SKF

# SKF precision bearings

**Made by SKF®** stands for excellence. It symbolises our consistent endeavour to achieve total quality in everything we do. For those who use our products, “Made by SKF” implies three main benefits.

**Reliability** – thanks to modern, efficient products, based on our worldwide application know-how, optimised materials, forward-looking designs and the most advanced production techniques.

**Cost effectiveness** – resulting from the favourable ratio between our product quality plus service facilities, and the purchase price of the product.

**Market lead** – which you can achieve by taking advantage of our products and services. Increased operating time and reduced down-time, as well as improved output and product quality are the key to a successful partnership.


# Contents

# A precision bearing range to meet all needs

It is not always possible to satisfactorily meet the demands of bearing applications using the bearings for general engineering purposes listed in the SKF General Catalogue. This is particularly true where machine tools are concerned, as the requirements placed on machine tool bearing arrangements, e.g. those of work spindles, are very demanding.

Bearings for such applications must have high running accuracy and high stiffness as well as low friction if high machining accuracy is to be obtained with the lowest possible operating temperatures at high speeds and minimum temperature changes over the whole speed range.

SKF produces special precision bearings to meet these exacting demands. This brochure contains the standard range of SKF precision bearings. Of course, SKF also produces many other precision bearings, particularly in larger sizes, and one speciality is complete spindle units, with or without integral drive.

**Universal competence**

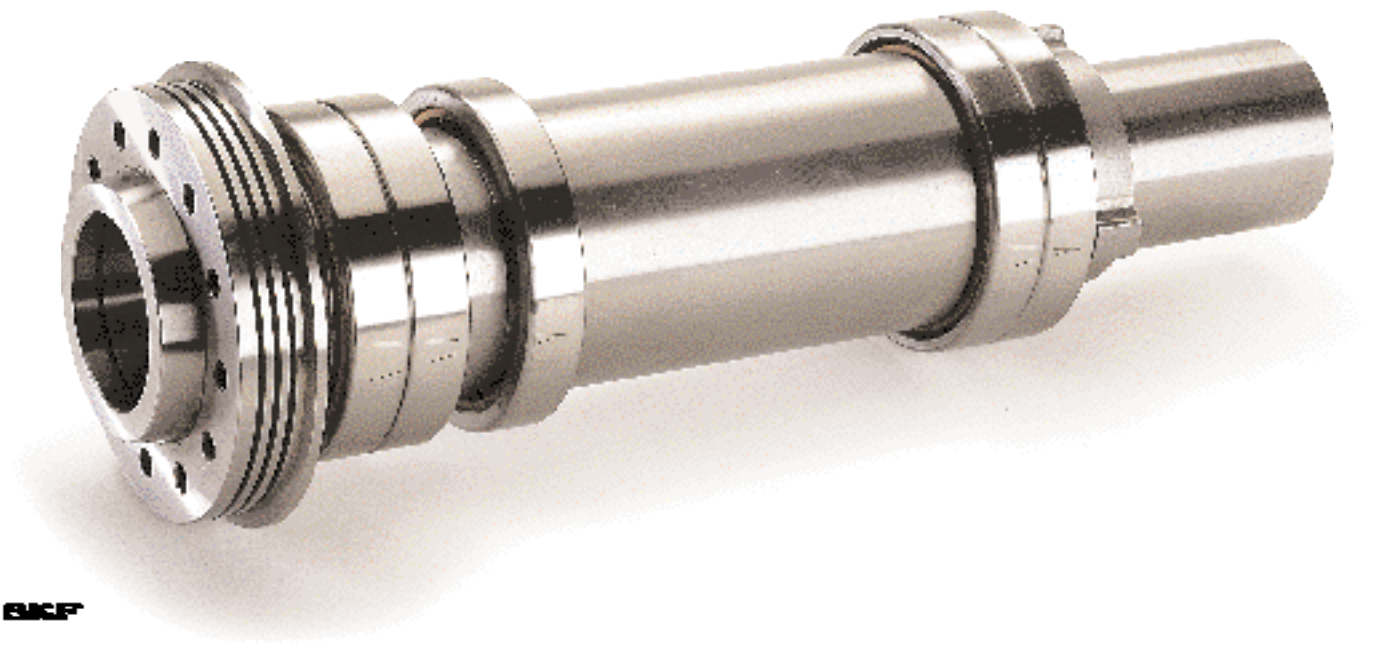
As the world's leading manufacturer of ball and roller bearings, SKF not only offers a very comprehensive range of bearings, but has a wealth of experience with bearing applications of all kinds. SKF has taken the lead, for example, in defining general design principles for machine tool bearing arrangements, which have gained acceptance in the machine tool industry. SKF competence in this sector has been built up over the years in close cooperation with customers worldwide.

The more complex the technical demands, particularly in new developments, the more reason to tap the comprehensive know-how available at SKF and to recognise the competence in the high precision bearing manufacture and application within the SKF Group.

**Brief and to the point**

The product tables in this brochure contain all the data required for the selection of a precision bearing and its arrangement design. A description of the particular features of the particular bearing type precedes each table section. General information regarding bearing tolerances as well as internal clearance or preload is also included.

More in-depth information on bearing technology, for example, the selection of bearing size, or lubrication, will be found in the SKF General Catalogue or in specialist handbooks and catalogues produced by SKF. The general information contained in the SKF catalogue 3700 "Precision bearings" will also be found useful.



# Selection of bearing type

The bearings shown in this brochure have been designed for machine tool and other applications where high demands are placed on accuracy and speed capability. Each of the bearing types has characteristic properties which make it especially suitable for particular applications.

In order to fully exploit the full potential of SKF precision bearings and to facilitate bearing selection the properties of the various types are explained. When designing a precision bearing arrangement the following factors have to be considered, for example:

- accuracy,
- available space,
- loads,
- stiffness,
- accommodation of axial displacements,
- speed, and
- heat generation.

Depending on the application, one or other of these factors will have a dominant influence. It is therefore not possible to set down general rules for the selection of bearing type or bearing series.

**Accuracy**

The running accuracy of a bearing arrangement is governed by the accuracy of all the component parts of the arrangement. Where the bearings are concerned it is primarily determined by the accuracy of form and position of the raceways on the bearing rings. When selecting the appropriate tolerance class for a particular bearing, the maximum radial runout of the inner ring ($K_{ia}$) is generally the determining factor for most applications.

To facilitate comparison, **Table 1** gives values of the radial runout for different tolerance classes and bearing bore diameters.

Normally, the maximum values of $K_{ia}$ given in the table are much higher than the actual values. This means, for example, that if bearings with class SP tolerances are used, running accuracies of under 3 µm can be achieved.

**Table 1**

| **Bore diameter** d | | **Maximum radial runout ($K_{ia}$)** Radial bearings Tolerance class | | | |
|---|---|---|---|---|---|
| over | incl. | SP | P4A | PA9A | UP |
| mm | | µm | | | |
| – | **18** | 3 | 1,3 | 1,3 | 1,5 |
| **18** | **30** | 3 | 2,5 | 2,5 | 1,5 |
| **30** | **50** | 4 | 2,5 | 2,5 | 2 |
| **50** | **80** | 4 | 2,5 | 2,5 | 2 |
| **80** | **120** | 5 | 2,5 | 2,5 | 3 |
| **120** | **150** | 6 | 4 | 2,5 | 3 |
| **150** | **180** | 6 | 6 | 5 | 3 |
| **180** | **250** | 8 | 7 | 5 | 4 |
| **250** | **315** | 8 | – | – | 5 |

***Maximum radial runout for different tolerance classes and bore diameters***

**Available space**

Precision bearing arrangements generally call for bearings with a low cross section because of the limited space available and the high requirements in respect of stiffness and running accuracy of the arrangement. These bearings generally have a large number of small-diameter rolling elements and consequently have a high stiffness. They also enable relatively large diameter spindles to be used for a given housing bore diameter and therefore exhibit all the advantages which are important both for the stiffness and the running accuracy of the bearing arrangement.

Almost all the angular contact ball bearings, cylindrical roller bearings and angular contact thrust ball bearings belong to the ISO Diameter Series 9 or 0. It is thus possible, by selecting a suitable combination of bearings, to achieve an optimum bearing arrangement for particular requirements within the same radial space.

To illustrate the space requirements, the cross sections of the most common machine tool spindle bearings are shown in **fig** 1.

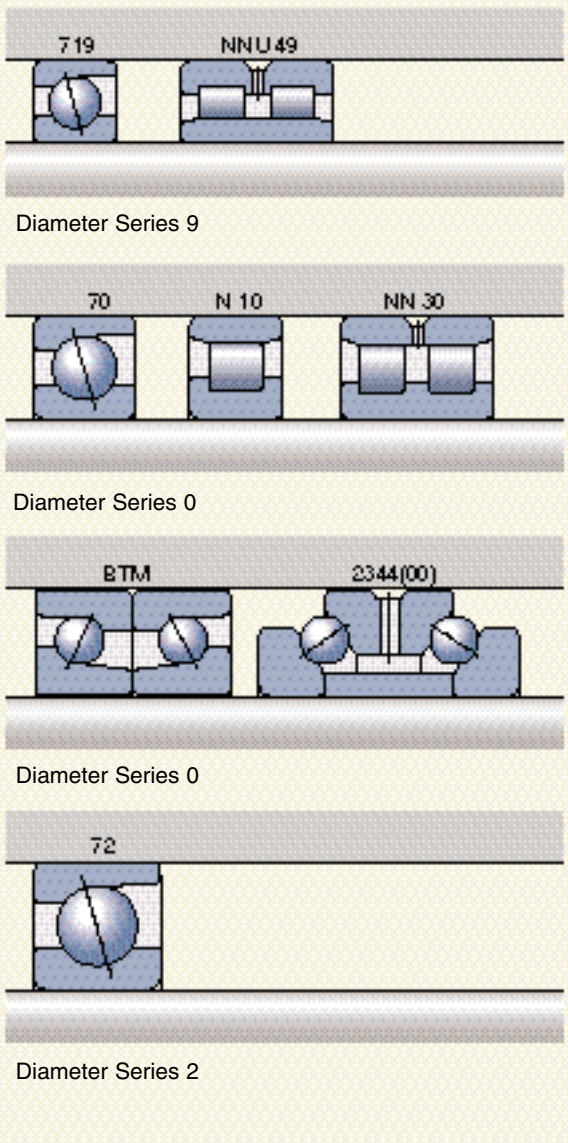
**Loads**

In machine tools, the main application for precision bearings, the load carrying capacity of a bearing is generally much less important when determining bearing size than in general engineering applications. Other criteria such as stiffness, size of the requisite bore in the spindle, machining speeds and accuracy, are the decisive factors.

When selecting the type of bearing for a given bearing arrangement, however, the magnitude as well as the direction of action of the load play an important part. As a general rule, roller bearings can carry heavier loads than ball bearings having the same envelope dimensions. Angular contact ball bearings, which have their raceways arranged at an angle to the bearing axis, are more appropriate for the accommodation of combined loads or purely axial loads.

***Cross sections of the various Dimension Series of the radial and thrust bearings commonly used for machine tool spindles***

**Fig 1**



**Stiffness**
The stiffness of a bearing, characterised by the magnitude of the elastic deformation of the bearing under load, is of particular importance where highly accurate bearing arrangements are required. Roller bearings are stiffer than ball bearings because of the contact conditions between the rolling elements and raceways. Stiffness can be enhanced by preloading the bearing.

A comparison of the radial and axial stiffnesses of the different precision bearing types is shown in **Table** 2.

**Axial displacement**
Cylindrical roller bearings are particularly suitable as non-locating bearings. Axial displacements in both directions can be accommodated between the rollers and the raceway of one of the rings. Both inner and outer ring can therefore be mounted with an interference fit.

If non-separable bearings, e.g angular contact ball bearings are used as non-locating bearings, one of the bearing rings must have a loose fit, generally the ring which does not rotate. However, this has a negative influence on the stiffness of the bearing arrangement system.

**Speed**
The speed at which a rolling bearing can operate is governed largely by the permissible operating temperature. Bearing types with low friction and thus low heat generation within the bearing are therefore the most suitable for high speed operation.

A comparison of the maximum speeds for precision bearings (single bearings and bearing combinations) is shown in **Table** 2.

Because of their design, thrust bearings do not permit such high speeds as radial bearings.

**Heat generation**
The heat generated in a bearing arrangement is of considerable importance for the operating conditions and performance of a machine. It is largely determined by the operating speed, but also depends on the bearing type, the method of lubrication, the degree of bearing preload and the load conditions.

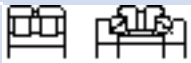
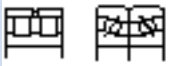
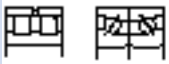
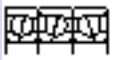
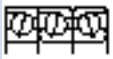
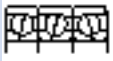
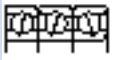
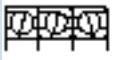
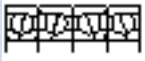
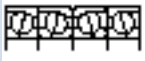
As bearing type, operating speed and load are generally fixed for a given bearing arrangement, the method of lubrication and the quantity of lubricant are decisive with respect to heat generation.

**Spindle bearing arrangements**
The most important factors which have to be considered when designing bearing arrangements for machine tool spindles as already mentioned are the stiffness, the running accuracy, the speed and the operating temperature.

In order to satisfy these partly conflicting demands, precision bearings of widely differing designs are used.

The most commonly used bearing combinations are shown in **Table** 2 with their most important characteristics. The guideline values for stiffness given in the table relate to spindles having a diameter of 100 mm at the work side and 90 mm at the opposite side. As the length of the spindle and inividual operating conditions are not considered, the table can only provide approximate values.

**Table 2**

| **Bearing combination** Work side | Opposite side | | **Characteristics** Stiffness axial | radial | Speed | Running accuracy | Load carrying capacity radial |
|---|---|---|---|---|---|---|---|
| – | | | % | | | | |
|  |  | NN 30 K/SP | 100 | 100 | 100 | 100 | 100 |
|  |  | NN 30 K/SP | 66 | 100 | 118 | 100 | 100 |
|  |  | NN 30 K/SP | 45 | 100 | 135 | 100 | 100 |
|  |  | N 10 K/SP | 45 | 73 | 135 | 100 | 80 |
|  |  | 70 CD/P4ADBA | 81 | 63 | 160 | 160 | 100 |
|  |  | 70 CD/P4ADBA | 81 | 66 | 180 | 160 | 100 |
|  |  | NN 30 K/SP | 81 | 58 | 155 | 160 | 110 |
|  |  | NN 30 K/SP | 81 | 59 | 155 | 160 | 90 |
|  |  | 719 CD/P4ADBA | 81 | 57 | 160 | 160 | 75 |
|  |  | N 10 K/SP | 42 | 71 | 180 | 160 | 70 |
|  |  | N 10 K/SP | 57 | 85 | 155 | 160 | 100 |
|  |  | N 10 K/SP | 21 | 42 | 180 | 160 | 55 |
|  |  | 70 CD/P4ADBA | 28 | 61 | 230 | 160 | 85 |
|  |  | 70 CE/P4ADT | 21 | 55 | 360 | 160 | 50 |


SKF

# Angular contact ball bearings

SKF produces state-of-the-art precision angular contact ball bearings for the work spindles of machine tools and similar applications where demands on running accuracy and speed capability are high or very high.

SKF precision angular contact ball bearings (➔ **fig** 1) are produced in three different dimension series 719, 70 and 72 and are available with contact angles of 15° (designation suffix CD) and 25° (designation suffix ACD) (➔ **fig** 2).

To meet the various demands with regard to running accuracy, speed capability, stiffness as well as load carrying capacity placed on precision bearing arrangements in an optimum manner, three different types of single row angular contact ball bearings are available:

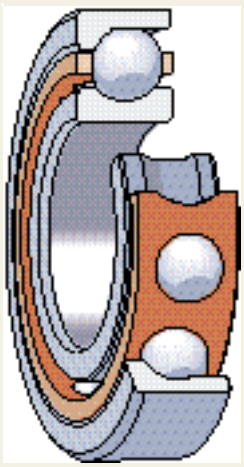
- precision angular contact ball bearings of standard design,
- hybrid precision angular contact ball bearings (with ceramic balls), and
- precision angular contact ball bearings with modified internal geometry.

**Precision angular contact ball bearings, standard design**

SKF precision angular contact ball bearings of the standard design are made of carbon chromium steel. They are available in the three bearing series with a contact angle of 15° (designation suffix CD) as well as with a contact angle of 25° (designation suffix ACD), (➔ **fig** 2). The bearings with the larger contact angle are used primarily where high axial stiffness or high axial load carrying capacity are required.

**Fig** 3 on **page 10** shows the different cross sections of the three bearing series with reference to the outside and bore diameters. The different space requirements of the three series are clearly apparent. Each series has typ-

**Fig 1**



***Precision angular contact ball bearing for machine tool work spindles***

***Precision angular contact ball bearings of standard design***

**Fig 2**

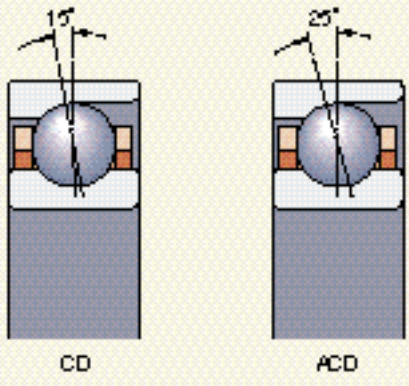
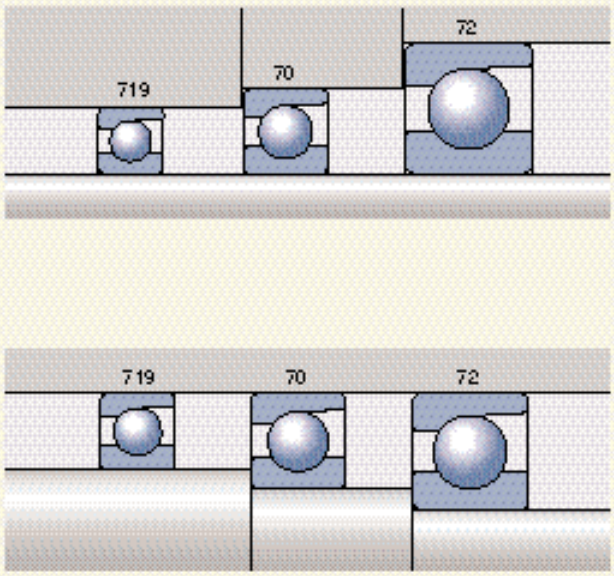


Fig 3




*Comparison of the cross sections of bearings of series 719, 70 and 72*

ical properties which are appropriate to different applications.

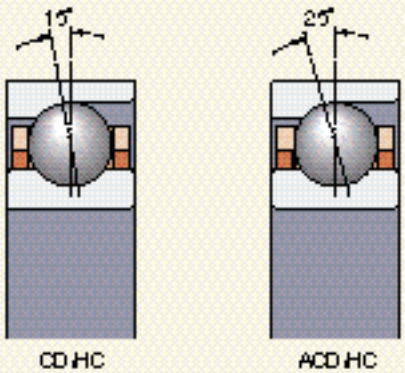
### Hybrid precision angular contact ball bearings

SKF hybrid precision angular contact ball bearings have the same design as the standard bearings but have ceramic balls instead of steel balls (➔ **fig** 4). The silicon nitride ceramic material demonstrates a good combination of stiffness, hardness, wear resistance and density. The ceramic balls have 60 % lower density than steel balls so that the centrifugal forces in the bearing are much reduced. The lighter balls also cause less alteration of the contact angle and increase the dynamic accuracy of the bearing.

A 70 % smaller thermal expansion than for steel balls considerably reduces the influence of temperature changes on the bearing preload. It is therefore possible for hybrid bearings to operate at speeds which are some 20 % higher than for all-steel bearings without any risk of uncontrolled preload increases occurring.

The modulus of elasticity of the ceramic material is some 50 % greater than for steel. Thus hybrid bearings are stiffer, by up to 20 % at elevated speeds. Power losses are reduced by approximately 10 % compared with all-steel bearings.

Fig 4




*Standard designs of SKF hybrid angular contact ball bearings*

**SKF hybrid precision angular contact ball bearings are identified by the designation suffix HC, e.g. 71912 CDGA/HCP4A.**

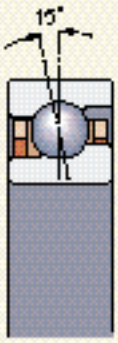
### Precision angular contact ball bearings with modified internal design

The majority of the high demands associated with machine tool spindle applications can be met with the standard design of precision angular contact ball bearings with steel balls or with ceramic balls. For applications where maximum speed capability and stiffness are required, however, some sizes of series 719 and 70 are also available with modified internal design. These bearings of the CE design have a contact angle of 15° and incorporate more, but smaller balls than the corresponding sizes of series 719 CD or 70 CD (➔ **fig** 5) except for the smallest sizes. The gyratory forces exerted by the balls on the outer ring raceways are much reduced for the small balls compared with the larger balls of the standard design and the surface pressure in the rolling contact is also reduced.

By using smaller balls, it is possible for the bearing rings to be correspondingly thicker for the same envelope dimensions. This means that any inaccuracies of form of the bearing seatings on the shaft or in the housing will have less influence on the accuracy of form of the bearing rings so that the bearings will have enhanced running accuracy. The CE-design bearings are fully interchangeable with the standard CD-design bearings. The CE-design bearings are characterised by very high speed capability compared with the CD-design bearings .

The bearings are available in an all-steel version, the CE design, or in a hybrid version with ceramic balls identified by the designation suffix CE/HC. They are produced as standard to tolerance class P4A specifications.

Fig 5




***Precision angular contact ball bearing, CE design***

**Matched bearing sets**

All SKF precision angular contact ball bearings can be supplied as required in complete sets of two, three or four matched bearings in the arrangements shown in **fig** 6.

The bearings of a set are matched in production so that when they are mounted immediately adjacent to each other in the prescribed order, a given preload will be obtained or the load will be evenly distributed. The bore and outside diameters of the bearings of a set differ from each other by half the permissible diameter tolerance. The difference is even smaller for bearings to tolerance class PA9A.

To facilitate correct mounting, the bearings of a set have a "V" marking on their outside cylindrical surface. The prescribed order must be adhered to if the set is to perform properly. The "V" marking also indicates how the set should be mounted in relation to the axial load. The point of the "V" indicates the direction in which the axial load, or where axial load acts in both directions, the greater of the axial loads, should act on the inner ring.

The bearings of a set are supplied in a unit package but are individually packed within the package.

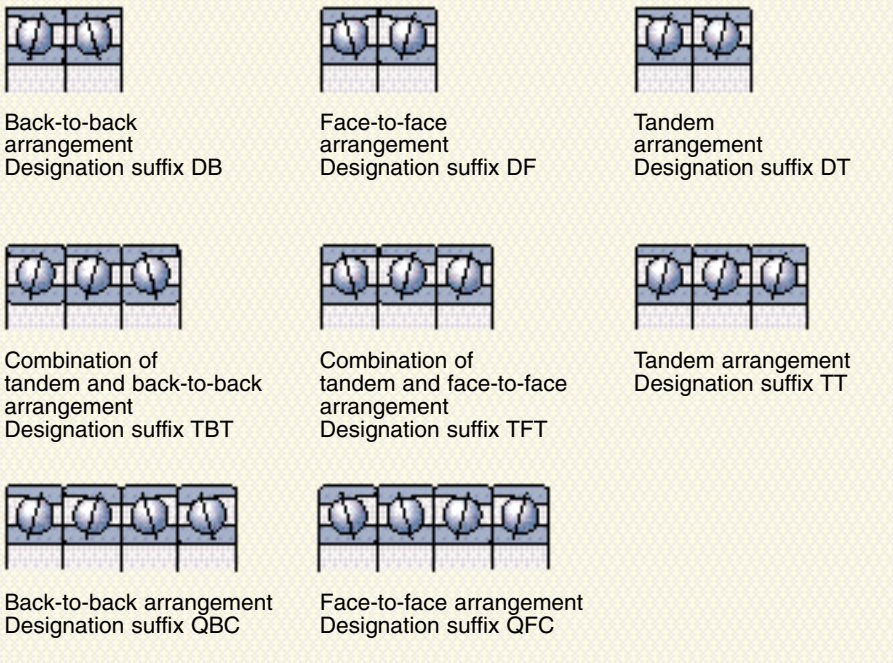
**Bearings for universal pairing**

A special execution of the SKF precision angular contact ball bearings is that for universal pairing. These bearings are matched during production so that they can be mounted immediately adjacent to each other in random order (back-to-back, face-to-face or in tandem) and will then have a light, medium or heavy preload when arranged back-to-back or face-to-face, as required.

Bearings for universal pairing are identified by the designation suffix G followed by A, B or C for the preload class, e.g. 71906 CDGA/P4A. When ordering it should be remembered that the number of individual bearings should be stated and not the number of pairs.

Sets of two bearings for universal pairing with matched bore and outside diameters are also available. Depending on preload class, these carry the designation suffix DGA, DGB or DGC, e.g. 71906 CD/P4ADGA. In this case, however, the number of pairs required must be stated, not the number of individual bearings.

Fig 6




***Possible combinations of matched bearing sets***

***Bearings of series 719: preload in bearings for universal pairing and bearing sets arranged back-to-back or face-to-face.***
*Hybrid bearings of the CD/HC and ACD/HC designs are only available with axial preload to classes A and B.*

Table 1

| Bearing | | Axial preload in bearing of series 719 of designs | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Bore diameter | Size | CD, CD/HC Class | | | ACD, ACD/HC Class | | | CE, CE/HC Class | |
| | | A | B | C | A | B | C | A | B |
| mm | – | N | | | | | | | |
| **10** | **00** | 10 | 20 | 40 | 15 | 30 | 60 | – | – |
| **12** | **01** | 10 | 20 | 40 | 15 | 30 | 60 | – | – |
| **15** | **02** | 15 | 30 | 60 | 25 | 50 | 100 | – | – |
| **17** | **03** | 15 | 30 | 60 | 25 | 50 | 100 | – | – |
| **20** | **04** | 25 | 50 | 100 | 35 | 70 | 140 | – | – |
| **25** | **05** | 25 | 50 | 100 | 40 | 80 | 160 | – | – |
| **30** | **06** | 25 | 50 | 100 | 40 | 80 | 160 | – | – |
| **35** | **07** | 35 | 70 | 140 | 60 | 120 | 240 | – | – |
| **40** | **08** | 45 | 90 | 180 | 70 | 140 | 280 | – | – |
| **45** | **09** | 50 | 100 | 200 | 80 | 160 | 320 | – | – |
| **50** | **10** | 50 | 100 | 200 | 80 | 160 | 320 | – | – |
| **55** | **11** | 70 | 140 | 280 | 120 | 240 | 480 | – | – |
| **60** | **12** | 70 | 140 | 280 | 120 | 240 | 480 | 100 | 200 |
| **65** | **13** | 80 | 160 | 320 | 120 | 240 | 480 | – | – |
| **70** | **14** | 130 | 260 | 520 | 200 | 400 | 800 | 150 | 300 |
| **75** | **15** | 130 | 260 | 520 | 210 | 420 | 840 | – | – |
| **80** | **16** | 140 | 280 | 560 | 220 | 440 | 880 | 160 | 320 |
| **85** | **17** | 170 | 340 | 680 | 270 | 540 | 1 080 | – | – |
| **90** | **18** | 180 | 360 | 720 | 280 | 560 | 1 120 | 220 | 440 |
| **95** | **19** | 190 | 380 | 760 | 290 | 580 | 1 160 | – | – |
| **100** | **20** | 230 | 460 | 920 | 360 | 720 | 1 440 | – | – |
| **105** | **21** | 230 | 460 | 920 | 360 | 720 | 1 440 | – | – |
| **110** | **22** | 230 | 460 | 920 | 370 | 740 | 1 480 | – | – |
| **120** | **24** | 290 | 580 | 1 160 | 450 | 900 | 1 800 | – | – |
| **130** | **26** | 350 | 700 | 1 400 | 540 | 1 080 | 2 160 | – | – |
| **140** | **28** | 360 | 720 | 1 440 | 560 | 1 120 | 2 240 | – | – |
| **150** | **30** | 470 | 940 | 1 880 | 740 | 1 480 | 2 960 | – | – |
| **160** | **32** | 490 | 980 | 1 960 | 800 | 1 600 | 3 200 | – | – |
| **170** | **34** | 500 | 1 000 | 2 000 | 800 | 1 600 | 3 200 | – | – |
| **180** | **36** | 630 | 1 260 | 2 520 | 1 000 | 2 000 | 4 000 | – | – |
| **190** | **38** | 640 | 1 280 | 2 560 | 1 000 | 2 000 | 4 000 | – | – |
| **200** | **40** | 800 | 1 600 | 3 200 | 1 250 | 2 500 | 5 000 | – | – |
| **220** | **44** | 850 | 1 700 | 3 400 | 1 300 | 2 600 | 5 200 | – | – |
| **240** | **48** | 850 | 1 700 | 3 400 | 1 350 | 2 700 | 5 400 | – | – |

## Dimensions

The boundary dimensions of the bearings shown in the bearing tables conform to ISO 15-1981, Dimension Series 19, 10 and 02.

## Tolerances

SKF precision angular contact ball bearings are produced as standard to tolerance class P4A specifications. They may also be supplied with greater accuracy to PA9A, to order.

The actual values of the tolerances for classes P4A and PA9A are given in **Tables** 1 and 2, **pages 67** and **68**. They correspond largely to ISO 492:1994 and ANSI/ABMA Std. 20-1987.

## Preload

To meet different requirements regarding speed capability, stiffness etc. matched sets of two precision angular contact ball bearings arranged back-to-back or face-to-face are supplied in three preload classes by SKF.

Class A: light preload
Class B: medium preload
Class C: heavy preload

The magnitude of the preload depends on the series, the contact angle and the bearing size. The actual values are given in **Tables** 1 to 3. The values apply to unmounted pairs arranged back-to-back and face-to-face and are nominal values.

Bearing sets of three or four bearings in tandem/back-to-back or tandem/face-to-face arrangements have a higher preload than that given in **Tables** 1 to 3. The actual preload can be obtained by multiplying the table values by

1,35 for TBT and TFT sets
2,00 for QBC and QFC sets
1,60 for QBT and QFT sets

**Table 2**

***Bearings of series 70: preload in bearings for universal pairing and bearing sets arranged back-to-back or face-to-face.***
*Hybrid bearings of the CD/HC and ACD/HC designs are only available with axial preload to classes A and B.*

| Bearing Bore diameter | Size | Axial preload in bearings of series 70 of designs CD, CD/HC Class A | B | C | ACD, ACD/HC Class A | B | C | CE, CE/HC Class A | B |
|---|---|---|---|---|---|---|---|---|---|
| mm | – | N | | | | | | | |
| **8** | **8** | 10 | 20 | 40 | 20 | 40 | 80 | – | – |
| **9** | **9** | 10 | 20 | 40 | 20 | 40 | 80 | – | – |
| **10** | **00** | 15 | 30 | 60 | 25 | 50 | 100 | – | – |
| **12** | **01** | 15 | 30 | 60 | 25 | 50 | 100 | – | – |
| **15** | **02** | 20 | 40 | 80 | 30 | 60 | 120 | – | – |
| **17** | **03** | 25 | 50 | 100 | 40 | 80 | 160 | – | – |
| **20** | **04** | 35 | 70 | 140 | 50 | 100 | 200 | – | – |
| **25** | **05** | 35 | 70 | 140 | 60 | 120 | 240 | 70 | 140 |
| **30** | **06** | 50 | 100 | 200 | 90 | 180 | 360 | 100 | 200 |
| **35** | **07** | 60 | 120 | 240 | 90 | 180 | 360 | 110 | 220 |
| **40** | **08** | 60 | 120 | 240 | 100 | 200 | 400 | 110 | 220 |
| **45** | **09** | 110 | 220 | 440 | 170 | 340 | 680 | – | – |
| **50** | **10** | 110 | 220 | 440 | 180 | 360 | 720 | 160 | 320 |
| **55** | **11** | 150 | 300 | 600 | 230 | 460 | 920 | – | – |
| **60** | **12** | 150 | 300 | 600 | 240 | 480 | 960 | 140 | 280 |
| **65** | **13** | 160 | 320 | 640 | 240 | 480 | 960 | 150 | 300 |
| **70** | **14** | 200 | 400 | 800 | 300 | 600 | 1 200 | 200 | 400 |
| **75** | **15** | 200 | 400 | 800 | 310 | 620 | 1 240 | – | – |
| **80** | **16** | 240 | 480 | 960 | 390 | 780 | 1 560 | 260 | 520 |
| **85** | **17** | 250 | 500 | 1 000 | 400 | 800 | 1 600 | – | – |
| **90** | **18** | 300 | 600 | 1 200 | 460 | 920 | 1 840 | 330 | 660 |
| **95** | **19** | 310 | 620 | 1 240 | 480 | 960 | 1 920 | – | – |
| **100** | **20** | 310 | 620 | 1 240 | 500 | 1 000 | 2 000 | 350 | 700 |
| **105** | **21** | 360 | 720 | 1 440 | 560 | 1 180 | 2 360 | – | – |
| **110** | **22** | 420 | 840 | 1 680 | 650 | 1 300 | 2 600 | – | – |
| **120** | **24** | 430 | 860 | 1 720 | 690 | 1 380 | 2 760 | – | – |
| **130** | **26** | 560 | 1 120 | 2 240 | 900 | 1 800 | 3 600 | – | – |
| **140** | **28** | 570 | 1 140 | 2 280 | 900 | 1 800 | 3 600 | – | – |
| **150** | **30** | 650 | 1 300 | 2 600 | 1 000 | 2 000 | 4 000 | – | – |
| **160** | **32** | 730 | 1 460 | 2 920 | 1 150 | 2 300 | 4 600 | – | – |
| **170** | **34** | 800 | 1 600 | 3 200 | 1 250 | 2 500 | 5 000 | – | – |
| **180** | **36** | 900 | 1 800 | 3 600 | 1 450 | 2 900 | 5 800 | – | – |
| **190** | **38** | 950 | 1 900 | 3 800 | 1 450 | 2 900 | 5 800 | – | – |
| **200** | **40** | 1 100 | 2 200 | 4 400 | 1 750 | 3 500 | 7 000 | – | – |
| **220** | **44** | 1 250 | 2 500 | 5 000 | 2 000 | 4 000 | 8 000 | – | – |
| **240** | **48** | 1 300 | 2 600 | 5 200 | 2 050 | 4 1000 | 8 200 | – | – |

## Cages

All SKF precision angular contact ball bearings are fitted with an outer ring centred cage (➔ **fig 7**) which is particularly lightweight so that gyratory forces are kept to a minimum. The cage form allows uninterrupted access of lubricant to the ball/raceway contacts.

The present fabric reinforced phenolic resin cages are gradually being replaced by an even more stable cage of PEEK (polyether ether ketone). Bearings with the new PEEK cage are identified by the designation suffix TNH, e.g. 71916 CDTNH/P4A.

## Speed ratings

The speed ratings quoted in the bearing tables are guideline values and apply provided the bearings operate under light loads ($P \leq 0{,}06\ C$) and are lightly preloaded by means of springs. Heat transport away from the bearing position should also be good.

The values given under oil spot lubrication are maximum values, as are those under grease lubrication; they can be attained using a good quality grease of soft consistency.

The speed ratings for bearing sets can be obtained by multiplying the ratings quoted for single bearings by the reduction factors given in **Table 4**.

**Fig 7**

***Cage made of fabric reinforced phenolic resin***

***Bearings of series 72: preload in bearings for universal pairing and bearing sets arranged back-to-back of face-to-face.***
*Hybrid bearings of the CD/HC and ACD/HC designs are only available with axial preload to classes A and B.*

**Table 3**

| Bearing Bore diameter | Size | Axial preload in bearings of series 72 of designs CD, CD/HC Class A | B | C | ACD, ACD/HC Class A | B | C |
|---|---|---|---|---|---|---|---|
| mm | – | N | | | | | |
| **10** | **00** | 20 | 40 | 80 | 35 | 70 | 140 |
| **12** | **01** | 20 | 40 | 80 | 35 | 70 | 140 |
| **15** | **02** | 30 | 60 | 120 | 45 | 90 | 180 |
| **17** | **03** | 35 | 70 | 140 | 60 | 120 | 240 |
| **20** | **04** | 45 | 90 | 180 | 70 | 140 | 280 |
| **25** | **05** | 50 | 100 | 200 | 80 | 160 | 320 |
| **30** | **06** | 90 | 180 | 360 | 150 | 300 | 600 |
| **35** | **07** | 120 | 240 | 480 | 190 | 380 | 760 |
| **40** | **08** | 150 | 300 | 600 | 240 | 480 | 960 |
| **45** | **09** | 160 | 320 | 640 | 260 | 520 | 1 040 |
| **50** | **10** | 170 | 340 | 680 | 260 | 520 | 1 040 |
| **55** | **11** | 210 | 420 | 840 | 330 | 660 | 1 320 |
| **60** | **12** | 250 | 500 | 1 000 | 400 | 800 | 1 600 |
| **65** | **13** | 290 | 580 | 1 160 | 450 | 900 | 1 800 |
| **70** | **14** | 300 | 600 | 1 200 | 480 | 960 | 1 920 |
| **75** | **15** | 310 | 620 | 1 240 | 500 | 1 000 | 2 000 |
| **80** | **16** | 370 | 740 | 1 480 | 580 | 1 160 | 2 320 |
| **85** | **17** | 370 | 740 | 1 480 | 600 | 1 200 | 2 400 |
| **90** | **18** | 480 | 960 | 1 920 | 750 | 1 500 | 3 000 |
| **95** | **19** | 520 | 1 040 | 2 080 | 850 | 1 700 | 3 400 |
| **100** | **20** | 590 | 1 180 | 2 360 | 950 | 1 900 | 3 800 |
| **105** | **21** | 650 | 1 300 | 2 600 | 1 000 | 2 000 | 4 000 |
| **110** | **22** | 670 | 1 340 | 2 680 | 1 050 | 2 100 | 4 200 |
| **120** | **24** | 750 | 1 500 | 3 000 | 1 200 | 2 400 | 4 800 |

***Reduction factors for speed ratings***

**Table 4**

| Bearing arrrangement | Reduction factors for preload arrangements Bearings of designs CD, CD/HC, ACD, ACD/HC, CE and CE/HC with d ≤ 50 mm and preload to class A | B | C | CE and CE/HC with d > 50 mm and preload to class A | B |
|---|---|---|---|---|---|
| Set of two bearings arranged in tandem | 0,90 | 0,80 | 0,65 | 0,90 | 0,70 |
| Set of two bearings arranged back-to-back or face-to-face | 0,80 | 0,70 | 0,55 | 0,75 | 0,60 |
| Set of three bearings | 0,70 | 0,55 | 0,35 | 0,65 | 0,40 |
| Set of four bearings | 0,65 | 0,45 | 0,25 | 0,55 | 0,30 |

### Load carrying capacity of bearing sets

The values given in the bearing tables for the basic dynamic and static load ratings apply to single bearings. The basic dynamic load ratings for sets of bearings in any order can be obtained by multiplying the C value for a single bearing by

1,62 for sets of two bearings
2,16 for sets of three bearings
2,64 for sets of four bearings.

