|-------------|-------------------|------|------|------------------------|------------------------|-----------------|----------------|-------------------------------|-------|--------------|---------------|
|          |             |                   |      |      |                        |                        | Dynamic         | Static         | Grease                        | Oil   |              |               |
|          |             |                   |      |      |                        |                        | C               | C <sub>0</sub> |                               |       |              |               |
| 30       | BK3012      | 30                | 37   | 12   | 9.3                    | 1                      | 11.6            | 16.8           | 7000                          | 11000 | 0.031        | -             |
|          | HK3012      | 30                | 37   | 12   | -                      | 1                      | 12.0            | 17.7           | 7000                          | 11000 | 0.024        | -             |
|          | BK3016      | 30                | 37   | 16   | 13.30                  | 1                      | 16.8            | 27.3           | 7000                          | 11000 | 0.041        | JR25x30x17    |
|          | HK3016      | 30                | 37   | 16   | -                      | 1                      | 16.8            | 27.3           | 7000                          | 11000 | 0.032        | JR25x30x17    |
|          | BK3020      | 30                | 37   | 20   | 17.3                   | 1                      | 22.4            | 39.6           | 7000                          | 11000 | 0.053        | JR25x30x20.5  |
|          | HK3020      | 30                | 37   | 20   | -                      | 1                      | 22.4            | 39.6           | 7000                          | 11000 | 0.042        | JR25x30x20.5  |
|          | BK3026      | 30                | 37   | 26   | 23.3                   | 1                      | 27.4            | 51.2           | 7000                          | 11000 | 0.067        | JR25x30x26.5  |
|          | HK3026      | 30                | 37   | 26   | -                      | 1                      | 27.4            | 51.2           | 7000                          | 11000 | 0.054        | JR25x30x26.5  |
|          | BK3038      | 30                | 37   | 38   | 35.3                   | 1                      | 38.4            | 79.2           | 7000                          | 11000 | 0.093        | JR25x30x38.5  |
| HK3038   | 30          | 37                | 38   | -    | 1                      | 38.4                   | 79.2            | 7000           | 11000                         | 0.075 | JR25x30x38.5 |               |
| 35       | HK3512      | 35                | 42   | 12   | -                      | 1                      | 13.0            | 20.6           | 5900                          | 9100  | 0.028        | -             |
|          | HK3516      | 35                | 42   | 16   | -                      | 1                      | 17.4            | 29.9           | 5900                          | 9100  | 0.037        | JR30x35x17    |
|          | BK3520      | 35                | 42   | 20   | 17.3                   | 1                      | 24.5            | 46.8           | 5900                          | 9100  | 0.065        | JR30x35x20.5  |
|          | HK3520      | 35                | 42   | 20   | -                      | 1                      | 24.5            | 46.8           | 5900                          | 9100  | 0.049        | JR30x35x20.5  |
| 40       | HK4012      | 40                | 47   | 12   | -                      | 1                      | 14.7            | 25.3           | 5200                          | 7900  | 0.033        | -             |
|          | HK4016      | 40                | 47   | 16   | -                      | 1                      | 18.9            | 34.8           | 5200                          | 7900  | 0.042        | JR35x40x17    |
|          | BK4020      | 40                | 47   | 20   | 17.3                   | 1                      | 25.1            | 50.4           | 5200                          | 7900  | 0.070        | JR35x40x20.5  |
|          | HK4020      | 40                | 47   | 20   | -                      | 1                      | 25.1            | 50.4           | 5200                          | 7900  | 0.060        | JR35x40x20.5  |
| 45       | HK4512      | 45                | 52   | 12   | -                      | 1                      | 14.1            | 24.8           | 4600                          | 7000  | 0.036        | -             |
|          | HK4516      | 45                | 52   | 16   | -                      | 1                      | 19.8            | 38.5           | 4600                          | 7000  | 0.048        | JR40x45x17    |
|          | BK4520      | 45                | 52   | 20   | 17.3                   | 1                      | 26.3            | 55.4           | 4600                          | 7000  | 0.079        | JR40x45x20.5  |
|          | HK4520      | 45                | 52   | 20   | -                      | 1                      | 27.2            | 58.2           | 4600                          | 7000  | 0.059        | JR40x45x20.5  |
| 50       | HK5012      | 50                | 58   | 12   | -                      | 1                      | 17.0            | 28.7           | 4100                          | 6300  | 0.045        | -             |
|          | HK5020      | 50                | 58   | 20   | -                      | 1                      | 30.9            | 62.2           | 4100                          | 6300  | 0.072        | JR45x50x20    |
|          | HK5025      | 50                | 58   | 25   | -                      | 1                      | 35.5            | 74.1           | 4100                          | 6300  | 0.092        | JR45x50x25.5  |
| 55       | HK5520      | 55                | 63   | 20   | -                      | 1                      | 31.0            | 64.4           | 3700                          | 5700  | 0.079        | JR45x55x20    |
| 60       | HK6012      | 60                | 68   | 12   | -                      | 1                      | 17.2            | 31.2           | 3400                          | 5200  | 0.060        | -             |
|          | HK6020      | 60                | 68   | 20   | -                      | 1                      | 35.6            | 79.5           | 3400                          | 5200  | 0.090        | JR5x60x20     |

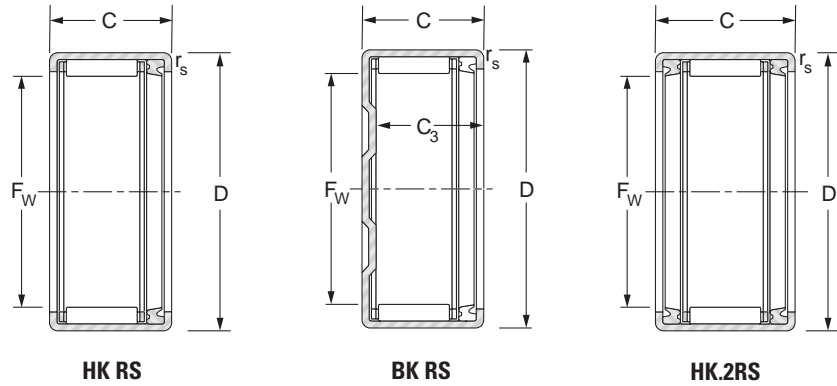
# CAGED NEEDLE BUSHES WITH SEAL

## SERIES HR...RS, BK...RS, HK...2RS



| Shaft mm | Designation | F <sub>w</sub> mm | D mm | C mm | C <sub>3 min</sub> mm | r <sub>s min</sub> mm | Load ratings kN |                | Speed limit min <sup>-1</sup> | Weight. kg | Internal Ring |
|----------|-------------|-------------------|------|------|-----------------------|-----------------------|-----------------|----------------|-------------------------------|------------|---------------|
|          |             |                   |      |      |                       |                       | Dynamic         | Static         |                               |            |               |
|          |             |                   |      |      |                       |                       | C               | C <sub>0</sub> | Grease                        |            |               |
| 8        | HK0810RS    | 8                 | 12   | 10   | -                     | 0.4                   | 2.90            | 2.73           | 20000                         | 0.004      | -             |
| 10       | HK1012RS    | 10                | 14   | 12   | -                     | 0.4                   | 4.78            | 5.51           | 19000                         | 0.006      | -             |
| 12       | HK1214RS    | 12                | 18   | 14   | -                     | 1                     | 6.61            | 7.29           | 14000                         | 0.013      | -             |
|          | HK1216.2RS  | 12                | 18   | 16   | -                     | 1                     | 6.87            | 7.65           | 14000                         | 0.016      | -             |
| 14       | BK1414RS    | 14                | 20   | 14   | 11.6                  | 1                     | 7.17            | 8.41           | 14000                         | 0.014      | -             |
|          | HK1414RS    | 14                | 20   | 14   | -                     | 1                     | 7.17            | 8.41           | 14000                         | 0.015      | JR10x14x16    |
|          | HK1416.2RS  | 14                | 20   | 16   | -                     | 1                     | 7.17            | 8.41           | 14000                         | 0.014      | JR10x14x20    |
| 15       | BK1514RS    | 15                | 21   | 14   | 11.3                  | 1                     | 7.87            | 9.69           | 13000                         | 0.017      | JR12x15x16.5  |
|          | HK1514RS    | 15                | 21   | 14   | -                     | 1                     | 7.87            | 9.69           | 13000                         | 0.016      | JR12x15x16.5  |
|          | HK1516.2RS  | 15                | 21   | 16   | -                     | 1                     | 7.87            | 9.69           | 13000                         | 0.019      | JR12x15x16.5  |
| 16       | HK1614RS    | 16                | 22   | 14   | -                     | 1                     | 7.82            | 9.76           | 12000                         | 0.014      | JR12x16x16    |
|          | HK1616.2RS  | 16                | 22   | 16   | -                     | 1                     | 7.82            | 9.76           | 12000                         | 0.015      | JR12x16x20    |
| 18       | HK1814RS    | 18                | 24   | 14   | -                     | 1                     | 8.41            | 11.10          | 11000                         | 0.018      | JR15x18x16.5  |
|          | HK1816.2RS  | 18                | 24   | 16   | -                     | 1                     | 8.41            | 11.10          | 11000                         | 0.017      | JR15x18x16.5  |
| 20       | HK2016.2RS  | 20                | 26   | 16   | -                     | 1                     | 8.97            | 12.50          | 9700                          | 0.023      | JR17x20x16.5  |
|          | HK2018RS    | 20                | 26   | 18   | -                     | 1                     | 12.40           | 18.90          | 9700                          | 0.025      | JR17x20x20.5  |
|          | HK2020.2RS  | 20                | 26   | 20   | -                     | 1                     | 12.40           | 18.90          | 9700                          | 0.028      | JR17x20x20.5  |
| 22       | HK2216.2RS  | 22                | 28   | 16   | -                     | 1                     | 9.81            | 14.50          | 8800                          | 0.025      | -             |
|          | HK2218RS    | 22                | 28   | 18   | -                     | 1                     | 13.10           | 20.90          | 8800                          | 0.027      | JR17x22x23    |
|          | HK2220.2RS  | 22                | 28   | 20   | -                     | 1                     | 13.10           | 20.90          | 8800                          | 0.026      | JR17x22x23    |
| 25       | HK2516.2RS  | 25                | 32   | 16   | -                     | 1                     | 11.10           | 15.10          | 7800                          | 0.030      | JR20x25x17    |
|          | HK2518RS    | 25                | 32   | 18   | -                     | 1                     | 16.20           | 24.60          | 7800                          | 0.034      | JR20x25x20.5  |
|          | HK2520.2RS  | 25                | 32   | 20   | -                     | 1                     | 16.20           | 24.60          | 7800                          | 0.033      | JR20x25x20.5  |
|          | HK2522RS    | 25                | 32   | 22   | -                     | 1                     | 20.60           | 33.40          | 7800                          | 0.042      | JR20x25x26    |
|          | HK2524.2RS  | 25                | 32   | 24   | -                     | 1                     | 20.6            | 33.4           | 7800                          | 0.047      | JR20x25x26    |

# 3.4



| Shaft mm | Designation | F <sub>w</sub> mm | D mm | C mm | C <sub>3 min</sub> mm | r <sub>s min</sub> mm | Load ratings kN |                | Speed limit       | Weight. kg | Internal Ring |
|----------|-------------|-------------------|------|------|-----------------------|-----------------------|-----------------|----------------|-------------------|------------|---------------|
|          |             |                   |      |      |                       |                       | Dynamic         | Static         | min <sup>-1</sup> |            |               |
|          |             |                   |      |      |                       |                       | C               | C <sub>0</sub> | Grease            |            |               |
| 28       | HK2820.2RS  | 28                | 35   | 20   | 1                     | 15.9                  | 24.9            | 6900           | 6900              | 0.042      | JR22x28x20.5  |
|          | HK3016.2RS  | 30                | 37   | 16   | 1                     | 11.6                  | 16.8            | 6500           | 6500              | 0.030      | JR25x30x17    |
| 30       | HK3018RS    | 30                | 37   | 18   | 1                     | 16.8                  | 27.3            | 6500           | 6500              | 0.042      | JR25x30x20.5  |
|          | HK3020.2RS  | 30                | 37   | 20   | 1                     | 16.8                  | 27.3            | 6500           | 6500              | 0.040      | JR25x30x20.5  |
|          | HK3022RS    | 30                | 37   | 22   | 1                     | 22.4                  | 39.6            | 6500           | 6500              | 0.051      | JR25x30x26    |
|          | HK3024.2RS  | 30                | 37   | 24   | 1                     | 22.4                  | 39.6            | 6500           | 6500              | 0.057      | JR25x30x26    |
| 35       | HK3516.2RS  | 35                | 42   | 16   | 1                     | 14.2                  | 23.2            | 5500           | 5500              | 0.047      | JR30x35x17    |
|          | HK3518RS    | 35                | 42   | 18   | 1                     | 17.4                  | 29.9            | 5500           | 5500              | 0.054      | JR30x35x20.5  |
|          | HK3520.2RS  | 35                | 42   | 20   | 1                     | 17.4                  | 29.9            | 5500           | 5500              | 0.044      | JR30x35x20.5  |
| 40       | HK4016.2RS  | 40                | 47   | 16   | 1                     | 13.4                  | 22.4            | 4900           | 4900              | 0.037      | JR35x40x20    |
|          | HK4018RS    | 40                | 47   | 18   | 1                     | 18.9                  | 34.8            | 4900           | 4900              | 0.057      | JR35x40x20.5  |
|          | HK4020.2RS  | 40                | 47   | 20   | 1                     | 18.9                  | 34.8            | 4900           | 4900              | 0.053      | JR35x40x20.5  |
| 45       | HK4518RS    | 45                | 52   | 18   | 1                     | 19.8                  | 38.5            | 4300           | 4300              | 0.064      | JR40x45x20.5  |
|          | HK4520.2RS  | 45                | 52   | 20   | 1                     | 19.8                  | 38.5            | 4300           | 4300              | 0.055      | JR40x45x20.5  |
| 50       | HK5022RS    | 50                | 58   | 22   | 1                     | 28.8                  | 56.6            | 3900           | 3900              | 0.097      | JR45x50x25.5  |
|          | HK5024.2RS  | 50                | 58   | 24   | 1                     | 28.8                  | 56.6            | 3900           | 3900              | 0.083      | JR45x50x25.5  |



# INTERNAL RINGS FOR NEEDLE BUSHES

## TECHNICAL SPECIFICATIONS

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When it is impractical to meet the shaft raceway design requirements (hardness, surface finish, case depth, etc.) outlined in the engineering section of this catalogue, standard inner rings may be used.

Inner rings are made of rolling bearing steel and after hardening, their bores, raceways and end surfaces are ground. Inner rings may be used to provide inner raceway surfaces for radial needle roller and cage assemblies, needle roller bearings and needle bushes.

The extended inner rings are suitable for use with bearings containing lip contact seals and for applications in which axial movement may be present.

### CONSTRUCTION

Inner rings are available in four basic designs and differ only by the chamfers at the ends of the raceway surfaces, the lubricant access holes and the raceway profile.

Inner rings of series **JR** have chamfers to assist in bearing installation but are without lubricating holes.

Inner rings of series **JR.JS1** have bearing installation chamfers and lubricating holes (bore diameters 5 to 50 mm). Inner rings of series **JRZ.JS1** are without installation chamfers, allowing for maximum possible raceway contact.

### DIMENSIONAL ACCURACY

The tolerances of size, form, and runout for inner rings meet the requirements of ISO normal tolerance class for radial bearings (see tables at the end of the catalogue).

Most inner rings are produced with outside diameter raceway tolerance in accordance with h5 which, in most cases, is suitable for combining the needle roller bearings to give the normal clearance class, and for use with needle bushes.

Other raceway tolerances may also be found on inner rings for combining with needle roller bearings to give one of the clearance requirement.

### MOUNTING OF INNER RINGS

Inner rings may be mounted on the shaft with either a loose transition fit or an interference fit.

These fits used in conjunction with the proper fit of the bearing outer ring, will provide the correct operating clearances for most applications.

Regardless of the fit of the inner ring on the shaft, the inner ring should be axially located by shaft shoulders or other positive means. The shaft shoulder diameter adjacent to the inner ring must not exceed the inner ring outside diameter.

When inner rings are to be used with the needle roller bearings, appropriate shaft tolerances should be selected from table 3 on page 94 in the needle bearing section.

When inner rings are to be used with needle bushes the suggested shaft tolerances are given in the "Radial play" paragraph on page 57 of the "Needle bushes" section of this catalogue.

### SEALING RINGS

Sealing rings series DH, tabulated on pages 191 to 193 are of a small cross section suitable for use with needle bushes. They provide a cost effective and compact construction in applications using grease lubrication.

### CONSTRUCTION

Sealing rings series DH comprise of a steel angle casing on the outside and a molded nitrile rubber sealing element containing the sealing lip.

These seals have an operating temperature range of -20°C to + 120°C.

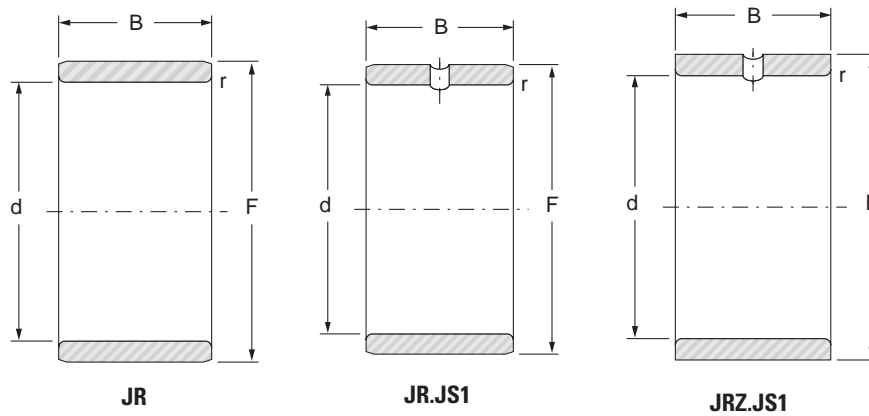
### MOUNTING OF LIP CONTACT SEALS

It is generally sufficient to press the seal into its predetermined position. Axial locating devices are not required for the seals in normal circumstances.

The shaft surface on which the seal is to run must be hardened and preferably plunge ground to a smooth finish, free from burrs, nicks or scratches which may damage the sealing lip.

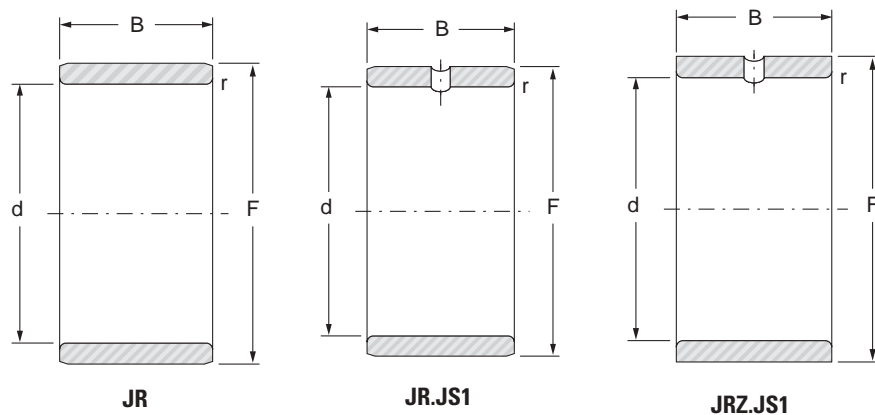
The end of the shaft should be chamfered or rounded to prevent lip damage and to ease installation. It is also recommended to apply a coating of a suitable lubricant on the shaft before mounting the seal.

# 3.5



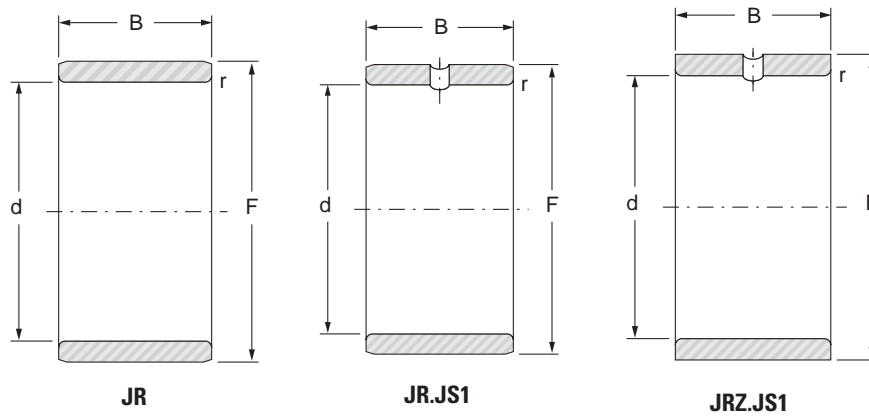
| Shaft mm   | Designation    | d mm | F mm | B mm | $r_s$ min. mm | Weight. kg |
|------------|----------------|------|------|------|---------------|------------|
| 5          | JR5x8x8JS1     | 5    | 8    | 8    | 0.3           | 0.002      |
|            | JR5x8x12       | 5    | 8    | 12   | 0.3           | 0.003      |
|            | JR5x8x16       | 5    | 8    | 16   | 0.3           | 0.004      |
| 6          | JR6x9x8JS1     | 6    | 9    | 8    | 0.3           | 0.002      |
|            | JR6x9x12       | 6    | 9    | 12   | 0.3           | 0.003      |
|            | JR6x9x16       | 6    | 9    | 16   | 0.3           | 0.004      |
|            | JR6x10x10      | 6    | 10   | 10   | 0.3           | 0.004      |
|            | JR6x10x10JS1   | 6    | 10   | 10   | 0.3           | 0.004      |
|            | JRZ6x10x12JS1  | 6    | 10   | 12   | 0.3           | 0.005      |
| 7          | JR7x10x10.5    | 7    | 10   | 10.5 | 0.3           | 0.003      |
|            | JR7x10x12      | 7    | 10   | 12   | 0.3           | 0.004      |
|            | JR7x10x16      | 7    | 10   | 16   | 0.3           | 0.005      |
| 8          | JR8x12x10      | 8    | 12   | 10   | 0.3           | 0.005      |
|            | JR8x12x10JS1   | 8    | 12   | 10   | 0.3           | 0.005      |
|            | JR8x12x10.5    | 8    | 12   | 10.5 | 0.3           | 0.005      |
|            | JRZ8x12x12JS1  | 8    | 12   | 12   | 0.3           | 0.006      |
|            | JR8x12x12.5    | 8    | 12   | 12.5 | 0.3           | 0.006      |
|            | JR8x12x16      | 8    | 12   | 16   | 0.3           | 0.007      |
| 9          | JR9x12x12      | 9    | 12   | 12   | 0.3           | 0.005      |
|            | JR9x12x16      | 9    | 12   | 16   | 0.3           | 0.006      |
| 10         | JR10x13x12.5   | 10   | 13   | 12.5 | 0.3           | 0.005      |
|            | JR10x14x11JS1  | 10   | 14   | 11   | 0.3           | 0.007      |
|            | JR10x14x12     | 10   | 14   | 12   | 0.3           | 0.007      |
|            | JR10x14x12JS1  | 10   | 14   | 12   | 0.3           | 0.007      |
|            | JR10x14x13     | 10   | 14   | 13   | 0.3           | 0.007      |
|            | JRZ10x14x14JS1 | 10   | 14   | 14   | 0.3           | 0.008      |
|            | JR10x14x16     | 10   | 14   | 16   | 0.3           | 0.009      |
| JR10x14x20 | 10             | 14   | 20   | 0.3  | 0.012         |            |

# INTERNAL RINGS FOR NEEDLE BUSHES



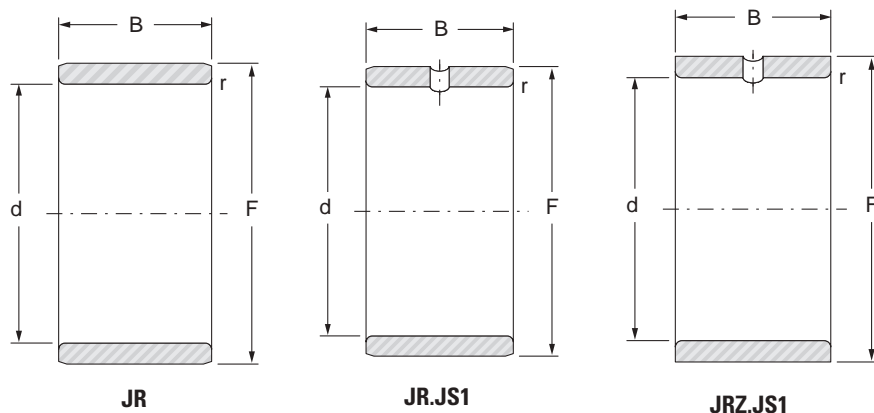
| Shaft mm | Designation    | d mm | F mm | B mm | r <sub>s</sub> min. mm | Weight. kg |
|----------|----------------|------|------|------|------------------------|------------|
| 12       | JR12x15x12.5   | 12   | 15   | 12.5 | 0.3                    | 0.006      |
|          | JR12x15x16     | 12   | 15   | 16   | 0.3                    | 0.008      |
|          | JR12x15x16.5   | 12   | 15   | 16.5 | 0.3                    | 0.008      |
|          | JR12x15x18.5   | 12   | 15   | 18.5 | 0.3                    | 0.009      |
|          | JR12x15x22.5   | 12   | 15   | 22.5 | 0.3                    | 0.011      |
|          | JR12x16x12     | 12   | 16   | 12   | 0.3                    | 0.008      |
|          | JR12x16x12JS1  | 12   | 16   | 12   | 0.3                    | 0.008      |
|          | JR12x16x13     | 12   | 16   | 13   | 0.3                    | 0.008      |
|          | JRZ12x16x14JS1 | 12   | 16   | 14   | 0.3                    | 0.010      |
|          | JR12x16x16     | 12   | 16   | 16   | 0.3                    | 0.011      |
|          | JR12x16x20     | 12   | 16   | 20   | 0.3                    | 0.014      |
|          | JR12x16x22     | 12   | 16   | 22   | 0.3                    | 0.015      |
| 14       | JR14x17x17     | 14   | 17   | 17   | 0.3                    | 0.009      |
| 15       | JR15x18x16.5   | 15   | 18   | 16.5 | 0.3                    | 0.010      |
|          | JR15x19x16     | 15   | 19   | 16   | 0.3                    | 0.013      |
|          | JR15x19x20     | 15   | 19   | 20   | 0.3                    | 0.017      |
|          | JR15x20x12     | 15   | 20   | 12   | 0.3                    | 0.012      |
|          | JR15x20x12JS1  | 15   | 20   | 12   | 0.3                    | 0.012      |
|          | JR15x20x13     | 15   | 20   | 13   | 0.3                    | 0.014      |
|          | JRZ15x20x14JS1 | 15   | 20   | 14   | 0.3                    | 0.015      |
|          | JR15x20x16     | 15   | 20   | 16   | 0.3                    | 0.017      |
|          | JR15x20x20     | 15   | 20   | 20   | 0.35                   | 0.021      |
|          | JR15x20x23     | 15   | 20   | 23   | 0.3                    | 0.025      |
|          | JR15x20x26     | 15   | 20   | 26   | 0.3                    | 0.028      |

# 3.5



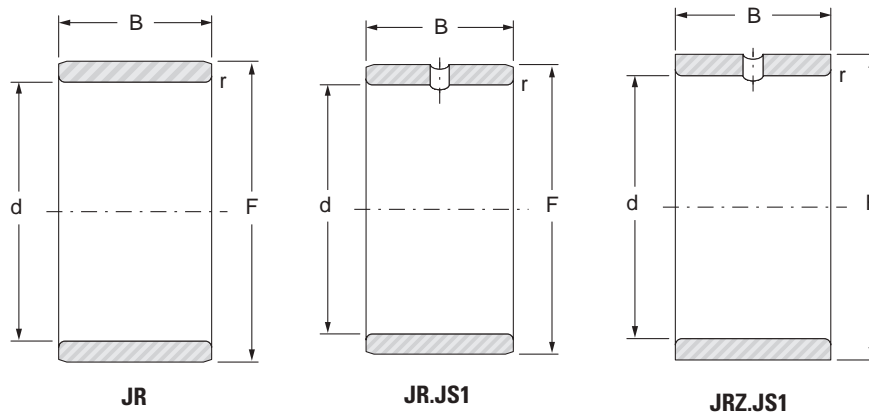
| Shaft mm | Designation    | d mm | F mm | B mm | $r_s$ min. mm | Weight. kg |
|----------|----------------|------|------|------|---------------|------------|
| 17       | JR17x20x1&5    | 17   | 20   | 16.5 | 0.3           | 0.011      |
|          | JR17x20x20     | 17   | 20   | 20   | 0.3           | 0.014      |
|          | JR17x20x20.5   | 17   | 20   | 20.5 | 0.3           | 0.014      |
|          | JR17x20x30.5   | 17   | 20   | 30.5 | 0.3           | 0.021      |
|          | JR17x21x16     | 17   | 21   | 16   | 0.3           | 0.015      |
|          | JR17x21x20     | 17   | 21   | 20   | 0.3           | 0.019      |
|          | JR17x22x13     | 17   | 22   | 13   | 0.3           | 0.015      |
|          | JR17x22x16     | 17   | 22   | 16   | 0.3           | 0.019      |
|          | JR17x22x16JS1  | 17   | 22   | 16   | 0.3           | 0.019      |
|          | JRZ17x22x16JS1 | 17   | 22   | 16   | 0.3           | 0.019      |
|          | JR17x22x20     | 17   | 22   | 20   | 0.35          | 0.023      |
|          | JR17x22x23     | 17   | 22   | 23   | 0.3           | 0.028      |
|          | JR17x22x26     | 17   | 22   | 26   | 0.3           | 0.031      |
|          | JR17x22x32     | 17   | 22   | 32   | 0.3           | 0.038      |
| 20       | JR20x24x16     | 20   | 24   | 16   | 0.3           | 0.018      |
|          | JR20x24x20     | 20   | 24   | 20   | 0.3           | 0.022      |
|          | JR20x25x16     | 20   | 25   | 16   | 0.3           | 0.022      |
|          | JR20x25x16JS1  | 20   | 25   | 16   | 0.3           | 0.022      |
|          | JR20x25x17     | 20   | 25   | 17   | 0.3           | 0.023      |
|          | JRZ20x25x18JS1 | 20   | 25   | 18   | 0.3           | 0.025      |
|          | JR20x25x20     | 20   | 25   | 20   | 0.3           | 0.028      |
|          | JR20x25x20.5   | 20   | 25   | 20.5 | 0.3           | 0.029      |
|          | JR20x25x26     | 20   | 25   | 26   | 0.3           | 0.036      |
|          | JR20x25x26.5   | 20   | 25   | 26.5 | 0.3           | 0.037      |
|          | JR20x25x30     | 20   | 25   | 30   | 0.3           | 0.042      |
|          | JR20x25x32     | 20   | 25   | 32   | 0.3           | 0.044      |
|          | JR20x25x38.5   | 20   | 25   | 38.5 | 0.3           | 0.054      |

# INTERNAL RINGS FOR NEEDLE BUSHES



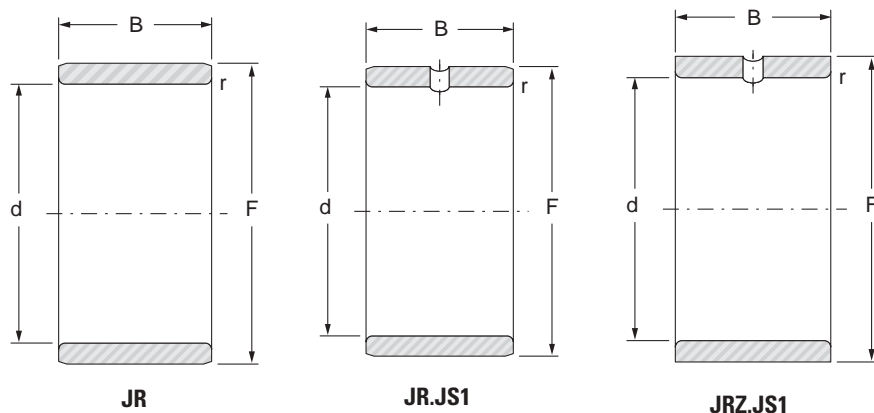
| Shaft mm | Designation    | d mm | F mm | B mm | r <sub>s min</sub> mm | Weight. kg |
|----------|----------------|------|------|------|-----------------------|------------|
| 22       | JR22x26x16     | 22   | 26   | 16   | 0.3                   | 0.019      |
|          | JR22x26x20     | 22   | 26   | 20   | 0.3                   | 0.023      |
|          | JR22x28x17     | 22   | 28   | 17   | 0.3                   | 0.030      |
|          | JR22x28x20.5   | 22   | 28   | 20.5 | 0.3                   | 0.038      |
|          | JR22x28x30     | 22   | 28   | 30   | 0.3                   | 0.056      |
| 25       | JR25x29x20     | 25   | 29   | 20   | 0.3                   | 0.027      |
|          | JR25x29x30     | 25   | 29   | 30   | 0.3                   | 0.040      |
|          | JR25x30x16     | 25   | 30   | 16   | 0.3                   | 0.027      |
|          | JR25x30x16JS1  | 25   | 30   | 16   | 0.3                   | 0.027      |
|          | JR25x30x17     | 25   | 30   | 17   | 0.3                   | 0.028      |
|          | JRZ25x30x18JS1 | 25   | 30   | 18   | 0.3                   | 0.031      |
|          | JR25x30x20     | 25   | 30   | 20   | 0.3                   | 0.034      |
|          | JR25x30x20.5   | 25   | 30   | 20.5 | 0.3                   | 0.035      |
|          | JR25x30x26     | 25   | 30   | 26   | 0.3                   | 0.044      |
|          | JR25x30x26.5   | 25   | 30   | 26.5 | 0.3                   | 0.045      |
|          | JR25x30x30     | 25   | 30   | 30   | 0.3                   | 0.051      |
|          | JR25x30x32     | 25   | 30   | 32   | 0.3                   | 0.054      |
|          | JR25x30x38.5   | 25   | 30   | 38.5 | 0.3                   | 0.066      |
| 28       | JR28x32x17     | 28   | 32   | 17   | 0.3                   | 0.028      |
|          | JR28x32x20     | 28   | 32   | 20   | 0.3                   | 0.030      |
|          | JR28x32x30     | 28   | 32   | 30   | 0.3                   | 0.044      |

# 3.5



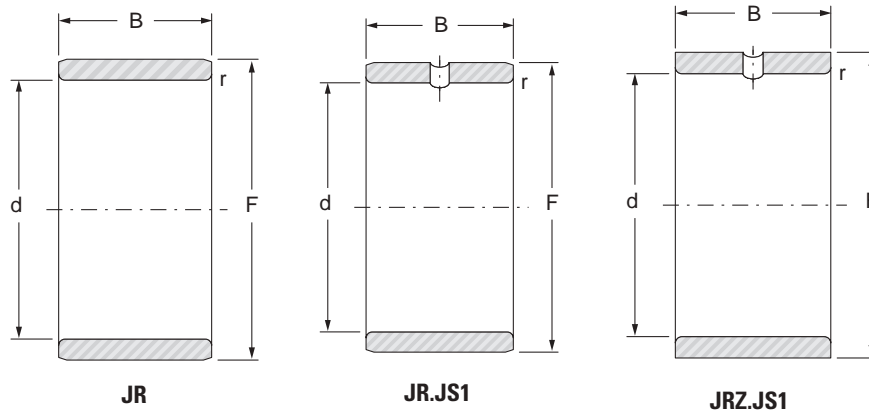
| Shaft mm   | Designation    | d mm | F mm | B mm | $r_s$ min. mm | Weight. kg |
|------------|----------------|------|------|------|---------------|------------|
| 30         | JR30x35x16     | 30   | 35   | 16   | 0.3           | 0.031      |
|            | JR30x35x17     | 30   | 35   | 17   | 0.3           | 0.033      |
|            | JRZ30x35x18JS1 | 30   | 35   | 18   | 0.3           | 0.036      |
|            | JR30x35x20     | 30   | 35   | 20   | 0.3           | 0.039      |
|            | JRZ30x35x20JS1 | 30   | 35   | 20   | 0.3           | 0.039      |
|            | JR30x35x20.5   | 30   | 35   | 20.5 | 0.3           | 0.040      |
|            | JR30x35x26     | 30   | 35   | 26   | 0.3           | 0.054      |
|            | JR30x35x30     | 30   | 35   | 30   | 0.3           | 0.057      |
|            | JR30x35x32     | 30   | 35   | 32   | 0.3           | 0.062      |
|            | JR30x38x20JS1  | 30   | 38   | 20   | 0.6           | 0.067      |
| 32         | JR32x37x20     | 32   | 37   | 20   | 0.3           | 0.043      |
|            | JR32x37x30     | 32   | 37   | 30   | 0.3           | 0.064      |
|            | JR32x40x20     | 32   | 40   | 20   | 0.6           | 0.069      |
|            | JR32x40x36     | 32   | 40   | 36   | 0.6           | 0.128      |
| 35         | JR35x40x17     | 35   | 40   | 17   | 0.3           | 0.040      |
|            | JR35x40x20     | 35   | 40   | 20   | 0.3           | 0.046      |
|            | JR35x40x20.5   | 35   | 40   | 20.5 | 0.3           | 0.049      |
|            | JR35x40x22     | 35   | 40   | 22   | 0.3           | 0.052      |
|            | JR35x40x30     | 35   | 40   | 30   | 0.3           | 0.071      |
|            | JR35x40x34     | 35   | 40   | 34   | 0.3           | 0.080      |
|            | JR35x40x40     | 35   | 40   | 40   | 0.3           | 0.094      |
|            | JR35x42x20     | 35   | 42   | 20   | 0.6           | 0.065      |
|            | JR35x42x20JS1  | 35   | 42   | 20   | 0.6           | 0.065      |
|            | JRZ35x42x23JS1 | 35   | 42   | 23   | 0.6           | 0.074      |
|            | JR35x42x36     | 35   | 42   | 36   | 0.6           | 0.122      |
| JR35x44x22 | 35             | 44   | 22   | 0.6  | 0.097         |            |

# INTERNAL RINGS FOR NEEDLE BUSHES



| Shaft mm   | Designation    | d mm       | F mm | B mm | $r_s$ min. mm | Weight. kg |
|------------|----------------|------------|------|------|---------------|------------|
| 37         | JR37x42x20     | 37         | 42   | 20   | 0.35          | 0.046      |
| 38         | JR38x43x20     | 38         | 43   | 20   | 0.3           | 0.050      |
|            | JR38x43x30     | 38         | 43   | 30   | 0.3           | 0.075      |
| 40         | JR40x45x17     | 40         | 45   | 17   | 0.3           | 0.044      |
|            | JR40x45x20     | 40         | 45   | 20   | 0.3           | 0,052      |
|            | JR40x45x20.5   | 40         | 45   | 20.5 | 0.3           | 0.054      |
|            | JR40x45x25     | 40         | 45   | 25   | 0.35          | 0.062      |
|            | JR40x45x30     | 40         | 45   | 30   | 0.3           | 0,078      |
|            | JR40x45x34     | 40         | 45   | 34   | 0.3           | 0.089      |
|            | JR40x45x40     | 40         | 45   | 40   | 0.3           | 0.115      |
|            | JR40x48x22     | 40         | 48   | 22   | 0.6           | 0.094      |
|            | JRZ40x48x23JS1 | 40         | 48   | 23   | 0.6           | 0.100      |
|            | JR40x48x40     | 40         | 48   | 40   | 0.6           | 0.173      |
|            | JR40x50x20     | 40         | 50   | 20   | 1             | 0.110      |
|            | 42             | JR42x47x20 | 42   | 47   | 20            | 0.3        |
| JR42x47x30 |                | 42         | 47   | 30   | 0.3           | 0.083      |
| JR45x50x20 |                | 45         | 50   | 20   | 0.3           | 0.058      |
| 45         | JR45x50x25     | 45         | 50   | 25   | 0.6           | 0.073      |
|            | JR45x50x25.5   | 45         | 50   | 25.5 | 0.3           | 0.075      |
|            | JR45x50x35     | 45         | 50   | 35   | 0.6           | 0.103      |
|            | JR45x50x40     | 45         | 50   | 40   | 0.3           | 0.117      |
|            | JR45x52x22     | 45         | 52   | 22   | 0.6           | 0.090      |
|            | JR45x52x23     | 45         | 52   | 23   | 0.6           | 0.096      |
|            | JRZ45x52x23JS1 | 45         | 52   | 23   | 0.6           | 0.096      |
|            | JR45x52x40     | 45         | 52   | 40   | 0.6           | 0.167      |
|            | JR45x55x20     | 45         | 55   | 20   | 1             | 0.133      |
|            | JR45x55x20JS1  | 45         | 55   | 20   | 1             | 0.133      |
|            | JR45x55x22     | 45         | 55   | 22   | 1             | 0.135      |
|            | JR45x55x40     | 45         | 55   | 40   | 1             | 0.247      |

# 3.5



| Shaft mm | Designation    | d mm | F mm | B mm | $r_s$ min* mm | Weight. kg |
|----------|----------------|------|------|------|---------------|------------|
| 50       | JR50x55x20     | 50   | 55   | 20   | 0.3           | 0.065      |
|          | JR50x55x25     | 50   | 55   | 25   | 0.6           | 0.081      |
|          | JR50x55x35     | 50   | 55   | 35   | 0.6           | 0.113      |
|          | JR50x55x40     | 50   | 55   | 40   | 0.3           | 0.130      |
|          | JR50x58x22     | 50   | 58   | 22   | 0.6           | 0.117      |
|          | JRZ50x58x23JS1 | 50   | 58   | 23   | 0.6           | 0.122      |
|          | JR50x58x40     | 50   | 58   | 40   | 0.6           | 0.213      |
|          | JR50x60x20     | 50   | 60   | 20   | 1             | 0.155      |
|          | JR50x60x20JS1  | 50   | 60   | 20   | 1             | 0.155      |
|          | JR50x60x25     | 50   | 60   | 25   | 1             | 0.170      |
|          | JR50x60x40     | 50   | 60   | 40   | 1             | 0.310      |
| 55       | JR55x60x25     | 55   | 60   | 25   | 0.6           | 0.088      |
|          | JR55x60x35     | 55   | 60   | 35   | 0.6           | 0.124      |





# BEARINGS WITH CAGE GUIDED NEEDLES



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4.1 TECHNICAL FEATURES

PAGE 72

4.2 BEARING WITH CAGE GUIDED WITH INNER RING

PAGE 74

4.3 BEARING WITH CAGE GUIDED WITHOUT INNER RING

# BEARINGS WITH CAGE | GUIDED NEEDLES

## TECHNICAL SPECIFICATIONS



Caged needle bearings possess an outer ring made from through-hardened bearing steel. The cage guides, the needles and retains them in the outer ring.

The bearings may be used without an inner ring if the shaft journal serving as a raceway is of sufficient hardness and has the correct surface finish. To ensure that the full load capacity of these bearings is achieved, a hardness of 58-64 HRC is required. A lower hardness will entail a reduction in the load capacities (both dynamic and static) as shown in the table of dimensions (see Technical Section).

### CONSTRUCTION

The basic construction of needle bearings are:

- with integral end flanges on the one-piece, channel-shaped outer rings ( $f_w > 12 \text{ mm}$ )
- with inserted-end washers to provide axial retention of the needle roller and cage assemblies ( $f_w < 10 \text{ mm}$ )

### Needle roller bearings with integral flanges

The needle roller bearings has one-piece, channel-shaped outer ring of bearing-quality steel heat treated to yield maximum load rating.

The integral end flanges provide axial location for the needle rollers. The bores of the end flanges serve as piloting surfaces for the cage.

A steel cage provides inward retention for the needle rollers and the design assures roller stability and minimizes friction between the cage and the needle rollers.

The cage has maximum strength consistent with the inherent high-load ratings of needle roller bearings.

The outer ring has a lubricating groove and a lubricating hole for more convenient lubrication of the bearing.

however, the smaller bearings of series **NKJ** ( $d < 7 \text{ mm}$ ) and **NK** ( $F_w < 10 \text{ mm}$ ) do not have lubricating groove or a lubricating hole.

### Reference standards are:

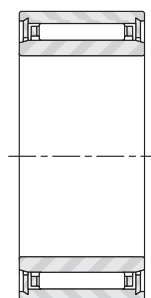
- ISO 1206 - needle roller bearings - Light and medium series - Dimension and tolerances.

### Suffixes:

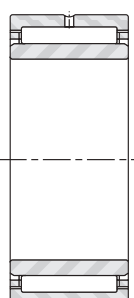
- TN - molded cage of engineered, reinforced polymer

### TYPES OF BEARINGS

#### Needle roller bearings with inner rings

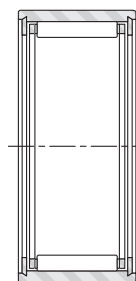


**NKJ**  
( $d \leq 7 \text{ mm}$ )

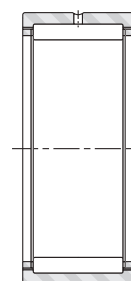


**NKJ, NKJS**  
( $d \geq 9 \text{ mm}$ )

#### Needle roller bearings without inner rings



**NK**  
( $F_w \leq 10 \text{ mm}$ )



**NK, NKS**  
( $F_w \geq 12 \text{ mm}$ )

## Needle roller bearings with inner rings

When it is impractical to finish the shaft to meet the desired raceway design requirements, an inner ring may be used. Standard needle roller bearings are available with inner rings to form complete bearings. Bearings furnished with inner rings meet the quality requirements in accordance with ISO standards.

- For inner- and outer - ring tolerances, the bearings follow the normal tolerance class in **ISO Standard 492** covering radial bearings. Bearings to more precise tolerance classes, P6 and P5, may be obtained upon request (see tables at the end of the catalogue).
- These bearings may be obtained with radial internal clearance in accordance with **ISO Standard 5753**, also specified for cylindrical roller bearings. Mostly, they follow the normal (CO) radial clearance group, although bearings to clearance groups C2, C3 and C4 may be made available on request (see tables at the end of the catalogue).
- Inner ring and outer ring chamfer dimensions meet the requirements of **ISO Standard 582**.

## Needle roller bearings without inner rings

Whenever the shaft can be used as the inner raceway, needle roller bearings without inner rings provide advantages of economy and close control of radial internal clearance in operation. Tolerance class F6 is the normal specification for the needle roller complement bore diameter of an unmounted bearing, as shown in Table 1.

**Table 1 - Caged needle roller complement bore diameter for bearings without inner ring**

| F <sub>w</sub> mm |     | Δ F <sub>w</sub> min μm |      |
|-------------------|-----|-------------------------|------|
| >                 | ≤   | low                     | high |
| -                 | 6   | +10                     | +18  |
| 6                 | 10  | +13                     | +22  |
| 10                | 18  | +16                     | +27  |
| 18                | 30  | +20                     | +33  |
| 30                | 50  | +25                     | +41  |
| 50                | 80  | +30                     | +49  |
| 80                | 120 | +36                     | +58  |
| 120               | 180 | +43                     | +68  |
| 180               | 250 | +50                     | +79  |
| 250               | 315 | +56                     | +88  |
| 315               | 400 | +62                     | +98  |

## BEARING MOUNTING

### General requirements

In general the mounting of needle roller bearings with or without inner rings, of normal precision, requires the shaft seat or raceway to be machined to quality IT5 or IT6. The housing bore should meet quality IT6 or IT7.

Other quality requirements for shafts and housings are given on page 13.

### Mounting dimensions

It is suggested that needle roller bearings are mounted in their housings with a clearance fit, if the load is stationary relative to the housing, or with a tight transition fit, if the load rotates relative to the housing.

Table 2 lists the suggested tolerances for the housing bore and the shaft raceway for bearings without inner rings.

Table 3 lists the suggested shaft tolerances for the above two mounting conditions when the bearings are used with inner rings.

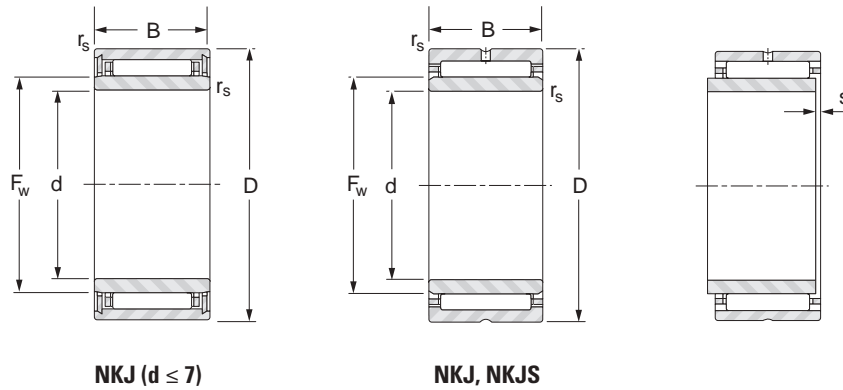
Other mounting dimensions may be required for special operating conditions such as:

1. Extremely heavy radial loads.
2. Shock loads.
3. Temperature gradient across bearing.
4. Housing material with heat expansion coefficient different than that of the bearing.
5. Oscillating motion applications.

**Table 2 - Mounting tolerances for bearings without inner ring**

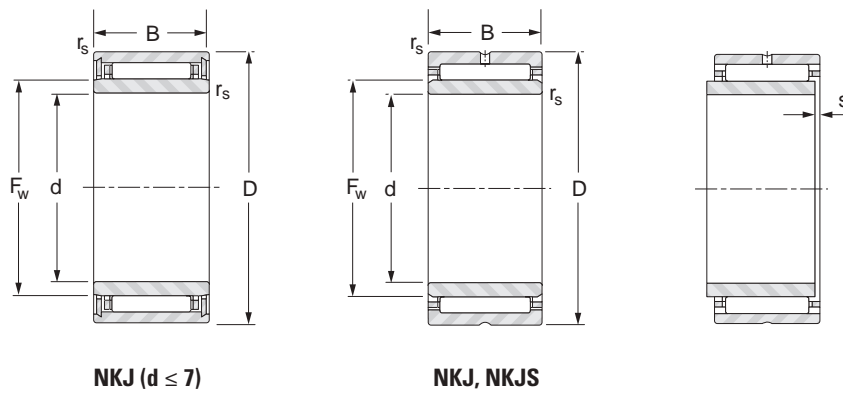
| Rotation conditions                 | Nominal housing bore diameter D mm | ISO tolerance zone for housing | Nominal shaft diameter F mm | ISO tolerance zone for shaft |
|-------------------------------------|------------------------------------|--------------------------------|-----------------------------|------------------------------|
| Load stationary relative to housing | All diameters                      | H7 (J7)                        | All diameters               | h6                           |
| General work with larger clearance  | All diameters                      | K7                             | All diameters               | g6                           |
| Load rotates relative to housing    | All diameters                      | N7                             | All diameters               | f6                           |

# BEARINGS WITH CAGE | GUIDED NEEDLES WITH INNER RING



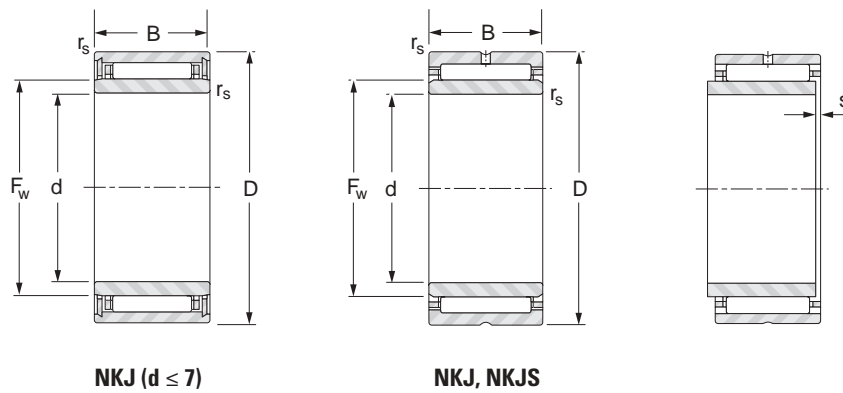
| Shaft mm | Designation | d mm | D mm | B mm | F <sub>w</sub> mm | r <sub>s</sub> min. mm | s <sup>(1)</sup> mm | Load ratings kN |                | Speed ratings kN min <sup>-1</sup> |        | Weight. kg |
|----------|-------------|------|------|------|-------------------|------------------------|---------------------|-----------------|----------------|------------------------------------|--------|------------|
|          |             |      |      |      |                   |                        |                     | Dynamic         | Static         | Oil                                | Grease |            |
|          |             |      |      |      |                   |                        |                     | C               | C <sub>0</sub> |                                    |        |            |
| 5        | NKJ5/12     | 5    | 15   | 12   | 8                 | 0.3                    | 1.5                 | 4.57            | 4.89           | 41.000                             | 26000  | 0.014      |
|          | NKJ5/16     | 5    | 15   | 16   | 8                 | 0.3                    | 1.5                 | 5.22            | 5.78           | 41.000                             | 26000  | 0.017      |
| 6        | NKJ6/12     | 6    | 16   | 12   | 9                 | 0.3                    | 1.5                 | 4.27            | 4.60           | 40.000                             | 26000  | 0.015      |
|          | NKJ6/16     | 6    | 16   | 16   | 9                 | 0.3                    | 1.5                 | 5.57            | 6.47           | 40.000                             | 26000  | 0.019      |
| 7        | NKJ7/12     | 7    | 17   | 12   | 11.5              | 0.3                    | 1.5                 | 5.40            | 6.43           | 39.000                             | 25000  | 0.017      |
|          | NKJ7/16TN   | 7    | 17   | 16   | 11.5              | 0.3                    | 1.5                 | 5.30            | 6.27           | 39.000                             | 25000  | 0.021      |
| 9        | NKJ9/12     | 9    | 19   | 12   | 12                | 0.3                    | 1.5                 | 6.86            | 7.60           | 30.000                             | 19000  | 0.018      |
|          | NKJ9/16     | 9    | 19   | 16   | 12                | 0.3                    | 1.5                 | 6.78            | 9.03           | 30.000                             | 19000  | 0.024      |
| 10       | NKJ10/16    | 10   | 22   | 16   | 14                | 0.6                    | 1.5                 | 12.4            | 14.8           | 24.000                             | 16000  | 0.032      |
|          | NKJ10/20    | 10   | 22   | 20   | 14                | 0.3                    | 1.5                 | 14.7            | 18.4           | 24.000                             | 16000  | 0.040      |
| 12       | NKJ12/16    | 12   | 24   | 16   | 16                | 0.3                    | 1.5                 | 13.0            | 16.2           | 28.000                             | 18000  | 0.036      |
|          | NKJ12/20    | 12   | 24   | 20   | 16                | 0.3                    | 1.5                 | 15.4            | 20.2           | 28.000                             | 18000  | 0.046      |
| 15       | NKJ15/16    | 15   | 27   | 16   | 19                | 0.3                    | 1.5                 | 14.1            | 19.0           | 24.000                             | 15000  | 0.042      |
|          | NKJ15/20    | 15   | 27   | 20   | 19                | 0.3                    | 1.5                 | 16.8            | 23.6           | 24.000                             | 15000  | 0.054      |
| 17       | NKJ17/16    | 17   | 29   | 16   | 21                | 0.3                    | 2.0                 | 15.3            | 21.6           | 21.000                             | 14000  | 0.047      |
|          | NKJ17/20    | 17   | 29   | 20   | 21                | 0.3                    | 1.5                 | 18.1            | 23.9           | 21.000                             | 14000  | 0.059      |
|          | NKJS17      | 17   | 37   | 20   | 24                | 0.6                    | 1.0                 | 29.1            | 32.8           | 20.000                             | 13000  | 0.108      |
| 20       | NKJ20/16    | 20   | 32   | 16   | 24                | 0.3                    | 1.5                 | 16.2            | 24.3           | 18.000                             | 12000  | 0.053      |
|          | NKJ20/20    | 20   | 32   | 20   | 24                | 0.3                    | 1.5                 | 19.3            | 30.3           | 18.000                             | 12000  | 0.067      |
|          | NKJS20      | 20   | 42   | 20   | 28                | 0.6                    | 1.0                 | 30.3            | 38.4           | 16.000                             | 11000  | 0.130      |
| 22       | NKJ22/16    | 22   | 34   | 16   | 26                | 0.3                    | 1.5                 | 16.6            | 25.7           | 17.000                             | 11000  | 0.058      |
|          | NKJ22/20    | 22   | 34   | 20   | 26                | 0.3                    | 2.0                 | 19.7            | 32.0           | 17.000                             | 11000  | 0.071      |
| 25       | NKJ25/20    | 25   | 38   | 20   | 29                | 0.3                    | 2.0                 | 23.4            | 36.4           | 15.000                             | 9800   | 0.086      |
|          | NKJ25/30    | 25   | 38   | 30   | 29                | 0.3                    | 2.0                 | 29.8            | 56.4           | 15000                              | 9800   | 0.130      |
|          | NKJS25      | 25   | 47   | 22   | 32                | 0.6                    | 1.5                 | 36.0            | 36.2           | 14000                              | 9200   | 0.174      |
| 28       | NKJ28/20    | 28   | 42   | 20   | 32                | 0.3                    | 2.0                 | 24.8            | 40.4           | 14000                              | 8800   | 0.104      |
|          | NKJ28/30    | 28   | 42   | 30   | 32                | 0.3                    | 2.0                 | 35.6            | 64.3           | 14000                              | 8800   | 0.156      |

