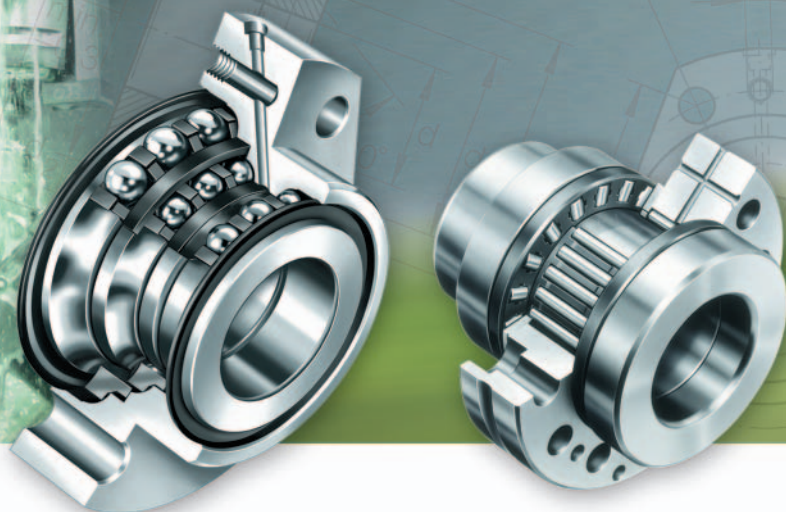




**FAG**

added  
competence



## **Bearings for screw drives**

**Axial angular contact ball bearings**  
**Needle roller/axial cylindrical roller bearings**  
**Seal carrier assemblies**  
**Precision locknuts**

**SCHAEFFLER GROUP**  
INDUSTRIAL



added  
competence

The right product  
for every application

=

Optimum benefit  
for you

With their forward-looking bearing arrangement solutions for feed spindles, main spindles, rotary tables and linear guidance units, INA and FAG have been at the forefront of the world market for decades. The bearing components alone, however, are often no longer the decisive factor for these machine subsystems.

Our customers have of course benefitted directly from significant performance improvements and unique selling propositions thanks to our “ready-to-fit” products; these compact, ready-to-fit bearings are used in accordance with the simple principle: unpack, screw mount, use. In order to optimise the entire machine tool system, however, it is becoming ever more important not simply to support the subsystems but to integrate important functions such as measurement, sealing, lubrication, braking etc. in the components themselves. This intellectual approach is fulfilled comprehensively by the new concept **added competence** in the Production Machinery Sector since it attaches central importance to systems solution thinking for the bearing, bearing position and entire system. This means that you can now access a product range that gives optimum coverage to all your applications in the machine tool.

Since direct drives and mechatronic solutions are used ever more frequently in machine tools, we have incorporated a further strong partner in the form of IDAM – INA Drives & Mechatronics – in our spectrum of capabilities. In this way, we can now supply you from a single source with bearing elements and the appropriate drive system to give complete systems that are precisely matched to each other. This opens up completely new technical and economic design possibilities for your requirements as well as significant advantages in the time and process chain.

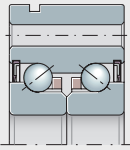
In terms of products, we offer you a comprehensive, precisely balanced range, precision technology and top product quality. In order to match the pulse of your developments as closely as possible, furthermore, we have a worldwide network of engineers, service and sales technicians working for you and ensuring that we maintain close contact with you in your own location.

In conclusion, we are convinced that we will always have the right product for your application. Just contact us to see what we can do for you.

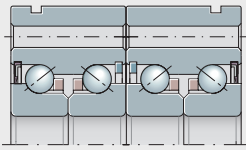
added  
competence

# Bearings for screw drives

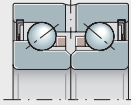
<b>Matrix for preselection of bearings</b>	4
<p>A matrix structured in terms of applications allows rapid preselection of the suitable bearing for a specific application.</p>	
<b>Axial angular contact ball bearings</b>	6
<p>Axial angular contact ball bearings are precision bearings for supporting screw drives. Depending on the series, they can support high radial forces as well as axial forces from one or both sides. The inner ring is matched to the ball and cage assemblies and the outer ring. As a result, the bearings can be set to a defined axial preload. Contact seals protect the rolling element system against contamination and moisture. For higher speeds, gap seals can be used.</p> <p>The bearings are available with and without fixing holes in the outer ring. Bearings with holes are screw mounted directly on the adjacent construction. This solution is particularly economical since there is no need for the locating bore otherwise required or for the bearing cover with the associated matching work.</p> <p>For applications in the handling sector, for woodworking machinery and transport type screw drives, a bearing arrangement with a lower level of precision is often sufficient. For this purpose, there are versions with less stringent tolerances.</p>	
<b>Needle roller/axial cylindrical roller bearings</b>	58
<p>Needle roller/axial cylindrical roller bearings are double direction precision axial cylindrical roller bearings with a radial bearing component. The inner ring, outer ring and cylindrical roller and cage assemblies are matched to each other such that the bearings can be set to a defined axial preload using a precision locknut.</p> <p>The bearings are available with and without fixing holes in the outer ring. Bearings with holes are screw mounted directly on the adjacent construction. The large contact surface and the small pitch of the holes allows a connection to the adjacent construction that is extremely rigid and with low tendency to settling. The bearing cover that would otherwise be required to hold the bearing, and the matching work required, can therefore be dispensed with.</p> <p>Needle roller/axial cylindrical roller bearings are also available with a stepped, extended shaft locating washer on one side. These bearings are used where the axial support of the shaft locating washer is insufficient or a seal raceway is required.</p>	
<b>Seal carrier assemblies Precision locknuts</b>	84
<p>Seal carrier assemblies DRS are complete sealing sets that are screw mounted on the central washer of needle roller/axial cylindrical roller bearings ZARF (L). They are precisely centred in this position and seal the bearings against external influences.</p> <p>The precision locknuts AM, ZM, ZMA for axial or radial locking are used to set bearings for screw drives to a defined axial preload.</p> <p>They are also used where high axial forces must be supported and high runout accuracy and rigidity are required.</p>	