The corresponding basic static load ratings are obtained by multiplying the $C_0$ value for a single bearing by the number of bearings in the set (2, 3 or 4).

### Equivalent dynamic bearing load

For single row angular contact ball bearings arranged singly or paired in tandem

$P = F_r$ when $F_a/F_r \leq e$
$P = XF_r + YF_a$ when $F_a/F_r > e$

The appropriate values for X and Y for the different contact angles will be found in **Table** 5. When calculating bearing pairs, $F_r$ and $F_a$ represent the forces acting on the bearing pair.

For bearing pairs arranged back-to-back or face-to-face

$P = F_r + Y_1F_a$ when $F_a/F_r \leq e$
$P = XF_r + Y_2F_a$ when $F_a/F_r > e$

The appropriate values for X, $Y_1$ and $Y_2$ for the different contact angles will be found in **Table** 6. When calculating bearing pairs, $F_r$ and $F_a$ represent the forces acting on the bearing pair.

When calculating sets of more than two bearings arranged back-to-back or face-to-face, it is necessary to consider the number of bearings supporting the load in each direction.

### Equivalent static bearing load

For single row angular contact ball bearings arranged singly or paired in tandem

$P_0 = 0{,}5\ F_r + Y_0F_a$

If $P_0 < F_r$, $P_0 = F_r$ should be used.

The appropriate values for $Y_0$ for the different contact angles will be found in **Table** 5. When calculating bearing pairs, $F_r$ and $F_a$ represent the forces acting on the bearing pair.

For bearing pairs arranged back-to-back or face-to-face

$P_0 = F_r + Y_0F_a$

The appropriate values for $Y_0$ for the different contact angles will be found in **Table** 6. When calculating bearing pairs, $F_r$ and $F_a$ represent the forces acting on the bearing pair.

When calculating sets of more than two bearings arranged back-to-back or face-to-face, it is necessary to consider the number of bearings supporting the load in each direction.

***Calculation factors for single row angular contact ball bearings arranged singly or paired in tandem***

**Table 5**

| $f_0\ F_a/C_0$ | e | X | Y | $Y_0$ |
|---|---|---|---|---|
| **Contact angle 15° (designation suffix CD and CE)** | | | | |
| ≤ 0,178 | 0,38 | 0,44 | 1,47 | 0,46 |
| 0,357 | 0,40 | 0,44 | 1,40 | 0,46 |
| 0,714 | 0,43 | 0,44 | 1,30 | 0,46 |
| 1,07 | 0,46 | 0,44 | 1,23 | 0,46 |
| 1,43 | 0,47 | 0,44 | 1,19 | 0,46 |
| 2,14 | 0,50 | 0,44 | 1,12 | 0,46 |
| 3,57 | 0,55 | 0,44 | 1,02 | 0,46 |
| ≥ 5,35 | 0,56 | 0,44 | 1,00 | 0,46 |
| **Contact angle 25° (designation suffix ACD)** | | | | |
| – | 0,68 | 0,41 | 0,87 | 0,38 |

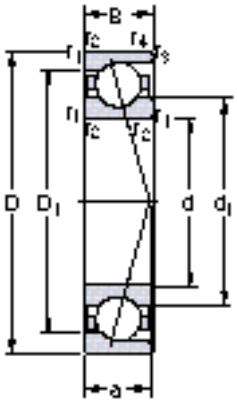
***Calculation factors for single row angular contact ball bearing pairs arranged back-to-back or face-to-face***

**Table 6**

| $2\ f_0\ F_a/C_0$ | e | X | $Y_1$ | $Y_2$ | $Y_0$ |
|---|---|---|---|---|---|
| **Contact angle 15° (designation suffix CD and CE)** | | | | | |
| ≤ 0,178 | 0,38 | 0,72 | 1,65 | 2,39 | 0,92 |
| 0,357 | 0,40 | 0,72 | 1,57 | 2,28 | 0,92 |
| 0,714 | 0,43 | 0,72 | 1,46 | 2,11 | 0,92 |
| 1,07 | 0,46 | 0,72 | 1,38 | 2,00 | 0,92 |
| 1,43 | 0,47 | 0,72 | 1,34 | 1,93 | 0,92 |
| 2,14 | 0,50 | 0,72 | 1,26 | 1,82 | 0,92 |
| 3,57 | 0,55 | 0,72 | 1,14 | 1,66 | 0,92 |
| ≥ 5,35 | 0,56 | 0,72 | 1,12 | 1,63 | 0,92 |
| **Contact angle 25° (designation suffix ACD )** | | | | | |
| – | 0,68 | 0,67 | 0,92 | 1,41 | 0,76 |

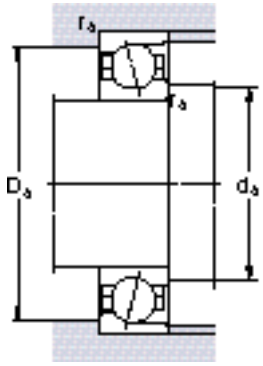
## Precision angular contact ball bearings

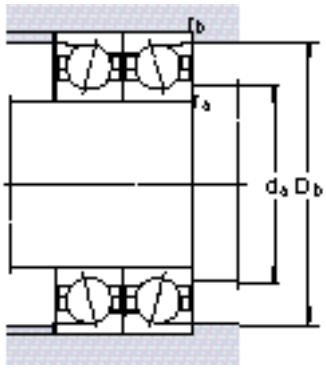
d **8 – 20** mm




CD, ACD

| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Calculation factor | Speed ratings Lubrication grease | oil spot | Mass | Designation |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | $f_0$ | | | | |
| mm | | | N | | N | – | r/min | | kg | – |
| **8** | 22 | 7 | 2 960 | 1 160 | 49 | 8,4 | 70 000 | 110 000 | 0,011 | **708 CD** |
| | 22 | 7 | 2 910 | 1 120 | 48 | – | 67 000 | 100 000 | 0,011 | **708 ACD** |
| **9** | 24 | 7 | 3 250 | 1 340 | 57 | 8,8 | 70 000 | 110 000 | 0,014 | **709 CD** |
| | 24 | 7 | 3 120 | 1 290 | 54 | – | 63 000 | 95 000 | 0,014 | **709 ACD** |
| **10** | 22 | 6 | 2 510 | 1 100 | 48 | 9,5 | 70 000 | 110 000 | 0,009 | **71900 CD** |
| | 22 | 6 | 2 420 | 1 060 | 45 | – | 63 000 | 95 000 | 0,009 | **71900 ACD** |
| | 26 | 8 | 4 100 | 1 660 | 71 | 8,3 | 67 000 | 100 000 | 0,018 | **7000 CD** |
| | 26 | 8 | 3 970 | 1 600 | 67 | – | 56 000 | 85 000 | 0,018 | **7000 ACD** |
| | 30 | 9 | 5 400 | 2 200 | 93 | 8,2 | 60 000 | 90 000 | 0,029 | **7200 CD** |
| | 30 | 9 | 5 200 | 2 120 | 90 | – | 53 000 | 80 000 | 0,029 | **7200 ACD** |
| **12** | 24 | 6 | 2 650 | 1 250 | 53 | 9,8 | 63 000 | 95 000 | 0,010 | **71901 CD** |
| | 24 | 6 | 2 550 | 1 180 | 50 | – | 56 000 | 85 000 | 0,010 | **71901 ACD** |
| | 28 | 8 | 4 490 | 1 900 | 80 | 8,7 | 60 000 | 90 000 | 0,020 | **7001 CD** |
| | 28 | 8 | 4 360 | 1 830 | 78 | – | 53 000 | 80 000 | 0,020 | **7001 ACD** |
| | 32 | 10 | 5 850 | 2 550 | 108 | 8,5 | 53 000 | 80 000 | 0,036 | **7201 CD** |
| | 32 | 10 | 5 720 | 2 450 | 104 | – | 48 000 | 70 000 | 0,036 | **7201 ACD** |
| **15** | 28 | 7 | 3 970 | 1 900 | 80 | 9,6 | 56 000 | 85 000 | 0,015 | **71902 CD** |
| | 28 | 7 | 3 770 | 1 800 | 78 | – | 50 000 | 75 000 | 0,015 | **71902 ACD** |
| | 32 | 9 | 5 200 | 2 450 | 104 | 9,3 | 50 000 | 75 000 | 0,028 | **7002 CD** |
| | 32 | 9 | 4 940 | 2 320 | 98 | – | 45 000 | 67 000 | 0,028 | **7002 ACD** |
| | 35 | 11 | 7 410 | 3 350 | 140 | 8,5 | 48 000 | 70 000 | 0,043 | **7202 CD** |
| | 35 | 11 | 7 150 | 3 200 | 134 | – | 43 000 | 63 000 | 0,043 | **7202 ACD** |
| **17** | 30 | 7 | 4 160 | 2 080 | 88 | 9,8 | 50 000 | 75 000 | 0,017 | **71903 CD** |
| | 30 | 7 | 3 970 | 2 000 | 85 | – | 45 000 | 67 000 | 0,017 | **71903 ACD** |
| | 35 | 10 | 6 760 | 3 250 | 137 | 9,1 | 48 000 | 70 000 | 0,037 | **7003 CD** |
| | 35 | 10 | 6 500 | 3 100 | 132 | – | 40 000 | 60 000 | 0,037 | **7003 ACD** |
| | 40 | 12 | 9 230 | 4 150 | 176 | 8,5 | 43 000 | 63 000 | 0,062 | **7203 CD** |
| | 40 | 12 | 8 840 | 4 000 | 170 | – | 38 000 | 56 000 | 0,062 | **7203 ACD** |
| **20** | 37 | 9 | 6 050 | 3 200 | 137 | 9,8 | 43 000 | 63 000 | 0,035 | **71904 CD** |
| | 37 | 9 | 5 720 | 3 050 | 129 | – | 38 000 | 56 000 | 0,035 | **71904 ACD** |
| | 42 | 12 | 8 710 | 4 300 | 180 | 9,2 | 38 000 | 56 000 | 0,065 | **7004 CD** |
| | 42 | 12 | 8 320 | 4 150 | 173 | – | 34 000 | 50 000 | 0,065 | **7004 ACD** |
| | 47 | 14 | 11 900 | 5 850 | 245 | 8,7 | 36 000 | 53 000 | 0,10 | **7204 CD** |
| | 47 | 14 | 11 400 | 5 600 | 236 | – | 32 000 | 48 000 | 0,10 | **7204 ACD** |

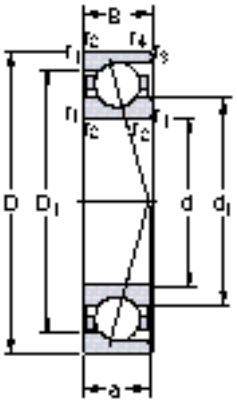


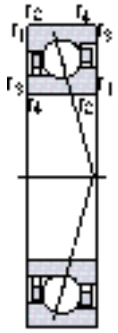

| Dimensions | | | | | | Abutment and fillet dimensions | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_1$ ≈ | $D_1$ ≈ | $r_{1,2}$ min | $r_{3,4}$ min | a | $d_a$ min | $D_a$ max | $D_b$ max | $r_a$ max | $r_b$ max |
| mm | | | | | | mm | | | | |
| **8** | 12,6 | 17,7 | 0,3 | 0,1 | 6 | 10 | 20 | 20,4 | 0,3 | 0,1 |
| | 12,6 | 17,5 | 0,3 | 0,1 | 7 | 10 | 20 | 20,4 | 0,3 | 0,1 |
| **9** | 13,9 | 19,5 | 0,3 | 0,1 | 6 | 11 | 22 | 22,4 | 0,3 | 0,1 |
| | 13,9 | 19,2 | 0,3 | 0,1 | 7 | 11 | 22 | 22,4 | 0,3 | 0,1 |
| **10** | 13,9 | 18,1 | 0,3 | 0,1 | 5 | 12 | 20 | 20,8 | 0,3 | 0,1 |
| | 13,9 | 18,1 | 0,3 | 0,1 | 7 | 12 | 20 | 20,8 | 0,3 | 0,1 |
| | 15,1 | 21,3 | 0,3 | 0,1 | 6 | 12 | 24 | 24,4 | 0,3 | 0,1 |
| | 15,1 | 21 | 0,3 | 0,1 | 8 | 12 | 24 | 24,4 | 0,3 | 0,1 |
| | 16,8 | 23,3 | 0,6 | 0,3 | 7 | 15 | 25 | 28 | 0,6 | 0,3 |
| | 16,8 | 23,3 | 0,6 | 0,3 | 9 | 15 | 25 | 28 | 0,6 | 0,3 |
| **12** | 15,9 | 20,1 | 0,3 | 0,1 | 5 | 14 | 22 | 22,8 | 0,3 | 0,1 |
| | 15,9 | 20,1 | 0,3 | 0,1 | 7 | 14 | 22 | 22,8 | 0,3 | 0,1 |
| | 17,1 | 23,3 | 0,3 | 0,1 | 7 | 14 | 26 | 26,4 | 0,3 | 0,1 |
| | 17,1 | 23 | 0,3 | 0,1 | 9 | 14 | 26 | 26,4 | 0,3 | 0,1 |
| | 18,2 | 25,8 | 0,6 | 0,3 | 8 | 17 | 27 | 30 | 0,6 | 0,3 |
| | 18,2 | 25,8 | 0,6 | 0,3 | 10 | 17 | 27 | 30 | 0,6 | 0,3 |
| **15** | 19,1 | 23,9 | 0,3 | 0,1 | 6 | 17 | 26 | 26,8 | 0,3 | 0,1 |
| | 19,1 | 23,9 | 0,3 | 0,1 | 9 | 17 | 26 | 26,8 | 0,3 | 0,1 |
| | 20,6 | 26,8 | 0,3 | 0,1 | 8 | 17 | 30 | 30,4 | 0,3 | 0,1 |
| | 20,6 | 26,5 | 0,3 | 0,1 | 10 | 17 | 30 | 30,4 | 0,3 | 0,1 |
| | 21,5 | 29,1 | 0,6 | 0,3 | 9 | 20 | 30 | 33 | 0,6 | 0,3 |
| | 21,5 | 29,1 | 0,6 | 0,3 | 12 | 20 | 30 | 33 | 0,6 | 0,3 |
| **17** | 21,1 | 25,9 | 0,3 | 0,1 | 7 | 19 | 28 | 28,8 | 0,3 | 0,1 |
| | 21,1 | 25,9 | 0,3 | 0,1 | 9 | 19 | 28 | 28,8 | 0,3 | 0,1 |
| | 22,9 | 29,6 | 0,3 | 0,1 | 9 | 19 | 33 | 33,4 | 0,3 | 0,1 |
| | 22,9 | 29,2 | 0,3 | 0,1 | 11 | 19 | 33 | 33,4 | 0,3 | 0,1 |
| | 24,2 | 32,8 | 0,6 | 0,3 | 10 | 22 | 35 | 38 | 0,6 | 0,3 |
| | 24,2 | 32,8 | 0,6 | 0,3 | 13 | 22 | 35 | 38 | 0,6 | 0,3 |
| **20** | 25,4 | 31,6 | 0,3 | 0,15 | 8 | 22 | 35 | 35,8 | 0,3 | 0,1 |
| | 25,4 | 31,6 | 0,3 | 0,15 | 11 | 22 | 35 | 35,8 | 0,3 | 0,1 |
| | 26,9 | 35,1 | 0,6 | 0,3 | 10 | 25 | 37 | 40 | 0,6 | 0,3 |
| | 26,9 | 35,1 | 0,6 | 0,3 | 13 | 25 | 37 | 40 | 0,6 | 0,3 |
| | 29,1 | 38,7 | 1 | 0,3 | 12 | 26 | 41 | 45 | 1 | 0,3 |
| | 29,1 | 38,7 | 1 | 0,3 | 15 | 26 | 41 | 45 | 1 | 0,3 |

## Precision angular contact ball bearings

d **25 – 45** mm

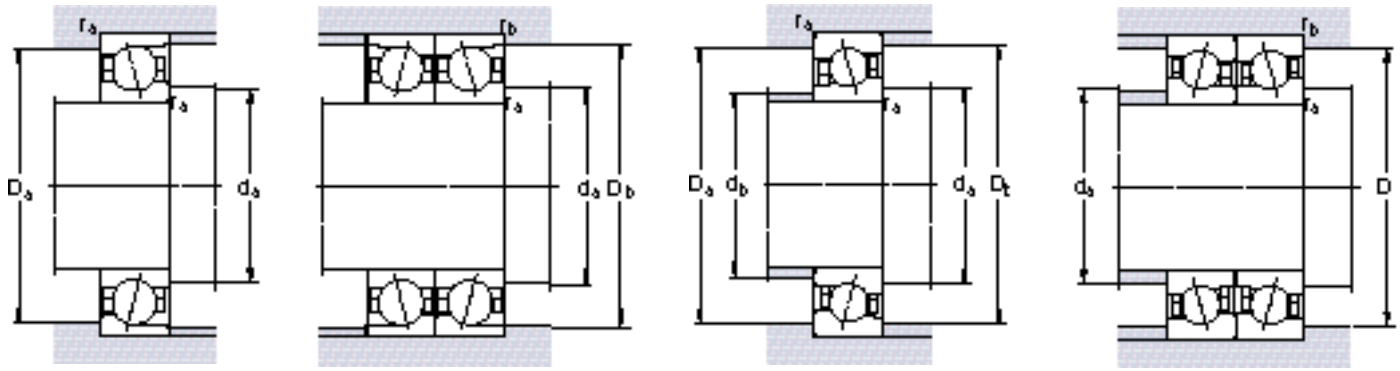



CD, ACD



CE

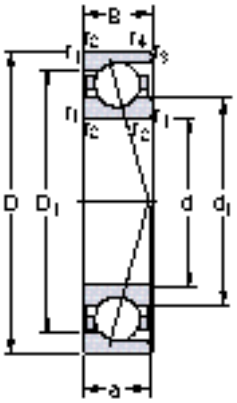
| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Calculation factor | Speed ratings Lubrication grease | oil spot | Mass | Designation |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | $f_0$ | | | | |
| mm | | | N | | N | – | r/min | | kg | – |
| **25** | 42 | 9 | 6 760 | 4 000 | 170 | 10 | 36 000 | 53 000 | 0,042 | **71905 CD** |
| | 42 | 9 | 6 370 | 3 800 | 160 | – | 32 000 | 48 000 | 0,042 | **71905 ACD** |
| | 47 | 12 | 9 560 | 5 200 | 220 | 9,6 | 34 000 | 50 000 | 0,075 | **7005 CD** |
| | 47 | 12 | 8 710 | 4 550 | 193 | 8,4 | 43 000 | 65 000 | 0,078 | **7005 CE** |
| | 47 | 12 | 9 230 | 5 000 | 212 | – | 28 000 | 43 000 | 0,075 | **7005 ACD** |
| | 52 | 15 | 13 500 | 7 200 | 305 | 9,1 | 30 000 | 45 000 | 0,14 | **7205 CD** |
| | 52 | 15 | 13 000 | 6 950 | 290 | – | 26 000 | 40 000 | 0,14 | **7205 ACD** |
| **30** | 47 | 9 | 7 150 | 4 550 | 193 | 10 | 30 000 | 45 000 | 0,048 | **71906 CD** |
| | 47 | 9 | 6 760 | 4 300 | 183 | – | 26 000 | 40 000 | 0,048 | **71906 ACD** |
| | 55 | 13 | 14 300 | 8 000 | 345 | 9,4 | 28 000 | 43 000 | 0,11 | **7006 CD** |
| | 55 | 13 | 13 000 | 6 950 | 300 | 8,2 | 36 000 | 53 000 | 0,11 | **7006 CE** |
| | 55 | 13 | 13 800 | 7 650 | 325 | – | 24 000 | 38 000 | 0,11 | **7006 ACD** |
| | 62 | 16 | 24 200 | 16 000 | 670 | 14 | 24 000 | 38 000 | 0,19 | **7206 CD** |
| | 62 | 16 | 23 400 | 15 300 | 640 | – | 20 000 | 34 000 | 0,19 | **7206 ACD** |
| **35** | 55 | 10 | 9 750 | 6 550 | 275 | 10 | 26 000 | 40 000 | 0,074 | **71907 CD** |
| | 55 | 10 | 9 230 | 6 200 | 260 | – | 22 000 | 36 000 | 0,074 | **71907 ACD** |
| | 62 | 14 | 15 600 | 9 500 | 400 | 9,7 | 22 000 | 36 000 | 0,15 | **7007 CD** |
| | 62 | 14 | 14 000 | 8 300 | 355 | 8,5 | 30 000 | 45 000 | 0,15 | **7007 CE** |
| | 62 | 14 | 14 800 | 9 000 | 380 | – | 19 000 | 32 000 | 0,15 | **7007 ACD** |
| | 72 | 17 | 31 900 | 21 600 | 915 | 14 | 20 000 | 34 000 | 0,28 | **7207 CD** |
| | 72 | 17 | 30 700 | 20 800 | 880 | – | 18 000 | 30 000 | 0,28 | **7207 ACD** |
| **40** | 62 | 12 | 12 400 | 8 500 | 360 | 10 | 20 000 | 34 000 | 0,11 | **71908 CD** |
| | 62 | 12 | 11 700 | 8 000 | 340 | – | 18 000 | 30 000 | 0,11 | **71908 ACD** |
| | 68 | 15 | 16 800 | 11 000 | 465 | 10 | 19 000 | 32 000 | 0,19 | **7008 CD** |
| | 68 | 15 | 15 100 | 9 500 | 405 | 8,7 | 26 000 | 40 000 | 0,19 | **7008 CE** |
| | 68 | 15 | 15 900 | 10 400 | 440 | – | 18 000 | 30 000 | 0,19 | **7008 ACD** |
| | 80 | 18 | 41 000 | 28 000 | 1 180 | 14 | 18 000 | 30 000 | 0,36 | **7208 CD** |
| | 80 | 18 | 39 000 | 27 000 | 1 140 | – | 16 000 | 26 000 | 0,36 | **7208 ACD** |
| **45** | 68 | 12 | 13 000 | 9 500 | 400 | 11 | 19 000 | 32 000 | 0,13 | **71909 CD** |
| | 68 | 12 | 12 400 | 9 000 | 380 | – | 17 000 | 28 000 | 0,13 | **71909 ACD** |
| | 75 | 16 | 28 600 | 22 400 | 950 | 15 | 18 000 | 30 000 | 0,23 | **7009 CD** |
| | 75 | 16 | 27 600 | 21 600 | 900 | – | 16 000 | 26 000 | 0,23 | **7009 ACD** |
| | 85 | 19 | 42 300 | 31 000 | 1 320 | 14 | 17 000 | 28 000 | 0,41 | **7209 CD** |
| | 85 | 19 | 41 000 | 30 000 | 1 250 | – | 15 000 | 24 000 | 0,41 | **7209 ACD** |



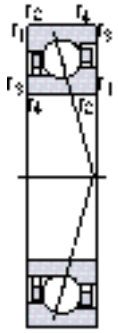

| Dimensions | | | | | | Abutment and fillet dimensions | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_1$ ≈ | $D_1$ ≈ | $r_{1,2}$ min | $r_{3,4}$ min | a | $d_a$ min | $d_b$ min | $D_a$ max | $D_b$ max | $r_a$ max | $r_b$ max |
| mm | | | | | | mm | | | | | |
| **25** | 30,4 | 36,6 | 0,3 | 0,15 | 9 | 27 | – | 40 | 40,8 | 0,3 | 0,1 |
| | 30,4 | 36,6 | 0,3 | 0,15 | 12 | 27 | – | 40 | 40,8 | 0,3 | 0,1 |
| | 31,9 | 40,1 | 0,6 | 0,3 | 11 | 30 | – | 42 | 45 | 0,6 | 0,3 |
| | 32,2 | 39,9 | 0,6 | 0,3 | 11 | 30 | 27 | 42 | 45 | 0,6 | 0,3 |
| | 31,9 | 40,1 | 0,6 | 0,3 | 15 | 30 | – | 42 | 45 | 0,6 | 0,3 |
| | 34,1 | 43,7 | 1 | 0,3 | 13 | 31 | – | 46 | 50 | 1 | 0,3 |
| | 34,1 | 43,7 | 1 | 0,3 | 17 | 31 | – | 46 | 50 | 1 | 0,3 |
| **30** | 35,4 | 41,6 | 0,3 | 0,15 | 10 | 32 | – | 45 | 45,8 | 0,3 | 0,1 |
| | 35,4 | 41,6 | 0,3 | 0,15 | 14 | 32 | – | 45 | 45,8 | 0,3 | 0,1 |
| | 38,1 | 46,9 | 1 | 0,3 | 12 | 36 | – | 49 | 53 | 1 | 0,3 |
| | 37,7 | 47,3 | 1 | 0,3 | 12 | 36 | 32 | 49 | 53 | 1 | 0,3 |
| | 38,1 | 46,9 | 1 | 0,3 | 17 | 36 | – | 49 | 53 | 1 | 0,3 |
| | 40,3 | 51,7 | 1 | 0,3 | 14 | 36 | – | 56 | 60 | 1 | 0,3 |
| | 40,3 | 51,7 | 1 | 0,3 | 19 | 36 | – | 56 | 60 | 1 | 0,3 |
| **35** | 41,2 | 48,8 | 0,6 | 0,15 | 11 | 40 | – | 50 | 53,8 | 0,6 | 0,1 |
| | 41,2 | 48,8 | 0,6 | 0,15 | 16 | 40 | – | 50 | 53,8 | 0,6 | 0,1 |
| | 43,7 | 53,3 | 1 | 0,3 | 14 | 41 | – | 56 | 60 | 1 | 0,3 |
| | 43,7 | 53,3 | 1 | 0,3 | 14 | 41 | 37 | 56 | 60 | 1 | 0,3 |
| | 43,7 | 53,3 | 1 | 0,3 | 19 | 41 | – | 56 | 60 | 1 | 0,3 |
| | 47 | 60 | 1,1 | 0,3 | 16 | 42 | – | 65 | 70 | 1 | 0,3 |
| | 47 | 60 | 1,1 | 0,3 | 21 | 42 | – | 65 | 70 | 1 | 0,3 |
| **40** | 46,7 | 55,3 | 0,6 | 0,15 | 13 | 45 | – | 57 | 60,8 | 0,6 | 0,1 |
| | 46,7 | 55,3 | 0,6 | 0,15 | 18 | 45 | – | 57 | 60,8 | 0,6 | 0,1 |
| | 49,2 | 58,8 | 1 | 0,3 | 15 | 46 | – | 62 | 66 | 1 | 0,3 |
| | 49,2 | 58,8 | 1 | 0,3 | 15 | 46 | 42 | 62 | 66 | 1 | 0,3 |
| | 49,2 | 58,8 | 1 | 0,3 | 20 | 46 | – | 62 | 66 | 1 | 0,3 |
| | 53 | 67 | 1,1 | 0,6 | 17 | 47 | – | 73 | 75 | 1 | 0,6 |
| | 53 | 67 | 1,1 | 0,6 | 23 | 47 | – | 73 | 75 | 1 | 0,6 |
| **45** | 52,2 | 60,8 | 0,6 | 0,15 | 14 | 50 | – | 63 | 66,8 | 0,6 | 0,1 |
| | 52,2 | 60,8 | 0,6 | 0,15 | 19 | 50 | – | 63 | 66,8 | 0,6 | 0,1 |
| | 54,7 | 65,3 | 1 | 0,3 | 16 | 51 | – | 69 | 73 | 1 | 0,3 |
| | 54,7 | 65,3 | 1 | 0,3 | 22 | 51 | – | 69 | 73 | 1 | 0,3 |
| | 57,5 | 72,5 | 1,1 | 0,6 | 18 | 52 | – | 78 | 80 | 1 | 0,6 |
| | 57,5 | 72,5 | 1,1 | 0,6 | 25 | 52 | – | 78 | 80 | 1 | 0,6 |

## Precision angular contact ball bearings

d **50 – 70** mm

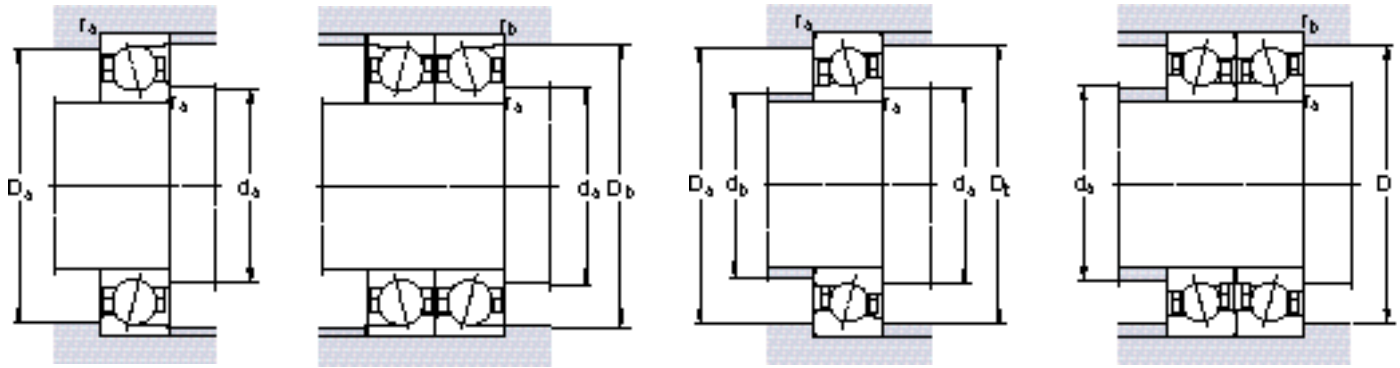



CD, ACD



CE

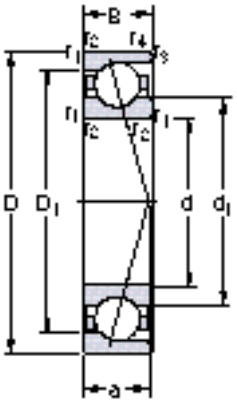
| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Calculation factor | Speed ratings Lubrication grease | oil spot | Mass | Designation |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | $f_0$ | | | | |
| mm | | | N | | N | – | r/min | | kg | – |
| **50** | 72 | 12 | 13 500 | 10 400 | 440 | 11 | 17 000 | 28 000 | 0,13 | **71910 CD** |
| | 72 | 12 | 12 700 | 9 800 | 415 | – | 16 000 | 26 000 | 0,13 | **71910 ACD** |
| | 80 | 16 | 29 600 | 24 000 | 1 020 | 15 | 17 000 | 28 000 | 0,25 | **7010 CD** |
| | 80 | 16 | 22 500 | 16 000 | 680 | 10 | 20 000 | 34 000 | 0,25 | **7010 CE** |
| | 80 | 16 | 28 100 | 23 200 | 980 | – | 15 000 | 24 000 | 0,25 | **7010 ACD** |
| | 90 | 20 | 44 900 | 34 000 | 1 430 | 15 | 16 000 | 26 000 | 0,46 | **7210 CD** |
| | 90 | 20 | 42 300 | 32 500 | 1 390 | – | 14 000 | 22 000 | 0,46 | **7210 ACD** |
| **55** | 80 | 13 | 19 500 | 14 600 | 620 | 10 | 16 000 | 26 000 | 0,18 | **71911 CD** |
| | 80 | 13 | 18 200 | 13 700 | 585 | – | 15 000 | 24 000 | 0,18 | **71911 ACD** |
| | 90 | 18 | 39 700 | 32 500 | 1 370 | 15 | 15 000 | 24 000 | 0,37 | **7011 CD** |
| | 90 | 18 | 37 100 | 31 000 | 1 320 | – | 14 000 | 22 000 | 0,37 | **7011 ACD** |
| | 100 | 21 | 55 300 | 43 000 | 1 800 | 14 | 14 000 | 22 000 | 0,61 | **7211 CD** |
| | 100 | 21 | 52 700 | 40 500 | 1 730 | – | 13 000 | 20 000 | 0,61 | **7211 ACD** |
| **60** | 85 | 13 | 19 900 | 15 300 | 655 | 11 | 15 000 | 24 000 | 0,19 | **71912 CD** |
| | 85 | 13 | 13 500 | 12 200 | 520 | 11 | 18 000 | 30 000 | 0,19 | **71912 CE** |
| | 85 | 13 | 18 600 | 14 600 | 620 | – | 14 000 | 22 000 | 0,19 | **71912 ACD** |
| | 95 | 18 | 40 300 | 34 500 | 1 500 | 15 | 14 000 | 22 000 | 0,40 | **7012 CD** |
| | 95 | 18 | 19 000 | 16 300 | 680 | 11 | 17 000 | 28 000 | 0,40 | **7012 CE** |
| | 95 | 18 | 39 000 | 33 500 | 1 400 | – | 13 000 | 20 000 | 0,40 | **7012 ACD** |
| | 110 | 22 | 67 600 | 53 000 | 2 240 | 14 | 13 000 | 20 000 | 0,80 | **7212 CD** |
| | 110 | 22 | 63 700 | 50 000 | 2 120 | – | 11 000 | 18 000 | 0,80 | **7212 ACD** |
| **65** | 90 | 13 | 20 800 | 17 000 | 710 | 11 | 14 000 | 22 000 | 0,21 | **71913 CD** |
| | 90 | 13 | 19 500 | 16 000 | 680 | – | 13 000 | 20 000 | 0,21 | **71913 ACD** |
| | 100 | 18 | 41 600 | 37 500 | 1 600 | 16 | 14 000 | 22 000 | 0,42 | **7013 CD** |
| | 100 | 18 | 19 900 | 17 600 | 750 | 11 | 16 000 | 26 000 | 0,42 | **7013 CE** |
| | 100 | 18 | 39 000 | 35 500 | 1 500 | – | 12 000 | 19 000 | 0,42 | **7013 ACD** |
| | 120 | 23 | 76 100 | 60 000 | 2 500 | 14 | 12 000 | 19 000 | 1,00 | **7213 CD** |
| | 120 | 23 | 72 800 | 57 000 | 2 400 | – | 10 000 | 17 000 | 1,00 | **7213 ACD** |
| **70** | 100 | 16 | 34 500 | 34 000 | 1 430 | 16 | 13 000 | 20 000 | 0,33 | **71914 CD** |
| | 100 | 16 | 20 300 | 18 300 | 780 | 11 | 16 000 | 26 000 | 0,32 | **71914 CE** |
| | 100 | 16 | 32 500 | 32 500 | 1 370 | – | 11 000 | 18 000 | 0,33 | **71914 ACD** |
| | 110 | 20 | 52 000 | 45 000 | 1 930 | 15 | 12 000 | 19 000 | 0,59 | **7014 CD** |
| | 110 | 20 | 27 000 | 23 600 | 1 000 | 11 | 15 000 | 24 000 | 0,58 | **7014 CE** |
| | 110 | 20 | 48 800 | 44 000 | 1 860 | – | 10 000 | 17 000 | 0,59 | **7014 ACD** |
| | 125 | 24 | 79 300 | 64 000 | 2 750 | 15 | 11 000 | 18 000 | 1,10 | **7214 CD** |
| | 125 | 24 | 76 100 | 62 000 | 2 600 | – | 9 500 | 16 000 | 1,10 | **7214 ACD** |



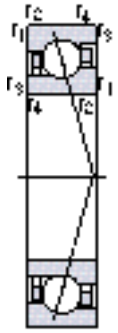

| Dimensions | | | | | | Abutment and fillet dimensions | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_1$ ≈ | $D_1$ ≈ | $r_{1,2}$ min | $r_{3,4}$ min | a | $d_a$ min | $d_b$ min | $D_a$ max | $D_b$ max | $r_a$ max | $r_b$ max |
| mm | | | | | | mm | | | | | |
| **50** | 56,7 | 65,3 | 0,6 | 0,15 | 14 | 55 | – | 67 | 70,8 | 0,6 | 0,1 |
| | 56,7 | 65,3 | 0,6 | 0,15 | 20 | 55 | – | 67 | 70,8 | 0,6 | 0,1 |
| | 59,7 | 70,3 | 1 | 0,3 | 17 | 56 | – | 74 | 78 | 1 | 0,3 |
| | 59,3 | 70,8 | 1 | 0,3 | 17 | 56 | 54 | 74 | 78 | 1 | 0,3 |
| | 59,7 | 70,3 | 1 | 0,3 | 17 | 56 | – | 74 | 78 | 1 | 0,3 |
| | 62,5 | 77,5 | 1,1 | 0,6 | 20 | 57 | – | 83 | 85 | 1 | 0,6 |
| | 62,5 | 77,5 | 1,1 | 0,6 | 27 | 57 | – | 83 | 85 | 1 | 0,6 |
| **55** | 62,7 | 72,3 | 1 | 0,3 | 16 | 61 | – | 74 | 78 | 1 | 0,3 |
| | 62,7 | 72,3 | 1 | 0,3 | 22 | 61 | – | 74 | 78 | 1 | 0,3 |
| | 66,3 | 78,7 | 1,1 | 0,6 | 19 | 62 | – | 83 | 86 | 1 | 0,6 |
| | 66,3 | 78,7 | 1,1 | 0,6 | 26 | 62 | – | 83 | 86 | 1 | 0,6 |
| | 69 | 85,9 | 1,5 | 0,6 | 21 | 64 | – | 91 | 95 | 1,5 | 0,6 |
| | 69 | 85,9 | 1,5 | 0,6 | 29 | 64 | – | 91 | 95 | 1,5 | 0,6 |
| **60** | 67,7 | 77,3 | 1 | 0,3 | 16 | 66 | – | 79 | 82 | 1 | 0,3 |
| | 68,6 | 76,4 | 1 | 0,3 | 16 | 66 | 63 | 79 | 82 | 1 | 0,3 |
| | 67,7 | 77,3 | 1 | 0,3 | 23 | 66 | – | 79 | 82 | 1 | 0,3 |
| | 71,3 | 83,7 | 1,1 | 0,6 | 20 | 67 | – | 88 | 91 | 1 | 0,6 |
| | 72,7 | 82,3 | 1,1 | 0,6 | 19 | 67 | 64 | 88 | 91 | 1 | 0,6 |
| | 71,3 | 83,7 | 1,1 | 0,6 | 27 | 67 | – | 88 | 91 | 1 | 0,6 |
| | 75,6 | 94,4 | 1,5 | 0,6 | 23 | 69 | – | 101 | 105 | 1,5 | 0,6 |
| | 75,6 | 94,4 | 1,5 | 0,6 | 31 | 69 | – | 101 | 105 | 1,5 | 0,6 |
| **65** | 72,7 | 82,3 | 1 | 0,3 | 17 | 71 | – | 84 | 87 | 1 | 0,3 |
| | 72,7 | 82,3 | 1 | 0,3 | 25 | 71 | – | 84 | 87 | 1 | 0,3 |
| | 76,3 | 88,7 | 1,1 | 0,6 | 20 | 72 | – | 93 | 96 | 1 | 0,6 |
| | 77,7 | 87,3 | 1,1 | 0,6 | 20 | 72 | 69 | 93 | 96 | 1 | 0,6 |
| | 76,3 | 88,7 | 1,1 | 0,6 | 28 | 72 | – | 93 | 96 | 1 | 0,6 |
| | 82,5 | 103 | 1,5 | 0,6 | 24 | 74 | – | 111 | 115 | 1,5 | 0,6 |
| | 82,5 | 103 | 1,5 | 0,6 | 33 | 74 | – | 111 | 115 | 1,5 | 0,6 |
| **70** | 79,3 | 90,7 | 1 | 0,3 | 19 | 76 | – | 94 | 97 | 1 | 0,3 |
| | 80,2 | 89,3 | 1 | 0,3 | 19 | 76 | 73 | 94 | 97 | 1 | 0,3 |
| | 79,3 | 90,7 | 1 | 0,3 | 28 | 76 | – | 94 | 97 | 1 | 0,3 |
| | 82,9 | 97,1 | 1,1 | 0,6 | 22 | 77 | – | 103 | 106 | 1 | 0,6 |
| | 84,2 | 95,8 | 1,1 | 0,6 | 22 | 77 | 74 | 103 | 106 | 1 | 0,6 |
| | 82,9 | 97,1 | 1,1 | 0,6 | 31 | 77 | – | 103 | 106 | 1 | 0,6 |
| | 87 | 108 | 1,5 | 0,6 | 25 | 79 | – | 116 | 120 | 1,5 | 0,6 |
| | 87 | 108 | 1,5 | 0,6 | 35 | 79 | – | 116 | 120 | 1,5 | 0,6 |