# 4.2



| Shaft mm | Designation | d mm | D mm | B mm | F <sub>w</sub> mm | r <sub>s</sub> min. mm | s <sup>(1)</sup> mm | Load ratings kN |                | Speed ratings kN min <sup>-1</sup> |        | Weight. kg |
|----------|-------------|------|------|------|-------------------|------------------------|---------------------|-----------------|----------------|------------------------------------|--------|------------|
|          |             |      |      |      |                   |                        |                     | Dynamic         | Static         | Oil                                | Grease |            |
|          |             |      |      |      |                   |                        |                     | C               | C <sub>0</sub> |                                    |        |            |
| 30       | NKJ30/20    | 30   | 45   | 20   | 35                | 0.3                    | 1.5                 | 26.1            | 44.4           | 12000                              | 8000   | 0.120      |
|          | NKJ30/30    | 30   | 45   | 30   | 35                | 0.3                    | 1.5                 | 37.4            | 70.6           | 12000                              | 8000   | 0.179      |
|          | NKJS30      | 30   | 52   | 22   | 37                | 0.6                    | 1.5                 | 39.0            | 53.4           | 12000                              | 7900   | 0.198      |
| 32       | NKJ32/20    | 32   | 47   | 20   | 37                | 0.3                    | 2.0                 | 26.6            | 46.4           | 12000                              | 7600   | 0.127      |
|          | NKJ32/30    | 32   | 47   | 30   | 37                | 0.3                    | 1.5                 | 38.2            | 73.9           | 12000                              | 7600   | 0.192      |
| 35       | NKJ35/20    | 35   | 50   | 20   | 40                | 0.3                    | 2.0                 | 27.8            | 50.4           | 11000                              | 7000   | 0.135      |
|          | NKJ35/30    | 35   | 50   | 30   | 40                | 0.3                    | 1.5                 | 40.0            | 80.2           | 11000                              | 7000   | 0.208      |
|          | NKJS35      | 35   | 58   | 22   | 43                | 0.6                    | 1.0                 | 41.6            | 60.7           | 10000                              | 6700   | 0.235      |
| 38       | NKJ38/20    | 38   | 53   | 20   | 43                | 0.3                    | 2.0                 | 29.0            | 54.4           | 9900                               | 6400   | 0.146      |
|          | NKJ38/30    | 38   | 53   | 30   | 43                | 0.3                    | 1.5                 | 41.6            | 86.6           | 9900                               | 6400   | 0.196      |
| 40       | NKJ40/20    | 40   | 55   | 20   | 45                | 0.3                    | 2.0                 | 29.5            | 56.4           | 9400                               | 6100   | 0.152      |
|          | NKJ40/30    | 40   | 55   | 30   | 45                | 0.3                    | 1.5                 | 42.3            | 89.8           | 9400                               | 6100   | 0.229      |
|          | NKJS40      | 40   | 65   | 22   | 50                | 1.0                    | 1.0                 | 45.5            | 71.3           | 8700                               | 5700   | 0.292      |
| 42       | NKJ42/20    | 42   | 57   | 20   | 47                | 0.3                    | 2.0                 | 30.0            | 58.5           | 9000                               | 5900   | 0.159      |
|          | NKJ42/30    | 42   | 57   | 30   | 47                | 0.3                    | 1.5                 | 39.9            | 84.1           | 9000                               | 5900   | 0.241      |
| 45       | NKJ45/25    | 45   | 62   | 25   | 50                | 0.6                    | 3.0                 | 40.7            | 79.3           | 8500                               | 5500   | 0.223      |
|          | NKJ45/35    | 45   | 62   | 35   | 50                | 0.6                    | 3.0                 | 55.0            | 117            | 8500                               | 5500   | 0.345      |
|          | NKJS45      | 45   | 72   | 22   | 55                | 1.0                    | 1.0                 | 47.9            | 78.4           | 7900                               | 5100   | 0.360      |
| 50       | NKJ50/25    | 50   | 68   | 25   | 55                | 0.6                    | 3.0                 | 46.1            | 87.3           | 7800                               | 5000   | 0.288      |
|          | NKJ50/35    | 50   | 68   | 35   | 55                | 0.6                    | 3.0                 | 62.3            | 129            | 7800                               | 5000   | 0.406      |
|          | NKJS50      | 50   | 80   | 28   | 60                | 1.1                    | 1.5                 | 66.9            | 103            | 7300                               | 4800   | 0.523      |
| 55       | NKJ55/25    | 55   | 72   | 25   | 60                | 0.6                    | 3.0                 | 44.3            | 94.0           | 7000                               | 4600   | 0.290      |
|          | NKJ55/35    | 55   | 72   | 35   | 60                | 0.6                    | 3.0                 | 59.9            | 139            | 7000                               | 4600   | 0.410      |
|          | NKJS55      | 55   | 85   | 28   | 65                | 1.1                    | 1.5                 | 71.0            | 114            | 6700                               | 4400   | 0.569      |
| 60       | NKJ60/25    | 60   | 82   | 25   | 68                | 0.6                    | 2.0                 | 49.0            | 101            | 6200                               | 4000   | 0.440      |
|          | NKJ60/35    | 60   | 82   | 35   | 68                | 0.6                    | 2.5                 | 66.2            | 149            | 6200                               | 4000   | 0.520      |
|          | NKJS60      | 60   | 90   | 28   | 70                | 1.1                    | 1.5                 | 72.6            | 120            | 6200                               | 4000   | 0.607      |

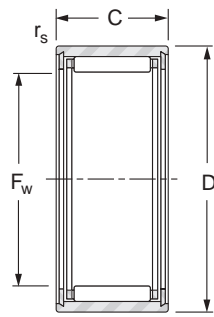
# BEARINGS WITH CAGE | GUIDED NEEDLES WITH INNER RING



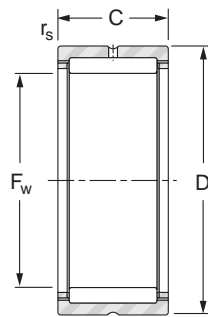
| Shaft mm | Designation | d mm | D mm | B mm | F <sub>w</sub> mm | r <sub>s</sub> min. mm | s <sup>(1)</sup> mm | Load ratings kN |                | Speed ratings kN min <sup>-1</sup> |        | Weight. kg |
|----------|-------------|------|------|------|-------------------|------------------------|---------------------|-----------------|----------------|------------------------------------|--------|------------|
|          |             |      |      |      |                   |                        |                     | Dynamic         | Static         | Oil                                | Grease |            |
|          |             |      |      |      |                   |                        |                     | C               | C <sub>0</sub> |                                    |        |            |
| 65       | NKJ65/25    | 65   | 90   | 25   | 73                | 0.6                    | 2.0                 | 61.5            | 119            | 5800                               | 3800   | 0.500      |
|          | NKJ65/35    | 65   | 90   | 35   | 73                | 0.6                    | 2.0                 | 82.5            | 173            | 5800                               | 3800   | 0.690      |
|          | NKJS65      | 65   | 95   | 28   | 75                | 1.1                    | 1.5                 | 76.5            | 132            | 5800                               | 3700   | 0.655      |
| 70       | NKJ70/25    | 70   | 95   | 25   | 80                | 1.0                    | 2.0                 | 65.0            | 131            | 5300                               | 3400   | 0.561      |
|          | NKJ70/35    | 70   | 95   | 35   | 80                | 1.0                    | 3.5                 | 79.7            | 184            | 5300                               | 3400   | 0.779      |
|          | NKJS70      | 70   | 100  | 28   | 80                | 1.1                    | 1.5                 | 80.1            | 143            | 5400                               | 3500   | 0.772      |
| 75       | NKJ75/25    | 75   | 105  | 25   | 85                | 1.0                    | 2.0                 | 76.4            | 137            | 5000                               | 3300   | 0.640      |
|          | NKJS75      | 75   | 105  | 32   | 90                | 1.1                    | 1.5                 | 91.5            | 176            | 4700                               | 3100   | 0.060      |
|          | NKJ75/35    | 75   | 105  | 35   | 85                | 1.0                    | 2.0                 | 108             | 214            | 5000                               | 3300   | 0.050      |
| 80       | NKJ80/25    | 80   | 110  | 25   | 90                | 1.0                    | 2.0                 | 79.5            | 147            | 4700                               | 3100   | 0.790      |
|          | NKJS80      | 80   | 110  | 32   | 95                | 1.1                    | 2.0                 | 95.1            | 188            | 4500                               | 2900   | 1.140      |
|          | NKJ80/35    | 80   | 110  | 35   | 90                | 1.0                    | 2.0                 | 113             | 230            | 4700                               | 3100   | 0.980      |
| 85       | NKJ85/26    | 85   | 115  | 26   | 95                | 1.0                    | 3.0                 | 49.3            | 114            | 4400                               | 2800   | 0.862      |
|          | NKJ85/36    | 85   | 115  | 36   | 95                | 1.0                    | 2.0                 | 114             | 238            | 4400                               | 2800   | 1.040      |
| 90       | NKJ90/26    | 90   | 120  | 26   | 100               | 1.0                    | 3.0                 | 83.6            | 163            | 4200                               | 2800   | 0.780      |
|          | NKJ90/36    | 90   | 120  | 36   | 100               | 1.0                    | 2.5                 | 118             | 254            | 4200                               | 2800   | 1.080      |
| 95       | NKJ95/26    | 95   | 125  | 26   | 105               | 1.0                    | 2.5                 | 52.2            | 127            | 3900                               | 2600   | 0.935      |
|          | NKJ95/36    | 95   | 125  | 36   | 105               | 1.0                    | 3.5                 | 72.8            | 195            | 3900                               | 2600   | 1.300      |
| 100      | NKJ100/30   | 100  | 130  | 30   | 110               | 1.1                    | 2.0                 | 103             | 220            | 3800                               | 2500   | 0.984      |
|          | NKJ100/40   | 100  | 130  | 40   | 110               | 1.1                    | 2.0                 | 132             | 301            | 3800                               | 2500   | 1.410      |
|          | NKJS100     | 100  | 135  | 32   | 115               | 1.1                    | 2.0                 | 104             | 226            | 3700                               | 2400   | 2.010      |

# BEARINGS WITH CAGE | GUIDED NEEDLES WITHOUT INNER RING

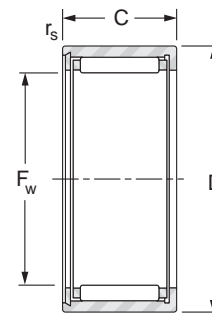
# 4.3



NK ( $F_w \leq 10$ )



NK, NKS

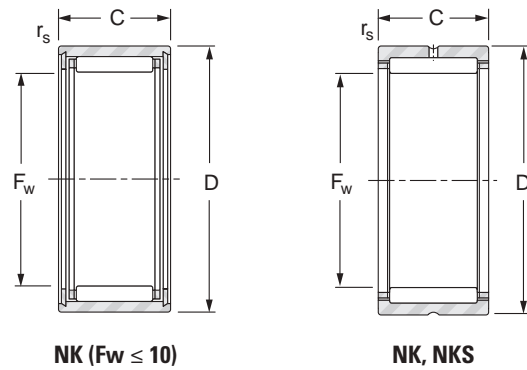


NKTN

| Shaft<br>mm | Designation | F <sub>w</sub><br>mm | D<br>mm | C<br>mm | r <sub>s</sub> min.<br>mm | Load ratings kN |                | Speed ratings kN<br>min <sup>-1</sup> |        | Weight.<br>kg |
|-------------|-------------|----------------------|---------|---------|---------------------------|-----------------|----------------|---------------------------------------|--------|---------------|
|             |             |                      |         |         |                           | Dynamic         | Static         | Oil                                   | Grease |               |
|             |             |                      |         |         |                           | C               | C <sub>0</sub> |                                       |        |               |
| 5           | NK5/10TN    | 5                    | 10      | 10      | 0.2                       | 2.18            | 1.71           | 47000                                 | 31000  | 0.004         |
|             | NK5/12TN    | 5                    | 10      | 12      | 0.2                       | 3.04            | 2.63           | 47000                                 | 31000  | 0.004         |
| 6           | NK6/10      | 6                    | 12      | 10      | 0.2                       | 3.19            | 2.90           | 44000                                 | 29000  | 0.005         |
|             | NK6/12TN    | 6                    | 12      | 12      | 0.2                       | 3.07            | 2.74           | 44000                                 | 29000  | 0.006         |
| 7           | NK7/10TN    | 7                    | 14      | 10      | 0.3                       | 2.74            | 2.44           | 42000                                 | 28000  | 0.007         |
|             | NK7/12TN    | 7                    | 14      | 12      | 0.3                       | 3.40            | 3.22           | 42000                                 | 28000  | 0.009         |
| 8           | NK8/12      | 8                    | 15      | 12      | 0.3                       | 4.57            | 4.89           | 41000                                 | 26000  | 0.011         |
|             | NK8/16      | 8                    | 15      | 16      | 0.3                       | 5.22            | 5.78           | 41000                                 | 26000  | 0.013         |
| 9           | NK9/12      | 9                    | 16      | 12      | 0.3                       | 4.27            | 4.60           | 40000                                 | 26000  | 0.012         |
|             | NK9/16      | 9                    | 16      | 16      | 0.3                       | 5.57            | 6.47           | 40000                                 | 26000  | 0.015         |
| 10          | NK10/12     | 10                   | 17      | 12      | 0.3                       | 5.40            | 6.43           | 39000                                 | 25000  | 0.013         |
|             | NK10/16TN   | 10                   | 17      | 16      | 0.3                       | 5.30            | 6.27           | 39000                                 | 25000  | 0.015         |
| 12          | NK12/12     | 12                   | 19      | 12      | 0.3                       | 6.86            | 7.60           | 30000                                 | 19000  | 0.013         |
|             | NK12/16     | 12                   | 19      | 16      | 0.3                       | 6.78            | 9.03           | 37000                                 | 24000  | 0.018         |
| 14          | NK14/16     | 14                   | 22      | 16      | 0.3                       | 12.4            | 14.8           | 24000                                 | 16000  | 0.023         |
|             | NK14/20     | 14                   | 22      | 20      | 0.3                       | 14.7            | 18.4           | 24000                                 | 16000  | 0.028         |
| 15          | NK15/16     | 15                   | 23      | 16      | 0.3                       | 12.4            | 15.0           | 24000                                 | 15000  | 0.024         |
|             | NK15/20     | 15                   | 23      | 20      | 0.3                       | 14.7            | 18.6           | 24000                                 | 15000  | 0.031         |
| 16          | NK16/16     | 16                   | 24      | 16      | 0.3                       | 15.4            | 20.2           | 28000                                 | 18000  | 0.025         |
|             | NK16/20     | 16                   | 24      | 20      | 0.3                       | 16.1            | 21.3           | 28000                                 | 18000  | 0.036         |
| 17          | NK17/16     | 17                   | 25      | 16      | 0.3                       | 13.6            | 17.5           | 27000                                 | 17000  | 0.027         |
|             | NK17/20     | 17                   | 25      | 20      | 0.3                       | 15.4            | 20.4           | 27000                                 | 17000  | 0.034         |
| 18          | NK18/16     | 18                   | 26      | 16      | 0.3                       | 13.6            | 17.7           | 25000                                 | 16000  | 0.028         |
|             | NK18/20     | 18                   | 26      | 20      | 0.3                       | 16.1            | 22.0           | 25000                                 | 16000  | 0.035         |
| 19          | NK19/16     | 19                   | 27      | 16      | 0.3                       | 14.1            | 19.0           | 24000                                 | 15000  | 0.029         |
|             | NK19/20     | 19                   | 27      | 20      | 0.3                       | 18.8            | 23.6           | 24000                                 | 15000  | 0.037         |
|             | NKS19       | 19                   | 30      | 16      | 0.3                       | 15.9            | 16.2           | 26000                                 | 17000  | 0.045         |

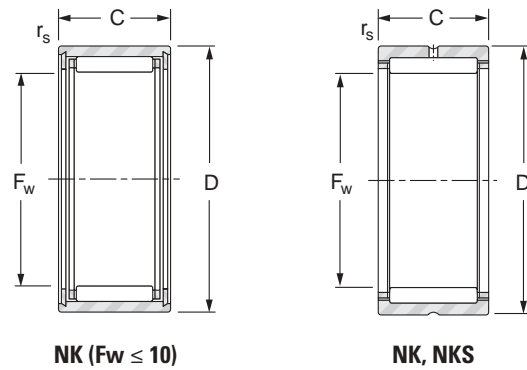


# BEARINGS WITH CAGE | GUIDED NEEDLES WITHOUT INNER RING



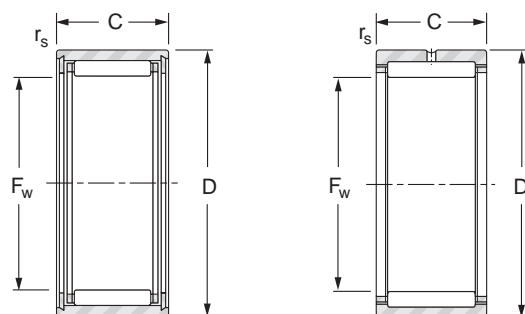
| Shaft mm | Designation | F <sub>w</sub> mm | D mm | C mm | r <sub>s</sub> min. mm | Load ratings kN |                | Speed ratings kN min <sup>-1</sup> |        | Weight. kg |
|----------|-------------|-------------------|------|------|------------------------|-----------------|----------------|------------------------------------|--------|------------|
|          |             |                   |      |      |                        | Dynamic         | Static         | Oil                                | Grease |            |
|          |             |                   |      |      |                        | C               | C <sub>0</sub> |                                    |        |            |
| 20       | NK20/16     | 20                | 28   | 16   | 0.3                    | 14.1            | 19.1           | 22000                              | 14000  | 0.030      |
|          | NK20/20     | 20                | 28   | 20   | 0.3                    | 17.5            | 25.3           | 22000                              | 14000  | 0.038      |
|          | NKS20       | 20                | 32   | 20   | 0.6                    | 24.4            | 26.7           | 24000                              | 15000  | 0.058      |
| 21       | NK21/16     | 21                | 29   | 16   | 0.3                    | 15.3            | 21.6           | 21000                              | 14000  | 0.032      |
|          | NK21/20     | 21                | 29   | 20   | 0.3                    | 18.1            | 26.9           | 21000                              | 14000  | 0.040      |
| 22       | NK22/16     | 22                | 30   | 16   | 0.3                    | 15.2            | 21.7           | 20000                              | 13000  | 0.033      |
|          | NK22/20     | 22                | 30   | 20   | 0.3                    | 18.0            | 27.0           | 20000                              | 13000  | 0.041      |
|          | NKS22       | 22                | 35   | 20   | 0.6                    | 22.9            | 27.1           | 21000                              | 14000  | 0.069      |
| 24       | NK24/16     | 24                | 32   | 16   | 0.3                    | 16.2            | 24.3           | 18000                              | 12000  | 0.035      |
|          | NK24/20     | 24                | 32   | 20   | 0.3                    | 19.3            | 30.3           | 18000                              | 12000  | 0.045      |
|          | NKS24       | 24                | 37   | 20   | 0.6                    | 29.1            | 32.8           | 20000                              | 13000  | 0.073      |
| 25       | NK25/16     | 25                | 33   | 16   | 0.3                    | 16.1            | 24.4           | 17000                              | 11000  | 0.037      |
|          | NK25/20     | 25                | 33   | 20   | 0.3                    | 19.1            | 30.4           | 17000                              | 11000  | 0.047      |
|          | NKS25       | 25                | 38   | 20   | 0.6                    | 29.1            | 33.0           | 19000                              | 12000  | 0.076      |
| 26       | NK26/16     | 26                | 34   | 16   | 0.3                    | 16.6            | 25.7           | 17000                              | 11000  | 0.039      |
|          | NK26/20     | 26                | 34   | 20   | 0.3                    | 19.7            | 32.0           | 17000                              | 11000  | 0.048      |
| 28       | NK28/20     | 28                | 37   | 20   | 0.3                    | 22.6            | 34.4           | 16000                              | 11000  | 0.057      |
|          | NK28/30     | 28                | 37   | 30   | 0.3                    | 29.0            | 53.8           | 16000                              | 11000  | 0.088      |
|          | NKS28       | 28                | 42   | 20   | 0.6                    | 30.3            | 38.4           | 16000                              | 11000  | 0.094      |
| 29       | NK29/20     | 29                | 38   | 20   | 0.3                    | 23.4            | 36.4           | 15000                              | 9800   | 0.059      |
|          | NK29/30     | 29                | 38   | 30   | 0.3                    | 29.8            | 56.4           | 15000                              | 9700   | 0.090      |
| 30       | NK30/20     | 30                | 40   | 20   | 0.3                    | 24.2            | 38.3           | 15000                              | 9500   | 0.071      |
|          | NK30/30     | 30                | 40   | 30   | 0.3                    | 34.7            | 61.0           | 15000                              | 9500   | 0.107      |
|          | NKS30       | 30                | 45   | 20   | 0.6                    | 34.3            | 42.8           | 15000                              | 9900   | 0.114      |
| 32       | NK32/20     | 32                | 42   | 20   | 0.3                    | 24.8            | 40.4           | 14000                              | 8800   | 0.074      |
|          | NK32/30     | 32                | 42   | 30   | 0.3                    | 35.6            | 64.3           | 14000                              | 8800   | 0.112      |
|          | NKS32       | 32                | 47   | 22   | 0.6                    | 36.0            | 46.2           | 14000                              | 9200   | 0.120      |
| 35       | NK35/20     | 35                | 45   | 20   | 0.3                    | 26.1            | 44.4           | 12000                              | 8000   | 0.081      |
|          | NK35/30     | 35                | 45   | 30   | 0.3                    | 37.4            | 70.6           | 12000                              | 8000   | 0.122      |
|          | NKS35       | 35                | 50   | 22   | 0.6                    | 37.5            | 49.9           | 13000                              | 8400   | 0.130      |

# 4.3



| Shaft mm | Designation | F <sub>w</sub> mm | D mm | B mm | r <sub>s min.</sub> mm | Load ratings kN |                | Speed ratings kN min <sup>-1</sup> |        | Weight. kg |
|----------|-------------|-------------------|------|------|------------------------|-----------------|----------------|------------------------------------|--------|------------|
|          |             |                   |      |      |                        | Dynamic         | Static         | Oil                                | Grease |            |
|          |             |                   |      |      |                        | C               | C <sub>0</sub> |                                    |        |            |
| 37       | NK37/20     | 37                | 47   | 20   | 0.3                    | 26.6            | 46.4           | 12000                              | 7600   | 0.084      |
|          | NK37/30     | 37                | 47   | 30   | 0.3                    | 38.2            | 73.9           | 12000                              | 7600   | 0.128      |
|          | NKS37       | 37                | 52   | 22   | 0.6                    | 39.0            | 53.4           | 12000                              | 7900   | 0.134      |
| 38       | NK38/20     | 38                | 48   | 20   | 0.3                    | 21.7            | 40.9           | 11000                              | 7300   | 0.087      |
|          | NK38/30     | 38                | 48   | 30   | 0.3                    | 31.9            | 67.0           | 11000                              | 7300   | 0.131      |
| 40       | NK40/20     | 40                | 50   | 20   | 0.3                    | 27.8            | 50.4           | 11000                              | 7000   | 0.089      |
|          | NK40/30     | 40                | 50   | 30   | 0.3                    | 40.0            | 80.2           | 11000                              | 7000   | 0.137      |
|          | NKS40       | 40                | 55   | 22   | 0.6                    | 40.3            | 57.0           | 11000                              | 7200   | 0.140      |
| 42       | NK42/20     | 42                | 52   | 20   | 0.3                    | 28.3            | 52.4           | 10000                              | 6600   | 0.085      |
|          | NK42/30     | 42                | 52   | 30   | 0.3                    | 40.7            | 83.5           | 10000                              | 6600   | 0.141      |
| 43       | NK43/20     | 43                | 53   | 20   | 0.3                    | 29.0            | 54.4           | 9900                               | 6400   | 0.096      |
|          | NK43/30     | 43                | 53   | 30   | 0.3                    | 41.6            | 86.6           | 9900                               | 6400   | 0.134      |
|          | NKS43       | 43                | 58   | 22   | 0.6                    | 41.6            | 60.7           | 10000                              | 6700   | 0.150      |
| 45       | NK45/20     | 45                | 55   | 20   | 0.3                    | 29.5            | 56.4           | 9400                               | 6100   | 0.100      |
|          | NK45/30     | 45                | 55   | 30   | 0.3                    | 42.3            | 89.8           | 9400                               | 6100   | 0.151      |
|          | NKS45       | 45                | 60   | 22   | 0.6                    | 43.0            | 64.2           | 9800                               | 6400   | 0.156      |
| 47       | NK47/20     | 47                | 57   | 20   | 0.3                    | 30.0            | 58.5           | 9000                               | 5900   | 0.104      |
|          | NK47/30     | 47                | 57   | 30   | 0.3                    | 43.0            | 93.1           | 9000                               | 5900   | 0.158      |
| 50       | NK50/25     | 50                | 62   | 25   | 0.3                    | 40.7            | 79.3           | 8500                               | 5500   | 0.171      |
|          | NK50/35     | 50                | 62   | 35   | 0.6                    | 55.0            | 117            | 8500                               | 5500   | 0.242      |
|          | NKS50       | 50                | 65   | 22   | 1.0                    | 45.5            | 71.3           | 8700                               | 5700   | 0.170      |
| 55       | NK55/25     | 55                | 68   | 25   | 0.6                    | 46.1            | 87.3           | 7800                               | 5000   | 0.207      |
|          | NK55/35     | 55                | 68   | 35   | 0.6                    | 62.3            | 129            | 7800                               | 5000   | 0.293      |
|          | NKS55       | 55                | 72   | 22   | 1.0                    | 47.9            | 78.4           | 7900                               | 5100   | 0.225      |
| 60       | NK60/25     | 60                | 72   | 25   | 0.6                    | 44.3            | 94.0           | 7000                               | 4400   | 0.202      |
|          | NK60/35     | 60                | 72   | 35   | 0.6                    | 59.9            | 139            | 7000                               | 4400   | 0.286      |
|          | NKS60       | 60                | 80   | 28   | 1.1                    | 66.9            | 103            | 7300                               | 4800   | 0.337      |
| 65       | NK65/25     | 65                | 78   | 25   | 0.6                    | 48.2            | 97.7           | 6500                               | 4200   | 0.257      |
|          | NK65/35     | 65                | 78   | 35   | 0.6                    | 65.2            | 144            | 6500                               | 4200   | 0.298      |
|          | NKS65       | 65                | 85   | 28   | 1.1                    | 71.0            | 114            | 6700                               | 4200   | 0.362      |

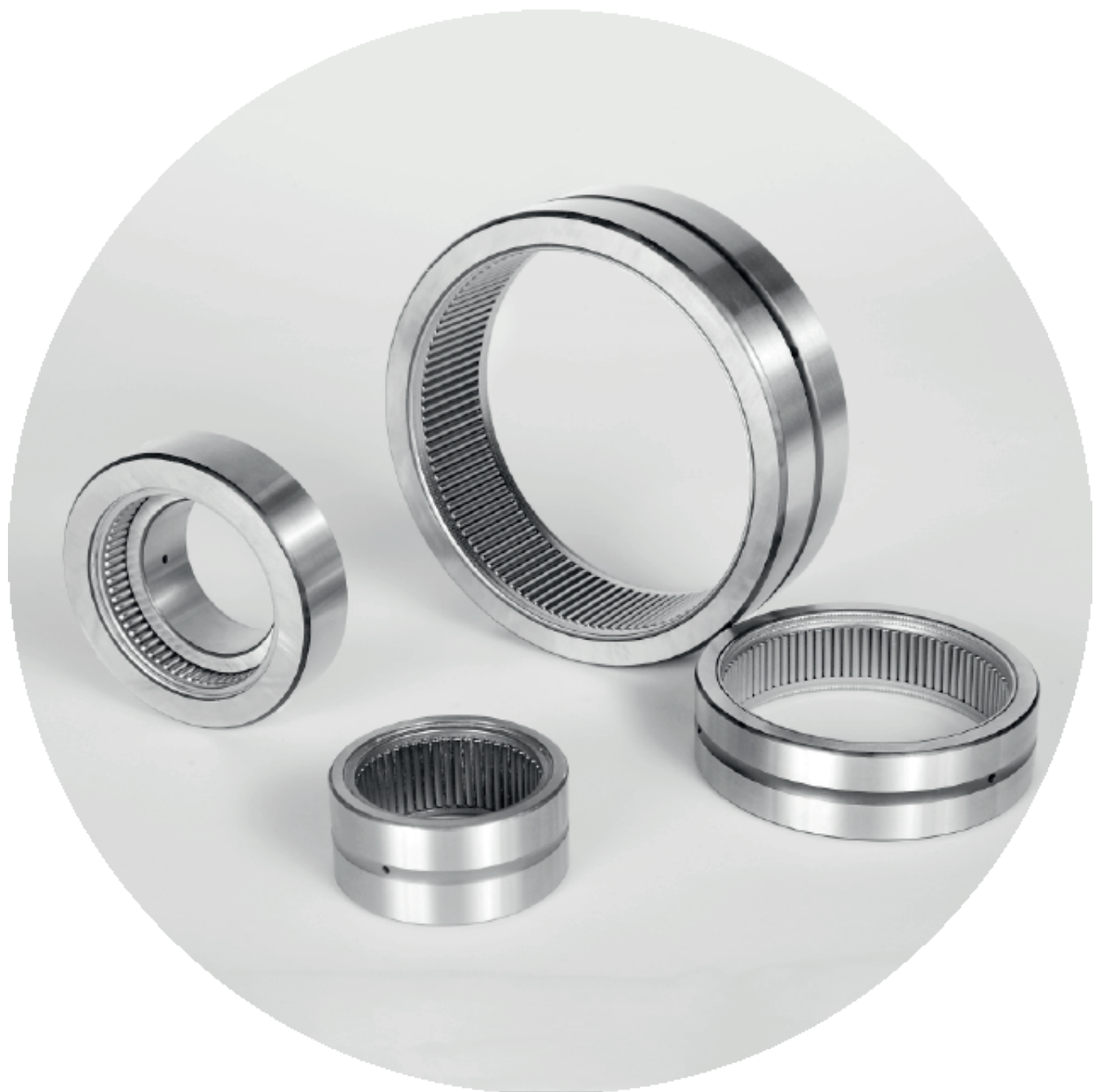
# BEARINGS WITH CAGE | GUIDED NEEDLES WITHOUT INNER RING



**NK ( $F_w \leq 10$ )**

**NK, NKS**

| Shaft mm | Designation | $F_w$ mm | D mm | B mm | $r_s$ min. mm | Load ratings kN |        | Speed ratings kN min <sup>-1</sup> |        | Weight. kg |
|----------|-------------|----------|------|------|---------------|-----------------|--------|------------------------------------|--------|------------|
|          |             |          |      |      |               | Dynamic         | Static |                                    |        |            |
|          |             |          |      |      |               | C               | $C_0$  | Oil                                | Grease |            |
| 68       | NK68/25     | 68       | 82   | 25   | 0.6           | 49.0            | 101    | 6200                               | 4000   | 0.287      |
|          | NK68/35     | 68       | 82   | 35   | 0.6           | 66.2            | 149    | 6200                               | 4000   | 0.350      |
| 70       | NK70/25     | 70       | 85   | 25   | 0.6           | 43.6            | 87.9   | 6000                               | 3900   | 0.298      |
|          | NK70/35     | 70       | 85   | 35   | 0.6           | 62.2            | 139    | 6000                               | 3900   | 0.411      |
|          | NKS70       | 70       | 90   | 28   | 1.1           | 72.6            | 120    | 6200                               | 4000   | 0.383      |
| 73       | NK73/25     | 73       | 90   | 25   | 0.6           | 61.5            | 119    | 5800                               | 3800   | 0.320      |
|          | NK73/35     | 73       | 90   | 35   | 0.6           | 82.5            | 173    | 5800                               | 3800   | 0.450      |
| 75       | NK75/25     | 75       | 92   | 25   | 0.6           | 43.7            | 90.2   | 5600                               | 3600   | 0.364      |
|          | NK75/35     | 75       | 92   | 35   | 0.6           | 60.9            | 138    | 5600                               | 3600   | 0.518      |
|          | NKS75       | 75       | 95   | 28   | 1.1           | 76.5            | 132    | 5800                               | 3700   | 0.413      |
| 80       | NK80/25     | 80       | 95   | 25   | 1.0           | 65.0            | 131    | 5300                               | 3400   | 0.331      |
|          | NK80/35     | 80       | 95   | 35   | 1.0           | 79.7            | 184    | 5300                               | 3400   | 0.380      |
| 85       | NK85/25     | 85       | 105  | 25   | 1.0           | 76.4            | 137    | 5000                               | 3300   | 0.506      |
|          | NK85/35     | 85       | 105  | 35   | 1.0           | 108             | 214    | 5000                               | 3300   | 0.610      |
| 90       | NK90/25     | 90       | 110  | 25   | 1.0           | 79.5            | 147    | 4700                               | 3100   | 0.450      |
|          | NK90/35     | 90       | 110  | 35   | 1.0           | 113             | 230    | 4700                               | 3100   | 0.745      |
| 95       | NK95/26     | 95       | 115  | 26   | 1.0           | 49.3            | 114    | 4400                               | 2800   | 0.572      |
|          | NK95/36     | 95       | 115  | 36   | 1.0           | 114             | 238    | 4500                               | 2900   | 0.803      |
| 100      | NK100/26    | 100      | 120  | 26   | 1.0           | 83.6            | 163    | 4200                               | 2800   | 0.530      |
|          | NK100/36    | 100      | 120  | 36   | 1.0           | 118             | 254    | 4200                               | 2800   | 0.658      |
| 105      | NK105/26    | 105      | 125  | 26   | 1.0           | 52.2            | 127    | 3900                               | 2600   | 0.595      |
| 110      | NK110/30    | 110      | 130  | 30   | 1.1           | 103             | 220    | 3800                               | 2500   | 0.660      |
|          | NK110/40    | 110      | 130  | 40   | 1.1           | 132             | 301    | 3800                               | 2500   | 0.900      |



# FULL COMPLEMENT NEEDLE BEARINGS

# 5

PAGE 82

5.1 TECHNICAL SPECIFICATIONS

PAGE 96

5.2 FULL COMPLEMENT NEEDLE BEARINGS WITH INNER RING

# FULL COMPLEMENT NEEDLE BEARINGS

## TECHNICAL SPECIFICATIONS



Full complement needle bearings have a through hardened outer ring which results in high static and dynamic load capacities and an ability to withstand overloading, shocks and vibration.

They are particularly suitable for operations involving oscillating motion but may also accept high speed conditions where good alignment is necessary.

This can more easily be achieved using a convex inner ring raceway (inner rings with suffix R6).

The retention of the needles in the outer ring enables the bearing to be installed easily during assembly.

The difference between the needle bearings with integral end flanges series 3000 and the others is explained in the Chapter of the Bearings with cages.

These bearings are available with or without an inner ring from 12 mm bore size. Standard complete bearings type NA have an inner ring with convex raceway form.

If extra wide inner rings or rings with lubrication hole are required, they should be ordered separately for use with the corresponding RNA series.

Reference standards are:

- ISO 1206 - Needle roller bearings – Light and medium-series – Dimensions and tolerances.

### FULL COMPLEMENT BEARINGS WITHOUT INNER RING

The shaft journal which is used directly as the inner ring raceway of the bearing should have adequate hardness and satisfactory surface finish.

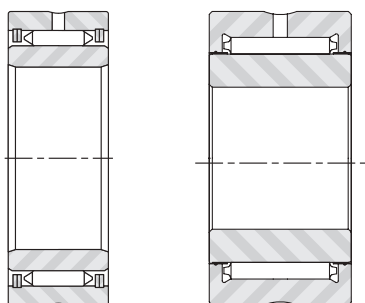
A hardness of 58-64 HRC will ensure full load capacity for the bearing. Lower hardness figures will entail a reduction in both static and dynamic capacities as shown in the table of dimensions (see Technical Section).

In cases of misalignment, a convex inner ring raceway can be machined directly at the shaft journal position by grinding, using a concave profile and inclining the diamond impregnated grinding wheel.

A convex inner ring raceway calculated to permit misalignment of 1 in 1000 does not affect bearing load capacity. A larger convex radius is necessary for a greater degree of misalignment but this will reduce the effective bearing load capacity.

### TYPES OF BEARINGS

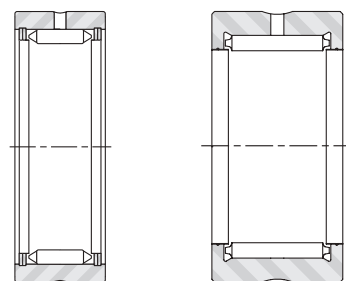
#### Needle roller bearings with inner rings



NA Serie 1000,  
2000, 22000

NA Serie 3000

#### Needle roller bearings without inner rings



RNA Serie 1000,  
2000, 22000

RNA Serie 3000

## INNER RINGS

Inner rings made from high quality bearing steel heat treated and through-hardened avoid any necessity for heat treatment of the shaft and enable the bearings to operate within their full load capacity.

### Inner rings with convex raceway “R6”

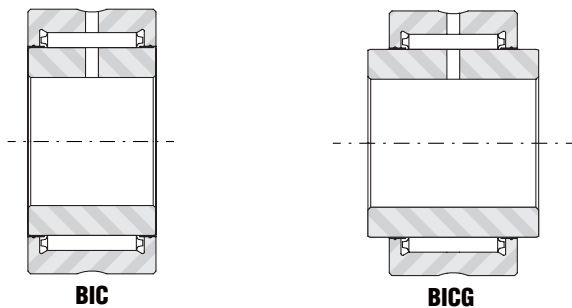
The inner rings without lubrication hole are of the same width as the outer ring and are supplied with series **NA** complete, types **1000**, **2000**, **22000** and **3000**. They can accept a misalignment of 1 in 1000 in continuous operation and up to 2 in 1000 temporarily, as in the case of sudden deflection due to overload conditions. The inner and outer rings may be displaced axially from one to the other by up to 5% of the ring width. The designation of the inner ring separated from the complete needle bearing is BI number R6. For example BI 2020 R6. The designation of the needle bearings complete of inner ring BI...R6 is NA number.

For example NA 2035.

### Inner rings with cylindrical raceway

Cylindrical inner rings of the same bore as those with convex raceway may be supplied on request in the following versions:

- with oil hole permitting lubrication through the shaft (BIC).
- wider than corresponding outer ring (BICG), to enable a displacement in position of one ring relative to the other (e.g. Expansion of the shaft) or lateral shaft movement. In the latter case, which can occur with or without simultaneous rotation of the shaft, please consult Nadella Technical Service.



The use of cylindrical inner rings with standard bearings type **RNA** series **1000**, **2000**, **22000** and **3000** requires that the housing and shaft be correctly aligned at assembly with due regard to the application under load.

If it is not essential to use these inner rings, it is always preferable to use complete bearings type **NA** with convex inner rings type “**R6**”, without oil hole, of the same width as the outer ring. In particular cases where lubrication is provided through the shaft, the inner ring with oil hole may be replaced by a lubrication hole at the face of the inner ring.

## RING TOLERANCES

Inner and outer rings for full complement standard needle bearings are manufactured in accordance with the tolerance class of ISO Standard 492 (class zero according to DIN 620). Closer tolerances, corresponding to classes 6, 5 and 4 may be necessary for special high precision applications (symbols P6, P5, P4).

See table at the end of the catalogue.

## RADIALPLAY

### Bearings without inner ring

The radial play of a bearing without inner ring results from the difference in diameter beneath the needles and the size of the shaft. The standard diameter beneath the needles for **RNA** bearings with the recommended shaft tolerances should provide suitable radial play for most normal applications.

For special applications (high precision, close fits, etc.), we can offer the diameter beneath the needles selected as follows:

- In the bottom half of the normal tolerance (**RNA ... TB**)
- In the upper half of the normal tolerance (**RNA...TC**).

Bearings without inner ring tolerance Class **TB** mounted on a shaft with k5 tolerance will have a reduced radial play suitable for certain applications.

| Nominal dimension<br>$F_w$<br>mm |     | Tolerance of diameter under needles |                              |                              |
|----------------------------------|-----|-------------------------------------|------------------------------|------------------------------|
|                                  |     | Normal<br>$\mu\text{m}$             | Selected TB<br>$\mu\text{m}$ | Selected TC<br>$\mu\text{m}$ |
| Above                            | To  |                                     |                              |                              |
| 5                                | 15  | +20 + 40                            | +20 +31                      | + 29 + 40                    |
| 15                               | 25  | +20 + 43                            | +20 +33                      | + 30 + 43                    |
| 25                               | 30  | +25 + 48                            | +25 +38                      | + 35 + 48                    |
| 30                               | 35  | +30 + 53                            | +30 + 43                     | + 40 + 53                    |
| 35                               | 60  | +35 + 58                            | +35 + 48                     | + 45 + 58                    |
| 60                               | 80  | +45 + 73                            | +45 + 60                     | + 58 + 73                    |
| 80                               | 115 | +50 + 78                            | +50 + 65                     | + 63 + 78                    |
| 115                              | 180 | +60 + 88                            | +60 + 75                     | + 73 + 88                    |
| 180                              | 220 | +70 +103                            | +70 + 88                     | + 85 +103                    |
| 220                              | 270 | +80 +113                            | +80 + 98                     | + 95 +113                    |
| 270                              | 350 | +90 +128                            | +90 +110                     | +108 +128                    |
| Examples of bearing              |     | RNA 1020                            | RNA 1020<br>TB               | RNA 1020<br>TC               |

# FULL COMPLEMENT NEEDLE BEARINGS

## TECHNICAL SPECIFICATIONS

### Standard complete bearings with inner ring

Complete bearings type NA are offered with a radial play that is suitable for the majority of applications.

They can be supplied if necessary:

- with the radial play selected from the bottom half of the normal tolerance (NA...TB)
- with the radial play selected from the upper half of the normal tolerance (NA...TC).

For bore dimensions  $d > 130$  mm, bearings NA...TB or NA...TC are supplied only on special request.

### Radial play of full complement bearings with convex inner ring "R6"

Series 1000, 2000, 22000

| Inner ring dimension d mm |     | Standard play $\mu\text{m}$ |      | Selected TB $\mu\text{m}$ |      | Selected TC $\mu\text{m}$ |      |
|---------------------------|-----|-----------------------------|------|---------------------------|------|---------------------------|------|
| Above                     | To  | Min.                        | Max. | Min.                      | Max. | Min.                      | Max. |
| 12                        | 20  | 20                          | 50   | 20                        | 35   | 35                        | 50   |
| 20                        | 25  | 25                          | 60   | 25                        | 43   | 42                        | 60   |
| 25                        | 30  | 30                          | 65   | 30                        | 48   | 47                        | 65   |
| 30                        | 50  | 35                          | 70   | 35                        | 53   | 52                        | 70   |
| 50                        | 55  | 45                          | 85   | 45                        | 65   | 65                        | 85   |
| 55                        | 65  | 45                          | 90   | 45                        | 68   | 67                        | 90   |
| 65                        | 70  | 45                          | 95   | 45                        | 70   | 70                        | 95   |
| 70                        | 105 | 50                          | 100  | 50                        | 75   | 75                        | 100  |
| 105                       | 125 | 60                          | 115  | 60                        | 88   | 87                        | 115  |
| 120                       | 140 | 80                          | 145  | 80                        | 113  | 112                       | 145  |
| 140                       | 170 | 100                         | 165  | -                         | -    | -                         | -    |
| 170                       | 190 | 120                         | 185  | -                         | -    | -                         | -    |
| 190                       | 210 | 130                         | 200  | -                         | -    | -                         | -    |
| 210                       | 230 | 130                         | 205  | -                         | -    | -                         | -    |
| 230                       | 260 | 160                         | 235  | -                         | -    | -                         | -    |
| 260                       | 290 | 180                         | 260  | -                         | -    | -                         | -    |
| 290                       | 310 | 180                         | 265  | -                         | -    | -                         | -    |

Series 3000

| Inner ring dimension d mm |     | Standard play $\mu\text{m}$ |      | Selected TB $\mu\text{m}$ |      | Selected TC $\mu\text{m}$ |      |
|---------------------------|-----|-----------------------------|------|---------------------------|------|---------------------------|------|
| Above                     | To  | Min.                        | Max. | Min.                      | Max. | Min.                      | Max. |
| 30                        | 45  | 35                          | 70   | 35                        | 53   | 52                        | 70   |
| 45                        | 55  | 45                          | 85   | 45                        | 65   | 65                        | 85   |
| 55                        | 65  | 45                          | 90   | 45                        | 68   | 67                        | 90   |
| 65                        | 70  | 50                          | 95   | 50                        | 73   | 72                        | 95   |
| 70                        | 100 | 50                          | 100  | 50                        | 75   | 75                        | 100  |
| 100                       | 105 | 60                          | 110  | 60                        | 85   | 85                        | 110  |
| 105                       | 130 | 60                          | 115  | 60                        | 88   | 87                        | 115  |
| 130                       | 140 | 80                          | 145  | 80                        | 113  | 112                       | 145  |
| 140                       | 170 | 100                         | 165  | -                         | -    | -                         | -    |
| 170                       | 190 | 120                         | 185  | -                         | -    | -                         | -    |
| 190                       | 210 | 130                         | 200  | -                         | -    | -                         | -    |
| 210                       | 230 | 130                         | 200  | -                         | -    | -                         | -    |
| 230                       | 260 | 160                         | 235  | -                         | -    | -                         | -    |
| 260                       | 290 | 180                         | 260  | -                         | -    | -                         | -    |
| 290                       | 310 | 180                         | 265  | -                         | -    | -                         | -    |

### Radial play of full complement bearings with cylindrical inner ring (not R6)

Series 1000, 22000

| Inner ring dimension d mm |    | Standard play $\mu\text{m}$ |      | Selected TB $\mu\text{m}$ |      | Selected TC $\mu\text{m}$ |      |
|---------------------------|----|-----------------------------|------|---------------------------|------|---------------------------|------|
| Above                     | To | Min.                        | Max. | Min.                      | Max. | Min.                      | Max. |
| 12                        | 17 | 20                          | 50   | 20                        | 35   | 35                        | 50   |
| 17                        | 20 | 30                          | 60   | 30                        | 45   | 45                        | 60   |
| 20                        | 25 | 35                          | 70   | 35                        | 53   | 52                        | 70   |
| 25                        | 30 | 40                          | 75   | 40                        | 58   | 57                        | 75   |
| 30                        | 35 | 45                          | 80   | 45                        | 63   | 62                        | 80   |
| 35                        | 50 | 50                          | 85   | 50                        | 68   | 67                        | 85   |
| 50                        | 55 | 60                          | 100  | 60                        | 80   | 80                        | 100  |
| 55                        | 65 | 60                          | 105  | 60                        | 83   | 82                        | 105  |
| 65                        | 70 | 60                          | 110  | 60                        | 85   | 85                        | 110  |
| 70                        | 90 | 65                          | 115  | 65                        | 90   | 90                        | 115  |

Series 2000

| Inner ring dimension d mm |     | Standard play $\mu\text{m}$ |      | Selected TB $\mu\text{m}$ |      | Selected TC $\mu\text{m}$ |      |
|---------------------------|-----|-----------------------------|------|---------------------------|------|---------------------------|------|
| Above                     | To  | Min.                        | Max. | Min.                      | Max. | Min.                      | Max. |
| 15                        | 20  | 30                          | 60   | 30                        | 45   | 45                        | 60   |
| 20                        | 25  | 35                          | 70   | 35                        | 53   | 52                        | 70   |
| 25                        | 30  | 40                          | 75   | 40                        | 58   | 57                        | 75   |
| 30                        | 35  | 45                          | 80   | 45                        | 63   | 62                        | 80   |
| 35                        | 50  | 50                          | 85   | 50                        | 68   | 67                        | 85   |
| 50                        | 55  | 60                          | 100  | 60                        | 80   | 80                        | 100  |
| 55                        | 65  | 60                          | 105  | 60                        | 83   | 82                        | 105  |
| 65                        | 70  | 60                          | 110  | 60                        | 85   | 85                        | 110  |
| 70                        | 105 | 65                          | 115  | 65                        | 90   | 90                        | 115  |
| 105                       | 125 | 75                          | 130  | 75                        | 103  | 102                       | 130  |



## Series 3000

| Inner ring dimension d mm |     | Standard play $\mu\text{m}$ |      | Selected TB $\mu\text{m}$ |      | Selected TC $\mu\text{m}$ |      |
|---------------------------|-----|-----------------------------|------|---------------------------|------|---------------------------|------|
| Above                     | To  | Min.                        | Max. | Min.                      | Max. | Min.                      | Max. |
| 30                        | 45  | 50                          | 85   | 50                        | 68   | 67                        | 85   |
| 45                        | 55  | 60                          | 100  | 60                        | 80   | 80                        | 100  |
| 55                        | 65  | 60                          | 105  | 60                        | 83   | 82                        | 105  |
| 65                        | 70  | 65                          | 110  | 65                        | 88   | 87                        | 110  |
| 70                        | 100 | 65                          | 115  | 65                        | 90   | 90                        | 115  |
| 100                       | 105 | 75                          | 125  | 75                        | 100  | 100                       | 125  |
| 105                       | 130 | 75                          | 130  | 75                        | 103  | 102                       | 130  |
| 130                       | 140 | 95                          | 160  | 95                        | 128  | 127                       | 160  |
| 140                       | 170 | 125                         | 190  | -                         | -    | -                         | -    |
| 170                       | 190 | 145                         | 210  | -                         | -    | -                         | -    |
| 190                       | 210 | 160                         | 230  | -                         | -    | -                         | -    |

### BEARING MOUNTING

#### General requirements

In general, the mounting of needle roller bearings with or without inner rings, of normal precision, requires the shaft seat or raceway to be machined to quality IT5 or IT6. The housing bore should meet quality IT6 or IT7.

Other quality requirements for shaft and housings are given on page 13.

#### MOUNTING DIMENSIONS

It is recommended that needle roller bearings are mounted in their housings with a clearance fit if the load is stationary relative to the housing, and with a tight transition fit if the load rotates relative to the housing.

Table 2- Mounting tolerances for bearings without inner ring

| Rotation conditions                 | Nominal housing bore diameter D mm | ISO tolerance zone for housing | Nominal shaft diameter D mm | ISO tolerance zone for shaft |
|-------------------------------------|------------------------------------|--------------------------------|-----------------------------|------------------------------|
| Load stationary relative to housing | All diameters                      | J6                             | All diameters               | h5                           |
| Load rotates relative to housing    | All diameters                      | M6                             | All diameters               | g5                           |

**NOTE:** Care should be taken that the selected bearing internal clearance is appropriate for the operating conditions. Details of shaft and housing quality requirements are given on pages 13 and 14.

Table 2 lists the recommended tolerances for the housing bore and the shaft raceway for bearings without inner rings.

Table 3 lists the recommended shaft tolerances for the above two mounting conditions when the bearings are used with inner rings.

Other mounting dimensions may be required for special operating conditions such as:

1. Extremely heavy radial loads
2. Shock loads
3. Temperature gradient across bearing
4. Housing material with heat expansion coefficient different to that of the bearing
5. Oscillating movements

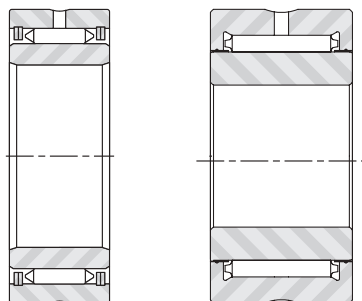
Table 3- Shaft tolerances for bearings with inner ring

| Rotation conditions                 | Nominal housing bore diameter D mm |     | ISO tolerance zone for housing | Nominal shaft diameter D mm | ISO tolerance zone for shaft |
|-------------------------------------|------------------------------------|-----|--------------------------------|-----------------------------|------------------------------|
|                                     | >                                  | </  |                                |                             |                              |
| Load stationary relative to housing | All diameters                      |     | h5 (h6)                        | All diameters               | J6                           |
| Load rotates relative to housing    | -                                  | 40  | k5                             | All diameters               | M6                           |
|                                     | 40                                 | 100 | m5                             |                             |                              |
|                                     | 100                                | 140 | m5                             |                             |                              |
|                                     | 140                                | -   | n6                             |                             |                              |

**NOTE:** Care should be taken that the selected bearing internal clearance is appropriate for the operating conditions. Details of shaft and housing quality requirements are given on pages 13 and 14.

# FULL COMPLEMENT NEEDLE BEARINGS WITH INNER RING

## NA 1000, 2000, 22000, 3000 SERIES



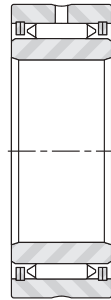
**NA Serie 1000,  
2000, 22000**

**NA Serie 3000**

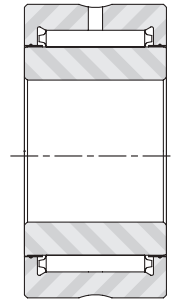
| Shaft<br>mm | Designation            | d<br>mm | D<br>mm | B<br>mm | F <sub>w</sub><br>mm | r <sub>s</sub> min.<br>mm | Load ratings kN |                | Speed ratings kN<br>min <sup>-1</sup> |        | Weight.<br>kg |
|-------------|------------------------|---------|---------|---------|----------------------|---------------------------|-----------------|----------------|---------------------------------------|--------|---------------|
|             |                        |         |         |         |                      |                           | Dynamic         | Static         | Oil                                   | Grease |               |
|             |                        |         |         |         |                      |                           | C               | C <sub>0</sub> |                                       |        |               |
| 12          | NA 1012 <sup>(1)</sup> | 12      | 28      | 15      | 17.6                 | 0.35                      | 11.0            | 16.5           | 22000                                 | 14000  | 0.050         |
| 15          | NA 1015 <sup>(1)</sup> | 15      | 32      | 15      | 20.8                 | 0.65                      | 12.4            | 19.5           | 18000                                 | 12000  | 0.044         |
|             | NA 2015 <sup>(1)</sup> | 15      | 35      | 22      | 22.1                 | 0.65                      | 23.5            | 37.5           | 17000                                 | 11000  | 0.082         |
| 17          | NA 1017 <sup>(1)</sup> | 17      | 35      | 15      | 23.9                 | 0.65                      | 13.7            | 22.5           | 16000                                 | 10000  | 0.047         |
| 20          | NA 1020                | 20      | 42      | 18      | 28.7                 | 0.65                      | 19.3            | 33.5           | 13000                                 | 8600   | 0.084         |
|             | NA 2020                | 20      | 42      | 22      | 28.7                 | 0.65                      | 28.5            | 49.0           | 13000                                 | 8600   | 0.104         |
| 25          | NA 1025                | 25      | 47      | 18      | 33.5                 | 0.65                      | 21.5            | 39.0           | 11000                                 | 7200   | 0.097         |
|             | NA 2025                | 25      | 47      | 22      | 33.5                 | 0.65                      | 33.0            | 60.0           | 11000                                 | 7200   | 0.122         |
|             | NA 22025               | 25      | 47      | 30      | 33.5                 | 0.65                      | 52.0            | 94.0           | 11000                                 | 7200   | 0.170         |
| 30          | NA 1030                | 30      | 52      | 18      | 38.2                 | 0.65                      | 23.5            | 44.5           | 10000                                 | 6500   | 0.107         |
|             | NA 2030                | 30      | 52      | 22      | 38.2                 | 0.65                      | 34.5            | 66.0           | 10000                                 | 6500   | 0.139         |
|             | NA 22030               | 30      | 52      | 30      | 38.2                 | 0.65                      | 57.0            | 108            | 10000                                 | 6500   | 0.193         |
|             | NA 3030                | 30      | 62      | 30      | 44.0                 | 0.65                      | 64.0            | 125            | 8600                                  | 5600   | 0.309         |
| 35          | NA 1035                | 35      | 58      | 18      | 44.0                 | 0.65                      | 26.0            | 51.0           | 8600                                  | 5600   | 0.127         |
|             | NA 2035                | 35      | 58      | 22      | 44.0                 | 0.65                      | 38.0            | 75.0           | 8600                                  | 5600   | 0.160         |
|             | NA 22035               | 35      | 58      | 30      | 44.0                 | 0.65                      | 63.0            | 124            | 8600                                  | 5600   | 0.225         |
|             | NA 3035                | 35      | 72      | 36      | 49.7                 | 0.65                      | 90.0            | 183            | 7600                                  | 4900   | 0.545         |
| 40          | NA 1040                | 40      | 65      | 18      | 49.7                 | 0.85                      | 28.5            | 58.0           | 7600                                  | 4900   | 0.160         |
|             | NA 2040                | 40      | 65      | 22      | 49.7                 | 0.85                      | 41.5            | 85.0           | 7600                                  | 4900   | 0.200         |
|             | NA 22040               | 40      | 65      | 30      | 49.7                 | 0.85                      | 68.0            | 140            | 7600                                  | 4900   | 0.278         |
|             | NA 3040                | 40      | 80      | 36      | 55.4                 | 0.85                      | 97.0            | 204            | 6900                                  | 4500   | 0.672         |
| 45          | NA 1045                | 45      | 72      | 18      | 55.4                 | 0.85                      | 30.5            | 65.0           | 6900                                  | 4500   | 0.193         |
|             | NA 2045                | 45      | 72      | 22      | 55.4                 | 0.85                      | 45.0            | 95.0           | 6900                                  | 4500   | 0.242         |
|             | NA 3045                | 45      | 85      | 38      | 62.1                 | 0.85                      | 105.0           | 230            | 6100                                  | 4000   | 0.710         |
| 50          | NA 1050                | 50      | 80      | 20      | 62.1                 | 0.85                      | 33.0            | 73.0           | 6100                                  | 4000   | 0.418         |
|             | NA 2050                | 50      | 80      | 28      | 62.1                 | 0.85                      | 64.0            | 142            | 6100                                  | 4000   | 0.603         |
|             | NA 3050                | 50      | 90      | 38      | 68.8                 | 0.85                      | 113.0           | 255            | 5500                                  | 3600   | 1,22          |

<sup>(1)</sup> Without holes and lubrication groove

# 5.2



**NA Serie 1000,  
2000, 22000**

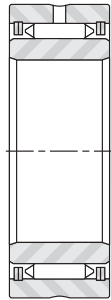


**NA Serie 3000**

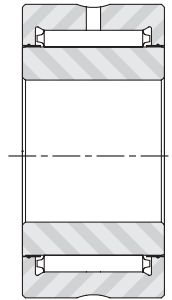
| Shaft<br>mm | Designation | d<br>mm | D<br>mm | B<br>mm | F <sub>w</sub><br>mm | r <sub>s</sub> min.<br>mm | Load ratings kN |                | Speed ratings kN<br>min <sup>-1</sup> |        | Weight.<br>kg |
|-------------|-------------|---------|---------|---------|----------------------|---------------------------|-----------------|----------------|---------------------------------------|--------|---------------|
|             |             |         |         |         |                      |                           | Dynamic         | Static         | Oil                                   | Grease |               |
|             |             |         |         |         |                      |                           | C               | C <sub>0</sub> |                                       |        |               |
| 55          | NA 1055     | 55      | 85      | 20      | 68.8                 | 0.85                      | 35.5            | so.0           | 5500                                  | 3600   | 0.258         |
|             | NA 2055     | 55      | 85      | 28      | 68.8                 | 0.85                      | 69              | 157            | 5500                                  | 3600   | 0.361         |
|             | NA 3055     | 55      | 95      | 38      | 72.6                 | 0.85                      | 117             | 268            | 5200                                  | 3400   | 0.782         |
| 60          | NA 1060     | 60      | 90      | 20      | 72.6                 | 0.85                      | 37              | 85,0           | 5200                                  | 3400   | 0.283         |
|             | NA 2060     | 60      | 90      | 28      | 72.6                 | 0.85                      | 72              | 165            | 5200                                  | 3400   | 0.413         |
|             | NA 3060     | 60      | 100     | 38      | 78.3                 | 0.85                      | 123             | 290            | 4900                                  | 3200   | 0.810         |
| 65          | NA 2065     | 65      | 95      | 28      | 78.3                 | 0.85                      | 78              | 184            | 4900                                  | 3200   | 0.433         |
|             | NA 3065     | 65      | 105     | 38      | 83.1                 | 0.85                      | 129             | 308            | 4500                                  | 2900   | 0.865         |
| 70          | NA 1070     | 70      | 100     | 20      | 83.1                 | 0.85                      | 43              | 103            | 4500                                  | 2900   | 0.322         |
|             | NA 2070     | 70      | 100     | 28      | 83,1                 | 0.85                      | 81              | 195            | 4500                                  | 2900   | 0.470         |
|             | NA 3070     | 70      | 110     | 38      | 88.0                 | 0.85                      | 134             | 325            | 4300                                  | 2800   | 0.906         |
| 75          | NA 2075     | 75      | 110     | 32      | 88.0                 | 0.85                      | 104             | 253            | 4300                                  | 2800   | 0.767         |
|             | NA 3075     | 75      | 120     | 38      | 96.0                 | 0.85                      | 142             | 355            | 4000                                  | 2600   | 1.098         |
| 80          | NA 1080     | 80      | 115     | 24      | 96.0                 | 0.85                      | 68              | 170            | 4000                                  | 2600   | 0.510         |
|             | NA 2080     | 80      | 115     | 32      | 96.0                 | 0.85                      | 110             | 275            | 4000                                  | 2600   | 0.694         |
|             | NA 3080     | 80      | 125     | 38      | 99.5                 | 0.85                      | 145             | 365            | 3800                                  | 2500   | 1.220         |
| 85          | NA 2085     | 85      | 120     | 32      | 99.5                 | 1.35                      | 113             | 285            | 3800                                  | 2500   | 0.787         |
|             | NA 3085     | 85      | 130     | 38      | 104.7                | 1.35                      | 150             | 390            | 3600                                  | 2300   | 1.252         |
| 90          | NA 2090     | 90      | 125     | 32      | 104.7                | 1.35                      | 117             | 300            | 3600                                  | 2300   | 0.837         |
|             | NA 3090     | 90      | 135     | 43      | 109.7                | 1.35                      | 185             | 480            | 3500                                  | 2300   | 1.522         |
| 95          | NA 2095     | 95      | 130     | 32      | 109.1                | 1.35                      | 120             | 315            | 3500                                  | 2300   | 0.882         |
|             | NA 3095     | 95      | 140     | 43      | 114.7                | 1.35                      | 190             | 505            | 3300                                  | 2100   | 1.551         |
| 100         | NA 2100     | 100     | 135     | 32      | 114.7                | 1.35                      | 125             | 330            | 3300                                  | 2100   | 0.677         |
|             | NA 3100     | 100     | 145     | 43      | 119.2                | 1.35                      | 195             | 520            | 3200                                  | 2100   | 1.645         |
| 105         | NA 2105     | 105     | 140     | 32      | 119.2                | 1.35                      | 129             | 340            | 3200                                  | 2100   | 0.941         |
|             | NA 3105     | 105     | 150     | 45      | 124.7                | 1.35                      | 203             | 550            | 3000                                  | 2000   | 1.762         |

# FULL COMPLEMENT NEEDLE BEARINGS WITH INNER RING

## NA 1000, 2000, 22000, 3000 SERIES



**NA Serie 1000,  
2000, 22000**



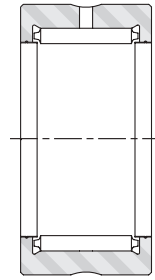
**NA Serie 3000**

| Shaft<br>mm | Designation | d<br>mm | D<br>mm | B<br>mm | F <sub>w</sub><br>mm | r <sub>s</sub> min.<br>mm | Load ratings kN |                | Speed ratings kN<br>min <sup>-1</sup> |        | Weight.<br>kg |
|-------------|-------------|---------|---------|---------|----------------------|---------------------------|-----------------|----------------|---------------------------------------|--------|---------------|
|             |             |         |         |         |                      |                           | Dynamic         | Static         | Oil                                   | Grease |               |
|             |             |         |         |         |                      |                           | C               | C <sub>0</sub> |                                       |        |               |
| 110         | NA 2110     | 110     | 145     | 34      | 124.7                | 1.35                      | 35.5            | so.0           | 5500                                  | 3600   | 0.258         |
|             | NA 3110     | 110     | 160     | 45      | 132.5                | 1.35                      | 69              | 157            | 5500                                  | 3600   | 0.361         |
| 115         | NA 2115     | 115     | 155     | 34      | 132.5                | 1.35                      | 117             | 268            | 5200                                  | 3400   | 0.782         |
|             | NA 3115     | 115     | 165     | 45      | 137.0                | 1.35                      | 37              | 85,0           | 5200                                  | 3400   | 0.283         |
| 120         | NA 2120     | 120     | 160     | 34      | 137.0                | 1.35                      | 72              | 165            | 5200                                  | 3400   | 0.413         |
|             | NA 3120     | 120     | 170     | 45      | 143.5                | 1.35                      | 123             | 290            | 4900                                  | 3200   | 0.810         |
| 125         | NA 2125     | 125     | 165     | 34      | 143.5                | 1.35                      | 78              | 184            | 4900                                  | 3200   | 0.433         |
| 130         | NA 2130     | 130     | 170     | 34      | 148.0                | 1.35                      | 129             | 308            | 4500                                  | 2900   | 0.865         |
| 140         | NA 2140     | 140     | 180     | 36      | 158.0                | 1.35                      | 43              | 103            | 4500                                  | 2900   | 0.322         |
|             | NA 3140     | 140     | 205     | 52      | 170.5                | 1.35                      | 81              | 195            | 4500                                  | 2900   | 0.470         |
| 150         | NA 2150     | 150     | 195     | 36      | 170.5                | 1.35                      | 134             | 325            | 4300                                  | 2800   | 0.906         |
| 160         | NA 2160     | 160     | 205     | 36      | 179.3                | 1.35                      | 104             | 253            | 4300                                  | 2800   | 0.767         |
| 170         | NA 2170     | 170     | 220     | 42      | 193.8                | 1.35                      | 142             | 355            | 4000                                  | 2600   | 1.098         |
| 180         | NA 2180     | 180     | 230     | 42      | 202.6                | 1.35                      | 68              | 170            | 4000                                  | 2600   | 0.510         |
| 190         | NA 2190     | 190     | 245     | 42      | 216.0                | 1.35                      | 110             | 275            | 4000                                  | 2600   | 0.694         |
| 200         | NA 2200     | 200     | 255     | 42      | 224.1                | 1.35                      | 145             | 365            | 3800                                  | 2500   | 1.220         |

# 5.2



**RNA Serie 1000,  
2000, 22000**



**RNA Serie 3000**

| Shaft<br>mm | Designation             | F <sub>w</sub><br>mm | D<br>mm | C<br>mm | E <sub>w</sub><br>mm | r <sub>s min.</sub><br>mm | Load ratings kN |                | Speed ratings kN<br>min <sup>-1</sup> |        | Weight.<br>kg |
|-------------|-------------------------|----------------------|---------|---------|----------------------|---------------------------|-----------------|----------------|---------------------------------------|--------|---------------|
|             |                         |                      |         |         |                      |                           | Dynamic         | Static         | Oil                                   | Grease |               |
|             |                         |                      |         |         |                      |                           | C               | C <sub>0</sub> |                                       |        |               |
| 7.3         | RNA 1005 <sup>(1)</sup> | 7.3                  | 16      | 12      | 12.3                 | 0.35                      | 3.95            | 4.45           | 52000                                 | 34000  | 0.010         |
| 9.7         | RNA 1007 <sup>(1)</sup> | 9.7                  | 19      | 12      | 14.7                 | 0.35                      | 4.80            | 5.90           | 39000                                 | 25000  | 0.013         |
| 12.1        | RNA 1009 <sup>(1)</sup> | 12.1                 | 22      | 12      | 17.1                 | 0.35                      | 5.60            | 7.40           | 31000                                 | 20000  | 0.018         |
| 14.4        | RNA 1010 <sup>(1)</sup> | 14.4                 | 24      | 12      | 19.4                 | 0.35                      | 6.35            | 8.90           | 26000                                 | 17000  | 0.020         |
| 17.6        | RNA 1012 <sup>(1)</sup> | 17.6                 | 28      | 15      | 22.6                 | 0.35                      | 11.0            | 16,5           | 22000                                 | 14000  | 0.034         |
| 20.8        | RNA 1015 <sup>(1)</sup> | 20.8                 | 32      | 15      | 25.8                 | 0.65                      | 12.4            | 19.5           | 18000                                 | 12000  | 0.044         |
| 22.1        | RNA 2015 <sup>(1)</sup> | 22.1                 | 35      | 22      | 28.1                 | 0.65                      | 23.5            | 37.5           | 17000                                 | 11000  | 0.082         |
| 23.9        | RNA 1017 <sup>(1)</sup> | 23.9                 | 35      | 15      | 28.9                 | 0.65                      | 13.7            | 22.5           | 16000                                 | 10000  | 0.047         |
| 28.7        | RNA 1020                | 28.7                 | 42      | 18      | 34.7                 | 0.65                      | 19.3            | 33.5           | 13000                                 | 8600   | 0.084         |
|             | RNA2020                 | 28.7                 | 42      | 22      | 34.7                 | 0.65                      | 28.5            | 49.0           | 13000                                 | 8600   | 0.104         |
| 33.5        | RNA 1025                | 33.5                 | 47      | 18      | 39.5                 | 0.65                      | 21.5            | 39.0           | 11000                                 | 7200   | 0.097         |
|             | RNA 2025                | 33.5                 | 47      | 22      | 39.5                 | 0.65                      | 33.0            | 60.0           | 11000                                 | 7200   | 0.122         |
|             | RNA 22025               | 33.5                 | 47      | 30      | 39.5                 | 0.65                      | 52.0            | 94.0           | 11000                                 | 7200   | 0.170         |
| 38.2        | RNA 1030                | 38.2                 | 52      | 18      | 44.2                 | 0.65                      | 23.5            | 44.5           | 10000                                 | 6500   | 0.107         |
|             | RNA2030                 | 38.2                 | 52      | 22      | 44.2                 | 0.65                      | 34.5            | 66,0           | 10000                                 | 6500   | 0.139         |
|             | RNA22030                | 38.2                 | 52      | 30      | 44.2                 | 0.65                      | 57.0            | 108.0          | 10000                                 | 6500   | 0.193         |
| 44          | RNA 1035                | 44.0                 | 58      | 18      | 50.0                 | 0.65                      | 26.0            | 51.0           | 8600                                  | 5600   | 0.127         |
|             | RNA 2035                | 44.0                 | 58      | 22      | 50.0                 | 0.65                      | 38.0            | 75.0           | 8600                                  | 5600   | 0.160         |
|             | RNA 22035               | 44.0                 | 58      | 30      | 50.0                 | 0.65                      | 63.0            | 124.0          | 8600                                  | 5600   | 0.225         |
|             | RNA 3030                | 44.0                 | 62      | 30      | 51.0                 | 0.65                      | 64.0            | 125.0          | 8600                                  | 5600   | 0.309         |
| 49.7        | RNA 1040                | 49.7                 | 65      | 18      | 55.7                 | 0.65                      | 28.5            | 58.0           | 7600                                  | 4900   | 0.160         |
|             | RNA2040                 | 49.7                 | 65      | 22      | 55.7                 | 0.65                      | 41.5            | 85.0           | 7600                                  | 4900   | 0.200         |
|             | RNA22040                | 49.7                 | 65      | 30      | 55.7                 | 0.65                      | 68.0            | 140.0          | 7600                                  | 4900   | 0.278         |
|             | RNA 3035                | 49.7                 | 72      | 36      | 56.8                 | 0.65                      | 90.0            | 183.0          | 7600                                  | 4900   | 0.545         |
| 55.4        | RNA 1045                | 55.4                 | 72      | 18      | 61.4                 | 0.85                      | 30.5            | 65.0           | 6900                                  | 4500   | 0.193         |
|             | RNA 2045                | 55.4                 | 72      | 22      | 61.4                 | 0.85                      | 45.0            | 95.0           | 6900                                  | 4500   | 0.242         |
|             | RNA 3040                | 55.4                 | 80      | 36      | 62.5                 | 0.85                      | 97.0            | 204.0          | 6900                                  | 4500   | 0.672         |

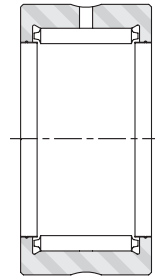
<sup>(1)</sup> Without holes and lubrication groove

# FULL COMPLEMENT NEEDLE BEARINGS WITH INNER RING

## NA 1000, 2000, 22000, 3000 SERIES



**RNA Serie 1000,  
2000, 22000**



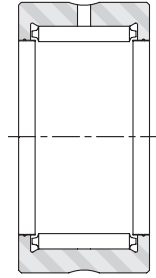
**RNA Serie 3000**

| Shaft mm | Designation | F <sub>w</sub> mm | D mm | C mm | E <sub>w</sub> mm | r <sub>s min.</sub> mm | Load ratings kN |                | Speed ratings kN min <sup>-1</sup> |        | Weight. kg |
|----------|-------------|-------------------|------|------|-------------------|------------------------|-----------------|----------------|------------------------------------|--------|------------|
|          |             |                   |      |      |                   |                        | Dynamic         | Static         | Oil                                | Grease |            |
|          |             |                   |      |      |                   |                        | C               | C <sub>0</sub> |                                    |        |            |
| 62.1     | RNA 1050    | 62.1              | 80   | 20   | 68.1              | 0.85                   | 33.0            | 73.0           | 6100                               | 4000   | 0.255      |
|          | RNA 2050    | 62.1              | 80   | 28   | 68.1              | 0.85                   | 64.0            | 142            | 6100                               | 4000   | 0.375      |
|          | RNA3045     | 62.1              | 85   | 38   | 69.2              | 0.85                   | 105.0           | 230            | 6100                               | 4000   | 0.710      |
| 68.8     | RNA 1055    | 68.8              | 85   | 20   | 74.8              | 0.85                   | 35.5            | 80.0           | 5500                               | 3600   | 0.258      |
|          | RNA 2055    | 68.8              | 85   | 28   | 74.8              | 0.85                   | 69.0            | 157            | 5500                               | 3600   | 0.361      |
|          | RNA 3050    | 68.8              | 90   | 38   | 75.9              | 0.85                   | 113.0           | 255            | 5500                               | 3600   | 0.705      |
| 72.6     | RNA 1060    | 72.6              | 90   | 20   | 78.6              | 0.85                   | 37.0            | 85.0           | 5200                               | 3400   | 0.283      |
|          | RNA.2060    | 72.6              | 90   | 28   | 78.6              | 0.85                   | 72.0            | 165            | 5200                               | 3400   | 0.413      |
|          | RNA3055     | 72.6              | 95   | 38   | 79.6              | 0.85                   | 117.0           | 268            | 5200                               | 3400   | 0.782      |
| 78.3     | RNA 1065    | 78.3              | 95   | 20   | 84.3              | 0.85                   | 41.5            | 97.0           | 4900                               | 3200   | 0.306      |
|          | RNA 2065    | 78.3              | 95   | 28   | 84.3              | 0.85                   | 78.0            | 184            | 4900                               | 3200   | 0.433      |
|          | RNA 3060    | 78.3              | 100  | 38   | 85.3              | 0.85                   | 123.0           | 290            | 4900                               | 3200   | 0.810      |
| 83.1     | RNA 1070    | 83.1              | 100  | 20   | 89.1              | 0.85                   | 43.0            | 103            | 4500                               | 2900   | 0.322      |
|          | RNA 2070    | 83.1              | 100  | 28   | 89.1              | 0.85                   | 81.0            | 195            | 4500                               | 2900   | 0.470      |
|          | RNA3065     | 83.1              | 105  | 38   | 90.2              | 0.85                   | 129.0           | 308            | 4500                               | 2900   | 0.865      |
| 88       | RNA 1075    | 88.0              | 110  | 24   | 95.0              | 0.85                   | 64.0            | 155            | 4300                               | 2800   | 0.577      |
|          | RNA 2075    | 88.0              | 110  | 32   | 95.0              | 0.85                   | 104.0           | 253            | 4300                               | 2800   | 0.767      |
|          | RNA 3070    | 88.0              | 110  | 38   | 95.0              | 0.85                   | 134.0           | 325            | 4300                               | 2800   | 0.906      |
| 96       | RNA 1080    | 96.0              | 115  | 24   | 103.0             | 0.85                   | 68.0            | 170            | 4000                               | 2600   | 0.510      |
|          | RNA 2080    | 96.0              | 115  | 32   | 103.0             | 0.85                   | 110.0           | 275            | 4000                               | 2600   | 0.694      |
|          | RNA 3075    | 96.0              | 120  | 38   | 103.0             | 0.85                   | 142.0           | 355            | 4000                               | 2600   | 1.098      |
| 99.5     | RNA 2085    | 99.5              | 120  | 32   | 106.5             | 1.35                   | 113.0           | 285            | 3800                               | 2500   | 0.787      |
|          | RNA 3080    | 99.5              | 125  | 38   | 106.5             | 0.85                   | 145.0           | 365            | 3800                               | 2500   | 1.220      |
| 104.7    | RNA 2090    | 104.7             | 125  | 32   | 111.7             | 1.35                   | 117.0           | 300            | 3600                               | 2300   | 0.837      |
|          | RNA 3085    | 104.7             | 130  | 38   | 111.7             | 1.35                   | 150.0           | 390            | 3600                               | 2300   | 1.252      |
| 109.1    | RNA 2095    | 109.1             | 130  | 32   | 116.1             | 1.35                   | 120.0           | 315            | 3500                               | 2300   | 0.882      |
|          | RNA 3090    | 109.1             | 135  | 43   | 116.1             | 1.35                   | 185.0           | 480            | 3500                               | 2300   | 1.522      |

# 5.2

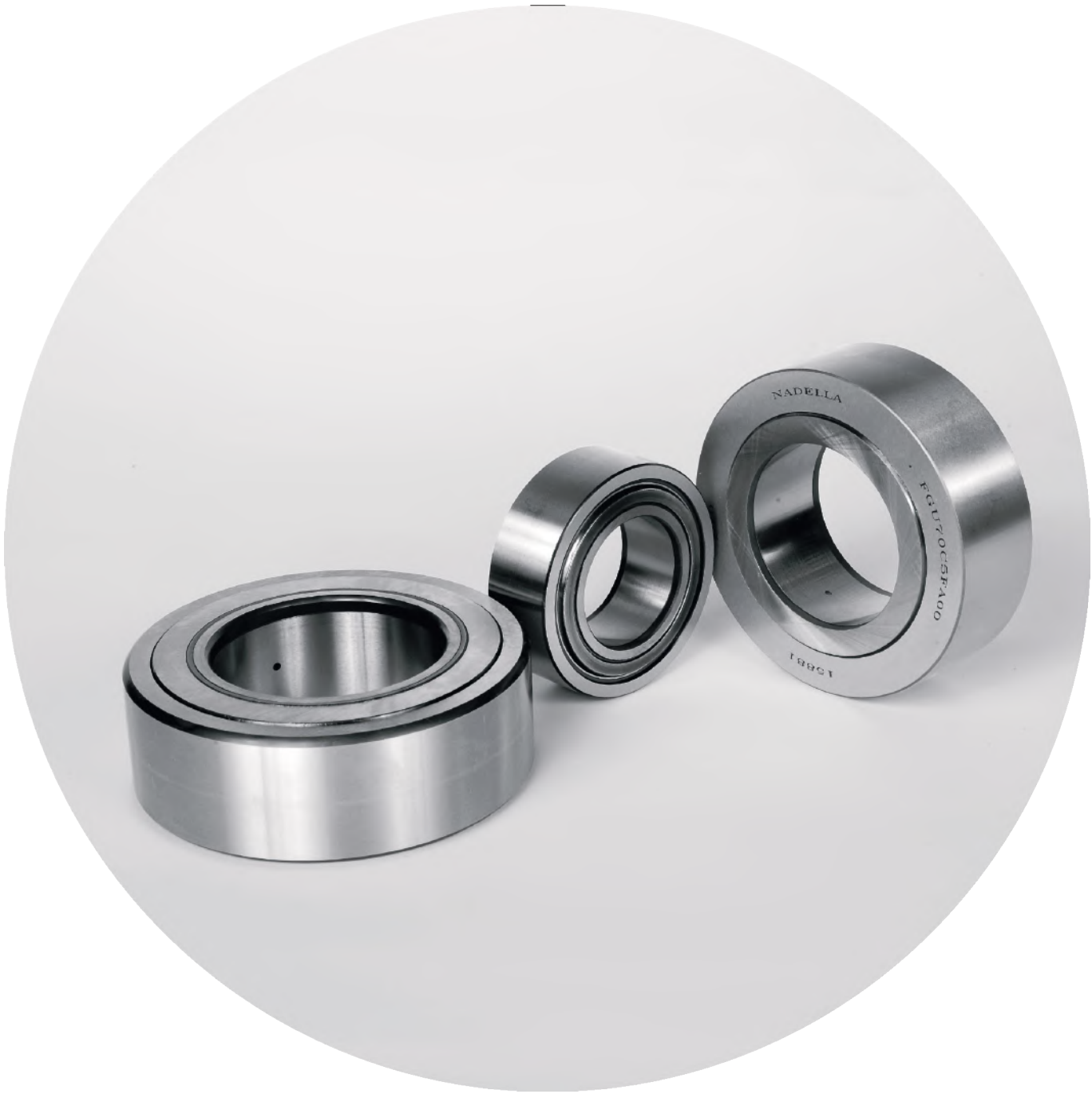


**RNA Serie 1000,  
2000, 22000**



**RNA Serie 3000**

| Shaft mm | Designation | F <sub>w</sub> mm | D mm | C mm | E <sub>w</sub> mm | r <sub>s min.</sub> mm | Load ratings kN |                | Speed ratings kN min <sup>-1</sup> |        | Weight. kg |
|----------|-------------|-------------------|------|------|-------------------|------------------------|-----------------|----------------|------------------------------------|--------|------------|
|          |             |                   |      |      |                   |                        | Dynamic         | Static         | Oil                                | Grease |            |
|          |             |                   |      |      |                   |                        | C               | C <sub>0</sub> |                                    |        |            |
| 114.7    | RNA 2100    | 114.7             | 135  | 32   | 121.7             | 1.35                   | 125             | 330            | 3300                               | 2100   | 0.677      |
|          | RNA3095     | 114.7             | 140  | 43   | 121.7             | 1.35                   | 190             | 505            | 3300                               | 2100   | 1.551      |
| 119.2    | RNA 2105    | 119.2             | 140  | 32   | 126.2             | 1.35                   | 129             | 340            | 3200                               | 2100   | 0.941      |
|          | RNA 3100    | 119.2             | 145  | 43   | 126.2             | 1.35                   | 195             | 520            | 3200                               | 2100   | 1.645      |
| 124.5    | RNA2110     | 124.5             | 145  | 34   | 131.5             | 1.35                   | 133             | 360            | 3000                               | 2000   | 1.015      |
|          | RNA 3105    | 124.5             | 150  | 45   | 131.5             | 1.35                   | 203             | 550            | 3000                               | 2000   | 1.762      |
| 132.5    | RNA 2115    | 132.5             | 155  | 34   | 139.5             | 1.35                   | 139             | 380            | 2900                               | 1900   | 1.205      |
|          | RNA 3110    | 132.5             | 160  | 45   | 139.5             | 1.35                   | 210             | 580            | 2900                               | 1900   | 2.037      |
| 137      | RNA 2120    | 137               | 160  | 34   | 144.0             | 1.35                   | 142             | 395            | 2800                               | 1800   | 1.265      |
|          | RNA3115     | 137               | 165  | 45   | 144.0             | 1.35                   | 215             | 600            | 2800                               | 1800   | 2.140      |
| 143.5    | RNA 2125    | 143.5             | 165  | 34   | 150.5             | 1.35                   | 145             | 410            | 2700                               | 1800   | 1.218      |
|          | RNA 3120    | 143.5             | 170  | 45   | 150.5             | 1.35                   | 224             | 630            | 2700                               | 1800   | 2.107      |
| 148      | RNA2130     | 148               | 170  | 34   | 155.0             | 1.35                   | 150             | 425            | 2600                               | 1700   | 1.292      |
| 158      | RNA 2140    | 158               | 180  | 36   | 165.0             | 1.35                   | 157             | 455            | 2400                               | 1600   | 1.478      |
|          | RNA 3130    | 158               | 190  | 52   | 166.0             | 1.35                   | 275             | 790            | 2400                               | 1600   | 3.285      |
| 170.5    | RNA 2150    | 170.5             | 195  | 36   | 177.5             | 1.35                   | 165             | 490            | 2200                               | 1400   | 1.790      |
|          | RNA 3140    | 170.5             | 205  | 52   | 178.5             | 1.35                   | 290             | 860            | 2200                               | 1400   | 3.840      |
| 179.3    | RNA 2160    | 179.3             | 205  | 36   | 186.3             | 1.35                   | 170             | 515            | 2100                               | 1400   | 1.970      |
|          | RNA 3150    | 179.3             | 215  | 52   | 187.3             | 1.35                   | 300             | 900            | 2100                               | 1400   | 4.185      |
| 193.8    | RNA2170     | 193.8             | 220  | 42   | 200.8             | 1.85                   | 233             | 720            | 2000                               | 1300   | 2.570      |
|          | RNA 3160    | 193.8             | 230  | 57   | 201.9             | 1.35                   | 360             | 1110           | 2000                               | 1300   | 4.955      |
| 202.6    | RNA 2180    | 202.6             | 230  | 42   | 209.6             | 1.85                   | 240             | 750            | 1900                               | 1200   | 2.835      |
| 216      | RNA 2190    | 216               | 245  | 42   | 223.0             | 1.85                   | 250             | 800            | 1800                               | 1200   | 3.210      |
|          | RNA 3180    | 216               | 255  | 57   | 224.1             | 1.85                   | 385             | 1240           | 1800                               | 1200   | 6.040      |
| 224.1    | RNA 2200    | 224.1             | 255  | 42   | 231.1             | 1.85                   | 257             | 830            | 1700                               | 1100   | 3.560      |
| 236      | RNA 2210    | 236               | 265  | 42   | 243.1             | 1.85                   | 279             | 910            | 1600                               | 1000   | 3.470      |
| 258.4    | RNA 3220    | 258.4             | 300  | 64   | 268.4             | 1.85                   | 490             | 1650           | 1500                               | 980    | 8.570      |
| 269.6    | RNA2240     | 269.6             | 300  | 49   | 276.6             | 1.85                   | 345             | 1190           | 1400                               | 910    | 4.985      |
| 281.9    | RNA 3240    | 281.9             | 325  | 64   | 291.9             | 1.85                   | 520             | 1800           | 1300                               | 850    | 9.480      |





# CAM FOLLOWER

# 6

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# TECHNICAL SPECIFICATIONS

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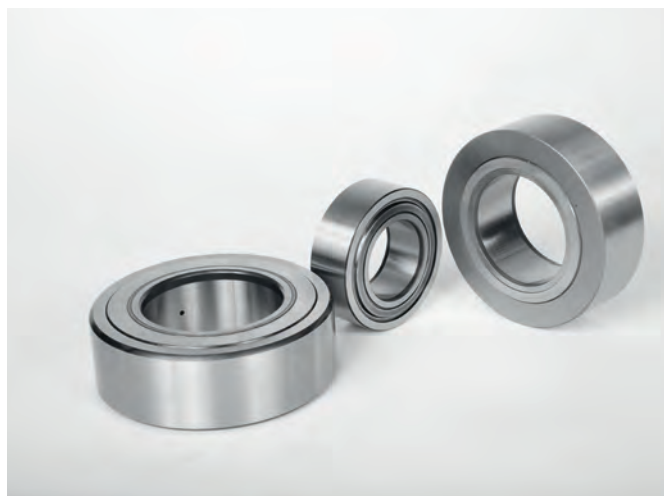
Cam followers are designed to rotate directly on cams, flat surfaces or guidex. In order to meet the unusual conditions of use - significant loads accompanied by substantial and repeated shocks - these types of bearings have the following characteristics:

- Heavy section outer ring, to support the load and minimise the risk of deformations that reduce the bearing's load-supporting capacity.
- Rolling or cup needle roller bearing, with cage or full complement to guarantee maximum load capacity.
- Outer profiled ring to compensate for parallelism errors between the roller and track or cylindrical ring to reduce contact pressure with the sliding surface.
- Lubrication hole with output under the needles to restore the grease through the axle.

The cam followers with stud can be equipped with an eccentric collar to adjust the pre-load during assembly.

The cam followers can be equipped with synthetic or metal seals to retain the grease.

Apart from the products shown in this catalogue, Nadella produces numerous variants for specific operating conditions.



## LOAD CAPACITY

The cam follower is generally used as a wheel that runs on a guide or cam. The load is applied to the cam follower without stud at the contact point with the race track and, unlike a bearing, the outer ring is not kept in the case and is free to deform. The elastic deformation of the outer ring affects the load distribution between the rolling bearing elements reducing the capacity calculated in compliance with ISO standards for bearings.

The dimensional tables show the load values

- The  $C_w$  load coefficient to be used to calculate the duration  $t$ . Keep in mind the bearing's load capacity  $C$  in compliance with ISO281 based on the rigidity of the outer ring.

$$L_{10} = \left( \frac{C_w}{f_w \cdot P_r} \right)^{10/3}$$

$$L_h = \frac{10^6 \cdot L_{10}}{60 \cdot n}$$

$$L_{km} = L_{10} \cdot \pi \cdot D$$

$C_w$  : dynamic load coefficient of the cam follower without stud for  $10^6$  revs  
 $f_w$  : overload factor  
 $P_r$  : radial load applied in N  
 $L_{10}$  : duration calculated in millions of revs  
 $L_h$  : duration in hours  
 $L_{km}$  : duration in km  
 $n$  : average speed in revs/minute

The maximum load applicable to the cam followers without stud takes into consideration the acceptable load from the bearing ( $C_o$  in accordance with ISO 76 reduced on the basis of the rigidity of the outer ring), the resistance of the outer ring and, for cam followers with stud, the resistance of the stud's resistance. The tables show the applicable limit load.

- Dynamic load limit  $F_r$ : this is the load which should not be exceeded when the cam followers without stud are subject to repeated strain.
- Static load limit  $F_{or}$ : this is the static resistance limit that the cam follower without stud can bear under exceptional conditions and should never be exceeded.

The safety coefficient  $f_s$  can be calculated as

$$f_s = F_r / P_r$$

$F_r$ : Product dynamic limit load

In any event, the applied load  $P_r$  needs to be lower than the product's static load  $F_{or}$ .

### Safety factor $f_s$ minimum recommended

|            |   |
|------------|---|
| $\geq 3$   | in the event of shocks or vibrations, applications with a need for gentle rolling |
| $\geq 1.5$ | functioning under normal conditions   |
| $\geq 1$   | almost static applications, without the need for gentle rolling                   |

The load limit  $F_r$  and  $F_{or}$  for the cam followers with stud in the product tables refers to the concentric version. Assessment will need to be made as to whether the eccentric load can rotate the pivot in its seating, if the GCR or GCUR or KRE eccentric version is used.

Furthermore, the rolling track resistance needs to be taken into consideration. The assessment method adopted is based on the calculation of the Hertz pressure compared to the pressure accepted by the cam material.

The product catalogue data refers to the standard steel version. The stainless steel products or those stabilised by high temperature have a reduced load capacity.

Contact Nadella Technical Assistance for more details.

### Overload factor $F_w$

|           |  |
|-----------|--|
| 1.0 - 1.2 | low speed functioning with regular load      |
| 1.2 - 1.5 | functioning under normal conditions          |
| 1.5 - 2.0 | functioning with minor shocks and vibrations |
| 2.0 - 4.0 | high speed, shocks and vibrations            |

# TECHNICAL SPECIFICATIONS

## PRECISION

Cam followers with stud in the series GC, GCU, FG, FGU, KR refer to the dimensions in standard ISO 6278.

The reference standard for the same products is ISO 7063.

The cam follower manufacturing tolerance given in the tables below are generally more restrictive compared to the reference standard, but in any event, still compliant with the standard.

In particular, the outer diameter of the cam followers without stud is produced in h6 or h7 tolerance even for the versions with profiled or convex outer ring

## RADIAL PLAY

The radial play of the standard cam followers without stud normally falls into category C2 established for needle roller bearings in compliance with standard ISO 5753-1.

### Cam follower without stud outer diameter tolerance D GC / PF / FG / FL / PFDL / GCU / FGU

|                             |    |
|-----------------------------|----|
| Up to diameter 32 inclusive | h6 |
| Beyond diameter 32          | h7 |

### Max error on rotation GC / PF / FG / FL / PFDL / GCU / FGU

| Diameter d |     | Kea um |
|------------|-----|--------|
| 10         | 18  | 15     |
| 18         | 30  | 15     |
| 30         | 50  | 20     |
| 50         | 80  | 25     |
| 80         | 120 | 35     |
| 120        | 150 | 40     |
| 150        | 180 | 45     |
| 180        | 240 | 50     |

### Diameter tolerance on cam follower stud d<sub>1</sub> GC / PF / PFDL / GCU

|                |    |
|----------------|----|
| All dimensions | h6 |
|----------------|----|

### Cam follower hole tolerance d (Micron) GC / PF / PFDL / GCU

| Diameter d |       | Tolerance um |       |
|------------|-------|--------------|-------|
| from       | up to | upper        | lower |
| 3          | 10    | 0            | -8    |
| 10         | 18    | 0            | -8    |
| 18         | 30    | 0            | -10   |
| 30         | 50    | 0            | -12   |
| 50         | 80    | 0            | -15   |
| 80         | 120   | 0            | -20   |
| 120        | 180   | 0            | -25   |

## SELECTION OF SEAL TYPE

The key function of the seals is to protect the bearing from its surrounding environment and treat the grease inside.

- The cam followers with no seal are shown in the applications with oil greasing coming from outside the cam follower without stud (typically high load and speed cams) where it is essential to allow for the entry of the oil in the bearing for greasing and cooling.
- The cam followers with stud in series GC and FG with a diameter of 16 inclusive can fit seals:
  - EEM type, of metal guards, are mechanically resistant and suited to any temperature.
  - EE type seal is manufactured with a Teflon ring in contact with the moving parts. The seal's maximum operating temperature is 220°C.
- Cam followers with stud in the GCU series can be fitted with MM type seals that act as labyrinth metal guards and are suited to any temperature.
- Cam followers without stud in the FGU series can be fitted with MM type seals that act as metal guards and are suited to any temperature.
- The cam followers without stud in the KK..EE series are fitted with plastic seals (not Teflon) integrated with the outer ring's axial containment abutment.
- The cam followers without stud in the PK and FK series fitted with RS type seals in NBR, can be used up to a temperature of 80°C. For temperatures in excess of this, the cam followers without stud up to and including size 90 can be fitted with Viton seals (suffix V). The acceptable temperature of the seal is 200°C.

## OPERATIONAL GREASING AND SEAL

The type of cam followers shown in this catalogue, with the exception of the RNA type cam followers without stud are supplied with a grease that permits an operating temperature from -20°C to 120°C. The stainless steel cam followers without stud use a category NSF H1 grease for alimentary purposes.

The RNA 11000 type cam followers without stud are supplied with a protection compatible to a lithium soap based grease. As with bearings, the protection is unsuited for greasing the cam followers without stud. The maximum operating temperature depends on the grease used.

For cam followers and full complement needle followers GC, GCU and derivatives, with metal or plastic seals (EE - Teflon), the operating temperature limit depends on the grease and in the case of standard cam followers without stud, is between -20°C and 120°C.

For full complement needle rollers with cage, the operating temperature is between -20°C and 80°C.

The cam followers without stud with tapered bearings type PK and FK are supplied already greased and in the standard version can operate between -20°C and 80°C (standard seals in NBR) or 120°C (seals in Viton). a suitable grease needs to be used for a higher temperature.

Greased bearings can be provided with suitable grease at high or low temperatures, or with no grease.

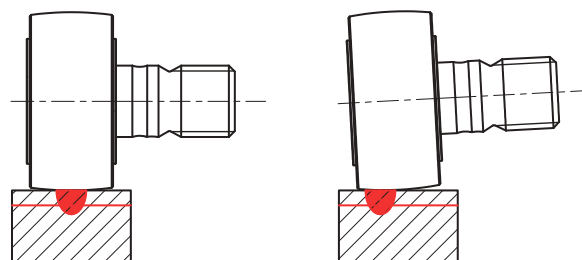
For high temperatures starting at 150°C, the products need to undergo stabilising heat treatment which involves a reduction of hardness and load capacity.

# TECHNICAL SPECIFICATIONS

## OPTIMISED PROFILE

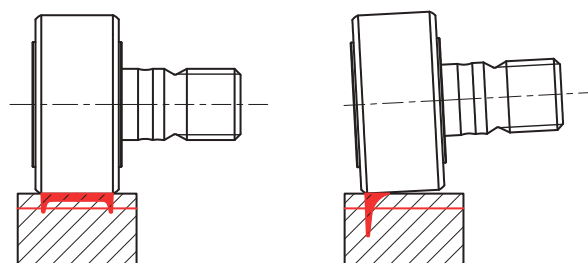
Cam rollers are generally used in contact with the cams or sliding guidex. The contact between the surface of the guide or cam and cam follower without stud is selected on the basis of the application considering the strain caused on the material and the consequences of any misalignments.

Cam followers without stud with **constant radius convex outer ring**. The theoretical point of contact under the effect of elastic deformations caused by the load converts into a surface, the contact pressure is calculated with the classic Hertz formulae and has a parabolic tendency with maximum strain in the centre of the contact area. The maximum value is taken as reference for the resistance assessment requested of the rolling track. As the diameter of the cam follower without stud and the convex radius expands, the contact pressure drops. Any misalignment of the cam follower without stud moves the contact zone without modifying dimension or strain. This is a solution suited to the application with an average load and relatively inexact geometries, typically applications for a linear movement.



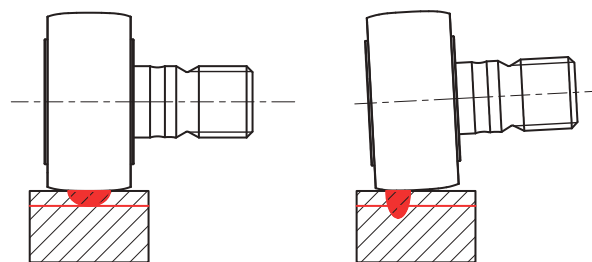
*Rollers with convex outer ring with constant radius*

Cam followers without stud with **cylindrical outer ring**. The theoretical contact line under the effect of the contact load opens onto a vast surface reducing the average and maximum pressure. As an initial estimate according to the Hertz formulae with equal load, the strain and deformation are considerably lower compared to the contact with the convex cam roller without stud but two important considerations need to be made: 1) at the ends of the contact line, due to the edge, there is a peak in the strain which, in practical terms, reduces the difference compared to the previous case 2) the effect of a misalignment, even a minor one, moves the contact to an extreme prejudicing the contact itself and even the load which weighs on the bearing below. This is a solution suited to applications with a high load and which require the machine to make careful mechanical processings to avoid misalignments.



*Rollers with cylindrical outer ring*

Cam followers without stud with **optimised profile outer ring**. The profile of the cam follower without stud is created with a wide radius in the central part of the sleeve that decreases by moving away from the central line of the cam follower without stud. When the cam follower without stud is properly aligned, the wide radius allows for a vast contact area and excellent distribution of the load; in the event of misalignment between the track and cam follower without stud, the contact moves in a similar fashion to the convex cam followers without reaching the edge of the strip, thus protecting the track and inner bearing against abnormal strain. This is a solution suited both to applications that require a high level of load accuracy and rigidity as well as to applications with misalignments.

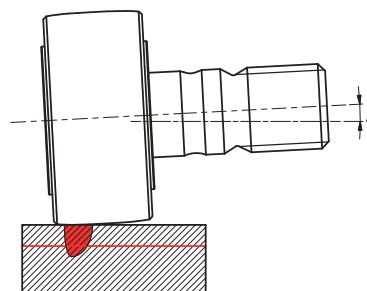


*Rollers with convex outer ring with optimised radius.*

## ALIGNMENT TOLERANCE PERMITTED BETWEEN ROLLER AND TRACK

Cam followers without stud with convex outer ring or optimised profile allow for an inclination compared to the surface of the track, up to a maximum as shown in the table.

| Cam follower without stud type  | Inclination $\Delta$ |
|---|----------------------|
| RNA 11 000 B6   | 1.5 per 1000         |
| Cam followers FG, GC, GCU with convex outer ring or optimised profile | 7 per 1000           |

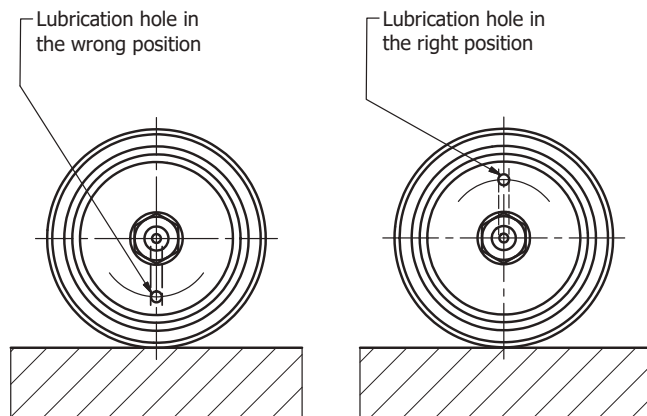


## ASSEMBLY INSTRUCTIONS

### Direction of the greasing radial hole

In the case of use with heavy loads, shocks or vibrations, it is best to avoid the greasing hole ending up in the area in which the load weighs down on the needles, which is the side in contact with the cam or rolling track.

The position of the hole in question in the cam followers with stud that is not visible from the outside, is indicated by a reference on the head of the cam follower with stud.



### Side rest for the cam followers

In the event of relevant axial loads or functioning in the presence of vibrations, we recommend the outer diameter of the rest be at least equal to the  $d_A$  quota in the dimensions tablex.

### Assembly hole diameter

The recommended tolerance for the slot hole in the cam follower with stud is  $d_1 H7$ .

### Assembly pivot diameter

The recommended tolerance for the pivot to be inserted in the cam followers hole in the FG and FGU series is h5.

### Nut clamping

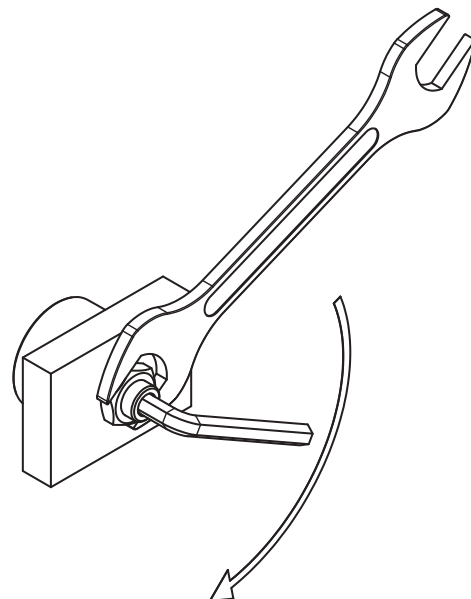
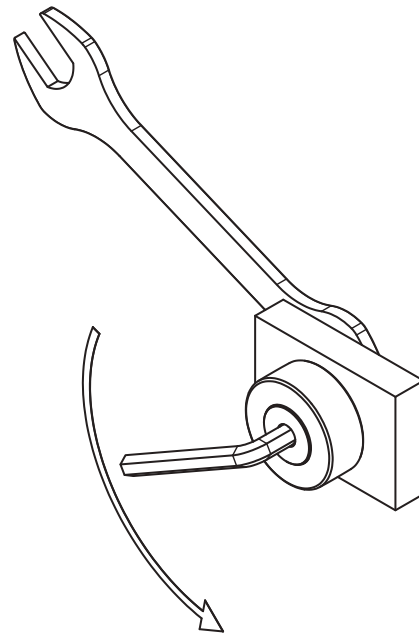
The clamping torque given in the table allows the pivot to be clamped securely in the housing. An upper clamping torque can damage the product.

The clamping torques are taken for non-greased threads; for greased threads, multiply the value of the torque in the table by 0.8.

For products in the GC and GCU series supplied with two nuts, clamp the first nut with the recommended torque and then the second one.

### Cam followers without stud with eccentric collar

The load applied to the cam follower without stud with eccentric collar generates a clamp that tends to rotate the stud in its housing. In order to avoid this effect generating a movement that could slacken the nut, adjust the eccentricity so that the cam follower is alongside the rolling track by rotating the stud in the same direction as the nut clamping.



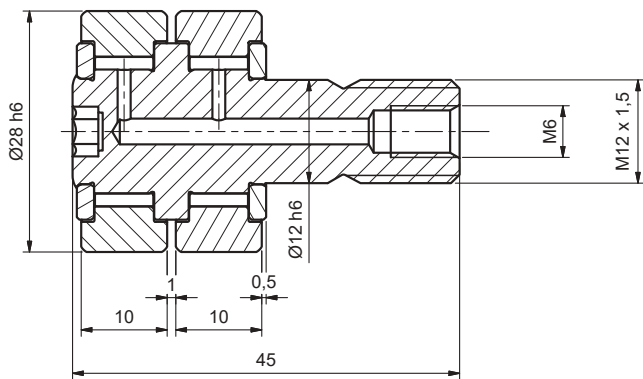
# SPECIAL APPLICATIONS

As well as the products in the catalogue, Nadella also designs and manufactures special needle and roller cam followers for specific applications. There can be variations on standard products or completely special products. Here are some examples:

## CAM FOLLOWER WITHOUT STUD WITH SPECIAL CONNECTIONS TO THE GREASING SYSTEM

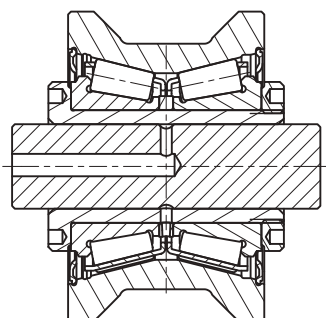
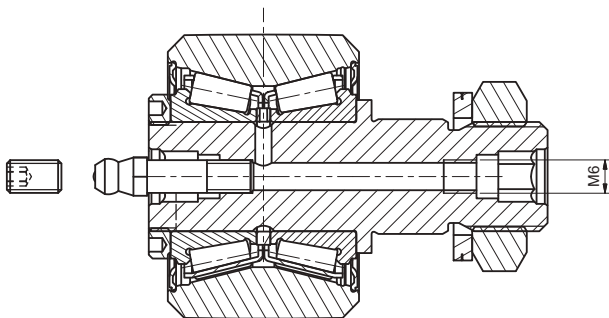
PFDL28.10 with threaded hole to connect to the grease dispensing system.

The full complement needle follower generally requires periodical greasing or, for more load and speed strained applications, the oil-filled function. An additional threaded hole in the stud was added to simplify periodical re-greasing connecting the cam roller to a centralised dispensing system.



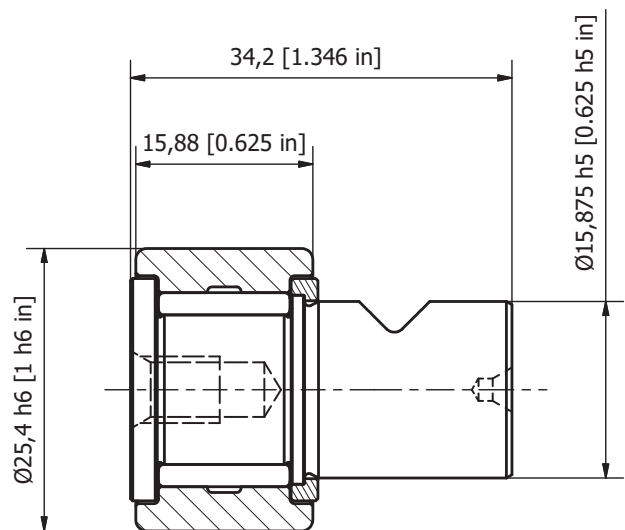
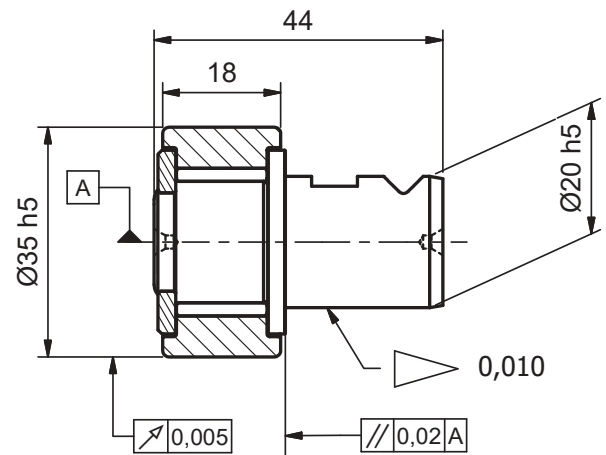
## PK52CNX LB cam followers without stud.

The PK series cam followers without stud with tapered bearings are normally considered greased for life. In some environments, for example, where there is a high humidity level, the grease might deteriorate over time and it is, therefore, advisable to take into consideration the possibility of having to top up the grease. The LB option for guide wheels with stud allows you to connect the nipple or plug screw to the threaded hole. For cam followers without stud and with through hole, this allows the grease to be inserted from the pivot (create hole and circular groove on the assembly pivot).



## CAM FOLLOWERS FOR CAMS AND INDEXERS

In the case of more complex mechanical applications, cam followers without stud are manufactured with materials, processing cycles, finishings, dimensional tolerances and radial play that are optimised to increase rigidity, load capacity and precision as much as possible.





## ANTI-CORROSION CAM FOLLOWERS WITHOUT STUD

The cam followers without stud and full complement needle followers can be supplied in anti-corrosion NX version. Nadella offers stainless steel or protected cam followers without stud with surface treatments. The stainless steel used is AISI 400 and achieves a hardness comparable to steel for bearings but has a limited resistance to corrosion. The inner needles can be in stainless steel or more commonly in 100Cr6 steel. In this case the corrosion protection of the needles is entrusted to grease (NSF H1 classified grease for alimentary use and resistant to humidity). Nuts and washers are supplied in A2 stainless steel, the greasing nipple in raw brass or stainless steel.

As an alternative to the stainless steel versions hard nickel or hard chrome treatments can be used.

Different solutions can be configured based on the environment in which it is applied

- NX 11: this is the most common version that has outer parts in stainless steel, seals protected by surface coating and needles in standard bearing steel
- NX 12: outer ring in stainless steel, remaining external components nickel-plated, inner needles or rollers in standard bearing steel.
- NX 17: entirely in stainless steel.
- NX 18: hard chromium-plated components, needles in standard bearing steel. This is the best option for small production batches.

## CAM FOLLOWERS FOR HIGH/LOW TEMPERATURE

These require suitable grease and stabilisation of the material for expected operating temperature.

## CAM FOLLOWERS FOR VACUUM

Entirely in stainless steel and slow evaporating grease.

## WEAR-RESISTANT MATERIALS

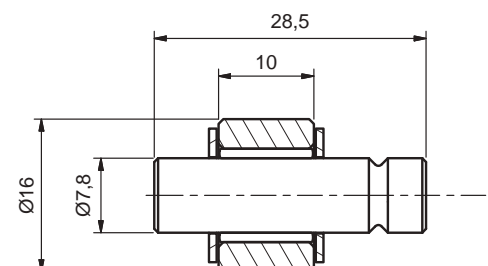
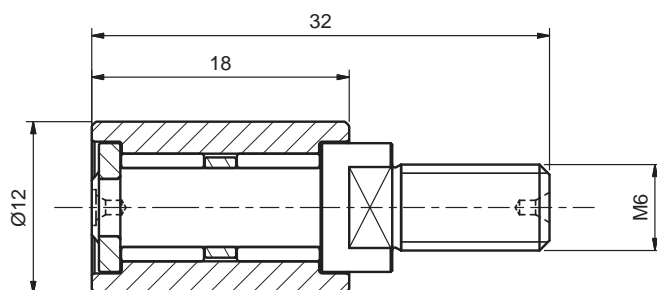
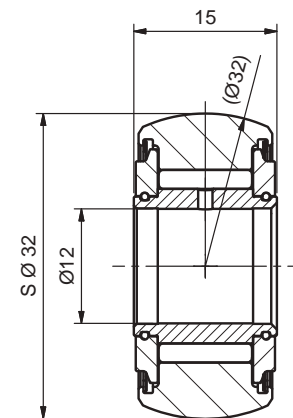
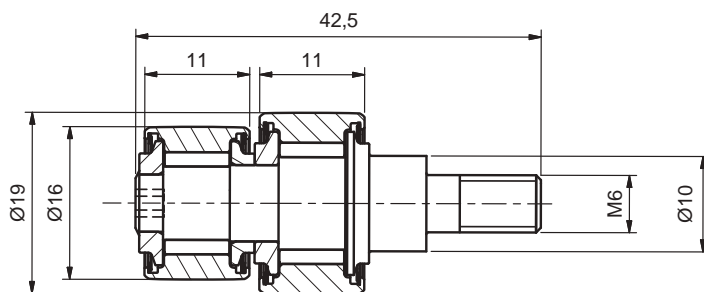
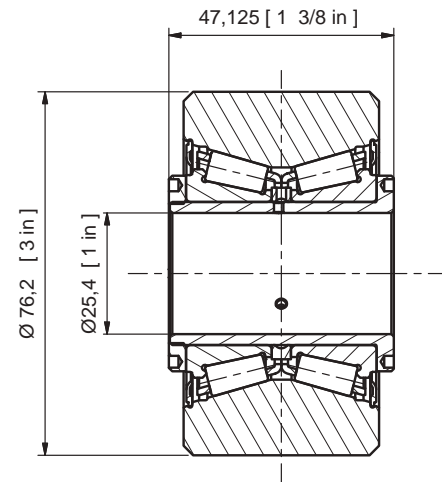
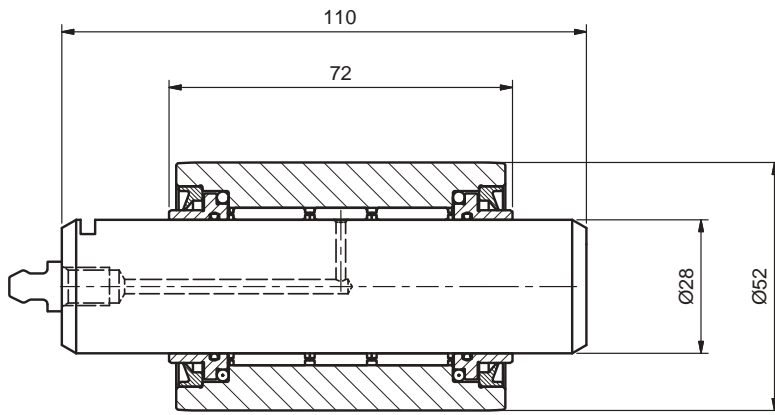
Cam followers without stud with stainless outer ring for wear-resistant tools.

## SURFACE FINISHINGS

Mirror polishing and oxidisation to add the colour black.

# OTHER PRODUCTS WITH SPECIAL SHAPE

# 6.3



## ACCESSORIES FOR CAM FOLLOWERS

### ECCENTRIC COLLARS

In order to allow for the cam follower with stud bearing position to be adjusted with respect to the hole, eccentric collars slipped onto the stud with interference are used. This way the position of the bearing can be regulated for the value  $\pm k$ , that is the eccentricity.

The eccentric collar obstructs the greasing hole on the shank of the stud; collars adapted to allow the eccentric cam followers without stud to be greased through the hole in the stud are supplied on request.

The eccentric collars are supplied already fitted to the pivots of the cam follower without stud GCR, GCUR and KRE.

### CLAMPING NUT

The cam followers with stud are supplied with nut and washer for assembly. See pages relative to the supply detail.

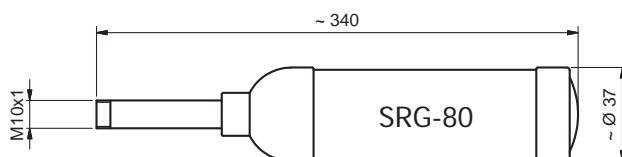
### NIPPLE AND GREASING PLUG

The full complement needle rollers in the GCU and GC..SW series complete with holes for re-greasing and built-in hexagonal socket at both ends. They are supplied with greasing plug and nipple. Insert one or the other in the specific ends depending on which side the re-greasing will be done.