## Precision angular contact ball bearings

d **75 – 95** mm

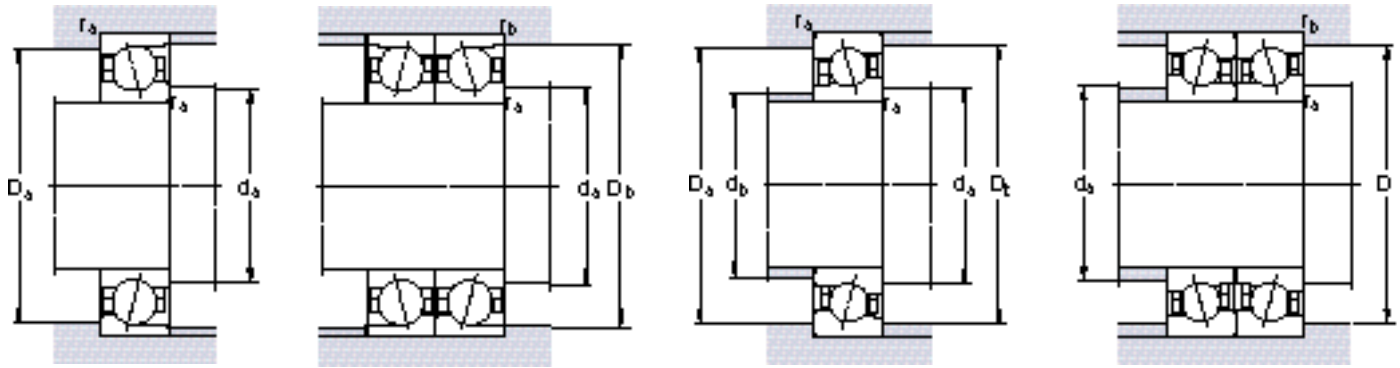



CD, ACD



CE

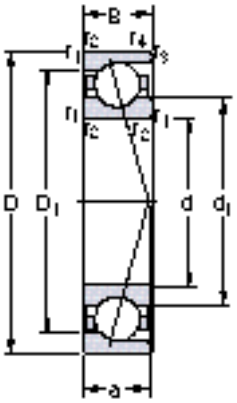
| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Calculation factor | Speed ratings Lubrication grease | oil spot | Mass | Designation |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | $f_0$ | | | | |
| mm | | | N | | N | – | r/min | | kg | – |
| **75** | 105 | 16 | 35 800 | 37 500 | 1 560 | 16 | 12 000 | 19 000 | 0,35 | **71915 CD** |
| | 105 | 16 | 33 800 | 35 500 | 1 500 | – | 10 000 | 17 000 | 0,35 | **71915 ACD** |
| | 115 | 20 | 52 700 | 49 000 | 2 080 | 16 | 11000 | 18 000 | 0,62 | **7015 CD** |
| | 115 | 20 | 49 400 | 46 500 | 1 960 | – | 9 500 | 16 000 | 0,62 | **7015 ACD** |
| | 130 | 25 | 83 200 | 69 500 | 2 900 | 15 | 10 000 | 17 000 | 1,20 | **7215 CD** |
| | 130 | 25 | 79 300 | 67 000 | 2 800 | – | 9 000 | 15 000 | 1,20 | **7215 ACD** |
| **80** | 110 | 16 | 36 400 | 39 000 | 1 660 | 16 | 11 000 | 18 000 | 0,37 | **71916 CD** |
| | 110 | 16 | 21 200 | 20 800 | 880 | 11 | 15 000 | 24 000 | 0,36 | **71916 CE** |
| | 110 | 16 | 34 500 | 36 500 | 1 560 | – | 9 500 | 16 000 | 0,37 | **71916 ACD** |
| | 125 | 22 | 65 000 | 61 000 | 2 550 | 16 | 10 000 | 17 000 | 0,85 | **7016 CD** |
| | 125 | 22 | 34 500 | 30 500 | 1 270 | 11 | 14 000 | 22 000 | 0,82 | **7016 CE** |
| | 125 | 22 | 62 400 | 58 500 | 2 450 | – | 9 000 | 15 000 | 0,85 | **7016 ACD** |
| | 140 | 26 | 97 500 | 81 500 | 3 350 | 15 | 9 500 | 16 000 | 1,45 | **7216 CD** |
| | 140 | 26 | 92 300 | 78 000 | 3 200 | – | 8 500 | 14 000 | 1,45 | **7216 ACD** |
| **85** | 120 | 18 | 46 200 | 48 000 | 2 040 | 16 | 10 000 | 17 000 | 0,53 | **71917 CD** |
| | 120 | 18 | 43 600 | 45 500 | 1 930 | – | 9 000 | 15 000 | 0,53 | **71917 ACD** |
| | 130 | 22 | 67 600 | 65 500 | 2 650 | 16 | 9 500 | 16 000 | 0,89 | **7017 CD** |
| | 130 | 22 | 63 700 | 62 000 | 2 500 | – | 8 500 | 14 000 | 0,89 | **7017 ACD** |
| | 150 | 28 | 99 500 | 88 000 | 3 450 | 15 | 9 000 | 15 000 | 1,80 | **7217 CD** |
| | 150 | 28 | 95 600 | 85 000 | 3 350 | – | 8 000 | 13 000 | 1,80 | **7217 ACD** |
| **90** | 125 | 18 | 47 500 | 51 000 | 2 080 | 16 | 9 500 | 16 000 | 0,55 | **71918 CD** |
| | 125 | 18 | 29 100 | 29 000 | 1 180 | 11 | 13 000 | 20 000 | 0,53 | **71918 CE** |
| | 125 | 18 | 44 200 | 48 000 | 1 960 | – | 8 500 | 14 000 | 0,55 | **71918 ACD** |
| | 140 | 24 | 79 300 | 76 500 | 3 000 | 16 | 9 000 | 15 000 | 1,15 | **7018 CD** |
| | 140 | 24 | 44 200 | 40 000 | 1 560 | 11 | 12 000 | 19 000 | 1,10 | **7018 CE** |
| | 140 | 24 | 74 100 | 72 000 | 2 850 | – | 8 000 | 13 000 | 1,15 | **7018 ACD** |
| | 160 | 30 | 127 000 | 112 000 | 4 250 | 15 | 8 500 | 14 000 | 2,25 | **7218 CD** |
| | 160 | 30 | 121000 | 106 000 | 4 050 | – | 7 500 | 12 000 | 2,25 | **7218 ACD** |
| **95** | 130 | 18 | 49 400 | 55 000 | 2 200 | 16 | 9 000 | 15 000 | 0,58 | **71919 CD** |
| | 130 | 18 | 46 200 | 52 000 | 2 080 | – | 8 500 | 14 000 | 0,58 | **71919 ACD** |
| | 145 | 24 | 81 900 | 80 000 | 3 100 | 16 | 8 500 | 14 000 | 1,20 | **7019 CD** |
| | 145 | 24 | 76 100 | 76 500 | 2 900 | – | 8 000 | 13 000 | 1,20 | **7019 ACD** |
| | 170 | 32 | 138 000 | 120 000 | 4 400 | 15 | 8 000 | 13 000 | 2,70 | **7219 CD** |
| | 170 | 32 | 133 000 | 114 000 | 4 250 | – | 7 500 | 12 000 | 2,70 | **7219 ACD** |



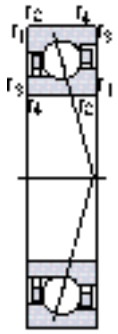

| Dimensions | | | | | | Abutment and fillet dimensions | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_1$ ≈ | $D_1$ ≈ | $r_{1,2}$ min | $r_{3,4}$ min | a | $d_a$ min | $d_b$ min | $D_a$ max | $D_b$ max | $r_a$ max | $r_b$ max |
| mm | | | | | | mm | | | | | |
| **75** | 84,3 | 95,7 | 1 | 0,3 | 20 | 81 | – | 99 | 102 | 1 | 0,3 |
| | 84,3 | 95,7 | 1 | 0,3 | 29 | 81 | – | 99 | 102 | 1 | 0,3 |
| | 87,9 | 103 | 1,1 | 0,6 | 23 | 82 | – | 108 | 111 | 1 | 0,6 |
| | 87,9 | 103 | 1,1 | 0,6 | 32 | 82 | – | 108 | 111 | 1 | 0,6 |
| | 92 | 113 | 1,5 | 0,6 | 26 | 84 | – | 121 | 125 | 1,5 | 0,6 |
| | 92 | 113 | 1,5 | 0,6 | 37 | 84 | – | 121 | 125 | 1,5 | 0,6 |
| **80** | 89,3 | 101 | 1 | 0,3 | 21 | 86 | – | 104 | 108 | 1 | 0,3 |
| | 90,2 | 99,8 | 1 | 0,3 | 21 | 86 | 83 | 104 | 108 | 1 | 0,3 |
| | 89,3 | 101 | 1 | 0,3 | 30 | 86 | – | 104 | 108 | 1 | 0,3 |
| | 94,4 | 111 | 1,1 | 0,6 | 25 | 87 | – | 118 | 121 | 1 | 0,6 |
| | 95,8 | 109,2 | 1,1 | 0,6 | 25 | 87 | 84 | 118 | 121 | 1 | 0,6 |
| | 94,4 | 111 | 1,1 | 0,6 | 35 | 87 | – | 118 | 121 | 1 | 0,6 |
| | 98,6 | 122 | 2 | 1 | 28 | 90 | – | 130 | 134 | 2 | 1 |
| | 98,6 | 122 | 2 | 1 | 39 | 90 | – | 130 | 134 | 2 | 1 |
| **85** | 95,8 | 110 | 1,1 | 0,6 | 23 | 92 | – | 113 | 115 | 1 | 0,6 |
| | 95,8 | 110 | 1,1 | 0,6 | 33 | 92 | – | 113 | 115 | 1 | 0,6 |
| | 99,4 | 116 | 1,1 | 0,6 | 26 | 92 | – | 123 | 125 | 1 | 0,6 |
| | 99,4 | 116 | 1,1 | 0,6 | 36 | 92 | – | 123 | 125 | 1 | 0,6 |
| | 106 | 130 | 1,2 | 1 | 30 | 95 | – | 140 | 144 | 2 | 1 |
| | 106 | 130 | 1,2 | 1 | 42 | 95 | – | 140 | 144 | 2 | 1 |
| **90** | 100 | 115 | 1,1 | 0,6 | 23 | 97 | – | 118 | 120 | 1 | 0,6 |
| | 101,7 | 113,3 | 1,1 | 0,6 | 24 | 97 | 95 | 118 | 120 | 1 | 0,6 |
| | 100 | 115 | 1,1 | 0,6 | 34 | 97 | – | 118 | 120 | 1 | 0,6 |
| | 106 | 124 | 1,5 | 0,6 | 28 | 99 | – | 131 | 135 | 1,5 | 0,6 |
| | 107,3 | 122,7 | 1,5 | 0,6 | 28 | 99 | 95 | 131 | 135 | 1,5 | 0,6 |
| | 106 | 124 | 1,5 | 0,6 | 39 | 99 | – | 131 | 135 | 1,5 | 0,6 |
| | 111 | 139 | 2 | 1 | 32 | 100 | – | 150 | 154 | 2 | 1 |
| | 111 | 139 | 2 | 1 | 44 | 100 | – | 150 | 154 | 2 | 1 |
| **95** | 105 | 120 | 1,1 | 0,6 | 24 | 102 | – | 123 | 125 | 1 | 0,6 |
| | 105 | 120 | 1,1 | 0,6 | 35 | 102 | – | 123 | 125 | 1 | 0,6 |
| | 111 | 129 | 1,5 | 0,6 | 28 | 104 | – | 136 | 140 | 1,5 | 0,6 |
| | 111 | 129 | 1,5 | 0,6 | 40 | 104 | – | 136 | 140 | 1,5 | 0,6 |
| | 118 | 147 | 2,1 | 1,1 | 34 | 107 | – | 158 | 163 | 2 | 1 |
| | 118 | 147 | 2,1 | 1,1 | 47 | 107 | – | 158 | 163 | 2 | 1 |

## Precision angular contact ball bearings

d **100 – 140** mm

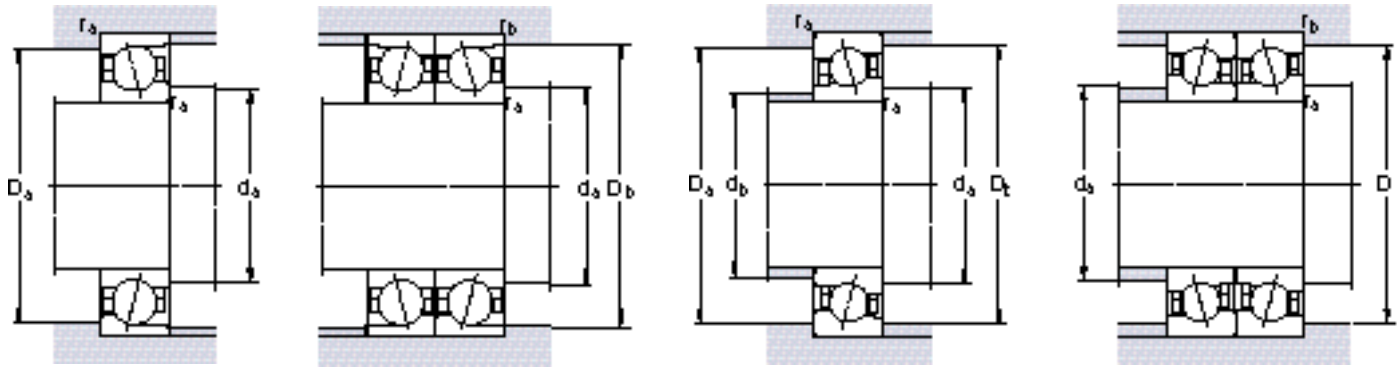



CD, ACD



CE

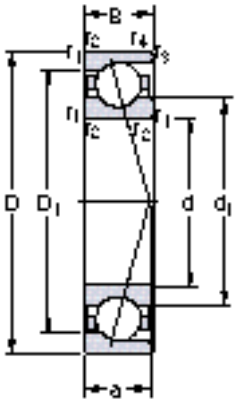
| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Calculation factor | Speed ratings Lubrication grease | oil spot | Mass | Designation |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | $f_0$ | | | | |
| mm | | | N | | N | – | r/min | | kg | – |
| **100** | 140 | 20 | 60 500 | 65 500 | 2 550 | 16 | 8 500 | 14 000 | 0,80 | **71920 CD** |
| | 140 | 20 | 57 200 | 63 000 | 2 400 | – | 8 000 | 13 000 | 0,80 | **71920 ACD** |
| | 150 | 24 | 83 200 | 85 000 | 3 200 | 16 | 8 500 | 14 000 | 1,25 | **7020 CD** |
| | 150 | 24 | 46 200 | 43 000 | 1 630 | 11 | 10 000 | 17 000 | 1,20 | **7020 CE** |
| | 150 | 24 | 79 300 | 80 000 | 3 050 | – | 7 500 | 12 000 | 1,25 | **7020 ACD** |
| | 180 | 34 | 156 000 | 137 000 | 4 900 | 15 | 7 500 | 12 000 | 3,25 | **7220 CD** |
| | 180 | 34 | 148 000 | 129 000 | 4 650 | – | 7 000 | 11 000 | 3,25 | **7220 ACD** |
| **105** | 145 | 20 | 61 800 | 69 500 | 2 600 | 16 | 8 500 | 14 000 | 0,82 | **71921 CD** |
| | 145 | 20 | 57 200 | 65 500 | 2 500 | – | 7 500 | 12 000 | 0,82 | **71921 ACD** |
| | 160 | 26 | 95 600 | 96 500 | 3 600 | 16 | 8 000 | 13 000 | 1,60 | **7021 CD** |
| | 160 | 26 | 90 400 | 93 000 | 3 400 | – | 7 500 | 12 000 | 1,60 | **7021 ACD** |
| | 190 | 36 | 172 000 | 153 000 | 5 300 | 15 | 7 500 | 12 000 | 3,85 | **7221 CD** |
| | 190 | 36 | 163 000 | 146 000 | 5 100 | – | 6 700 | 10 000 | 3,85 | **7221 ACD** |
| **110** | 150 | 20 | 62 400 | 72 000 | 2 700 | 17 | 8 000 | 13 000 | 0,86 | **71922 CD** |
| | 150 | 20 | 58 500 | 68 000 | 2 550 | – | 7 500 | 12 000 | 0,86 | **71922 ACD** |
| | 170 | 28 | 111 000 | 108 000 | 3 900 | 16 | 7 500 | 12 000 | 1,95 | **7022 CD** |
| | 170 | 28 | 104 000 | 104 000 | 3 750 | – | 7 000 | 11 000 | 1,95 | **7022 ACD** |
| | 200 | 38 | 178 000 | 166 000 | 5 600 | 15 | 7 000 | 11 000 | 4,55 | **7222 CD** |
| | 200 | 38 | 168 000 | 160 000 | 5 400 | – | 6 700 | 10 000 | 4,55 | **7222 ACD** |
| **120** | 165 | 22 | 78 000 | 91 500 | 3 250 | 16 | 7 500 | 12 000 | 1,15 | **71924 CD** |
| | 165 | 22 | 72 800 | 86 500 | 3 050 | – | 7 000 | 11 000 | 1,15 | **71924 ACD** |
| | 180 | 28 | 114 000 | 122 000 | 4 250 | 16 | 7 000 | 11 000 | 2,10 | **7024 CD** |
| | 180 | 28 | 111 000 | 116 000 | 4 000 | – | 6 700 | 10 000 | 2,10 | **7024 ACD** |
| | 215 | 40 | 199 000 | 193 000 | 6 300 | 15 | 6 700 | 10 000 | 5,40 | **7224 CD** |
| | 215 | 40 | 190 000 | 183 000 | 6 000 | – | 6 000 | 9 000 | 5,40 | **7224 ACD** |
| **130** | 180 | 24 | 92 300 | 108 000 | 3 650 | 16 | 7 000 | 11 000 | 1,55 | **71926 CD** |
| | 180 | 24 | 87 100 | 102 000 | 3 450 | – | 6 700 | 10 000 | 1,55 | **71926 ACD** |
| | 200 | 33 | 148 000 | 156 000 | 5 200 | 16 | 6 700 | 10 000 | 3,20 | **7026 CD** |
| | 200 | 33 | 140 000 | 150 000 | 4 900 | – | 6 000 | 9 000 | 3,20 | **7026 ACD** |
| **140** | 190 | 24 | 95 600 | 116 000 | 3 900 | 17 | 6 700 | 10 000 | 1,65 | **71928 CD** |
| | 190 | 24 | 90 400 | 110 000 | 3 650 | – | 6 000 | 9 000 | 1,65 | **71928 ACD** |
| | 210 | 33 | 153 000 | 166 000 | 5 300 | 16 | 6 700 | 10 000 | 3,40 | **7028 CD** |
| | 210 | 33 | 146 000 | 156 000 | 5 100 | – | 5 600 | 8 500 | 3,40 | **7028 ACD** |




| Dimensions | | | | | | Abutment and fillet dimensions | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_1$ ≈ | $D_1$ ≈ | $r_{1,2}$ min | $r_{3,4}$ min | a | $d_a$ min | $d_b$ min | $D_a$ max | $D_b$ max | $r_a$ max | $r_b$ max |
| mm | | | | | | mm | | | | | |
| **100** | 112 | 128 | 1,1 | 0,6 | 26 | 107 | – | 133 | 135 | 1 | 0,6 |
| | 112 | 128 | 1,1 | 0,6 | 38 | 107 | – | 133 | 135 | 1 | 0,6 |
| | 116 | 134 | 1,5 | 0,6 | 29 | 109 | – | 141 | 145 | 1,5 | 0,6 |
| | 117,3 | 132,7 | 1,5 | 0,6 | 29 | 109 | 105 | 141 | 145 | 1,5 | 0,6 |
| | 116 | 134 | 1,5 | 0,6 | 41 | 109 | – | 141 | 145 | 1,5 | 0,6 |
| | 124 | 155 | 2,1 | 1,1 | 36 | 112 | – | 168 | 173 | 2 | 1 |
| | 124 | 155 | 2,1 | 1,1 | 50 | 112 | – | 168 | 173 | 2 | 1 |
| **105** | 117 | 133 | 1,1 | 0,6 | 27 | 112 | – | 138 | 140 | 1 | 0,6 |
| | 117 | 133 | 1,1 | 0,6 | 39 | 112 | – | 138 | 140 | 1 | 0,6 |
| | 122 | 143 | 2 | 1 | 31 | 115 | – | 150 | 154 | 2 | 1 |
| | 122 | 143 | 2 | 1 | 44 | 115 | – | 150 | 154 | 2 | 1 |
| | 131 | 164 | 2,1 | 1,1 | 38 | 117 | – | 178 | 183 | 2 | 1 |
| | 131 | 164 | 2,1 | 1,1 | 53 | 117 | – | 178 | 183 | 2 | 1 |
| **110** | 122 | 138 | 1,1 | 0,6 | 27 | 117 | – | 143 | 145 | 1 | 0,6 |
| | 122 | 138 | 1,1 | 0,6 | 40 | 117 | – | 143 | 145 | 1 | 0,6 |
| | 129 | 151 | 2 | 1 | 33 | 120 | – | 160 | 164 | 2 | 1 |
| | 129 | 151 | 2 | 1 | 47 | 120 | – | 160 | 164 | 2 | 1 |
| | 138 | 172 | 2,1 | 1,1 | 40 | 122 | – | 188 | 193 | 2 | 1 |
| | 138 | 172 | 2,1 | 1,1 | 55 | 122 | – | 188 | 193 | 2 | 1 |
| **120** | 133 | 152 | 1,1 | 0,6 | 30 | 127 | – | 158 | 160 | 1 | 0,6 |
| | 133 | 152 | 1,1 | 0,6 | 44 | 127 | – | 158 | 160 | 1 | 0,6 |
| | 139 | 161 | 2 | 1 | 34 | 130 | – | 170 | 174 | 2 | 1 |
| | 139 | 161 | 2 | 1 | 49 | 130 | – | 170 | 174 | 2 | 1 |
| | 150 | 187 | 2,1 | 1,1 | 43 | 132 | – | 203 | 208 | 2 | 1 |
| | 150 | 187 | 2,1 | 1,1 | 60 | 132 | – | 203 | 208 | 2 | 1 |
| **130** | 145 | 165 | 1,5 | 0,6 | 33 | 139 | – | 171 | 175 | 1,5 | 0,6 |
| | 145 | 165 | 1,5 | 0,6 | 48 | 139 | – | 171 | 175 | 1,5 | 0,6 |
| | 152 | 178 | 2 | 1 | 39 | 140 | – | 190 | 194 | 2 | 1 |
| | 152 | 178 | 2 | 1 | 55 | 140 | – | 190 | 194 | 2 | 1 |
| **140** | 155 | 175 | 1,5 | 0,6 | 34 | 149 | – | 181 | 185 | 1,5 | 0,6 |
| | 155 | 175 | 1,5 | 0,6 | 51 | 149 | – | 181 | 185 | 1,5 | 0,6 |
| | 162 | 188 | 2 | 1 | 40 | 150 | – | 200 | 204 | 2 | 1 |
| | 162 | 188 | 2 | 1 | 58 | 150 | – | 200 | 204 | 2 | 1 |

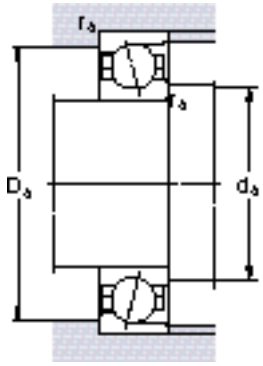
## Precision angular contact ball bearings

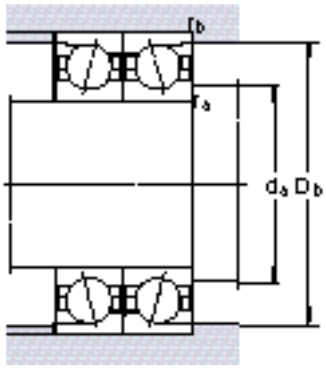
d **150 – 240** mm




CD, ACD

| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Calculation factor | Speed ratings Lubrication grease | oil spot | Mass | Designation |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | $f_0$ | | | | |
| mm | | | N | | N | – | r/min | | kg | – |
| **150** | 210 | 28 | 125 000 | 146 000 | 4 750 | 16 | 6 300 | 9 500 | 2,55 | **71930 CD** |
| | 210 | 28 | 119 000 | 140 000 | 4 500 | – | 5 000 | 8 500 | 2,55 | **71930 ACD** |
| | 225 | 35 | 172 000 | 190 000 | 5 850 | 16 | 6 000 | 9 000 | 4,15 | **7030 CD** |
| | 225 | 35 | 163 000 | 180 000 | 5 600 | – | 5 300 | 8 000 | 4,15 | **7030 ACD** |
| **160** | 220 | 28 | 130 000 | 160 000 | 5 000 | 16 | 6 000 | 9 000 | 2,70 | **71932 CD** |
| | 220 | 28 | 124 000 | 153 000 | 4 750 | – | 5 600 | 8 500 | 2,70 | **71932 ACD** |
| | 240 | 38 | 195 000 | 216 000 | 6 550 | 16 | 5 600 | 8 500 | 5,10 | **7032 CD** |
| | 240 | 38 | 182 000 | 204 000 | 6 200 | – | 5 000 | 7 500 | 5,10 | **7032 ACD** |
| **170** | 230 | 28 | 133 000 | 166 000 | 5 100 | 16 | 5 600 | 8 500 | 2,85 | **71934 CD** |
| | 230 | 28 | 124 000 | 160 000 | 4 800 | – | 5 000 | 7 500 | 2,85 | **71934 ACD** |
| | 260 | 42 | 212 000 | 245 000 | 7 100 | 16 | 5 300 | 8 000 | 6,85 | **7034 CD** |
| | 260 | 42 | 199 000 | 232 000 | 6 700 | – | 4 800 | 7 000 | 6,85 | **7034 ACD** |
| **180** | 250 | 33 | 168 000 | 212 000 | 6 100 | 16 | 5 300 | 8 000 | 4,20 | **71936 CD** |
| | 250 | 33 | 159 000 | 200 000 | 5 850 | – | 4 800 | 7 000 | 4,20 | **71936 ACD** |
| | 280 | 46 | 242 000 | 290 000 | 8 150 | 16 | 5 000 | 7 500 | 8,90 | **7036 CD** |
| | 280 | 46 | 229 000 | 275 000 | 7 650 | – | 4 300 | 6 300 | 8,90 | **7036 ACD** |
| **190** | 260 | 33 | 172 000 | 220 000 | 6 200 | 16 | 5 000 | 7 500 | 4,35 | **71938 CD** |
| | 260 | 33 | 163 000 | 208 000 | 5 850 | – | 4 500 | 6 700 | 4,35 | **71938 ACD** |
| | 290 | 46 | 247 000 | 300 000 | 8 300 | 16 | 4 800 | 7 000 | 9,35 | **7038 CD** |
| | 290 | 46 | 234 000 | 290 000 | 8 000 | – | 4 300 | 6 300 | 9,35 | **7038 ACD** |
| **200** | 280 | 38 | 208 000 | 265 000 | 7 200 | 16 | 4 800 | 7 000 | 6,10 | **71940 CD** |
| | 280 | 38 | 199 000 | 250 000 | 6 800 | – | 4 300 | 6 300 | 6,10 | **71940 ACD** |
| | 310 | 51 | 296 000 | 390 000 | 10 200 | 16 | 4 500 | 6 700 | 12,0 | **7040 CD** |
| | 310 | 51 | 281 000 | 365 000 | 9 800 | – | 4 000 | 6 000 | 12,0 | **7040 ACD** |
| **220** | 300 | 38 | 221 000 | 300 000 | 7 800 | 16 | 4 300 | 6 300 | 6,60 | **71944 CD** |
| | 300 | 38 | 208 000 | 285 000 | 7 500 | – | 3 800 | 5 600 | 6,60 | **71944 ACD** |
| | 340 | 56 | 338 000 | 455 000 | 11 600 | 16 | 4 000 | 6 000 | 16,0 | **7044 CD** |
| | 340 | 56 | 319 000 | 440 000 | 11 000 | – | 3 600 | 5 300 | 16,0 | **7044 ACD** |
| **240** | 320 | 38 | 225 000 | 310 000 | 8 000 | 17 | 4 000 | 6 000 | 8,50 | **71948 CD** |
| | 320 | 38 | 212 000 | 300 000 | 7 500 | – | 3 600 | 5 300 | 8,50 | **71948 ACD** |
| | 360 | 56 | 345 000 | 490 000 | 12 000 | 16 | 3 800 | 5 600 | 17,0 | **7048 CD** |
| | 360 | 56 | 325 000 | 465 000 | 11 400 | – | 3 200 | 4 800 | 17,0 | **7048 ACD** |

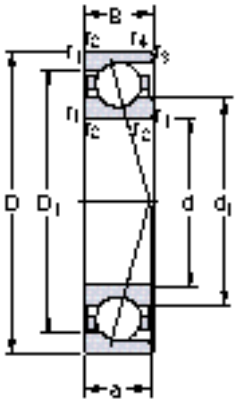



| Dimensions | | | | | | Abutment and fillet dimensions | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_1$ ≈ | $D_1$ ≈ | $r_{1,2}$ min | $r_{3,4}$ min | a | $d_a$ min | $D_a$ max | $D_b$ max | $r_a$ max | $r_b$ max |
| mm | | | | | | mm | | | | |
| **150** | 168 | 192 | 2 | 1 | 38 | 160 | 200 | 204 | 2 | 1 |
| | 168 | 192 | 2 | 1 | 56 | 160 | 200 | 204 | 2 | 1 |
| | 174 | 201 | 2,1 | 1 | 43 | 162 | 213 | 219 | 2 | 1 |
| | 174 | 201 | 2,1 | 1 | 62 | 162 | 213 | 219 | 2 | 1 |
| **160** | 178 | 202 | 2 | 1 | 40 | 170 | 210 | 214 | 2 | 1 |
| | 178 | 202 | 2 | 1 | 58 | 170 | 210 | 214 | 2 | 1 |
| | 185 | 215 | 2,1 | 1 | 46 | 172 | 228 | 234 | 2 | 1 |
| | 185 | 215 | 2,1 | 1 | 66 | 172 | 228 | 234 | 2 | 1 |
| **170** | 188 | 212 | 2 | 1 | 41 | 180 | 220 | 224 | 2 | 1 |
| | 188 | 212 | 2 | 1 | 61 | 180 | 220 | 224 | 2 | 1 |
| | 199 | 231 | 2,1 | 1,1 | 50 | 182 | 248 | 253 | 2 | 1 |
| | 199 | 231 | 2,1 | 1,1 | 71 | 182 | 248 | 253 | 2 | 1 |
| **180** | 201 | 229 | 2 | 1 | 45 | 190 | 240 | 244 | 2 | 1 |
| | 201 | 229 | 2 | 1 | 67 | 190 | 240 | 244 | 2 | 1 |
| | 212 | 248 | 2,1 | 1,1 | 54 | 192 | 268 | 273 | 2 | 1 |
| | 212 | 248 | 2,1 | 1,1 | 77 | 192 | 268 | 273 | 2 | 1 |
| **190** | 211 | 239 | 2 | 1 | 47 | 200 | 250 | 254 | 2 | 1 |
| | 211 | 239 | 2 | 1 | 69 | 200 | 250 | 254 | 2 | 1 |
| | 222 | 258 | 2,1 | 1,1 | 55 | 202 | 278 | 283 | 2 | 1 |
| | 222 | 258 | 2,1 | 1,1 | 79 | 202 | 278 | 283 | 2 | 1 |
| **200** | 224 | 256 | 2,1 | 1 | 51 | 212 | 268 | 274 | 2 | 1 |
| | 224 | 256 | 2,1 | 1 | 75 | 212 | 268 | 274 | 2 | 1 |
| | 234 | 276 | 2,1 | 1,1 | 60 | 212 | 298 | 303 | 2 | 1 |
| | 234 | 276 | 2,1 | 1,1 | 85 | 212 | 298 | 303 | 2 | 1 |
| **220** | 244 | 276 | 2,1 | 1 | 54 | 232 | 288 | 294 | 2 | 1 |
| | 244 | 276 | 2,1 | 1 | 80 | 232 | 288 | 294 | 2 | 1 |
| | 258 | 302 | 3 | 1,1 | 66 | 234 | 326 | 333 | 2,5 | 1 |
| | 258 | 302 | 3 | 1,1 | 94 | 234 | 326 | 333 | 2,5 | 1 |
| **240** | 267 | 295 | 2,1 | 1,1 | 57 | 252 | 308 | 313 | 2 | 1 |
| | 267 | 295 | 2,1 | 1,1 | 84 | 252 | 308 | 313 | 2 | 1 |
| | 278 | 322 | 3 | 1,1 | 68 | 254 | 346 | 353 | 2,5 | 1 |
| | 278 | 322 | 3 | 1,1 | 98 | 254 | 346 | 353 | 2,5 | 1 |

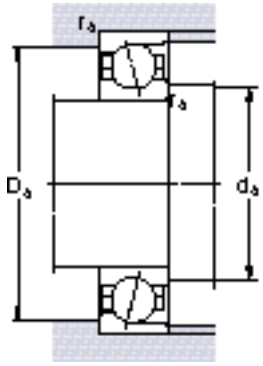
## Hybrid precision angular contact ball bearings

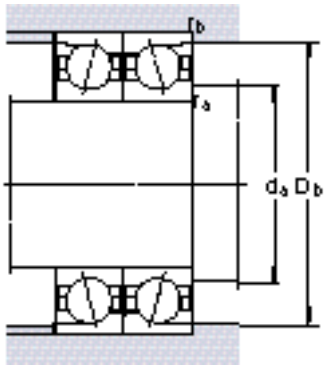
d **8 – 20** mm




CD/HC, ACD/HC

| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Calculation factor | Speed ratings Lubrication grease | oil spot | Mass | Designation |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | $f_0$ | | | | |
| mm | | | N | | N | – | r/min | | kg | – |
| **8** | 22 | 7 | 2 960 | 1 160 | 49 | 8,4 | 80 000 | 120 000 | 0,010 | **708 CD/HC** |
| | 22 | 7 | 2 910 | 1 120 | 48 | – | 75 000 | 110 000 | 0,010 | **708 ACD/HC** |
| **9** | 24 | 7 | 3 250 | 1 340 | 57 | 8,8 | 80 000 | 120 000 | 0,012 | **709 CD/HC** |
| | 24 | 7 | 3 120 | 1 290 | 54 | – | 75 000 | 110 000 | 0,012 | **709 ACD/HC** |
| **10** | 22 | 6 | 2 510 | 1 100 | 48 | 9,5 | 80 000 | 120 000 | 0,0080 | **71900 CD/HC** |
| | 22 | 6 | 2 420 | 1 060 | 45 | – | 75 000 | 110 000 | 0,0080 | **71900 ACD/HC** |
| | 26 | 8 | 4 100 | 1 660 | 71 | 8,3 | 75 000 | 110 000 | 0,016 | **7000 CD/HC** |
| | 26 | 8 | 3 970 | 1 600 | 67 | – | 70 000 | 100 000 | 0,016 | **7000 ACD/HC** |
| | 30 | 9 | 5 400 | 2 200 | 93 | 8,2 | 70 000 | 100 000 | 0,025 | **7200 CD/HC** |
| | 30 | 9 | 5 200 | 2 120 | 90 | – | 67 000 | 95 000 | 0,025 | **7200 ACD/HC** |
| **12** | 24 | 6 | 2 650 | 1 250 | 53 | 9,8 | 75 000 | 110 000 | 0,0090 | **71901 CD/HC** |
| | 24 | 6 | 2 550 | 1 180 | 50 | – | 70 000 | 100 000 | 0,0090 | **71901 ACD/HC** |
| | 28 | 8 | 4 490 | 1 900 | 80 | 8,7 | 70 000 | 100 000 | 0,017 | **7001 CD/HC** |
| | 28 | 8 | 4 360 | 1 830 | 78 | – | 67 000 | 95 000 | 0,017 | **7001 ACD/HC** |
| | 32 | 10 | 5 850 | 2 550 | 108 | 8,5 | 67 000 | 95 000 | 0,032 | **7201 CD/HC** |
| | 32 | 10 | 5 720 | 2 450 | 104 | – | 60 000 | 85 000 | 0,032 | **7201 ACD/HC** |
| **15** | 28 | 7 | 3 970 | 1 900 | 80 | 9,6 | 67 000 | 95 000 | 0,013 | **71902 CD/HC** |
| | 28 | 7 | 3 770 | 1 800 | 78 | – | 63 000 | 90 000 | 0,013 | **71902 ACD/HC** |
| | 32 | 9 | 5 200 | 2 450 | 104 | 9,3 | 63 000 | 90 000 | 0,025 | **7002 CD/HC** |
| | 32 | 9 | 4 940 | 2 320 | 98 | – | 56 000 | 80 000 | 0,025 | **7002 ACD/HC** |
| | 35 | 11 | 7 410 | 3 350 | 140 | 8,5 | 60 000 | 85 000 | 0,037 | **7202 CD/HC** |
| | 35 | 11 | 7 150 | 3 200 | 134 | – | 53 000 | 75 000 | 0,037 | **7202 ACD/HC** |
| **17** | 30 | 7 | 4 160 | 2 080 | 88 | 9,8 | 63 000 | 90 000 | 0,015 | **71903 CD/HC** |
| | 30 | 7 | 3 970 | 2 000 | 85 | – | 56 000 | 80 000 | 0,015 | **71903 ACD/HC** |
| | 35 | 10 | 6 760 | 3 250 | 137 | 9,1 | 56 000 | 80 000 | 0,032 | **7003 CD/HC** |
| | 35 | 10 | 6 500 | 3 100 | 132 | – | 53 000 | 75 000 | 0,032 | **7003 ACD/HC** |
| | 40 | 12 | 9 230 | 4 150 | 176 | 8,5 | 43 000 | 63 000 | 0,062 | **7203 CD/HC** |
| | 40 | 12 | 8 840 | 4 000 | 170 | – | 38 000 | 56 000 | 0,062 | **7203 ACD/HC** |
| **20** | 37 | 9 | 6 050 | 3 200 | 137 | 9,8 | 53 000 | 75 000 | 0,031 | **71904 CD/HC** |
| | 37 | 9 | 5 720 | 3 050 | 129 | – | 48 000 | 67 000 | 0,031 | **71904 ACD/HC** |
| | 42 | 12 | 8 710 | 4 300 | 180 | 9,2 | 48 000 | 67 000 | 0,058 | **7004 CD/HC** |
| | 42 | 12 | 8 320 | 4 150 | 173 | – | 43 000 | 60 000 | 0,058 | **7004 ACD/HC** |
| | 47 | 14 | 11 900 | 5 850 | 245 | 8,7 | 43 000 | 60 000 | 0,089 | **7204 CD/HC** |
| | 47 | 14 | 11 400 | 5 600 | 236 | – | 40 000 | 56 000 | 0,089 | **7204 ACD/HC** |