### GREASING INJECTOR

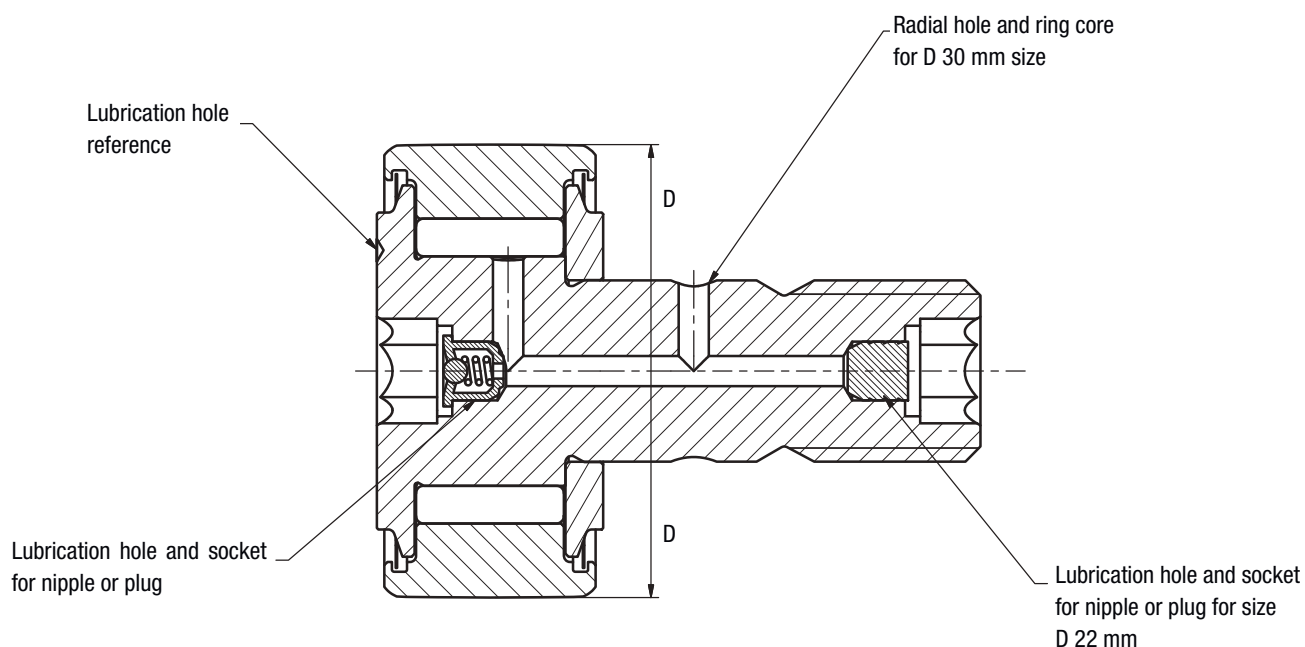
The SRG-80 pump with 150 cc capacity can be used to manually re-grease the cam followers.

It should be fitted with a tip suited to the nipple being used.



#### Tip for greasing injector

|   |        |
|---|--------|
| Cam followers with stud, in the series GCU and GC..SW with GC35 size concave greaser included.  | PS80-A |
| Cam followers with stud, in the series GC..SW with GC16 and GC32 size concave greaser included. | PS80-C |
| Cam followers without stud with convex head greaser with option ..LB                            | PS80-B |

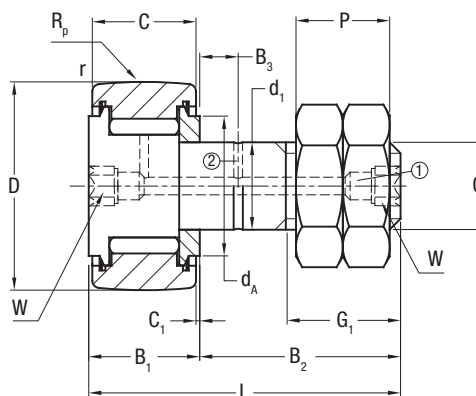


# CAM FOLLOWERS WITH STUD

## GC .. SW

Full complement needle rollers with outer diameter from 16 to 90 mm

See page 47 for details on stainless steel versions.



Bore hole ① starting from D=22 mm  
Bore hole ② starting from D=30 mm

| ∅ outer D<br>mm | Designation <sup>1)</sup> | d <sub>1</sub> <sup>2)</sup><br>mm | L<br>mm | B <sub>1</sub><br>mm<br>MAX | B <sub>2</sub><br>mm | Threading G<br>mm | G <sub>1</sub><br>mm | C<br>mm | C <sub>1</sub><br>mm | d <sub>A</sub><br>mm | B <sub>3</sub><br>mm | r<br>mm | R <sub>p</sub> <sup>3)</sup><br>mm |
|-----------------|---------------------------|------------------------------------|---------|-----------------------------|----------------------|-------------------|----------------------|---------|----------------------|----------------------|----------------------|---------|------------------------------------|
|                 | GC .. SW                  |                                    |         |                             |                      |                   |                      |         |                      |                      |                      |         |                                    |
| 16              | 16                        | 6                                  | 28      | 12.2                        | 16                   | M6x1              | 8                    | 11      | 0.6                  | 10.4                 | -                    | 0.3     | 500                                |
| 19              | 19                        | 8                                  | 32      | 12.2                        | 20                   | M8x1.25           | 10                   | 11      | 0.6                  | 12.6                 | -                    | 0.3     | 500                                |
| 22              | 22                        | 10                                 | 36      | 13.2                        | 23                   | M10x1.25          | 12                   | 12      | 0.6                  | 15.5                 | -                    | 0.3     | 600                                |
| 24              | 24                        | 10                                 | 36      | 13.2                        | 23                   | M10x1.25          | 12                   | 12      | 0.6                  | 15.5                 | -                    | 0.3     | 600                                |
| 26              | 26                        | 10                                 | 36      | 13.2                        | 23                   | M10x1.25          | 12                   | 12      | 0.6                  | 18                   | -                    | 0.3     | 600                                |
| 28              | 28                        | 10                                 | 36      | 13.2                        | 23                   | M10x1.25          | 12                   | 12      | 0.6                  | 18                   | -                    | 0.3     | 600                                |
| 30              | 30                        | 12                                 | 40      | 15.2                        | 25                   | M12x1.5           | 13                   | 14      | 0.6                  | 21                   | 6                    | 0.6     | 700                                |
| 32              | 32                        | 12                                 | 40      | 15.2                        | 25                   | M12x1.5           | 13                   | 14      | 0.6                  | 21                   | 6                    | 0.6     | 700                                |
| 35              | 35                        | 16                                 | 52      | 19.6                        | 32.5                 | M16x1.5           | 17                   | 18      | 0.8                  | 26                   | 8                    | 0.6     | 800                                |
| 40              | 40                        | 18                                 | 58      | 21.6                        | 36.5                 | M18x1.5           | 19                   | 20      | 0.8                  | 31                   | 8                    | 1.0     | 1000                               |
| 47              | 47                        | 20                                 | 66      | 25.6                        | 40.5                 | M20x1.5           | 21                   | 24      | 0.8                  | 35                   | 9                    | 1.0     | 1200                               |
| 52              | 52                        | 20                                 | 66      | 25.6                        | 40.5                 | M20x1.5           | 21                   | 24      | 0.8                  | 35                   | 9                    | 1.0     | 1200                               |
| 62              | 62                        | 24                                 | 80      | 30.6                        | 49.5                 | M24x1.5           | 25                   | 29      | 0.8                  | 45                   | 11                   | 1.0     | 1500                               |
| 72              | 72                        | 24                                 | 80      | 30.6                        | 49.5                 | M24x1.5           | 25                   | 29      | 0.8                  | 45                   | 11                   | 1.0     | 1500                               |
| 80              | 80                        | 30                                 | 100     | 37.0                        | 63                   | M30x1.5           | 32                   | 35      | 1.0                  | 61                   | 15                   | 1.0     | 1700                               |
| 85              | 85 <sup>9)</sup>          | 30                                 | 100     | 37.0                        | 63                   | M30x1.5           | 32                   | 35      | 1.0                  | 61                   | 15                   | 1.0     | 1700                               |
| 90              | 90                        | 30                                 | 100     | 3.07                        | 63                   | M30x1.5           | 32                   | 35      | 1.0                  | 61                   | 15                   | 1.0     | 1700                               |

1) Cam follower with stud designation

GC..SW Concentric cam follower with stud optimised profile outer ring

GCL..SW Concentric cam follower with stud cylindrical outer ring (product available on request)

GCR.. Cam follower with stud with eccentric collar

No suffix Without seal

Suffix ..EE With plastic seal, ex. GC40EESW

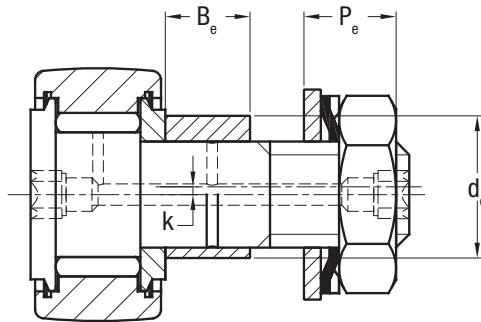
Suffix ..EEM With metal seal, ex. GC40EEMSW

2) Hole diameter for assembly of concentric cam follower without stud: d<sub>1</sub>, H7

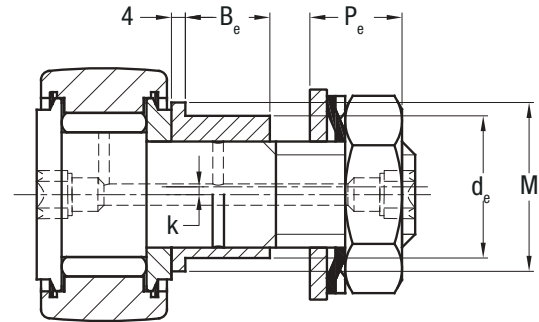
3) Convex radius in the central part to contact pressure calculation

# 6.5

See page 47 for details  
on stainless steel versions.



from GCR16SW to GCR52SW



from GCR62SW to GCR90SW

| W<br>mm | P <sup>7)</sup><br>mm | Eccentric bearing                     |                       |                       |                                    |                                    | Load coefficients (N) <sup>6)</sup> |                     |                       | Greasing speed limit<br>with grease (min <sup>-1</sup> ) | Weight with nuts<br>and washers<br>Kg | Clamping<br>torque Nm | ∅ outer D<br>mm |
|---------|-----------------------|---------------------------------------|-----------------------|-----------------------|------------------------------------|------------------------------------|-------------------------------------|---------------------|-----------------------|--|---------------------------------------|-----------------------|-----------------|
|         |                       | d <sub>e</sub> <sup>4) 5)</sup><br>mm | k <sup>5)</sup><br>mm | M <sup>5)</sup><br>mm | B <sub>e</sub> <sup>5)</sup><br>mm | P <sub>e</sub> <sup>8)</sup><br>mm | C <sub>w</sub>                      | Din. F <sub>r</sub> | Stat. F <sub>or</sub> |  |                                       |                       |                 |
| 4       | 6.4                   | 9                                     | 0.5                   | -                     | 8                                  | 5.6                                | 4900                                | 1200                | 2300                  | 5000   | 0.024                                 | 3                     | 16              |
| 4       | 8                     | 11                                    | 0.5                   | -                     | 10                                 | 6.4                                | 5600                                | 2900                | 5400                  | 4100   | 0.039                                 | 8                     | 19              |
| 4       | 10                    | 14                                    | 1.0                   | -                     | 11                                 | 7.9                                | 6900                                | 5300                | 9400                  | 3400   | 0.057                                 | 20                    | 22              |
| 4       | 10                    | 14                                    | 1.0                   | -                     | 11                                 | 7.9                                | 7600                                | 5300                | 9800                  | 3400   | 0.072                                 | 20                    | 24              |
| 4       | 10                    | 14                                    | 1.0                   | -                     | 11                                 | 7.9                                | 8600                                | 5300                | 9800                  | 3000   | 0.080                                 | 20                    | 26              |
| 4       | 10                    | 14                                    | 1.0                   | -                     | 11                                 | 7.9                                | 9200                                | 5300                | 9800                  | 3000   | 0.088                                 | 20                    | 28              |
| 6       | 12                    | 16                                    | 1.0                   | -                     | 11                                 | 9.5                                | 13000                               | 7900                | 15000                 | 2600   | 0.118                                 | 26                    | 30              |
| 6       | 12                    | 16                                    | 1.0                   | -                     | 11                                 | 9.5                                | 13000                               | 7900                | 15000                 | 2600   | 0.126                                 | 26                    | 32              |
| 10      | 16                    | 21                                    | 1.5                   | -                     | 14                                 | 12.2                               | 18000                               | 14000               | 23000                 | 2100   | 0.220                                 | 64                    | 35              |
| 12      | 18                    | 24                                    | 1.5                   | -                     | 16                                 | 13.4                               | 22000                               | 19000               | 34000                 | 1800   | 0.321                                 | 90                    | 40              |
| 14      | 20                    | 27                                    | 2.0                   | -                     | 17.5                               | 14.4                               | 27000                               | 22000               | 35000                 | 1500   | 0.500                                 | 120                   | 47              |
| 14      | 20                    | 27                                    | 2.0                   | -                     | 17.5                               | 14.4                               | 33000                               | 22000               | 40000                 | 1500   | 0.568                                 | 120                   | 52              |
| 12      | 24                    | 36                                    | 3.0                   | 44                    | 18                                 | 17.5                               | 42000                               | 31000               | 58000                 | 1200   | 1.035                                 | 220                   | 62              |
| 12      | 24                    | 36                                    | 3.0                   | 44                    | 18                                 | 17.5                               | 46000                               | 31000               | 58000                 | 1200   | 1.278                                 | 220                   | 72              |
| 14      | 30                    | 42                                    | 3.0                   | 50                    | 27                                 | 20.6                               | 58000                               | 50000               | 93000                 | 900  | 2.074                                 | 450                   | 80              |
| 14      | 30                    | 42                                    | 3.0                   | 50                    | 27                                 | 20.6                               | 61000                               | 50000               | 93000                 | 900  | 2.235                                 | 450                   | 85              |
| 14      | 30                    | 42                                    | 3.0                   | 50                    | 27                                 | 20.6                               | 63000                               | 50000               | 93000                 | 900  | 2.435                                 | 450                   | 90              |

4) Hole diameter for assembly of the eccentric cam follower without stud: d<sub>e</sub> H7

5) Dimensions of the eccentric bearing.

6) Fr and For load for cam follower without stud, with no eccentric collar.

7) The GC concentric cam followers with stud are supplied with two clamping nuts.

8) GCR eccentric cam followers with stud are supplied with eccentric bearing already fitted, clamping nut, cogged washer and support surface washer.

9) Product available on request

# CAM FOLLOWERS WITH STUD

## KR..EE

Cam followers with stud, with roller cage and outer diameter from 16 to 90 mm



| ∅ outer D<br>mm | Designation <sup>1)</sup> | d <sub>1</sub> <sup>2)</sup><br>mm | L<br>mm | B <sub>1</sub><br>mm | B <sub>2</sub><br>mm | Threading G<br>mm | G <sub>1</sub><br>mm | C<br>mm | C <sub>1</sub><br>mm | d <sub>A</sub><br>mm | B <sub>3</sub><br>mm | r<br>mm | R <sup>4)</sup><br>mm |
|-----------------|---------------------------|------------------------------------|---------|----------------------|----------------------|-------------------|----------------------|---------|----------------------|----------------------|----------------------|---------|-----------------------|
|                 | KR, KR..EE                |                                    |         |                      |                      |                   |                      |         |                      |                      |                      |         |                       |
| 16              | KR16 <sup>3)</sup>        | 6                                  | 28      | 12.2                 | 16                   | M6x1              | 8                    | 11      | 0.6                  | 12.5                 | -                    | 0.15    | 500                   |
|                 | KR16EE <sup>3)</sup>      | 6                                  | 28      | 12.2                 | 16                   | M6x1              | 8                    | 11      | 0.6                  | 12.5                 | -                    | 0.15    | 500                   |
| 19              | KR19 <sup>3)</sup>        | 8                                  | 32      | 12.2                 | 20                   | M8x1.25           | 10                   | 11      | 0.6                  | 15                   | -                    | 0.15    | 500                   |
|                 | KR19EE <sup>3)</sup>      | 8                                  | 32      | 12.2                 | 20                   | M8x1.25           | 10                   | 11      | 0.6                  | 15                   | -                    | 0.15    | 500                   |
| 22              | KR22                      | 10                                 | 36      | 13.2                 | 23                   | M10x1             | 12                   | 12      | 0.6                  | 17.5                 | -                    | 0.3     | 500                   |
|                 | KR22EE                    | 10                                 | 36      | 13.2                 | 23                   | M10x1             | 12                   | 12      | 0.6                  | 17.5                 | -                    | 0.3     | 500                   |
| 26              | KR26                      | 10                                 | 36      | 13.2                 | 23                   | M10x1             | 12                   | 12      | 0.6                  | 17.5                 | -                    | 0.3     | 500                   |
|                 | KR26EE                    | 10                                 | 36      | 13.2                 | 23                   | M10x1             | 12                   | 12      | 0.6                  | 17.5                 | -                    | 0.3     | 500                   |
| 30              | KR30                      | 12                                 | 40      | 15.2                 | 25                   | M12x1.5           | 13                   | 14      | 0.6                  | 23                   | 6                    | 0.6     | 500                   |
|                 | KR30EE                    | 12                                 | 40      | 15.2                 | 25                   | M12x1.5           | 13                   | 14      | 0.6                  | 23                   | 6                    | 0.6     | 500                   |
| 32              | KR32                      | 12                                 | 40      | 15.2                 | 25                   | M12x1.5           | 13                   | 14      | 0.6                  | 23                   | 6                    | 0.6     | 500                   |
|                 | KR32EE                    | 12                                 | 40      | 15.2                 | 25                   | M12x1.5           | 13                   | 14      | 0.6                  | 23                   | 6                    | 0.6     | 500                   |
| 35              | KR35                      | 16                                 | 52      | 19.6                 | 32.5                 | M16x1.5           | 17                   | 18      | 0.8                  | 27.6                 | 8                    | 0.6     | 500                   |
|                 | KR35EE                    | 16                                 | 52      | 19.6                 | 32.5                 | M16x1.5           | 17                   | 18      | 0.8                  | 27.6                 | 8                    | 0.6     | 500                   |
| 40              | KR40                      | 18                                 | 58      | 21.6                 | 36.5                 | M18x1.5           | 19                   | 20      | 0.8                  | 31.5                 | 8                    | 1       | 500                   |
|                 | KR40EE                    | 18                                 | 58      | 21.6                 | 36.5                 | M18x1.5           | 19                   | 20      | 0.8                  | 31.5                 | 8                    | 1       | 500                   |
| 47              | KR47                      | 20                                 | 66      | 25.6                 | 40.5                 | M20x1.5           | 21                   | 24      | 0.8                  | 36.5                 | 9                    | 1       | 500                   |
|                 | KR47EE                    | 20                                 | 66      | 25.6                 | 40.5                 | M20x1.5           | 21                   | 24      | 0.8                  | 36.5                 | 9                    | 1       | 500                   |
| 52              | KR52                      | 20                                 | 66      | 25.6                 | 40.5                 | M20x1.5           | 21                   | 24      | 0.8                  | 36.5                 | 9                    | 1       | 500                   |
|                 | KR52EE                    | 20                                 | 66      | 25.6                 | 40.5                 | M20x1.5           | 21                   | 24      | 0.8                  | 36.5                 | 9                    | 1       | 500                   |
| 62              | KR62                      | 24                                 | 80      | 30.6                 | 49.5                 | M24x1.5           | 25                   | 29      | 0.8                  | 44                   | 11                   | 1       | 500                   |
|                 | KR62EE                    | 24                                 | 80      | 30.6                 | 49.5                 | M24x1.5           | 25                   | 29      | 0.8                  | 44                   | 11                   | 1       | 500                   |
| 72              | KR72                      | 24                                 | 80      | 30.6                 | 49.5                 | M24x1.5           | 25                   | 29      | 0.8                  | 44                   | 11                   | 1.1     | 500                   |
|                 | KR72EE                    | 24                                 | 80      | 30.6                 | 49.5                 | M24x1.5           | 25                   | 29      | 0.8                  | 44                   | 11                   | 1.1     | 500                   |
| 80              | KR80                      | 30                                 | 100     | 37                   | 63                   | M30x1.5           | 32                   | 35      | 1                    | 53                   | 15                   | 1.1     | 500                   |
|                 | KR80EE                    | 30                                 | 100     | 37                   | 63                   | M30x1.5           | 32                   | 35      | 1                    | 53                   | 15                   | 1.1     | 500                   |
| 90              | KR90                      | 30                                 | 100     | 37                   | 63                   | M30x1.5           | 32                   | 35      | 1                    | 53                   | 15                   | 1.1     | 500                   |
|                 | KR90EE                    | 30                                 | 100     | 37                   | 63                   | M30x1.5           | 32                   | 35      | 1                    | 53                   | 15                   | 1.1     | 500                   |

1) Cam follower with stud designation

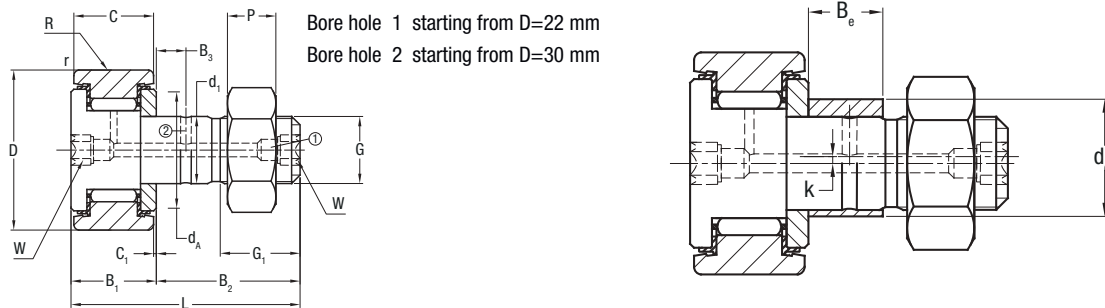
KR.. Cam follower with stud, with no seals, KR..EE Cam follower with stud with axial drag discs and seals, KRE.. Cam follower with stud with no seals, with eccentric collar, KRE..

EE Cam follower with stud with axial drag discs and seals and with eccentric collar.

2) Hole diameter for assembly of concentric cam follower without stud: d<sub>1</sub>, H7

3) For 16 and 19 mm diameter the standard cam followers with stud on the head side are supplied with screwdriver slot and grease nipple. The version with built-in hexagonal socket and no grease nipple is identifiable by the SK suffix

# 6.5



| W<br>mm | P<br>mm | Eccentric bearing                     |                       |                                    | Load coefficients (N) <sup>6)</sup> |                               |                       | Speed limit<br>greasing (min <sup>-1</sup> ) | Weight of nut and<br>washers<br>Kg | Clamping<br>torque Nm | ∅ outer D<br>mm |
|---------|---------|---------------------------------------|-----------------------|------------------------------------|-------------------------------------|-------------------------------|-----------------------|--|------------------------------------|-----------------------|-----------------|
|         |         | d <sub>e</sub> <sup>5) 6)</sup><br>mm | k <sup>6)</sup><br>mm | B <sub>e</sub> <sup>5)</sup><br>mm | C <sub>w</sub>                      | C <sub>uw</sub> <sup>8)</sup> | Stat. F <sub>or</sub> |  |                                    |                       |                 |
| -       | 3.2     | 9                                     | 0.5                   | 7                                  | 3150                                | 450                           | 3350                  | 14000  | 0.02                               | 3                     | 16              |
| -       | 3.2     | 9                                     | 0.5                   | 7                                  | 3150                                | 450                           | 3350                  | 14000  | 0.02                               | 3                     |                 |
| -       | 4       | 11                                    | 0.5                   | 9                                  | 3500                                | 540                           | 4000                  | 11000  | 0.032                              | 8                     | 19              |
| -       | 4       | 11                                    | 0.5                   | 9                                  | 3500                                | 540                           | 4000                  | 11000  | 0.032                              | 8                     |                 |
| 5       | 5       | 13                                    | 0.5                   | 10                                 | 4550                                | 730                           | 5300                  | 8000   | 0.047                              | 15                    | 22              |
| 5       | 5       | 13                                    | 0.5                   | 10                                 | 4550                                | 730                           | 5300                  | 8000   | 0.047                              | 15                    |                 |
| 5       | 5       | 13                                    | 0.5                   | 10                                 | 5100                                | 840                           | 6400                  | 8000   | 0.062                              | 15                    | 26              |
| 5       | 5       | 13                                    | 0.5                   | 10                                 | 5100                                | 840                           | 6400                  | 8000   | 0.062                              | 15                    |                 |
| 6       | 6       | 15                                    | 0.5                   | 11                                 | 6800                                | 1220                          | 8600                  | 5500   | 0.093                              | 22                    | 30              |
| 6       | 6       | 15                                    | 0.5                   | 11                                 | 6800                                | 1220                          | 8600                  | 5500   | 0.093                              | 22                    |                 |
| 6       | 6       | 15                                    | 0.5                   | 11                                 | 7100                                | 1290                          | 9200                  | 5500   | 0.104                              | 22                    | 32              |
| 6       | 6       | 15                                    | 0.5                   | 11                                 | 7100                                | 1290                          | 9200                  | 5500   | 0.104                              | 22                    |                 |
| 8       | 8       | 20                                    | 1.0                   | 14                                 | 9700                                | 1830                          | 14300                 | 3600   | 0.177                              | 58                    | 35              |
| 8       | 8       | 20                                    | 1.0                   | 14                                 | 9700                                | 1830                          | 14300                 | 3600   | 0.177                              | 58                    |                 |
| 8       | 9       | 22                                    | 1.0                   | 16                                 | 10900                               | 2090                          | 15800                 | 2900   | 0.255                              | 87                    | 40              |
| 8       | 9       | 22                                    | 1.0                   | 16                                 | 10900                               | 2090                          | 15800                 | 2900   | 0.255                              | 87                    |                 |
| 10      | 10      | 24                                    | 1.0                   | 18                                 | 15400                               | 3400                          | 26000                 | 2400   | 0.400                              | 120                   | 47              |
| 10      | 10      | 24                                    | 1.0                   | 18                                 | 15400                               | 3400                          | 26000                 | 2400   | 0.400                              | 120                   |                 |
| 10      | 10      | 24                                    | 1.0                   | 18                                 | 16600                               | 3800                          | 29000                 | 2400   | 0.473                              | 120                   | 52              |
| 10      | 10      | 24                                    | 1.0                   | 18                                 | 16600                               | 3800                          | 29000                 | 2400   | 0.473                              | 120                   |                 |
| 14      | 12      | 28                                    | 1.0                   | 22                                 | 26000                               | 6800                          | 48000                 | 1900   | 0.798                              | 220                   | 62              |
| 14      | 12      | 28                                    | 1.0                   | 22                                 | 26000                               | 6800                          | 48000                 | 1900   | 0.798                              | 220                   |                 |
| 14      | 12      | 28                                    | 1.0                   | 22                                 | 28000                               | 7200                          | 53000                 | 1900   | 1.038                              | 220                   | 72              |
| 14      | 12      | 28                                    | 1.0                   | 22                                 | 28000                               | 7200                          | 53000                 | 1900   | 1.038                              | 220                   |                 |
| 14      | 15      | 35                                    | 1.5                   | 29                                 | 38500                               | 11000                         | 77000                 | 1300   | 1.665                              | 450                   | 80              |
| 14      | 15      | 35                                    | 1.5                   | 29                                 | 38500                               | 11000                         | 77000                 | 1300   | 1.665                              | 450                   |                 |
| 14      | 15      | 35                                    | 1.5                   | 29                                 | 40500                               | 11700                         | 83000                 | 1300   | 2.032                              | 450                   | 90              |
| 14      | 15      | 35                                    | 1.5                   | 29                                 | 40500                               | 11700                         | 83000                 | 1300   | 2.032                              | 450                   |                 |

4) Convex radius in the standard version. The version with cylindrical outer ring is identifiable by the X suffix. E.g. KR40EEX

5) Hole diameter for assembly of the eccentric cam follower without stud: d<sub>e</sub> H7

6) Dimensions of the eccentric bearing.

7) Fr and For load for cam follower without stud and no eccentric collar

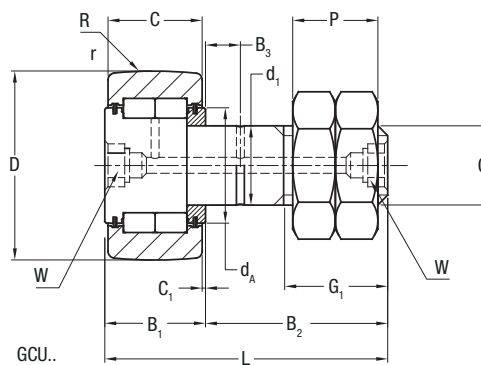
8) Fatigue load coefficient

The KR concentric cam followers with stud are supplied with one clamping nut.

The KRE eccentric cam followers with stud are supplied with an eccentric bearing already fitted and one clamping nut.

# CAM FOLLOWERS WITH THREADED STUD GCU

Full complement needle followers  
with outer diameter from 35 to 130 mm



| ∅ outer D<br>mm | Designation <sup>1)</sup> | d <sub>1</sub> <sup>2)</sup><br>mm | L<br>mm | B <sub>1</sub><br>mm<br>MAX | B <sub>2</sub><br>mm | Threading G<br>mm | G <sub>1</sub><br>mm | C<br>mm | C <sub>1</sub><br>mm | d <sub>A</sub><br>mm | B <sub>3</sub><br>mm | r<br>mm | R <sup>3)</sup><br>mm |
|-----------------|---------------------------|------------------------------------|---------|-----------------------------|----------------------|-------------------|----------------------|---------|----------------------|----------------------|----------------------|---------|-----------------------|
|                 | GCU,<br>GCU..MM           |                                    |         |                             |                      |                   |                      |         |                      |                      |                      |         |                       |
| 35              | 35                        | 16                                 | 52      | 19.6                        | 32.5                 | M16x1.5           | 17                   | 18      | 0.8                  | 25.5                 | 8                    | 0.6     | 320                   |
| 40              | 40                        | 18                                 | 58      | 21.6                        | 36.5                 | M18x1.5           | 19                   | 20      | 0.8                  | 28.6                 | 8                    | 1       | 400                   |
| 47              | 47                        | 20                                 | 66      | 25.6                        | 40.5                 | M20x1.5           | 21                   | 24      | 0.8                  | 32.5                 | 9                    | 1       | 500                   |
| 52              | 52                        | 20                                 | 66      | 25.6                        | 40.5                 | M20x1.5           | 21                   | 24      | 0.8                  | 33.6                 | 9                    | 1       | 500                   |
| 62              | 62                        | 24                                 | 80      | 30.6                        | 49.5                 | M24x1.5           | 25                   | 29      | 0.8                  | 38                   | 11                   | 1       | 640                   |
| 72              | 72                        | 24                                 | 80      | 30.6                        | 49                   | M24x1.5           | 25                   | 29      | 0.8                  | 38                   | 11                   | 1.1     | 640                   |
| 80              | 80                        | 30                                 | 100     | 37                          | 63                   | M30x1.5           | 32                   | 35      | 1                    | 51                   | 15                   | 1.1     | 800                   |
| 85              | 85 <sup>9)</sup>          | 30                                 | 100     | 37                          | 63                   | M30x1.5           | 32                   | 35      | 1                    | 51                   | 15                   | 1.1     | 800                   |
| 90              | 90                        | 30                                 | 100     | 37                          | 63                   | M30x1.5           | 32                   | 35      | 1                    | 51                   | 15                   | 1.1     | 800                   |
| 100             | 100                       | 36                                 | 117     | 42                          | 75                   | M36x3             | 38                   | 40      | 1                    | 61                   | 20                   | 2       | 1000                  |
| 110             | 110                       | 36                                 | 117     | 42                          | 75                   | M36x3             | 38                   | 40      | 1                    | 61                   | 20                   | 2       | 1000                  |
| 120             | 120                       | 42                                 | 136     | 48                          | 88                   | M42x3             | 44                   | 46      | 1                    | 71                   | 24                   | 2       | 1200                  |
| 130             | 130                       | 42                                 | 136     | 48                          | 88                   | M42x3             | 44                   | 46      | 1                    | 71                   | 24                   | 2       | 1200                  |

1) Cam follower with stud designation

GCU.. Concentric cam follower with stud and convex outer ring

GCU... Concentric cam follower with stud and cylindrical outer ring

GCUR.. Eccentric cam follower with stud and convex outer ring

GCURL.. Eccentric cam follower with stud and cylindrical outer ring

No suffix Without guards

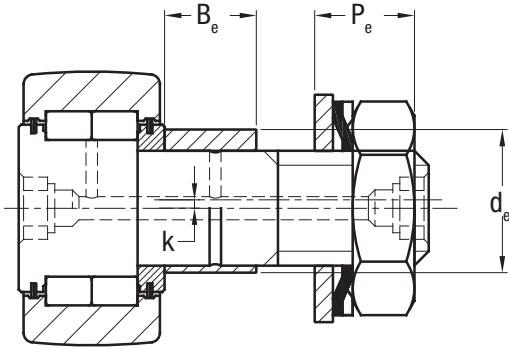
Suffix..MM With metal guards

2) Hole diameter for assembly of concentric cam follower without stud: d<sub>1</sub> H7

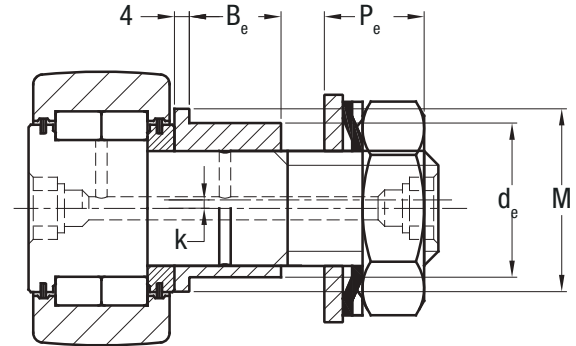
3) Convex radius in the standard version GCU.



# 6.6



from GCUR35.. to GCUR52..



from GCUR62.. to GCUR130..

| W<br>mm | P <sup>7)</sup><br>mm | Eccentric bearing                     |                       |                       |                                    |                                    | Load coefficients (KN) <sup>6)</sup> |                     |              | Greasing speed limit<br>with grease (min <sup>-1</sup> ) | Weight of nut<br>and washers<br>Kg | Clamping<br>torque Nm | ∅ outer D<br>mm |
|---------|-----------------------|---------------------------------------|-----------------------|-----------------------|------------------------------------|------------------------------------|--------------------------------------|---------------------|--------------|--|------------------------------------|-----------------------|-----------------|
|         |                       | d <sub>e</sub> <sup>4) 5)</sup><br>mm | k <sup>5)</sup><br>mm | M <sup>5)</sup><br>mm | B <sub>e</sub> <sup>5)</sup><br>mm | P <sub>e</sub> <sup>8)</sup><br>mm | C <sub>w</sub>                       | Din. F <sub>r</sub> | Stat.<br>For |  |                                    |                       |                 |
| 8       | 16                    | 21                                    | 1.5                   | -                     | 14                                 | 12.2                               | 15.4                                 | 7.25                | 13.1         | 2200   | 0.215                              | 64                    | 35              |
| 8       | 18                    | 24                                    | 1.5                   | -                     | 16                                 | 13.4                               | 18.7                                 | 12.1                | 21.8         | 2200   | 0.313                              | 90                    | 40              |
| 10      | 20                    | 27                                    | 2                     | -                     | 17.5                               | 14.4                               | 30.6                                 | 21.2                | 38.2         | 1600   | 0.5                                | 120                   | 47              |
| 10      | 20                    | 27                                    | 2                     | -                     | 17.5                               | 14.4                               | 30.6                                 | 21.2                | 38.2         | 1600   | 0.555                              | 120                   | 52              |
| 14      | 24                    | 36                                    | 3                     | 44                    | 18                                 | 17.5                               | 44.1                                 | 30.9                | 55.6         | 1400   | 1.035                              | 220                   | 62              |
| 14      | 24                    | 36                                    | 3                     | 44                    | 18                                 | 17.5                               | 50.8                                 | 52.7                | 84.1         | 1400   | 1.278                              | 220                   | 72              |
| 14      | 30                    | 42                                    | 3                     | 50                    | 27                                 | 20.6                               | 66.8                                 | 43.8                | 78.8         | 1000   | 2.07                               | 450                   | 80              |
| 14      | 30                    | 42                                    | 3                     | 50                    | 27                                 | 20.6                               | 75.8                                 | 68.1                | 122          | 1000   | 2.23                               | 450                   | 85              |
| 14      | 30                    | 42                                    | 3                     | 50                    | 27                                 | 20.6                               | 75.8                                 | 68.1                | 122          | 1000   | 2.47                               | 450                   | 90              |
| 17      | 36                    | 48                                    | 3                     | 56                    | 32                                 | 24.6                               | 82.1                                 | 76.6                | 135          | 840  | 3.38                               | 740                   | 100             |
| 17      | 36                    | 48                                    | 3                     | 56                    | 32                                 | 24.6                               | 89.7                                 | 107                 | 161          | 840  | 3.86                               | 740                   | 110             |
| 19      | 42                    | 54                                    | 3                     | 62                    | 39                                 | 26.8                               | 124                                  | 107                 | 193          | 740  | 5.1                                | 1200                  | 120             |
| 19      | 42                    | 54                                    | 3                     | 62                    | 39                                 | 26.8                               | 133                                  | 142                 | 228          | 740  | 5.59                               | 1200                  | 130             |

4) Hole diameter for assembly of the eccentric cam follower without stud: d<sub>e</sub> H7

5) Dimensions of the pivot with eccentric collar

6) F<sub>r</sub> and F<sub>or</sub> load for cam follower without stud and no eccentric collar

7) The GCU concentric cam followers with stud are supplied with double clamping nut.

8) The GCUR eccentric cam followers with stud are supplied with eccentric bearing already fitted, clamping nut, cogged washer and support surface washer

9) Product available on request

# CAM FOLLOWERS WITH STUD

## GC ..MINI

Full complement needle rollers with outer diameter up to 15mm.

GC, GCL series without seal.



| ∅ outer D<br>mm | Designation <sup>1)</sup><br>GC, GCL | d <sub>1</sub> <sup>2)</sup><br>mm | L<br>mm | B <sub>1</sub><br>mm | B <sub>2</sub><br>mm | Threading G<br>mm | G <sub>1</sub><br>mm | C<br>mm | C <sub>1</sub><br>mm | d <sub>A</sub><br>mm | r<br>mm | R <sup>3)</sup><br>mm |
|-----------------|--------------------------------------|------------------------------------|---------|----------------------|----------------------|-------------------|----------------------|---------|----------------------|----------------------|---------|-----------------------|
| 10              | 10                                   | 4                                  | 19.5    | 8.5                  | 11                   | M4x0.7            | 6                    | 8       | 0.25                 | 8.4                  | 0.2     | 130                   |
| 11              | 11                                   | 4                                  | 19.5    | 8.5                  | 11                   | M4x0.7            | 6                    | 8       | 0.25                 | 8.4                  | 0.2     | 130                   |
| 12              | 12                                   | 5                                  | 22.5    | 9.5                  | 13                   | M5x0.8            | 7                    | 9       | 0.25                 | 10.3                 | 0.2     | 130                   |
| 13              | 13                                   | 5                                  | 22.5    | 9.5                  | 13                   | M5x0.8            | 7                    | 9       | 0.25                 | 10.3                 | 0.2     | 130                   |
| 14              | 14                                   | 6                                  | 26      | 10                   | 16                   | M6x1              | 8                    | 9       | 0.25                 | 11.8                 | 0.3     | 130                   |
| 15              | 15                                   | 6                                  | 26      | 10                   | 16                   | M6x1              | 8                    | 9       | 0.25                 | 11.8                 | 0.3     | 130                   |

1) Cam follower with stud designation

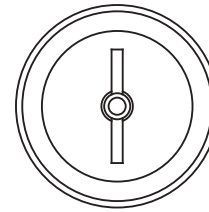
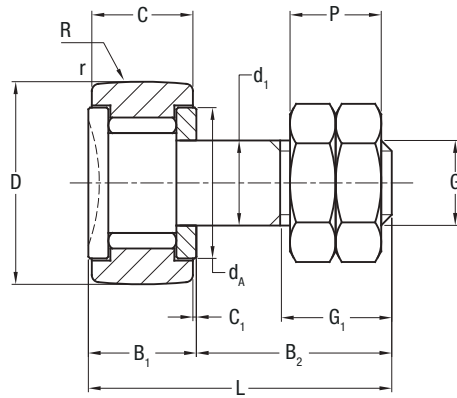
GC.. Concentric cam follower with stud with convex outer ring

GCL.. Concentric cam follower with stud with cylindrical outer ring

2) Hole diameter for assembly d<sub>1</sub>, H7

3) Convex radius for GC version..

# 6.6



| P<br>mm | Load coefficients (N) |                     |                       | Speed limit with<br>grease (min <sup>-1</sup> ) | Weight<br>Kg | Clamping torque<br>Nm | ∅ outer D<br>mm |
|---------|-----------------------|---------------------|-----------------------|---|--------------|-----------------------|-----------------|
|         | C <sub>w</sub>        | Din. F <sub>r</sub> | Stat. F <sub>or</sub> |   |              |                       |                 |
| 6       | 2100                  | 520                 | 960                   | 7500  | 0.006        | 0.9                   | 10              |
| 6       | 2400                  | 520                 | 960                   | 7400  | 0.007        | 0.9                   | 11              |
| 5.4     | 2900                  | 900                 | 1700                  | 6000  | 0.011        | 1.8                   | 12              |
| 5.4     | 3200                  | 900                 | 1700                  | 6000  | 0.011        | 1.8                   | 13              |
| 6.4     | 3400                  | 1500                | 2800                  | 5500  | 0.016        | 3                     | 14              |
| 6.4     | 3600                  | 1500                | 2800                  | 5500  | 0.018        | 3                     | 15              |

The concentric cam followers with stud in the GC Mini series are supplied with two clamping nuts.

# SMALL CAM ROLLERS WITHOUT STUD

## FP

Full complement needle followers  
with outer diameter from 10 to 15mm



| ∅ outer D<br>mm | Designation <sup>1)</sup> | d <sup>2)</sup><br>mm | B<br>mm | C<br>mm | d <sub>A</sub><br>mm | r<br>mm | r <sub>i</sub><br>mm | R <sup>3)</sup><br>mm |
|-----------------|---------------------------|-----------------------|---------|---------|----------------------|---------|----------------------|-----------------------|
|                 | FP, FPL                   |                       |         |         |                      |         |                      |                       |
| 10              | 3 10                      | 3                     | 8.7     | 8       | 8.5                  | 0.2     | 0.15                 | 130                   |
| 11              | 3 11 <sup>4)</sup>        | 3                     | 8.7     | 8       | 8.5                  | 0.2     | 0.15                 | 130                   |
| 12              | 4 12                      | 4                     | 9.7     | 9       | 9.9                  | 0.2     | 0.15                 | 130                   |
| 13              | 4 13 <sup>4)</sup>        | 4                     | 9.7     | 9       | 9.9                  | 0.2     | 0.15                 | 130                   |
| 14              | 4 14 <sup>4)</sup>        | 4                     | 10.2    | 9       | 11.8                 | 0.3     | 0.15                 | 130                   |
| 15              | 4 15                      | 4                     | 10.2    | 9       | 11.8                 | 0.3     | 0.15                 | 130                   |

1) Designation

FP outer convex ring

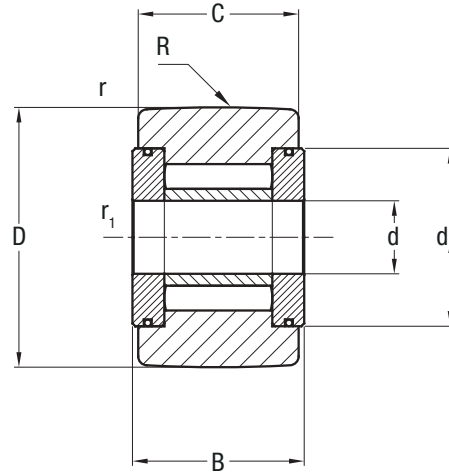
FPL outer cylindrical ring

2) Diameter of the pivot to insert in the recommended hole: h5

3) Version FP convex radius

4) Product available on request

# 6.7



| C <sub>w</sub> | Load coefficients (N) |                       | Grease speed limit (min <sup>-1</sup> ) | Weight Kg |
|----------------|-----------------------|-----------------------|---|-----------|
|                | Din F <sub>r</sub>    | Stat. F <sub>or</sub> |   |           |
| 2.2            | 2200                  | 2200                  | 8200                                    | 0.004     |
| 2.3            | 2300                  | 2300                  | 8200                                    | 0.005     |
| 3.1            | 3500                  | 3500                  | 6800                                    | 0.006     |
| 3.2            | 3800                  | 3800                  | 6800                                    | 0.008     |
| 3.3            | 3900                  | 3900                  | 6800                                    | 0.010     |
| 3.3            | 3900                  | 3900                  | 6800                                    | 0.011     |

# FULL COMPLEMENT NEEDLE ROLLERS

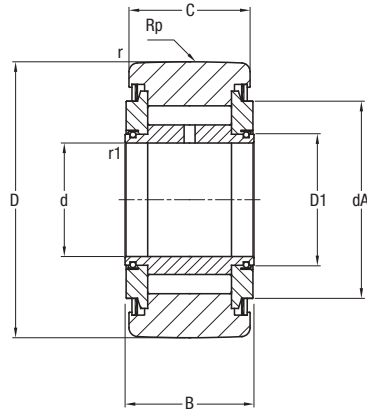
## FG ..SW

Full complement needle followers  
with outer diameter from 16 to 270 mm



| ∅ outer D<br>mm | Designation <sup>1)</sup> | d <sup>2)</sup><br>mm | B<br>mm | C<br>mm | D <sub>1</sub><br>mm | d <sub>A</sub> <sup>3)</sup><br>mm | r<br>mm | r <sub>1</sub><br>mm | R <sub>p</sub> <sup>4)</sup><br>mm |
|-----------------|---------------------------|-----------------------|---------|---------|----------------------|------------------------------------|---------|----------------------|------------------------------------|
|                 | FG ..SW                   |                       |         |         |                      |                                    |         |                      |                                    |
| 16              | 5 16                      | 5                     | 12      | 11      | 7.1                  | 10.4                               | 0.3     | 0.3                  | 500                                |
| 19              | 6 19                      | 6                     | 12      | 11      | 8.1                  | 12.6                               | 0.3     | 0.3                  | 500                                |
| 24              | 8 24                      | 8                     | 13      | 12      | 10.8                 | 15.5                               | 0.3     | 0.3                  | 600                                |
|                 | 8 24 15                   | 8                     | 15      | 14      | 10.8                 | 15.5                               | 0.3     | 0.3                  | 600                                |
| 30              | 10 30                     | 10                    | 15      | 14      | 13.8                 | 22                                 | 0.6     | 0.3                  | 700                                |
| 32              | 12 32                     | 12                    | 15      | 14      | 14.6                 | 22                                 | 0.6     | 0.3                  | 700                                |
| 35              | 15 35                     | 15                    | 19      | 18      | 18.7                 | 26                                 | 0.6     | 0.3                  | 800                                |
| 40              | 17 40                     | 17                    | 21      | 20      | 21.1                 | 31                                 | 0.6     | 0.3                  | 1000                               |
| 47              | 20 47                     | 20                    | 25      | 24      | 25.7                 | 35                                 | 1       | 0.3                  | 1200                               |
| 52              | 25 52                     | 25                    | 25      | 24      | 29.5                 | 35                                 | 1       | 0.3                  | 1200                               |
| 62              | 30 62                     | 30                    | 29      | 28      | 34.8                 | 45                                 | 1       | 0.3                  | 1500                               |
| 72              | 35 72                     | 35                    | 29      | 28      | 39.9                 | 45                                 | 1       | 0.6                  | 1500                               |
| 80              | 40 80                     | 40                    | 32      | 30      | 46.6                 | 61.1                               | 1       | 0.6                  | 1700                               |
| 85              | 45 85 <sup>5)</sup>       | 45                    | 32      | 30      | 51                   | 61.1                               | 1       | 0.6                  | 1700                               |
| 90              | 50 90                     | 50                    | 32      | 30      | 59                   | 71                                 | 1       | 0.6                  | 1700                               |
| 100             | 55 100                    | 55                    | 36      | 34      | 61.3                 | 71                                 | 1.5     | 0.6                  | 2000                               |
| 110             | 60 110                    | 60                    | 36      | 34      | 67                   | 77                                 | 1.5     | 0.6                  | 2000                               |
| 120             | 65 120                    | 65                    | 42      | 40      | 74                   | 83                                 | 1.5     | 0.6                  | 2500                               |
| 125             | 70 125 <sup>5)</sup>      | 70                    | 42      | 40      | 80                   | 91                                 | 1.5     | 0.6                  | 2500                               |
| 130             | 75 130 <sup>5)</sup>      | 75                    | 42      | 40      | 82                   | 94                                 | 1.5     | 0.6                  | 2500                               |
| 140             | 80 140                    | 80                    | 48      | 46      | 87                   | 100                                | 2       | 1                    | 2800                               |
| 150             | 85 150 <sup>5)</sup>      | 85                    | 48      | 46      | 94                   | 105                                | 2       | 1                    | 2800                               |
| 160             | 90 160 <sup>5)</sup>      | 90                    | 54      | 52      | 100.9                | 115                                | 2       | 1                    | 3000                               |
| 170             | 95 170                    | 95                    | 54      | 52      | 107                  | 120                                | 2       | 1                    | 1200 <sup>6)</sup>                 |
| 180             | 100 180                   | 100                   | 65      | 63      | 112                  | 128                                | 2       | 1.5                  | 1200 <sup>6)</sup>                 |
| 200             | 110 200 <sup>5)</sup>     | 110                   | 65      | 63      | 122.5                | 138                                | 2       | 1.5                  | 1400 <sup>6)</sup>                 |
| 215             | 120 215 <sup>5)</sup>     | 120                   | 65      | 63      | 130.1                | 145                                | 2       | 1.5                  | 1400 <sup>6)</sup>                 |
| 230             | 130 230 <sup>5)</sup>     | 130                   | 78      | 75      | 150                  | 168                                | 3       | 1.5                  | 1400 <sup>6)</sup>                 |
| 250             | 140 250 <sup>5)</sup>     | 140                   | 78      | 75      | 162                  | 183                                | 3       | 1.5                  | 1600 <sup>6)</sup>                 |
| 270             | 150 270 <sup>5)</sup>     | 150                   | 78      | 75      | 168                  | 188                                | 3       | 1.5                  | 1600 <sup>6)</sup>                 |

# 6.8



| Load coefficients (N) |                    |                       | Speed limit greasing (min <sup>-1</sup> ) | Weight Kg | Designation FG ..SW   |
|-----------------------|--------------------|-----------------------|---|-----------|-----------------------|
| C <sub>w</sub>        | Din F <sub>r</sub> | Stat. F <sub>or</sub> |   |           |                       |
| 4900                  | 4900               | 5300                  | 5000                                      | 0.016     | 5 16                  |
| 5600                  | 5800               | 6600                  | 4100                                      | 0.019     | 6 19                  |
| 7600                  | 10000              | 10000                 | 3400                                      | 0.037     | 8 24                  |
| 9200                  | 13000              | 13000                 | 3400                                      | 0.044     | 8 24 15               |
| 13000                 | 12000              | 15000                 | 2600                                      | 0.066     | 10 30                 |
| 13000                 | 11000              | 16000                 | 2500                                      | 0.077     | 12 32                 |
| 17000                 | 15000              | 24000                 | 2000                                      | 0.103     | 15 35                 |
| 22000                 | 21000              | 34000                 | 1800                                      | 0.155     | 17 40                 |
| 27000                 | 22000              | 35000                 | 1500                                      | 0.295     | 20 47                 |
| 29000                 | 33000              | 54000                 | 1400                                      | 0.31      | 25 52                 |
| 38000                 | 43000              | 69000                 | 1100                                      | 0.49      | 30 62                 |
| 43000                 | 56000              | 87000                 | 1000                                      | 0.67      | 35 72                 |
| 52000                 | 66000              | 110000                | 870                                       | 0.89      | 40 80                 |
| 54000                 | 68000              | 110000                | 810                                       | 0.97      | 45 85 <sup>5)</sup>   |
| 49000                 | 57000              | 93000                 | 710                                       | 1.04      | 50 90                 |
| 66000                 | 100000             | 150000                | 670                                       | 1.35      | 55 100                |
| 71000                 | 120000             | 170000                | 620                                       | 1.65      | 60 110                |
| 81000                 | 140000             | 210000                | 560                                       | 2.35      | 65 120                |
| 84000                 | 140000             | 220000                | 530                                       | 2.5       | 70 125 <sup>5)</sup>  |
| 84000                 | 140000             | 220000                | 510                                       | 2.65      | 75 130 <sup>5)</sup>  |
| 110000                | 190000             | 280000                | 480                                       | 3.4       | 80 140                |
| 110000                | 200000             | 300000                | 440                                       | 4         | 85 150 <sup>5)</sup>  |
| 130000                | 320000             | 340000                | 420                                       | 5.3       | 90 160 <sup>5)</sup>  |
| 130000                | 250000             | 390000                | 390                                       | 6         | 95 170                |
| 180000                | 280000             | 460000                | 360                                       | 8.05      | 100 180               |
| 200000                | 380000             | 550000                | 340                                       | 10        | 110 200 <sup>5)</sup> |
| 220000                | 460000             | 620000                | 320                                       | 11.5      | 120 215 <sup>5)</sup> |
| 250000                | 340000             | 560000                | 280                                       | 15.5      | 130 230 <sup>5)</sup> |
| 280000                | 410000             | 670000                | 260                                       | 18.5      | 140 250 <sup>5)</sup> |
| 300000                | 540000             | 860000                | 250                                       | 22        | 150 270 <sup>5)</sup> |

1) Cam follower without stud designation

FG..SW Cam follower without stud with optimised outer profile ring without seal

Suffix..EE With plastic seals available up to outer diameter of 90 mm e.g. FG1740EESW

Suffix ..EEM With metal seals e.g. FG1740EEMSW

FGL..SW Cam follower with cylindrical outer ring

2) Recommended diameter for pivot: h5

3) Minimum recommended abutment support diameter in the event of excessive axial load or if there are vibrations

4) Convex radius in the central part to contact pressure calculation

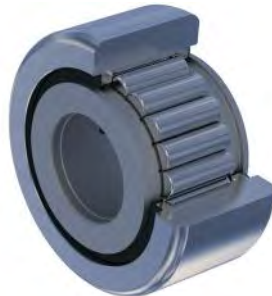
5) Product available on request

6) Constant radius crowning

# FULL COMPLEMENT ROLLERS

## FGU LIGHT SERIES

Full complement rollers with outer diameter  
from 35 to 270 mm



| ∅ outer D<br>mm | Designation <sup>1)</sup> | d <sup>2)</sup><br>mm | B<br>mm | C<br>mm | D <sub>1</sub><br>mm | d <sub>A</sub> <sup>3)</sup><br>mm | r<br>mm | r <sub>1</sub><br>mm | R <sup>4)</sup><br>mm |
|-----------------|---------------------------|-----------------------|---------|---------|----------------------|------------------------------------|---------|----------------------|-----------------------|
|                 | FGU,<br>FGU ..MM          |                       |         |         |                      |                                    |         |                      |                       |
| 35              | 15 35                     | 15                    | 19      | 18      | 19.0                 | 25.4                               | 1.0     | 0.3                  | 320                   |
| 40              | 17 40                     | 17                    | 21      | 20      | 22.0                 | 28                                 | 1.0     | 0.3                  | 400                   |
| 47              | 20 47                     | 20                    | 25      | 24      | 25.8                 | 33.5                               | 1.0     | 0.3                  | 500                   |
| 52              | 25 52                     | 25                    | 25      | 24      | 30.0                 | 38.2                               | 1.0     | 0.3                  | 500                   |
| 62              | 30 62                     | 30                    | 29      | 28      | 36.8                 | 45.9                               | 1.0     | 0.3                  | 640                   |
| 72              | 35 72 <sup>5)</sup>       | 35                    | 29      | 28      | 44.0                 | 53.6                               | 1.0     | 0.6                  | 640                   |
| 80              | 40 80 <sup>5)</sup>       | 40                    | 32      | 30      | 49.5                 | 59.3                               | 1.0     | 0.6                  | 800                   |
| 85              | 45 85 <sup>5)</sup>       | 45                    | 32      | 30      | 54.0                 | 63.1                               | 1.5     | 0.6                  | 800                   |
| 90              | 50 90 <sup>5)</sup>       | 50                    | 32      | 30      | 59.5                 | 68.8                               | 1.5     | 0.6                  | 800                   |
| 100             | 55 100 <sup>5)</sup>      | 55                    | 36      | 34      | 64.0                 | 75.8                               | 1.5     | 0.6                  | 800                   |
| 110             | 60 110 <sup>5)</sup>      | 60                    | 36      | 34      | 69.5                 | 81.5                               | 1.5     | 0.6                  | 800                   |
| 120             | 65 120 <sup>5)</sup>      | 65                    | 42      | 40      | 74.5                 | 86.7                               | 2.0     | 0.6                  | 900                   |
| 125             | 70 125                    | 70                    | 42      | 40      | 79.6                 | 91.8                               | 2.0     | 0.6                  | 900                   |
| 130             | 75 130 <sup>5)</sup>      | 75                    | 42      | 40      | 84.0                 | 97                                 | 2.0     | 0.6                  | 900                   |
| 140             | 80 140 <sup>5)</sup>      | 80                    | 48      | 46      | 90.0                 | 102                                | 2.0     | 1.0                  | 1000                  |
| 150             | 85 150 <sup>5)</sup>      | 85                    | 48      | 46      | 94.0                 | 108.5                              | 2.0     | 1.0                  | 1000                  |
| 160             | 90 160 <sup>5)</sup>      | 90                    | 54      | 52      | 100.0                | 114.7                              | 2.0     | 1.0                  | 1200                  |
| 170             | 95 170 <sup>5)</sup>      | 95                    | 54      | 52      | 106.7                | 121.2                              | 2.0     | 1.0                  | 1200                  |
| 180             | 100 180 <sup>5)</sup>     | 100                   | 65      | 63      | 113.0                | 127.6                              | 2.0     | 1.5                  | 1400                  |
| 200             | 110 200 <sup>5)</sup>     | 110                   | 65      | 63      | 122.0                | 137                                | 3.0     | 1.5                  | 1400                  |
| 215             | 120 215 <sup>5)</sup>     | 120                   | 65      | 63      | 132.0                | 149.3                              | 3.0     | 1.5                  | 1400                  |
| 230             | 130 230 <sup>5)</sup>     | 130                   | 78      | 75      | 143.0                | 160.6                              | 3.0     | 1.5                  | 1600                  |
| 250             | 140 250 <sup>5)</sup>     | 140                   | 78      | 75      | 151.0                | 168                                | 3.0     | 1.5                  | 1600                  |
| 270             | 150 270 <sup>5)</sup>     | 150                   | 78      | 75      | 162.0                | 179.5                              | 3.0     | 1.5                  | 1600                  |