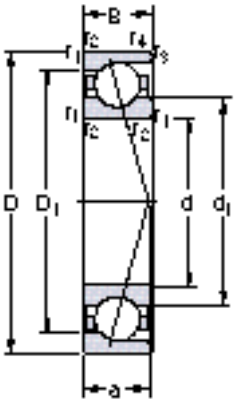


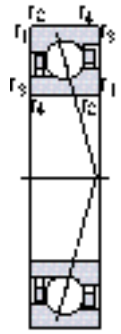

| Dimensions | | | | | | Abutment and fillet dimensions | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_1$ ≈ | $D_1$ ≈ | $r_{1,2}$ min | $r_{3,4}$ min | a | $d_a$ min | $D_a$ max | $D_b$ max | $r_a$ max | $r_b$ max |
| mm | | | | | | mm | | | | |
| **8** | 12,6 | 17,7 | 0,3 | 0,1 | 6 | 10 | 20 | 20,4 | 0,3 | 0,1 |
| | 12,6 | 17,5 | 0,3 | 0,1 | 7 | 10 | 20 | 20,4 | 0,3 | 0,1 |
| **9** | 13,9 | 19,5 | 0,3 | 0,1 | 6 | 11 | 22 | 22,4 | 0,3 | 0,1 |
| | 13,9 | 19,2 | 0,3 | 0,1 | 7 | 11 | 22 | 22,4 | 0,3 | 0,1 |
| **10** | 13,9 | 18,1 | 0,3 | 0,1 | 5 | 12 | 20 | 20,8 | 0,3 | 0,1 |
| | 13,9 | 18,1 | 0,3 | 0,1 | 7 | 12 | 20 | 20,8 | 0,3 | 0,1 |
| | 15,1 | 21,3 | 0,3 | 0,1 | 6 | 12 | 24 | 24,4 | 0,3 | 0,1 |
| | 15,1 | 21 | 0,3 | 0,1 | 8 | 12 | 24 | 24,4 | 0,3 | 0,1 |
| | 16,8 | 23,3 | 0,6 | 0,3 | 7 | 15 | 25 | 28 | 0,6 | 0,3 |
| | 16,8 | 23,3 | 0,6 | 0,3 | 9 | 15 | 25 | 28 | 0,6 | 0,3 |
| **12** | 15,9 | 20,1 | 0,3 | 0,1 | 5 | 14 | 22 | 22,8 | 0,3 | 0,1 |
| | 15,9 | 20,1 | 0,3 | 0,1 | 7 | 14 | 22 | 22,8 | 0,3 | 0,1 |
| | 17,1 | 23,3 | 0,3 | 0,1 | 7 | 14 | 26 | 26,4 | 0,3 | 0,1 |
| | 17,1 | 23 | 0,3 | 0,1 | 9 | 14 | 26 | 26,4 | 0,3 | 0,1 |
| | 18,2 | 25,8 | 0,6 | 0,3 | 8 | 17 | 27 | 30 | 0,6 | 0,3 |
| | 18,2 | 25,8 | 0,6 | 0,3 | 10 | 17 | 27 | 30 | 0,6 | 0,3 |
| **15** | 19,1 | 23,9 | 0,3 | 0,1 | 6 | 17 | 26 | 26,8 | 0,3 | 0,1 |
| | 19,1 | 23,9 | 0,3 | 0,1 | 9 | 17 | 26 | 26,8 | 0,3 | 0,1 |
| | 20,6 | 26,8 | 0,3 | 0,1 | 8 | 17 | 30 | 30,4 | 0,3 | 0,1 |
| | 20,6 | 26,5 | 0,3 | 0,1 | 10 | 17 | 30 | 30,4 | 0,3 | 0,1 |
| | 21,5 | 29,1 | 0,6 | 0,3 | 9 | 20 | 30 | 33 | 0,6 | 0,3 |
| | 21,5 | 29,1 | 0,6 | 0,3 | 12 | 20 | 30 | 33 | 0,6 | 0,3 |
| **17** | 21,1 | 25,9 | 0,3 | 0,1 | 7 | 19 | 28 | 28,8 | 0,3 | 0,1 |
| | 21,1 | 25,9 | 0,3 | 0,1 | 9 | 19 | 28 | 28,8 | 0,3 | 0,1 |
| | 22,9 | 29,6 | 0,3 | 0,1 | 9 | 19 | 33 | 33,4 | 0,3 | 0,1 |
| | 22,9 | 29,2 | 0,3 | 0,1 | 11 | 19 | 33 | 33,4 | 0,3 | 0,1 |
| | 24,2 | 32,8 | 0,6 | 0,3 | 10 | 22 | 35 | 38 | 0,6 | 0,3 |
| | 24,2 | 32,8 | 0,6 | 0,3 | 13 | 22 | 35 | 38 | 0,6 | 0,3 |
| **20** | 25,4 | 31,6 | 0,3 | 0,15 | 8 | 22 | 35 | 35,8 | 0,3 | 0,1 |
| | 25,4 | 31,6 | 0,3 | 0,15 | 11 | 22 | 35 | 35,8 | 0,3 | 0,1 |
| | 26,9 | 35,1 | 0,6 | 0,3 | 10 | 25 | 37 | 40 | 0,6 | 0,3 |
| | 26,9 | 35,1 | 0,6 | 0,3 | 13 | 25 | 37 | 40 | 0,6 | 0,3 |
| | 29,1 | 38,7 | 1 | 0,3 | 12 | 26 | 41 | 45 | 1 | 0,3 |
| | 29,1 | 38,7 | 1 | 0,3 | 15 | 26 | 41 | 45 | 1 | 0,3 |

## Hybrid precision angular contact ball bearings

d **25 – 45** mm

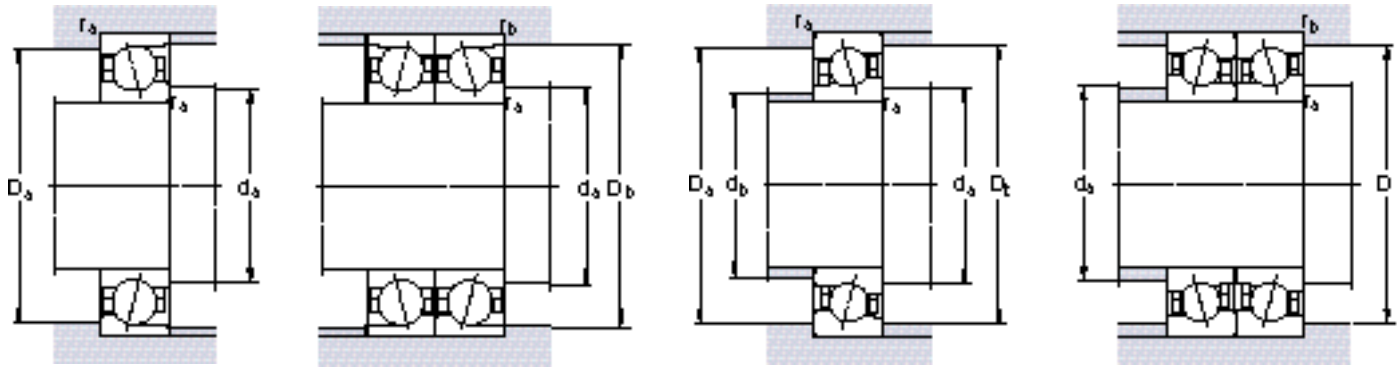



CD/HC, ACD/HC



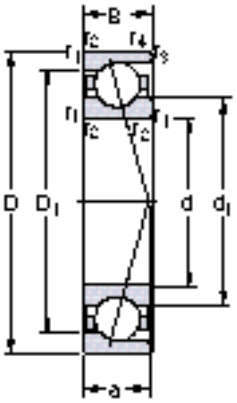
CE/HC

| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Calculation factor | Speed ratings Lubrication grease | oil spot | Mass | Designation |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | $f_0$ | | | | |
| mm | | | N | | N | – | r/min | | kg | – |
| **25** | 42 | 9 | 6 760 | 4 000 | 170 | 10 | 45 000 | 63 000 | 0,037 | **71905 CD/HC** |
| | 42 | 9 | 6 370 | 3 800 | 160 | – | 40 000 | 56 000 | 0,037 | **71905 ACD/HC** |
| | 47 | 12 | 9 560 | 5 200 | 220 | 9,6 | 40 000 | 56 000 | 0,066 | **7005 CD/HC** |
| | 47 | 12 | 8 710 | 4 550 | 193 | 8,4 | 50 000 | 70 000 | 0,067 | **7005 CE/HC** |
| | 47 | 12 | 9 230 | 5 000 | 212 | – | 38 000 | 53 000 | 0,066 | **7005 ACD/HC** |
| | 52 | 15 | 13 500 | 7 200 | 305 | 9,1 | 38 000 | 53 000 | 0,12 | **7205 CD/HC** |
| | 52 | 15 | 13 000 | 6 950 | 290 | – | 34 000 | 48 000 | 0,12 | **7205 ACD/HC** |
| **30** | 47 | 9 | 7 150 | 4 550 | 193 | 10 | 38 000 | 53 000 | 0,043 | **71906 CD/HC** |
| | 47 | 9 | 6 760 | 4 300 | 183 | – | 34 000 | 48 000 | 0,043 | **71906 ACD/HC** |
| | 55 | 13 | 14 300 | 8 000 | 345 | 9,4 | 34 000 | 48 000 | 0,094 | **7006 CD/HC** |
| | 55 | 13 | 13 000 | 6 950 | 300 | 8,2 | 43 000 | 60 000 | 0,094 | **7006 CE/HC** |
| | 55 | 13 | 13 800 | 7 650 | 325 | – | 32 000 | 45 000 | 0,094 | **7006 ACD/HC** |
| | 62 | 16 | 24 200 | 16 000 | 670 | 14 | 32 000 | 45 000 | 0,17 | **7206 CD/HC** |
| | 62 | 16 | 23 400 | 15 300 | 640 | – | 28 000 | 40 000 | 0,17 | **7206 ACD/HC** |
| **35** | 55 | 10 | 9 750 | 6 550 | 275 | 10 | 32 000 | 45 000 | 0,065 | **71907 CD/HC** |
| | 55 | 10 | 9 230 | 6 200 | 260 | – | 30 000 | 43 000 | 0,065 | **71907 ACD/HC** |
| | 62 | 14 | 15 600 | 9 500 | 400 | 9,7 | 30 000 | 43 000 | 0,13 | **7007 CD/HC** |
| | 62 | 14 | 14 000 | 8 300 | 355 | 8,5 | 38 000 | 50 000 | 0,13 | **7007 CE/HC** |
| | 62 | 14 | 14 800 | 9 000 | 380 | – | 26 000 | 38 000 | 0,13 | **7007 ACD/HC** |
| | 72 | 17 | 31 900 | 21 600 | 915 | 14 | 26 000 | 38 000 | 0,24 | **7207 CD/HC** |
| | 72 | 17 | 30 700 | 20 800 | 880 | – | 22 000 | 34 000 | 0,24 | **7207 ACD/HC** |
| **40** | 62 | 12 | 12 400 | 8 500 | 360 | 10 | 28 000 | 40 000 | 0,096 | **71908 CD/HC** |
| | 62 | 12 | 11 700 | 8 000 | 340 | – | 24 000 | 36 000 | 0,096 | **71908 ACD/HC** |
| | 68 | 15 | 16 800 | 11 000 | 465 | 10 | 26 000 | 38 000 | 0,16 | **7008 CD/HC** |
| | 68 | 15 | 15 100 | 9 500 | 405 | 8,7 | 34 000 | 48 000 | 0,16 | **7008 CE/HC** |
| | 68 | 15 | 15 900 | 10 400 | 440 | – | 22 000 | 34 000 | 0,16 | **7008 ACD/HC** |
| | 80 | 18 | 41 000 | 28 000 | 1 180 | 14 | 22 000 | 34 000 | 0,30 | **7208 CD/HC** |
| | 80 | 18 | 39 000 | 27 000 | 1 140 | – | 20 000 | 32 000 | 0,30 | **7208 ACD/HC** |
| **45** | 68 | 12 | 13 000 | 9 500 | 400 | 11 | 24 000 | 36 000 | 0,11 | **71909 CD/HC** |
| | 68 | 12 | 12 400 | 9 000 | 380 | – | 22 000 | 34 000 | 0,11 | **71909 ACD/HC** |
| | 75 | 16 | 28 600 | 22 400 | 950 | 15 | 22 000 | 34 000 | 0,20 | **7009 CD/HC** |
| | 75 | 16 | 27 600 | 21 600 | 900 | – | 20 000 | 32 000 | 0,20 | **7009 ACD/HC** |
| | 85 | 19 | 42 300 | 31 000 | 1 320 | 14 | 20 000 | 32 000 | 0,34 | **7209 CD/HC** |
| | 85 | 19 | 41 000 | 30 000 | 1 250 | – | 18 000 | 28 000 | 0,34 | **7209 ACD/HC** |

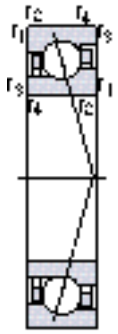



| Dimensions | | | | | | Abutment and fillet dimensions | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_1$ ≈ | $D_1$ ≈ | $r_{1,2}$ min | $r_{3,4}$ min | a | $d_a$ min | $d_b$ min | $D_a$ max | $D_b$ max | $r_a$ max | $r_b$ max |
| mm | | | | | | mm | | | | | |
| **25** | 30,4 | 36,6 | 0,3 | 0,15 | 9 | 27 | – | 40 | 40,8 | 0,3 | 0,1 |
| | 30,4 | 36,6 | 0,3 | 0,15 | 12 | 27 | – | 40 | 40,8 | 0,3 | 0,1 |
| | 31,9 | 40,1 | 0,6 | 0,3 | 11 | 30 | – | 42 | 45 | 0,6 | 0,3 |
| | 32,2 | 39,9 | 0,6 | 0,3 | 11 | 30 | 27 | 42 | 45 | 0,3 | – |
| | 31,9 | 40,1 | 0,6 | 0,3 | 15 | 30 | – | 42 | 45 | 0,6 | 0,3 |
| | 34,1 | 43,7 | 1 | 0,3 | 13 | 31 | – | 46 | 50 | 1 | 0,3 |
| | 34,1 | 43,7 | 1 | 0,3 | 17 | 31 | – | 46 | 50 | 1 | 0,3 |
| **30** | 35,4 | 41,6 | 0,3 | 0,15 | 10 | 32 | – | 45 | 45,8 | 0,3 | 0,1 |
| | 35,4 | 41,6 | 0,3 | 0,15 | 14 | 32 | – | 45 | 45,8 | 0,3 | 0,1 |
| | 38,1 | 46,9 | 1 | 0,3 | 12 | 36 | – | 49 | 53 | 1 | 0,3 |
| | 37,7 | 47,3 | 1 | 0,3 | 12 | 36 | 32 | 49 | 53 | 1 | 0,3 |
| | 38,1 | 46,9 | 1 | 0,3 | 17 | 36 | – | 49 | 53 | 1 | 0,3 |
| | 40,3 | 51,7 | 1 | 0,3 | 14 | 36 | – | 56 | 60 | 1 | 0,3 |
| | 40,3 | 51,7 | 1 | 0,3 | 19 | 36 | – | 56 | 60 | 1 | 0,3 |
| **35** | 41,2 | 48,8 | 0,6 | 0,15 | 11 | 40 | – | 50 | 53,8 | 0,6 | 0,1 |
| | 41,2 | 48,8 | 0,6 | 0,15 | 16 | 40 | – | 50 | 53,8 | 0,6 | 0,1 |
| | 43,7 | 53,3 | 1 | 0,3 | 14 | 41 | – | 56 | 60 | 1 | 0,3 |
| | 43,7 | 53,3 | 1 | 0,3 | 14 | 41 | 37 | 56 | 60 | 1 | 0,3 |
| | 43,7 | 53,3 | 1 | 0,3 | 19 | 41 | – | 56 | 60 | 1 | 0,3 |
| | 47 | 60 | 1,1 | 0,3 | 16 | 42 | – | 65 | 70 | 1 | 0,3 |
| | 47 | 60 | 1,1 | 0,3 | 21 | 42 | – | 65 | 70 | 1 | 0,3 |
| **40** | 46,7 | 55,3 | 0,6 | 0,15 | 13 | 45 | – | 57 | 60,8 | 0,6 | 0,1 |
| | 46,7 | 55,3 | 0,6 | 0,15 | 18 | 45 | – | 57 | 60,8 | 0,6 | 0,1 |
| | 49,2 | 58,8 | 1 | 0,3 | 15 | 46 | – | 62 | 66 | 1 | 0,3 |
| | 49,2 | 58,8 | 1 | 0,3 | 15 | 46 | 42 | 62 | 66 | 1 | 0,3 |
| | 49,2 | 58,8 | 1 | 0,3 | 20 | 46 | – | 62 | 66 | 1 | 0,3 |
| | 53 | 67 | 1,1 | 0,6 | 17 | 47 | – | 73 | 75 | 1 | 0,6 |
| | 53 | 67 | 1,1 | 0,6 | 23 | 47 | – | 73 | 75 | 1 | 0,6 |
| **45** | 52,2 | 60,8 | 0,6 | 0,15 | 14 | 50 | – | 63 | 66,8 | 0,6 | 0,1 |
| | 52,2 | 60,8 | 0,6 | 0,15 | 19 | 50 | – | 63 | 66,8 | 0,6 | 0,1 |
| | 54,7 | 65,3 | 1 | 0,3 | 16 | 51 | – | 69 | 73 | 1 | 0,3 |
| | 54,7 | 65,3 | 1 | 0,3 | 22 | 51 | – | 69 | 73 | 1 | 0,3 |
| | 57,5 | 72,5 | 1,1 | 0,6 | 18 | 52 | – | 78 | 80 | 1 | 0,6 |
| | 57,5 | 72,5 | 1,1 | 0,6 | 25 | 52 | – | 78 | 80 | 1 | 0,6 |

## Hybrid precision angular contact ball bearings
d **50 – 75** mm

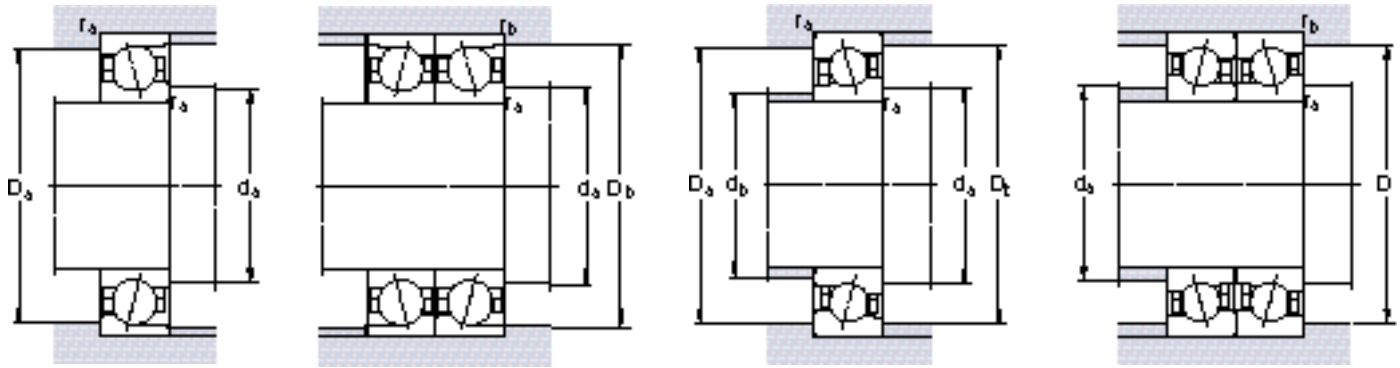



CD/HC, ACD/HC



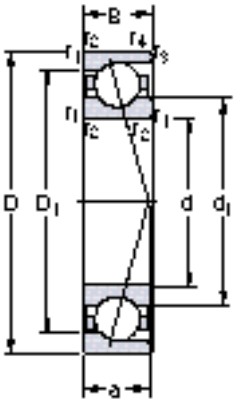
CE/HC

| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Calculation factor | Speed ratings Lubrication grease | oil spot | Mass | Designation |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | $f_0$ | | | | |
| mm | | | N | | N | – | r/min | | kg | – |
| **50** | 72 | 12 | 13 500 | 10 400 | 440 | 11 | 22 000 | 34 000 | 0,11 | **71910 CD/HC** |
| | 72 | 12 | 12 700 | 9 800 | 415 | – | 19 000 | 30 000 | 0,11 | **71910 ACD/HC** |
| | 80 | 16 | 29 600 | 24 000 | 1 020 | 15 | 20 000 | 32 000 | 0,21 | **7010 CD/HC** |
| | 80 | 16 | 22 500 | 16 000 | 680 | 10 | 28 000 | 40 000 | 0,21 | **7010 CE/HC** |
| | 80 | 16 | 28 100 | 23 200 | 980 | – | 18 000 | 28 000 | 0,21 | **7010 ACD/HC** |
| | 90 | 20 | 44 900 | 34 000 | 1 430 | 15 | 19 000 | 30 000 | 0,38 | **7210 CD/HC** |
| | 90 | 20 | 42 300 | 32 500 | 1 390 | – | 17 000 | 26 000 | 0,38 | **7210 ACD/HC** |
| **55** | 80 | 13 | 19 500 | 14 600 | 620 | 10 | 19 000 | 3 0000 | 0,15 | **71911 CD/HC** |
| | 80 | 13 | 18 200 | 13 700 | 585 | – | 18 000 | 28 000 | 0,15 | **71911 ACD/HC** |
| | 90 | 18 | 39 700 | 32 500 | 1 370 | 15 | 18 000 | 28 000 | 0,31 | **7011 CD/HC** |
| | 90 | 18 | 37 100 | 31 000 | 1 320 | – | 17 000 | 26 000 | 0,31 | **7011 ACD/HC** |
| | 100 | 21 | 55 300 | 43 000 | 1 800 | 14 | 17 000 | 26 000 | 0,51 | **7211 CD/HC** |
| | 100 | 21 | 52 700 | 40 500 | 1 730 | – | 16 000 | 24 000 | 0,51 | **7211 ACD/HC** |
| **60** | 85 | 13 | 19 900 | 15 300 | 655 | 11 | 18 000 | 28 000 | 0,16 | **71912 CD/HC** |
| | 85 | 13 | 13 500 | 12 200 | 520 | 11 | 24 000 | 36 000 | 0,17 | **71912 CE/HC** |
| | 85 | 13 | 18 600 | 14 600 | 620 | – | 17 000 | 26 000 | 0,16 | **71912 ACD/HC** |
| | 95 | 18 | 40 300 | 34 500 | 1 500 | 15 | 17 000 | 26 000 | 0,34 | **7012 CD/HC** |
| | 95 | 18 | 19 000 | 16 300 | 680 | 11 | 20 000 | 32 000 | 0,36 | **7012 CE/HC** |
| | 95 | 18 | 39 000 | 33 500 | 1 400 | – | 16 000 | 24 000 | 0,34 | **7012 ACD/HC** |
| | 110 | 22 | 67 600 | 53 000 | 2 240 | 14 | 16 000 | 24 000 | 0,65 | **7212 CD/HC** |
| | 110 | 22 | 63 700 | 50 000 | 2 120 | – | 15 000 | 22 000 | 0,65 | **7212 ACD/HC** |
| **65** | 90 | 13 | 20 800 | 17 000 | 710 | 11 | 17 000 | 26 000 | 0,17 | **71913 CD/HC** |
| | 90 | 13 | 19 500 | 16 000 | 680 | – | 16 000 | 24 000 | 0,17 | **71913 ACD/HC** |
| | 100 | 18 | 41 600 | 37 500 | 1 600 | 16 | 16 000 | 24 000 | 0,36 | **7013 CD/HC** |
| | 100 | 18 | 19 900 | 17 600 | 750 | 11 | 19 000 | 30 000 | 0,36 | **7013 CE/HC** |
| | 100 | 18 | 39 000 | 35 500 | 1 500 | – | 15 000 | 22 000 | 0,36 | **7013 ACD/HC** |
| **70** | 100 | 16 | 34 500 | 34 000 | 1 430 | 16 | 16 000 | 24 000 | 0,28 | **71914 CD/HC** |
| | 100 | 16 | 20 300 | 18 300 | 780 | 11 | 19 000 | 30 000 | 0,29 | **71914 CE/HC** |
| | 100 | 16 | 32 500 | 32 500 | 1 370 | – | 15 000 | 22 000 | 0,28 | **71914 ACD/HC** |
| | 110 | 20 | 52 000 | 45 500 | 1 930 | 15 | 15 000 | 22 000 | 0,49 | **7014 CD/HC** |
| | 110 | 20 | 27 000 | 23 600 | 1 000 | 15 | 18 000 | 28 000 | 0,53 | **7014 CE/HC** |
| | 110 | 20 | 48 800 | 44 000 | 1 860 | – | 14 000 | 20 000 | 0,49 | **7014 ACD/HC** |
| **75** | 105 | 16 | 35 800 | 37 500 | 1 560 | 16 | 15 000 | 22 000 | 0,30 | **71915 CD/HC** |
| | 105 | 16 | 33 800 | 35 500 | 1 500 | – | 14 000 | 20 000 | 0,30 | **71915 ACD/HC** |
| | 115 | 20 | 52 700 | 49 000 | 2 080 | 16 | 15 000 | 22 000 | 0,52 | **7015 CD/HC** |
| | 115 | 20 | 49 400 | 46 500 | 1 960 | – | 13 000 | 19 000 | 0,52 | **7015 ACD/HC** |

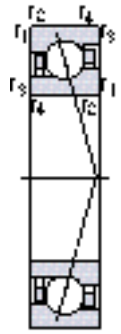



| Dimensions | | | | | | Abutment and fillet dimensions | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_1$ ≈ | $D_1$ ≈ | $r_{1,2}$ min | $r_{3,4}$ min | a | $d_a$ min | $d_b$ min | $D_a$ max | $D_b$ max | $r_a$ max | $r_b$ max |
| mm | | | | | | mm | | | | | |
| **50** | 56,7 | 65,3 | 0,6 | 0,15 | 14 | 55 | – | 67 | 70,8 | 0,6 | 0,1 |
| | 56,7 | 65,3 | 0,6 | 0,15 | 20 | 55 | – | 67 | 70,8 | 0,6 | 0,1 |
| | 59,7 | 70,3 | 1 | 0,3 | 17 | 56 | – | 74 | 78 | 1 | 0,3 |
| | 59,3 | 70,8 | 1 | 0,3 | 17 | 56 | 54 | 74 | 78 | 1 | 0,3 |
| | 59,7 | 70,3 | 1 | 0,3 | 17 | 56 | – | 74 | 78 | 1 | 0,3 |
| | 62,5 | 77,5 | 1,1 | 0,6 | 20 | 57 | – | 83 | 85 | 1 | 0,6 |
| | 62,5 | 77,5 | 1,1 | 0,6 | 27 | 57 | – | 83 | 85 | 1 | 0,6 |
| **55** | 62,7 | 72,3 | 1 | 0,3 | 16 | 61 | – | 74 | 78 | 1 | 0,3 |
| | 62,7 | 72,3 | 1 | 0,3 | 22 | 61 | – | 74 | 78 | 1 | 0,3 |
| | 66,3 | 78,7 | 1,1 | 0,6 | 19 | 62 | – | 83 | 86 | 1 | 0,6 |
| | 66,3 | 78,7 | 1,1 | 0,6 | 26 | 62 | – | 83 | 86 | 1 | 0,6 |
| | 69 | 85,9 | 1,5 | 0,6 | 21 | 64 | – | 91 | 95 | 1,5 | 0,6 |
| | 69 | 85,9 | 1,5 | 0,6 | 29 | 64 | – | 91 | 95 | 1,5 | 0,6 |
| **60** | 67,7 | 77,3 | 1 | 0,3 | 16 | 66 | – | 79 | 82 | 1 | 0,3 |
| | 68,6 | 76,4 | 1 | 0,3 | 16 | 66 | 63 | 79 | 82 | 1 | 0,3 |
| | 67,7 | 77,3 | 1 | 0,3 | 23 | 66 | – | 79 | 82 | 1 | 0,3 |
| | 71,3 | 83,7 | 1,1 | 0,6 | 20 | 67 | – | 88 | 91 | 1 | 0,6 |
| | 72,7 | 82,3 | 1,1 | 0,6 | 19 | 67 | 64 | 88 | 91 | 1 | 0,6 |
| | 71,3 | 83,7 | 1,1 | 0,6 | 27 | 67 | – | 88 | 91 | 1 | 0,6 |
| | 75,6 | 94,4 | 1,5 | 0,6 | 23 | 69 | – | 101 | 105 | 1,5 | 0,6 |
| | 75,6 | 94,4 | 1,5 | 0,6 | 31 | 69 | – | 101 | 105 | 1,5 | 0,6 |
| **65** | 72,7 | 82,3 | 1 | 0,3 | 17 | 71 | – | 84 | 87 | 1 | 0,3 |
| | 72,7 | 82,3 | 1 | 0,3 | 25 | 71 | – | 84 | 87 | 1 | 0,3 |
| | 76,3 | 88,7 | 1,1 | 0,6 | 20 | 72 | – | 93 | 96 | 1 | 0,6 |
| | 77,7 | 87,3 | 1,1 | 0,6 | 20 | 72 | 69 | 93 | 96 | 1 | 0,6 |
| | 76,3 | 88,7 | 1,1 | 0,6 | 28 | 72 | – | 93 | 96 | 1 | 0,6 |
| **70** | 79,3 | 90,7 | 1 | 0,3 | 19 | 76 | – | 94 | 97 | 1 | 0,3 |
| | 80,2 | 89,3 | 1 | 0,3 | 19 | 76 | 73 | 94 | 97 | 1 | 0,3 |
| | 79,3 | 90,7 | 1 | 0,3 | 28 | 76 | – | 94 | 97 | 1 | 0,3 |
| | 82,9 | 97,1 | 1,1 | 0,6 | 22 | 77 | – | 103 | 106 | 1 | 0,6 |
| | 84,2 | 95,8 | 1,1 | 0,6 | 22 | 77 | 74 | 103 | 106 | 1 | 0,6 |
| | 82,9 | 97,1 | 1,1 | 0,6 | 31 | 77 | – | 103 | 106 | 1 | 0,6 |
| **75** | 84,3 | 95,7 | 1 | 0,3 | 20 | 81 | – | 99 | 102 | 1 | 0,3 |
| | 84,3 | 95,7 | 1 | 0,3 | 29 | 81 | – | 99 | 102 | 1 | 0,3 |
| | 87,9 | 103 | 1,1 | 0,6 | 23 | 82 | – | 108 | 111 | 1 | 0,6 |
| | 87,9 | 103 | 1,1 | 0,6 | 32 | 82 | – | 108 | 111 | 1 | 0,6 |

## Hybrid precision angular contact ball bearings
d **80 – 140** mm

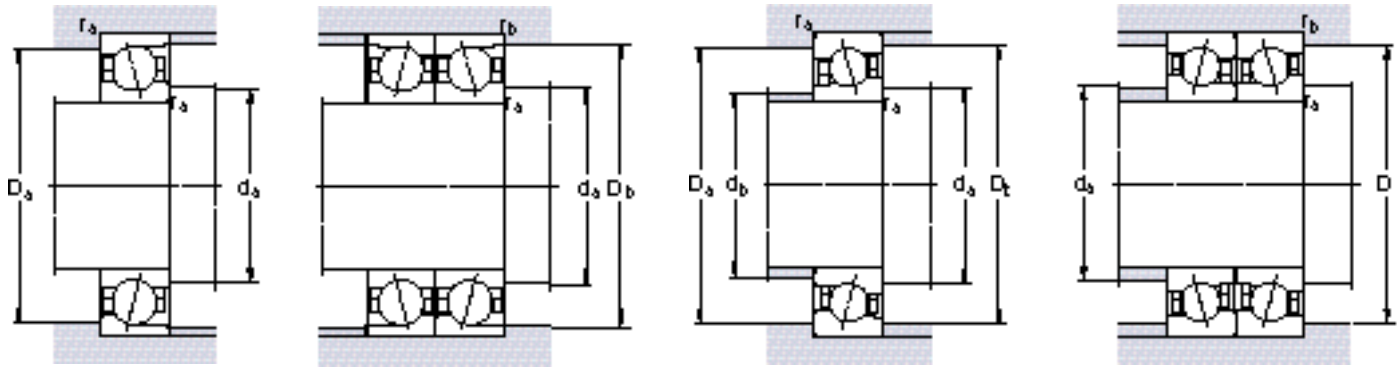



CD/HC, ACD/HC

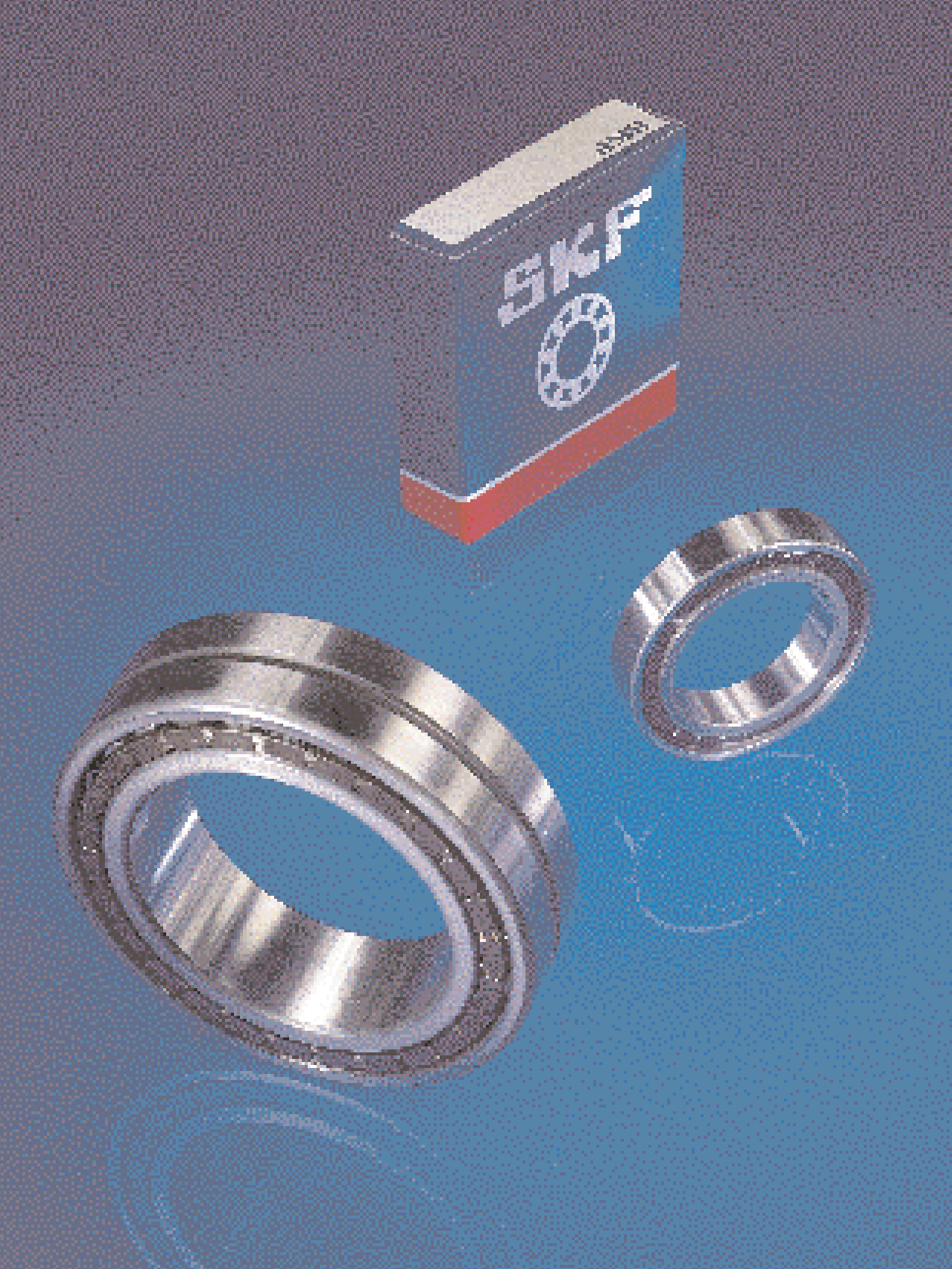


CE/HC

| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Calculation factor | Speed ratings Lubrication grease | oil spot | Mass | Designation |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | $f_0$ | | | | |
| mm | | | N | | N | – | r/min | | kg | – |
| **80** | 110 | 16 | 36 400 | 39 000 | 1 660 | 16 | 15 000 | 22 000 | 0,31 | **71916 CD/HC** |
| | 110 | 16 | 21 200 | 20 800 | 880 | 11 | 17 000 | 26 000 | 0,32 | **71916 CE/HC** |
| | 110 | 16 | 34 500 | 36 500 | 1 560 | – | 13 000 | 19 000 | 0,31 | **71916 ACD/HC** |
| | 125 | 22 | 65 000 | 61 000 | 2 550 | 16 | 14 000 | 20 000 | 0,71 | **7016 CD/HC** |
| | 125 | 22 | 34 500 | 30 500 | 1 270 | 11 | 16 000 | 24 000 | 0,74 | **7016 CE/HC** |
| | 125 | 22 | 62 400 | 58 500 | 2 450 | – | 12 000 | 18 000 | 0,71 | **7016 ACD/HC** |
| **85** | 120 | 18 | 46 200 | 48 000 | 2 040 | 16 | 14 000 | 20 000 | 0,44 | **71917 CD/HC** |
| | 120 | 18 | 43 600 | 45 500 | 1 930 | – | 12 000 | 18 000 | 0,44 | **71917 ACD/HC** |
| | 130 | 22 | 67 600 | 65 500 | 2 650 | 16 | 13 000 | 19 000 | 0,74 | **7017 CD/HC** |
| | 130 | 22 | 63 700 | 62 000 | 2 500 | – | 11 000 | 17 000 | 0,74 | **7017 ACD/HC** |
| **90** | 125 | 18 | 47 500 | 51 000 | 2 080 | 16 | 13 000 | 19 000 | 0,47 | **71918 CD/HC** |
| | 125 | 18 | 29 100 | 29 000 | 1 180 | 11 | 16 000 | 24 000 | 0,47 | **71918 CE/HC** |
| | 125 | 18 | 44 200 | 48 000 | 1 960 | – | 11 000 | 17 000 | 0,47 | **71918 ACD/HC** |
| | 140 | 24 | 79 300 | 76 500 | 3 000 | 16 | 12 000 | 18 000 | 0,95 | **7018 CD/HC** |
| | 140 | 24 | 44 200 | 40 000 | 1 560 | 11 | 15 000 | 22 000 | 0,95 | **7018 CE/HC** |
| | 140 | 24 | 74 100 | 72 000 | 2 850 | – | 10 000 | 16 000 | 0,95 | **7018 ACD/HC** |
| **95** | 130 | 18 | 49 400 | 55 000 | 2 200 | 16 | 12 000 | 18 000 | 0,49 | **71919 CD/HC** |
| | 130 | 18 | 46 200 | 52 000 | 2 080 | – | 10 000 | 16 000 | 0,49 | **71919 ACD/HC** |
| | 145 | 24 | 81 900 | 80 000 | 3 100 | 16 | 11 000 | 17 000 | 1,00 | **7019 CD/HC** |
| | 145 | 24 | 76 100 | 76 500 | 2 900 | – | 9 500 | 15 000 | 1,00 | **7019 ACD/HC** |
| **100** | 140 | 20 | 60 500 | 65 500 | 2 550 | 16 | 11 000 | 17 000 | 0,66 | **71920 CD/HC** |
| | 140 | 20 | 57 200 | 63 000 | 2 400 | – | 9 500 | 15 000 | 0,66 | **71920 ACD/HC** |
| | 150 | 24 | 83 200 | 85 000 | 3 200 | 16 | 10 000 | 16 000 | 1,05 | **7020 CD/HC** |
| | 150 | 24 | 46 200 | 43 000 | 1 630 | 11 | 14 000 | 20 000 | 1,10 | **7020 CE/HC** |
| | 150 | 24 | 79 300 | 80 000 | 3 050 | – | 9 500 | 15 000 | 1,05 | **7020 ACD/HC** |
| **105** | 145 | 20 | 61 800 | 69 500 | 2 600 | 16 | 10 000 | 16 000 | 0,69 | **71921 CD/HC** |
| | 145 | 20 | 57 200 | 65 500 | 2 500 | – | 9 500 | 15 000 | 0,69 | **71921 ACD/HC** |
| **110** | 150 | 20 | 62 400 | 72 000 | 2 700 | 17 | 10 000 | 16 000 | 0,72 | **71922 CD/HC** |
| | 150 | 20 | 58 500 | 68 000 | 2 550 | – | 9 000 | 14 000 | 0,72 | **71922 ACD/HC** |
| **120** | 165 | 22 | 78 000 | 91 500 | 3 250 | 16 | 9 000 | 14 000 | 0,97 | **71924 CD/HC** |
| | 165 | 22 | 72 800 | 86 500 | 3 050 | – | 8 500 | 13 000 | 0,97 | **71924 ACD/HC** |
| **130** | 180 | 24 | 92 300 | 108 000 | 3 650 | 16 | 8 500 | 13 000 | 1,30 | **71926 CD/HC** |
| | 180 | 24 | 87 100 | 102 000 | 3 450 | – | 8 000 | 12 000 | 1,30 | **71926 ACD/HC** |
| **140** | 190 | 24 | 95 600 | 116 000 | 3 900 | 17 | 8 000 | 12 000 | 1,35 | **71928 CD/HC** |
| | 190 | 24 | 90 400 | 110 000 | 3 650 | – | 7 500 | 11 000 | 1,35 | **71928 ACD/HC** |