1) Cam follower without stud designation:

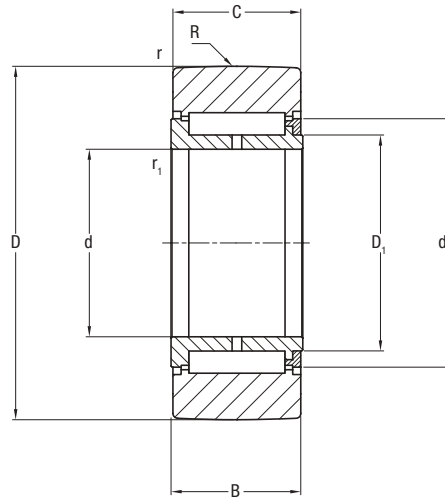
FGU.. Cam follower without stud with optimised outer profile ring and no seals

FGU ..MM With metal seals (e.g. FGU 35 72 MM)

FGUL.. Cam follower with cylindrical outer ring



# 6.8



| Load coefficients (N) |                     |                       | Speed limit greasing (min <sup>-1</sup> ) | Weight Kg | Designation <sup>1)</sup> |
|-----------------------|---------------------|-----------------------|---|-----------|---------------------------|
| C <sub>w</sub>        | Din. F <sub>r</sub> | Stat. F <sub>or</sub> |   |           | FGU, FGU ..MM             |
| 15000                 | 8100                | 13000                 | 2200                                      | 0.099     | 15 35                     |
| 19000                 | 15000               | 21000                 | 2000                                      | 0.142     | 17 40                     |
| 28000                 | 25000               | 30000                 | 1800                                      | 0.239     | 20 47                     |
| 27000                 | 17000               | 28000                 | 1500                                      | 0.276     | 25 52                     |
| 41000                 | 22000               | 36000                 | 1200                                      | 0.461     | 30 62                     |
| 52000                 | 46000               | 67000                 | 1100                                      | 0.629     | 35 72 <sup>5)</sup>       |
| 59000                 | 50000               | 72000                 | 1000                                      | 0.831     | 40 80 <sup>5)</sup>       |
| 59000                 | 38000               | 62000                 | 890                                       | 0.895     | 45 85 <sup>5)</sup>       |
| 61000                 | 38000               | 62000                 | 830                                       | 0.963     | 50 90 <sup>5)</sup>       |
| 72000                 | 37000               | 60000                 | 730                                       | 1.350     | 55 100 <sup>5)</sup>      |
| 90000                 | 70000               | 110000                | 700                                       | 1.672     | 60 110 <sup>5)</sup>      |
| 110000                | 89000               | 140000                | 640                                       | 2.364     | 65 120 <sup>5)</sup>      |
| 110000                | 84000               | 140000                | 600                                       | 2.480     | 70 125                    |
| 110000                | 79000               | 130000                | 670                                       | 2.611     | 75 130 <sup>5)</sup>      |
| 140000                | 120000              | 190000                | 540                                       | 3.520     | 80 140 <sup>5)</sup>      |
| 140000                | 130000              | 200000                | 500                                       | 4.077     | 85 150 <sup>5)</sup>      |
| 180000                | 160000              | 260000                | 480                                       | 5.227     | 90 160 <sup>5)</sup>      |
| 190000                | 180000              | 290000                | 460                                       | 5.943     | 95 170 <sup>5)</sup>      |
| 240000                | 240000              | 390000                | 430                                       | 8.178     | 100 180 <sup>5)</sup>     |
| 260000                | 290000              | 470000                | 390                                       | 10.343    | 110 200 <sup>5)</sup>     |
| 280000                | 320000              | 510000                | 370                                       | 11.782    | 120 215 <sup>5)</sup>     |
| 350000                | 340000              | 550000                | 340                                       | 15.859    | 130 230 <sup>5)</sup>     |
| 380000                | 400000              | 650000                | 310                                       | 19.034    | 140 250 <sup>5)</sup>     |
| 430000                | 590000              | 810000                | 310                                       | 20.014    | 150 270 <sup>5)</sup>     |

2) Recommended diameter for pivot: h5

3) Minimum recommended abutment support diameter in the event of excessive axial load or if there are vibrations

4) Convex radius in the central part to contact pressure calculation

5) Product available on request

# FULL COMPLEMENT ROLLERS

## FGU HEAVY SERIES

Full complement rollers with outer diameter from 42 to 320 mm.



| ∅ outer D<br>mm | Designation <sup>1)</sup> | d <sup>2)</sup><br>mm | B<br>mm | C<br>mm | D <sub>1</sub><br>mm | d <sub>A</sub> <sup>3)</sup><br>mm | r<br>mm | r <sub>1</sub><br>mm | R <sup>4)</sup><br>mm |
|-----------------|---------------------------|-----------------------|---------|---------|----------------------|------------------------------------|---------|----------------------|-----------------------|
|                 | FGU,<br>FGU ..MM          |                       |         |         |                      |                                    |         |                      |                       |
| 42              | 15 42                     | 15                    | 19      | 18      | 19.0                 | 25.4                               | 1       | 0.3                  | 320                   |
| 47              | 17 47                     | 17                    | 21      | 20      | 22.0                 | 28                                 | 1       | 0.3                  | 400                   |
| 52              | 20 52                     | 20                    | 25      | 24      | 25.8                 | 33.5                               | 1       | 0.3                  | 500                   |
| 62              | 25 62                     | 25                    | 25      | 24      | 30.0                 | 38.2                               | 1       | 0.3                  | 500                   |
| 72              | 30 72                     | 30                    | 29      | 28      | 36.8                 | 45.9                               | 1       | 0.3                  | 640                   |
| 80              | 35 80                     | 35                    | 29      | 28      | 44.0                 | 53.6                               | 1       | 0.6                  | 640                   |
| 90              | 40 90 <sup>5)</sup>       | 40                    | 32      | 30      | 49.5                 | 59.3                               | 1       | 0.6                  | 800                   |
| 100             | 45 100                    | 45                    | 32      | 30      | 54.0                 | 63.1                               | 1.5     | 0.6                  | 800                   |
| 110             | 50 110                    | 50                    | 32      | 30      | 59.5                 | 68.8                               | 1.5     | 0.6                  | 800                   |
| 120             | 55 120                    | 55                    | 36      | 34      | 64.0                 | 75.8                               | 1.5     | 0.6                  | 800                   |
| 130             | 60 130                    | 60                    | 36      | 34      | 69.5                 | 81.5                               | 1.5     | 0.6                  | 800                   |
| 140             | 65 140                    | 65                    | 42      | 40      | 74.5                 | 86.7                               | 2       | 0.6                  | 900                   |
| 150             | 70 150                    | 70                    | 42      | 40      | 79.6                 | 91.8                               | 2       | 0.6                  | 900                   |
| 160             | 75 160 <sup>5)</sup>      | 75                    | 42      | 40      | 84.0                 | 97                                 | 2       | 0.6                  | 900                   |
| 170             | 80 170                    | 80                    | 48      | 46      | 90.0                 | 102                                | 2       | 1                    | 1000                  |
| 180             | 85 180 <sup>5)</sup>      | 85                    | 48      | 46      | 94.0                 | 108.5                              | 2       | 1                    | 1000                  |
| 190             | 90 190 <sup>5)</sup>      | 90                    | 54      | 52      | 100.0                | 114.7                              | 2       | 1                    | 1200                  |
| 200             | 95 200                    | 95                    | 54      | 52      | 106.7                | 121.2                              | 2       | 1                    | 1200                  |
| 215             | 100 215                   | 100                   | 65      | 63      | 113.0                | 127.6                              | 2       | 1.5                  | 1400                  |
| 240             | 110 240 <sup>5)</sup>     | 110                   | 65      | 63      | 122.0                | 137                                | 3       | 1.5                  | 1400                  |
| 260             | 120 260 <sup>5)</sup>     | 120                   | 65      | 63      | 132.0                | 149.3                              | 3       | 1.5                  | 1400                  |
| 280             | 130 280 <sup>5)</sup>     | 130                   | 78      | 75      | 143.0                | 160.6                              | 3       | 1.5                  | 1600                  |
| 300             | 140 300                   | 140                   | 78      | 75      | 151.0                | 168                                | 3       | 1.5                  | 1600                  |
| 320             | 150 320 <sup>5)</sup>     | 150                   | 78      | 75      | 162.0                | 179.5                              | 3       | 1.5                  | 1600                  |

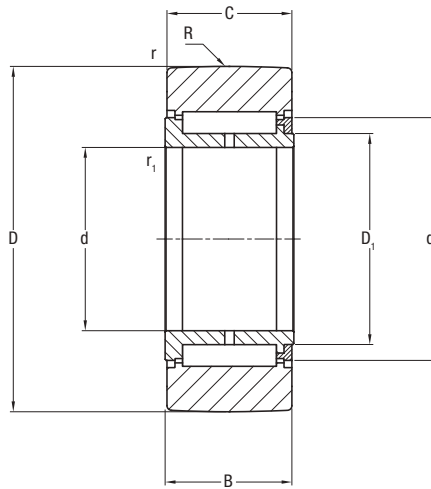
1) Cam follower without stud designation

FGU.. Cam follower without stud with optimised outer profile ring and no seals

FGU ..MM With metal seals e.g. FGU 35 80 MM

FGUL... Cam follower without stud with cylindrical outer ring

# 6.8



| Load coefficients (N) |                    |                       | Speed limit greasing (min <sup>-1</sup> ) | Weight Kg | Designation <sup>1)</sup> |
|-----------------------|--------------------|-----------------------|---|-----------|---------------------------|
| C <sub>w</sub>        | Din F <sub>r</sub> | Stat. F <sub>or</sub> |   |           | FGU, FGU ..MM             |
| 23000                 | 26000              | 26000                 | 2200                                      | 0.16      | 15 42                     |
| 25000                 | 30000              | 30000                 | 2000                                      | 0.22      | 17 47                     |
| 34000                 | 40000              | 40000                 | 1800                                      | 0.31      | 20 52                     |
| 39000                 | 50000              | 50000                 | 1500                                      | 0.45      | 25 62                     |
| 58000                 | 70000              | 76000                 | 1200                                      | 0.70      | 30 72                     |
| 64000                 | 88000              | 88000                 | 1100                                      | 0.73      | 35 80                     |
| 74000                 | 98000              | 98000                 | 1000                                      | 1.13      | 40 90 <sup>5)</sup>       |
| 83000                 | 120000             | 120000                | 890                                       | 1.40      | 45 100                    |
| 90000                 | 130000             | 130000                | 830                                       | 1.70      | 50 110                    |
| 110000                | 150000             | 160000                | 730                                       | 2.27      | 55 120                    |
| 120000                | 180000             | 180000                | 700                                       | 2.68      | 60 130                    |
| 140000                | 220000             | 220000                | 640                                       | 3.60      | 65 140                    |
| 150000                | 240000             | 240000                | 600                                       | 4.17      | 70 150                    |
| 150000                | 260000             | 260000                | 570                                       | 4.75      | 75 160 <sup>5)</sup>      |
| 180000                | 330000             | 330000                | 540                                       | 6.16      | 80 170                    |
| 190000                | 350000             | 350000                | 500                                       | 6.87      | 85 180 <sup>5)</sup>      |
| 240000                | 400000             | 400000                | 480                                       | 8.57      | 90 190 <sup>5)</sup>      |
| 250000                | 420000             | 420000                | 460                                       | 9.50      | 95 200                    |
| 310000                | 570000             | 570000                | 430                                       | 13.54     | 100 215                   |
| 330000                | 630000             | 630000                | 390                                       | 13.95     | 110 240 <sup>5)</sup>     |
| 350000                | 670000             | 670000                | 370                                       | 21.19     | 120 260 <sup>5)</sup>     |
| 460000                | 860000             | 860000                | 340                                       | 27.63     | 130 280 <sup>5)</sup>     |
| 480000                | 910000             | 910000                | 310                                       | 31.73     | 140 300                   |
| 500000                | 930000             | 930000                | 310                                       | 35.97     | 150 320 <sup>5)</sup>     |

2) Recommended diameter for pivot: h5

3) Minimum recommended abutment support diameter in the event of excessive axial load or if there are vibrations

4) Convex radius in the central part to contact pressure calculation

5) Product available on request

# FULL COMPLEMENT NEEDLE ROLLERS

## RNA 11000

Ring with full complement needle rollers,  
mechanically fastened and separate inner ring.  
Outer diameter from 19 to 90 mm



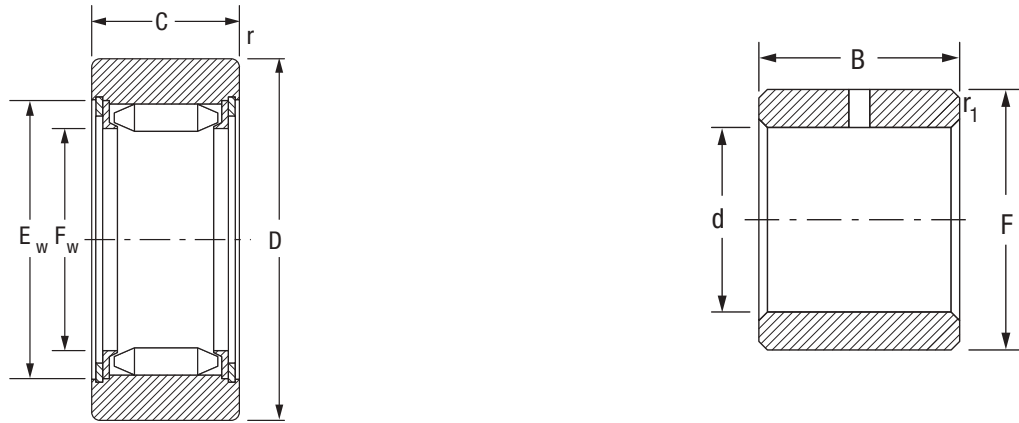
| ∅ outer D<br>mm | Designation | F <sub>w</sub> <sup>2)</sup><br>mm | D <sup>1)</sup><br>mm | C          |                | E <sub>w</sub><br>mm | r min.<br>mm | Weight<br>g | Load<br>coefficients (N) <sup>2)</sup> |
|-----------------|-------------|------------------------------------|-----------------------|------------|----------------|----------------------|--------------|-------------|--|
|                 | RNA ..B6    |                                    |                       | nom.<br>mm | tol.<br>mm     |                      |              |             | C <sub>w</sub>                         |
| 19              | 11005 B6    | 7.3                                | 19                    | 12         | 0<br>-0.10     | 7.3                  | 0.35         | 19          | 5100                                   |
| 22              | 11007 B6    | 9.7                                | 22                    | 12         | 0<br>-0.10     | 14.7                 | 0,35         | 25          | 6000                                   |
| 24              | 14601 B6    | 12.1                               | 24                    | 12         | 0<br>-0.10     | 17.1                 | 0.35         | 27          | 6200                                   |
| 28              | 11009 B6    | 12.1                               | 28                    | 12         | -0.20<br>-0.30 | 17.1                 | 0.35         | 42          | 7400                                   |
| 32              | 11012 B6    | 17.6                               | 32                    | 15         | -0.20<br>-0.30 | 22.6                 | 0.35         | 57          | 10800                                  |
| 35              | 11015 B6    | 20.8                               | 35                    | 15         | -0.20<br>-0.30 | 25.8                 | 0.65         | 62          | 10800                                  |
| 42              | 11017 B6    | 23.9                               | 42                    | 15         | -0.20<br>-0.30 | 28.9                 | 0.65         | 98          | 13400                                  |
| 47              | 11020 B6    | 28.7                               | 47                    | 18         | -0.20<br>-0.30 | 34.7                 | 0.65         | 133         | 16800                                  |
| 52              | 11025 B6    | 33.5                               | 52                    | 18         | -0.20<br>-0.30 | 39.5                 | 0.65         | 152         | 17200                                  |
| 62              | 11030 B6    | 38.2                               | 62                    | 22         | -0.20<br>-0.30 | 44.2                 | 0.65         | 275         | 28500                                  |
| 72              | 11035 B6    | 44                                 | 72                    | 22         | -0.22<br>-0.34 | 50                   | 0.65         | 370         | 32000                                  |
| 80              | 11040 B6    | 49.7                               | 80                    | 22         | -0.22<br>-0.34 | 55.7                 | 0.85         | 450         | 34000                                  |
| 85              | 11045 B6    | 55.4                               | 85                    | 22         | -0.22<br>-0.34 | 62.4                 | 0.85         | 480         | 33500                                  |
| 90              | 11050 B6    | 62.1                               | 90                    | 24         | -0.22<br>-0.34 | 68.1                 | 0.85         | 540         | 32500                                  |

1) Tolerances on the D dimension: h7

2) Recommended tolerance per F<sub>w</sub> diameter of the pivot without the use of inner ring: h5

3) Misalignment permitted for convexing the B6 ring: 1.5/1000

# 6.9



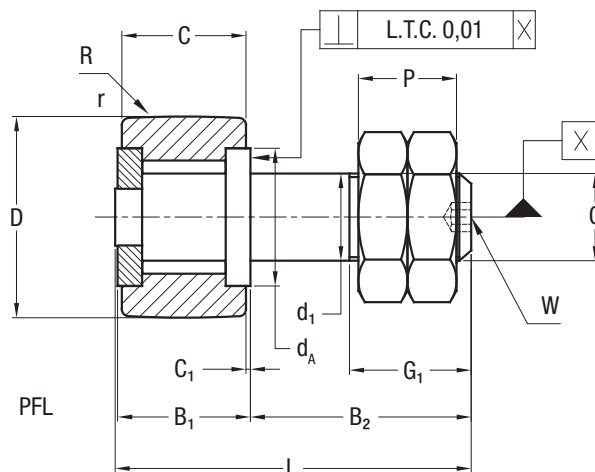
Inner rings

| Load coefficients (N) <sup>2)</sup> |                       | Speed limit with greasing (min <sup>-1</sup> ) | Shaft $\varnothing$ mm | Designation BIC series | d mm | F mm | B       |            | r <sub>1</sub> min mm | Weight g | For cam follower type | $\varnothing$ outer D mm |
|-------------------------------------|-----------------------|--|------------------------|------------------------|------|------|---------|------------|-----------------------|----------|-----------------------|--------------------------|
| Din F <sub>r</sub>                  | Stat. F <sub>or</sub> |  |                        |                        |      |      | nom. mm | tol. mm    |                       |          |                       |                          |
| 4050                                | 4050                  | 8700   | -                      | -                      | -    | -    | -       | -          | -                     | -        | -                     | 19                       |
| 5100                                | 5200                  | 7000   | -                      | -                      | -    | -    | -       | -          | -                     | -        | -                     | 22                       |
| 4700                                | 5600                  | 5800   | -                      | -                      | -    | -    | -       | -          | -                     | -        | -                     | 24                       |
| 7100                                | 7100                  | 5800   | -                      | -                      | -    | -    | -       | -          | -                     | -        | -                     | 28                       |
| 9100                                | 12700                 | 4200   | 12                     | BIC 1012               | 12   | 17.6 | 15      | 0<br>-0.10 | 0.35                  | 16       | 11012                 | 32                       |
| 9100                                | 13400                 | 3650   | 15                     | BIC 1015               | 15   | 20.8 | 15      | 0<br>-0.10 | 0.65                  | 18       | 11015                 | 35                       |
| 13900                               | 18500                 | 3200   | 17                     | BIC 1017               | 17   | 23.9 | 15      | 0<br>-0.10 | 0.65                  | 26       | 11017                 | 42                       |
| 15400                               | 23000                 | 2700   | 20                     | BIC 1020               | 20   | 28.7 | 18      | 0<br>-0.10 | 0.65                  | 46       | 11020                 | 47                       |
| 16500                               | 24700                 | 2330   | 25                     | BIC 1025               | 25   | 33.5 | 18      | 0<br>-0.10 | 0.65                  | 54       | 11025                 | 52                       |
| 31500                               | 49500                 | 2050   | 30                     | BIC 2030               | 30   | 38.2 | 22      | 0<br>-0.10 | 0.65                  | 74       | 11030                 | 62                       |
| 41000                               | 61000                 | 1800   | 35                     | BIC 2035               | 35   | 44   | 22      | 0<br>-0.12 | 0.65                  | 93       | 11035                 | 72                       |
| 47000                               | 68000                 | 1620   | 40                     | BIC 2040               | 40   | 49.7 | 22      | 0<br>-0.12 | 0.85                  | 115      | 11040                 | 80                       |
| 47500                               | 69000                 | 1450   | 45                     | BIC 2045               | 45   | 55.4 | 22      | 0<br>-0.12 | 0.85                  | 139      | 11045                 | 85                       |
| 51000                               | 68000                 | 1300   | 50                     | BIC 11050              | 50   | 62.1 | 24      | 0<br>-0.12 | 0.85                  | 196      | 11050                 | 90                       |

# CAM FOLLOWERS WITH HEAVY STUD PFL

# 6.10

Cam followers with high precision and load capacity.  
Outer diameter of cam follower without stud from 10 to 22 mm



| ∅ outer D<br>mm | Designation <sup>1)</sup> | d <sub>1</sub> <sup>2)</sup><br>mm | L<br>mm | B <sub>1</sub><br>mm | B <sub>2</sub><br>mm | Threading G<br>mm | G <sub>1</sub><br>mm | C<br>mm | C <sub>1</sub><br>mm | d <sub>A</sub><br>mm | r<br>mm | R <sup>3)</sup><br>mm |
|-----------------|---------------------------|------------------------------------|---------|----------------------|----------------------|-------------------|----------------------|---------|----------------------|----------------------|---------|-----------------------|
|                 | PF.. PFL..                |                                    |         |                      |                      |                   |                      |         |                      |                      |         |                       |
| 10              | 10                        | 6                                  | 26.5    | 10                   | 16                   | M6 x 1            | 8                    | 9       | 0.5                  | 8.5                  | 0.5     | 800                   |
| 11              | 11                        | 6                                  | 26.5    | 10                   | 16                   | M6 x 1            | 8                    | 9       | 0.5                  | 8.5                  | 0.5     | 800                   |
| 12              | 12                        | 6                                  | 26.5    | 10                   | 16                   | M6 x 1            | 8                    | 9       | 0.5                  | 9.9                  | 0.5     | 800                   |
| 13              | 13                        | 6                                  | 26.5    | 10                   | 16                   | M6 x 1            | 8                    | 9       | 0.5                  | 9.9                  | 0.05    | 800                   |
| 14              | 14                        | 8                                  | 31.5    | 11                   | 20                   | M8 x 1.25         | 10                   | 10      | 0.5                  | 11.8                 | 0.5     | 800                   |
| 15              | 15                        | 8                                  | 31.5    | 11                   | 20                   | M8 x 1.25         | 10                   | 10      | 0.5                  | 11.8                 | 0.5     | 800                   |
| 16              | 16                        | 8                                  | 32.5    | 12                   | 20                   | M8 x 1.25         | 10                   | 11      | 0.5                  | 13.3                 | 1       | 800                   |
| 19              | 19                        | 10                                 | 36.5    | 13                   | 23                   | M10 x 1.25        | 12                   | 12      | 0.5                  | 15.3                 | 1       | 800                   |
| 22              | 22                        | 10                                 | 36.5    | 13                   | 23                   | M10 x 1.25        | 12                   | 12      | 0.5                  | 18.2                 | 1       | 800                   |

- 1) Designation PFL: cam follower with stud and outer cylindrical ring  
Designation PF: cam follower with stud and outer convex ring R=800 mm  
2) The diameter of the stud is calculated with h6 tolerance. Greasing holes are not foreseen.  
3) Convex radius for PF version

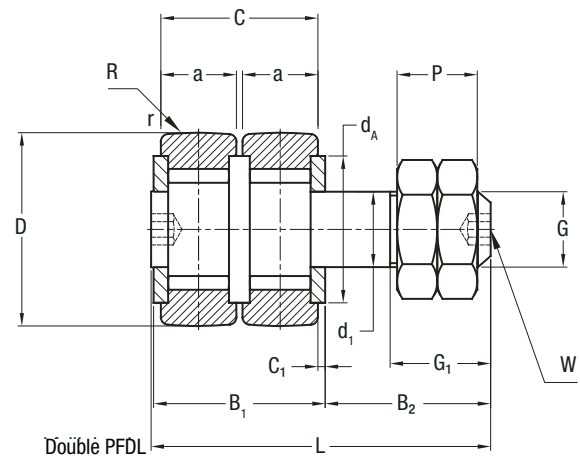
| W<br>mm | P<br>mm | Load coefficients (N) |                     |                       | Speed limit<br>with grease (min <sup>-1</sup> ) | Weight<br>Kg | Clamping torque<br>Nm | ∅ outer D<br>mm |
|---------|---------|-----------------------|---------------------|-----------------------|---|--------------|-----------------------|-----------------|
|         |         | C <sub>w</sub>        | Din. F <sub>r</sub> | Stat. F <sub>or</sub> |   |              |                       |                 |
| 3       | 6.4     | 2400                  | 1500                | 2600                  | 13000   | 0.011        | 3                     | PFL 10          |
| 3       | 6.4     | 2900                  | 1500                | 2800                  | 13000   | 0.013        | 3                     | PFL 11          |
| 3       | 6.4     | 3000                  | 1500                | 2800                  | 11400   | 0.014        | 3                     | PFL 12          |
| 3       | 6.4     | 3300                  | 1500                | 2800                  | 11400   | 0.015        | 3                     | PFL 13          |
| 3       | 8       | 4200                  | 3200                | 4200                  | 10100   | 0.025        | 8                     | PFL 14          |
| 3       | 8       | 4700                  | 3200                | 4900                  | 10100   | 0.027        | 8                     | PFL 15          |
| 3       | 8       | 4900                  | 2900                | 5400                  | 9300  | 0.031        | 8                     | PFL 16          |
| 4       | 10      | 6300                  | 5300                | 7900                  | 7600  | 0.046        | 20                    | PFL 19          |
| 4       | 10      | 6200                  | 5300                | 8100                  | 6300  | 0.06         | 20                    | PFL 22          |

# CAM FOLLOWERS

## DOUBLE PFDL

# 6.11

For assembling on double contact cam movements.  
Outer diameter of cam follower without stud from 24 to 32 mm



| ∅ outer D<br>mm | Designation <sup>1)</sup> | d <sub>1</sub> <sup>2)</sup><br>mm | L<br>mm | B <sub>1</sub><br>mm | B <sub>2</sub><br>mm | Threading G<br>mm | G <sub>1</sub><br>mm | C<br>mm | a<br>mm | C <sub>1</sub><br>mm | d <sub>A</sub><br>mm | r<br>mm | R <sup>3)</sup><br>mm |
|-----------------|---------------------------|------------------------------------|---------|----------------------|----------------------|-------------------|----------------------|---------|---------|----------------------|----------------------|---------|-----------------------|
|                 | PFDL                      |                                    |         |                      |                      |                   |                      |         |         |                      |                      |         |                       |
| 24              | PFDL 24.10                | 10                                 | 45      | 23                   | 21.5                 | M10 x 1.25        | 12.5                 | 21      | 10      | 1                    | 17.9                 | 1.6     | 200                   |
| 28              | PFDL 28.10                | 12                                 | 45      | 22                   | 22.5                 | M12 x 1.5         | 13.5                 | 21      | 10      | 0.5                  | 20.5                 | 1.6     | 200                   |
| 32              | PFDL 32.10                | 12                                 | 45      | 22                   | 22.5                 | M12 x 1.5         | 13.5                 | 21      | 10      | 0.5                  | 24.5                 | 1.8     | 250                   |
| 32              | PFDL 32.14                | 12                                 | 60      | 30                   | 29.5                 | M12 x 1.5         | 19                   | 29      | 14      | 0.5                  | 24.5                 | 1.8     | 250                   |

- 1) Designation PFDL, cam follower with outer cylindrical ring  
Designation PFD., cam follower with stud and outer convex rings  
2) The diameter of the stud is calculated with h6 tolerance  
3) Convex radius for the PFD version

| W<br>mm | P<br>mm | Load coefficients (N)            |                                   |                                     | Speed limit<br>with grease (min <sup>-1</sup> ) | Weight<br>Kg | Clamping<br>torque Nm | ∅ outer D<br>mm |
|---------|---------|----------------------------------|-----------------------------------|-------------------------------------|---|--------------|-----------------------|-----------------|
|         |         | Din C <sub>w</sub> <sup>4)</sup> | Din. F <sub>r</sub> <sup>5)</sup> | Stat. F <sub>or</sub> <sup>5)</sup> |   |              |                       |                 |
| 4       | 10      | 6700                             | 2400                              | 4400                                | 3400  | 0.086        | 20                    | PFDL 24.10      |
| 5       | 12      | 7500                             | 4100                              | 7600                                | 2900  | 0.116        | 26                    | PFDL 28.10      |
| 5       | 12      | 9800                             | 4100                              | 7600                                | 2600  | 0.144        | 26                    | PFDL 32.10      |
| 5       | 12      | 13000                            | 3000                              | 5500                                | 2600  | 0.199        | 26                    | PFDL 32.14      |

- 4) The load coefficient refers to each cam follower without stud of the two cam follower with stud components  
5) With load applied to the opposite cam follower on the stud side







# NEEDLE AND ROLLER THRUST BEARINGS

|          |  |
|----------|--|
| PAGE 128 | 7.1 TECHNICAL SPECIFICATIONS                 |
| PAGE 130 | 7.2 MOUNTING ARRANGEMENTS                    |
| PAGE 132 | 7.3 NEEDLE THRUST BEARINGS AND PLATES        |
| PAGE 138 | 7.4 ROLLER AND NEEDLE THRUST BEARINGS PLATES |

# NEEDLE AND ROLLER THRUST BEARINGS

## TECHNICAL SPECIFICATIONS

The rolling elements of a thrust bearing are retained and guided in radial pockets within the cage (1). The latter is itself retained in relation to the plate (2) by means of a steel ring (3). This assembly of parts is easy to handle and install and to provide a high axial load capacity whilst occupying minimal space.

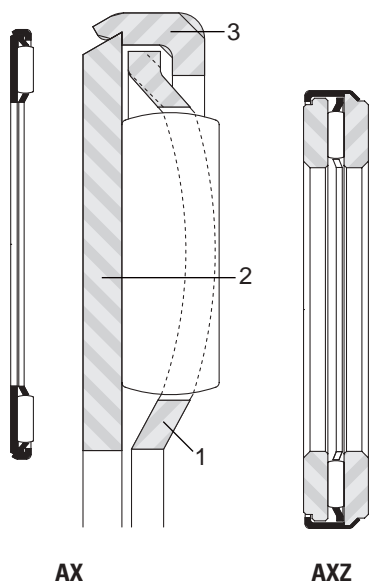
The design of Nadella thrust bearings serves to minimize the friction between the rolling elements and the cage that guides them.

For correct installation and adequate oil lubrication, the coefficient of friction will be between 0.003 and 0.004 for needle thrust bearings and between 0.004 and 0.005 for roller thrust bearings.

This result is due principally to the design of the one-piece steel cage (1) which has a special curvature that guides the rolling elements by their ends along their centre-lines.

Thus, the loads imposed on the cage by the rollers cannot create components parallel to the axis of rotation and therefore no increase in internal friction is generated, and correct operation without wear or overheating is ensured. In addition, this special curvature gives the steel cage great rigidity and being relatively thin provides maximum space for the lubricant.

### TYPES OF THRUST BEARINGS



### THRUST PLATES

The plate incorporated in the thrust bearing is made from hardened bearing steel and forms one of the raceways for the rolling elements. The opposing raceway is generally provided by a separate thrust plate of similar design supplied by Nadella. When the thrust bearing is centred by the revolving part, the thrust plate must be centred by the stationary part and vice versa. If the revolving part and the stationary part are noticeably eccentric to each other, the thrust bearing with integral plate must without exception be centred by the revolving part (see mounting examples on pages 140 and 141).

The second raceway for the rolling elements may also be formed by the face of a shoulder or an inserted ring, provided these have the correct geometrical dimensions and hardness.

### THRUST BEARINGS WITH THRUST PLATE

Thrust bearings type AXZ and ARZ have two thrust plates retained by a steel ring giving protection against the entry of dirt and metal particles whilst at the same time assisting retention of the lubricant.

### OPERATION

When the ring of rolling elements begins to rotate, it is automatically centred in relation to the shaft axis. Thus the thrust bearing does not need to be precisely centred by the incorporated plate. Hence it is possible to align the bearing (on the shaft or in the housing) allowing wide tolerances to be used and without surface hardening.

This enables costs to be reduced. The same feature applies to centring of the thrust plate.

| Thrust bearings with incorporated plate                     | Separate thrust plates            | Thrust bearings with plate and thrust plate incorporated |
|---|-----------------------------------|--|
| Needle thrust bearings<br>AX thin series<br>AX thick series | CP thin series<br>CP thick series | Needle thrust bearings<br>AXZ thick series               |
|   |                                   | Roller thrust bearings<br>ARZ light series               |

Needle thrust bearings with a thin plate are of minimal thickness and are particularly economic to use. They should be considered whenever the degree of support and rotational accuracy permits.

## THICKNESS AND AXIAL RUN-OUT TOLERANCES

|  | Internal Dc1 mm      | Thickness tolerance $\mu\text{m}$ | Axial run-out max |
|--|----------------------|-----------------------------------|-------------------|
| Axial run-out max  | $Dc1 \leq 60$        | + 30/- 40 1)                      | 20 1)             |
|  | $60 < Dc1 \leq 90$   | + 50/- 60 2)                      | 25 2)             |
|  | $90 < Dc1 \leq 120$  | + 50/- 60 2)                      | 30 2)             |
| Thrust plates (thin)                                     | $Dc1 \leq 60$        | + 30/- 40 1)                      | 20 1)             |
|  | $60 < Dc1 \leq 90$   | + 50/- 50 2)                      | 25 2)             |
|  | $90 < Dc1 \leq 120$  | + 50/- 50 2)                      | 30 2)             |
| Needle thrust bearings (thick)<br>Roller thrust bearings | $Dc1 \leq 120$       | + 50/- 60                         | 5 *               |
|  | $120 < Dc1 \leq 180$ | + 50/- 110                        | 7 *               |
|  | $180 < Dc1 \leq 250$ | + 50/- 160                        | 10 *              |
| Thrust plates (thick)                                    | $Dc1 \leq 120$       | + 50/- 50                         | 5 *               |
|  | $120 < Dc1 \leq 180$ | + 50/- 100                        | 7 *               |
|  | $180 < Dc1 \leq 250$ | + 50/- 150                        | 10 *              |

(1) Under min. load of 150 N

(2) Under min. load of 250 N

### SUPPORTING FACES

For smooth running operation of needle or roller thrust bearings, it is necessary that their supporting faces should be parallel.

For a thrust bearing with intermediate thrust plate, the permissible degree of deviation from true parallelism between the two supporting faces should be no more than 1 min. (or approx. 0.3 per 1000).

For a thrust bearing without intermediate thrust plate, the deviation must be no more than 1 min. 30 sec. (or approx. 0.45 per 1000).

Thin needle thrust bearings and thin thrust plates must be supported on a flat, rigid and continuous face throughout the area of circulation of the needles bounded by dimensions Eb and Ea.

Thick needle thrust bearings and thick thrust plates can be supported on a more restricted or discontinuous shoulder, provided that the deflection of the plate under load does not endanger the smooth operation of the thrust bearing or the axial run-out required.

Since roller thrust bearings generally run under considerable loads, their incorporated plate and thrust plate should be supported on a shoulder covering the whole area of circulation of the rollers bounded by dimensions Eb and Ea.

Where an application does not involve the use of a thrust plate, the surface forming the second raceway must:

- Extend at least across the whole area of circulation of the rolling elements between dimensions Eb and Ea;
- Possess a suitable surface finish ( $\leq 0.5 \mu\text{m}$  C.L.A.) and sufficient hardness in relation to the load to be supported.

A hardness of 58-64 HRC enables thrust bearings to carry their full load capacity. Lower hardness values reduce the capacities shown in the tables of dimensions (see Technical Section).

### TOLERANCES FOR CENTRING SUPPORTS

Centring on the shaft: H10 on dimension Dc1 for thrust bearings or thrust plates.

Centring in the housing: H10 on dimension D for thrust bearings and dimension d1 for thrust plates.

### LOAD RATINGS

#### Minimum axial load

Slippage can occur if the applied axial load is too light and the operating speed of the needle thrust bearings is high – particularly if accompanied by inadequate lubrication. For satisfactory operation, a certain minimum load must be applied to a needle thrust bearing which

can be calculated from:

$$F_{a \text{ min}} = C_0/2200 \text{ [kN]}$$

Where:

$C_0$  static load rating [kN]

$F_{a \text{ min}}$  minimum axial load [kN]

### COEFFICIENT OF FRICTION

In general, the coefficient of friction of a thrust bearing (consisting of a needle thrust bearing and thrust plate) is defined as the friction torque, divided by the product of the applied load and the bearing pitch radius. This coefficient of friction is not a constant value, but will vary considerably with load, speed and lubricant.

Generally, the coefficient of friction becomes smaller as the load is increased, and larger as the speed is increased.

It is suggested that a value of 0.008 as a conservative estimate.

### LUBRICATION

Oil is the preferred lubricant for needle thrust bearings and an ample oil flow is absolutely necessary for high speeds or for moderate speeds when the load is relatively high.

When the application must utilize grease lubrication, the needle thrust bearing should be ordered pre-greased.

When the speeds are low and rotation is not continuous, the initial charge of grease may be suitable for the life of the application.

When the speeds are moderate, the designer must provide for frequent re-greasing. Because the needle rollers tend to expel the lubricant radially outward, relubrication passages should be directed to the bore of the cage whether oil or grease is used as the lubricant.

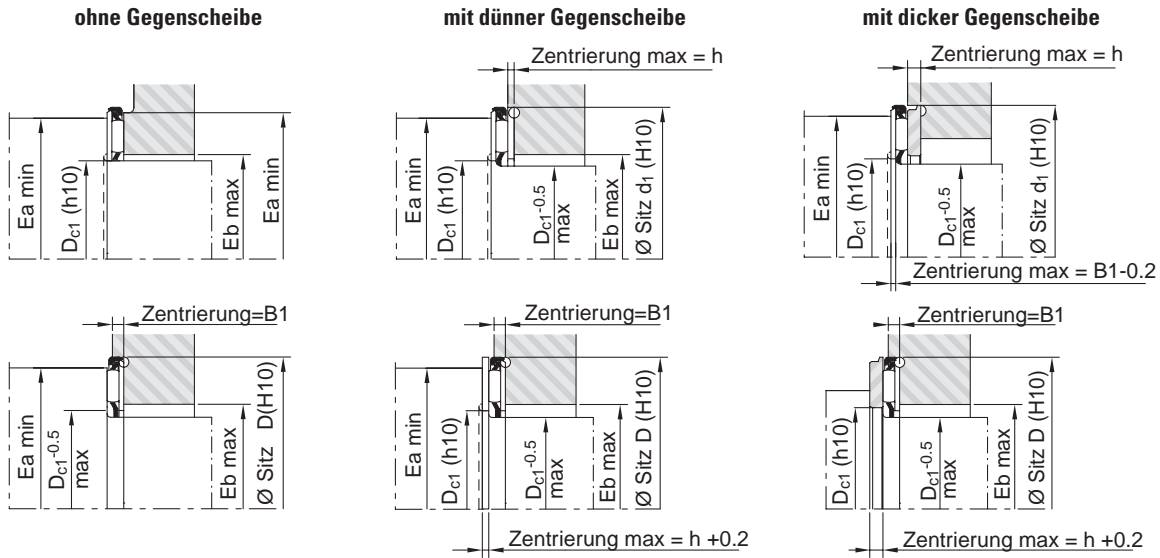
### SPECIAL DESIGNS

Needle thrust bearings and thrust plates are made to special dimensions and configurations, as well as from special materials – when quantities permit economical

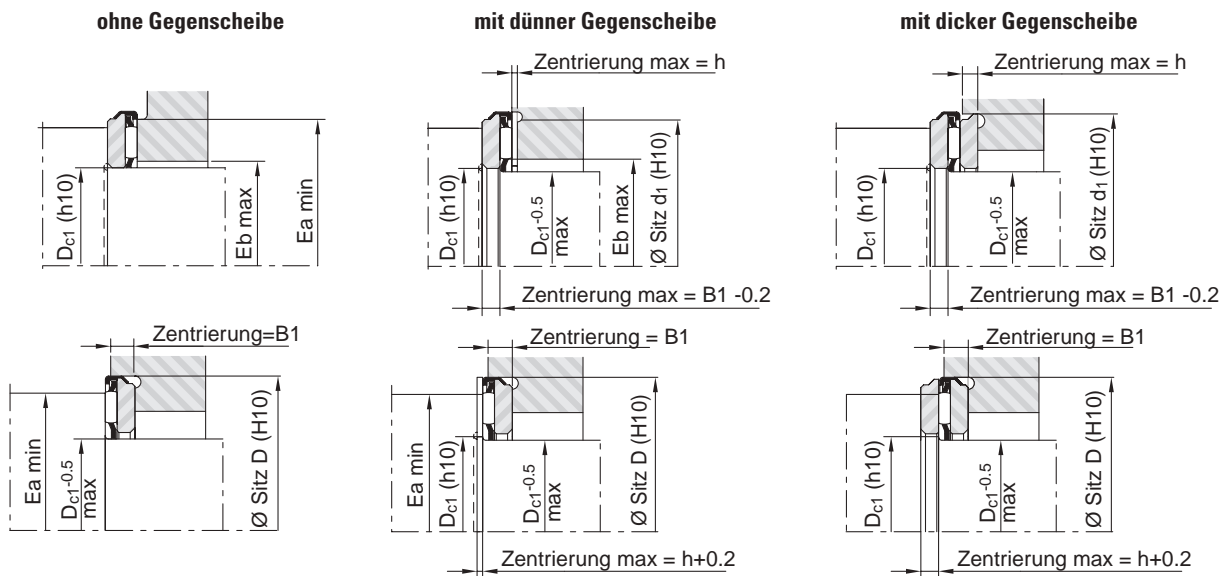
# NEEDLE AND ROLLER THRUST BEARINGS

## MOUNTING ARRANGEMENTS

### NEEDLE THRUST BEARINGS WITH THIN THRUST PLATE

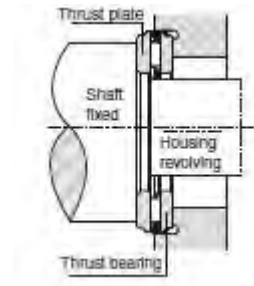
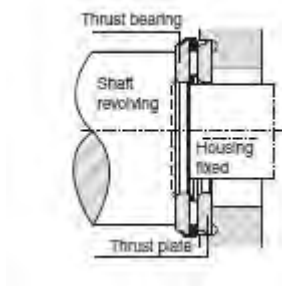


### NEEDLE THRUST BEARINGS WITH THICK PLAT OR PLATE OR LIGHT SERIES ROLLER THRUST BEARINGS



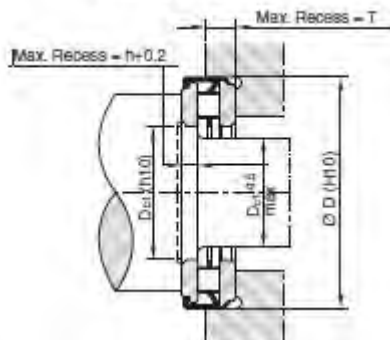
# 7.2

## MOUNTING FOR ECCENTRIC OPERATION

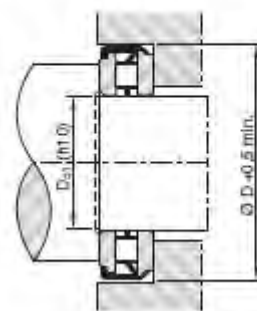


NEEDLE THRUST BEARINGS AXZ OR ROLLER THRUST BEARINGS ARZ

Mounting for high speed rotation

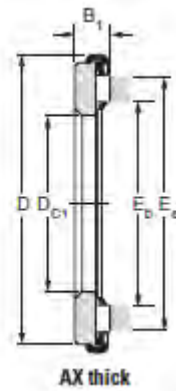
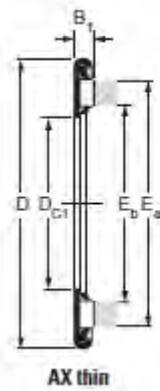


Mounting for slow speed rotation or oscillating motion



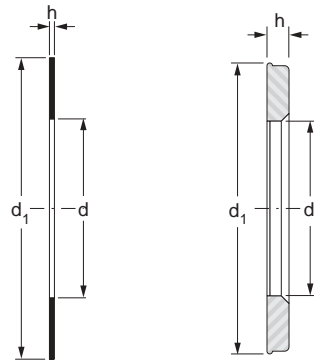
# NEEDLE THRUST BEARINGS

## AX THIN AND THICK SERIES



| Shaft<br>∅<br>mm | Designation    |                 | DC1<br>mm | D<br>mm | B1<br>mm | Eb mm | Ea mm | Load ratings |             | Speed rating<br>oil min-1 | Weight kg |
|------------------|----------------|-----------------|-----------|---------|----------|-------|-------|--------------|-------------|---------------------------|-----------|
|                  | AX thin series | AX thick series |           |         |          |       |       | Dyn. C kN    | Stat. Co kN |                           |           |
| 5                | AX 5 13        |                 | 5         | 13      | 2.3      | 6.3   | 10.9  | 3.00         | 5.70        | 25000                     | 0.001     |
|                  |                | AX 3.5 5 13     | 5         | 13      | 3.5      | 6.3   | 10.9  | 3.00         | 5.70        | 25000                     | 0.002     |
| 6                | AX 6 14        |                 | 6         | 14      | 2.3      | 7.3   | 11.9  | 3.15         | 6.35        | 22000                     | 0.001     |
|                  |                | AX 3.5 6 14     | 6         | 14      | 3.5      | 7.3   | 11.9  | 3.15         | 6.35        | 22000                     | 0.002     |
| 7                | AX 7 15        |                 | 7         | 15      | 2.3      | 8.3   | 12.9  | 3.55         | 7.60        | 22000                     | 0.002     |
|                  |                | AX 3.5 7 15     | 7         | 15      | 3.5      | 8.3   | 12.9  | 3.55         | 7.60        | 22000                     | 0.003     |
| 8                | AX 8 16        |                 | 8         | 16      | 2.3      | 9.3   | 13.9  | 3.70         | 8.30        | 22000                     | 0.002     |
|                  |                | AX 3.5 8 16     | 8         | 16      | 3.5      | 9.3   | 13.9  | 3.70         | 8.30        | 22000                     | 0.003     |
| 9                | AX 9 17        |                 | 9         | 17      | 2.3      | 10.3  | 14.9  | 4.05         | 9.50        | 19000                     | 0.002     |
|                  |                | AX 3.5 9 17     | 9         | 17      | 3.5      | 10.3  | 14.9  | 4.05         | 9.50        | 19000                     | 0.004     |
| 10               | AX 10 22       |                 | 10        | 22      | 2.8      | 12.0  | 18.6  | 5.00         | 10.90       | 15500                     | 0.004     |
|                  |                | AX 4 10 22      | 10        | 22      | 4.0      | 12.0  | 18.6  | 5.00         | 10.90       | 15500                     | 0.007     |
| 12               | AX 12 26       |                 | 12        | 26      | 2.8      | 15.0  | 22.6  | 6.90         | 17.70       | 13000                     | 0.006     |
|                  |                | AX 4 12 26      | 12        | 26      | 4.0      | 15.0  | 22.6  | 6.90         | 17.70       | 13000                     | 0.010     |
| 13               | AX 13 26       |                 | 13        | 26      | 2.8      | 15.0  | 22.6  | 6.90         | 17.70       | 13000                     | 0.006     |
|                  |                | AX 4 13 26      | 13        | 26      | 4.0      | 15.0  | 22.6  | 6.90         | 17.70       | 13000                     | 0.010     |
| 15               | AX 15 28       |                 | 15        | 28      | 2.8      | 17.0  | 24.6  | 7.40         | 20.00       | 11500                     | 0.007     |
|                  |                | AX 4 15 28      | 15        | 28      | 4.0      | 17.0  | 24.6  | 7.40         | 20.00       | 11500                     | 0.009     |
| 17               | AX 17 30       |                 | 17        | 30      | 2.8      | 19.0  | 26.6  | 7.80         | 22.00       | 10500                     | 0.008     |
|                  |                | AX 4 17 30      | 17        | 30      | 4.0      | 19.0  | 26.6  | 7.80         | 22.00       | 10500                     | 0.010     |
| 19               | AX 19 32       |                 | 19        | 32      | 2.8      | 21.0  | 28.6  | 8.00         | 23.30       | 10000                     | 0.009     |
|                  |                | AX 4 19 32      | 19        | 32      | 4.0      | 21.0  | 28.6  | 8.00         | 23.30       | 10000                     | 0.013     |
| 20               | AX 20 35       |                 | 20        | 35      | 2.8      | 22.0  | 31.6  | 11.80        | 39.00       | 9000                      | 0.010     |
|                  |                | AX 5 20 35      | 20        | 35      | 5.0      | 22.0  | 31.6  | 11.80        | 39.00       | 9000                      | 0.018     |
| 25               | AX 25 42       |                 | 25        | 42      | 2.8      | 27.7  | 37.4  | 13.30        | 49.00       | 7500                      | 0.012     |
|                  |                | AX 5 25 42      | 25        | 42      | 5.0      | 27.7  | 37.4  | 13.30        | 49.00       | 7500                      | 0.025     |
| 27               | AX 27 44       |                 | 27        | 44      | 2.8      | 30.0  | 39.6  | 13.70        | 52.00       | 7200                      | 0.012     |
| 30               | AX 30 47       |                 | 30        | 47      | 2.8      | 32.7  | 42.4  | 14.50        | 57.00       | 6500                      | 0.014     |
|                  |                | AX 5 30 47      | 30        | 47      | 5.0      | 32.7  | 42.4  | 14.50        | 57.00       | 6500                      | 0.029     |
| 35               | AX 35 52       |                 | 35        | 52      | 2.8      | 37.2  | 49.0  | 18.90        | 84.00       | 5500                      | 0.019     |
|                  |                | AX 5 35 52      | 35        | 52      | 5.0      | 37.2  | 49.0  | 18.90        | 84.00       | 5500                      | 0.035     |
|                  | AX 35 53       |                 | 35        | 53      | 2.8      | 37.2  | 49.0  | 18.90        | 84.00       | 5500                      | 0.019     |
|                  |                | AX 5 35 53      | 35        | 53      | 5.0      | 37.2  | 49.0  | 18.90        | 84.00       | 5500                      | 0.036     |

## NEEDLE THRUST PLATES CP THIN AND THICK SERIES



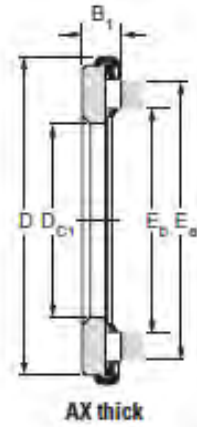
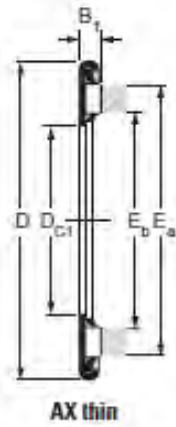
CP dünne Baureihe

CP dicke Baureihe

| Shaft<br>∅<br>mm | Designation    |                 | d mm | d <sub>1</sub> mm | h mm | Weight kg | Thrust bearings |                |
|------------------|----------------|-----------------|------|-------------------|------|-----------|-----------------|----------------|
|                  | CP thin series | CP thick series |      |                   |      |           | AX thin series  | AX thick serie |
| 5                | CP 5 13        |                 | 5    | 12.4              | 0.8  | 0.001     | AX 5 13         |                |
|                  |                | CP 2 5 13       | 5    | 12.4              | 2.0  | 0.002     |                 | AX 3.5 5 13    |
| 6                | CP 6 14        |                 | 6    | 13.4              | 0.8  | 0.001     | AX 6 14         |                |
|                  |                | CP 2 6 14       | 6    | 13.4              | 2.0  | 0.002     |                 | AX 3.5 6 14    |
| 7                | CP 7 15        |                 | 7    | 14.4              | 0.8  | 0.001     | AX 7 15         |                |
|                  |                | CP 2 7 15       | 7    | 14.4              | 2.0  | 0.002     |                 | AX 3.5 7 15    |
| 8                | CP 8 16        |                 | 8    | 15.4              | 0.8  | 0.001     | AX 8 16         |                |
|                  |                | CP 2 8 16       | 8    | 15.4              | 2.0  | 0.002     |                 | AX 3.5 8 16    |
| 9                | CP 9 17        |                 | 9    | 16.4              | 0.8  | 0.001     | AX 9 17         |                |
|                  |                | CP 2 9 17       | 9    | 16.4              | 2.0  | 0.002     |                 | AX 3.5 9 17    |
| 10               | CP 10 22       |                 | 10   | 21.5              | 0.8  | 0.002     | AX 10 22        |                |
|                  |                | CP 2 10 22      | 10   | 21.5              | 2.0  | 0.002     |                 | AX 4 10 22     |
| 12               | CP 12 26       |                 | 12   | 25.5              | 0.8  | 0.003     | AX 12 26        |                |
|                  |                | CP 2 12 26      | 12   | 25.5              | 2.0  | 0.006     |                 | AX 4 12 26     |
| 13               | CP 13 26       |                 | 13   | 25.5              | 0.8  | 0.002     | AX 13 26        |                |
|                  |                | CP 2 13 26      | 13   | 25.5              | 2.0  | 0.006     |                 | AX 4 13 26     |
| 15               | CP 15 28       |                 | 15   | 27.5              | 0.8  | 0.003     | AX 15 28        |                |
|                  |                | CP 2 15 28      | 15   | 27.5              | 2.0  | 0.006     |                 | AX 4 15 28     |
| 17               | CP 17 30       |                 | 17   | 29.5              | 0.8  | 0.003     | AX 17 30        |                |
|                  |                | CP 2 17 30      | 17   | 29.5              | 2.0  | 0.007     |                 | AX 4 17 30     |
| 19               | CP 19 32       |                 | 19   | 31.5              | 0.8  | 0.004     | AX 19 32        |                |
|                  |                | CP 2 19 32      | 19   | 31.5              | 2.0  | 0.009     |                 | AX 4 19 32     |
| 20               | CP 20 35       |                 | 20   | 34.5              | 0.8  | 0.004     | AX 20 35        |                |
|                  |                | CP 3 20 35      | 20   | 34.5              | 3.0  | 0.013     |                 | AX 5 20 35     |
| 25               | CP 25 42       |                 | 25   | 41.5              | 0.8  | 0.005     | AX 25 42        |                |
|                  |                | CP 3 25 42      | 25   | 41.5              | 3.0  | 0.019     |                 | AX 5 25 42     |
| 27               | CP 27 44       |                 | 27   | 43.7              | 0.8  | 0.006     | AX 27 44        |                |
| 30               | CP 30 47       |                 | 30   | 46.5              | 0.8  | 0.006     | AX 30 47        |                |
|                  |                | CP 3 30 47      | 30   | 46.5              | 3.0  | 0.022     |                 | AX 5 30 47     |
| 35               | CP 35 52       |                 | 35   | 51.5              | 0.8  | 0.007     | AX 35 52        |                |
|                  |                | CP 3 35 52      | 35   | 51.5              | 3.0  | 0.026     |                 | AX 5 35 52     |
|                  | CP 35 53       |                 | 35   | 52.5              | 0.8  | 0.007     | AX 35 53        |                |
|                  |                | CP 3 35 53      | 35   | 52.5              | 3.0  | 0.027     |                 | AX 5 35 53     |