| Dimensions | | | | | | Abutment and fillet dimensions | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_1$ ≈ | $D_1$ ≈ | $r_{1,2}$ min | $r_{3,4}$ min | a | $d_a$ min | $d_b$ min | $D_a$ max | $D_b$ max | $r_a$ max | $r_b$ max |
| mm | | | | | | mm | | | | | |
| **80** | 89,3 | 101 | 1 | 0,3 | 21 | 86 | – | 104 | 108 | 1 | 0,3 |
| | 90,2 | 99,8 | 1 | 0,3 | 21 | 86 | 83 | 104 | 108 | 1 | 0,3 |
| | 89,3 | 101 | 1 | 0,3 | 30 | 86 | – | 104 | 108 | 1 | 0,3 |
| | 94,4 | 111 | 1,1 | 0,6 | 25 | 87 | – | 118 | 121 | 1 | 0,6 |
| | 95,8 | 109,2 | 1,1 | 0,6 | 25 | 87 | 84 | 118 | 121 | 1 | 0,6 |
| | 94,4 | 111 | 1,1 | 0,6 | 35 | 87 | – | 118 | 121 | 1 | 0,6 |
| **85** | 95,8 | 110 | 1,1 | 0,6 | 23 | 92 | – | 113 | 115 | 1 | 0,6 |
| | 95,8 | 110 | 1,1 | 0,6 | 33 | 92 | – | 113 | 115 | 1 | 0,6 |
| | 99,4 | 116 | 1,1 | 0,6 | 26 | 92 | – | 123 | 126 | 1 | 0,6 |
| | 99,4 | 116 | 1,1 | 0,6 | 36 | 92 | – | 123 | 126 | 1 | 0,6 |
| **90** | 100 | 115 | 1,1 | 0,6 | 23 | 97 | – | 118 | 120 | 1 | 0,6 |
| | 101,7 | 113,3 | 1,1 | 0,6 | 24 | 97 | 95 | 118 | 120 | 1 | 0,6 |
| | 100 | 115 | 1,1 | 0,6 | 34 | 97 | – | 118 | 120 | 1 | 0,6 |
| | 106 | 124 | 1,5 | 0,6 | 28 | 99 | – | 131 | 135 | 1,5 | 0,6 |
| | 107,3 | 122,7 | 1,5 | 0,6 | 28 | 99 | 95 | 131 | 135 | 1,5 | 0,6 |
| | 106 | 124 | 1,5 | 0,6 | 39 | 99 | – | 131 | 135 | 1,5 | 0,6 |
| **95** | 105 | 120 | 1,1 | 0,6 | 24 | 102 | – | 123 | 125 | 1 | 0,6 |
| | 105 | 120 | 1,1 | 0,6 | 35 | 102 | – | 123 | 125 | 1 | 0,6 |
| | 111 | 129 | 1,5 | 0,6 | 28 | 104 | – | 136 | 140 | 1,5 | 0,6 |
| | 111 | 129 | 1,5 | 0,6 | 40 | 104 | – | 136 | 140 | 1,5 | 0,6 |
| **100** | 112 | 128 | 1,1 | 0,6 | 26 | 107 | – | 133 | 135 | 1 | 0,6 |
| | 112 | 128 | 1,1 | 0,6 | 38 | 107 | – | 133 | 135 | 1 | 0,6 |
| | 116 | 134 | 1,5 | 0,6 | 29 | 109 | – | 141 | 145 | 1,5 | 0,6 |
| | 117,3 | 132,7 | 1,5 | 0,6 | 29 | 109 | 105 | 141 | 145 | 1,5 | 0,6 |
| | 116 | 134 | 1,5 | 0,6 | 41 | 109 | – | 141 | 145 | 1,5 | 0,6 |
| **105** | 117 | 133 | 1,1 | 0,6 | 27 | 112 | – | 138 | 140 | 1 | 0,6 |
| | 117 | 133 | 1,1 | 0,6 | 39 | 112 | – | 138 | 140 | 1 | 0,6 |
| **110** | 122 | 138 | 1,1 | 0,6 | 27 | 117 | – | 143 | 145 | 1 | 0,6 |
| | 122 | 138 | 1,1 | 0,6 | 40 | 117 | – | 143 | 145 | 1 | 0,6 |
| **120** | 133 | 152 | 1,1 | 0,6 | 30 | 127 | – | 158 | 160 | 1 | 0,6 |
| | 133 | 152 | 1,1 | 0,6 | 44 | 127 | – | 158 | 160 | 1 | 0,6 |
| **130** | 145 | 165 | 1,5 | 0,6 | 33 | 139 | – | 171 | 175 | 1,5 | 0,6 |
| | 145 | 165 | 1,5 | 0,6 | 48 | 139 | – | 171 | 175 | 1,5 | 0,6 |
| **140** | 155 | 175 | 1,5 | 0,6 | 34 | 149 | – | 181 | 185 | 1,5 | 0,6 |
| | 155 | 175 | 1,5 | 0,6 | 51 | 149 | – | 181 | 185 | 1,5 | 0,6 |


SKF

# Cylindrical roller bearings



High precision cylindrical roller bearings are bearings with a low cross section, high load carrying capacity and little resilience. These properties make them particularly suitable for machine tool applications where spindle bearing arrangements are required to support heavy loads and have high stiffness. SKF produces double row as well as single row bearings.

**Double row cylindrical roller bearings**
Double row high precision cylindrical roller bearings are produced by SKF in the NN and NNU designs and in Dimension Series 30 and 49. The bearings of series NNU 49 have a particularly low cross section and give very stiff arrangements whereas those of series NN 30 have a somewhat higher cross section but can carry much heavier loads.

In bearings of the NN design (→ **fig** 1) the rollers are guided between integral flanges on the inner ring and in bearings of the NNU design (→ **fig** 2) between integral flanges in the outer ring. The other ring is without flanges. Axial displace-ment of the shaft relative to the housing in both directions can therefore take place, within certain limits, inside the bearings of both designs. The bearings are separable, i.e. the ring with integral flanges and the roller and cage assem-blies can be withdrawn from the other ring. This simplifies mounting and dismounting.

The bearings are produced with a cylindrical bore as well as with a tapered bore (taper 1:12); the bearings of series NN 30 normally have a tapered bore. Bearings with a tapered bore can be adjusted on mounting to a given radial clearance or preload.

In order to facilitate efficient lubrication, bearings of series NN 30 having a bore diameter of 50 mm and above and all bearings of series NNU 49 have an annular groove and three lubrication holes in the outer ring – the W33 feature.

Fig 1

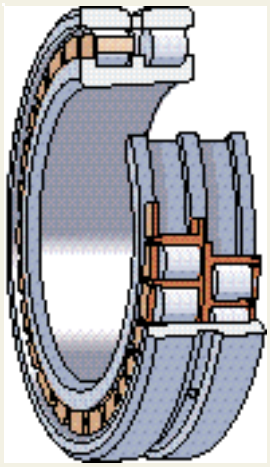


Fig 2

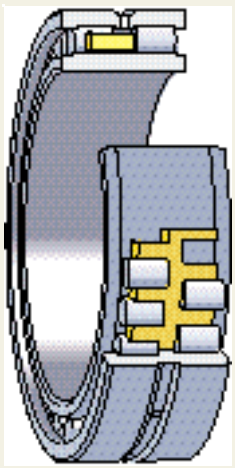
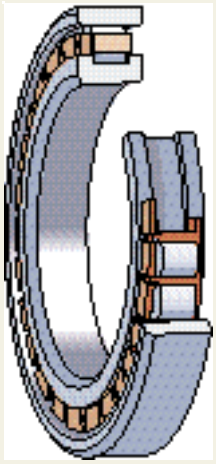


***Fig 1***
***Cylindrical roller bearing, NN design***

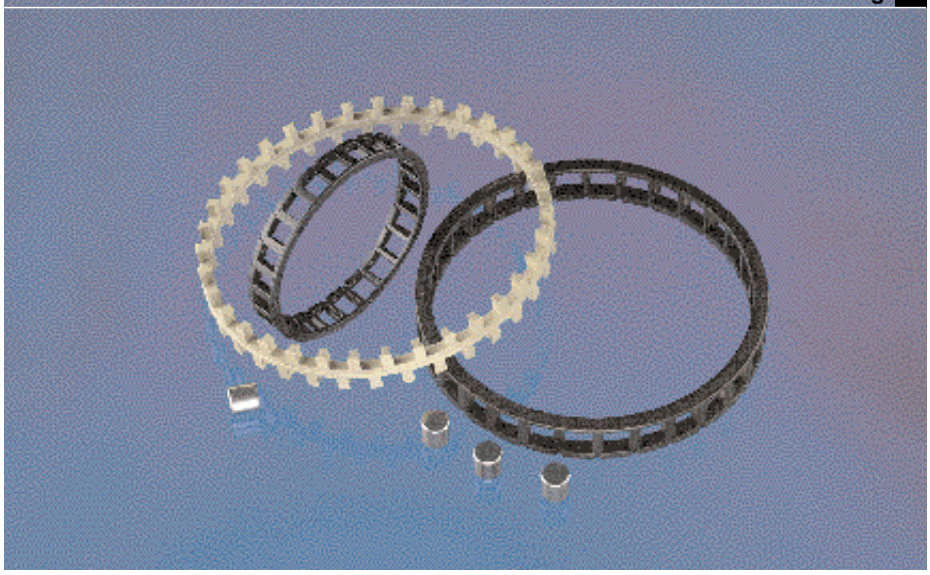
***Fig 2***
***Cylindrical roller bearing, NNU design***

Fig 3



*Cylindrical roller bearing, N design*

Fig 4



*Cages for double row cylindrical roller bearings*

## Single row cylindrical roller bearings

The single row high precision cylindrical roller bearings (➔ **fig** 3) are designed for bearing arrangements where the high load carrying capacity of the double row cylindrical roller bearings is not required. They belong to Dimension Series 10 which has the same diameters as the NN 30 bearings. They are produced exclusively with a tapered bore (taper 1:12) and the series is designated N 10 K.

The rollers of these single row bearings are guided between two integral flanges on the inner ring. The outer ring is without flanges. Axial displacement of the shaft relative to the housing in both directions can there-fore take place, within certain limits, inside the bearing itself. The bearings are also separable, i.e. the inner ring with integral flanges and the roller and cage assembly can be withdrawn from the outer ring. This facilitates mounting and dismounting.

## Cages

SKF double row cylindrical roller bearings are fitted, depending on series and size with either

- two separate pronged cages with cover, made of polyamide 6,6 or
- one double pronged machined brass cage (➔ **fig** 4)

The single row bearings of series N 10 K are fitted with the same polyamide cages as the corresponding size of series NN 30 K.

The bearings fitted with polyamide cages are identified by the designation suffix TN or TN9 and can be used without reservation at the temperatures normally occurring in machine tool applications. The cage properties are also not affected by the lubricants normally used for bearings, with the exception of some synthetic oils or greases with synthetic base oils.

## Dimensions

The boundary dimensions of the bearings shown in the tables are in accordance with ISO 15-1981, Dimension Series 10, 30 and 49.

## Tolerances

SKF high precision cylindrical roller bearings are produced to tolerance class SP specifications which were specially defined for machine tool applications. The double row bearings with tapered bore are also available to tolerance class UP specifications to special order.

The actual values of the tolerances for classes SP and UP are given in **Table** 3 to 5**, pages 69** to **71.**

### Internal clearance

The bearings made to tolerance class SP are produced with C1 radial in-ternal clearance as standard, although C1 does not appear in the bearing designation. The rings of one bearing may not be mixed with those of other bearings as otherwise the clearance may become inadmissibly large or small. The bearings are therefore supplied in individual packages, or if this is not the case, the components of a given bearing carry the same serial number.

Bearings to tolerance class SP, particularly those of series NNU 49, are also available with radial internal clearances greater than C1. When ordering it is necessary to state the required clearance class, viz.

| | |
|---|---|
| SPC2 | Radial internal clearance greater than C1 |
| CN | Normal radial internal clearance |
| C3 | Radial internal clearance greater than Normal |

The clearance limits are given in **Table 1** and are in accordance with ISO 5753:1991. The SPC2 clearance range is narrower than specified by ISO for C2 and displaced to the smaller side. The values in the table apply to bearings before mounting and under zero measuring load.

### Equivalent dynamic bearing load

For SKF high precision cylindrical roller bearings, which can only accommodate radial loads

$$P = F_r$$

### Equivalent static bearing load

For SKF high precision cylindrical roller bearings, which can only accommodate radial loads

$$P_0 = F_r$$

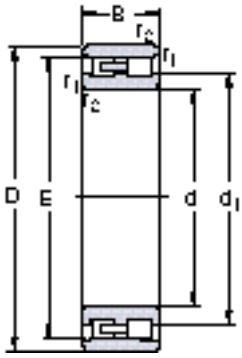
### Speed ratings

The ratings quoted in the bearings tables are guideline values which apply provided the bearings have a maximum preload in operation of 2 µm and the associated components are made with the recommended accuracy. Where heavier preloads occur or where the associated components are less accurate, the speed ratings must be reduced.

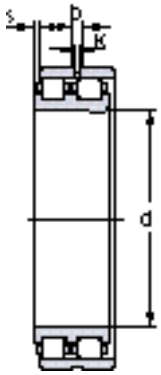
***Radial internal clearance of cylindrical roller bearings***

**Table 1**

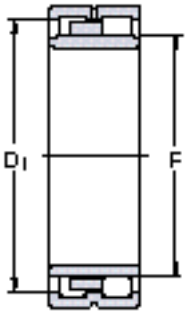
| Bore diameter | | Radial internal clearance | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Bearings with cylindrical bore | | | | | | | | Bearings with tapered bore | | | |
| d | | C1 | | SPC2 | | Normal | | C3 | | C1 | | SPC2 | |
| over | incl. | min | max | min | max | min | max | min | max | min | max | min | max |
| mm | | µm | | | | | | | | µm | | | |
| **24** | **30** | 5 | 15 | 10 | 25 | 20 | 45 | 35 | 60 | 15 | 25 | 25 | 35 |
| **30** | **40** | 5 | 15 | 12 | 25 | 25 | 50 | 45 | 70 | 15 | 25 | 25 | 40 |
| **40** | **50** | 5 | 18 | 15 | 30 | 30 | 60 | 50 | 80 | 17 | 30 | 30 | 45 |
| **50** | **65** | 5 | 20 | 15 | 35 | 40 | 70 | 60 | 90 | 20 | 35 | 35 | 50 |
| **65** | **80** | 10 | 25 | 20 | 40 | 40 | 75 | 65 | 100 | 25 | 40 | 40 | 60 |
| **80** | **100** | 10 | 30 | 25 | 45 | 50 | 85 | 75 | 110 | 35 | 55 | 45 | 70 |
| **100** | **120** | 10 | 30 | 25 | 50 | 50 | 90 | 85 | 125 | 40 | 60 | 50 | 80 |
| **120** | **140** | 10 | 35 | 30 | 60 | 60 | 105 | 100 | 145 | 45 | 70 | 60 | 90 |
| **140** | **160** | 10 | 35 | 35 | 65 | 70 | 120 | 115 | 165 | 50 | 75 | 65 | 100 |
| **160** | **180** | 10 | 40 | 35 | 75 | 75 | 125 | 120 | 170 | 55 | 85 | 75 | 110 |
| **180** | **200** | 15 | 45 | 40 | 80 | 90 | 145 | 140 | 195 | 60 | 90 | 80 | 120 |
| **200** | **225** | 15 | 50 | 45 | 90 | 105 | 165 | 160 | 220 | 60 | 95 | 90 | 135 |
| **225** | **250** | 15 | 50 | 50 | 100 | 110 | 175 | 170 | 235 | 65 | 100 | 100 | 150 |
| **250** | **280** | 20 | 55 | 55 | 110 | 125 | 195 | 190 | 260 | 75 | 110 | 110 | 165 |
| **280** | **315** | 20 | 60 | 60 | 120 | 130 | 205 | 200 | 275 | 80 | 120 | 120 | 180 |



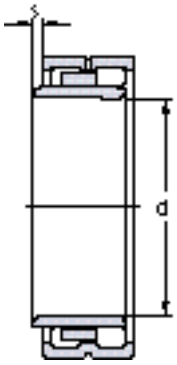

NN 30




NN 30 KTN/W33

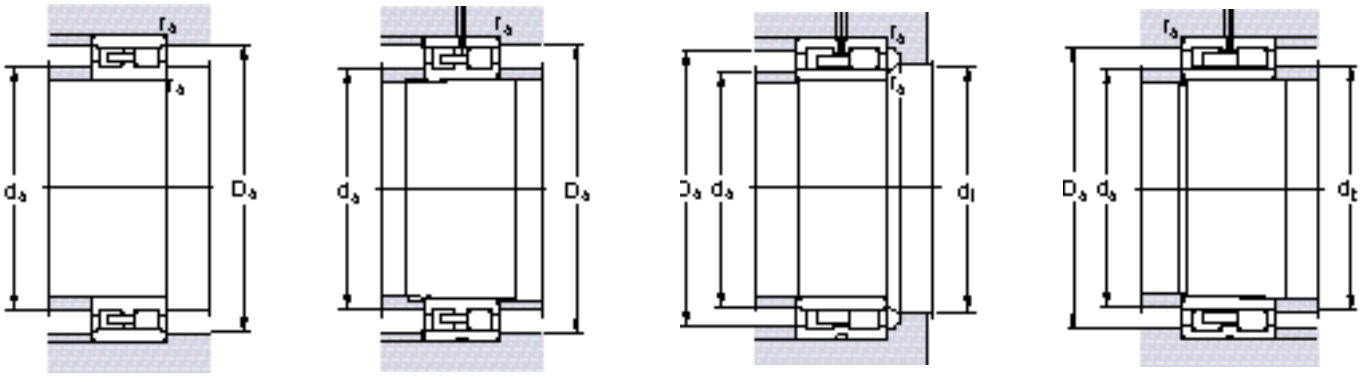



NNU 49 B/W33




NNU 49 BK/W33

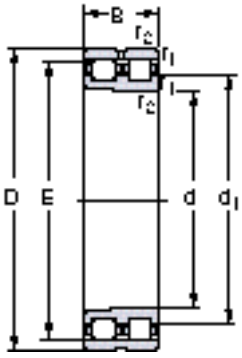
| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Speed ratings Lubrication grease | oil spot | Mass | Designation |
|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | | | | |
| mm | | | N | | N | r/min | | kg | – |
| **25** | 47 | 16 | 26 000 | 30 000 | 3 100 | 19 000 | 22 000 | 0,12 | **NN 3005 K** |
| **30** | 55 | 19 | 30 800 | 37 500 | 3 900 | 16 000 | 18 000 | 0,19 | **NN 3006** |
| | 55 | 19 | 30 800 | 37 500 | 3 900 | 16 000 | 18 000 | 0,19 | **NN 3006 KTN** |
| **35** | 62 | 20 | 39 100 | 50 000 | 5 400 | 14 000 | 16 000 | 0,25 | **NN 3007** |
| | 62 | 20 | 39 100 | 50 000 | 5 400 | 14 000 | 16 000 | 0,25 | **NN 3007 K** |
| **40** | 68 | 21 | 42 900 | 56 000 | 6 480 | 12 000 | 14 000 | 0,30 | **NN 3008 TN** |
| | 68 | 21 | 42 900 | 56 000 | 6 480 | 12 000 | 14 000 | 0,30 | **NN 3008 KTN** |
| **45** | 75 | 23 | 50 100 | 65 500 | 7 650 | 11 000 | 13 000 | 0,38 | **NN 3009 TN** |
| | 75 | 23 | 50 100 | 65 500 | 7 650 | 11 000 | 13 000 | 0,38 | **NN 3009 KTN** |
| **50** | 80 | 23 | 52 800 | 73 500 | 8 500 | 10 000 | 12 000 | 0,42 | **NN 3010 TN/W33** |
| | 80 | 23 | 52 800 | 73 500 | 8 500 | 10 000 | 12 000 | 0,42 | **NN 3010 KTN/W33** |
| **55** | 90 | 26 | 69 300 | 96500 | 11 600 | 9 500 | 11 000 | 0,62 | **NN 3011 TN/W33** |
| | 90 | 26 | 69 300 | 96 500 | 11 600 | 9 500 | 11 000 | 0,62 | **NN 3011 KTN/W33** |
| **60** | 95 | 26 | 73 700 | 106 000 | 12 700 | 9 000 | 10 000 | 0,66 | **NN 3012 TN/W33** |
| | 95 | 26 | 73 700 | 106 000 | 12 700 | 9 000 | 10 000 | 0,66 | **NN 3012 KTN/W33** |
| **65** | 100 | 26 | 76 500 | 116 000 | 13 700 | 8 500 | 9 500 | 0,71 | **NN 3013 TN/W33** |
| | 100 | 26 | 76 500 | 116 000 | 13 700 | 8 500 | 9 500 | 0,71 | **NN 3013 KTN/W33** |
| **70** | 110 | 30 | 96 800 | 150 000 | 17 300 | 7 500 | 8 500 | 1,00 | **NN 3014 TN/W33** |
| | 110 | 30 | 96 800 | 150 000 | 17 300 | 7 500 | 8 500 | 1,00 | **NN 3014 KTN/W33** |
| **75** | 115 | 30 | 96 800 | 150 000 | 17 600 | 7 000 | 8 000 | 1,10 | **NN 3015 TN/W33** |
| | 115 | 30 | 96 800 | 150 000 | 17 600 | 7 000 | 8 000 | 1,10 | **NN 3015 KTN/W33** |
| **80** | 125 | 34 | 119 000 | 186 000 | 22 000 | 6 700 | 7 500 | 1,45 | **NN 3016 TN/W33** |
| | 125 | 34 | 119 000 | 186 000 | 22 000 | 6 700 | 7 500 | 1,50 | **NN 3016 KTN/W33** |
| **85** | 130 | 34 | 125 000 | 204 000 | 23 200 | 6 300 | 7 000 | 1,60 | **NN 3017 TN9/W33** |
| | 130 | 34 | 125 000 | 204 000 | 23 200 | 6 300 | 7 000 | 1,55 | **NN 3017 KTN9/W33** |
| **90** | 140 | 37 | 138 000 | 216 000 | 26 000 | 6 000 | 6 700 | 2,00 | **NN 3018 TN9/W33** |
| | 140 | 37 | 138 000 | 216 000 | 26 000 | 6 000 | 6 700 | 1,95 | **NN 3018 KTN9/W33** |
| **95** | 145 | 37 | 142 000 | 232 000 | 27 500 | 5 600 | 6 300 | 2,10 | **NN 3019 TN9/W33** |
| | 145 | 37 | 142 000 | 232 000 | 27 500 | 5 000 | 6 300 | 2,05 | **NN 3019 KTN9/W33** |
| **100** | 140 | 40 | 128 000 | 255 000 | 29 000 | 5 600 | 6 300 | 1,90 | **NNU 4920 B/W33** |
| | 140 | 40 | 128 000 | 255 000 | 29 000 | 5 600 | 6 300 | 1,80 | **NNU 4920 BK/W33** |
| | 150 | 37 | 151 000 | 250 000 | 29 000 | 5 300 | 6 000 | 2,20 | **NN 3020 TN9/W33** |
| | 150 | 37 | 151 000 | 250 000 | 29 000 | 5 300 | 6 000 | 2,10 | **NN 3020 KTN9/W33** |



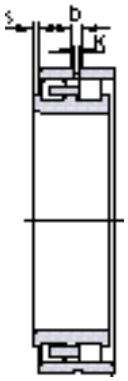
| Dimensions | | | | | | | Abutment and fillet dimensions | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_1$, $D_1$ ≈ | E, F | b | K | $r_{1,2}$ min | s | $d_a$ min | $d_a$ max | $d_b$ min | $D_a$ max | $D_a$ min | $r_a$ max |
| mm | | | | | | | mm | | | | | |
| **25** | 33,3 | 41,3 | – | – | 0,6 | 1,4 | 29 | – | – | 43 | 42 | 0,6 |
| **30** | 39,7 | 48,5 | – | – | 1 | 1,8 | 35 | – | – | 50 | 49 | 1 |
| | 39,7 | 48,5 | – | – | 1 | 1,8 | 35 | – | – | 50 | 49 | 1 |
| **35** | 45,4 | 55 | – | – | 1 | 1,8 | 40 | – | – | 57 | 56 | 1 |
| | 45,4 | 55 | – | – | 1 | 1,8 | 40 | – | – | 57 | 56 | 1 |
| **40** | 50,6 | 61 | – | – | 1 | 1,3 | 45 | – | – | 63 | 62 | 1 |
| | 50,6 | 61 | – | – | 1 | 1,3 | 45 | – | – | 63 | 62 | 1 |
| **45** | 56,3 | 67,5 | – | – | 1 | 2 | 50 | – | – | 70 | 69 | 1 |
| | 56,3 | 67,5 | – | – | 1 | 2 | 50 | – | – | 70 | 69 | 1 |
| **50** | 61,3 | 72,5 | 3,7 | 2 | 1 | 2 | 55 | – | – | 75 | 74 | 1 |
| | 61,3 | 72,5 | 3,7 | 2 | 1 | 2 | 55 | – | – | 75 | 74 | 1 |
| **55** | 68,2 | 81 | 3,7 | 2 | 1,1 | 2 | 61,5 | – | – | 83,5 | 82 | 1 |
| | 68,2 | 81 | 3,7 | 2 | 1,1 | 2 | 61,5 | – | – | 83,5 | 82 | 1 |
| **60** | 73,3 | 86,1 | 3,7 | 2 | 1,1 | 2 | 66,5 | – | – | 88,5 | 87 | 1 |
| | 73,3 | 86,1 | 3,7 | 2 | 1,1 | 2 | 66,5 | – | – | 88,5 | 87 | 1 |
| **65** | 78,2 | 91 | 3,7 | 2 | 1,1 | 2 | 71,5 | – | – | 93,5 | 92 | 1 |
| | 78,2 | 91 | 3,7 | 2 | 1,1 | 2 | 71,5 | – | – | 93,5 | 92 | 1 |
| **70** | 85,6 | 100 | 5,5 | 3 | 1,1 | 2,5 | 76,5 | – | – | 103,5 | 101 | 1 |
| | 85,6 | 100 | 5,5 | 3 | 1,1 | 2,5 | 76,5 | – | – | 103,5 | 101 | 1 |
| **75** | 90,6 | 105 | 5,5 | 3 | 1,1 | 2,5 | 81,5 | – | – | 108,5 | 106 | 1 |
| | 90,6 | 105 | 5,5 | 3 | 1,1 | 2,5 | 81,5 | – | – | 108,5 | 106 | 1 |
| **80** | 97 | 113 | 5,5 | 3 | 1,1 | 3 | 86,5 | – | – | 118,5 | 114 | 1 |
| | 97 | 113 | 5,5 | 3 | 1,1 | 3 | 86,5 | – | – | 118,5 | 114 | 1 |
| **85** | 102 | 118 | 5,5 | 3 | 1,1 | 2,5 | 91,5 | – | – | 123,5 | 119 | 1 |
| | 102 | 118 | 5,5 | 3 | 1,1 | 2,5 | 91,5 | – | – | 123,5 | 119 | 1 |
| **90** | 109 | 127 | 5,5 | 3 | 1,5 | 2,8 | 98 | – | – | 132 | 129 | 1,5 |
| | 109 | 127 | 5,5 | 3 | 1,5 | 2,8 | 98 | – | – | 132 | 129 | 1,5 |
| **95** | 114 | 132 | 5,5 | 3 | 1,5 | 2,8 | 103 | – | – | 137 | 134 | 1,5 |
| | 114 | 132 | 5,5 | 3 | 1,5 | 2,8 | 103 | – | – | 137 | 134 | 1,5 |
| **100** | 126 | 113 | 5,5 | 3 | 1,1 | 1,7 | 106,5 | 111 | 116 | 133,5 | – | 1 |
| | 126 | 113 | 5,5 | 3 | 1,1 | 1,7 | 106,5 | 111 | 116 | 133,5 | – | 1 |
| | 119 | 137 | 5,5 | 3 | 1,5 | 2,8 | 108 | – | – | 142 | 139 | 1,5 |
| | 119 | 137 | 5,5 | 3 | 1,5 | 2,8 | 108 | – | – | 142 | 139 | 1,5 |

## Cylindrical roller bearings, double row

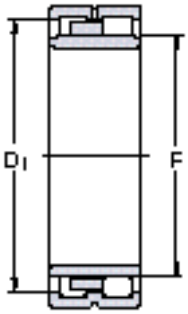
d **105 – 220** mm



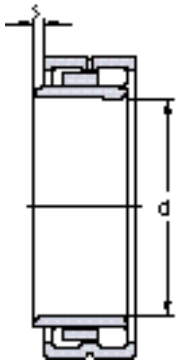

NN 30 KTN9/W33




NN 30 K/W33

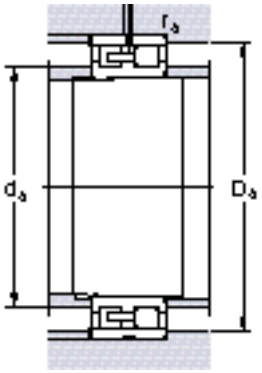


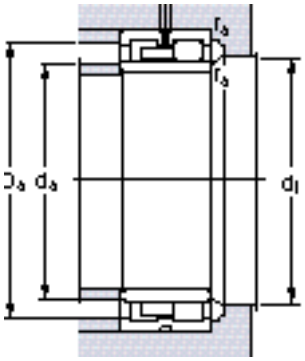

NNU 49 B/W33

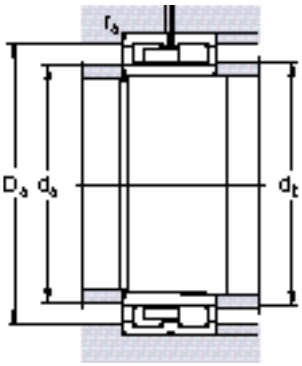



NNU 49 BK/W33

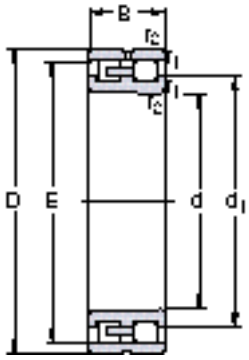
| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Speed ratings Lubrication grease | oil spot | Mass | Designation |
|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | | | | |
| mm | | | N | | N | r/min | | kg | – |
| **105** | 145 | 40 | 130 000 | 260 000 | 29 000 | 5 300 | 6 000 | 2,00 | **NNU 4921 B/W33** |
| | 145 | 40 | 130 000 | 260 000 | 29 000 | 5 300 | 6 000 | 1,90 | **NNU 4921 BK/W33** |
| | 160 | 41 | 190 000 | 305 000 | 36 000 | 5 000 | 5 600 | 2,70 | **NN 3021 KTN9/W33** |
| **110** | 150 | 40 | 132 000 | 270 000 | 30 000 | 5 300 | 6 000 | 2,05 | **NNU 4922 B/W33** |
| | 150 | 40 | 132 000 | 270 000 | 30 000 | 5 300 | 6 000 | 1,95 | **NNU 4922 BK/W33** |
| | 170 | 45 | 220 000 | 360 000 | 41 500 | 4 800 | 5 300 | 3,40 | **NN 3022 KTN9/W33** |
| **120** | 165 | 45 | 176 000 | 340 000 | 37 500 | 4 800 | 5 300 | 2,80 | **NNU 4924 B/W33** |
| | 165 | 45 | 176 000 | 340 000 | 37 500 | 4 800 | 5 300 | 2,65 | **NNU 4924 BK/W33** |
| | 180 | 46 | 229 000 | 390 000 | 44 000 | 4 500 | 5 000 | 3,70 | **NN 3024 KTN9/W33** |
| **130** | 180 | 50 | 187 000 | 390 000 | 41 500 | 4 300 | 4 800 | 3,85 | **NNU 4926 B/W33** |
| | 180 | 50 | 187 000 | 390 000 | 41 500 | 4 300 | 4 800 | 3,65 | **NNU 4926 BK/W33** |
| | 200 | 52 | 286 000 | 475 000 | 53 000 | 4 000 | 4 500 | 5,55 | **NN 3026 KTN9/W33** |
| **140** | 190 | 50 | 190 000 | 400 000 | 41 500 | 4 000 | 4 500 | 4,10 | **NNU 4928 B/W33** |
| | 190 | 50 | 190 000 | 400 000 | 41 500 | 4 000 | 4 500 | 3,90 | **NNU 4928 BK/W33** |
| | 210 | 53 | 297 000 | 520 000 | 56 000 | 3 800 | 4 300 | 6,00 | **NN 3028 K/W33** |
| **150** | 210 | 60 | 330 000 | 655 000 | 71 000 | 3 800 | 4 300 | 6,25 | **NNU 4930 B/W33** |
| | 210 | 60 | 330 000 | 655 000 | 71 000 | 3 800 | 4 300 | 6,15 | **NNU 4930 BK/W33** |
| | 225 | 56 | 330 000 | 570 000 | 62 000 | 3 600 | 4 000 | 7,30 | **NN 3030 K/W33** |
| **160** | 220 | 60 | 330 000 | 680 000 | 72 000 | 3 600 | 4 000 | 6,60 | **NNU 4932 B/W33** |
| | 220 | 60 | 330 000 | 680 000 | 72 000 | 3 600 | 4 000 | 6,30 | **NNU 4932 BK/W33** |
| | 240 | 60 | 369 000 | 655 000 | 69 500 | 3 400 | 3 800 | 8,80 | **NN 3032 K/W33** |
| **170** | 230 | 60 | 336 000 | 695 000 | 73 500 | 3 400 | 3 800 | 6,95 | **NNU 4934 B/W33** |
| | 230 | 60 | 336 000 | 695 000 | 73 500 | 3 400 | 3 800 | 6,65 | **NNU 4934 BK/W33** |
| | 260 | 67 | 457 000 | 815 000 | 85 000 | 3 000 | 3 400 | 12,0 | **NN 3034 K/W33** |
| **180** | 250 | 69 | 402 000 | 850 000 | 88 000 | 3 000 | 3 400 | 10,5 | **NNU 4936 B/W33** |
| | 250 | 69 | 402 000 | 850 000 | 88 000 | 3 000 | 3 400 | 10,0 | **NNU 4936 BK/W33** |
| | 280 | 74 | 561 000 | 1 000 000 | 102 000 | 2 800 | 3 200 | 16,0 | **NN 3036 K/W33** |
| **190** | 260 | 69 | 402 000 | 880 000 | 90 000 | 2 800 | 3 200 | 11,0 | **NNU 4938 B/W33** |
| | 260 | 69 | 402 000 | 880 000 | 90 000 | 2 800 | 3 200 | 10,5 | **NNU 4938 BK/W33** |
| | 290 | 75 | 594 000 | 1 080 000 | 108 000 | 2 600 | 3 000 | 17,0 | **NN 3038 K/W33** |
| **200** | 280 | 80 | 484 000 | 1 040 000 | 106 000 | 2 600 | 3 000 | 15,0 | **NNU 4940 B/W33** |
| | 280 | 80 | 484 000 | 1 040 000 | 106 000 | 2 600 | 3 000 | 14,5 | **NNU 4940 BK/W33** |
| | 310 | 82 | 644 000 | 1 140 000 | 118 000 | 2 400 | 2 800 | 21,0 | **NN 3040 K/W33** |
| **220** | 300 | 80 | 512 000 | 1 140 000 | 114 000 | 2 400 | 2 800 | 16,5 | **NNU 4944 B/W33** |
| | 300 | 80 | 512 000 | 1 140 000 | 114 000 | 2 400 | 2 800 | 16,0 | **NNU 4944 BK/W33** |
| | 340 | 90 | 809 000 | 1 460 000 | 143 000 | 2 200 | 2 600 | 27,5 | **NN 3044 K/W33** |