# NEEDLE THRUST BEARINGS

## AX THIN AND THICK SERIES



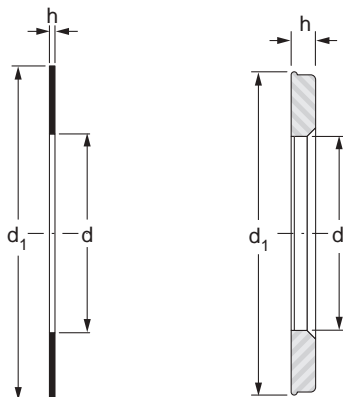
| Shaft<br>∅<br>mm | Designation    |                 | DC <sub>1</sub><br>mm | D<br>mm | B <sub>1</sub><br>mm | E <sub>b</sub><br>mm | E <sub>a</sub><br>mm | Load ratings |             | Speed rating<br>oil min <sup>-1</sup> | Weight kg |
|------------------|----------------|-----------------|-----------------------|---------|----------------------|----------------------|----------------------|--------------|-------------|---------------------------------------|-----------|
|                  | AX thin series | AX thick series |                       |         |                      |                      |                      | Dyn. C kN    | Stat. Co kN |                                       |           |
| 40               | AX 40 60       |                 | 40                    | 60      | 2.8                  | 43.0                 | 54.9                 | 20.40        | 96.00       | 5000                                  | 0.024     |
|                  |                | AX 5 40 60      | 40                    | 60      | 5.0                  | 43.0                 | 54.9                 | 20.40        | 96.00       | 5000                                  | 0.046     |
| 45               | AX 45 65       |                 | 45                    | 65      | 2.8                  | 48.0                 | 59.9                 | 21.80        | 109         | 4500                                  | 0.025     |
|                  |                | AX 5 45 65      | 45                    | 65      | 5.0                  | 48.0                 | 59.9                 | 21.80        | 109         | 4500                                  | 0.050     |
| 50               | AX 50 70       |                 | 50                    | 70      | 2.8                  | 53.3                 | 65.7                 | 22.50        | 118         | 4000                                  | 0.026     |
|                  |                | AX 5 50 70      | 50                    | 70      | 5.0                  | 53.3                 | 65.7                 | 22.50        | 118         | 4000                                  | 0.055     |
| 55               | AX 55 78       |                 | 55                    | 78      | 2.8                  | 58.4                 | 72.5                 | 28.50        | 164         | 3800                                  | 0.034     |
|                  |                | AX 6 55 78      | 55                    | 78      | 6.0                  | 58.4                 | 72.5                 | 28.50        | 164         | 3800                                  | 0.089     |
| 60               | AX 60 85       |                 | 60                    | 85      | 2.8                  | 63.5                 | 79.2                 | 31.50        | 193         | 3500                                  | 0.040     |
|                  |                | AX 6 60 85      | 60                    | 85      | 6.0                  | 63.5                 | 79.2                 | 31.50        | 193         | 3500                                  | 0.106     |
| 65               | AX 3.5 65 90   |                 | 65                    | 90      | 3.5                  | 68.5                 | 84.2                 | 33.50        | 210         | 3200                                  | 0.059     |
|                  |                | AX 6 65 90      | 65                    | 90      | 6.0                  | 68.5                 | 84.2                 | 33.50        | 210         | 3200                                  | 0.114     |
| 70               | AX 3.5 70 95   |                 | 70                    | 95      | 3.5                  | 73.5                 | 89.2                 | 34.50        | 223         | 3000                                  | 0.061     |
|                  |                | AX 6 70 95      | 70                    | 95      | 6.0                  | 73.5                 | 89.2                 | 34.50        | 223         | 3000                                  | 0.120     |
| 75               | AX 3.5 75 100  |                 | 75                    | 100     | 3.5                  | 78.5                 | 94.2                 | 36.00        | 240         | 2900                                  | 0.065     |
|                  |                | AX 6 75 100     | 75                    | 100     | 6.0                  | 78.5                 | 94.2                 | 36.00        | 240         | 2900                                  | 0.127     |
| 80               | AX 3.5 80 105  |                 | 80                    | 105     | 3.5                  | 83.5                 | 99.2                 | 36.50        | 253         | 2700                                  | 0.069     |
|                  |                | AX 6 80 105     | 80                    | 105     | 6.0                  | 83.5                 | 99.2                 | 36.50        | 253         | 2700                                  | 0.134     |
| 85               | AX 3.5 85 110  |                 | 85                    | 110     | 3.5                  | 88.5                 | 104.2                | 38.00        | 270         | 2600                                  | 0.078     |
|                  |                | AX 6 85 110     | 85                    | 110     | 6.0                  | 88.5                 | 104.2                | 38.00        | 270         | 2600                                  | 0.142     |
| 90               | AX 4.5 90 120  |                 | 90                    | 120     | 4.5                  | 94.2                 | 112.9                | 59.00        | 360         | 2400                                  | 0.117     |
|                  |                | AX 8 90 120     | 90                    | 120     | 8.0                  | 94.2                 | 112.9                | 59.00        | 360         | 2400                                  | 0.238     |
| 100              | AX 4.5 100 135 |                 | 100                   | 135     | 4.5                  | 104.2                | 127.3                | 73.00        | 490         | 2100                                  | 0.155     |
|                  |                | AX 9 100 135    | 100                   | 135     | 9.0                  | 104.2                | 127.3                | 73.00        | 490         | 2100                                  | 0.364     |
| 110              | AX 4.5 110 145 |                 | 110                   | 145     | 4.5                  | 114.2                | 137.3                | 77.00        | 550         | 2000                                  | 0.168     |
|                  |                | AX 9 110 145    | 110                   | 145     | 9.0                  | 114.2                | 137.3                | 77.00        | 550         | 2000                                  | 0.393     |
| 120              | AX 4.5 120 155 |                 | 120                   | 155     | 4.5                  | 124.2                | 147.3                | 80.00        | 590         | 1800                                  | 0.182     |
|                  |                | AX 9 120 155    | 120                   | 155     | 9.0                  | 124.2                | 147.3                | 80.00        | 590         | 1800                                  | 0.424     |



# NEEDLE THRUST PLATES

## CP THIN AND THICK SERIES

# 7.3



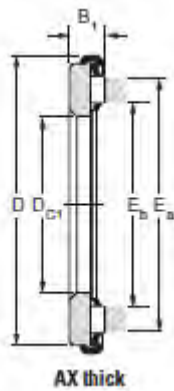
CP dünne Baureihe

CP dicke Baureihe

| Shaft<br>∅<br>mm | Designation    |                 | d mm | d <sub>1</sub> mm | h mm | Weight kg | Thrust bearings |                |
|------------------|----------------|-----------------|------|-------------------|------|-----------|-----------------|----------------|
|                  | CP thin series | CP thick series |      |                   |      |           | AX thin series  | AX thick serie |
| 40               | CP 40 60       |                 | 40   | 59.5              | 0.8  | 0.009     | AX 40 60        |                |
|                  |                | CP 3 40 60      | 40   | 59.5              | 3.0  | 0.034     |                 | AX 5 40 60     |
| 45               | CP 45 65       |                 | 45   | 64.4              | 0.8  | 0.010     | AX 45 65        |                |
|                  |                | CP 3 45 65      | 45   | 64.4              | 3.0  | 0.037     |                 | AX 5 45 65     |
| 50               | CP 50 70       |                 | 50   | 69.4              | 0.8  | 0.011     | AX 50 70        |                |
|                  |                | CP 3 50 70      | 50   | 69.4              | 3.0  | 0.040     |                 | AX 5 50 70     |
| 55               | CP 55 78       |                 | 55   | 77.4              | 0.8  | 0.014     | AX 55 78        |                |
|                  |                | CP 4 55 78      | 55   | 77.4              | 4.0  | 0.069     |                 | AX 6 55 78     |
| 60               | CP 60 85       |                 | 60   | 84.3              | 0.8  | 0.017     | AX 60 85        |                |
|                  |                | CP 4 60 85      | 60   | 84.3              | 4.0  | 0.083     |                 | AX 6 60 85     |
| 65               | CP 1.5 65 90   |                 | 65   | 89.3              | 1.5  | 0.033     | AX 3.5 65 90    |                |
|                  |                | CP 4 65 90      | 65   | 89.3              | 4.0  | 0.088     |                 | AX 6 65 90     |
| 70               | CP 1.5 70 95   |                 | 70   | 94.3              | 1.5  | 0.034     | AX 3.5 70 95    |                |
|                  |                | CP 4 70 95      | 70   | 94.3              | 4.0  | 0.093     |                 | AX 6 70 95     |
| 75               | CP 1.5 75 100  |                 | 75   | 99.3              | 1.5  | 0.037     | AX 3.5 75 100   |                |
|                  |                | CP 4 75 100     | 75   | 99.3              | 4.0  | 0.099     |                 | AX 6 75 100    |
| 80               | CP 1.5 80 105  |                 | 80   | 104.3             | 1.5  | 0.039     | AX 3.5 80 105   |                |
|                  |                | CP 4 80 105     | 80   | 104.3             | 4.0  | 0.104     |                 | AX 6 80 105    |
| 85               | CP 1.5 85 110  |                 | 85   | 109.3             | 1.5  | 0.047     | AX 3.5 85 110   |                |
|                  |                | CP 4 85 110     | 85   | 109.3             | 4.0  | 0.111     |                 | AX 6 85 110    |
| 90               | CP 1.5 90 120  |                 | 90   | 118.8             | 1.5  | 0.052     | AX 4.5 90 120   |                |
|                  |                | CP 5 90 120     | 90   | 118.8             | 5.0  | 0.173     |                 | AX 8 90 120    |
| 100              | CP 1.5 100 135 |                 | 100  | 133.8             | 1.5  | 0.068     | AX 4.5 100 135  |                |
|                  |                | CP 6 100 135    | 100  | 133.8             | 6.0  | 0.277     |                 | AX 9 100 135   |
| 110              | CP 1.5 110 145 |                 | 110  | 143.8             | 1.5  | 0.075     | AX 4.5 110 145  |                |
|                  |                | CP 6 110 145    | 110  | 143.8             | 6.0  | 0.300     |                 | AX 9 110 145   |
| 120              | CP 1.5 120 155 |                 | 120  | 153.8             | 1.5  | 0.081     | AX 4.5 120 155  |                |
|                  |                | CP 6 120 155    | 120  | 153.8             | 6.0  | 0.323     |                 | AX 9 120 155   |

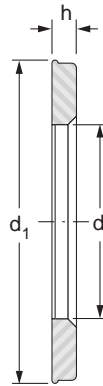
# NEEDLE THRUST BEARINGS

## AX THIN AND THICK SERIES



| Shaft<br>∅<br>mm | Designation<br><br>AX thick series | D <sub>C1</sub><br>mm | D<br>mm | B <sub>1</sub><br>mm | Eb mm | Ea mm | Load ratings |             | Speed rating oil<br>min-1 | Weight<br>kg |
|------------------|------------------------------------|-----------------------|---------|----------------------|-------|-------|--------------|-------------|---------------------------|--------------|
|                  |                                    |                       |         |                      |       |       | Dyn. C kN    | Stat. Co kN |                           |              |
| 130              | AX 11 130 170                      | 130                   | 170     | 11                   | 135   | 161   | 106          | 710         | 1700                      | 0.660        |
| 140              | AX 11 140 180                      | 140                   | 180     | 11                   | 145   | 171   | 111          | 770         | 1600                      | 0.670        |
| 150              | AX 11 150 190                      | 150                   | 190     | 11                   | 155   | 181   | 115          | 830         | 1500                      | 0.710        |
| 160              | AX 11 160 200                      | 160                   | 200     | 11                   | 165   | 191   | 118          | 870         | 1400                      | 0.760        |
| 170              | AX 12 170 215                      | 170                   | 215     | 12                   | 175   | 207   | 165          | 1160        | 1300                      | 1.000        |
| 180              | AX 12 180 225                      | 180                   | 225     | 12                   | 185   | 217   | 173          | 1250        | 1200                      | 1.050        |
| 190              | AX 14 190 240                      | 190                   | 240     | 14                   | 196   | 232   | 230          | 1650        | 1200                      | 1.400        |
| 200              | AX 14 200 250                      | 200                   | 250     | 14                   | 206   | 242   | 239          | 1730        | 1100                      | 1.500        |
| 220              | AX 14 220 270                      | 220                   | 270     | 14                   | 226   | 262   | 248          | 1850        | 1000                      | 1.600        |
| 240              | AX 15 240 300                      | 240                   | 300     | 15                   | 246   | 286   | 280          | 2240        | 900                       | 2.300        |

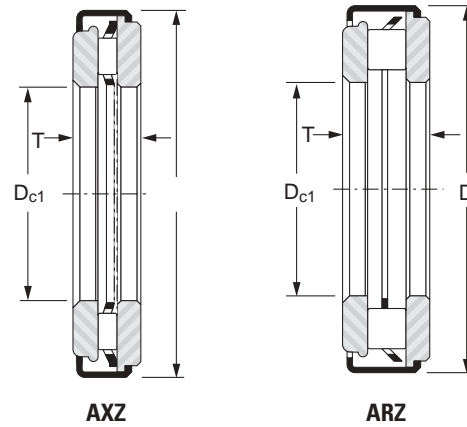
## NEEDLE THRUST PLATES CP THIN AND THICK SERIES



CP dicke Baureihe

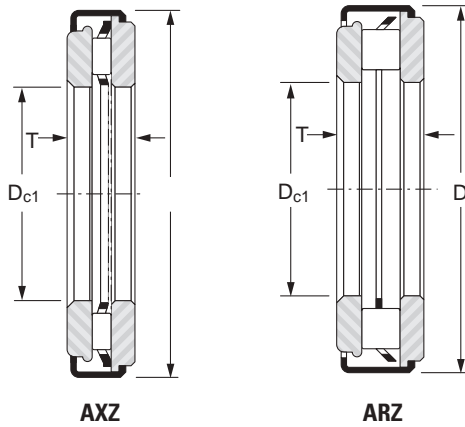
| Shaft<br>∅<br>mm | Designation     | d mm | d <sub>1</sub> mm | h mm | Weight kg | Thrust bearings |
|------------------|-----------------|------|-------------------|------|-----------|-----------------|
|                  | CP thick series |      |                   |      |           | AX thick serie  |
| 130              | CP 7 130 170    | 130  | 168.7             | 7.0  | 0.480     | AX 11 130 170   |
| 140              | CP 7 140 180    | 140  | 178.7             | 7.0  | 0.500     | AX 11 140 180   |
| 150              | CP 7 150 190    | 150  | 188.7             | 7.0  | 0.530     | AX 11 150 190   |
| 160              | CP 7 160 200    | 160  | 198.7             | 7.0  | 0.560     | AX 11 160 200   |
| 170              | CP 7 170 215    | 170  | 213.5             | 7.0  | 0.700     | AX 12 170 215   |
| 180              | CP 7 180 225    | 180  | 223.5             | 7.0  | 0.735     | AX 12 180 225   |
| 190              | CP 8 190 240    | 190  | 238.3             | 8.0  | 0.950     | AX 14 190 240   |
| 200              | CP 8 200 250    | 200  | 248.3             | 8.0  | 1.000     | AX 14 200 250   |
| 220              | CP 8 220 270    | 220  | 268.3             | 8.0  | 1.100     | AX 14 220 270   |
| 240              | CP 9 240 300    | 240  | 298.5             | 9.0  | 1.600     | AX 15 240 300   |

# ROLLER AND NEEDLE THRUST BEARINGS WITH THRUST PLATE AXZ AND ARZ LIGHT SERIES



| Shaft<br>∅<br>mm | Designation   |                     | d mm | D<br>mm | T<br>mm | Load ratings |             | Speed rating<br>oil min <sup>-1</sup> | Weight<br>kg |
|------------------|---------------|---------------------|------|---------|---------|--------------|-------------|---------------------------------------|--------------|
|                  | AXZ           | ARZ<br>light series |      |         |         | Dyn. C kN    | Stat. Co kN |                                       |              |
| 5                | AXZ 5.5 5 13  |                     | 5    | 13      | 5.5     | 3.00         | 5.70        | 25000                                 | 0.004        |
| 6                | AXZ 5.5 6 14  |                     | 6    | 14      | 5.5     | 3.15         | 6.35        | 22000                                 | 0.004        |
| 7                | AXZ 5.5 7 15  |                     | 7    | 15      | 5.5     | 3.55         | 7.60        | 22000                                 | 0.005        |
| 8                | AXZ 5.5 8 16  |                     | 8    | 16      | 5.5     | 3.70         | 8.30        | 22000                                 | 0.005        |
| 9                | AXZ 5.5 9 17  |                     | 9    | 17      | 5.5     | 4.05         | 9.50        | 19000                                 | 0.005        |
| 10               | AXZ 6 10 22.4 |                     | 10   | 22,4    | 6       | 5.00         | 10.9        | 15500                                 | 0.011        |
|                  |               | ARZ 6.5 10 22.4     | 10   | 22,4    | 6.5     | 8.20         | 17.9        | 15500                                 | 0.012        |
| 12               | AXZ 6 12 26.4 |                     | 12   | 26,4    | 6       | 6.90         | 17.7        | 13000                                 | 0.017        |
|                  |               | ARZ 7 12 26.4       | 12   | 26,4    | 7       | 12.7         | 29.5        | 13000                                 | 0.017        |
| 15               | AXZ 6 15 28.4 |                     | 15   | 28,4    | 6       | 7.40         | 20.0        | 11500                                 | 0.016        |
|                  |               | ARZ 7 15 28.4       | 15   | 28,4    | 7       | 14.0         | 34.0        | 11500                                 | 0.019        |
| 17               | AXZ 6 17 30.4 |                     | 17   | 30,4    | 6       | 7.80         | 22.0        | 10500                                 | 0.018        |
|                  |               | ARZ 7 17 30.4       | 17   | 30,4    | 7       | 15.0         | 39.0        | 10500                                 | 0.022        |
| 20               | AXZ 8 20 35.4 |                     | 20   | 35,4    | 8       | 11.80        | 39.0        | 9000                                  | 0.033        |
|                  |               | ARZ 10 20 35.4      | 20   | 35,4    | 10      | 22.0         | 54.0        | 9000                                  | 0.038        |
| 25               | AXZ 8 25 43   |                     | 25   | 43      | 8       | 13.30        | 49.0        | 7500                                  | 0.047        |
|                  |               | ARZ 10 30 43        | 25   | 43      | 10      | 25.5         | 70.0        | 7500                                  | 0.057        |
| 30               | AXZ 8 30 48   |                     | 30   | 48      | 8       | 14.50        | 57.0        | 6500                                  | 0.054        |
|                  |               | ARZ 10 30 48        | 30   | 48      | 10      | 26.5         | 77.0        | 6500                                  | 0.065        |
| 35               | AXZ 8 35 54   |                     | 35   | 54      | 8       | 18.90        | 84.0        | 5500                                  | 0.066        |
|                  |               | ARZ 11 35 54        | 35   | 54      | 11      | 33.8         | 94.0        | 5500                                  | 0.087        |

# 7.4



| Shaft<br>∅<br>mm | Designation   |                     | d mm | D mm | T mm | Load ratings |             | Speed rating<br>oil min <sup>-1</sup> | Weight<br>kg |
|------------------|---------------|---------------------|------|------|------|--------------|-------------|---------------------------------------|--------------|
|                  | AXN           | ARZ<br>light series |      |      |      | Dyn. C kN    | Stat. Co kN |                                       |              |
| 40               | AXZ 8 40 61   |                     | 40   | 61   | 8    | 20.40        | 96.0        | 5000                                  | 0.084        |
|                  |               | ARZ 12 40 61        | 40   | 61   | 12   | 46.0         | 129         | 5000                                  | 0.114        |
| 45               | AXZ 8 45 66   |                     | 45   | 66   | 8    | 21.80        | 109         | 4500                                  | 0.092        |
|                  |               | ARZ 12 45 66        | 45   | 66   | 12   | 49.0         | 143         | 4500                                  | 0.126        |
| 50               | AXZ 8 50 71   |                     | 50   | 71   | 8    | 22.50        | 118         | 4000                                  | 0.100        |
|                  |               | ARZ 12 50 71        | 50   | 71   | 12   | 51.0         | 157         | 4000                                  | 0.137        |
| 60               | AXZ 10 60 86  |                     | 60   | 86   | 10   | 31.50        | 193         | 3500                                  | 0.194        |
|                  |               | ARZ 14 60 86        | 60   | 86   | 14   | 71.0         | 255         | 3500                                  | 0.246        |
| 70               | AXZ 10 70 96  |                     | 70   | 96   | 10   | 34.50        | 223         | 3000                                  | 0.220        |
|                  |               | ARZ 14 70 96        | 70   | 96   | 14   | 77.0         | 295         | 3000                                  | 0.279        |
| 80               | AXZ 10 80 106 |                     | 80   | 106  | 10   | 36.50        | 253         | 2700                                  | 0.256        |
|                  |               | ARZ 14 80 106       | 80   | 106  | 14   | 82.0         | 330         | 2700                                  | 0.312        |



# COMBINED BEARINGS



|          |   |
|----------|---|
| PAGE 142 | 8.1 TECHNICAL FEATURES                              |
| PAGE 146 | 8.2 METHODS OF INSTALLATION                         |
| PAGE 148 | 8.3 COMBINED BEARINGS                               |
| PAGE 150 | 8.4 COMBINED BEARINGS WITH INCORPORATE THRUST PLATE |
| PAGE 154 | 8.5 THRUST PLATES FOR STANDARD COMBINED BEARINGS    |
| PAGE 155 | 8.6 INNER RING FOR STANDARD COMBINED BEARINGS       |

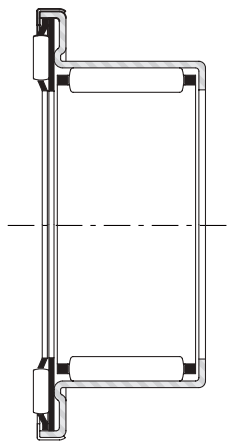
# TYPES OF COMBINED BEARINGS

## TECHNICAL SPECIFICATIONS

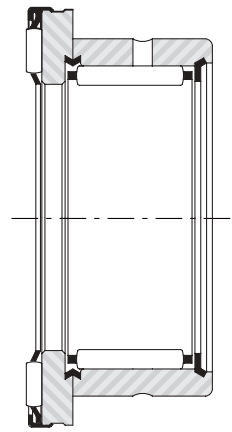
Nadella combined needle bearings type RAX and derivatives are designed to support simultaneously both a radial and an axial load. They comprise a needle thrust bearing (or roller thrust bearing) and needle cage retained in a common outer ring. The technical characteristics of the thrust bearing and the needle cage are set out in the appropriate sections. These bearings form one integral unit permitting easy storage, handling and fitting. Their high radial and axial load capacities and small space requirement enable cost effective solutions to be achieved. Calculations for combined bearings are carried out taking the axial component and the radial component separately without transforming the axial load into an equivalent radial load.

The independent operation of the thrust bearing and the needle cage precludes any interaction harmful to precise axial and radial rotation. Axial expansion of the shaft, for example, will have no effect on the accuracy of the radial component. Bearings can be used without inner rings or thrust plates, if the shaft journals, that serving as raceways, are of sufficient hardness and possess a suitable surface finish. Hardness of 58-64 HRC will ensure that the full capacity of these bearings is achieved. Lower hardness result in reduced static and dynamic capacities (both axial and radial), as indicated in dimensional tables (see Technical Section).

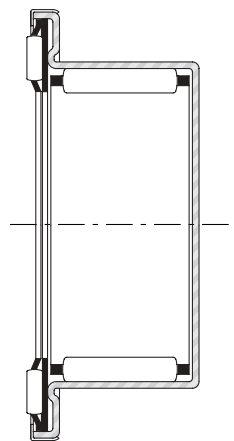
TYPES OF BEARINGS  
Standard combined bearings



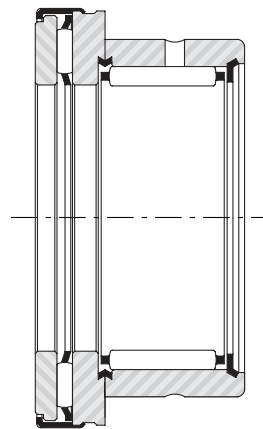
RAX700



RAX400



RAXF700



RAXPZ400



## Combined bearings type RAX 700 and RAXF 700

Combined bearings type RAX 700 possess a onepiece outer ring formed from thin sheet steel accurately controlled and hardened by suitable heat treatment.

The shape of this outer ring prevents weakness in the area between the axial component and the radial component, even after the latter has been tightly fitted into a housing.

This type of combined bearing is inexpensive and occupies little space, thus providing a very economical solution.

Because they are easy to use and can be fitted rapidly, they are often employed in preference to an arrangement with two separate needle bearings.

Closed-end combined bearings type RAXF 700 ensure perfect sealing at the end of a shaft and do not require the use of blind housings or end caps.

## Combined bearings type RAX 400

Combined needle bearings type RAX 400 comprise a thrust plate and an outer ring machined separately and joined by a strong metal insert. This arrangement prevents localised stresses and weakness in the area between the two components, thus eliminating the risk of damage during mounting or operation.

Although combined bearings type RAX 700 should be considered first on grounds of economy, combined bearings with thick outer ring type RAX 400 should be used when operating conditions require higher limit loads or greater rotational accuracy.

Moreover, they can be supplied in machine-tool quality type RAXN.

## Standard combined bearings type RAXPZ 400

These bearings have an incorporated thrust plate retained by a steel ring set on the thrust plate. They are better protected against the introduction of dust and metal particles and are therefore recommended for spindles of drilling machines.

|                        | With needle thrust bearing |           |                               |                            |
|------------------------|----------------------------|-----------|-------------------------------|----------------------------|
|                        | Thin outer ring            |           | Thick outer ring              |                            |
|                        | Open                       | Closedend | Without retained thrust plate | With retained thrust plate |
| Bearings               | RAX 700                    | RAXF 700  | RAX 400                       | RAXPZ 400                  |
| Separate thrust plates | CP thick or thin           |           | CP thick or thin              | -                          |
| Inner rings (1)        | JR                         | JR        | JR                            | JR                         |

## TOLERANCES OF COMBINED BEARINGS

### Combined bearings types RAX 700 and RAXF 700

Types RAX 700 and RAXF 700 have an outer ring formed from thin sheet steel, the radial component of these bearings can only be inspected using a ring-gauge having sufficient thickness to withstand deformation and with a bore ground with great accuracy.

The diameters of the ring-gauge and the "GO" and "NOGO" plug-gauges are identical to those given on page 58 in the inspection table for caged needle bushes type DL having identical inner and outer diameters.

Thickness tolerance of the axial component C1:  $\pm 0,1$  mm

### Standard combined bearings type RAX 400 and derivatives

- *Radial component*

Diameter under the needles Fw: tolerance F6 (ISO Standard 1206).

Outer diameter D

Out-of-roundness

Inner rings JR

Normal tolerance class according to ISO Standard 1206 (see table on page 219).

- *Axial component*

Thickness C1: + 0,05/ - 0,06 mm

Axial run-out max: 0,01 mm

| Tolerance         | Thin thrust plates |                    | Thick thrust plates mm |
|-------------------|--------------------|--------------------|------------------------|
|                   | Internal d ≤ 60 mm | Internal d > 60 mm |                        |
| Thickness         | $h \pm 0,030$ (1)  | $h \pm 0,050$ (2)  | $h \pm 0,050$          |
| Max axial run-out | 0,020 (1)          | 0,025 (2)          | 0,005                  |

(1) Under minimum load of 150 N - (2) Under minimum load of 250 N

# TYPES OF COMBINED BEARINGS

## TECHNICAL SPECIFICATIONS

### RADIAL PLAY

#### Combined bearings types RAX 700, RAXF 700

The fit of a combined bearing with thin outer ring in the housing determines, to a large extent, the dimension under the needles and consequently the radial play during operation.

The recommended shaft and housing tolerances give a radial play whose limits are suitable for most normal applications. To obtain a closer clearance, it is possible to match the shaft diameters with the diameters under the needles of the bearings, after the latter have been fitted into their housings.

The possible differences in the stiffness of housings and the variations of clamping force resulting from the tolerance build up do not permit to establish a range of dimensions under the needles for every application.

However, for housings of very thick steel, taking into account the probable restraining force, the variations of the dimensions under the needles after installation will be within the tolerances given below:

- + 15/ + 50  $\mu\text{m}$  up to  $F_w$  20 mm
- + 20/ + 60  $\mu\text{m}$  up to  $F_w = 25$  a  $F_w = 40$  mm
- + 20/ + 65  $\mu\text{m}$  up to  $F_w = 45$  mm

The limits of radial play should also take into account the tolerance of the shaft used directly as a raceway or of the outer diameter of the inner ring after it has been fitted on to the shaft.

Where an inner ring is used on a shaft of recommended tolerance k5 (or m5), the minimum play may be slightly lower and the maximum play slightly higher than for the case of an assembly without inner ring on a shaft with tolerance h5.

#### Combined bearings type RAX 400 and derivatives

##### *Bearings without inner ring*

The radial play of these bearings when used without inner rings is the difference between the diameter under the needles, which is kept within tolerance F6, and the diameter of the shaft which is machined to the recommended tolerances.

This type of combined bearing without inner ring can be supplied having a diameter under the needles selected in the lower half of tolerance F6 (suffix TB) or in the upper half (suffix TC) according to the table below.

| Nominal dimension<br>$F_w$<br>mm |      | Tolerance of diameter under the needles |                     |                     |
|----------------------------------|------|---|---------------------|---------------------|
|                                  |      | Normal F6<br>$\mu\text{m}$              | TB<br>$\mu\text{m}$ | TC<br>$\mu\text{m}$ |
| above                            | to   |   |                     |                     |
| da 6                             | a 10 | +13/+22                                 | +13/+18             | + 17/+22            |
| da 10                            | a 18 | +16/+27                                 | +16/+22             | +21/+27             |
| da 18                            | a 30 | +20/+33                                 | +20/+27             | +26/+33             |
| da 30                            | a 50 | +25/+41                                 | +25/+33             | +33/+41             |
| da 50                            | a 80 | +30/+49                                 | +30/+40             | +39/+49             |

##### *Bearings with inner ring*

The radial play prior to installation of standard combined bearings with inner ring is in conformance with the normal group of ISO Standard 5753. The closely controlled play provided by this standard can be provided on request.

### SHAFT AND HOUSING TOLERANCES

| Com-<br>bined<br>bearings               | Shaft   |             |  |             | Housing            |   |
|---|---|-------------|--|-------------|--------------------|---|
|   | Dimension d<br>for bearings<br>without inner ring |             | Dimension d<br>for bearings<br>with inner ring |             | Dimension D        |   |
|   | Rotation  | Oscillation | Rotation                                       | Oscillation | Steel or cast-iron | Non-ferrous metal (1) or thin castings in steel |
| RAX, RAXF 700                           | h5 (h6)   | j5 (j6)     | k5 (k6)  | m5 (m6)     | H6 (H7)            | M6 (M7)   |
| RAX,<br>RAXPZ,<br>RAXZ<br>series<br>400 | h5  | j5          | k5   | m5          | K6                 | M6  |

1) If a housing of non - ferrous metal reaches temperatures considerably higher (or lower) than 20 ° C, account should be taken of the difference in expansion (or contraction) of the outer race of the bearing and suitable adjustments to the fits should be made. The cylindrical tolerance defined as the difference in radii of two coaxial cylinders (ISO Standard 1101) should normally be less than a quarter of the manufacturing tolerance. However, for high precision or high

### SUPPORTING FACES- RACEWAYS

The bearing shoulder must be a flat surface at right angles to the housing axis, otherwise the axial precision will be compromised and the smooth running characteristics of the thrust bearing will be reduced. Similarly, the shaft shoulder, on which the needles of the thrust bearing rotate or on which the thrust plate is supported, must be flat and square to the axis. The deviation from true parallelism between the two supporting faces must be no more than:

- 0.3 in 1000, corresponding to an angle of 1 minute, for a combined bearing with thrust plate.
- 0.45 in 1000, corresponding to an angle of 1'30", for a combined bearing without thrust plate.

In the case of an assembly where neither thrust plate nor inner ring is used, the shaft journal on which the needle rotate must have sufficient hardness, i.e. 58-64 HRC to ensure maximum load capacities are attained. the shaft shoulder is used directly as a raceway for the needles of the thrust bearing or, if it supports a thin thrust plate (thickness 0.8 or 1.5 mm), it must be rigid and continuous throughout the area of circulation of the needles bounded by dimensions  $E_b$ , and  $E_a$ .

# 8.1

A thick thrust plate can be supported on a smaller shaft shoulder or on one that is discontinuous (as in the case of splines), provided the deflection of the plate does not affect the smooth running or required accuracy of the thrust bearing. speed applications, it is advisable to restrict this tolerance to the one - eighth of the manufacturing tolerance.

## INSTALLATION

The bearing must be correctly aligned with the housing. is wise to use a small press fitted with a mandrel having supporting face square to the axis and covering the whole area bounded by dimensions  $E_b$ , and  $E_a$ . This method prevents the thrust component from undergoing shock load which might damage the bearing. When **RAX** or **RAXF 700** bearings are placed in position during installation care must be taken to ensure that the force exerted by the press does not exceed the axial limit load shown in the table of dimensions. The fitting inner rings on shafts manufactured to the recommended tolerances is usually sufficient to render the use of retaining rings unnecessary. However, if it is necessary to employ a ring to support an adjacent pinion, this ring must have an outer diameter slightly smaller than dimension  $F_w$  to enable it to pass smoothly into the bearing when the shaft is introduced.

## LUBRICATION

When the applied axial loads are relatively high, the use of oil as a lubrication method is allowed. Combined bearings with a dust cap may use oil lubrication, although their design makes them better suited for use with grease lubrication.

Combined bearings are typically shipped protected with a corrosion preventive compound that is not a lubricant.

The bearings may be used in oil or grease lubricated applications, with out removal of the corrosion-preventive compound. However, it may be advisable to remove the corrosion-preventive compound before packing the bearings (with a suitable grease) to obtain optimum grease performance and to minimize the possibility of confusing grease bearings with bearings containing corrosion preventive.

## LOAD RATINGS

Calculations for combined bearings are carried out taking the axial component and the radial component separately without transforming the axial load into an equivalent radial load.

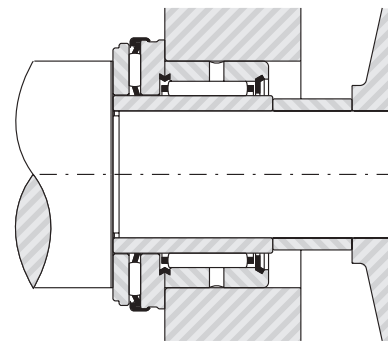
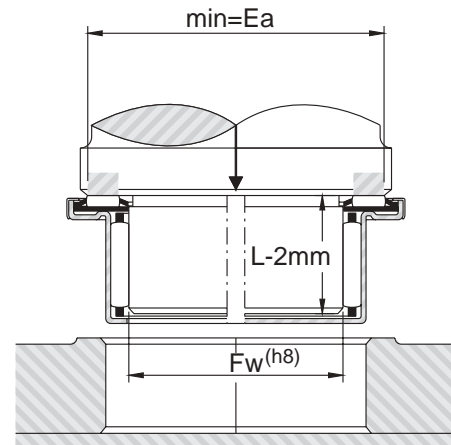
For the meaning of the Load Ratings in the tables of combined bearings **RAX 400** and derivatives, see the Technical Section.

Combined bearings type **RAX700** and **RAXF700** has a limitation for the maximum axial permissible load, both axial and radial, because are made in thin outer ring.

Limit loads are in the table on page 148.

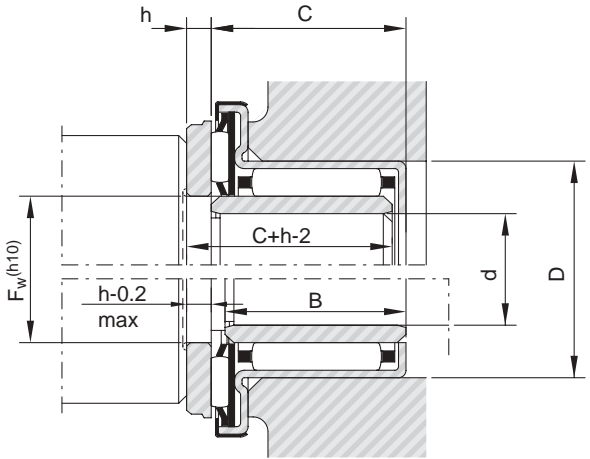
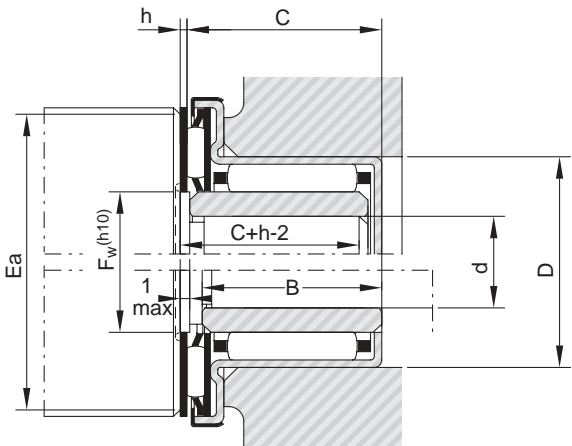
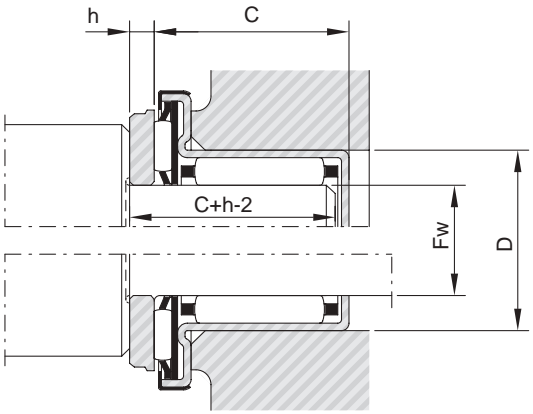
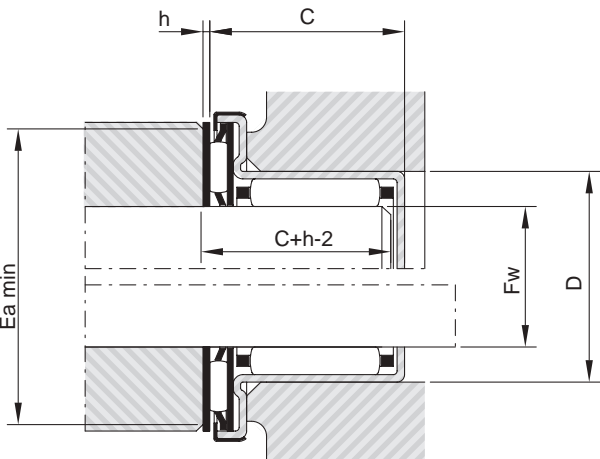
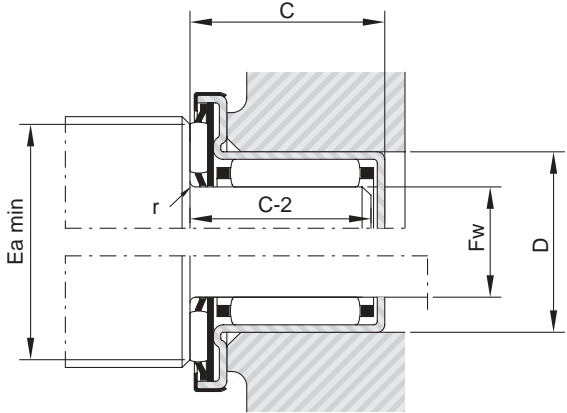
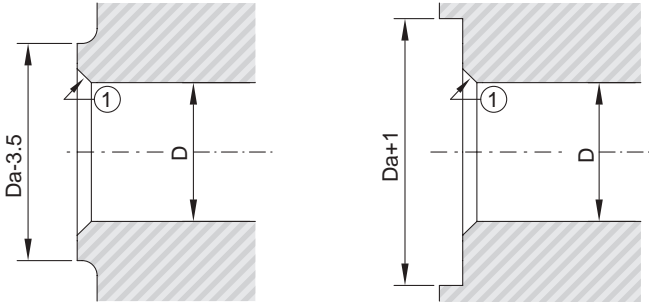
## TYPICAL ARRANGEMENTS USING COMBINED BEARINGS

The special inner rings (series 19000 or 20600) designed for machine - tool quality combined bearings are of sufficient width to permit centring of the thrust plate and thus eliminate the need for a shaft shoulder.



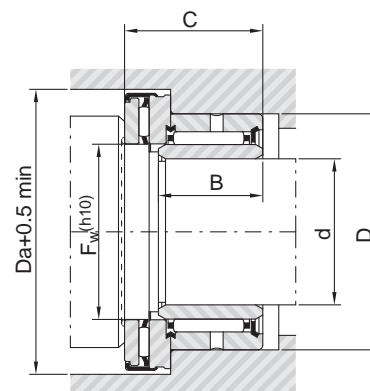
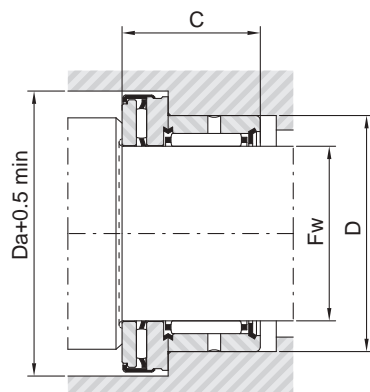
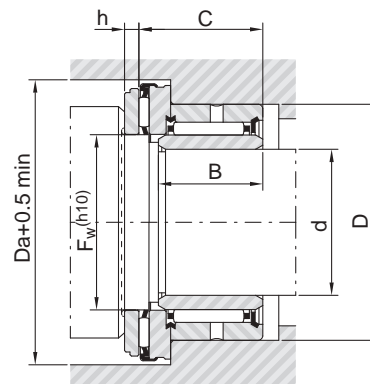
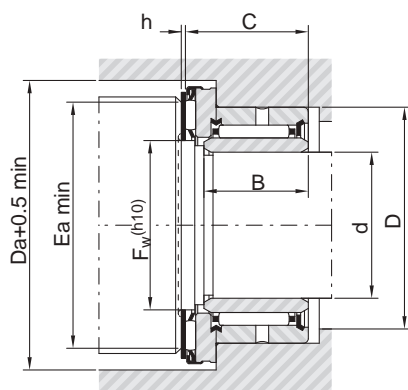
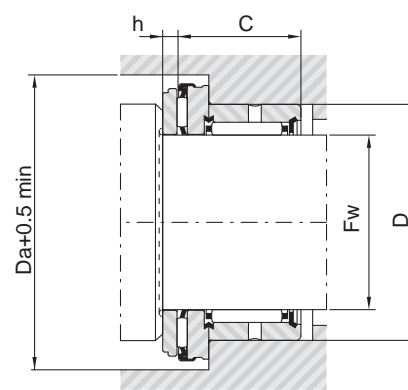
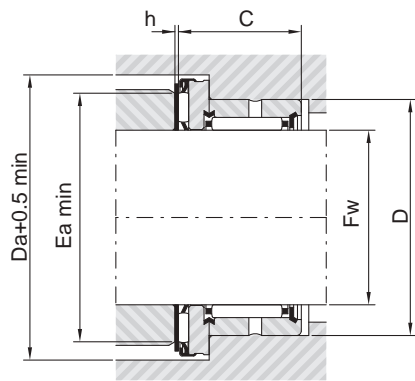
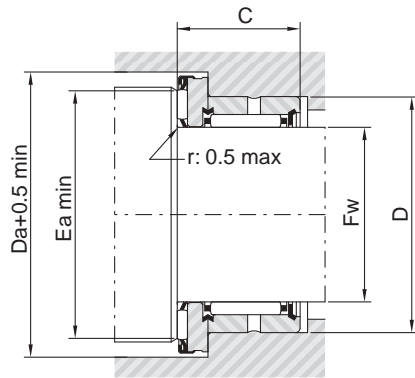
# METHODS OF INSTALLATION

## RAX AND RAXF 700



# 8.2

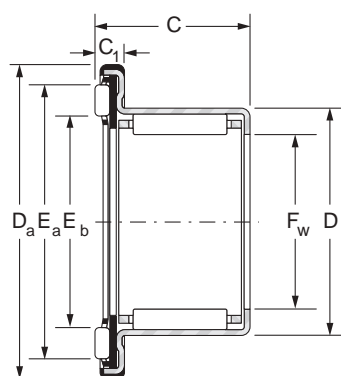
## RAX 400, RAXPZ 400



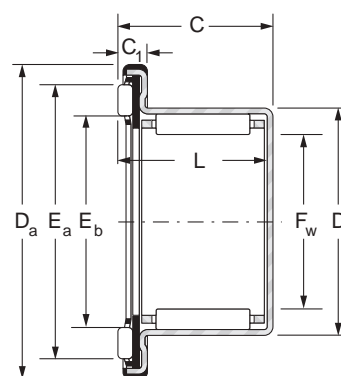
# COMBINED BEARINGS

## RAXF 700

- Open RAX 700 series
- Closed RAXF 700 series



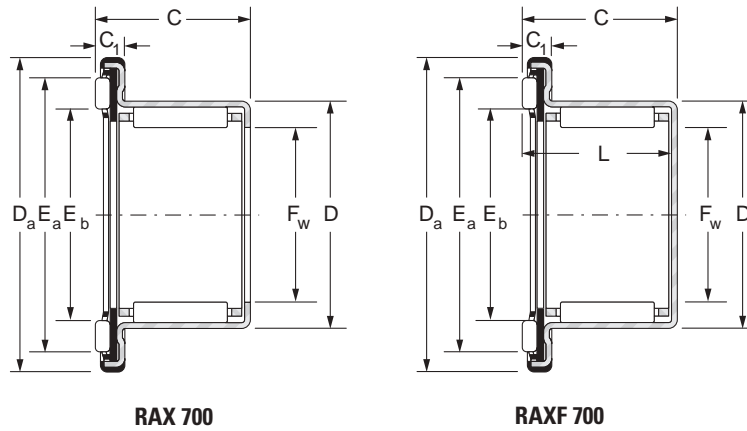
RAX 700



RAXF 700

| Shaft<br>∅<br>mm | Designations      |                    | F <sub>w</sub> mm | D<br>mm | C<br>mm | D <sub>a</sub> mm | E <sub>b</sub> mm | E <sub>a</sub> mm | C <sub>1</sub><br>mm | L<br>mm | Load ratings kN |          |        |          |
|------------------|-------------------|--------------------|-------------------|---------|---------|-------------------|-------------------|-------------------|----------------------|---------|-----------------|----------|--------|----------|
|                  | RAX 700<br>series | RAXF 700<br>series |                   |         |         |                   |                   |                   |                      |         | Radial          |          | Axial  |          |
|                  |                   |                    |                   |         |         |                   |                   |                   |                      |         | Dyn. C          | Stat. Co | Dyn. C | Stat. Co |
| 5                | RAX 705           | -                  | 5                 | 9       | 11      | 15.5              | 7.2               | 11.2              | 3.3                  | -       | 2.15            | 1.95     | 3.15   | 6.35     |
| 12               | RAX 712           | RAXF 712           | 12                | 18      | 14.2    | 27.5              | 15                | 22.6              | 4.2                  | 13.2    | 6.30            | 7.20     | 6.90   | 17.7     |
| 14               | RAX 714           | RAXF 714           | 14                | 20      | 14.2    | 29.5              | 17                | 24.6              | 4.2                  | 13.2    | 6.90            | 8.50     | 7.40   | 20.0     |
| 15               | RAX 715           | RAXF 715           | 15                | 21      | 14.2    | 31.5              | 19                | 26.6              | 4.2                  | 13.2    | 7.40            | 9.30     | 7.80   | 22.0     |
| 18               | RAX 718           | RAXF 718           | 18                | 24      | 18.2    | 33.5              | 21                | 28.6              | 4.2                  | 17.2    | 11.5            | 17.7     | 8.00   | 23.0     |
| 20               | RAX 720           | RAXF 720           | 20                | 26      | 18.2    | 36.5              | 22                | 31.6              | 4.2                  | 17.2    | 12.2            | 19.5     | 11.8   | 39.0     |
| 25               | RAX 725           | RAXF 725           | 25                | 33      | 22.2    | 45.5              | 30                | 39.6              | 4.2                  | 21.2    | 20.5            | 32.0     | 13.7   | 52.0     |
| 30               | RAX 730           | RAXF 730           | 30                | 38      | 22.2    | 50.5              | 35                | 44.7              | 4.2                  | 21.2    | 22.3            | 37.5     | 14.9   | 60.0     |
| 35               | RAX 735           | -                  | 35                | 43      | 22.2    | 56.5              | 39                | 50.9              | 4.2                  | 21.2    | 24.5            | 45.0     | 19.4   | 88.0     |
| 40               | RAX 740           | RAXF 740           | 40                | 48      | 22.2    | 61.5              | 43                | 54.9              | 4.2                  | 21.2    | 26.2            | 51.0     | 20.4   | 96.0     |
| 45               | RAX 745           | -                  | 45                | 52      | 22.2    | 66.5              | 48                | 59.9              | 4.2                  | 21.2    | 24.8            | 55.0     | 21.8   | 109      |

# 8.3

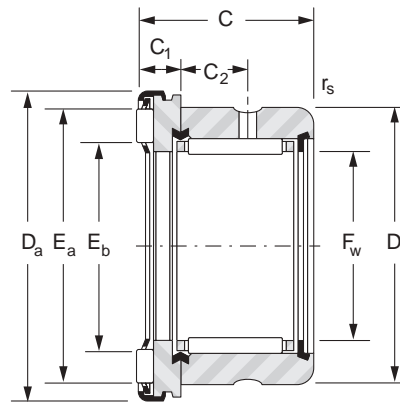


| Limit Loads kN |       | Speed rating min <sup>-1</sup> | Weight |         | Inspection   |                   |                      | Inner ring    | Thrust plate |            | Shaft ∅ mm |
|----------------|-------|--------------------------------|--------|---------|--------------|-------------------|----------------------|---------------|--------------|------------|------------|
| Radial         | Axial |                                | RAX Kg | RAXF Kg | Housing ∅ mm | GO plug-gauges mm | NO-GO plug-gauges mm |               | Thin         | Thick      |            |
| 0.74           | 3.5   | 25000                          | 0.005  | -       | 9.000        | 5.009             | 5.036                | -             | -            | -          | 5          |
| 2.5            | 11    | 13000                          | 0.017  | 0.018   | 18.000       | 12.009            | 12.035               | JR 8x12x12.5  | CP 12 26     | CP 2 12 26 | 12         |
| 2.9            | 12.5  | 11500                          | 0.018  | 0.020   | 20.000       | 14.009            | 14.035               | JR 10x14x12   | CP 14 26     | CP 2 14 26 | 14         |
| 3.1            | 14    | 10500                          | 0.020  | 0.022   | 21.000       | 15.009            | 15.035               | JR 12x15x12.5 | CP 15 28     | CP 2 15 28 | 15         |
| 5.8            | 16    | 10000                          | 0.027  | 0.030   | 24.000       | 18.009            | 18.035               | JR 15x18x16.5 | CP 18 30     | CP 2 18 30 | 18         |
| 6.4            | 18    | 9000                           | 0.031  | 0.035   | 26.000       | 20.009            | 20.035               | JR 15x20x16   | CP 20 35     | CP 3 20 35 | 20         |
| 10.5           | 22    | 7200                           | 0.055  | 0.060   | 33.000       | 25.015            | 25.041               | JR 20x25x20.5 | CP 25 42     | CP 3 25 42 | 25         |
| 12             | 25    | 6300                           | 0.063  | 0.070   | 38.000       | 30.015            | 30.041               | JR 25x30x20.5 | CP 30 47     | CP 3 30 47 | 30         |
| 14.3           | 27    | 5500                           | 0.075  | 0.084   | 43.000       | 35.015            | 35.041               | JR 30x35x20.5 | CP 35 52     | CP 3 35 52 | 35         |
| 16             | 30    | 5000                           | 0.086  | 0.096   | 48.000       | 40.015            | 40.041               | JR 35x40x20.5 | CP 40 60     | CP 3 40 60 | 40         |
| 17             | 32    | 4500                           | 0.088  | 0.099   | 52.000       | 45.015            | 45.041               | JR 40x45x20.5 | CP 45 65     | CP 3 45 65 | 45         |

# COMBINED BEARINGS WITH INCORPORATE THRUST PLATE

## RAX 400

Machine-tool quality  
combined bearings

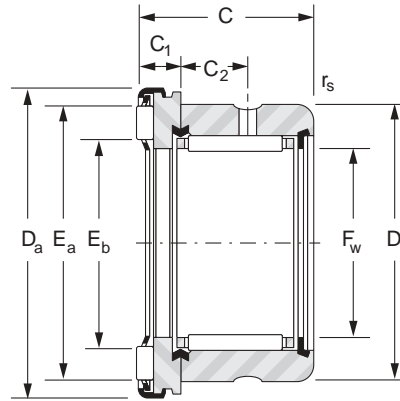


**RAX 400**

| Shaft<br>∅<br>mm | Designations      | F <sub>w</sub><br>mm | C<br>mm | D<br>mm | D <sub>a</sub><br>mm | E <sub>b</sub><br>mm | E <sub>a</sub><br>mm | C <sub>1</sub><br>mm | C <sub>2</sub><br>mm | r <sub>s</sub> min<br>mm |
|------------------|-------------------|----------------------|---------|---------|----------------------|----------------------|----------------------|----------------------|----------------------|--------------------------|
|                  | RAX 400<br>series |                      |         |         |                      |                      |                      |                      |                      |                          |
| 10               | RAX 410           | 10                   | 19      | 19      | 22                   | 12                   | 18.6                 | 5                    | 6                    | 0.35                     |
| 12               | RAX 412           | 12                   | 19      | 21      | 26                   | 15                   | 22.6                 | 5                    | 6                    | 0.35                     |
| 15               | RAX 415           | 15                   | 19      | 24      | 28                   | 17                   | 24.6                 | 5                    | 6                    | 0.35                     |
| 17               | RAX 417           | 17                   | 21      | 26      | 30                   | 19                   | 26.6                 | 5                    | 6                    | 0.65                     |
| 20               | RAX 420           | 20                   | 24      | 30      | 35                   | 22                   | 31.6                 | 6                    | 9                    | 0.85                     |
| 25               | RAX 425           | 25                   | 24      | 37      | 42                   | 27.7                 | 37.4                 | 6                    | 9                    | 0.85                     |
| 30               | RAX430            | 30                   | 24      | 42      | 47                   | 32.7                 | 42.4                 | 6                    | 9                    | 0.85                     |
| 35               | RAX 435           | 35                   | 24      | 47      | 53                   | 37.2                 | 49                   | 6                    | 9                    | 0.85                     |
| 40               | RAX 440           | 40                   | 24      | 52      | 60                   | 43                   | 54.9                 | 6                    | 9                    | 0.85                     |
| 45               | RAX 445           | 45                   | 24      | 58      | 65                   | 48                   | 59.9                 | 6                    | 9                    | 0.85                     |
| 50               | RAX 450           | 50                   | 27      | 62      | 70                   | 53.3                 | 65.7                 | 6                    | 11                   | 1.3                      |
| 60               | RAX 460           | 60                   | 28      | 72      | 85                   | 63.5                 | 79.2                 | 7                    | 11                   | 1.3                      |
| 70               | RAX 470           | 70                   | 28      | 85      | 95                   | 73.5                 | 89.2                 | 7                    | 11                   | 1.3                      |



# 8.4

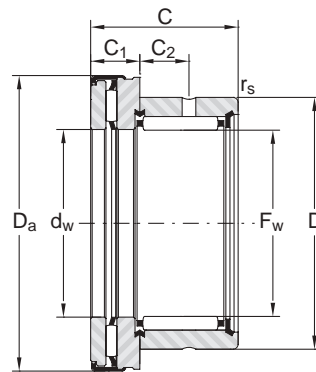


**RAX 400**

| Load Ratings kN |          |        |          | Speed rating<br>min <sup>-1</sup> | Weight<br>kg | Inner<br>Ring | Thrust Plate |            | Shaft<br>∅<br>mm |
|-----------------|----------|--------|----------|-----------------------------------|--------------|---------------|--------------|------------|------------------|
| Radial          |          | Axial  |          |                                   |              |               | Thin         | Thick      |                  |
| Dyn. C          | Stat. Co | Dyn. C | Stat. Co |                                   |              |               |              |            |                  |
| 5.90            | 7.16     | 5.00   | 10.9     | 15500                             | 0.025        | JR 7x10x16    | CP 10 22     | CP 2 10 22 | 10               |
| 6.78            | 9.03     | 7.10   | 18.5     | 13000                             | 0.032        | JR 9x12x16    | CP 12 26     | CP 2 12 26 | 12               |
| 9.66            | 12.6     | 7.60   | 20.8     | 11500                             | 0.034        | JR 12x15x16   | CP 15 28     | CP 2 15 28 | 15               |
| 11.8            | 16.3     | 8.1    | 23       | 10500                             | 0.041        | JR 14x17x17   | CP 17 30     | CP 2 17 30 | 17               |
| 14.8            | 23.7     | 11.8   | 39       | 9000                              | 0.066        | JR 17x20x20   | CP 20 35     | CP 3 20 35 | 20               |
| 15.1            | 26.2     | 13.3   | 49       | 7500                              | 0.099        | JR 20x25x20   | CP 25 42     | CP 3 25 42 | 25               |
| 20.2            | 34.6     | 14.5   | 57       | 6.500                             | 0.111        | JR 25x30x20   | CP 30 47     | CP 3 30 47 | 30               |
| 22.1            | 40.8     | 18.9   | 84       | 5.500                             | 0.130        | JR 30x35x20   | CP 35 52     | CP 3 35 52 | 35               |
| 23.8            | 47.0     | 20.4   | 96       | 5.000                             | 0.150        | JR 35x40x20   | CP 40 60     | CP 3 40 60 | 40               |
| 24.9            | 51.8     | 21.8   | 109      | 4.500                             | 0.179        | JR 40x45x20   | CP 45 65     | CP 3 45 65 | 45               |
| 30.2            | 68.5     | 22.5   | 118      | 4.000                             | 0.205        | JR 45x50x25   | CP 50 70     | CP 3 50 70 | 50               |
| 31.9            | 78.1     | 31.5   | 193      | 3.500                             | 0.282        | JR 55x60x25   | CP 60 85     | CP 4 60 85 | 60               |
| 36.1            | 84.7     | 34.5   | 223      | 3.000                             | 0.386        | JR 60x70x25   | CP 1.5 70 95 | CP 4 70 95 | 70               |

# COMBINED BEARINGS WITH INCORPORATE THRUST PLATE

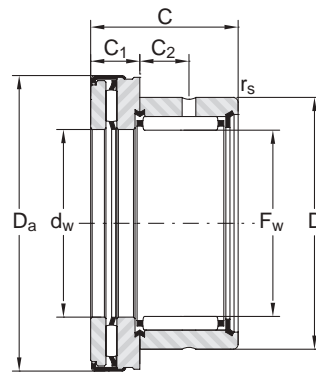
## RAXPZ 400



**RAXPZ400**

| Shaft<br>∅<br>mm | Designations        | F <sub>w</sub> mm | D<br>mm | C<br>mm | d <sub>a</sub> mm | D <sub>a</sub> mm | C <sub>1</sub><br>mm | C <sub>2</sub><br>mm | r <sub>s</sub> min<br>mm |
|------------------|---------------------|-------------------|---------|---------|-------------------|-------------------|----------------------|----------------------|--------------------------|
|                  | RAXPZ 400<br>series |                   |         |         |                   |                   |                      |                      |                          |
| 10               | RAXPZ 410           | 10                | 19      | 21      | 10                | 22.4              | 7                    | 6                    | 0.35                     |
| 12               | RAXPZ 412           | 12                | 21      | 21      | 12                | 26.4              | 7                    | 6                    | 0.35                     |
| 15               | RAXPZ 415           | 15                | 24      | 21      | 15                | 28.4              | 7                    | 6                    | 0.35                     |
| 17               | RAXPZ 417           | 17                | 26      | 23      | 17                | 30.4              | 7                    | 8                    | 0.65                     |
| 20               | RAXPZ 420           | 20                | 30      | 27      | 20                | 35.4              | 9                    | 9                    | 0.85                     |
| 25               | RAXPZ 425           | 25                | 37      | 27      | 25                | 43                | 9                    | 9                    | 0.85                     |
| 30               | RAXPZ 430           | 30                | 42      | 27      | 30                | 48                | 9                    | 9                    | 0.85                     |
| 35               | RAXPZ 435           | 35                | 71      | 27      | 35                | 54                | 9                    | 9                    | 0.85                     |
| 40               | RAXPZ 440           | 40                | 52      | 27      | 40                | 61                | 9                    | 9                    | 0.85                     |
| 45               | RAXPZ 445           | 45                | 58      | 27      | 45                | 66                | 9                    | 9                    | 0.85                     |
| 50               | RAXPZ 450           | 50                | 62      | 30      | 50                | 71                | 9                    | 11                   | 1.3                      |
| 60               | RAXPZ 460           | 60                | 72      | 32      | 60                | 86                | 11                   | 11                   | 1.3                      |
| 70               | RAXPZ 470           | 70                | 85      | 32      | 70                | 96                | 11                   | 11                   | 1.3                      |