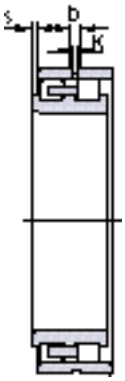



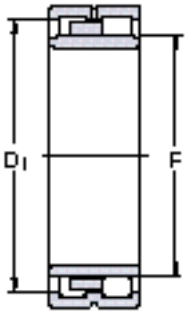

| Dimensions | | | | | | | Abutment and fillet dimensions | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_1$, $D_1$ ≈ | E, F | b | K | $r_{1,2}$ min | s | $d_a$ min | $d_a$ max | $d_b$ min | $D_a$ max | $D_a$ min | $r_a$ max |
| mm | | | | | | | mm | | | | | |
| **105** | 131 | 118 | 5,5 | 3 | 1,1 | 1,7 | 111,5 | 116 | 121 | 138,5 | – | 1 |
| | 131 | 118 | 5,5 | 3 | 1,1 | 1,7 | 111,5 | 116 | 121 | 138,5 | – | 1 |
| | 125 | 146 | 5,5 | 3 | 2 | 1,8 | 115 | – | – | 150 | 148 | 2 |
| **110** | 136 | 123 | 5,5 | 3 | 1,1 | 1,7 | 116,5 | 121 | 126 | 143,5 | – | 1 |
| | 136 | 123 | 5,5 | 3 | 1,1 | 1,7 | 116,5 | 121 | 126 | 143,5 | – | 1 |
| | 132 | 155 | 5,5 | 3 | 2 | 3,8 | 120 | – | – | 160 | 157 | 2 |
| **120** | 151 | 134,5 | 5,5 | 3 | 1,1 | 1,7 | 126,5 | 133 | 137 | 158,5 | – | 1 |
| | 151 | 134,5 | 5,5 | 3 | 1,1 | 1,7 | 126,5 | 133 | 137 | 158,5 | – | 1 |
| | 142 | 165 | 5,5 | 3 | 2 | 3,8 | 130 | – | – | 170 | 167 | 2 |
| **130** | 162 | 146 | 5,5 | 3 | 1,5 | 2,2 | 138 | 144 | 149 | 172 | – | 1,5 |
| | 162 | 146 | 5,5 | 3 | 1,5 | 2,2 | 138 | 144 | 149 | 172 | – | 1,5 |
| | 156 | 182 | 8,3 | 4,5 | 1,1 | 3,8 | 140 | – | – | 190 | 183 | 2 |
| **140** | 172 | 156 | 5,5 | 3 | 1,5 | 2,2 | 148 | 154 | 159 | 182 | – | 1,5 |
| | 172 | 156 | 5,5 | 3 | 1,5 | 2,2 | 148 | 154 | 159 | 182 | – | 1,5 |
| | 166 | 192 | 8,3 | 4,5 | 2 | 3,8 | 150 | – | – | 200 | 194 | 2 |
| **150** | 191 | 168,5 | 5,5 | 3 | 2 | 2 | 160 | 166 | 172 | 200 | – | 2 |
| | 191 | 168,5 | 5,5 | 3 | 2 | 2 | 160 | 166 | 172 | 200 | – | 2 |
| | 178 | 206 | 8,3 | 4,5 | 2,1 | 4 | 161 | – | – | 214 | 208 | 2 |
| **160** | 201 | 178,5 | 5,5 | 3 | 2 | 2 | 170 | 176 | 182 | 210 | – | 2 |
| | 201 | 178,5 | 5,5 | 3 | 2 | 2 | 170 | 176 | 182 | 210 | – | 2 |
| | 190 | 219 | 8,3 | 4,5 | 2,1 | 5 | 171 | – | – | 229 | 221 | 2 |
| **170** | 211 | 188,5 | 5,5 | 3 | 2 | 2 | 180 | 186 | 192 | 220 | – | 2 |
| | 211 | 188,5 | 5,5 | 3 | 2 | 2 | 180 | 186 | 192 | 220 | – | 2 |
| | 204 | 236 | 8,3 | 4,5 | 2,1 | 5 | 181 | – | – | 249 | 238 | 2 |
| **180** | 226 | 202 | 8,3 | 4,5 | 2 | 1,1 | 190 | 199 | 205 | 240 | – | 2 |
| | 226 | 202 | 8,3 | 4,5 | 2 | 1,1 | 190 | 199 | 205 | 240 | – | 2 |
| | 218 | 255 | 11,1 | 6 | 2,1 | 5 | 191 | – | – | 269 | 257 | 2 |
| **190** | 236 | 212 | 8,3 | 4,5 | 2 | 1,1 | 200 | 209 | 215 | 250 | – | 2 |
| | 236 | 212 | 8,3 | 4,5 | 2 | 1,1 | 200 | 209 | 215 | 250 | – | 2 |
| | 228 | 265 | 11,1 | 6 | 2,1 | 5 | 201 | – | – | 279 | 267 | 2 |
| **200** | 253 | 225 | 11,1 | 6 | 2,1 | 3,7 | 211 | 222 | 228 | 269 | – | 2 |
| | 253 | 225 | 11,1 | 6 | 2,1 | 3,7 | 211 | 222 | 228 | 269 | – | 2 |
| | 242 | 282 | 11,1 | 6 | 2,1 | 6,5 | 211 | – | – | 299 | 285 | 2 |
| **220** | 273 | 245 | 11,1 | 6 | 2,1 | 3,7 | 231 | 242 | 249 | 289 | – | 2 |
| | 273 | 245 | 11,1 | 6 | 2,1 | 3,7 | 231 | 242 | 249 | 289 | – | 2 |
| | 265 | 310 | 13,9 | 7,5 | 3 | 7,4 | 233 | – | – | 327 | 313 | 2,5 |



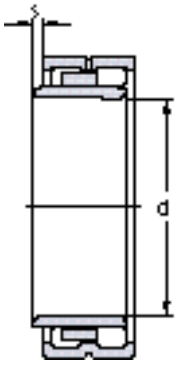

NN 30 K/W33




NN 30 K/W33

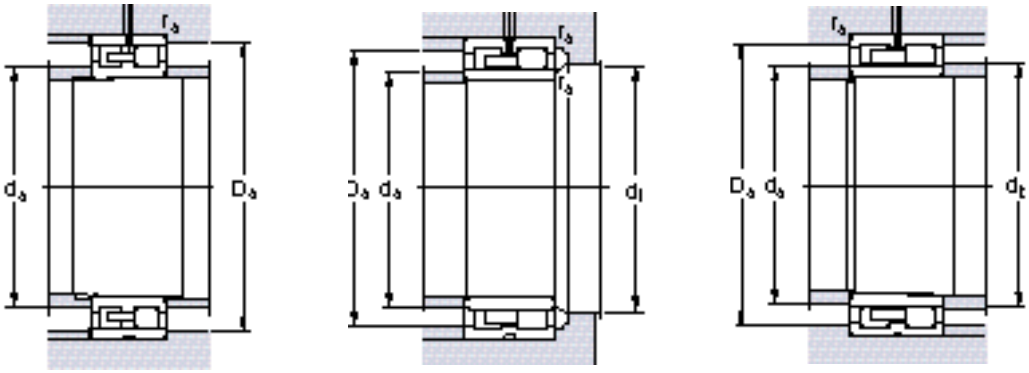



NNU 49 B/W33

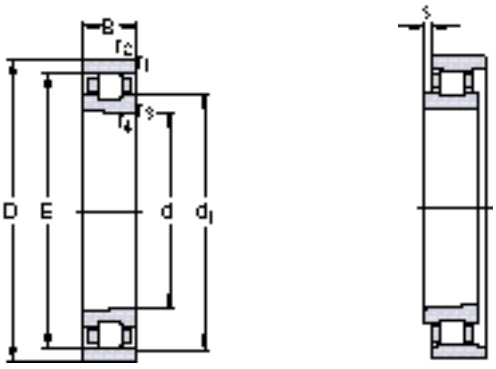



NNU 49 BK/W33

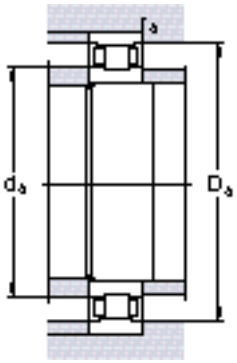
| **Principal dimensions** | | | **Basic load ratings** dynamic | static | **Fatigue load limit** | **Speed ratings** Lubrication grease | oil spot | **Mass** | **Designation** |
|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | | | | |
| mm | | | N | | N | r/min | | kg | – |
| **240** | 320 | 80 | 528 000 | 1 220 000 | 118 000 | 2 200 | 2 600 | 17,5 | **NNU 4948 B/W33** |
| | 320 | 80 | 528 000 | 1 220 000 | 118 000 | 2 200 | 2 600 | 16,5 | **NNU 4948 BK/W33** |
| | 360 | 92 | 842 000 | 1 560 000 | 153 000 | 2 000 | 2 400 | 30,5 | **NN 3048 K/W33** |
| **260** | 360 | 100 | 748 000 | 1 700 000 | 163 000 | 2 000 | 2 400 | 30,5 | **NNU 4952 B/W33** |
| | 360 | 100 | 748 000 | 1 700 000 | 163 000 | 2 000 | 2 400 | 29,5 | **NNU 4952 BK/W33** |
| **280** | 380 | 100 | 765 000 | 1 800 000 | 170 000 | 1 900 | 2 200 | 32,5 | **NNU 4956 B/W33** |
| | 380 | 100 | 765 000 | 1 800 000 | 170 000 | 1 900 | 2 200 | 31,5 | **NNU 4956 BK/W33** |
| **300** | 420 | 118 | 1 020 000 | 2 360 000 | 224 000 | 1 800 | 2 000 | 50,0 | **NNU 4960 B/W33** |
| | 420 | 118 | 1 020 000 | 2 360 000 | 224 000 | 1 800 | 2 000 | 48,5 | **NNU 4960 BK/W33** |



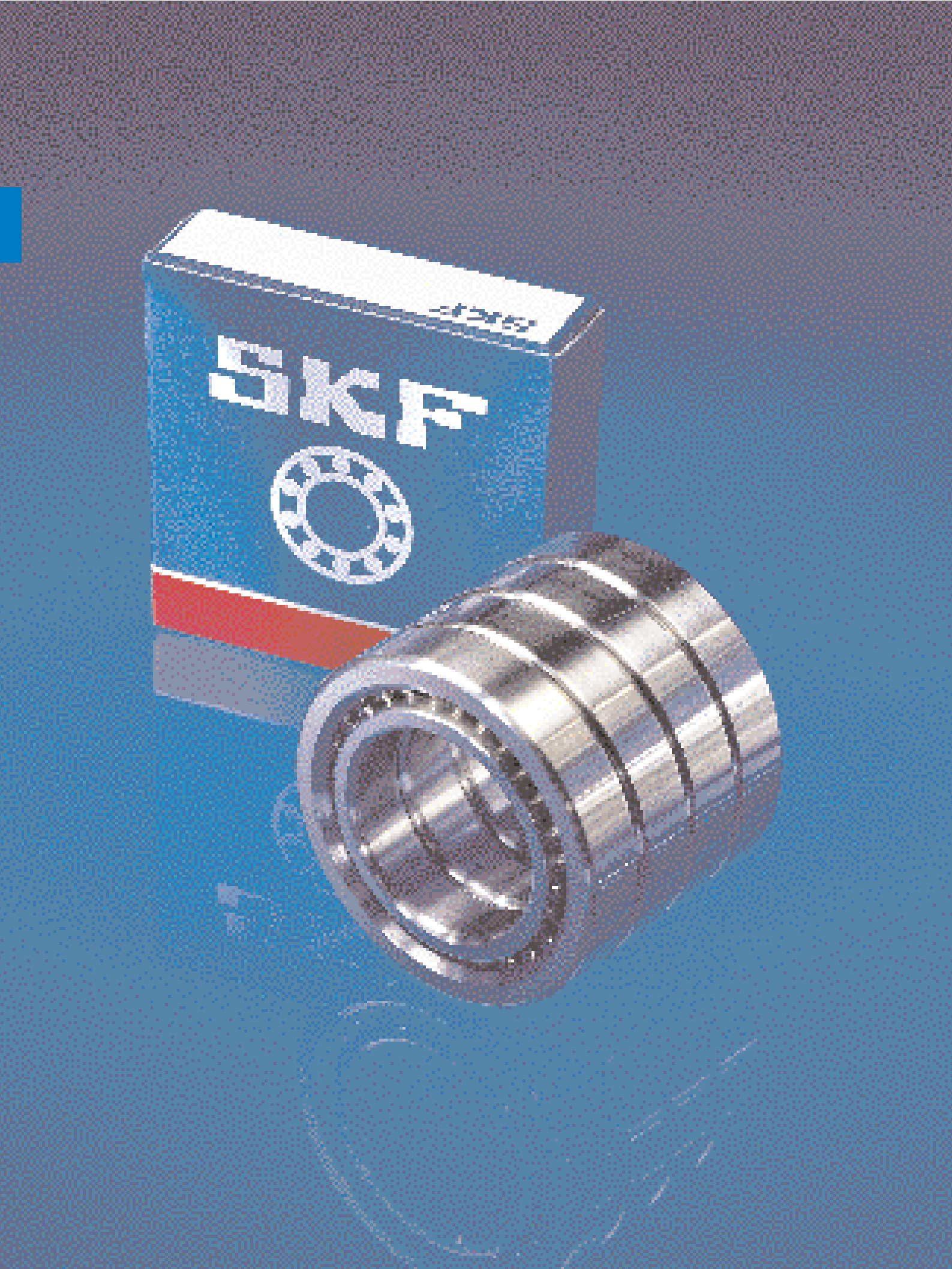

| Dimensions | | | | | | | Abutment and fillet dimensions | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_1$, $D_1$ ≈ | E, F | b | K | $r_{1,2}$ min | s | $d_a$ min | $d_a$ max | $d_b$ min | $D_a$ max | $D_a$ min | $r_a$ max |
| mm | | | | | | | mm | | | | | |
| **240** | 293 | 265 | 11,1 | 6 | 2,1 | 3,7 | 251 | 262 | 269 | 309 | – | 2 |
| | 293 | 265 | 11,1 | 6 | 2,1 | 3,7 | 251 | 262 | 269 | 309 | – | 2 |
| | 285 | 330 | 13,9 | 7,5 | 3 | 7,4 | 253 | – | – | 347 | 333 | 2,5 |
| **260** | 326 | 292 | 13,9 | 7,5 | 2,1 | 4,5 | 271 | 288 | 296 | 349 | – | 2 |
| | 326 | 292 | 13,9 | 7,5 | 2,1 | 4,5 | 271 | 288 | 296 | 349 | – | 2 |
| **280** | 346 | 312 | 13,9 | 7,5 | 2,1 | 4,5 | 291 | 308 | 316 | 369 | – | 2 |
| | 346 | 312 | 13,9 | 7,5 | 2,1 | 4,5 | 291 | 308 | 316 | 369 | – | 2 |
| **300** | 379 | 339 | 16,7 | 9 | 3 | 5,5 | 313 | 335 | 343 | 407 | – | 2,5 |
| | 379 | 339 | 16,7 | 9 | 3 | 5,5 | 313 | 335 | 343 | 407 | – | 2,5 |




| **Principal dimensions** | | | **Basic load ratings** dynamic | static | **Fatigue load limit** | **Speed ratings** Lubrications grease | oil spot | **Mass** | **Designation** |
|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | | | | |
| mm | | | N | | N | r/min | | kg | – |
| **50** | 80 | 16 | 30 800 | 36 500 | 4 250 | 12 000 | 14 000 | 0,26 | **N 1010 KTN** |
| **65** | 100 | 18 | 44 600 | 58 500 | 6 800 | 9 500 | 11 000 | 0,44 | **N 1013 KTN** |
| **70** | 110 | 20 | 57 200 | 75 000 | 8 650 | 9 000 | 10 000 | 0,62 | **N 1014 KTN** |
| **80** | 125 | 22 | 69 300 | 93 000 | 11 000 | 8 000 | 9 000 | 0,89 | **N 1016 KTN9** |
| **85** | 130 | 22 | 73 700 | 102 000 | 11 600 | 7 500 | 8 500 | 0,93 | **N 1017 KTN9** |
| **95** | 145 | 24 | 84 200 | 116 000 | 14 000 | 6 700 | 7 500 | 1,25 | **N 1019 KTN9** |
| **100** | 150 | 24 | 88 000 | 125 000 | 14 600 | 6 700 | 7 500 | 1,30 | **N 1020 KTN9** |
| **110** | 170 | 28 | 128 000 | 180 000 | 20 800 | 5 600 | 6 300 | 2,05 | **N 1022 KTN9** |




| Dimensions | | | | | | Abutment and fillet dimensions | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_1$ ≈ | E | $r_{1,2}$ min | $r_{3,4}$ min | s | $d_a$ min | $d_a$ max | $D_a$ min | $D_a$ max | $r_a$ max |
| mm | | | | | | mm | | | | |
| **50** | 61,3 | 72,5 | 1 | 0,5 | 3 | 55 | 70 | 74 | 75 | 1 |
| **65** | 78,2 | 91 | 1,1 | 0,6 | 3 | 71,5 | 89 | 92 | 93,5 | 1 |
| **70** | 85,6 | 100 | 1,1 | 0,6 | 3,5 | 76,5 | 98 | 101 | 103,5 | 1 |
| **80** | 97 | 113 | 1,1 | 0,6 | 3,5 | 86,5 | 110 | 114 | 118,5 | 1 |
| **85** | 102 | 118 | 1,1 | 0,6 | 3,5 | 91,5 | 115 | 119 | 123,5 | 1 |
| **95** | 114 | 132 | 1,5 | 1 | 4 | 103 | 129 | 134 | 137 | 1,5 |
| **100** | 119 | 137 | 1,5 | 1 | 4 | 108 | 134 | 139 | 142 | 1,5 |
| **110** | 132 | 155 | 2 | 1 | 4 | 119 | 152 | 157 | 161 | 2 |

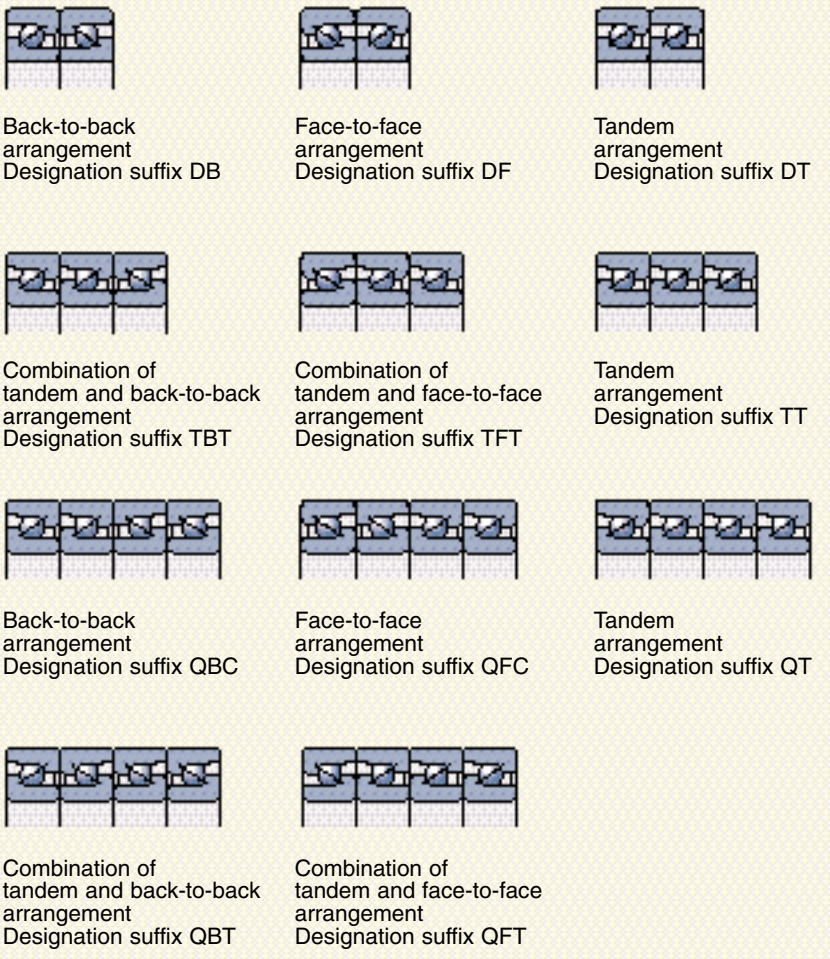

SKF

# Single direction angular contact thrust ball bearings



The single direction angular contact thrust ball bearings (screw support bearings) were specially developed for the support of ball and roller screws in machine tool applications, but can be used successfully in other applications. The bearings are characterised by high axial stiffness, high running accuracy and low friction torque.

Fig 1




***Possible combinations of matched bearing sets***

SKF single direction angular contact thrust ball bearings are non-separable. The particularly close conformity of the raceways to the balls and the contact angle of 60° contribute to the necessary high axial stiffness and high axial load carrying capacity.

Single direction angular contact thrust ball bearings can only accept axial loads acting in one direction and must therefore be adjusted against a second bearing which provides location in the opposite direction. To meet all the demands for different bearing arrangements, these bearings can be supplied singly for universal mounting or in matched sets. Bearing sets are used when the load carrying capacity of a single bearing is inadequate and/or when the bearing arrangement is required to take up axial loads acting in both directions.

**Matched bearing sets**

SKF single direction angular contact ball bearings can be supplied in matched sets of two, three or four bearings. The possible combinations are shown in **fig** 1.

The sets of bearings are matched during production so that when mounted immediately adjacent to each other, the predetermined value of the preload and/or an even distribution of the load will be obtained. The bore and outside diameters of the bearings of a set differ at the most by half the permissible tolerance range.

To ensure that the bearings of a set are mounted in the right order, the outside cylindrical surfaces are marked with a “V”. The matched bearing sets are supplied as packaged units, each bearing of the set being individually packed within the unit package.

### Bearings for universal mounting

A special design of the single direction angular contact thrust ball bearings is available for universal mounting in sets. These bearings are produced so that they can be mounted immediately adjacent to each other in random order. When mounted in a back-to-back or face-to-face arrangement, the bearings will have a suitable preload.

Bearings for universal pairing are identified by the suffix G followed by A or B to indicate the preload class, e.g. BSD 2047 C/GA. When ordering, it is necessary to state the number of individual bearings required and not the number of sets.

Sets of two bearings for universal pairing which have matched bore and outside diameters are also available. These bearings are identified by the designation suffix DGA or DGB, depending on preload class, e.g. BSD 2047 C/DGB. Here it is necessary to state the number of sets required when ordering, not the number of individual bearings.

### Cartridge units

In order to simplify still further the arrangement and mounting of screw support bearings, cartridge units consisting of SKF single direction angular contact ball bearings filled with grease and mounted in a flanged housing are also available (➔ **fig** 2). There is a choice of units with two bearings, or two bearing pairs in tandem, arranged back-to-back or face-to-face. Further details will be supplied on request.

Fig 2

***Cartridge unit with four single direction angular contact thrust ball bearings***

### Cages

SKF single direction angular contact thrust ball bearings are fitted with a ball-centred cage of glass fibre rein-forced polyamide 6,6.

### Dimensions

The boundary dimensions of SKF single row angular contact thrust ball bearings of series BSA 2 and BSA 3 follow the Dimension Plan for radial bearings in ISO 15-1981. The dimensions of bearings of series BSD and BDAB are not standardised.

### Tolerances

SKF single direction angular contact thrust ball bearings are made to the tolerances shown in **Table** 6 on **page 72**. The dimensional accuracy corresponds to ISO 492:1994 class 4, whilst the running accuracy is according to ANSI/ABMA Std. 20-1987, although these standards apply to radial bearings. The values given in the table apply to single bearings.

The axial runout (lateral eccentricity) of a single direction angular contact thrust ball bearing is an important parameter. For matched sets which are correctly mounted on accurately ma-chined seatings, the axial runout will generally not exceed 2,5 µm.

### Preload

All bearing sets of two bearings ar-ranged back-to-back or face-to-face are available with preload to class A and class B (➔ **Table** 1). The values given in the table refer to unmounted bearing pairs, i.e. the bearing rings are free to expand. This means that after mounting the preload will increase, the increase being greater, the tighter the fit applied.

Matched sets of 3 and 4 bearings arranged back-to-back or face-to-face have a higher preload. The appropriate values can be obtained by multiplying the values given in the table by

1,35 for TBT and TFT sets
1,60 for QBT and QFT sets
2,00 for QBC and QFC sets

### Axial stiffness

Single direction angular contact thrust ball bearings are designed for high stiffness. The actual values are given in **Table** 1 and apply to bearing sets of two bearings arranged back-to-back or face-to-face.

Matched sets of 3 and 4 bearings arranged back-to-back or face-to-face have a higher axial stiffness. The appropriate values can be obtained by multiplying the values given in the table by

1,45 for TBT and TFT sets
1,80 for QBT and QFT sets
2,00 for QBC and QFC sets

### Friction torque

SKF single direction angular contact thrust ball bearings have low friction. The actual values for the torque are given in **Table** 1 and are valid for unmounted bearing sets of two bearings.

Matched sets of 3 and 4 bearings arranged back-to-back or face-to-face have a higher friction torque. The appropriate values can be obtained by multiplying the values given in the table by

1,35 for TBT and TFT sets
1,55 for QBT and QFT sets
2,00 for QBC and QFC sets

### Speed ratings

The speed ratings given in the bearing tables are guideline values and apply to single bearings. Speed ratings for matched sets of 2, 3 or 4 bearings are obtained by mutliplying the values given in the table by

0,8 for sets of 2 bearings
0,65 for sets of 3 bearings
0,5 for sets of 4 bearings

***Preload, axial stiffness and friction torque***

**Table 1**

| Designation | Preload class | | Axial stiffness class | | Friction torque class | |
|---|---|---|---|---|---|---|
| | A | B | A | B | A | B |
| – | N | | N/µm | | Nm | |
| **BSA 201 C** | 650 | 1 300 | 345 | 440 | 0,016 | 0,029 |
| **BSA 202 C** | 775 | 1 550 | 408 | 522 | 0,023 | 0,040 |
| **BSA 204 C** | 1 480 | 2 960 | 587 | 750 | 0,056 | 0,100 |
| **BSA 205 C** | 1 580 | 3 160 | 632 | 807 | 0,077 | 0,132 |
| **BSA 206 C** | 2 250 | 4 500 | 809 | 1 036 | 0,130 | 0,225 |
| **BSA 207 C** | 2 950 | 5 900 | 960 | 1 228 | 0,200 | 0,345 |
| **BSA 305 C** | 2 400 | 4 800 | 785 | 1 000 | 0,120 | 0,215 |
| **BSA 306 C** | 3 300 | 6 600 | 900 | 1 145 | 0,194 | 0,345 |
| **BSA 307 C** | 4 500 | 9 000 | 1 055 | 1 355 | 0,290 | 0,523 |
| **BSD 1547 C** | 1 480 | 2 960 | 587 | 750 | 0,056 | 0,100 |
| **BSD 2047 C** | 1 480 | 2 960 | 587 | 750 | 0,056 | 0,100 |
| **BSD 2562 C** | 2 400 | 4 800 | 785 | 1 000 | 0,120 | 0,215 |
| **BSD 3062 C** | 2 250 | 4 500 | 809 | 1 036 | 0,130 | 0,224 |
| **BSD 3572 C** | 2 950 | 5 900 | 960 | 1 228 | 0,200 | 0,345 |
| **BSD 55100 C** | 6 500 | 13 000 | 1 390 | 1 770 | 0,550 | 0,970 |
| **BDAB 634200 C** | 1 480 | 2 960 | 587 | 750 | 0,056 | 0,100 |
| **BDAB 634201 C** | 2 400 | 4 800 | 785 | 1 000 | 0,120 | 0,215 |
| **BDAB 634203 C** | 2 900 | 5 800 | 1 065 | 1 355 | 0,255 | 0,415 |

### Equivalent dynamic bearing load

The equivalent dynamic bearing load for single bearings and bearing sets can be calculated separately for the two directions of axial load from

$P = YF_a + XF_r$ where $F_a/F_r \leq 2{,}17$
$P = F_a + 0{,}92\ F_r$ where $F_a/F_r > 2{,}17$

When calculating $F_a$, the preload force acting on the bearing set must be taken into account. The calculation factors X and Y can be obtained from **Table 2**.

### Equivalent static bearing load

For bearing sets with bearings arranged back-to-back or face-to-face, the equivalent static bearing load can be calculated separately for each direction of axial load from

$P_0 = F_a + 4\ F_r$

The equation is also valid for single bearings and sets of bearings arranged in tandem provided the ratio $F_r/F_a$ does not exceed 0,25 and gives satisfactory but less accurate values when $F_r/F_a$ is greater than 0,25 but does not exceed 0,4.

### Load carrying capacity of bearing sets

The values of the basic dynamic and static load ratings given in the bearing tables relate to single bearings. For sets of bearings it must be remembered that each bearing can only support axial loads acting in one direction. It is therefore necessary to calculate using only the number of bearings supporting the load in a given direction, i.e. for a pair of bearings arranged back-to-back, only one bearing will carry the load in a given direction. Appropriate guidance for the calculation of the basic dynamic and static load ratings of matched bearing sets is given in the **Table 2**. The arrows indicate the direction of the load acting on the outer rings.

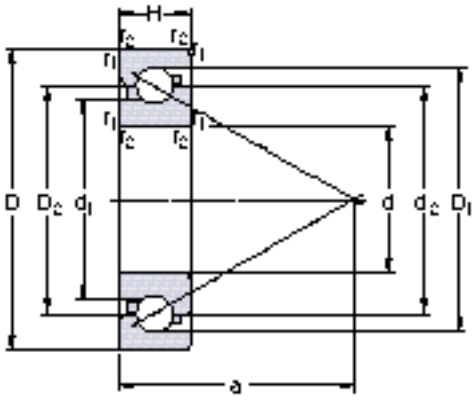
***Calculation factors for bearing sets***

**Table 2**

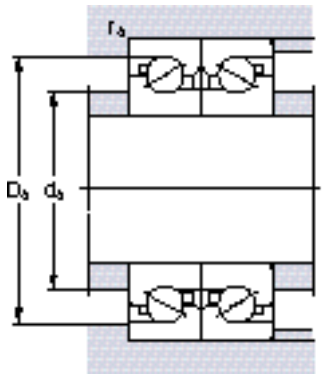
| No. of bearings and arrangement | | | Load carrying capacity of bearing set | | Calculation factors | |
|---|---|---|---|---|---|---|
| | | | dynamic | static | X | Y |
| 2 | **DB** |  | C | $C_0$ | 1,9 | 0,55 |
| | **DF** |  | C | $C_0$ | 1,9 | 0,55 |
| | **DT** |  | 1,63 C | 2 $C_0$ | – | – |
| 3 | **TBT** |  | C | $C_0$ | 1,43 | 0,76 |
| | |  | 1,63 C | 2 $C_0$ | 2,32 | 0,35 |
| | **TFT** |  | C | $C_0$ | 1,43 | 0,76 |
| | |  | 1,63 C | 2 $C_0$ | 2,32 | 0,35 |
| | **TT** |  | 2,16 C | 3 $C_0$ | – | – |
| 4 | **QBT** |  | C | $C_0$ | 1,17 | 0,88 |
| | |  | 2,16 C | 3 $C_0$ | 2,52 | 0,26 |
| | **QFT** |  | C | $C_0$ | 1,17 | 0,88 |
| | |  | 2,16 C | 3 $C_0$ | 2,52 | 0,26 |
| | **QBC** |  | 1,63 C | 2 $C_0$ | 1,9 | 0,55 |
| | **QFC** |  | 1,63 C | 2 $C_0$ | 1,9 | 0,55 |
| | **QT** |  | 2,64 C | 4 $C_0$ | – | – |

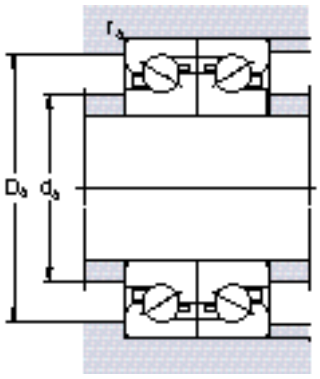
## Angular contact thrust ball bearing, single direction

d **12 – 55** mm

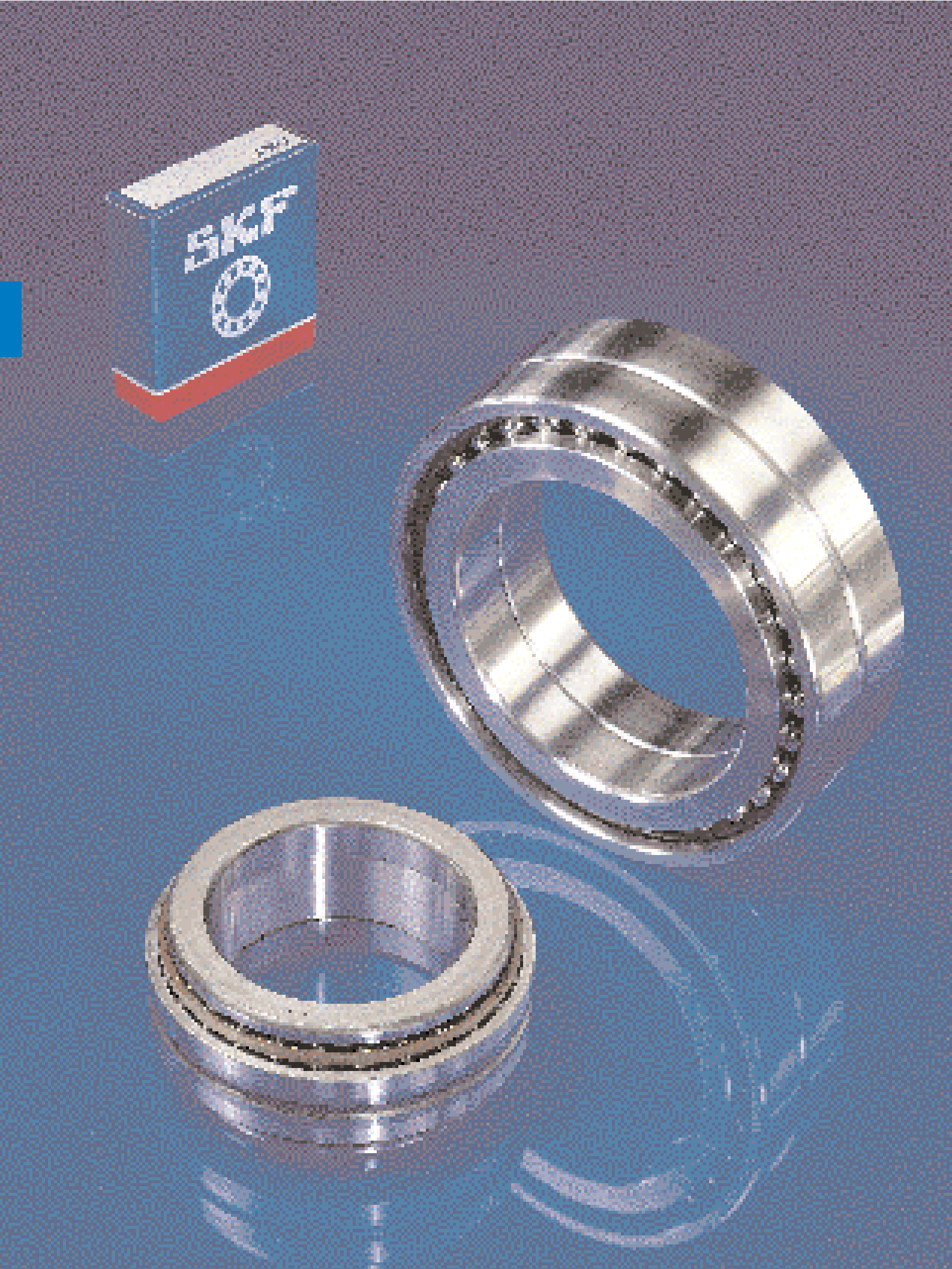



| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Maximum axial load | Speed ratings Lubrication grease | oil spot | Mass | Designation |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | H | C | $C_0$ | $P_u$ | | | | | |
| mm | | | N | | N | N | r/min | | kg | – |
| **12** | 32 | 10 | 11 200 | 15 600 | 710 | 7 250 | 12 000 | 16 000 | 0,024 | **BSA 201 C** |
| **15** | 35 | 11 | 12 100 | 18 600 | 850 | 8 500 | 11 000 | 15 000 | 0,054 | **BSA 202 C** |
| | 47 | 15 | 21 200 | 35 500 | 1 600 | 19 500 | 8 200 | 11 000 | 0,15 | **BSD 1547 C** |
| **20** | 47 | 14 | 21 200 | 35 500 | 1 600 | 19 500 | 8 200 | 11 000 | 0,13 | **BSA 204 C** |
| | 47 | 15 | 21 200 | 35 500 | 1 600 | 19 500 | 8 200 | 11 000 | 0,13 | **BSD 2047 C** |
| | 47 | 15,875 | 21 200 | 35 500 | 1 600 | 19 500 | 7 500 | 10 000 | 0,14 | **BDAB 634200 C** |
| **23,838** | 61,999 | 15,875 | 32 500 | 58 500 | 2 700 | 36 000 | 6 900 | 9 300 | 0,26 | **BDAB 634201 C** |
| **25** | 52 | 15 | 21 600 | 38 000 | 1 730 | 20 800 | 7 500 | 10 000 | 0,15 | **BSA 205 C** |
| | 62 | 15 | 32 500 | 58 500 | 2 700 | 36 000 | 7 200 | 9 600 | 0,25 | **BSD 2562 C** |
| | 62 | 17 | 32 500 | 58 500 | 2 700 | 36 000 | 6 700 | 9 000 | 0,27 | **BSA 305 C** |
| **30** | 62 | 16 | 28 100 | 54 000 | 2 500 | 31 500 | 6 900 | 9 300 | 0,24 | **BSA 206 C** |
| | 62 | 15 | 28 100 | 54 000 | 2 500 | 31 500 | 7 200 | 9 600 | 0,22 | **BSD 3062 C** |
| | 72 | 19 | 44 200 | 80 000 | 3 600 | 52 800 | 5 900 | 7 900 | 0,41 | **BSA 306 C** |
| **35** | 72 | 15 | 35 100 | 71 000 | 3 250 | 42 750 | 6 600 | 8 900 | 0,30 | **BSD 3572 C** |
| | 72 | 17 | 35 100 | 71 000 | 3 250 | 42 750 | 6 300 | 8 400 | 0,34 | **BSA 207 C** |
| | 80 | 21 | 58 500 | 108 000 | 4 900 | 69 000 | 5 700 | 7 100 | 0,56 | **BSA 307 C** |
| **40** | 72 | 15 | 35 100 | 71 000 | 3 250 | 42 750 | 6 600 | 8 900 | 0,30 | **BSD 4072 C** |
| | 90 | 20 | 61 800 | 122 000 | 4 700 | 78 200 | 5 100 | 6 900 | 0,64 | **BSD 4090 C** |
| **44,475** | 76,2 | 15,875 | 31 200 | 69 500 | 3 250 | 40 200 | 6 300 | 8 400 | 0,31 | **BDAB 634203 C** |
| **45** | 100 | 20 | 79 300 | 160 000 | 7 350 | 107 400 | 4 800 | 6 500 | 0,80 | **BSD 45100 C** |
| **50** | 100 | 20 | 79 300 | 160 000 | 7 350 | 107 400 | 4 800 | 6 500 | 0,80 | **BSD 50100 C** |
| **55** | 100 | 20 | 79 300 | 160 000 | 7 350 | 107 400 | 4 800 | 6 500 | 0,70 | **BSD 55100 C** |




| Dimensions | | | | | | | Abutment and fillet dimensions | | |
|---|---|---|---|---|---|---|---|---|---|
| d | $d_1$ ≈ | $d_2$ ≈ | $D_1$ ≈ | $D_2$ ≈ | $r_{1,2}$ min | a | $d_a$ min | $D_a$ max | $r_a$ max |
| mm | | | | | | | mm | | |
| **12** | 18 | 22,2 | 27,1 | 22,7 | 0,6 | 24 | 16 | 28 | 0,6 |
| **15** | 21 | 25,2 | 30,1 | 24,8 | 0,6 | 27 | 19 | 31 | 0,6 |
| | 29,2 | 34,7 | 41,1 | 34,2 | 1 | 37 | 22,5 | 42 | 1 |
| **20** | 29,2 | 34,7 | 41,1 | 34,2 | 1 | 36 | 26,5 | 42 | 1 |
| | 29,2 | 34,7 | 41,1 | 34,2 | 1 | 37 | 26,5 | 42 | 1 |
| | 29,2 | 34,7 | 41,1 | 34,2 | 1 | 38 | 26,5 | 42 | 1 |
| **23,838** | 39,4 | 46,2 | 54,2 | 45,6 | 1,1 | 47 | 32,5 | 55 | 1 |
| **25** | 33,2 | 38,7 | 45,1 | 38,2 | 1 | 40 | 31 | 47 | 1 |
| | 39,4 | 46,2 | 54,2 | 45,6 | 1,1 | 47 | 34 | 55 | 1 |
| | 39,4 | 46,2 | 54,2 | 45,6 | 1,1 | 48 | 34 | 55 | 1 |
| **30** | 41 | 47,2 | 54,4 | 46,6 | 1 | 48 | 37 | 56,5 | 1 |
| | 41 | 47,2 | 54,4 | 46,6 | 1 | 48 | 37 | 56,5 | 1 |
| | 43,3 | 51,7 | 61,2 | 51,1 | 1,1 | 54 | 40 | 64,5 | 1 |
| **35** | 48,4 | 55,2 | 63,1 | 54,6 | 1,1 | 55 | 43,5 | 65 | 1 |
| | 48,4 | 55,2 | 63,1 | 54,6 | 1,1 | 56 | 43,5 | 65 | 1 |
| | 48,9 | 58,7 | 69,8 | 58,1 | 1,5 | 61 | 46,5 | 71,5 | 1,5 |
| **40** | 48,4 | 55,2 | 63,1 | 54,6 | 1,1 | 55 | 47,4 | 65,3 | 1 |
| | 56,9 | 66,7 | 77,8 | 66,1 | 1,5 | 69 | 51,5 | 81,4 | 1,5 |
| **44,475** | 54 | 60,2 | 67,4 | 59,6 | 1,1 | 59 | 52 | 69,5 | 1 |
| **45** | 65,5 | 76,7 | 89,4 | 76,1 | 1,5 | 76 | 58,1 | 90,5 | 1,5 |
| **50** | 65,5 | 76,7 | 89,4 | 76,1 | 1,5 | 76 | 58,1 | 90,5 | 1,5 |
| **55** | 65,5 | 76,7 | 89,4 | 76,1 | 1,5 | 76 | 65,5 | 90,5 | 1,5 |


SKF

# Double direction angular contact thrust ball bearings



Double direction angular contact thrust ball bearings were developed many years ago by SKF. They are used to axially locate a spindle in both directions and are intended for use together with cylindrical roller bearings of series NN 30 K and N 10 K.

Double direction angular contact thrust ball bearings have the same bore and outside diameters as the cylindrical roller bearings of series NN 30 K and N 10 K. The outside diameter of the housing washer is, however, made to tolerances such that sufficient radial clearance will be obtained to the hous-ing bore seating, which is common to the thrust bearing and the cylindrical roller bearing. The machining of the housing bore is also simplified.

Two designs of SKF double direction angular contact thrust ball bearings are available: the standard design of series 2344(00) and the high-speed design of series BTM .. A and BTM .. B.

**Standard bearings, series 2344(00)**
The bearings of series 2344(00) are separable and have a one-piece housing washer, two ball and cage thrust assemblies and two shaft washers, separated by a spacer sleeve (➔ **fig** 1) so dimensioned that after mounting the bearings will be preloaded. The contact angle of 60°, the preload and the large number of balls in each row give the bearings high axial stiffness and enable them to operate at relatively high speeds.

To ensure efficient lubrication, all bearings have an annular groove and three lubrication holes in the housing washer.

**High-speed bearings, BTM design**
The SKF high-speed bearings of the BTM design (➔ **fig** 2) are a new development and replace the bearings of the BTA design which are no longer

Fig 1

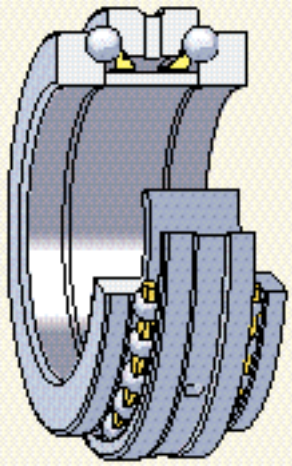


Fig 2

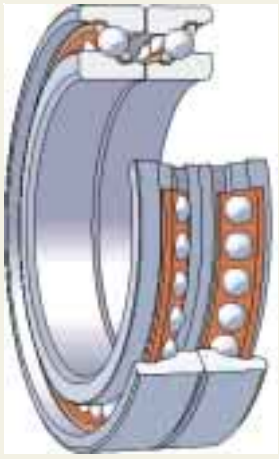


***Fig 1***
***Double direction angular contact thrust ball bearing, series 2344(00)***

***Fig 2***
***Double direction angular contact thrust ball bearing, series BTM .. A***

produced. Their design is essentially that of two matched single row angular contact ball bearings arranged back-to-back. The contact angle is 40° for series BTM .. B and 30° for series BTM .. A. The bore and outside diameters of both series are the same as those of series 2344(00) bearings but they are 25 % narrower. They are of simple design so that mounting is easy.

Because the contact angle of the BTM-design bearings is less steep than that of the 2344(00) series bearings they are not as axially stiff and cannot carry such heavy axial loads but they are able to operate at 12 and almost 30 % higher speeds, respectively. As both the standard and high-speed bearings are intended to carry axial loads exclusively, the load ratings quoted in the bearing table are for axial loads, although the high-speed bearings with their contact angles of 40° and 30° are, by ISO definition, radial bearings.

The high permissible operating speeds make the BTM-design bearings eminently suitable for CNC lathes and milling machines where the requisite high radial stiffness of the high-speed spindles calls for the use of cylindrical roller bearings and where the speeds exceed the capability of the 2344(00) series bearings.

The SKF range of high-speed bearings covers five sizes of each series having bore diameters of 80 to 130 mm, inclusive, to cover the most common spindle diameters.

## Dimensions

The dimensions of these double direction angular contact thrust ball bearings are not standardised but have won general acceptance. However, the bore and outside diameters conform to those of Diameter Series 0 for radial bearings according to ISO 15-1981.

## Tolerances

SKF double direction angular contact thrust ball bearings meet the same high demands with respect to dimensional and running accuracy as the cylindrical roller bearings of series NN 30 K and N 10 K.

Bearings of series 2344(00) are produced as standard to tolerance class SP specifications, but may, to special order, also be produced with class UP tolerances.

The high-speed bearings of the BTM design are produced to tolerance class P4C specifications.

The actual tolerance values for classes P4C, SP and UP will be found in **Tables** 7 to 9 on **pages 72** and **73**.

## Preload

SKF double direction angular contact thrust ball bearings are supplied with a preload as specified in **Tables** 1 and 2.

The values quoted in the table apply to bearings before mounting. When mounted, the bearings may have a higher preload, depending on the shaft tolerance selected.

## Speed ratings

The speed ratings quoted in the bearing tables for BTM bearings apply to bearings with class A preload, where the load is light ($P \leq 0{,}06\ C$) and heat transfer from the bearing position is good. The values quoted for oil spot lubrication are maximum ratings which must be reduced for other methods of oil lubrication. For heavily loaded bearings with class B preload the values should be reduced; they should be multiplied with the factor 0,55.

## Cages

SKF double direction angular contact thrust ball bearings are fitted with two ball centred cages. Depending on series and size, the cages may be either of machined brass or heat stabilised, glass fibre reinforced polyamide 6,6 (→ **fig** 3). Bearings of series 2344(00) fitted with polyamide cages are identified by the designation suffix TN or TN9. The BTM-design bearings are fitted exclusively with polyamide cages so that there is no extra TN or TN9 suffix in the designation.

Bearings with polyamide 6,6 cages can be used at operating temperatures up to +120 °C. The cage properties are not affected by the lubricants normally used for bearings with the exception of some synthetic oils and greases with a synthetic oil base.

## Equivalent dynamic bearing load

For double direction angular contact thrust ball bearings subjected to axial load only

$$P = F_a$$

## Equivalent static bearing load

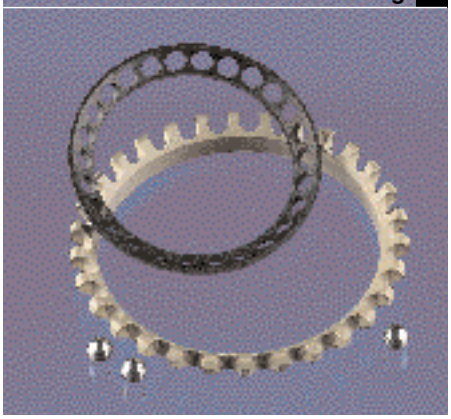
For double direction angular contact thrust ball bearings subjected to axial load only

$$P_0 = F_a$$

## Mounting instructions

When mounting double direction angular contact thrust ball bearings care should be taken not to mix the components of one bearing with those of other bearings. When mounting bearings of series 2344(00) care should also be taken not to apply too much axial force as otherwise the spacer sleeve may be deformed and excessive axial preload may result which would cause a rise in running temperature and would shorten bearing life. Suitable values for the axial force (in Newton) to be applied lie between 80 and 200 × d (d = bearing bore diameter in mm).

Fig 3



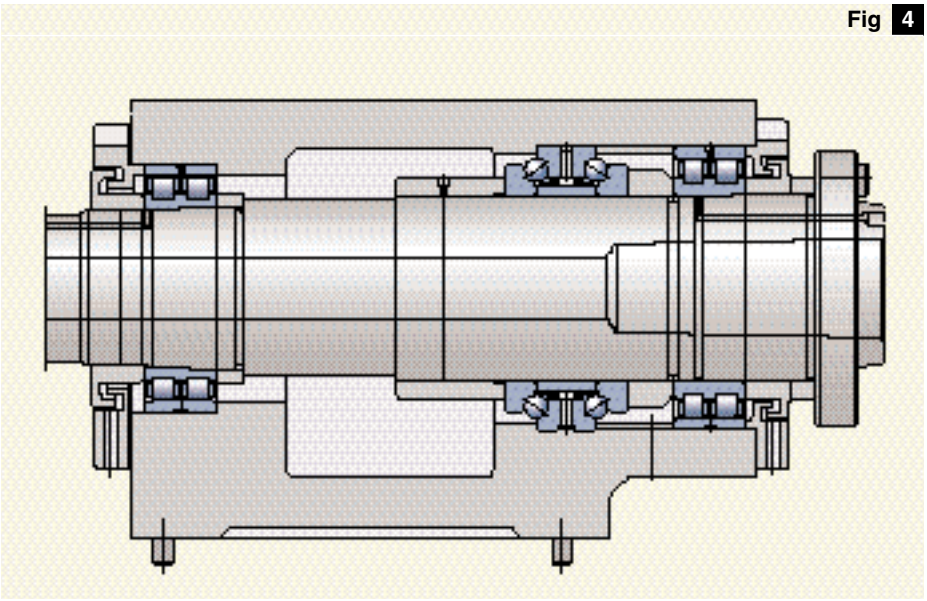
***Cages for double direction angular contact thrust ball bearings***

Table 1

| Bore diameter | Axial preload | Bore diameter | Axial preload |
|---|---|---|---|
| mm | N | mm | N |
| **40** | 360 | **100** | 690 |
| **45** | 390 | **105** | 710 |
| **50** | 415 | **110** | 735 |
| **55** | 440 | **120** | 800 |
| **60** | 470 | **130** | 870 |
| **65** | 490 | **140** | 940 |
| **70** | 515 | **150** | 1 015 |
| **75** | 545 | **160** | 1 100 |
| **80** | 575 | **170** | 1 185 |
| **85** | 600 | **180** | 1 290 |
| **90** | 625 | **190** | 1 385 |
| **95** | 655 | **200** | 1 525 |

***Axial preload in double direction angular contact thrust ball bearings, series 2344(00)***

Fig 4



***SKF spindle unit of the MSUP design with standard bearing arrangement***
*Two double row cylindrical roller bearings of series NN 30 K and one double direction angular contact thrust ball bearing of series 2344(00)*

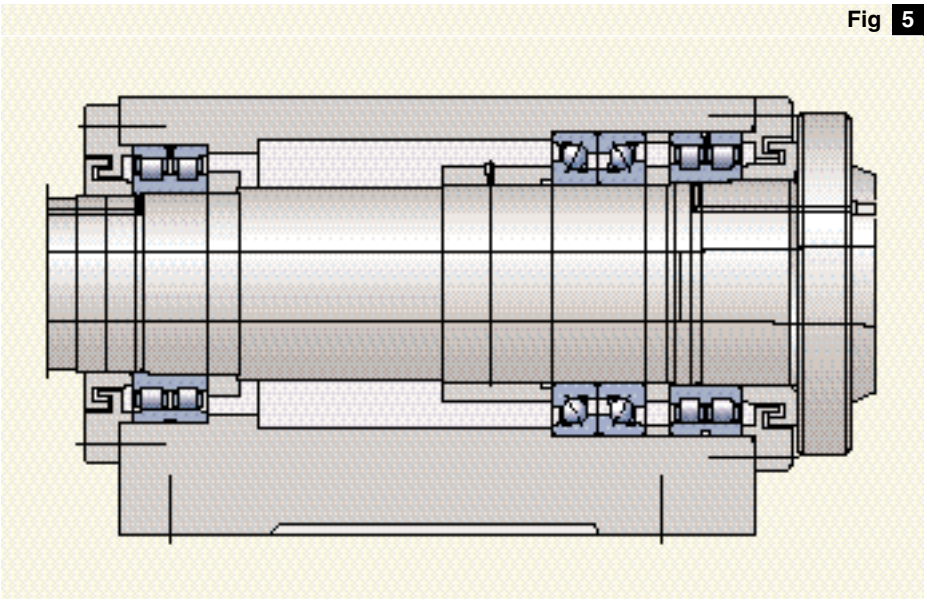


Table 2

| Bore diameter | Axial preload BTM .. A Preload class DBA | DBB | BTM .. B Preload class DBA | DBB |
|---|---|---|---|---|
| mm | N | | N | |
| **80** | 300 | 750 | 400 | 1 200 |
| **90** | 400 | 1 000 | 550 | 1 450 |
| **100** | 400 | 1 000 | 550 | 1 650 |
| **120** | 600 | 1 500 | 850 | 2 450 |
| **130** | 800 | 1 900 | 1 050 | 3 000 |

***Axial preload in double direction angular contact thrust ball bearings, series BTM .. A and BTM .. B***

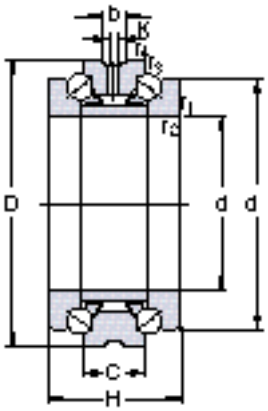
Fig 5



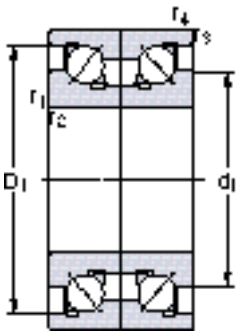
***Classic spindle bearing arrangement with two double row cylindrical roller bearings of series NN 30 K and one double direction angular contact thrust ball bearing of the BTM design for high machining performance***

## Angular contact thrust ball bearings, double direction

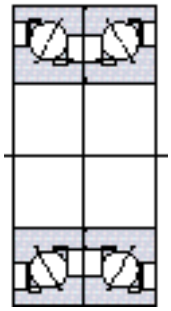
d **40 – 170** mm




2344(00)

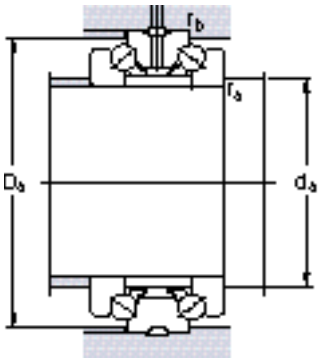


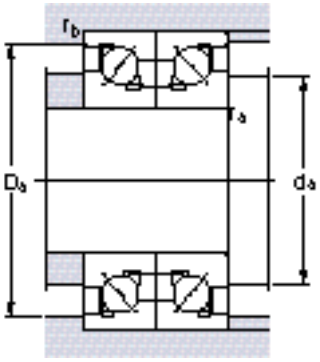

BTM .. B



BTM .. A

| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Speed ratings Lubrication grease | oil spot | Mass | Designation |
|---|---|---|---|---|---|---|---|---|---|
| d | D | H | C | $C_0$ | $P_u$ | | | | |
| mm | | | N | | N | r/min | | kg | – |
| **40** | 68 | 36 | 21 600 | 60 000 | 2 240 | 9 500 | 12 000 | 0,46 | **234408 BM1** |
| **45** | 75 | 38 | 24 700 | 71 000 | 2 600 | 9 000 | 11 000 | 0,58 | **234409 BM1** |
| **50** | 80 | 38 | 25 500 | 78 000 | 2 850 | 8 500 | 10 000 | 0,62 | **234410 BM1** |
| **55** | 90 | 44 | 33 800 | 104 000 | 3 800 | 7 000 | 8 500 | 0,94 | **234411 BM1** |
| **60** | 95 | 44 | 34 500 | 108 000 | 4 000 | 7 000 | 8 500 | 1,00 | **234412 TN9** |
| **65** | 100 | 44 | 35 800 | 116 000 | 4 300 | 6 700 | 8 000 | 1,05 | **234413 TN9** |
| **70** | 110 | 48 | 43 600 | 143 000 | 5 300 | 6 300 | 7500 | 1,45 | **234414 TN9** |
| **75** | 115 | 48 | 44 200 | 150 000 | 5 600 | 6 000 | 7 000 | 1,55 | **234415 BM1** |
| **80** | 125 | 40,5 | 41 500 | 104 000 | 3 900 | 7 000 | 9 000 | 1,60 | **BTM 80 A/DBA** |
| | 125 | 40,5 | 49 000 | 120 000 | 4 400 | 6 300 | 8 000 | 1,60 | **BTM 80 B/DBA** |
| | 125 | 54 | 54 000 | 180 000 | 6 550 | 5 300 | 6 300 | 2,10 | **234416 TN9** |
| **85** | 130 | 54 | 54 000 | 190 000 | 6 700 | 5 300 | 6 300 | 2,20 | **234417 TN9** |
| **90** | 140 | 45 | 49 000 | 125 000 | 4 470 | 6 300 | 8 000 | 2,30 | **BTM 90 A/DBA** |
| | 140 | 45 | 57 000 | 143 000 | 5 100 | 5 600 | 7 000 | 2,30 | **BTM 90 B/DBA** |
| | 140 | 60 | 62 400 | 220 000 | 7 650 | 4 800 | 5 600 | 3,00 | **234418 TN9** |
| **95** | 145 | 60 | 63 700 | 232 000 | 7 800 | 4 800 | 5 600 | 3,05 | **234419 BM1** |
| **100** | 150 | 45 | 51 000 | 140 000 | 4 740 | 6 000 | 7 500 | 2,40 | **BTM 100 A/DBA** |
| | 150 | 45 | 61 000 | 163 000 | 5 400 | 5 300 | 6 700 | 2,40 | **BTM 100 B/DBA** |
| | 150 | 60 | 66 300 | 245 000 | 8 150 | 4 800 | 5 600 | 3,15 | **234420 TN9** |
| **105** | 160 | 66 | 74 100 | 275 000 | 8 800 | 4 300 | 5 000 | 4,05 | **234421 BM1** |
| **110** | 170 | 72 | 92 300 | 335 000 | 10 400 | 4 000 | 4 800 | 5,05 | **234422 BM1** |
| **120** | 180 | 54 | 73 500 | 212 000 | 6 500 | 4 800 | 6 000 | 4,35 | **BTM 120 A/DBA** |
| | 180 | 54 | 86 500 | 240 000 | 7 200 | 4 300 | 5 300 | 4,35 | **BTM 120 B/DBA** |
| | 180 | 72 | 93 600 | 360 000 | 10 800 | 3 800 | 4 500 | 5,70 | **234424 TN9** |
| **130** | 200 | 63 | 90 000 | 265 000 | 7 700 | 4 500 | 5 600 | 6,25 | **BTM 130 A/DBA** |
| | 200 | 63 | 108 000 | 300 000 | 8 800 | 3 800 | 4 800 | 6,25 | **BTM 130 B/DBA** |
| | 200 | 84 | 117 000 | 455 000 | 13 200 | 3 400 | 4 000 | 8,15 | **234426 TN9** |
| **140** | 210 | 84 | 117 000 | 475 000 | 13 200 | 3 200 | 3 800 | 8,65 | **234428 BM1** |
| **150** | 225 | 90 | 140 000 | 570 000 | 15 300 | 3 000 | 3 600 | 10,5 | **234430 BM1** |
| **160** | 240 | 96 | 156 000 | 640 000 | 16 600 | 2 800 | 3 400 | 14,0 | **234432 BM1** |
| **170** | 260 | 108 | 195 000 | 780 000 | 19 600 | 2 400 | 3 000 | 17,5 | **234434 BM1** |



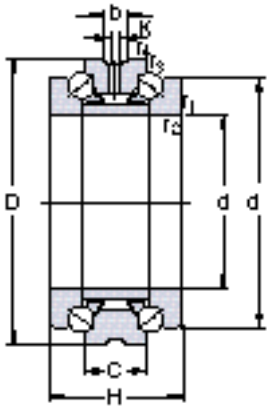





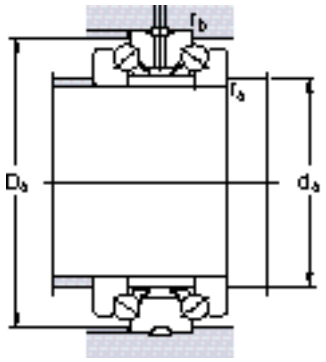

| Dimensions | | | | | | | Abutment and fillet dimensions | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_1$ ≈ | C, $D_1$ | K | b | $r_{1,2}$ min | $r_{3,4}$ min | $d_a$ min | $D_a$ min | $r_a$ max | $r_b$ max |
| mm | | | | | | | mm | | | |
| **40** | 58,5 | 18 | 3 | 5,5 | 1 | 0,15 | 50 | 64 | 1 | 0,1 |
| **45** | 65 | 19 | 3 | 5,5 | 1 | 0,15 | 56 | 71 | 1 | 0,1 |
| **50** | 70 | 19 | 3 | 5,5 | 1 | 0,15 | 61 | 76 | 1 | 0,1 |
| **55** | 78 | 22 | 3 | 5,5 | 1,1 | 0,3 | 68 | 85 | 1 | 0,3 |
| **60** | 83 | 22 | 3 | 5,5 | 1,1 | 0,3 | 73 | 90 | 1 | 0,3 |
| **65** | 88 | 22 | 3 | 5,5 | 1,1 | 0,3 | 78 | 95 | 1 | 0,3 |
| **70** | 97 | 24 | 3 | 5,5 | 1,1 | 0,3 | 85 | 105 | 1 | 0,3 |
| **75** | 102 | 24 | 3 | 5,5 | 1,1 | 0,3 | 90 | 110 | 1 | 0,3 |
| **80** | 100 | 115 | – | – | 1,1 | 0,6 | 89 | 117 | 1 | 0,6 |
| | 100 | 115 | – | – | 1,1 | 0,6 | 89 | 117 | 1 | 0,6 |
| | 110 | 27 | 4,5 | 8,3 | 1,1 | 0,3 | 97 | 119 | 1 | 0,3 |
| **85** | 115 | 27 | 4,5 | 8,3 | 1,1 | 0,3 | 102 | 124 | 1 | 0,3 |
| **90** | 113 | 129 | – | – | 1,5 | 0,6 | 101 | 131 | 1,5 | 0,6 |
| | 113 | 129 | – | – | 1,5 | 0,6 | 101 | 131 | 1,5 | 0,6 |
| | 123 | 30 | 4,5 | 8,3 | 1,5 | 0,3 | 109 | 132 | 1,5 | 0,3 |
| **95** | 128 | 30 | 4,5 | 8,3 | 1,5 | 0,3 | 114 | 137 | 1,5 | 0,3 |
| **100** | 123 | 139 | – | – | 1,5 | 0,6 | 107 | 141 | 1,5 | 0,6 |
| | 123 | 139 | – | – | 1,5 | 0,6 | 107 | 141 | 1,5 | 0,6 |
| | 133 | 30 | 4,5 | 8,3 | 1,5 | 0,3 | 119 | 142 | 1,5 | 0,3 |
| **105** | 142 | 33 | 4,5 | 8,3 | 2 | 0,6 | 125 | 151 | 2 | 0,6 |
| **110** | 150 | 36 | 4,5 | 8,3 | 2 | 0,6 | 132 | 161 | 2 | 0,6 |
| **120** | 147 | 167 | – | – | 2 | 1 | 128 | 169 | 2 | 1 |
| | 147 | 167 | – | – | 2 | 1 | 128 | 169 | 2 | 1 |
| | 160 | 36 | 4,5 | 8,3 | 2 | 0,6 | 142 | 171 | 2 | 0,6 |
| **130** | 162 | 183 | – | – | 2 | 1 | 143 | 188 | 1,5 | 1 |
| | 162 | 183 | – | – | 2 | 1 | 143 | 188 | 1,5 | 1 |
| | 177 | 42 | 6 | 11,1 | 2 | 0,6 | 156 | 190 | 2 | 0,6 |
| **140** | 187 | 42 | 6 | 11,1 | 2,1 | 0,6 | 166 | 200 | 2 | 0,6 |
| **150** | 200 | 45 | 7,5 | 13,9 | 2,1 | 0,6 | 178 | 213 | 2 | 0,6 |
| **160** | 212 | 48 | 7,5 | 13,9 | 2,1 | 0,6 | 190 | 227 | 2 | 0,6 |
| **170** | 230 | 54 | 7,5 | 13,9 | 2,1 | 0,6 | 204 | 246 | 2 | 0,6 |

## Angular contact thrust ball bearings, double direction

d **180 – 200** mm

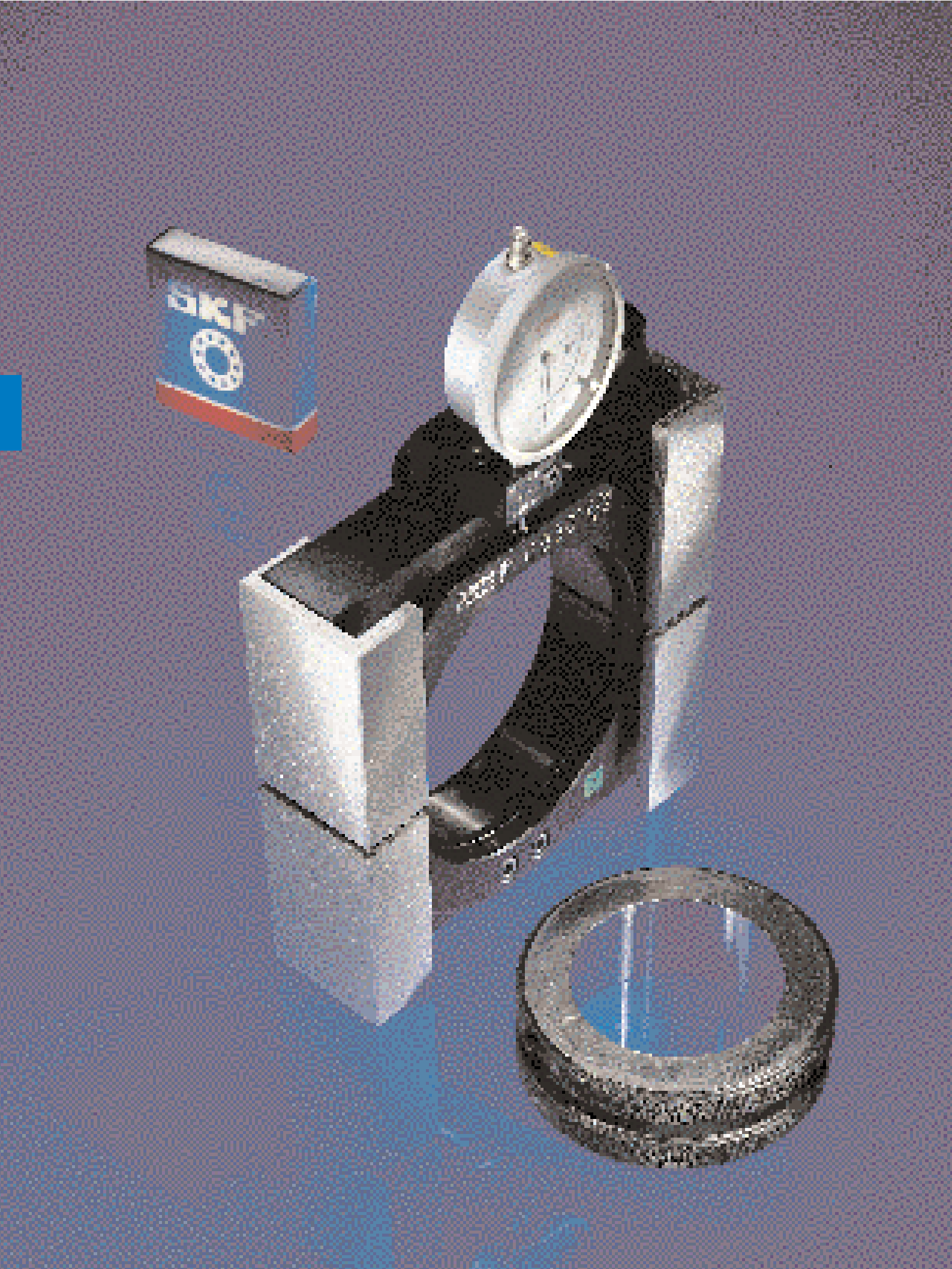



| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Speed ratings Lubrication grease | oil spot | Mass | Designation |
|---|---|---|---|---|---|---|---|---|---|
| d | D | H | C | $C_0$ | $P_u$ | | | | |
| mm | | | N | | N | r/min | | kg | – |
| **180** | 280 | 120 | 225 000 | 915 000 | 22 400 | 2 000 | 2 600 | 23,0 | **234436 BM1** |
| **190** | 290 | 120 | 225 000 | 950 000 | 22 800 | 2 000 | 2 600 | 24,0 | **234438 BM1** |
| **200** | 310 | 132 | 265 000 | 1 100 000 | 25 500 | 1 900 | 2 400 | 31,0 | **234440 BM1** |






| Dimensions | | | | | | | Abutment and fillet dimensions | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_1$ ≈ | C | K | b | $r_{1,2}$ min | $r_{3,4}$ min | $d_a$ min | $D_a$ min | $r_a$ max | $r_b$ max |
| mm | | | | | | | mm | | | |
| **180** | 248 | 60 | 9 | 16,7 | 2,1 | 0,6 | 214 | 264 | 2 | 0,6 |
| **190** | 258 | 60 | 9 | 16,7 | 2,1 | 0,6 | 224 | 274 | 2 | 0,6 |
| **200** | 274 | 66 | 9 | 16,7 | 2,1 | 0,6 | 236 | 292 | 2 | 0,6 |



# Gauges

Conventional measuring methods and instruments are not entirely satisfactory for checking tapered journals or the radial internal clearance of cylindrical roller bearings. SKF has therefore developed a range of gauges especially to suit the requirements of rolling bearing applications, although they are equally useful for other applications.

## Ring gauges

SKF GRA 30 ring gauges are practical aids for checking the tapered shaft seatings for bearings of series NN 30 K, which are commonly used for machine tool applications. The gauges can also be used to check the shaft seatings for bearings of series N 10 K as well as those for series NNU 49 K; the width of the latter series differs only slightly from that of series NN 30 K.

SKF ring gauges are available for tapered seatings having diameters up to and including 200 mm (➔ **Product table** on **page 64**).

The gauging or reference face of ring gauges of series GRA 30 is at the large end of the bore and is used to determine the position of the tapered seating relative to a reference surface on the shaft. This reference surface may be either in front of, or behind the gauging face of the ring gauge. Where there is a free choice of dimensions it should be remembered that the reference length $B_c$ should always be longer than the dimension $B_b$, the width of the intermediate ring, by an amount corresponding to the difference $B_c - B_b$, as the bearing will be driven up further on the seating than the ring gauge when the bearing is being mounted. The final value of dimension $B_b$ is determined during mounting, taking into account the desired bearing radial internal clearance.

Ring gauges can also be used to check whether the reference surface of the shaft shoulder is at right angles to the centreline of the tapered seating, as well as for checking the position and diameter of the seating. This is done by measuring the distance between the gauging surface of the ring gauge and the reference surface of the shaft using end measures. Errors of form of the taper are checked using marking blue.

## Internal clearance gauges

SKF gauges of series GB 30 are available for use with double row cylindrical roller bearings NN 3006 K to NN 3040 K, inclusive. They may also be used for the single row cylindrical roller bearings of series N 10 K.

SKF GB gauges are made in two different designs depending on size. The one design is that of gauges GB 3006 to GB 3020, inclusive. These can be used to measure the circumscribed diameter, i.e. the diameter over the rollers when they are in contact with the inner ring raceway, to an accuracy of 1 µm. The larger gauges GB 3021 to GB 3040, inclusive, have a measuring accuracy of 2 µm. The body of the gauges up to and including GB 3020 is in two parts, that of the larger gauges is slotted.

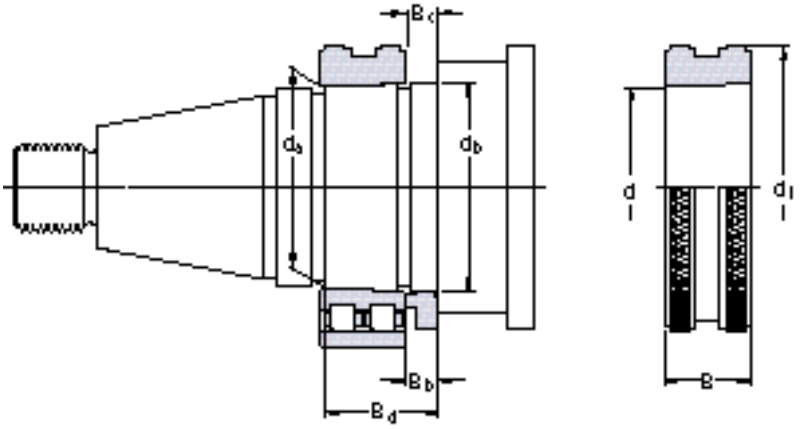
The body of the gauges has two diametrically opposed gauging zones which are ground on its bore diameter surface. The body can be expanded by means of an adjustable screw. This enables the gauge to be pushed over the inner ring with roller and cage assembly without damaging the rollers and gauging surfaces. The measuring ring which is screwed to one half of the gauging ring transmits the diameter measured by both halves of the gauging ring to the indicator dial.

**Measuring**

Using a bore gauge, the raceway of the mounted outer ring is measured, and the recorded dimension trans-ferred to the centres of the gauging zones, taking into consideration the desired radial internal clearance or preload. The indicator of the GB 30 gauge is then set to zero. The inner ring with roller and cage assembly is pushed up on to its tapered journal and driven up until the indicator of the pre-set gauge again shows zero when the gauge is placed in position around the bearing set.