# 8.4

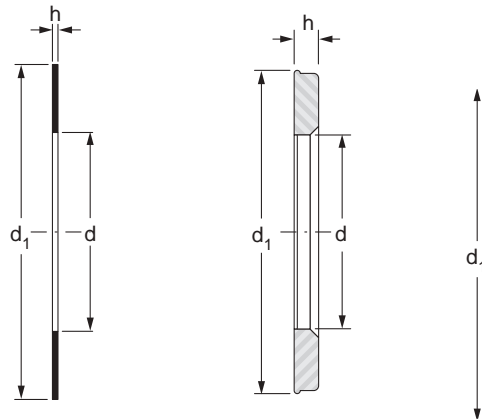


**RXPZ400**

| Load Ratings kN |          |        |          | Speed rating min <sup>-1</sup> | Weight kg | Shaft<br>∅<br>mm |
|-----------------|----------|--------|----------|--------------------------------|-----------|------------------|
| Radial          |          | Axial  |          |                                |           |                  |
| Dyn. C          | Stat. Co | Dyn. C | Stat. Co |                                |           |                  |
| 5.90            | 7.16     | 5.00   | 10.9     | 15500                          | 0.029     | 10               |
| 6.78            | 9.03     | 7.10   | 18.5     | 13000                          | 0.038     | 12               |
| 9.66            | 12.6     | 7.60   | 20.8     | 11500                          | 0.040     | 15               |
| 11.8            | 16.3     | 8.1    | 23       | 10500                          | 0.048     | 17               |
| 14.8            | 23.7     | 11.8   | 39       | 9000                           | 0.079     | 20               |
| 15.1            | 26.2     | 13.3   | 49       | 7500                           | 0.118     | 25               |
| 20.2            | 34.6     | 14.5   | 57       | 6.500                          | 0.133     | 30               |
| 22.1            | 40.8     | 18.9   | 84       | 5.500                          | 0.157     | 35               |
| 23.8            | 47.0     | 20.4   | 96       | 5.000                          | 0.184     | 40               |
| 24.9            | 51.8     | 21.8   | 109      | 4.500                          | 0.216     | 45               |
| 30.2            | 68.5     | 22.5   | 118      | 4.000                          | 0.245     | 50               |
| 31.9            | 78.1     | 31.5   | 193      | 3.500                          | 0.365     | 60               |
| 36.1            | 84.7     | 34.5   | 223      | 3.000                          | 0.479     | 70               |

## THRUST PLATES FOR STANDARD COMBINED BEARINGS

CP thin and thick series



CP dünne Baureihe

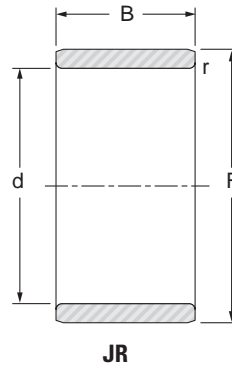
CP dicke Baureihe

| Shaft<br>∅<br>mm | Designations      |                    | d mm | d <sub>1</sub> mm | h mm | Weight g | For combined bearings |         |
|------------------|-------------------|--------------------|------|-------------------|------|----------|-----------------------|---------|
|                  | CP<br>Thin series | CF<br>Thick series |      |                   |      |          | RAX 700<br>RAXF 700   | RAX 400 |
| 10               | CP 10 22          |                    | 10   | 21.5              | 0.8  | 1.7      |                       | RAX 410 |
|                  |                   | CP 2 10 22         | 10   | 21.5              | 2    | 4.3      |                       |         |
| 12               | CP 12 26          |                    | 12   | 25.5              | 0.8  | 2.5      | RAX, RAXF 712         | RAX 412 |
|                  |                   | CP 2 12 26         | 12   | 25.5              | 2    | 6.2      |                       |         |
| 14               | CP 14 26          |                    | 14   | 25.5              | 0.8  | 2.3      | RAX, RAXF 714         |         |
|                  |                   | CP 2 14 26         | 14   | 25.5              | 2    | 5.6      |                       |         |
| 15               | CP 15 28          |                    | 15   | 27.5              | 0.8  | 2.8      | RAX, RAXF 715         | RAX 415 |
|                  |                   | CP 2 15 28         | 15   | 27.5              | 2    | 6        |                       |         |
| 17               | CP 17 30          |                    | 17   | 29.5              | 0.8  | 2.5      |                       | RAX 417 |
|                  |                   | CP 2 17 30         | 17   | 29.5              | 2    | 7        |                       |         |
| 18               | CP 18 30          |                    | 18   | 29.5              | 0.8  | 2.3      | RAX, RAXF 718         |         |
|                  |                   | CP 2 18 30         | 18   | 29.5              | 2    | 5.7      |                       |         |
| 20               | CP 20 35          |                    | 20   | 34.5              | 0.8  | 3.8      | RAX, RAXF 720         | RAX 420 |
|                  |                   | CP 3 20 35         | 20   | 34.5              | 3    | 13       |                       |         |
| 25               | CP 25 42          |                    | 25   | 41.5              | 0.8  | 5.3      | RAX, RAXF725          |         |
|                  |                   | CP 3 25 42         | 25   | 41.5              | 3    | 19       |                       |         |
| 30               | CP 30 47          |                    | 30   | 46.5              | 0.8  | 6        | RAX, RAXF 730         | RAX 430 |
|                  |                   | CP 3 30 47         | 30   | 46.5              | 3    | 22       |                       |         |
| 35               | CP 35 52          |                    | 35   | 51.5              | 0.8  | 7        | RAX, RAXF 735         | RAX 435 |
|                  |                   | CP 3 35 52         | 35   | 51.5              | 3    | 26       |                       |         |
| 40               | CP 40 60          |                    | 40   | 59.5              | 0.8  | 9.3      | RAX, RAXF 740         | RAX 440 |
|                  |                   | CP 3 40 60         | 40   | 59.5              | 3    | 34       |                       |         |
| 45               | CP 45 65          |                    | 45   | 64.4              | 0.8  | 10       | RAX, RAXF 745         | RAX 445 |
|                  |                   | CP 3 45 65         | 45   | 64.4              | 3    | 37       |                       |         |
| 50               | CP 50 70          |                    | 50   | 69.4              | 0.8  | 11       |                       | RAX 450 |
|                  |                   | CP 3 50 70         | 50   | 69.4              | 3    | 40       |                       |         |
| 60               | CP 60 85          |                    | 60   | 84.3              | 0.8  | 17       |                       | RAX 460 |
|                  |                   | CP 4 60 85         | 60   | 84.3              | 4    | 83       |                       |         |
| 70               | CP 1.5 70 95      |                    | 70   | 94.3              | 1.5  | 32       |                       | RAX 470 |
|                  |                   | CP 4 70 95         | 70   | 94.3              | 4    | 93       |                       |         |

# 8.6

## INNER RINGS FOR STANDARD COMBINED BEARINGS

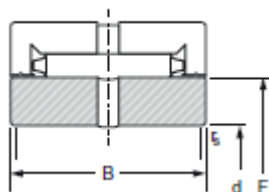
JR standard series



| Shaft<br>∅<br>mm | Designations  |             | d mm | F mm | B mm | r mm | Weight g | For combined bearings |                      |
|------------------|---------------|-------------|------|------|------|------|----------|-----------------------|----------------------|
|                  | JR series     | JR series   |      |      |      |      |          | RAX 700<br>RAXF 700   | RAX 400<br>RAXPZ 400 |
| 7                |               | JR 7x10x16  | 7    | 10   | 16   | 0.2  | 4.8      |                       | RAX 410              |
| 8                | JR 8x12x12.5  |             | 8    | 12   | 12.5 | 0.3  | 5.8      | RAX 712               |                      |
| 9                |               | JR 9x12x16  | 9    | 12   | 16   | 0.2  | 5.9      |                       | RAX 412              |
| 10               | JR 10x14x12   |             | 10   | 14   | 12   | 0.3  | 7        | RAX 714               |                      |
| 12               | JR 12x15x12.5 |             | 12   | 15   | 12.5 | 0.2  | 5.8      | RAX 715               |                      |
|                  |               | JR 12x15x16 | 12   | 15   | 16   | 0.2  | 7.6      |                       | RAX 415              |
| 13               | JR 15x18x16.5 |             | 13   | 18   | 16.5 | 0.35 | 15       | RAX 718               |                      |
| 14               |               | JR 14x17x17 | 14   | 17   | 17   | 0.2  | 9.3      |                       | RAX 417              |
| 15               | JR 15x20 16   |             | 15   | 20   | 16   | 0.35 | 17       | RAX 720               |                      |
|                  |               | JR 17x20x20 | 15   | 20   | 20   | 0.35 | 20.5     |                       | RAX 420              |
| 20               |               | JR 20x25x20 | 20   | 25   | 20   | 0.35 | 32       |                       | RAX 425              |
|                  | JR 20x25x20.5 |             | 20   | 25   | 20.5 | 0.35 | 33       | RAX 725               |                      |
| 25               |               | JR 25x30x20 | 25   | 30   | 20   | 0.35 | 32       |                       | RAX 430              |
|                  | JR 25x30x20.5 |             | 25   | 30   | 20.5 | 0.35 | 33       | RAX 730               |                      |
| 30               |               | JR 30x35x20 | 30   | 35   | 20   | 0.35 | 38       |                       | RAX 435              |
|                  | JR 30x35x20.5 |             | 30   | 35   | 20.5 | 0.35 | 39       | RAX 735               |                      |
| 35               |               | JR 35x40x20 | 35   | 40   | 20   | 0.35 | 44       |                       | RAX 440              |
|                  | JR 35x40x20.5 |             | 35   | 40   | 20.5 | 0.35 | 45       | RAX 740               |                      |
| 40               |               | JR 40x45x20 | 40   | 45   | 20   | 0.35 | 50       |                       | RAX 445              |
|                  | JR 40x45x20.5 |             | 40   | 45   | 20.5 | 0.35 | 51       | RAX 745               |                      |
| 45               |               | JR 45x50x25 | 45   | 50   | 25   | 0.65 | 69       |                       | RAX 450              |
| 55               |               | JR 55x60x25 | 55   | 60   | 25   | 0.65 | 84       |                       | RAX 460              |
| 60               |               | JR 60x70x25 | 60   | 70   | 25   | 0.85 | 190      |                       | RAX 470              |

# CYLINDRICAL INNER RINGS WITH HOLE FOR RNA BEARINGS

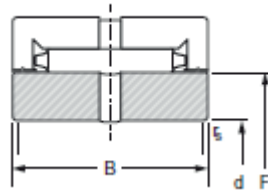
BI / BIC series



| Shaft<br>Ø | Designations | d<br>mm | F<br>mm | B<br>mm | r <sub>s</sub> min<br>mm | Weight g |
|------------|--------------|---------|---------|---------|--------------------------|----------|
| 12         | BIC 1012     | 12      | 17.6    | 15      | 1                        | 0.016    |
| 15         | BIC 1015     | 15      | 20.8    | 15      | 1                        | 0.018    |
|            | BIC 2015     | 15      | 22.1    | 22      | 1                        | 0.035    |
| 17         | BIC 1017     | 17      | 23.9    | 15      | 1                        | 0.026    |
| 20         | BIC 1020     | 20      | 28.7    | 18      | 1                        | 0.046    |
|            | BIC 2020     | 20      | 28.7    | 22      | 1                        | 0.056    |
| 25         | BIC 1025     | 25      | 33.5    | 18      | 1                        | 0.054    |
|            | BIC 2025     | 25      | 33.5    | 22      | 1                        | 0.065    |
|            | BIC 22025    | 25      | 33.5    | 30      | 1                        | 0.500    |
| 30         | BIC 1030     | 30      | 38.2    | 18      | 1                        | 0.060    |
|            | BIC 2030     | 30      | 38.2    | 22      | 1                        | 0.074    |
|            | BIC 3030     | 30      | 44.0    | 30      | 1                        | 0.188    |
| 35         | BIC 1035     | 35      | 44.0    | 18      | 1                        | 0.077    |
|            | BIC 2035     | 35      | 44.0    | 22      | 1                        | 0.093    |
| 40         | BIC 1040     | 40      | 49.7    | 18      | 1.5                      | 0.094    |
|            | BIC 2040     | 40      | 49.7    | 22      | 1.5                      | 0.115    |
|            | BIC 3040     | 40      | 55.4    | 36      | 1.5                      | 0.321    |
| 45         | BIC 1045     | 45      | 55.4    | 18      | 1.5                      | 0.113    |
|            | BIC 2045     | 45      | 55.4    | 22      | 1.5                      | 0.139    |
|            | BIC 3045     | 45      | 62.1    | 38      | 1.5                      | 0.422    |

# 8.7

BIC series



| Shaft<br>Ø | Designations | d<br>mm | F<br>mm | B<br>mm | r <sub>s</sub> min<br>mm | Weight g |
|------------|--------------|---------|---------|---------|--------------------------|----------|
| 50         | BIC 1050     | 50      | 62.1    | 20      | 2                        | 0.163    |
|            | BIC 11050    | 50      | 62.1    | 24      | 2                        | 0.196    |
|            | BIC 2050     | 50      | 62.1    | 28      | 2                        | 0.228    |
|            | BIC 3050     | 50      | 68.8    | 38      | 2                        | 0.515    |
| 55         | BIC 1055     | 55      | 68.8    | 20      | 2                        | 0.205    |
|            | BIC 3055     | 55      | 72.6    | 38      | 2                        | 0.525    |
| 60         | BIC 2060     | 60      | 72.6    | 28      | 2                        | 0.282    |
|            | BIC 3060     | 60      | 78.3    | 38      | 2                        | 0.583    |
| 65         | BIC 3065     | 65      | 83.1    | 38      | 2                        | 0.623    |
| 70         | BIC 3070     | 70      | 88.0    | 38      | 2                        | 0.662    |
| 75         | BIC 2075     | 75      | 88.0    | 32      | 2                        | 0.410    |
| 80         | BIC 1080     | 80      | 96.0    | 24      | 2                        | 0.410    |
|            | BIC 2080     | 80      | 96.0    | 32      | 2                        | 0.545    |
|            | BIC 3080     | 80      | 99.5    | 38      | 2                        | 0.805    |
| 90         | BIC 2090     | 90      | 104.7   | 32      | 2                        | 0.531    |
|            | BIC 3090     | 90      | 109.1   | 43      | 2                        | 0.990    |
| 95         | BIC 2095     | 95      | 109.1   | 32      | 2                        | 0.548    |
|            | BIC 3095     | 95      | 114.7   | 43      | 2                        | 1.075    |
| 100        | BIC 3100     | 100     | 119.2   | 43      | 2                        | 1.090    |
| 105        | BIC 2105     | 105     | 119.2   | 32      | 2                        | 0.615    |
| 110        | BIC 2110     | 110     | 124.7   | 34      | 2                        | 0.705    |
| 130        | BIC 3130     | 130     | 158.0   | 52      | 2                        | 2.530    |





# SEALING RINGS

9

PAGE 158

9.1 TECHNICAL FEATURES

PAGE 159

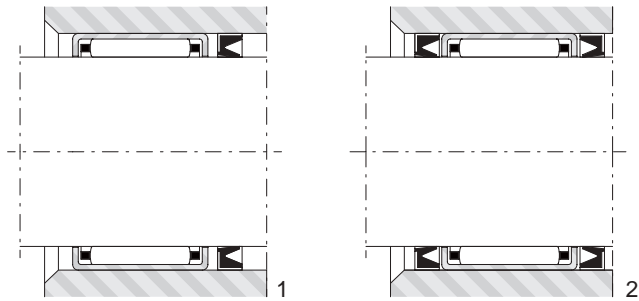
9.2 SEAL RINGS

## SEALING RINGS TECHNICAL SPECIFICATIONS

Nadella sealing rings type DH, made in synthetic rubber and incorporating a metal insert, have the same inner and outer dimensions as Nadella needle bushes and the radial portion of the combined bearings type RAX 700. The recommended housing and shaft tolerances for these bearings ensure a tight fit of the sealing ring in the housing bore and the optimum friction between lip and shaft. The simple installation of this seal, requiring no special machining, provides a very economical seal within a minimum space.

In the case of grease lubrication, the seal should be installed with the lip facing away from the bearing (fig. 1) to enable expulsion of old grease when replenishing by means of a pump.

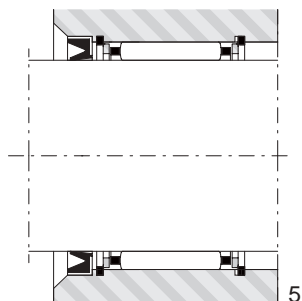
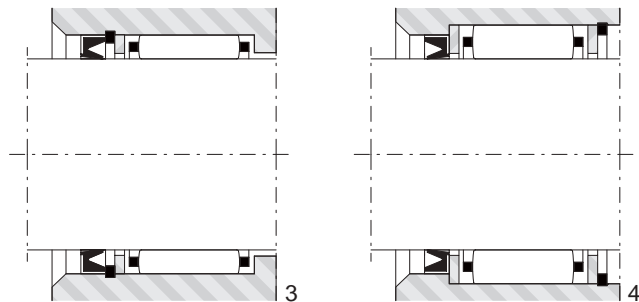
For oil lubrication, installation the opposite way is recommended (fig. 2). If the prevailing conditions are particularly dirty, it may be necessary to protect the seal additionally by means of a labyrinth.



Sealing rings may also be used with needle cages having the same shaft and housing diameters (fig. 3) or with those having larger or smaller housing diameters than that of the seal (fig. 4 and fig. 5).

The hardness and surface finish required for the raceway on the shaft enable these sealing rings to operate at circumferential speeds of 10-12 m/s, providing lubrication is adequate.

Standard type DH sealing rings will operate satisfactorily at temperatures from -20°C to + 120°C. For conditions outside this temperature range, please consult Nadella Technical Department.



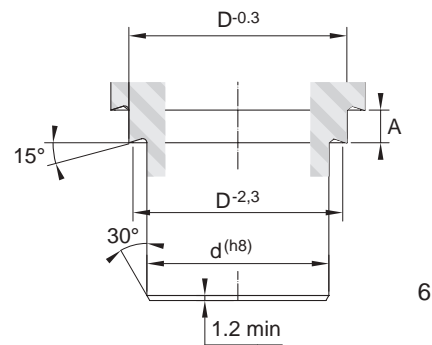
### INSTALLATION

Type DH sealing rings should be smeared with grease before mounting- on the outside diameter to facilitate assembly and avoid damage and on the inside to prevent dry operation when starting from rest.

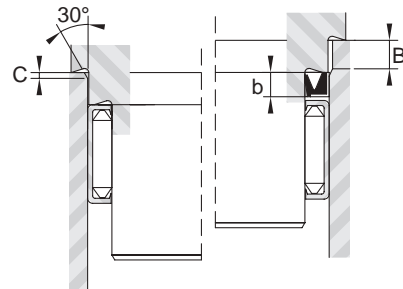
The edge of the housing bore should be chamfered to prevent damage to the seal and to facilitate assembly. A small press should be used for this purpose - such as that used to install needle bushes, in order to guide the sealing ring parallel to the axis of the housing bore.

The needle bush and the sealing ring must be installed separately in two distinct operations. The same mandrel (fig. 6) may be used for both operations: the seal installation being effected by limiting the mandrel stroke with a spacer (fig. 7).

In order to prevent the risk of damage to the seal lip, the shaft end must be chamfered.

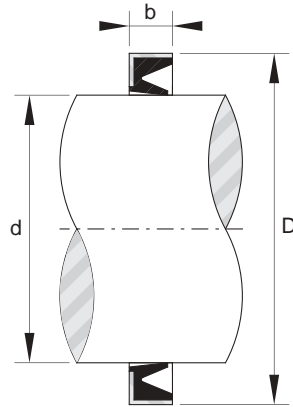


$$A = b + 1.2 \div 1.4$$



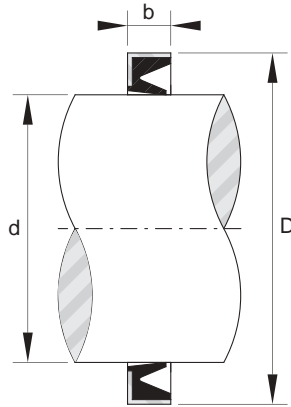
$$B = b + (0.3 \div 0.5)$$

$$C = 0.5 \div 0.7$$



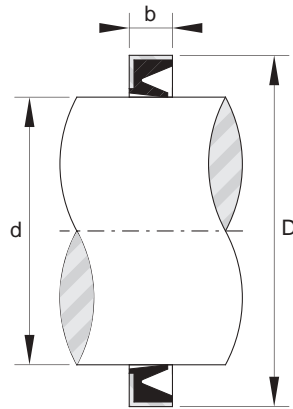
| Shaft<br>Ø<br>mm | Designation  | d mm | D<br>mm | b mm | Speed rating min <sup>-1</sup> | Weight g |
|------------------|--------------|------|---------|------|--------------------------------|----------|
| 5                | DH 5x9x2     | 5    | 9       | 2    | 22500                          | 0.21     |
| 6                | DH 6x10x2    | 6    | 10      | 2    | 20000                          | 0.3      |
|                  | DH 6x12x2    | 6    | 12      | 2    | 20000                          | 0.5      |
| 7                | DH 7x11x2    | 7    | 11      | 2    | 15000                          | 0.34     |
|                  | DH 7x14x2    | 7    | 14      | 2    | 15000                          | 0.55     |
| 8                | DH 8x12x3    | 8    | 12      | 3    | 15000                          | 0.55     |
|                  | DH 8x15x3    | 8    | 15      | 3    | 15000                          | 1.1      |
| 9                | DH 9x13x3    | 9    | 13      | 3    | 12500                          | 0.69     |
| 10               | DH 10x14x3   | 10   | 14      | 3    | 12500                          | 0.74     |
| 12               | DH 12x16x3   | 12   | 16      | 3    | 10000                          | 0.8      |
|                  | DH 12x18x3   | 12   | 18      | 3    | 10000                          | 1.29     |
|                  | DH 12x19x3   | 12   | 19      | 3    | 10000                          | 1.61     |
| 13               | DH 13x19x3   | 13   | 19      | 3    | 10000                          | 1.37     |
| 14               | DH 14x18x2.5 | 14   | 18      | 2.5  | 9000                           | 1.03     |
|                  | DH 14x20x3   | 14   | 20      | 3    | 9000                           | 1.4      |
|                  | DH 14x22x3   | 14   | 22      | 3    | 9000                           | 1.98     |
| 15               | DH 15x21x3   | 15   | 21      | 3    | 9000                           | 1.5      |
|                  | DH 15x23x3   | 15   | 23      | 3    | 9000                           | 1.54     |
| 16               | DH 16x20x2.5 | 16   | 20      | 2.5  | 8500                           | 1.22     |
|                  | DH 16x22x3   | 16   | 22      | 3    | 8500                           | 1.52     |
|                  | DH 16x24x3   | 16   | 24      | 3    | 8500                           | 1.56     |

# SEALING RINGS



| Shaft<br>∅<br>mm | Designation  | d mm | D mm | b mm | Speed rating min <sup>-1</sup> | Weight g |
|------------------|--------------|------|------|------|--------------------------------|----------|
| 17               | DH 17x23x3   | 17   | 23   | 3    | 8000                           | 1.54     |
|                  | DH 17x25x3   | 17   | 25   | 3    | 8000                           | 1.61     |
| 18               | DH 18x24x3   | 18   | 24   | 3    | 8000                           | 1.55     |
|                  | DH 18x26x4   | 18   | 26   | 4    | 8000                           | 1.7      |
| 19               | DH 19x27x4   | 19   | 27   | 4    | 7500                           | 1.8      |
| 20               | DH 20x24x2.5 | 20   | 24   | 2.5  | 7500                           | 1.48     |
|                  | DH 20x26x4   | 20   | 26   | 4    | 7500                           | 1.59     |
|                  | DH 20x28x4   | 20   | 28   | 4    | 7500                           | 1.99     |
| 21               | DH 21x29x4   | 21   | 29   | 4    | 7000                           | 2.18     |
| 22               | DH 22x26x2.5 | 22   | 26   | 2.5  | 7000                           | 1.52     |
|                  | DH 22x28x4   | 22   | 28   | 4    | 7000                           | 1.65     |
|                  | DH 22x30x4   | 22   | 30   | 4    | 7000                           | 2.8      |
| 24               | DH 24x32x4   | 24   | 32   | 4    | 6500                           | 3.8      |
| 25               | DH 25x31x2.5 | 25   | 31   | 2.5  | 6500                           | 1.84     |
|                  | DH 25x32x4   | 25   | 32   | 4    | 6500                           | 2.15     |
|                  | DH 25x33x4   | 25   | 33   | 4    | 6500                           | 4.2      |
| 26               | DH 26x34x4   | 26   | 34   | 4    | 6000                           | 4.3      |
| 28               | DH 28x35x4   | 28   | 35   | 4    | 6000                           | 4        |
|                  | DH 28x37x4   | 28   | 37   | 4    | 6000                           | 4.64     |
| 29               | DH 29x38x4   | 29   | 38   | 4    | 6000                           | 4.95     |
| 30               | DH 30x36x2.5 | 30   | 36   | 2.5  | 5500                           | 2        |
|                  | DH 30x37x4   | 30   | 37   | 4    | 5500                           | 4.57     |
|                  | DH 30x40x4   | 30   | 40   | 4    | 5500                           | 5.15     |

# 9.2



| Shaft<br>Ø<br>mm | Designation  | d mm | D<br>mm | b mm | Speed rating min <sup>-1</sup> | Weight g |
|------------------|--------------|------|---------|------|--------------------------------|----------|
| 32               | DH 32x42x4   | 32   | 42      | 4    | 5500                           | 5.5      |
|                  | DH 32x45x4   | 32   | 45      | 4    | 5500                           | 6.15     |
| 35               | DH 35x41x2.5 | 35   | 41      | 2.5  | 5000                           | 2.16     |
|                  | DH 35x42x4   | 35   | 42      | 4    | 5000                           | 5.3      |
|                  | DH 35x45x4   | 35   | 45      | 4    | 5000                           | 5.65     |
| 37               | DH 37x47x4   | 37   | 47      | 4    | 5000                           | 7.5      |
| 38               | DH 38x48x4   | 38   | 48      | 4    | 5000                           | 7.6      |
| 40               | DH 40x47x4   | 40   | 47      | 4    | 4700                           | 6.2      |
|                  | DH 40x50x4   | 40   | 50      | 4    | 4700                           | 8.01     |
| 42               | DH 42x49x5   | 42   | 49      | 5    | 4500                           | 5        |
|                  | DH 42x52x4   | 42   | 52      | 4    | 4500                           | 8.4      |
| 45               | DH 45x52x4   | 45   | 52      | 4    | 4500                           | 6.7      |
|                  | DH 45x55x4   | 45   | 55      | 4    | 4500                           | 8.9      |
| 48               | DH 48x55x3.5 | 48   | 55      | 3.5  | 4200                           | 6.8      |
| 50               | DH 50x58x4   | 50   | 58      | 4    | 4000                           | 6.95     |
|                  | DH 50x62x5   | 50   | 62      | 5    | 4000                           | 10.9     |
| 52               | DH 52x59x3.5 | 52   | 59      | 3.5  | 4000                           | 7.1      |
| 58               | DH 58x65x3.5 | 58   | 65      | 3.5  | 3700                           | 7.8      |



# NEEDLE ROLLERS

# 10

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10.1 TECHNICAL FEATURES

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10.3 NEEDLE ROLLERS STANDARD

# NEEDLE ROLLERS

## TECHNICAL SPECIFICATIONS

In certain applications, the limited amount of space available for bearings and the loads to be supported require the use of a full complement of needles independent of any system of retention. The dimensions of the needle, diameter and length, are determined in relation to the load capacity required.

The needles are placed directly between shaft and housing without the use of inner or outer rings. Thus shaft of maximum diameter is permissible to increase rigidity and load capacity.

In rotating applications where the load capacity requires the use of needles that are long in relation to the shaft diameter, it is preferable to employ two rows of needles of equal length separated by a spacer ring. In such cases, the needles must be selected with diameters in the same tolerance class. This arrangement is particularly recommended for mounting parts such as long idler wheels, especially where they are subjected to rotational torque.

### RACEWAYS

Maximum load capacity is obtained with hardened inner and outer raceways of surface hardness 58-64 HRC.

Parts used for the lateral retention of needles at their ends should be of equivalent hardness.

The inner and outer raceways should both be aligned on installation and before operation under load. In the case of parts fitted with a single row of needles, the inner raceway may be ground convex to allow misalignment.

A convexity permitting misalignment of 1 in 1000 (or up to 2 in 1000 in cases of instantaneous overloading) does not reduce the calculated load capacity. This convexity, which also depends on the length of the needles, may be produced on a separate inner ring or directly on the shaft journal using a grinding wheel with concave profile obtained by inclining the diamond impregnated cutting wheel. Further technical information is available, consult Nadella Technical Department.

### TYPES AND DIMENSIONS

The standard needle type **BR**, of increased use, has rounded ends. On request, can also be supplied needles with flat ends, type **BP**. The standard dimensions of the BR type needles are given in the table following (pages 198, 199 and 200).

Needles of special dimensions may be manufactured on request.

### CHARACTERISTICS

Nadella standard needles are made in through-hardened bearing steel of hardness 58-65 HRC.

Needles in heat treated corrosion resistant steel (hardness 57-62 HRC) may be produced on request the preferred diameters being 1.5, 2, 2.5, 3 and 4 mm.

The surface finish is 0.2 micron according to Ra system.

The profile of a needle is not cylindrical along its whole length as there is a very slight taper towards the ends.

Therefore, precise measurement of the diameter can only be carried out in the central area of the needle.

Needles having a greater taper at the ends may be supplied on request (suffix ... DTN).

### MANUFACTURING TOLERANCES

In general, the diameter of standard needles with rounded ends type **BR** and with flat ends type **BP** is produced to a tolerance up to 10 micron less from the nominal dimension.

However, the maximum variation on any one production lot is 5 µm according to one of the classes of grade G5 in the table below. On request, a variation of 3 µm may be obtained according to the classes of grade G3, and a variation of 2 µm according to the classes of grade G2.

Unless specified otherwise, quantities supplied are divided by Nadella into different classes of each grade G2, G3 or G5.

However the current supply are generally available in grade G2 according to the classes printed in bold type.

The colour codes shown for class G2 are only used by agreement. The length of needles type BR and BP is kept within tolerance h13.

### TOLERANCES ON NEEDLE DIAMETER

| Grade G | Variation in diameter µm | Standard classes                                      | Deviation from true circularity µm |
|---------|--------------------------|---|------------------------------------|
| 2       | 2                        | <b>0-2 -1-3 -2-4 -3-5 -4-6</b><br>5-7 -6-8 -7-9 -8-10 | 1                                  |
| 3       | 3                        | 0-3 -15-4,5 -3-6 -4,5-7,5<br>-6-9 -7-10               | 1,5                                |
| 5       | 5                        | 0-5 -3-8 -5-10  | 2,5                                |

Example of designation:  $\emptyset$  2,5 x 15,8 BR/G2-2-4

### COLOUR CODES FOR THE CLASSES OF GRADE G2

|     |      |      |          |       |      |       |        |        |
|-----|------|------|----------|-------|------|-------|--------|--------|
| 0-2 | 1-3  | 2-4  | 3-5      | 4-6   | 5-7  | 6-8   | 7-9    | 8-10   |
| Red | Pink | Blue | Sky blue | White | Grey | Green | Orange | Yellow |

### SHAFT AND HOUSING TOLERANCES

| Operating conditions                    | Shaft Fw | Housing |             |
|---|----------|---------|-------------|
|   |          | Quota D | Quota B (1) |
| Rotation on a convex inner raceway      | j5       | F6      | H12         |
| Rotation on a cylindrical inner raceway | h5       | F6      |             |
| Oscillatory motion                      | h5       | G6      |             |

(1) Nominal dimension B = length of needle Lw + 0,2 mm

The cylindrical tolerance, defined as the difference in radii of two coaxial cylinders (ISO Standard 1101), should normally be less than a quarter of the manufacturing tolerance.

However, for high precision or high speed applications, it is recommended to restrict this tolerance to one-eighth of the manufacturing tolerance.



## LIMITING SPEED

With effective oil lubrication and good alignment between shaft and housing, limiting speed may reach:

$$n(\text{min}^{-1}) = \frac{380\,000}{F_w}$$

( $F_w$ : diameter of inner raceway in mm)

up to a maximum speed of 70 000 mm<sup>-1</sup>. For grease lubrication, use approximately half these values.

## DYNAMIC AND STATIC CAPACITIES

The dynamic capacity  $C_R$ , in Newton (N), is given by the formula:

$$1) C_R = K L_u$$

K: variable factor relating to diameter of inner raceway

$F_w$ : according to tables on pages 201, 202 and 203.

$L_u$  (mm): effective needle length, as shown in the table of dimensions.

The static capacity  $C_{OR}$  in Newton (N), is given by the formula:

$$2) C_{OR} = \frac{44(1-\emptyset)}{F_w + \emptyset} \emptyset L_u Z$$

$\emptyset$  (mm): diameter of needles

$L_u$  (mm): effective needle length, as shown in the table of dimensions.

Z: number of needles

$F_w$ : diameter of inner raceway in mm.

## NUMBER OF NEEDLES - CIRCUMFERENTIAL PLAY

The number of needles Z is given, as a function of the proposed shaft diameter  $F_w$  and the needle diameter  $\emptyset$ , by the formula:

$$3) Z = \frac{\pi(F_w + \emptyset)}{\emptyset}$$

adjusted to the nearest whole number.

To ensure the circumferential play  $j_c$ , which should normally be between 0.3 and 1 mm, the shaft diameter  $F_w$  is corrected with the following formula:

$$4) F_w = \gamma \emptyset + \frac{j_c}{\pi}$$

is a variable factor shown in the tables on pages 201, 202 and 203 in respect to the number of needles Z.

Example: needles of diameter  $d = 2.5$  mm on a shaft of diameter  $F_w = \text{approx. } 30$  mm.

$$\text{Number of needle } Z = \frac{\pi(30 + 2,5)}{2,5}$$

To ensure circumferential play  $j_c = 0,3$  mm the shaft diameter  $F_w$  planned is corrected with the formula 4) with  $\gamma = 12.06$  for 41 needles (tables on pages 201, 202 and 203), thus:

$$F_w = 12,06 \times 2,5 + \frac{0,3}{\pi} = 30,25 \text{ mm (adjusted up)}$$

The shaft diameter  $F_w$  can therefore be designed at the nominal dimension adjusted up to 30.3 mm to take 41 needles of diameter 2.5 mm, with a circumferential play of approx. 0.3 mm.

Note: Having established the number of needles Z, reference may then be made to the table on pages 201, 202 and 203, giving the corresponding  $F_w$  dimensions according to needle diameter and for a circumferential play between 0.3 and 0.6 mm. Thus, for 41 needles of diameter 2.5 mm, diameter  $F_w$  is 30.3 mm.

## INSTALLATION OF LOOSE NEEDLE

Because of the large number of shaft diameters possible, depending on the number of needles chosen and their diameter, needles cannot be packed in rings ready for installation.

The needles, which are supplied loose, should therefore be arranged in a ring around the inner or outer raceway, which must be pre-greased to ensure their retention during installation of the parts that will retain them.

In cases where the shaft has to be introduced blind into a ring of needles, it may be useful to retain the needles in their housing by means of a mounting shaft of the same length as the needles. This can then be withdrawn when the shaft is introduced.

Arrangement of the needles in a ring may be carried out by hand where the number of installations is small.

The use of automatic machines with high-speed rotary loading should be considered only for production quantities large enough to ensure that the high cost of investment can be absorbed.

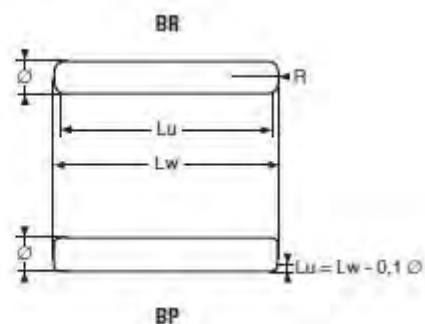
# NEEDLE ROLLERS

## WITH ROUNDED ENDS TYPE BR AND BP

| ∅ |   | in mm  |        |
|---|---|--------|--------|
| > | ≤ | r min. | r max. |
| - | 1 | 0,1    | 0,3    |
| 1 | 3 | 0,1    | 0,4    |
| 3 | 5 | 0,1    | 0,6    |

Example of designation:  
∅ 3 x 23,8 BR

Example of designation:  
∅ 3 x 23,8 BP



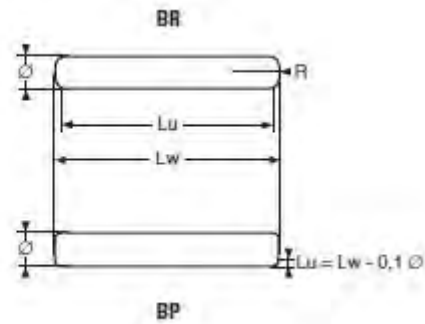
| ∅ mm | BP Lw mm | BR    |       | Weight ‰ g |
|------|----------|-------|-------|------------|
|      |          | Lw mm | Lu mm |            |
| 1    | -        | 5.8   | 5     | 34         |
|      | -        | 7.8   | 7     | 46         |
| 1.5  | 5.8      | 5.8   | 4.9   | 76         |
|      | 6.8      | 6.8   | 5.9   | 90         |
|      | -        | 7.8   | 6.9   | 103        |
|      | 9.8      | 9.8   | 8.9   | 130        |
|      | -        | 11.8  | 10.9  | 157        |
|      | -        | 13.8  | 12.9  | 185        |
|      | -        | 15.8  | 14.9  | 210        |
| 2    | -        | 3.8   | 2.8   | 87         |
|      | -        | 5.8   | 4.8   | 135        |
|      | 7.8      | 7.8   | 6.8   | 182        |
|      | 8.8      | -     | -     | -          |
|      | 9.8      | 9.8   | 8.8   | 230        |
|      | -        | 11.8  | 10.8  | 280        |
|      | 12.8     | -     | -     | -          |
|      | 13.8     | 13.8  | 12.8  | 325        |
|      | 15.8     | 15.8  | 14.8  | 375        |
|      | -        | 17.8  | 16.8  | 420        |
|      | 19.8     | 19.8  | 18.8  | 470        |
| 2.5  | 7.8      | 7.8   | 6.7   | 285        |
|      | -        | 9.8   | 8.7   | 360        |
|      | -        | 11.8  | 10.7  | 430        |
|      | -        | 13.8  | 12.7  | 510        |
|      | 14       | -     | -     | -          |
|      | 15.8     | 15.8  | 14.7  | 580        |
|      | -        | 17.8  | 16.7  | 660        |
|      | -        | 19.8  | 18.7  | 730        |
|      | -        | 21.8  | 20.7  | 800        |
|      | 27.8     | 23.8  | 22.7  | 880        |

# 10.2

Example of designation:  
 $\varnothing 3 \times 23,8$  BR

Example of designation:  
 $\varnothing 3 \times 23,8$  BP

| $\varnothing$ | in mm |         |
|---------------|-------|---------|
|               | >     | $\leq$  |
| -             | 1     | 0,1 0,3 |
| 1             | 3     | 0,1 0,4 |
| 3             | 5     | 0,1 0,6 |



| $\varnothing$<br>mm | BP<br>Lw mm          | BR    |       | Weight<br>‰<br>g |
|---------------------|----------------------|-------|-------|------------------|
|                     |                      | Lw mm | Lu mm |                  |
| 3                   | 9.8 9.8 8.5 510      | 9.8   | 8.5   | 510              |
|                     | 11.8 11.8 10.5 620   | 11.8  | 10.5  | 620              |
|                     | 12.8                 | -     | -     | -                |
|                     | 13.8 13.8 12.5 730   | 13.8  | 12.5  | 730              |
|                     | 15.8 15.8 14.5 840   | 15.8  | 14.5  | 840              |
|                     | 17.8 17.8 16.5 940   | 17.8  | 16.5  | 940              |
|                     | 19.8 19.8 18.5 1 050 | 19.8  | 18.5  | 1.050            |
|                     | 21.8 21.8 20.5 1 150 | 21.8  | 20.5  | 1.150            |
|                     | 23.8 23.8 22.5 1 260 | 23.8  | 22.5  | 1.260            |
|                     | 25.4                 | -     | -     | -                |
|                     | 25.8 25.8 24.5 1 370 | 25.8  | 24.5  | 1.370            |
|                     | 26.8                 | -     | -     | -                |
|                     | 27.8 27.8 26.5 1 480 | 27.8  | 26.5  | 1.480            |
|                     | 29.8 29.8 28.5 1 600 | 29.8  | 28.5  | 1.600            |
| 3.5                 | 8.8                  | -     | -     | -                |
|                     | -                    | 11.8  | 10.3  | 840              |
|                     | -                    | 13.8  | 12.3  | 990              |
|                     | -                    | 15.8  | 14.3  | 1.130            |
|                     | -                    | 17.8  | 16.3  | 1.280            |
|                     | -                    | 19.8  | 18.3  | 1.430            |
|                     | -                    | 21.8  | 20.3  | 1.510            |
|                     | -                    | 23.8  | 22.3  | 1.720            |
|                     | -                    | 25.8  | 24.3  | 1.850            |
|                     | -                    | 27.8  | 26.3  | 2.000            |
|                     | -                    | 29.8  | 28.3  | 2.150            |
|                     | -                    | 34.8  | 33.3  | 2.500            |

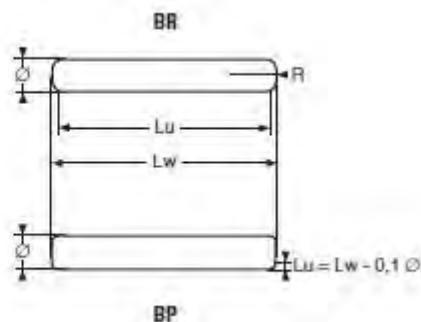
# NEEDLE ROLLERS WITH ROUNDED ENDS BR AND BP

# 10.2

| ∅ |   | in mm  |        |
|---|---|--------|--------|
| > | ≤ | r min. | r max. |
| - | 1 | 0,1    | 0,3    |
| 1 | 3 | 0,1    | 0,4    |
| 3 | 5 | 0,1    | 0,6    |

Example of designation:  
∅ 3 x 23,8 BR

Example of designation:  
∅ 3 x 23,8 BP



| ∅ mm | BP Lw mm | BR    |       | Weight<br>‰<br>g     |
|------|----------|-------|-------|----------------------|
|      |          | Lw mm | Lu mm |                      |
| 4    | 8.8      | 13.8  | 12.1  | 1 280                |
|      | -        | 15.8  | 14.1  | 1 480                |
|      | -        | 17.8  | 16.1  | 1 650                |
|      | -        | 19.8  | 18.1  | 1 850                |
|      | -        | 21.8  | 20.1  | 2 050                |
|      | -        | 23.8  | 22.1  | 2 250                |
|      | -        | 25.8  | 24.1  | 2 450                |
|      | -        | 27.8  | 26.1  | 2 600                |
|      | -        | 29.8  | 28.1  | 2 800                |
|      | -        | 34.8  | 33.1  | 3 300                |
|      | -        | 39.8  | 38.1  | 3 800                |
|      | -        | 44.8  | 43.1  | 4 200                |
| 5    | 8.8      | -     | -     | -                    |
|      | -        | 19.8  | 17.5  | 2 900                |
|      | -        | 21.8  | 19.5  | 3 200                |
|      | -        | 23.8  | 21.5  | 3 500                |
|      | -        | 25.8  | 23.5  | 3 800                |
|      | -        | 27.8  | 25.5  | 4 100                |
|      | -        | 29.8  | 27.5  | 4 400                |
|      | -        | 34.8  | 32.5  | 5 100                |
|      | -        | 39.8  | 37.5  | 5 900                |
|      | -        | 49.8  | 47.5  | 7 400                |
|      |          |       |       | <b>Unit weight g</b> |
| 6    | -        | 29.8  | 27.6  | 6.3                  |
|      | -        | 39.8  | 37.6  | 8.4                  |
|      | -        | 59.8  | 57.2  | 12.7                 |
| 7    | -        | 69.8  | 66.9  | 20.2                 |
| 8    | -        | 79.8  | 76.7  | 30                   |

# NEEDLE ROLLERS STANDARD

# 10.3

Shaft diameter Fw for Z needles of diameter  $\varnothing$  and a circumferential clearance jc between 0.3 and 0.6 mm  
Coefficient  $\gamma$  : formula 4)  
Coefficient K: formula 1)

| $\varnothing$ mm |          | 1     |       | 1.5   |       | 2     |       | 2.5   |       | 3     |       | 3.5   |       | 4     |       | 5     |       |
|------------------|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Z                | $\gamma$ | Fw mm | K     | Fw mm | K     | Fw mm | K     | Fw mm | K     | Fw mm | K     | Fw mm | K     | Fw mm | K     | Fw mm | K     |
| 10               | 2.24     | 2.3   | 531   | 3.5   | 823   | 4.6   | 1.119 | 5.7   | 1.420 | 6.9   | 1.730 | 8.0   | 2.040 | 9.1   | 2.351 | 11.3  | 2.985 |
| 11               | 2.55     | 2.7   | 586   | 4     | 905   | 5.2   | 1.228 | 6.5   | 1.561 | 7.8   | 1.898 | 9.1   | 2.241 | 10.3  | 2.583 | 12.9  | 3.283 |
| 12               | 2.86     | 3     | 635   | 4.4   | 978   | 5.9   | 1.334 | 7.3   | 1.693 | 8.7   | 2.058 | 10.2  | 2.429 | 11.6  | 2.803 | 14.5  | 3.562 |
| 13               | 3.18     | 3.3   | 680   | 4.9   | 1.050 | 6.5   | 1.430 | 8.1   | 1.817 | 9.7   | 2.210 | 11.3  | 2.608 | 12.9  | 3.010 | 16    | 3.822 |
| 14               | 3.49     | 3.6   | 723   | 5.4   | 1.118 | 7.1   | 1.522 | 8.9   | 1.935 | 10.6  | 2.352 | 12.4  | 2.776 | 14.1  | 3.203 | 17.6  | 4.070 |
| 15               | 3.81     | 3.9   | 765   | 5.9   | 1.182 | 7.8   | 1.609 | 9.7   | 2.045 | 11.6  | 2.488 | 13.5  | 2.936 | 15.4  | 3.388 | 19.2  | 4.306 |
| 16               | 4.13     | 4.2   | 804   | 6.3   | 1.242 | 8.4   | 1.693 | 10.5  | 2.151 | 12.5  | 2.617 | 14.6  | 3.088 | 16.6  | 3.564 | 20.8  | 4.530 |
| 17               | 4.44     | 4.5   | 841   | 6.8   | 1.301 | 9     | 1.772 | 11.2  | 2.253 | 13.5  | 2.740 | 15.7  | 3.233 | 17.9  | 3.732 | 22.3  | 4.743 |
| 18               | 4.76     | 4.9   | 878   | 7.3   | 1.356 | 9.7   | 1.849 | 12.0  | 2.349 | 14.4  | 2.858 | 16.8  | 3.372 | 19.2  | 3.893 | 23.9  | 4.948 |
| 19               | 5.08     | 5.2   | 913   | 7.8   | 1.411 | 10.3  | 1.921 | 12.8  | 2.443 | 15.4  | 2.971 | 17.9  | 3.507 | 20.4  | 4.048 | 25.5  | 5.144 |
| 20               | 5.39     | 5.5   | 945   | 8.2   | 1.463 | 10.9  | 1.992 | 13.6  | 2.532 | 16.3  | 3.080 | 19    | 3.635 | 21.7  | 4.196 | 27.1  | 5.333 |
| 21               | 5.71     | 5.8   | 978   | 8.7   | 1.512 | 11.6  | 2.059 | 14.4  | 2.618 | 17.3  | 3.185 | 20.1  | 3.758 | 23    | 4.339 | 28.7  | 5.515 |
| 22               | 6.03     | 6.1   | 1.010 | 9.2   | 1.560 | 12.2  | 2.125 | 15.2  | 2.701 | 18.2  | 3.286 | 21.2  | 3.879 | 24.3  | 4.477 | 30.3  | 5.690 |
| 23               | 6.34     | 6.4   | 1.039 | 9.6   | 1.607 | 12.8  | 2.189 | 16    | 2.783 | 19.2  | 3.385 | 22.3  | 3.996 | 25.5  | 4.611 | 31.8  | 5.861 |
| 24               | 6.66     | 6.8   | 1.067 | 10.1  | 1.652 | 13.5  | 2.250 | 16.8  | 2.861 | 20.1  | 3.481 | 23.4  | 4.107 | 26.8  | 4.741 | 33.4  | 6.026 |
| 25               | 6.98     | 7.1   | 1.097 | 106   | 1.695 | 14.1  | 2.311 | 17.6  | 2.936 | 21.1  | 3.572 | 24.6  | 4.216 | 28.1  | 4.866 | 35    | 6.187 |
| 26               | 7.30     | 7.4   | 1.124 | 11.1  | 1.738 | 14.7  | 2.369 | 18.4  | 3.011 | 22    | 3.664 | 25.7  | 4.322 | 29.3  | 4.991 | 36.6  | 6.342 |
| 27               | 7.61     | 7.7   | 1.151 | 11.6  | 1.779 | 15.4  | 2.425 | 19.2  | 3.082 | 23    | 3.751 | 26.8  | 4.426 | 30.6  | 5.109 | 38.2  | 6.494 |
| 28               | 7.93     | 8     | 1.178 | 12    | 1.822 | 16    | 2.481 | 20    | 3.153 | 23.9  | 3.836 | 27.9  | 4.528 | 31.9  | 5.225 | 39.8  | 6.642 |
| 29               | 8.25     | 8.4   | 1.202 | 12.5  | 1.860 | 16.6  | 2.535 | 20.8  | 3.221 | 24.9  | 3.919 | 29    | 4.626 | 33.1  | 5.341 | 41.4  | 6.786 |
| 30               | 8.57     | 8.7   | 1.228 | 13    | 1.898 | 17.3  | 2.587 | 21.6  | 3.289 | 25.8  | 4.002 | 30.1  | 4.723 | 34.4  | 5.451 | 43    | 6.927 |
| 31               | 8.88     | 9     | 1.252 | 13.5  | 1.936 | 17.9  | 2.639 | 22.3  | 3.356 | 26.8  | 4.081 | 31.2  | 4.818 | 35.7  | 5.560 | 44.5  | 7.069 |
| 32               | 9.20     | 9.3   | 1.277 | 13.9  | 1.975 | 18.5  | 2.691 | 23.1  | 3.420 | 27.7  | 4.161 | 32.3  | 4.910 | 36.9  | 5.668 | 46.1  | 7.204 |
| 33               | 9.52     | 9.6   | 1.301 | 14.4  | 2.011 | 19.2  | 2.739 | 23.9  | 3.483 | 28.7  | 4.236 | 33.5  | 4.998 | 38.2  | 5.772 | 47.7  | 7.336 |
| 34               | 9.84     | 9.9   | 1.325 | 14.9  | 2.046 | 19.8  | 2.788 | 24.7  | 3.545 | 29.7  | 4.311 | 34.6  | 5.088 | 39.5  | 5.874 | 49.3  | 7.466 |
| 35               | 10.16    | 10.3  | 1.345 | 15.4  | 2.081 | 20.5  | 2.835 | 25.5  | 3.606 | 30.6  | 4.386 | 35.7  | 5.176 | 40.8  | 5.974 | 50.9  | 7.595 |
| 36               | 10.47    | 10.6  | 1.368 | 15.8  | 2.118 | 21.1  | 2.883 | 26.3  | 3.666 | 31.5  | 4.460 | 36.8  | 5.262 | 42    | 6.075 | 52.5  | 7.720 |
| 37               | 10.79    | 10.9  | 1.390 | 16.3  | 2.150 | 21.7  | 2.930 | 27.1  | 3.725 | 32.5  | 4.530 | 37.9  | 5.346 | 43.3  | 6.172 | 54.1  | 7.843 |
| 38               | 11.11    | 11.2  | 1.413 | 16.8  | 2.183 | 22.4  | 2.974 | 27.9  | 3.782 | 33.5  | 4.600 | 39    | 5.430 | 44.6  | 6.267 | 55.7  | 7.965 |
| 39               | 11.43    | 11.5  | 1.434 | 17.3  | 2.216 | 23    | 3.020 | 28.7  | 3.839 | 34.4  | 4.670 | 40.1  | 5.512 | 45.9  | 6.360 | 57.3  | 8.085 |
| 40               | 11.75    | 21.9  | 1.453 | 17.8  | 2.247 | 23.6  | 3.065 | 29.5  | 3.895 | 35.4  | 4.738 | 41.3  | 5.590 | 47.1  | 6.455 | 58.9  | 8.202 |

# NEEDLE ROLLERS

## STANDARD

Shaft diameter Fw for Z needles of diameter  $\varnothing$  and a circumferential clearance jc between 0.3 and 0.6 mm

Coefficient  $\gamma$  : formula 4)

Coefficient K: formula 1)

| $\varnothing$ mm |          | 1     |   | 1.5 |   | 2     |       | 2.5   |       | 3     |       | 3.5   |       | 4     |       | 5     |        |
|------------------|----------|-------|---|-----|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| Z                | $\gamma$ | Fw mm | K | Fw  | K | Fw mm | K     | Fw mm | K     | Fw mm | K     | Fw mm | K     | Fw mm | K     | Fw mm | K      |
| 41               | 12.06    | -     | - | -   | - | 24.3  | 3.107 | 30.3  | 3.949 | 36.3  | 4.805 | 42.3  | 5.673 | 48.4  | 6.546 | 60.4  | 8.321  |
| 42               | 12.38    | -     | - | -   | - | 24.9  | 3.150 | 31.1  | 4.005 | 37.3  | 4.871 | 43.5  | 5.748 | 49.7  | 6.635 | 62    | 8.435  |
| 43               | 12.70    | -     | - | -   | - | 25.5  | 3.194 | 31.9  | 4.058 | 38.2  | 4.938 | 44.6  | 5.826 | 50.9  | 6.726 | 63.6  | 8.548  |
| 44               | 13.02    | -     | - | -   | - | 26.2  | 3.233 | 32.7  | 4.111 | 39.2  | 5.001 | 45.7  | 5.902 | 52.2  | 6.813 | 65.2  | 8.660  |
| 45               | 13.34    | -     | - | -   | - | 26.8  | 3.275 | 33.5  | 4.163 | 40.2  | 5.064 | 46.8  | 5.978 | 53.5  | 6.899 | 66.8  | 8.769  |
| 46               | 13.65    | -     | - | -   | - | 27.4  | 3.317 | 34.3  | 4.215 | 41.1  | 5.127 | 47.9  | 6.052 | 54.7  | 6.986 | 68.4  | 8.879  |
| 47               | 13.97    | -     | - | -   | - | 28.1  | 3.356 | 35.1  | 4.266 | 42    | 5.190 | 49    | 6.126 | 56    | 7.071 | 70    | 8.986  |
| 48               | 14.29    | -     | - | -   | - | 28.7  | 3.396 | 35.9  | 4.316 | 43    | 5.251 | 50.2  | 6.197 | 57.3  | 7.153 | 71.6  | 9.091  |
| 49               | 14.61    | -     | - | -   | - | 29.4  | 3.434 | 36.7  | 4.366 | 44    | 5.311 | 51.3  | 6.286 | 58.6  | 7.236 | 73.2  | 9.196  |
| 50               | 14.93    | -     | - | -   | - | 30    | 3.474 | 37.5  | 4.415 | 44.9  | 5.372 | 52.4  | 6.339 | 59.9  | 7.317 | 74.8  | 9.300  |
| 51               | 15.24    | -     | - | -   | - | 30.6  | 3.513 | 38.2  | 4.465 | 45.9  | 5.430 | 53.5  | 6.409 | 61.1  | 7.399 | 76.3  | 9.405  |
| 52               | 15.56    | -     | - | -   | - | 31.3  | 3.550 | 39    | 4.514 | 46.8  | 5.490 | 54.6  | 6.479 | 62.4  | 7.479 | 77.9  | 9.506  |
| 53               | 15.88    | -     | - | -   | - | 31.9  | 3.588 | 39.8  | 4.561 | 47.8  | 5.547 | 55.7  | 6.548 | 63.7  | 7.556 | 79.5  | 9.606  |
| 54               | 16.20    | -     | - | -   | - | 32.5  | 3.626 | 40.6  | 4.609 | 48.7  | 5.606 | 56.8  | 6.616 | 64.9  | 7.637 | 81.1  | 9.706  |
| 55               | 16.52    | -     | - | -   | - | 33.2  | 3.661 | 41.4  | 4.655 | 49.7  | 5.661 | 58    | 6.681 | 66.2  | 7.713 | 82.7  | 9.804  |
| 56               | 16.83    | -     | - | -   | - | 33.8  | 3.699 | 42.2  | 4.701 | 50.6  | 5.719 | 59    | 6.750 | 67.5  | 7.789 | 84.3  | 9.901  |
| 57               | 17.15    | -     | - | -   | - | 34.4  | 3.736 | 43    | 4.747 | 51.6  | 5.774 | 60.2  | 6.814 | 68.7  | 7.867 | 85.9  | 9.997  |
| 58               | 17.47    | -     | - | -   | - | 35.1  | 3.770 | 43.8  | 4.793 | 52.5  | 5.831 | 61.3  | 6.880 | 70    | 7.942 | 87.5  | 10.093 |
| 59               | 17.79    | -     | - | -   | - | 35.7  | 3.806 | 44.6  | 4.837 | 53.5  | 5.884 | 62.4  | 6.944 | 71.3  | 8.016 | 89.1  | 10.188 |
| 60               | 18.11    | -     | - | -   | - | 36.4  | 3.840 | 45.4  | 4.882 | 54.5  | 5.938 | 63.5  | 7.009 | 72.6  | 8.090 | 90.7  | 10.282 |
| 61               | 18.43    | -     | - | -   | - | -     | -     | 46.2  | 4.926 | 55.4  | 5.992 | 64.6  | 7.073 | 73.9  | 8.162 | 92.3  | 10.374 |
| 62               | 18.74    | -     | - | -   | - | -     | -     | 47    | 4.970 | 56.4  | 6.045 | 65.7  | 7.136 | 75.1  | 8.236 | 93.8  | 10.468 |
| 63               | 19.06    | -     | - | -   | - | -     | -     | 47.8  | 5.013 | 57.3  | 6.100 | 66.8  | 7.198 | 76.4  | 8.307 | 95.4  | 10.559 |
| 64               | 19.38    | -     | - | -   | - | -     | -     | 48.6  | 5.056 | 58.3  | 6.150 | 68    | 7.258 | 77.7  | 8.379 | 97    | 10.651 |
| 65               | 19.70    | -     | - | -   | - | -     | -     | 49.4  | 5.099 | 59.2  | 6.204 | 69.1  | 7.320 | 78.9  | 8.451 | 98.6  | 10.740 |
| 66               | 20.02    | -     | - | -   | - | -     | -     | 50.2  | 5.141 | 60.2  | 6.254 | 70.2  | 7.381 | 80.2  | 8.521 | 100.2 | 10.829 |
| 67               | 20.33    | -     | - | -   | - | -     | -     | 51    | 5.184 | 61.1  | 6.306 | 71.3  | 7.442 | 81.5  | 8.590 | 101.8 | 10.917 |
| 68               | 20.65    | -     | - | -   | - | -     | -     | 51.8  | 5.225 | 62.1  | 6.357 | 72.4  | 7.502 | 82.7  | 8.660 | 103.4 | 11.005 |
| 69               | 20.97    | -     | - | -   | - | -     | -     | 52.6  | 5.266 | 63    | 6.408 | 73.5  | 7.562 | 84    | 8.729 | 105   | 11.092 |
| 70               | 21.29    | -     | - | -   | - | -     | -     | 53.4  | 5.308 | 64    | 6.458 | 74.7  | 7.620 | 85.3  | 8.796 | 106.6 | 11.179 |

# 10.3

Shaft diameter Fw for Z needles of diameter  $\varnothing$  and a circumferential clearance jc between 0.3 and 0.6 mm  
 Coefficient  $\gamma$  : formula 4)  
 Coefficient K: formula 1)

| $\varnothing$ mm |          | 1     |   | 1.5   |   | 2     |   | 2.5   |       | 3     |       | 3.5   |       | 4     |        | 5     |        |
|------------------|----------|-------|---|-------|---|-------|---|-------|-------|-------|-------|-------|-------|-------|--------|-------|--------|
| Z                | $\gamma$ | Fw mm | K | Fw mm | K | Fw mm | K | Fw mm | K     | Fw mm | K     | Fw mm | K     | Fw mm | K      | Fw mm | K      |
| 71               | 21.61    | -     | - | -     | - | -     | - | 54.2  | 5.349 | 65    | 6.506 | 75.8  | 7.678 | 86.6  | 8.863  | 108.2 | 11.265 |
| 72               | 21.93    | -     | - | -     | - | -     | - | 55    | 5.389 | 65.9  | 6.557 | 76.9  | 7.737 | 87.9  | 8.930  | 109.8 | 11.350 |
| 73               | 22.24    | -     | - | -     | - | -     | - | 55.7  | 5.431 | 66.9  | 6.604 | 78    | 7.795 | 89.1  | 8.998  | 111.3 | 11.437 |
| 74               | 22.56    | -     | - | -     | - | -     | - | 56.5  | 5.471 | 67.8  | 6.654 | 79.1  | 7.852 | 90.4  | 9.064  | 112.9 | 11.520 |
| 75               | 22.88    | -     | - | -     | - | -     | - | 57.3  | 5.510 | 68.8  | 6.702 | 80.2  | 7.910 | 91.7  | 9.129  | 114.5 | 11.604 |
| 76               | 23.20    | -     | - | -     | - | -     | - | 58.1  | 5.550 | 69.7  | 6.751 | 81.3  | 7.966 | 92.9  | 9.195  | 116.1 | 11.686 |
| 77               | 23.52    | -     | - | -     | - | -     | - | 58.9  | 5.589 | 70.7  | 6.798 | 82.5  | 8.022 | 94.2  | 9.260  | 117.7 | 11.769 |
| 78               | 23.83    | -     | - | -     | - | -     | - | 59.7  | 5.628 | 71.6  | 6.846 | 83.5  | 8.079 | 95.5  | 9.324  | 119.3 | 11.851 |
| 79               | 24.15    | -     | - | -     | - | -     | - | 60.5  | 5.666 | 72.6  | 6.892 | 84.7  | 8.134 | 96.7  | 9.389  | 120.9 | 11.933 |
| 80               | 24.47    | -     | - | -     | - | -     | - | 61.3  | 5.704 | 73.5  | 6.940 | 85.8  | 8.189 | 98    | 9.453  | 122.5 | 12.013 |
| 81               | 24.79    | -     | - | -     | - | -     | - | -     | -     | 74.5  | 6.985 | 86.9  | 8.243 | 99.3  | 9.516  | 124.1 | 12.093 |
| 82               | 25.11    | -     | - | -     | - | -     | - | -     | -     | 75.5  | 7.030 | 88    | 8.298 | 100.6 | 9.578  | 125.7 | 12.173 |
| 83               | 25.43    | -     | - | -     | - | -     | - | -     | -     | 76.4  | 7.078 | 89.1  | 8.353 | 101.9 | 9.640  | 127.3 | 12.252 |
| 84               | 25.74    | -     | - | -     | - | -     | - | -     | -     | 77.4  | 7.123 | 90.2  | 8.407 | 103.1 | 9.703  | 128.8 | 12.332 |
| 85               | 26.06    | -     | - | -     | - | -     | - | -     | -     | 78.3  | 7.169 | 91.3  | 8.461 | 104.4 | 9.764  | 130.4 | 12.410 |
| 86               | 26.38    | -     | - | -     | - | -     | - | -     | -     | 79.3  | 7.213 | 92.5  | 8.512 | 105.7 | 9.825  | 132   | 12.488 |
| 87               | 26.70    | -     | - | -     | - | -     | - | -     | -     | 80.2  | 7.258 | 93.6  | 8.565 | 106.9 | 9.887  | 133.6 | 12.566 |
| 88               | 27.07    | -     | - | -     | - | -     | - | -     | -     | 81.2  | 7.302 | 94.7  | 8.618 | 108.2 | 9.947  | 135.2 | 12.643 |
| 89               | 27.34    | -     | - | -     | - | -     | - | -     | -     | 82.2  | 7.345 | 95.8  | 8.670 | 109.5 | 10.007 | 136.8 | 12.720 |
| 90               | 27.65    | -     | - | -     | - | -     | - | -     | -     | 83.1  | 7.390 | 96.9  | 8.723 | 110.7 | 10.069 | 138.4 | 12.796 |
| 91               | 27.97    | -     | - | -     | - | -     | - | -     | -     | 84    | 7.436 | 98    | 8.775 | 112   | 10.128 | 140   | 12.871 |
| 92               | 28.29    | -     | - | -     | - | -     | - | -     | -     | 85    | 7.479 | 99.2  | 8.825 | 113.3 | 10.187 | 141.6 | 12.947 |
| 93               | 28.61    | -     | - | -     | - | -     | - | -     | -     | 86    | 7.520 | 100.3 | 8.876 | 114.6 | 10.245 | 143.2 | 13.021 |
| 94               | 28.93    | -     | - | -     | - | -     | - | -     | -     | 86.9  | 7.565 | 101.4 | 8.927 | 115.9 | 10.303 | 144.8 | 13.096 |
| 95               | 29.24    | -     | - | -     | - | -     | - | -     | -     | 87.9  | 7.607 | 102.5 | 8.978 | 117.1 | 10.363 | 146.3 | 13.172 |
| 96               | 29.56    | -     | - | -     | - | -     | - | -     | -     | 88.8  | 7.650 | 103.6 | 9.028 | 118.4 | 10.420 | 147.9 | 13.245 |
| 97               | 29.88    | -     | - | -     | - | -     | - | -     | -     | 89.8  | 7.692 | 104.7 | 9.079 | 119.7 | 10.478 | 149.5 | 13.318 |
| 98               | 30.20    | -     | - | -     | - | -     | - | -     | -     | 90.7  | 7.735 | 105.8 | 9.129 | 120.9 | 10.537 | 151.1 | 13.391 |
| 99               | 30.52    | -     | - | -     | - | -     | - | -     | -     | 91.7  | 7.777 | 107   | 9.177 | 122.2 | 10.593 | 152.7 | 13.464 |
| 100              | 30.84    | -     | - | -     | - | -     | - | -     | -     | 92.7  | 7.817 | 108.1 | 9.227 | 123.5 | 10.650 | 154.3 | 13.536 |





# INNER RINGS



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11.1 TECHNICAL SPECIFICATIONS

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11.2 INNER RINGS

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11.3 CYLINDRICAL INNER RINGS  
WITH HOLE FOR RNA BEARINGS

# INNER RINGS

## TECHNICAL SPECIFICATIONS

When it is impractical to meet the shaft raceway design requirements (hardness, surface finish, case depth, etc.) standard inner rings may be used.

Inner rings are made of rolling bearing steel and after hardening, their bores, raceways and end surfaces are ground.

Inner rings may be used to provide inner raceway surfaces for radial needle roller bearings, needle roller bearings and needle bushes with opened and closed end.

For a generic bearing with a given internal diameter, there is a choice of inner rings with the same diameter  $F$  but of different widths. Normally, the width of the inner ring should never be less than that of the bearing. Alternatively, a cylindrical inner ring wider than the bearing may be used to permit the fitting of a sealing ring, which would locate on the extended portion at one end of the bearing. In this case, if the inner ring has an oil hole, care should be taken to ensure that the hole does not coincide with the ends of the needles.

### CONSTRUCTION

Inner rings are available in four basic designs and differ only by the chamfers at the ends of the raceway surfaces, the lubricant access holes and the raceway profile.

Inner rings of series JR have chamfers to assist in bearing installation but are without lubricating holes.

Inner rings of series JR.JS1 have bearing installation chamfers and lubricating holes (bore diameters 5 to 50 mm). Inner rings of series JRZ.JS1 are without installation chamfers, allowing for maximum possible raceway contact.

In the following tables are listed all the inner rings for needle bushes, cages, needle bearings with cages, with full complement and combined bearings that are showed in this catalogue.

### Inner rings features

| Series  | Lubrication hole | Chamfer |
|---------|------------------|---------|
| JR      |                  | x       |
| JR.JS1  | x                | x       |
| JRZ.JS1 | x                |         |

### Nominal diameter of lubrication hole

| Series            | Internal diameter of the inner ring mm |    | Nominal diameter of the lubrication hole (mm) |
|-------------------|--|----|---|
|                   | >                                      | ≤  |   |
| JR.JS1<br>JRZ.JS1 | -                                      | 20 | 2   |
|                   | 20                                     | 40 | 2,5   |
|                   | 40                                     | 80 | 3   |
|                   | 80                                     | -  | 3.5   |

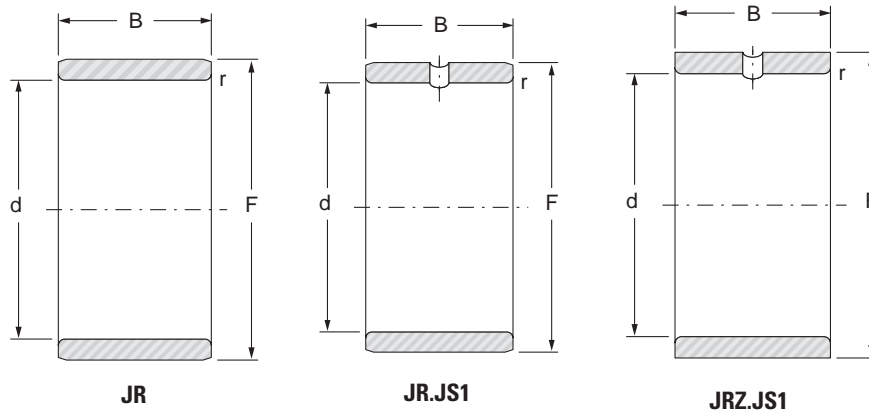
### Construction tolerance of inner rings

| Series              | Tolerance on external diameter $F$ | Other tolerances  |
|---------------------|------------------------------------|-------------------|
| JR<br>with suffix P | h5                                 | According ISO 492 |

# INNER RINGS

## SUMMARY TABLE

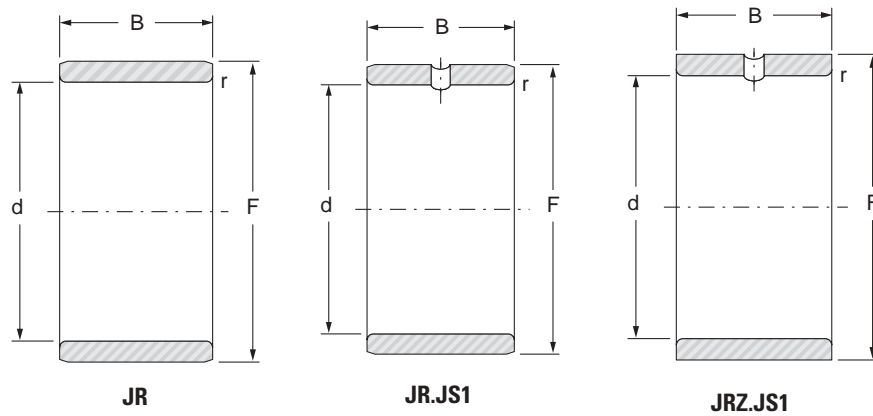
# 11.2



| Shaft<br>∅<br>mm | Designation    | d mm | F mm | B mm | r <sub>s</sub> min<br>mm | Weight kg |
|------------------|----------------|------|------|------|--------------------------|-----------|
| 5                | JR5x8x8JS1     | 5    | 8    | 8    | 0.3                      | 0.002     |
|                  | JR5x8x12       | 5    | 8    | 12   | 0.3                      | 0.003     |
|                  | JR5x8x16       | 5    | 8    | 16   | 0.3                      | 0.004     |
| 6                | JR6x9x8JS1     | 6    | 9    | 8    | 0.3                      | 0.002     |
|                  | JR6x9x12       | 6    | 9    | 12   | 0.3                      | 0.003     |
|                  | JR6x9x16       | 6    | 9    | 16   | 0.3                      | 0.004     |
|                  | JR6x10x10      | 6    | 10   | 10   | 0.3                      | 0.004     |
|                  | JR6x10x10JS1   | 6    | 10   | 10   | 0.3                      | 0.004     |
|                  | JRZ6x10x12JS1  | 6    | 10   | 12   | 0.3                      | 0.005     |
| 7                | JR7x10x10.5    | 7    | 10   | 10.5 | 0.3                      | 0.003     |
|                  | JR7x10x12      | 7    | 10   | 12   | 0.3                      | 0.004     |
|                  | JR7x10x16      | 7    | 10   | 16   | 0.3                      | 0.005     |
| 8                | JR8x12x10      | 8    | 12   | 10   | 0.3                      | 0.005     |
|                  | JR8x12x10JS1   | 8    | 12   | 10   | 0.3                      | 0.005     |
|                  | JR8x12x10.5    | 8    | 12   | 10.5 | 0.3                      | 0.005     |
|                  | JRZ8x12x12JS1  | 8    | 12   | 12   | 0.3                      | 0.006     |
|                  | JR8x12x12.5    | 8    | 12   | 12.5 | 0.3                      | 0.006     |
|                  | JR 8x12x16     | 8    | 12   | 16   | 0.3                      | 0.007     |
| 9                | JR9x12x12      | 9    | 12   | 12   | 0.3                      | 0.005     |
|                  | JR9x12x16      | 9    | 12   | 16   | 0.3                      | 0.006     |
| 10               | JR10x13x12.5   | 10   | 13   | 12.5 | 0.3                      | 0.005     |
|                  | JR10x14x11JS1  | 10   | 14   | 11   | 0.3                      | 0.007     |
|                  | JR10x14x12     | 10   | 14   | 12   | 0.3                      | 0.007     |
|                  | JR10x14x12JS1  | 10   | 14   | 12   | 0.3                      | 0.007     |
|                  | JR10x14x13     | 10   | 14   | 13   | 0.3                      | 0.007     |
|                  | JRZ10x14x14JS1 | 10   | 14   | 14   | 0.3                      | 0.008     |
|                  | JR10x14x16     | 10   | 14   | 16   | 0.3                      | 0.009     |
|                  | JR10x14x20     | 10   | 14   | 20   | 0.3                      | 0.012     |

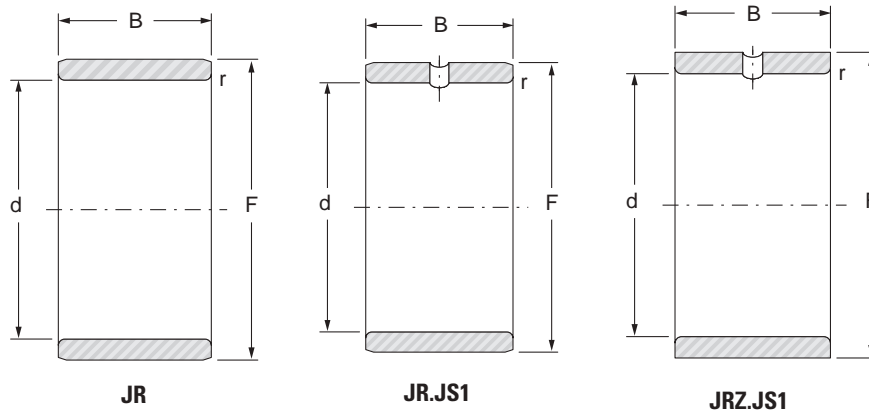
# INNER RINGS

## SUMMARY TABLE



| Shaft<br>∅<br>mm | Designation    | d mm | F<br>mm | B<br>mm | r <sub>s min</sub><br>mm | Weight kg |
|------------------|----------------|------|---------|---------|--------------------------|-----------|
| 12               | JR12x15x12.5   | 12   | 15      | 12.5    | 0.3                      | 0.006     |
|                  | JR12x15x16     | 12   | 15      | 16      | 0.3                      | 0.008     |
|                  | JR12x15x16.5   | 12   | 15      | 16.5    | 0.3                      | 0.008     |
|                  | JR12x15x18.5   | 12   | 15      | 18.5    | 0.3                      | 0.009     |
|                  | JR12x15x22.5   | 12   | 15      | 22.5    | 0.3                      | 0.011     |
|                  | JR12x16x12     | 12   | 16      | 12      | 0.3                      | 0.008     |
|                  | JR12x16x12JS1  | 12   | 16      | 12      | 0.3                      | 0.008     |
|                  | JR12x16x13     | 12   | 16      | 13      | 0.3                      | 0.008     |
|                  | JRZ12x16x14JS1 | 12   | 16      | 14      | 0.3                      | 0.010     |
|                  | JR12x16x16     | 12   | 16      | 16      | 0.3                      | 0.011     |
|                  | JR12x16x20     | 12   | 16      | 20      | 0.3                      | 0.014     |
|                  | JR12x16x22     | 12   | 16      | 22      | 0.3                      | 0.015     |
| 14               | JR14x17x17     | 14   | 17      | 17      | 0.3                      | 0.009     |
| 15               | JR15x18x16.5   | 15   | 18      | 16.5    | 0.3                      | 0.010     |
|                  | JR15x19x16     | 15   | 19      | 16      | 0.3                      | 0.013     |
|                  | JR15x19x20     | 15   | 19      | 20      | 0.3                      | 0.017     |
|                  | JR15x20x12     | 15   | 20      | 12      | 0.3                      | 0.012     |
|                  | JR15x20x12JS1  | 15   | 20      | 12      | 0.3                      | 0.012     |
|                  | JR15x20x13     | 15   | 20      | 13      | 0.3                      | 0.014     |
|                  | JRZ15x20x14JS1 | 15   | 20      | 14      | 0.3                      | 0.015     |
|                  | JR15x20x16     | 15   | 20      | 16      | 0.3                      | 0.017     |
|                  | JR 15x20x20    | 15   | 20      | 20      | 0.35                     | 0.021     |
|                  | JR15x20x23     | 15   | 20      | 23      | 0.3                      | 0.025     |
|                  | JR15x20x26     | 15   | 20      | 26      | 0.3                      | 0.028     |

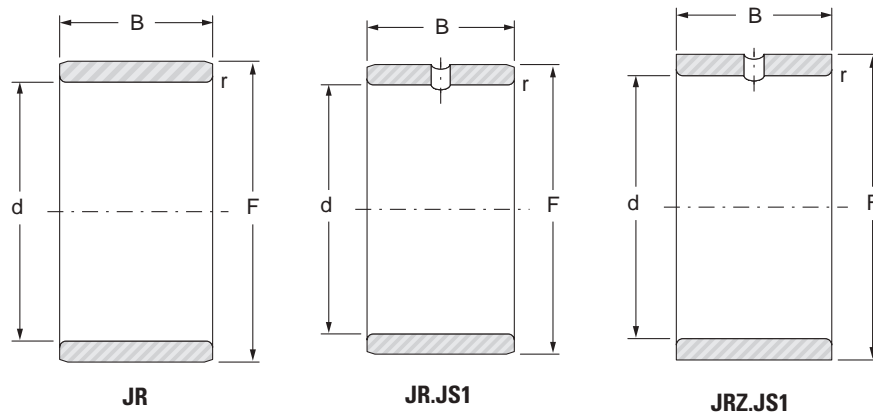
# 11.2



| Shaft<br>∅<br>mm | Designation    | d mm | F mm | B mm | r <sub>s</sub> min<br>mm | Weight kg |
|------------------|----------------|------|------|------|--------------------------|-----------|
| 17               | JR17x20x16.5   | 17   | 20   | 16.5 | 0.3                      | 0.011     |
|                  | JR17x20x20     | 17   | 20   | 20   | 0.3                      | 0.014     |
|                  | JR17x20x20.5   | 17   | 20   | 20.5 | 0.3                      | 0.014     |
|                  | JR17x20x30.5   | 17   | 20   | 30.5 | 0.3                      | 0.021     |
|                  | JR17x21x16     | 17   | 21   | 16   | 0.3                      | 0.015     |
|                  | JR17x21x20     | 17   | 21   | 20   | 0.3                      | 0.019     |
|                  | JR17x22x13     | 17   | 22   | 13   | 0.3                      | 0.015     |
|                  | JR17x22x16     | 17   | 22   | 16   | 0.3                      | 0.019     |
|                  | JR17x22x16JS1  | 17   | 22   | 16   | 0.3                      | 0.019     |
|                  | JRZ17x22x16JS1 | 17   | 22   | 16   | 0.3                      | 0.019     |
|                  | JR17x22x20     | 17   | 22   | 20   | 0.35                     | 0.023     |
|                  | JR17x22x23     | 17   | 22   | 23   | 0.3                      | 0.028     |
|                  | JR17x22x26     | 17   | 22   | 26   | 0.3                      | 0.031     |
|                  | JR17x22x32     | 17   | 22   | 32   | 0.3                      | 0.038     |
| 20               | JR20x24x16     | 20   | 24   | 16   | 0.3                      | 0.018     |
|                  | JR20x24x20     | 20   | 24   | 20   | 0.3                      | 0.022     |
|                  | JR20x25x16     | 20   | 25   | 16   | 0.3                      | 0.022     |
|                  | JR20x25x16JS1  | 20   | 25   | 16   | 0.3                      | 0.022     |
|                  | JR20x25x17     | 20   | 25   | 17   | 0.3                      | 0.023     |
|                  | JRZ20x25x18JS1 | 20   | 25   | 18   | 0.3                      | 0.025     |
|                  | JR20x25x20     | 20   | 25   | 20   | 0.3                      | 0.028     |
|                  | JR20x25x20.5   | 20   | 25   | 20.5 | 0.3                      | 0.029     |
|                  | JR20x25x26     | 20   | 25   | 26   | 0.3                      | 0.036     |
|                  | JR20x25x26.5   | 20   | 25   | 26.5 | 0.3                      | 0.037     |
|                  | JR20x25x30     | 20   | 25   | 30   | 0.3                      | 0.042     |
|                  | JR20x25x32     | 20   | 25   | 32   | 0.3                      | 0.044     |
|                  | JR20x25x38.5   | 20   | 25   | 38.5 | 0.3                      | 0.054     |

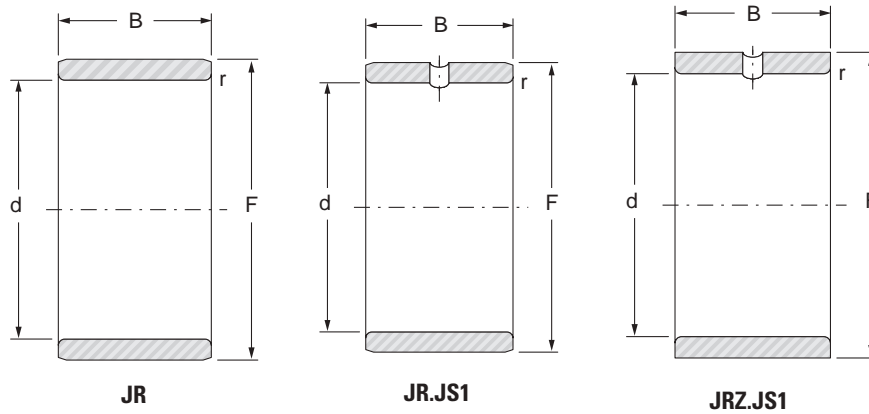
# INNER RINGS

## SUMMARY TABLE



| Shaft<br>∅<br>mm | Designation    | d mm | F mm | B mm | r <sub>s</sub> min<br>mm | Weight kg |
|------------------|----------------|------|------|------|--------------------------|-----------|
| 22               | JR22x26x16     | 22   | 26   | 16   | 0.3                      | 0.019     |
|                  | JR22x26x20     | 22   | 26   | 20   | 0.3                      | 0.023     |
|                  | JR22x28x17     | 22   | 28   | 17   | 0.3                      | 0.030     |
|                  | JR22x28x20.5   | 22   | 28   | 20.5 | 0.3                      | 0.038     |
|                  | JR22x28x30     | 22   | 28   | 30   | 0.3                      | 0.056     |
| 23               | JR23x28x20     | 23   | 28   | 20   | 0.35                     | 0.030     |
| 25               | JR25x29x20     | 25   | 29   | 20   | 0.3                      | 0.027     |
|                  | JR25x29x30     | 25   | 29   | 30   | 0.3                      | 0.040     |
|                  | JR25x30x16     | 25   | 30   | 16   | 0.3                      | 0.027     |
|                  | JR25x30x16JS1  | 25   | 30   | 16   | 0.3                      | 0.027     |
|                  | JR25x30x17     | 25   | 30   | 17   | 0.3                      | 0.028     |
|                  | JRZ25x30x18JS1 | 25   | 30   | 18   | 0.3                      | 0.031     |
|                  | JR25x30x20     | 25   | 30   | 20   | 0.3                      | 0.034     |
|                  | JR25x30x20.5   | 25   | 30   | 20.5 | 0.3                      | 0.035     |
|                  | JR25x30x26     | 25   | 30   | 26   | 0.3                      | 0.044     |
|                  | JR25x30x26.5   | 25   | 30   | 26.5 | 0.3                      | 0.045     |
|                  | JR25x30x30     | 25   | 30   | 30   | 0.3                      | 0.051     |
|                  | JR25x30x32     | 25   | 30   | 32   | 0.3                      | 0.054     |
| JR25x30x38.5     | 25             | 30   | 38.5 | 0.3  | 0.066                    |           |
| 28               | JR28x32x17     | 28   | 32   | 17   | 0.3                      | 0.028     |
|                  | JR28x32x20     | 28   | 32   | 20   | 0.3                      | 0.030     |
|                  | JR28x32x30     | 28   | 32   | 30   | 0.3                      | 0.044     |
| 30               | JR30x35x16     | 30   | 35   | 16   | 0.3                      | 0.031     |
|                  | JR30x35x17     | 30   | 35   | 17   | 0.3                      | 0.033     |
|                  | JRZ30x35x18JS1 | 30   | 35   | 18   | 0.3                      | 0.036     |
|                  | JR30x35x20     | 30   | 35   | 20   | 0.3                      | 0.039     |
|                  | JRZ30x35x20JS1 | 30   | 35   | 20   | 0.3                      | 0.039     |

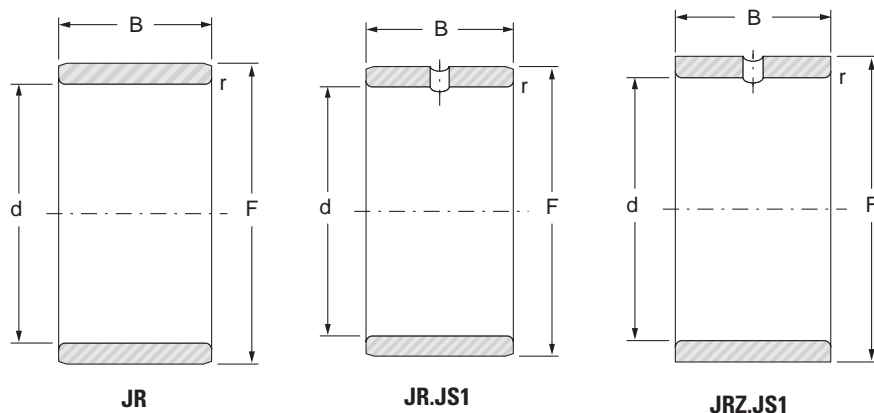
# 11.2



| Shaft<br>Ø<br>mm | Designation    | d mm | F mm | B mm | r <sub>s</sub> min<br>mm | Weight kg |
|------------------|----------------|------|------|------|--------------------------|-----------|
| 30               | JR30x35x20.5   | 30   | 35   | 20.5 | 0.3                      | 0.040     |
|                  | JR30x35x26     | 30   | 35   | 26   | 0.3                      | 0.054     |
|                  | JR30x35x30     | 30   | 35   | 30   | 0.3                      | 0.057     |
|                  | JR30x35x32     | 30   | 35   | 32   | 0.3                      | 0.062     |
|                  | JR30x38x20JS1  | 30   | 38   | 20   | 0.6                      | 0.067     |
| 32               | JR32x37x20     | 32   | 37   | 20   | 0.3                      | 0.043     |
|                  | JR32x37x30     | 32   | 37   | 30   | 0.3                      | 0.064     |
|                  | JR32x40x20     | 32   | 40   | 20   | 0.6                      | 0.069     |
|                  | JR32x40x36     | 32   | 40   | 36   | 0.6                      | 0.128     |
| 35               | JR35x40x17     | 35   | 40   | 17   | 0.3                      | 0.040     |
|                  | JR35x40x20     | 35   | 40   | 20   | 0.3                      | 0.046     |
|                  | JR35x40x20.5   | 35   | 40   | 20.5 | 0.3                      | 0.049     |
|                  | JR35x40x22     | 35   | 40   | 22   | 0.3                      | 0.052     |
|                  | JR35x40x30     | 35   | 40   | 30   | 0.3                      | 0.071     |
|                  | JR35x40x34     | 35   | 40   | 34   | 0.3                      | 0.080     |
|                  | JR35x40x40     | 35   | 40   | 40   | 0.3                      | 0.094     |
|                  | JR35x42x20     | 35   | 42   | 20   | 0.6                      | 0.065     |
|                  | JR35x42x20JS1  | 35   | 42   | 20   | 0.6                      | 0.065     |
|                  | JRZ35x42x23JS1 | 35   | 42   | 23   | 0.6                      | 0.074     |
|                  | JR35x42x36     | 35   | 42   | 36   | 0.6                      | 0.122     |
|                  | JR35x44x22     | 35   | 44   | 22   | 0.6                      | 0.097     |
| 37               | JR37x42x20     | 37   | 42   | 20   | 0.35                     | 0.046     |
| 38               | JR38x43x20     | 38   | 43   | 20   | 0.3                      | 0.050     |
|                  | JR38x43x30     | 38   | 43   | 30   | 0.3                      | 0.075     |

# INNER RINGS

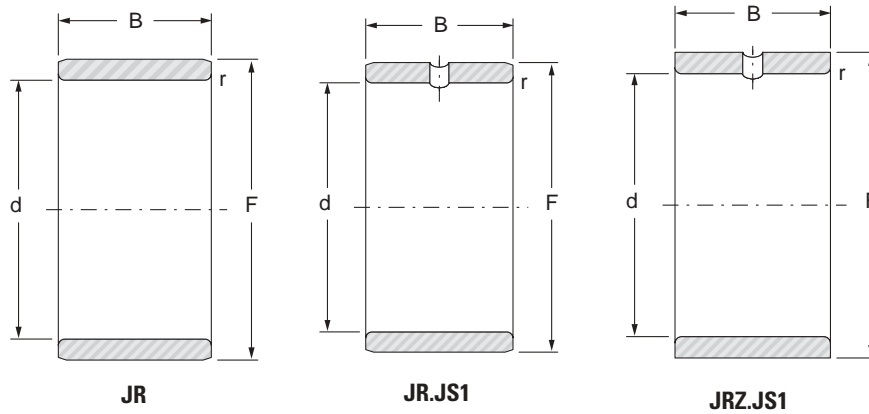
## SUMMARY TABLE



| Shaft<br>∅<br>mm | Designation    | d mm | F mm | B mm | r <sub>s min</sub><br>mm | Weight kg |
|------------------|----------------|------|------|------|--------------------------|-----------|
| 40               | JR40x45x17     | 40   | 45   | 17   | 0.3                      | 0.044     |
|                  | JR40x45x20     | 40   | 45   | 20   | 0.3                      | 0.052     |
|                  | JR40x45x20.5   | 40   | 45   | 20.5 | 0.3                      | 0.054     |
|                  | JR40x45x25     | 40   | 45   | 25   | 0.35                     | 0.062     |
|                  | JR40x45x30     | 40   | 45   | 30   | 0.3                      | 0.078     |
|                  | JR40x45x34     | 40   | 45   | 34   | 0.3                      | 0.089     |
|                  | JR40x45x40     | 40   | 45   | 40   | 0.3                      | 0.115     |
|                  | JR40x48x22     | 40   | 48   | 22   | 0.6                      | 0.094     |
|                  | JRZ40x48x23JS1 | 40   | 48   | 23   | 0.6                      | 0.100     |
|                  | JR40x48x40     | 40   | 48   | 40   | 0.6                      | 0.173     |
| JR40x50x20       | 40             | 50   | 20   | 1    | 0.110                    |           |
| 42               | JR42x47x20     | 42   | 47   | 20   | 0.3                      | 0.055     |
|                  | JR42x47x30     | 42   | 47   | 30   | 0.3                      | 0.083     |
| 45               | JR45x50x20     | 45   | 50   | 20   | 0.3                      | 0.058     |
|                  | JR45x50x25     | 45   | 50   | 25   | 0.6                      | 0.073     |
|                  | JR45x50x25.5   | 45   | 50   | 25.5 | 0.3                      | 0.075     |
|                  | JR45x50x35     | 45   | 50   | 35   | 0.6                      | 0.103     |
|                  | JR45x50x40     | 45   | 50   | 40   | 0.3                      | 0.117     |
|                  | JR45x52x22     | 45   | 52   | 22   | 0.6                      | 0.090     |
|                  | JR45x52x23     | 45   | 52   | 23   | 0.6                      | 0.096     |
|                  | JRZ45x52x23JS1 | 45   | 52   | 23   | 0.6                      | 0.096     |
|                  | JR45x52x40     | 45   | 52   | 40   | 0.6                      | 0.167     |
|                  | JR45x55x20     | 45   | 55   | 20   | 1                        | 0.133     |
|                  | JR45x55x20JS1  | 45   | 55   | 20   | 1                        | 0.133     |
|                  | JR45x55x22     | 45   | 55   | 22   | 1                        | 0.135     |
|                  | JR45x55x40     | 45   | 55   | 40   | 1                        | 0.247     |



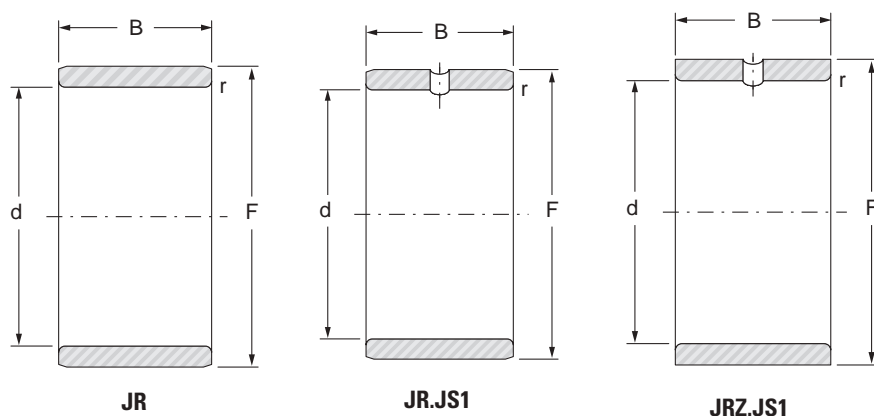
# 11.2



| Shaft<br>Ø<br>mm | Designation    | d mm | F<br>mm | B<br>mm | r <sub>s</sub> min<br>mm | Weight kg |
|------------------|----------------|------|---------|---------|--------------------------|-----------|
| 50               | JR50x55x20     | 50   | 55      | 20      | 0.3                      | 0.065     |
|                  | JR50x55x25     | 50   | 55      | 25      | 0.6                      | 0.081     |
|                  | JR50x55x35     | 50   | 55      | 35      | 0.6                      | 0.113     |
|                  | JR50x55x40     | 50   | 55      | 40      | 0.3                      | 0.130     |
|                  | JR50x58x22     | 50   | 58      | 22      | 0.6                      | 0.117     |
|                  | JRZ50x58x23JS1 | 50   | 58      | 23      | 0.6                      | 0.122     |
|                  | JR50x58x40     | 50   | 58      | 40      | 0.6                      | 0.213     |
|                  | JR50x60x20     | 50   | 60      | 20      | 1                        | 0.155     |
|                  | JR50x60x20JS1  | 50   | 60      | 20      | 1                        | 0.155     |
|                  | JR50x60x25     | 50   | 60      | 25      | 1                        | 0.170     |
| JR50x60x40       | 50             | 60   | 40      | 1       | 0.310                    |           |
| 55               | JR55x60x25     | 55   | 60      | 25      | 0.6                      | 0.088     |
|                  | JR55x60x35     | 55   | 60      | 35      | 0.6                      | 0.124     |
|                  | JR55x63x25     | 55   | 63      | 25      | 1                        | 0.141     |
|                  | JR55x63x45     | 55   | 63      | 45      | 1                        | 0.286     |
|                  | JR55x65x30     | 55   | 65      | 30      | 1                        | 0.222     |
|                  | JR55x65x60     | 55   | 65      | 60      | 1                        | 0.444     |
| 60               | JR60x68x25     | 60   | 68      | 25      | 0.6                      | 0.153     |
|                  | JR60x68x35     | 60   | 68      | 35      | 0.6                      | 0.220     |
|                  | JR60x68x45     | 60   | 68      | 45      | 1                        | 0.284     |
|                  | JR60x70x25     | 60   | 70      | 25      | 1                        | 0.200     |
|                  | JR60x70x30     | 60   | 70      | 30      | 1                        | 0.240     |
|                  | JR60x70x60     | 60   | 70      | 60      | 1                        | 0.480     |

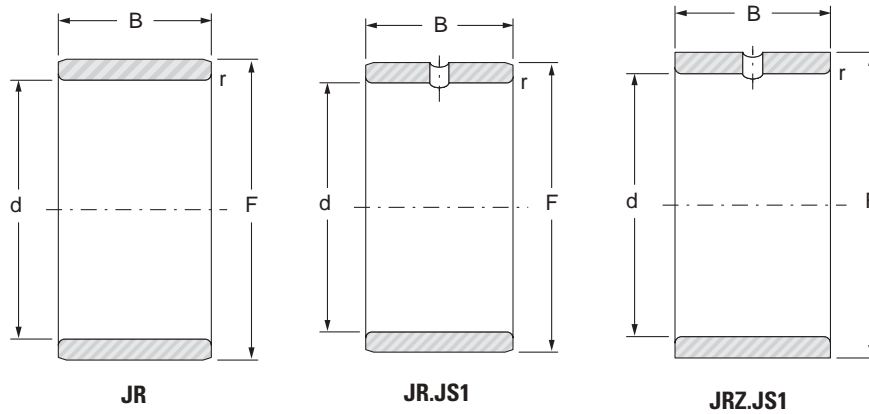
# INNER RINGS

## SUMMARY TABLE



| Shaft<br>∅<br>mm | Designation | d mm | F<br>mm | B<br>mm | r <sub>s</sub> min<br>mm | Weight kg |
|------------------|-------------|------|---------|---------|--------------------------|-----------|
| 65               | JR65x72x25  | 65   | 72      | 25      | 1                        | 0.143     |
|                  | JR65x72x45  | 65   | 72      | 45      | 1                        | 0.266     |
|                  | JR65x73x25  | 65   | 73      | 25      | 0.6                      | 0.170     |
|                  | JR65x73x35  | 65   | 73      | 35      | 0.6                      | 0.240     |
|                  | JR65x75x28  | 65   | 75      | 28      | 1                        | 0.240     |
|                  | JR65x75x30  | 65   | 75      | 30      | 1                        | 0.260     |
|                  | JR65x75x60  | 65   | 75      | 60      | 1                        | 0.520     |
| 70               | JR70x80x25  | 70   | 80      | 25      | 1                        | 0.230     |
|                  | JR70x80x30  | 70   | 80      | 30      | 1                        | 0.270     |
|                  | JR70x80x35  | 70   | 80      | 35      | 1                        | 0.320     |
|                  | JR70x80x54  | 70   | 80      | 54      | 1                        | 0.500     |
|                  | JR70x80x60  | 70   | 80      | 60      | 1                        | 0.556     |
| 75               | JR75x85x25  | 75   | 85      | 25      | 1                        | 0.240     |
|                  | JR75x85x30  | 75   | 85      | 30      | 1                        | 0.289     |
|                  | JR75x85x35  | 75   | 85      | 35      | 1                        | 0.338     |
|                  | JR75x85x54  | 75   | 85      | 54      | 1                        | 0.530     |
| 80               | JR80x90x25  | 80   | 90      | 25      | 1                        | 0.260     |
|                  | JR80x90x30  | 80   | 90      | 30      | 1                        | 0.306     |
|                  | JR80x90x35  | 80   | 90      | 35      | 1                        | 0.355     |
|                  | JR80x90x54  | 80   | 90      | 54      | 1                        | 0.565     |
| 85               | JR85x95x26  | 85   | 95      | 26      | 1                        | 0.290     |
|                  | JR85x95x30  | 85   | 95      | 30      | 1                        | 0.334     |
|                  | JR85x95x36  | 85   | 95      | 36      | 1                        | 0.397     |
|                  | JR85x100x35 | 85   | 100     | 35      | 1.1                      | 0.595     |
|                  | JR85x100x63 | 85   | 100     | 63      | 1.1                      | 1.080     |

# 11.2

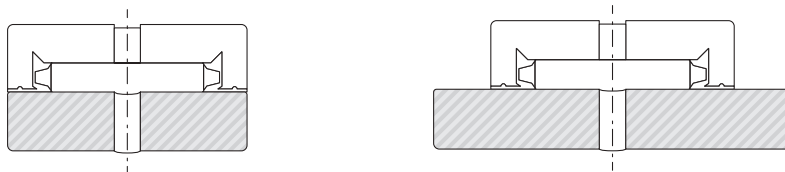


| Shaft<br>∅<br>mm | Designation  | d mm | F<br>mm | B<br>mm | r <sub>s</sub> min<br>mm | Weight kg |
|------------------|--------------|------|---------|---------|--------------------------|-----------|
| 90               | JR90x100x26  | 90   | 100     | 26      | 1                        | 0.300     |
|                  | JR90x100x30  | 90   | 100     | 30      | 1                        | 0.350     |
|                  | JR90x100x36  | 90   | 100     | 36      | 1                        | 0.422     |
|                  | JR90x105x32  | 90   | 105     | 32      | 1.1                      | 0.580     |
|                  | JR90x105x35  | 90   | 105     | 35      | 1.1                      | 0.624     |
|                  | JR90x105x63  | 90   | 105     | 63      | 1.1                      | 1.140     |
| 95               | JR95x105x26  | 95   | 105     | 26      | 1                        | 0.310     |
|                  | JR95x105x36  | 95   | 105     | 36      | 1                        | 0.430     |
|                  | JR95x110x35  | 95   | 110     | 35      | 1.1                      | 0.653     |
|                  | JR95x110x63  | 95   | 110     | 63      | 1.1                      | 1.200     |
| 100              | JR100x110x30 | 100  | 110     | 30      | 1.1                      | 0.384     |
|                  | JR100x110x40 | 100  | 110     | 40      | 1.1                      | 0.510     |
|                  | JR100x115x40 | 100  | 115     | 40      | 1.1                      | 0.790     |
| 110              | JR110x120x30 | 110  | 120     | 30      | 1                        | 0.425     |
|                  | JR110x125x40 | 110  | 125     | 40      | 1.1                      | 0.870     |
| 120              | JR120x130x30 | 120  | 130     | 30      | 1                        | 0.460     |
|                  | JR120x135x45 | 120  | 135     | 45      | 1.1                      | 1.060     |
| 130              | JR130x145x35 | 130  | 145     | 35      | 1.1                      | 0.890     |
|                  | JR130x150x50 | 130  | 150     | 50      | 1.5                      | 1.730     |
| 140              | JR140x155x35 | 140  | 155     | 35      | 1.1                      | 0.955     |
|                  | JR140x160x50 | 140  | 160     | 50      | 1.5                      | 1.860     |
| 150              | JR150x165x40 | 150  | 165     | 40      | 1.1                      | 1.170     |
| 160              | JR160x175x40 | 160  | 175     | 40      | 1.1                      | 1.240     |
| 170              | JR170x185x45 | 170  | 185     | 45      | 1.1                      | 1.480     |
| 180              | JR180x195x45 | 180  | 195     | 45      | 1.1                      | 1.560     |

# CYLINDRICAL INNER RINGS WITH AND WITHOUT HOLE FOR RNA BEARINGS

## SUMMARY TABLE

BIC and BICG series



| Shaft<br>∅<br>mm | Designation       | d mm | F<br>mm | B<br>mm | r <sub>s</sub> min mm | Weight kg |
|------------------|-------------------|------|---------|---------|-----------------------|-----------|
| 12               | <b>BI/C 1012</b>  | 12   | 17.6    | 15      | 1                     | 0.016     |
| 15               | <b>BI/C 1015</b>  | 15   | 20.8    | 15      | 1                     | 0.018     |
|                  | <b>BI/C 2015</b>  | 15   | 22.1    | 22      | 1                     | 0.035     |
| 17               | <b>BI/C 1017</b>  | 17   | 23.9    | 15      | 1                     | 0.026     |
| 20               | <b>BI/C 1020</b>  | 20   | 28.7    | 18      | 1                     | 0.046     |
|                  | <b>BI/C 2020</b>  | 20   | 28.7    | 22      | 1                     | 0.056     |
| 25               | <b>BI/C 1025</b>  | 25   | 33.5    | 18      | 1                     | 0.054     |
|                  | <b>BI/C 2025</b>  | 25   | 33.5    | 22      | 1                     | 0.065     |
|                  | <b>BI/C 22025</b> | 25   | 33.5    | 30      | 1                     | 0.500     |
| 30               | <b>BI/C 1030</b>  | 30   | 38.2    | 18      | 1                     | 0.060     |
|                  | <b>BI/C 2030</b>  | 30   | 38.2    | 22      | 1                     | 0.074     |
|                  | <b>BI/C 3030</b>  | 30   | 44.0    | 30      | 1                     | 0.188     |
| 35               | <b>BI/C 1035</b>  | 35   | 44.0    | 18      | 1                     | 0.077     |
|                  | <b>BI/C 2035</b>  | 35   | 44.0    | 22      | 1                     | 0.093     |
| 40               | <b>BI/C 1040</b>  | 40   | 49.7    | 18      | 1.5                   | 0.094     |
|                  | <b>BI/C 2040</b>  | 40   | 49.7    | 22      | 1.5                   | 0.115     |
|                  | <b>BI/C 3040</b>  | 40   | 55.4    | 36      | 1.5                   | 0.321     |
| 45               | <b>BI/C 1045</b>  | 45   | 55.4    | 18      | 1.5                   | 0.113     |
|                  | <b>BI/C 2045</b>  | 45   | 55.4    | 22      | 1.5                   | 0.139     |
|                  | <b>BI/C 3045</b>  | 45   | 62.1    | 38      | 1.5                   | 0.422     |

# 11.3



| Shaft<br>∅<br>mm | Designation       | d mm | F<br>mm | B<br>mm | r <sub>s</sub> min mm | Weight kg |
|------------------|-------------------|------|---------|---------|-----------------------|-----------|
| 50               | <b>BI/C 1050</b>  | 50   | 62.1    | 20      | 2                     | 0.163     |
|                  | <b>BI/C 11050</b> | 50   | 62.1    | 24      | 2                     | 0.196     |
|                  | <b>BI/C 2050</b>  | 50   | 62.1    | 28      | 2                     | 0.228     |
|                  | <b>BI/C 3050</b>  | 50   | 68.8    | 38      | 2                     | 0.515     |
| 55               | <b>BI/C 1055</b>  | 55   | 68.8    | 20      | 2                     | 0.205     |
|                  | <b>BI/C 3055</b>  | 55   | 72.6    | 38      | 2                     | 0.525     |
| 60               | <b>BI/C 2060</b>  | 60   | 72.6    | 28      | 2                     | 0.282     |
|                  | <b>BI/C 3060</b>  | 60   | 78.3    | 38      | 2                     | 0.583     |
| 65               | <b>BI/C 3065</b>  | 65   | 83.1    | 38      | 2                     | 0.623     |
| 70               | <b>BI/C 3070</b>  | 70   | 88.0    | 38      | 2                     | 0.662     |
| 75               | <b>BI/C 2075</b>  | 75   | 88.0    | 32      | 2                     | 0.410     |
| 80               | <b>BI/C 1080</b>  | 80   | 96.0    | 24      | 2                     | 0.410     |
|                  | <b>BI/C 2080</b>  | 80   | 96.0    | 32      | 2                     | 0.545     |
|                  | <b>BI/C 3080</b>  | 80   | 99.5    | 38      | 2                     | 0.805     |
| 90               | <b>BI/C 2090</b>  | 90   | 104.7   | 32      | 2                     | 0.531     |
|                  | <b>BI/C 3090</b>  | 90   | 109.1   | 43      | 2                     | 0.990     |
| 95               | <b>BI/C 2095</b>  | 95   | 109.1   | 32      | 2                     | 0.548     |
|                  | <b>BI/C 3095</b>  | 95   | 114.7   | 43      | 2                     | 1.075     |
| 100              | <b>BI/C 3100</b>  | 100  | 119.2   | 43      | 2                     | 1.090     |
| 105              | <b>BI/C 2105</b>  | 105  | 119.2   | 32      | 2                     | 0.615     |
| 110              | <b>BI/C 2110</b>  | 110  | 124.7   | 34      | 2                     | 0.705     |
| 130              | <b>BI/C 3130</b>  | 130  | 158.0   | 52      | 2                     | 2.530     |

# CODE SYMBOLS SUMMARY TABLE

| CODE              | DESCRIPTION   | PAGE |
|-------------------|---|------|
|                   | <b>A</b>  | 127  |
| ARZ               | Roller thrust bearing with retained plate   | 127  |
| AX                | Needle thrust bearing   | 127  |
| AXNZ              | Needle thrust bearing with retained plate   |      |
|                   | <b>B</b>  | 136  |
| BI                | There is the inner ring BI without lubrication hole and the BIC with lubrication hole.                  |      |
| ...B6             | Convex outer diameter for RNA 11000 series  |      |
| BI/C              | Cylindrical inner ring with and without lubrication hole for full complement needle bearings RNA series |      |
| BK                | Cylindrical inner ring with lubrication hole for RNAB seriesBK Caged needle bush, closed-end            |      |
| BK...RS           | Caged needle bush, closed-end with one seal   |      |
| BR                | Needle roller with round ends   |      |
| BP                | Needle roller with flat ends  |      |
|                   | <b>C</b>  | 127  |
| ...C2, C3, C4, C5 | Radial play different from standard play for complete bearings with thick inner and outer ring          | 127  |
| CP                | Plate for needle thrust bearing, roller thrust bearing (light series) and combined bearing              |      |
|                   | <b>D</b>  | 157  |
| DH                | Sealing rings   | 45   |
| DL                | Full complement needle bush, open   | 45   |
| DLF               | Full complement needle bush, closed-end   |      |
|                   | <b>E</b>  |      |
| ...EE             | Seal incorporated on two sides  |      |
| ...EEM            | Metal seals incorporated on two sides   |      |
|                   | <b>F</b>  | 93   |
| FG                | Needle cam follower with convex outer ring  | 93   |
| FGL               | Needle cam follower FG with cylindrical outer ring  | 93   |
| FG...EE           | Needle cam follower with convex outer ring with two seals   | 93   |
| FGL...EE          | Needle cam follower FG with cylindrical outer ring with two seals                                       | 93   |
| FG...EEM          | Needle cam follower with convex outer ring with two metallic shields                                    | 93   |
| FGL...EEM         | Needle cam follower FG with cylindrical outer ring with two metallic shields                            | 93   |
| FGU               | Full complement roller cam follower with convex outer ring  | 93   |
| FGU...MM          | Full complement roller cam follower with convex outer ring and metallic shields                         | 93   |
| FGUL              | Full complement roller cam follower with cylindrical outer ring   | 93   |
| FGUL...MM         | Full complement roller cam follower with cylindrical outer ring and metallic shields                    | 93   |
| FP                | Small needle cam follower with convex outer ring  |      |
| FPL               | Small needle cam follower with cylindrical outer ring   |      |

| CODE          | DESCRIPTION   | PAGE |
|---------------|---|------|
|               | <b>G</b>  | 93   |
| GC            | Needle cam follower with stud, convex outer ring  | 93   |
| GC..EE        | Needle cam follower with stud, convex outer ring with two seals   | 93   |
| GCL           | Needle cam follower with stud, cylindrical outer ring   | 93   |
| GCL...EE      | Needle cam follower with stud, cylindrical outer ring with two seals  | 93   |
| GC...EEM      | Needle cam follower with stud, convex outer ring with two metallic shields  | 93   |
| GCL...EEM     | Needle cam follower with stud, cylindrical outer ring with two metallic shields   | 93   |
| GCR           | Needle cam follower with eccentric stud, convex outer ring  | 93   |
| GCR...EE      | Needle cam follower GC...EE with eccentric stud   | 93   |
| GCRL          | Needle cam follower with eccentric stud and cylindrical outer ring  | 93   |
| GCRL...EE     | Needle cam follower GCL...EE with eccentric stud  | 93   |
| GCR...EEM     | Needle cam follower GC...EEM with eccentric stud  | 93   |
| GCRL...EEM    | Needle cam follower GCL...EEM with eccentric stud   | 93   |
| GPU           | Roller cam follower with stud, convex outer ring  | 93   |
| GCUL          | Roller cam follower with cylindrical outer ring   |      |
| GCUR          | Roller cam follower with eccentric stud, convex outer ring  |      |
| GCURL         | Roller cam follower with eccentric stud, cylindrical outer ring   |      |
|               | <b>H</b>  | 45   |
| HK            | Caged needle bush, open, according to ISO tolerances  | 45   |
| HK...RS       | Caged needle bush, open, with one seal  | 45   |
| HK...2RS      | Caged needle bush, open, with two seals   | 45   |
|               | <b>J</b>  | 173  |
| JR            | Inner ring for bushes and bearings without lubrication hole   | 173  |
| JR...JS1      | Inner ring for bushes and bearings with lubrication hole  | 173  |
| JRZ...JS1     | Inner ring for bushes and bearings with lubrication hole, without chamfer on the raceway. Radial clearance other than standard for complete bearings with thick inner and outer ring. | 173  |
|               | <b>N</b>  | 81   |
| NA            | Full complement needle bearings with inner ring   | 81   |
| NK            | Caged needle bearings without inner ring  | 81   |
| NKS           | Caged needle bearings without inner ring  | 81   |
| NKJ           | Caged needle bearings with inner ring   | 81   |
| NKJS          | Caged needle bearings with inner ring   | 81   |
|               | <b>P</b>  | 173  |
| ...P6, P5, P4 | Precision tolerance codes for thick inner and outer ring  | 173  |
|               | <b>K</b>  | 27   |
| K             | Needle cage with single row   | 27   |
| K...ZW        | Needle cage with double-row   | 27   |
| K...TN        | Molded cage of reinforced engineered polymer, with single-row   | 27   |

# CODE SYMBOLS

## SUMMARY TABLE

| CODE     | DESCRIPTION  | PAGE |
|----------|--|------|
| <b>R</b> |  |      |
| ...R6    | Convex inner ring raceway  | 141  |
| RAX 400  | Needle combined bearing with needle thrust cage                                      | 141  |
| RAX 700  | Needle combined bearing with thin outer ring, open                                   | 141  |
| RAXF 700 | Needle combined bearing with thin outer ring, closed end                             | 141  |
| RNA      | Full complement needle bearing without inner ring                                    | 141  |
| RNAB     | Cam follower 11.000 series, convex outer diameter greater than B6                    | 141  |
| RNA...B6 | Cam follower 11.000 series, convex outer diameter                                    | 141  |
| RNAL     | Cam follower 11.000 series, cylindrical outer diameter                               |      |
| ...RS    | Seals for needle bushes HK and BK  |      |
| <b>T</b> |  |      |
| ...TB    | Radial play or diameter under needle selected from lower half of standards tolerance | 184  |
| ...TC    | Radial play or diameter under needle selected from upper half of standards tolerance | 184  |
| ...TN    | Molded cage of reinforced engineered polymer   | 184  |