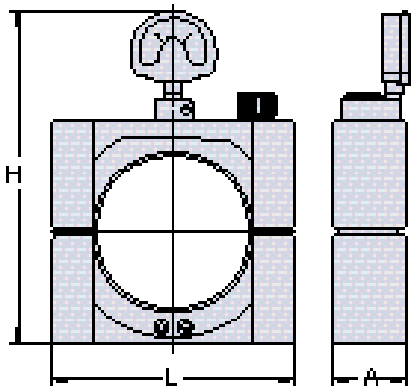
## Ring gauges, series GRA 30

d **25 – 200** mm

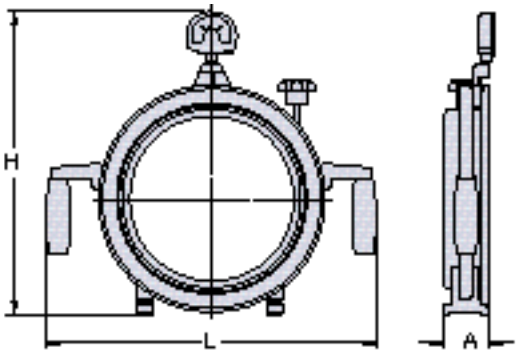



Taper 1 : 12

| **Bearing** Designation | **Bearing seating** Dimensions | | | | | | **Ring gauge** Dimensions | | | Mass | Designation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | $d_a$ | $d_b$ | $B_b$ | $B_c$ Nominal | Tolerance | $B_d$ | d | $d_1$ | B | | |
| – | mm | | | | | | mm | | | kg | – |
| **NN 3005 K** | 25,10 | 27 | 4 | 4,2 | ±0,1 | 19 | 25 | 46 | 16 | 0,13 | **GRA 3005** |
| **NN 3006 K** | 30,10 | 32 | 6 | 6,2 | ±0,1 | 24 | 30 | 52 | 19 | 0,18 | **GRA 3006** |
| **NN 3007 K** | 35,10 | 37 | 6 | 6,2 | ±0,1 | 25 | 35 | 57 | 20 | 0,21 | **GRA 3007** |
| **NN 3008 K** | 40,10 | 42 | 8 | 8,2 | ±0,1 | 28 | 40 | 62 | 21 | 0,26 | **GRA 3008** |
| **NN 3009 K** | 45,10 | 47 | 8 | 8,2 | ±0,1 | 30 | 45 | 67 | 23 | 0,31 | **GRA 3009** |
| **NN 3010 K** | 50,10 | 52 | 8 | 8,2 | ±0,1 | 30 | 50 | 72 | 23 | 0,34 | **GRA 3010** |
| **NN 3011 K** | 55,15 | 57 | 8 | 8,3 | ±0,12 | 32,5 | 55 | 77 | 26 | 0,42 | **GRA 3011** |
| **NN 3012 K** | 60,15 | 62 | 10 | 10,3 | ±0,12 | 34,5 | 60 | 82 | 26 | 0,45 | **GRA 3012** |
| **NN 3013 K** | 65,15 | 67 | 10 | 10,3 | ±0,12 | 34,5 | 65 | 88 | 26 | 0,51 | **GRA 3013** |
| **NN 3014 K** | 70,15 | 73 | 10 | 10,3 | ±0,12 | 38,5 | 70 | 95 | 30 | 0,69 | **GRA 3014** |
| **NN 3015 K** | 75,15 | 78 | 10 | 10,3 | ±0,12 | 38,5 | 75 | 100 | 30 | 0,73 | **GRA 3015** |
| **NN 3016 K** | 80,15 | 83 | 12 | 12,3 | ±0,12 | 44,5 | 80 | 105 | 34 | 0,88 | **GRA 3016** |
| **NN 3017 K** | 85,20 | 88 | 12 | 12,4 | ±0,15 | 44 | 85 | 112 | 34 | 1,00 | **GRA 3017** |
| **NN 3018 K** | 90,20 | 93 | 12 | 12,4 | ±0,15 | 47 | 90 | 120 | 37 | 1,30 | **GRA 3018** |
| **NN 3019 K** | 95,20 | 98 | 12 | 12,4 | ±0,15 | 47 | 95 | 128 | 37 | 1,55 | **GRA 3019** |
| **NN 3020 K** | 100,20 | 103 | 12 | 12,4 | ±0,15 | 47 | 100 | 135 | 37 | 1,70 | **GRA 3020** |
| **NN 3021 K** | 105,20 | 109 | 12 | 12,4 | ±0,15 | 51 | 105 | 142 | 41 | 2,10 | **GRA 3021** |
| **NN 3022 K** | 110,25 | 114 | 12 | 12,5 | ±0,15 | 54,5 | 110 | 150 | 45 | 2,60 | **GRA 3022** |
| **NN 3024 K** | 120,25 | 124 | 15 | 15,5 | ±0,15 | 58,5 | 120 | 162 | 46 | 3,05 | **GRA 3024** |
| **NN 3026 K** | 130,25 | 135 | 15 | 15,5 | ±0,15 | 64,5 | 130 | 175 | 52 | 3,95 | **GRA 3026** |
| **NN 3028 K** | 140,30 | 145 | 15 | 15,6 | ±0,15 | 65 | 140 | 188 | 53 | 4,75 | **GRA 3028** |
| **NN 3030 K** | 150,30 | 155 | 15 | 15,6 | ±0,15 | 68 | 150 | 200 | 56 | 5,60 | **GRA 3030** |
| **NN 3032 K** | 160,30 | 165 | 15 | 15,6 | ±0,15 | 72 | 160 | 215 | 60 | 6,80 | **GRA 3032** |
| **NN 3034 K** | 170,30 | 176 | 15 | 15,6 | ±0,15 | 79 | 170 | 230 | 67 | 8,80 | **GRA 3034** |
| **NN 3036 K** | 180,35 | 187 | 20 | 20,7 | ±0,15 | 90,5 | 180 | 245 | 74 | 11,5 | **GRA 3036** |
| **NN 3038 K** | 190,35 | 197 | 20 | 20,7 | ±0,18 | 91,5 | 190 | 260 | 75 | 13,0 | **GRA 3038** |
| **NN 3040 K** | 200,35 | 207 | 20 | 20,7 | ±0,18 | 98,5 | 200 | 270 | 82 | 15,0 | **GRA 3040** |




GB 3006 – GB 3020




GB 3021 – GB 3040

| **Bearing** Designation | **Internal clearance gauge** Dimensions | | | Mass | Designation |
|---|---|---|---|---|---|
| | L | H | A | | |
| – | mm | | | kg | – |
| **NN 3006 K** | 107 | 175 | 36 | 2,00 | **GB 3006** |
| **NN 3007 K** | 112 | 180 | 37 | 2,00 | **GB 3007** |
| **NN 3008 K** | 117 | 185 | 39 | 2,00 | **GB 3008** |
| **NN 3009 K** | 129 | 197 | 40 | 2,50 | **GB 3009** |
| **NN 3010 K** | 134 | 202 | 40 | 2,50 | **GB 3010** |
| **NN 3011 K** | 144 | 212 | 43 | 3,50 | **GB 3011** |
| **NN 3012 K** | 152 | 222 | 44 | 4,00 | **GB 3012** |
| **NN 3013 K** | 157 | 225 | 44 | 4,00 | **GB 3013** |
| **NN 3014 K** | 164 | 232 | 48 | 5,00 | **GB 3014** |
| **NN 3015 K** | 168 | 236 | 48 | 5,00 | **GB 3015** |
| **NN 3016 K** | 176 | 244 | 52 | 6,00 | **GB 3016** |
| **NN 3017 K** | 185 | 253 | 53 | 6,50 | **GB 3017** |
| **NN 3018 K** | 198 | 266 | 56 | 8,00 | **GB 3018** |
| **NN 3019 K** | 203 | 271 | 56 | 9,00 | **GB 3019** |
| **NN 3020 K** | 212 | 280 | 56 | 9,00 | **GB 3020** |
| **NN 3021 K** | 322 | 350 | 46 | 10,5 | **GB 3021** |
| **NN 3022 K** | 332 | 362 | 46 | 11,0 | **GB 3022** |
| **NN 3024 K** | 342 | 376 | 48 | 12,0 | **GB 3024** |
| **NN 3026 K** | 364 | 396 | 54 | 13,0 | **GB 3026** |
| **NN 3028 K** | 378 | 410 | 54 | 14,5 | **GB 3028** |
| **NN 3030 K** | 391 | 426 | 58 | 15,0 | **GB 3030** |
| **NN 3032 K** | 414 | 446 | 60 | 16,0 | **GB 3032** |
| **NN 3034 K** | 430 | 464 | 62 | 17,0 | **GB 3034** |
| **NN 3036 K** | 454 | 490 | 70 | 17,5 | **GB 3036** |
| **NN 3038 K** | 468 | 504 | 70 | 18,0 | **GB 3038** |
| **NN 3040 K** | 488 | 520 | 74 | 19,0 | **GB 3040** |

# Tolerances



The dimensional and running accuracy of rolling bearings has been standardised internationally. In addition to the Normal tolerances which are adequate for the majority of bearing applications, the ISO standards cover closer tolerances, e.g. tolerance classes 6 and 5. For precision bearings, which are primarily used for machine tool spindles of all types, even greater accuracy is required.

SKF precision bearings are therefore produced to the following tolerance class specifications, depending on the type of bearing and the most usual applications. The actual values are given in **Tables** 1 to 9. The tolerance classes are as follows.

- P4A and PA9A for radial angular contact ball bearings
- SP and UP for radial cylindrical roller bearings
- P4/P2 for single direction angular contact thrust ball bearings
- P4C for double direction angular contact thrust ball bearings of the BTM design
- SP and UP for double direction angular contact thrust ball bearings of series 2344(00)

The actual values correspond, or are closer than those specified in

- DIN 620-2:1988 and DIN 620-3:1982
- ISO 492:1994 and. ISO 199:1979
- ANSI/AFBMA Standard 20-1987

The tolerance symbols used in the tolerance tables are explained in the following.

**$d$** nominal bore diameter

**$d_{mp}$** mean bore diameter; arithmetical mean of the largest and smallest single bore diameters in one plane

**$d_s$** single bore diameter

**$\Delta_{dmp}$** deviation of the mean bore diameter from the nominal

**$\Delta_{d2mp}$** deviation of the mean bore diameter at the theoretical small end of a tapered bore from the nominal

**$\Delta_{d3mp}$** deviation of the mean bore diameter at the theoretical large end of a tapered bore from the nominal

**$\Delta_{ds}$** deviation of a single bore diameter from the nominal

**$V_{dp}$** bore diameter variation; difference between the largest and smallest single bore diameters in one plane

**$V_{dmp}$** mean bore diameter variation; difference between the largest and smallest single bore diameters in one plane

**$D$** nominal outside diameter

**$D_{mp}$** mean outside diameter; arithmetical mean of the largest and smallest single outside diameters in one plane

**$D_s$** single outside diameter

**$\Delta_{Dmp}$** deviation of the mean outside diameter from the nominal

**$\Delta_{Ds}$** deviation of a single outside diameter from the nominal

**$V_{Dp}$** outside diameter variation; difference between the largest and smallest single outside diameters in one plane

**$V_{Dmp}$** mean outside diameter variation; difference between the largest and smallest mean bore diameters of one ring or washer

**$B_s$, $C_s$** single width of inner ring and outer ring, respectively

**$B_{1s}$, $C_{1s}$** single width of inner ring and outer ring, respectively, of a bearing specially manufactured for paired mounting

**$\Delta_{Bs}$, $\Delta_{Cs}$** deviation of single inner ring width or single outer ring width from the nominal

**$\Delta_{B1s}$, $\Delta_{C1s}$** deviation of single inner ring width or single outer ring width from the nominal of a bearing specially manufactured for paired mounting

**$V_{Bs}$, $V_{Cs}$** ring width variation; difference between the largest and smallest single widths of inner ring and of outer ring, respectively

**$\Delta_{Ts}$** deviation of single height of thrust bearing from the nominal

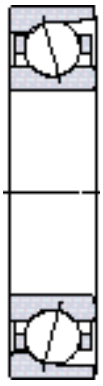
**$K_{ia}$, $K_{ea}$** radial runout of assembled bearing inner ring and assembled bearing outer ring, respectively

**$S_d$** side face runout with reference to bore (of inner ring)

**$S_D$** outside inclination variation; variation in inclination of outside cylindrical surface to outer ring side face

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

**$S_i$, $S_e$** thickness variation, measured from middle of raceway to back (seating) face of shaft washer and of housing washer, respectively (axial runout)



***Class P4A tolerances for radial angular contact ball bearings***

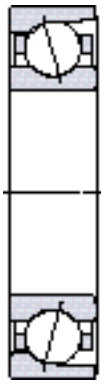
**Table 1**

**Inner ring**

| d | | $\Delta_{dmp}$ | | $\Delta_{ds}$ | | $V_{dp}$ | $V_{dmp}$ | $\Delta_{Bs}$ | | $\Delta_{B1s}$ | | $V_{Bs}$ | $K_{ia}$ | $S_d$ | $S_{ia}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| over | incl. | high | low | high | low | max | max | high | low | high | low | max | max | max | max |
| mm | | µm | | µm | | µm | µm | µm | | | | µm | µm | µm | µm |
| **2,5** | **10** | 0 | –4 | 0 | –4 | 1,3 | 1 | 0 | –40 | 0 | –250 | 1,3 | 1,3 | 1,3 | 1,3 |
| **10** | **18** | 0 | –4 | 0 | –4 | 1,3 | 1 | 0 | –80 | 0 | –250 | 1,3 | 1,3 | 1,3 | 1,3 |
| **18** | **30** | 0 | –5 | 0 | –5 | 1,3 | 1 | 0 | –120 | 0 | –250 | 1,3 | 2,5 | 1,3 | 2,5 |
| **30** | **50** | 0 | –6 | 0 | –6 | 1,3 | 1 | 0 | –120 | 0 | –250 | 1,3 | 2,5 | 1,3 | 2,5 |
| **50** | **80** | 0 | –7 | 0 | –7 | 2 | 1,3 | 0 | –150 | 0 | –250 | 1,3 | 2,5 | 1,3 | 2,5 |
| **80** | **120** | 0 | –8 | 0 | –8 | 2,5 | 1,5 | 0 | –200 | 0 | –250 | 2,5 | 2,5 | 2,5 | 2,5 |
| **120** | **150** | 0 | –10 | 0 | –10 | 6 | 3 | 0 | –250 | 0 | –380 | 4 | 4 | 4 | 4 |
| **150** | **180** | 0 | –10 | 0 | –10 | 6 | 3 | 0 | –250 | 0 | –380 | 4 | 6 | 5 | 6 |
| **180** | **250** | 0 | –12 | 0 | –12 | 7 | 4 | 0 | –300 | 0 | –500 | 5 | 7 | 6 | 7 |

**Outer ring**

| D | | $\Delta_{Dmp}$ | | $\Delta_{Ds}$ | | $V_{Dp}$ | $V_{Dmp}$ | $\Delta_{Cs}$, $\Delta_{C1s}$ | $V_{Cs}$ | $K_{ea}$ | $S_D$ | $S_{ea}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| over | incl. | high | low | high | low | max | max | | max | max | max | max |
| mm | | µm | | µm | | µm | µm | | µm | µm | µm | µm |
| **18** | **30** | 0 | –5 | 0 | –5 | 2 | 1,3 | Values are | 1,3 | 2,5 | 1,3 | 2,5 |
| **30** | **50** | 0 | –6 | 0 | –6 | 2 | 1,3 | identical | 1,3 | 2,5 | 1,3 | 2,5 |
| **50** | **80** | 0 | –7 | 0 | –7 | 2 | 1,3 | to those of inner ring | 1,3 | 3,8 | 1,3 | 3,8 |
| **80** | **120** | 0 | –8 | 0 | –8 | 2,5 | 1,3 | of same | 2,5 | 5 | 2,5 | 5 |
| **120** | **150** | 0 | –9 | 0 | –9 | 2,5 | 1,5 | bearing | 2,5 | 5 | 2,5 | 5 |
| **150** | **180** | 0 | –10 | 0 | –10 | 6 | 3 | | 4 | 6 | 4 | 6 |
| **180** | **250** | 0 | –11 | 0 | –11 | 6 | 4 | | 5 | 8 | 5 | 8 |
| **250** | **315** | 0 | –13 | 0 | –13 | 8 | 5 | | 5 | 9 | 6 | 8 |
| **315** | **400** | 0 | –15 | 0 | –15 | 9 | 6 | | 7 | 10 | 8 | 10 |



***Class PA9A tolerances for radial angular contact ball bearings***

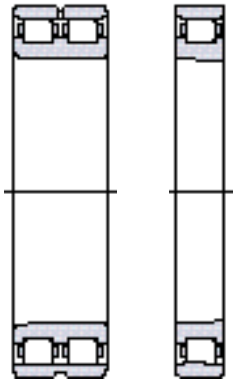
**Table 2**

**Inner ring**

| d | | $\Delta_{ds}$ | | $V_{dp}$ | $V_{dmp}$ | $\Delta_{Bs}$ | | $\Delta_{B1s}$ | | $V_{Bs}$ | $K_{ia}$ | $S_d$ | $S_{ia}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| over | incl. | high | low | max | max | high | low | high | low | max | max | max | max |
| mm | | µm | | µm | µm | µm | | µm | | µm | µm | µm | µm |
| **2,5** | **10** | 0 | –2,5 | 1,3 | 1 | 0 | –25 | 0 | –250 | 1,3 | 1,3 | 1,3 | 1,3 |
| **10** | **18** | 0 | –2,5 | 1,3 | 1 | 0 | –80 | 0 | –250 | 1,3 | 1,3 | 1,3 | 1,3 |
| **18** | **30** | 0 | –2,5 | 1,3 | 1 | 0 | –120 | 0 | –250 | 1,3 | 2,5 | 1,3 | 2,5 |
| **30** | **50** | 0 | –2,5 | 1,3 | 1 | 0 | –120 | 0 | –250 | 1,3 | 2,5 | 1,3 | 2,5 |
| **50** | **80** | 0 | –3,8 | 2 | 1,3 | 0 | –150 | 0 | –250 | 1,3 | 2,5 | 1,3 | 2,5 |
| **80** | **120** | 0 | –5 | 2,5 | 1,5 | 0 | –200 | 0 | –380 | 2,5 | 2,5 | 2,5 | 2,5 |
| **120** | **150** | 0 | –6,5 | 3 | 2 | 0 | –250 | 0 | –380 | 2,5 | 2,5 | 2,5 | 2,5 |
| **150** | **180** | 0 | –6,5 | 3 | 2 | 0 | –300 | 0 | –500 | 3,8 | 5 | 3,8 | 5 |
| **180** | **250** | 0 | –7,5 | 4 | 2,5 | 0 | –350 | 0 | –500 | 3,8 | 5 | 3,8 | 5 |

**Outer ring**

| D | | $\Delta_{Ds}$ | | $V_{Dp}$ | $V_{Dmp}$ | $\Delta_{Cs}$, $\Delta_{C1s}$ | $V_{Cs}$ | $K_{ea}$ | $S_D$ | $S_{ea}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| over | incl. | high | low | max | max | | max | max | max | max |
| mm | | µm | | µm | µm | | µm | µm | µm | µm |
| **18** | **30** | 0 | –3,8 | 2 | 1,3 | Values are | 1,3 | 2,5 | 1,3 | 2,5 |
| **30** | **50** | 0 | –3,8 | 2 | 1,3 | indentical | 1,3 | 2,5 | 1,3 | 2,5 |
| **50** | **80** | 0 | –3,8 | 2 | 1,3 | inner ring of same | 1,3 | 3,8 | 1,3 | 3,8 |
| **80** | **120** | 0 | –5 | 2,5 | 1,3 | bearing | 2,5 | 5 | 2,5 | 5 |
| **120** | **150** | 0 | –5 | 2,5 | 1,5 | | 2,5 | 5 | 2,5 | 5 |
| **150** | **180** | 0 | –6,5 | 3 | 2 | | 2,5 | 5 | 2,5 | 5 |
| **180** | **250** | 0 | –7,5 | 4 | 2,5 | | 3,8 | 6,5 | 3,8 | 6,5 |
| **250** | **315** | 0 | –7,5 | 4 | 3,5 | | 3,8 | 6,5 | 3,8 | 6,5 |
| **315** | **400** | 0 | –10 | 5 | 5 | | 6,5 | 7,5 | 6,5 | 7,5 |



***Class SP tolerances for cylindrical roller bearings***

**Table 3**

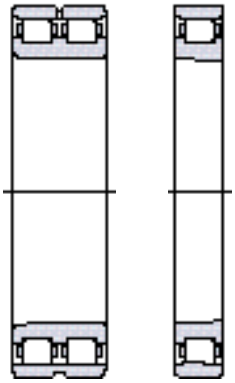
**Inner ring**

| d | | $\Delta_{ds}$ [1] | | $V_{dp}$ | $\Delta_{Bs}$ | | $V_{Bs}$ | $K_{ia}$ | $S_d$ |
|---|---|---|---|---|---|---|---|---|---|
| over | incl. | high | low | max | high | low | max | max | max |
| mm | | µm | | µm | µm | | µm | µm | µm |
| – | 18 | 0 | –5 | 3 | 0 | –100 | 5 | 3 | 8 |
| 18 | 30 | 0 | –6 | 3 | 0 | –100 | 5 | 3 | 8 |
| 30 | 50 | 0 | –8 | 4 | 0 | –120 | 5 | 4 | 8 |
| 50 | 80 | 0 | –9 | 5 | 0 | –150 | 6 | 4 | 8 |
| 80 | 120 | 0 | –10 | 5 | 0 | –200 | 7 | 5 | 9 |
| 120 | 180 | 0 | –13 | 7 | 0 | –250 | 8 | 6 | 10 |
| 180 | 250 | 0 | –15 | 8 | 0 | –300 | 10 | 8 | 11 |
| 250 | 315 | 0 | –18 | 9 | 0 | –350 | 13 | 10 | 13 |
| 315 | 400 | 0 | –23 | 12 | 0 | –400 | 15 | 12 | 15 |

[1] SP tolerances for tapered bore (taper 1:12 ) see Table 5

**Outer ring**

| D | | $\Delta_{Ds}$ | | $V_{Dp}$ | $\Delta_{Cs}$, $V_{Cs}$ | $K_{ea}$ | $S_D$ |
|---|---|---|---|---|---|---|---|
| over | incl | high | low | max | | max | max |
| mm | | µm | | µm | | µm | µm |
| 30 | 50 | 0 | –7 | 4 | Values are | 5 | 8 |
| 50 | 80 | 0 | –9 | 5 | identical | 5 | 8 |
| 80 | 120 | 0 | –10 | 5 | to those of inner ring | 6 | 9 |
| 120 | 150 | 0 | –11 | 6 | of same | 7 | 10 |
| 150 | 180 | 0 | –13 | 7 | bearing | 8 | 10 |
| 180 | 250 | 0 | –15 | 8 | | 10 | 11 |
| 250 | 315 | 0 | –18 | 9 | | 11 | 13 |
| 315 | 400 | 0 | –20 | 10 | | 13 | 13 |
| 400 | 500 | 0 | –23 | 12 | | 15 | 15 |



***Class UP tolerances for cylindrical roller bearings***

**Table 4**

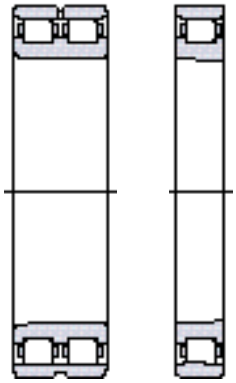
**Inner ring**

| d | | $\Delta_{ds}$ [1] | | $V_{dp}$ | $\Delta_{Bs}$ | | $V_{Bs}$ | $K_{ia}$ | $S_d$ |
|---|---|---|---|---|---|---|---|---|---|
| over | incl. | high | low | max | high | low | max | max | max |
| mm | | µm | | µm | µm | | µm | µm | µm |
| – | 18 | 0 | –4 | 2 | 0 | –25 | 1,5 | 1,5 | 2 |
| 18 | 30 | 0 | –5 | 2,5 | 0 | –25 | 1,5 | 1,5 | 3 |
| 30 | 50 | 0 | –6 | 3 | 0 | –30 | 2 | 2 | 3 |
| 50 | 80 | 0 | –7 | 3,5 | 0 | –40 | 3 | 2 | 4 |
| 80 | 120 | 0 | –8 | 4 | 0 | –50 | 3 | 3 | 4 |
| 120 | 180 | 0 | –10 | 5 | 0 | –60 | 4 | 3 | 5 |
| 180 | 250 | 0 | –12 | 6 | 0 | –75 | 5 | 4 | 6 |
| 250 | 315 | 0 | –18 | 9 | 0 | –90 | 6 | 5 | 6 |
| 315 | 400 | 0 | –23 | 12 | 0 | –100 | 8 | 6 | 6 |

[1] SP tolerances for tapered bore (taper 1:12 ) see Table 5.

**Outer ring**

| D | | $\Delta_{Ds}$ | | $V_{Dp}$ | $\Delta_{Cs}$, $V_{Cs}$ | $K_{ea}$ | $S_D$ |
|---|---|---|---|---|---|---|---|
| over | incl. | high | low | max | | max | max |
| mm | | µm | | µm | | µm | µm |
| 30 | 50 | 0 | –5 | 3 | Values are | 3 | 2 |
| 50 | 80 | 0 | –6 | 3 | identical | 3 | 2 |
| 80 | 120 | 0 | –7 | 4 | to those of inner ring | 3 | 3 |
| 120 | 150 | 0 | –8 | 4 | of same | 4 | 3 |
| 150 | 180 | 0 | –9 | 5 | bearing | 4 | 3 |
| 180 | 250 | 0 | –10 | 5 | | 5 | 4 |
| 250 | 315 | 0 | –12 | 6 | | 6 | 4 |
| 315 | 400 | 0 | –14 | 7 | | 7 | 5 |
| 400 | 500 | 0 | –17 | 9 | | 8 | 5 |



***Class SP and UP tolerances for tapered bore, taper 1:12***

**Table 5**

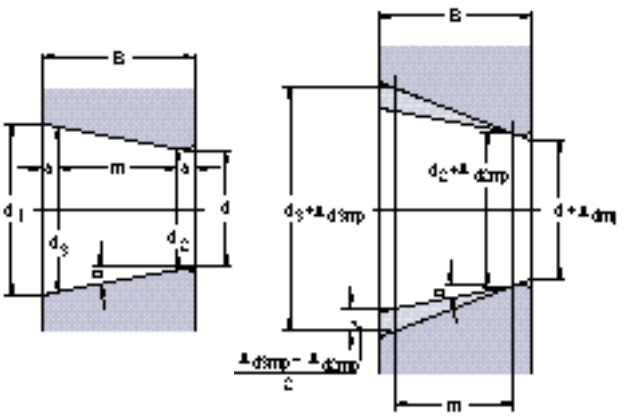
| d | | Tolerance class SP | | | | | Tolerance class UP | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $\Delta_{d2mp}$ | | $V_{dp}$ | $\Delta_{d3mp} - \Delta_{d2mp}$ [1] | | $\Delta_{d2mp}$ | | $V_{dp}$ | $\Delta_{d3mp} - \Delta_{d2mp}$ [1] | |
| over | incl. | high | low | max | high | low | high | low | max | high | low |
| mm | | µm | | µm | µm | | µm | | µm | µm | |
| **18** | **30** | +10 | 0 | 3 | +4 | 0 | +6 | 0 | 2,5 | +2 | 0 |
| **30** | **50** | +12 | 0 | 4 | +4 | 0 | +7 | 0 | 3 | +3 | 0 |
| **50** | **80** | +15 | 0 | 5 | +5 | 0 | +8 | 0 | 3,5 | +3 | 0 |
| **80** | **120** | +20 | 0 | 5 | +6 | 0 | +10 | 0 | 4 | +4 | 0 |
| **120** | **180** | +25 | 0 | 7 | +8 | 0 | +12 | 0 | 5 | +4 | 0 |
| **180** | **250** | +30 | 0 | 8 | +10 | 0 | +14 | 0 | 6 | +5 | 0 |
| **250** | **315** | +35 | 0 | 9 | +12 | 0 | +15 | 0 | 8 | +6 | 0 |

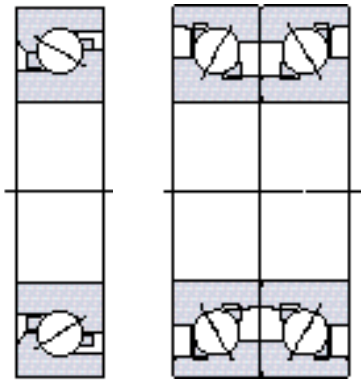
[1] $\Delta_{d3mp} - \Delta_{d2mp}$ = angular deviation over measuring length m

**Measuring distance a**

| Chamfer dimension $r_{s\ min}$ | Bearing bore d over | incl. | Measuring distance a |
|---|---|---|---|
| mm | mm | | mm |
| 0,6 | – | – | 2,5 |
| 1 | – | – | 3,5 |
| 1,1 | – | 120 | 4 |
| | 120 | – | 5 |
| 1,5 | – | 120 | 5 |
| | 120 | – | 6 |
| 2 | – | 80 | 5,5 |
| | 80 | 220 | 6 |
| | 220 | – | 7 |
| 2,1 | – | 280 | 7,5 |
| | 280 | – | 8,5 |
| 2,5 | – | 280 | 7,5 |
| | 280 | – | 8,5 |
| 3 | – | – | 9,5 |

**Tapered bore**
Half angle of taper: $\alpha = 2° 23' 9{,}4''$
Largest theoretical diameter: $d_1 = d + \frac{1}{12} B$





### *Class P4/P2 tolerances for single direction angular contact thrust ball bearings*

**Table 6**

**Shaft washer, housing washer and bearing height**

| d, D | | $\Delta_{ds}$ | | $\Delta_{Ds}$ | | $\Delta_{Ts}$ | | $S_i$, $S_e$ |
|---|---|---|---|---|---|---|---|---|
| over | incl. | high | low | high | low | high | low | max |
| mm | | µm | | µm | | µm | | µm |
| **10** | **18** | 0 | –3,8 | – | – | 0 | –80 | 1,5 |
| **18** | **30** | 0 | –3,8 | – | – | 0 | –120 | 2,5 |
| **30** | **50** | 0 | –5 | 0 | –5 | 0 | –120 | 2,5 |
| **50** | **80** | 0 | –5 | 0 | –5 | 0 | –150 | 2,5 |
| **80** | **120** | – | – | 0 | –7,5 | 0 | –200 | 2,5 |

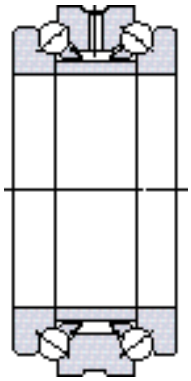
### *Class P4C tolerances for double direction angular contact thrust ball bearings, series BTM*

**Table 7**

**Shaft washer, housing washer and bearing height**

| d, D | | $\Delta_{ds}$ | | $\Delta_{Ds}$ | | $\Delta_{Cs}$ | | $S_i$, $S_e$ [1)] |
|---|---|---|---|---|---|---|---|---|
| over | incl. | high | low | high | low | high | low | max |
| mm | | µm | | µm | | µm | | µm |
| **50** | **80** | 0 | –7 | – | – | 0 | –200 | 3 |
| **80** | **120** | 0 | –8 | –28 | –38 | 0 | –400 | 4 |
| **120** | **150** | 0 | –10 | –33 | –44 | 0 | –500 | 4 |
| **150** | **180** | – | – | –33 | –46 | – | – | – |
| **180** | **250** | – | – | –37 | –42 | – | – | – |
| **250** | **315** | – | – | –41 | –59 | – | – | – |

[1)] The tolerance values quoted must be considered as approximate, as the raceway runout is measured in the direction of the ball load. When the bearing has been mounted, the axial runout is generally smaller than quoted in the table



## *Class SP tolerances for double direction angular contact thrust ball bearings, series 2344(00)*

**Table 8**

### Shaft washer and bearing height

| d | | $\Delta_{ds}$ | | $S_i$ [1] | $\Delta_{Ts}$ | |
|---|---|---|---|---|---|---|
| over | incl. | high | low | max | high | low |
| mm | | µm | | µm | µm | |
| **18** | **30** | +1 | –9 | 3 | +50 | –80 |
| **30** | **50** | +1 | –11 | 3 | +60 | –100 |
| **50** | **80** | +2 | –14 | 4 | +70 | –120 |
| **80** | **120** | +3 | –18 | 4 | +85 | –140 |
| **120** | **180** | +3 | –21 | 5 | +95 | –160 |
| **180** | **250** | +4 | –26 | 5 | +120 | –200 |

[1] The tolerance values quoted must be considered as approximate, as the raceway runout is measured in the direction of the ball load. When the bearing has been mounted, the axial runout is generally smaller than quoted in the table

### Housing washer

| D | | $\Delta_{Ds}$ | | $\Delta_{Cs}$ | | $S_i$, $S_e$ [1] |
|---|---|---|---|---|---|---|
| over | incl. | high | low | high | low | |
| mm | | µm | | µm | | |
| **30** | **50** | –20 | –27 | 0 | –60 | Values are identical to those of shaft washer of same bearing |
| **50** | **80** | –24 | –33 | 0 | –60 | |
| **80** | **120** | –28 | –38 | 0 | –60 | |
| **120** | **150** | –33 | –44 | 0 | –60 | |
| **150** | **180** | –33 | –46 | 0 | –60 | |
| **180** | **250** | –37 | –52 | 0 | –60 | |
| **250** | **315** | –41 | –59 | 0 | –60 | |

## *Class UP tolerances for double direction angular contact thrust ball bearings, series 2344(00)*

**Table 9**

### Shaft washer and bearing height

| d | | $\Delta_{ds}$ | | $S_i$ [1] | $\Delta_{Ts}$ | |
|---|---|---|---|---|---|---|
| over | incl. | high | low | max | high | low |
| mm | | µm | | µm | µm | |
| **18** | **30** | 0 | –6 | 1,5 | +50 | –80 |
| **30** | **50** | 0 | –8 | 1,5 | +60 | –100 |
| **50** | **80** | 0 | –9 | 2 | +70 | –120 |
| **80** | **120** | 0 | –10 | 2 | +85 | –140 |
| **120** | **180** | 0 | –13 | 3 | +95 | –160 |
| **180** | **250** | 0 | –15 | 3 | +120 | –200 |

[1] The tolerance values quoted must be considered as approximate, as the raceway runout is measured in the direction of the ball load. When the bearing has been mounted, the axial runout is generally smaller than quoted in the table

### Housing washer

| D | | $\Delta_{Ds}$ | | $\Delta_{Cs}$ | | $S_e$ |
|---|---|---|---|---|---|---|
| over | incl. | high | low | high | low | |
| mm | | µm | | µm | | |
| **30** | **50** | –20 | –27 | 0 | –60 | Values are identical to those of shaft washer of same bearing |
| **50** | **80** | –24 | –33 | 0 | –60 | |
| **80** | **120** | –28 | –38 | 0 | –60 | |
| **120** | **150** | –33 | –44 | 0 | –60 | |
| **150** | **180** | –33 | –46 | 0 | –60 | |
| **180** | **250** | –37 | –52 | 0 | –60 | |
| **250** | **315** | –41 | –59 | 0 | –60 | |

# The SKF group – a worldwide corporation

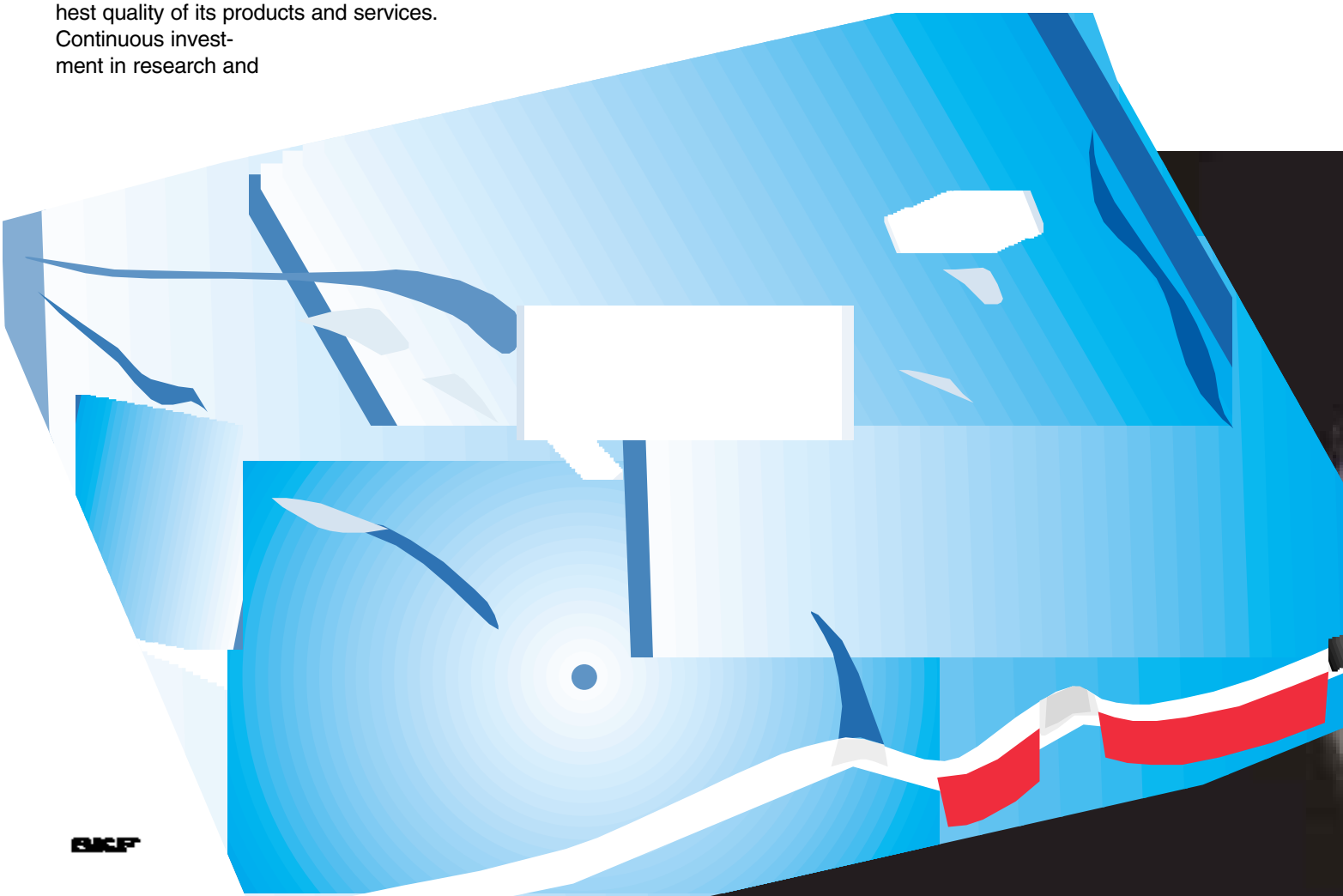
SKF is an international industrial Group operating in some 130 countries and is world leader in bearings.

The company was founded in 1907 following the invention of the self-aligning ball bearing by Sven Wingquist and, after only a few years, SKF began to expand all over the world.

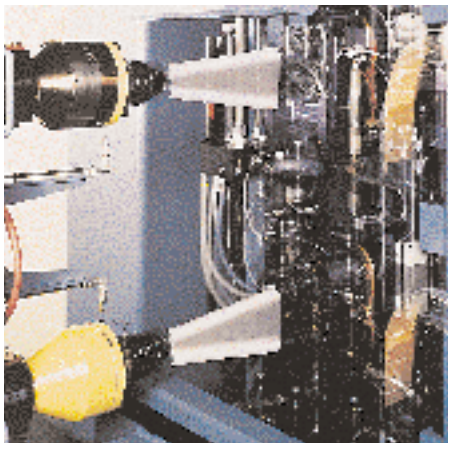
Today, SKF has some 43 000 employees and more than 80 manufacturing facilities spread throughout the world. An international sales network includes a large number of sales companies and some 20 000 distributors and retailers. Worldwide availability of SKF products is supported by a compre-hensive technical advisory service.

The key to success has been a consistent emphasis on maintaining the highest quality of its products and services. Continuous investment in research and development has also played a vital role, resulting in many examples of epoch-making innovations.

The business of the Group consists of bearings, seals, special steel and a comprehensive range of other high-tech industrial components. The experience gained in these various fields provides SKF with the essential knowledge and expertise required in order to provide the customers with the most advanced engineering products and efficient service.



*The SKF house colours are blue and red, but the thinking is green. The latest example is the factory in Malaysia, where the bearing component cleaning process conforms to the strictest ecological standards. Instead of trichloroethylene, a water-based cleaning fluid is used in a closed system. The cleaning fluid is recycled in the factory's own treatment plant.*



*The SKF Engineering & Research Centre is situated just outside Utrecht in The Netherlands. In an area of 17 000 square metres (185 000 sq.ft) some 150 scientists, engineers and support staff are engaged in the further improvement of bearing performance. They are developing technologies aimed at achieving better materials, better designs, better lubricants and better seals – together leading to an even better understanding of the operation of a bearing in its application. This is also where the SKF Life Theory was evolved, enabling the design of bearings which are even more compact and offer even longer operational life.*

*SKF has developed the Channel concept in factories all over the world. This drastically reduces the lead time from raw material to end product as well as work in progress and finished goods in stock. The concept enables faster and smoother information flow, eliminates bottlenecks and bypasses unnecessary steps in production. The Channel team members have the knowledge and commitment needed to share the responsibility for fulfilling objectives in areas such as quality, delivery time, production flow etc.*

*SKF manufactures ball bearings, roller bearings and plain bearings. The smallest are just a few millimetres (a fraction of an inch) in diameter, the largest several metres. In order to protect the bearings effectively against the ingress of contamination and the escape of lubricant, SKF also manu-factures oil and bearing seals. SKF's subsidiaries CR and RFT S.p.A. are among the world's largest producers of seals.*

The data in this publication are based on current production. Redesign or more recent computer calculations have resulted in some changes. The basic dynamic and static load ratings have been calculated in accordance with the latest standards.

Earlier publications, in which the data deviate from those given here, are rendered invalid. The right is reserved to make changes necessitated by technological developments.



Publication **4411 E**

Printed in Sweden on environmentally friendly, chlorine-free paper (Multiart Silk) by SG idé & tryck ab