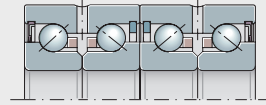
ZKLF



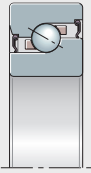
ZKLF..-2RS-2AP



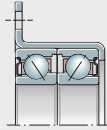
ZKLN



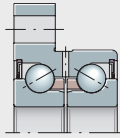
ZKLN..-2RS-2AP



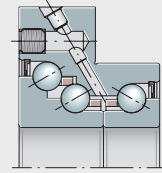
7602, 7603,  
BSB



ZKLR

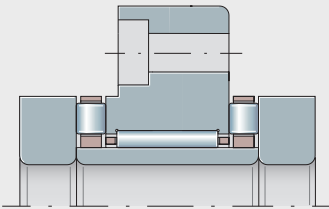


ZKLFA

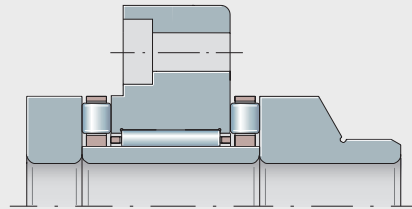


DKLFA

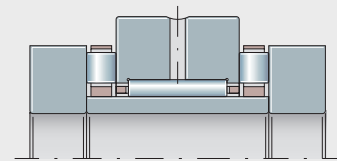
107 558a



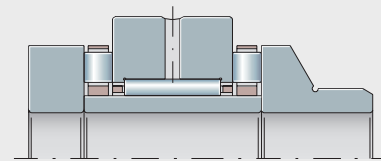
ZARF



ZARF..-L

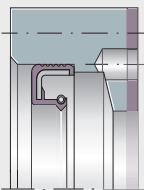


ZARN

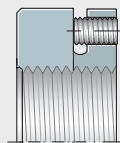


ZARN..-L

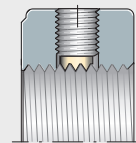
107 559



DRS



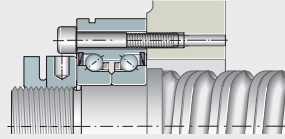
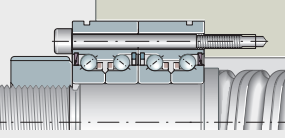
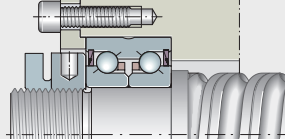
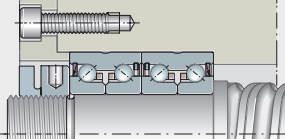
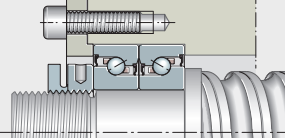
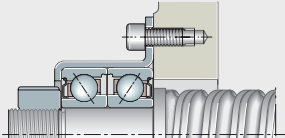
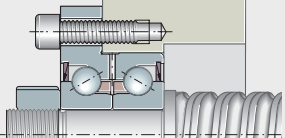
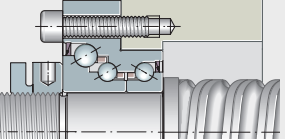
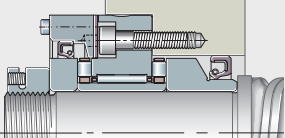
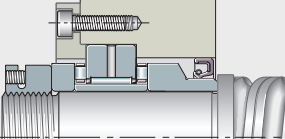
AM



ZM, ZMA

107 560

## Matrix for preselection of bearings

Application	Series	
<b>For standard applications</b>		<b>ZKLF...-2Z</b> <b>ZKLF...-2RS</b> <b>ZKLF...-2RS-PE</b>
		<b>ZKLF...-2RS-2AP</b>
		<b>ZKLN...-2Z</b> <b>ZKLN...-2RS</b> <b>ZKLN...-2RS-PE</b>
		<b>ZKLN...-2RS-2AP</b>
		<b>7602</b> <b>7602-2RS</b> <b>7603</b> <b>7603-2RS</b> <b>BSB</b> <b>BSB-2RS</b>
<b>For special applications</b>		<b>ZKLR...-2Z</b> <b>ZKLR...-2RS</b>
		<b>ZKLFA...-2Z</b> <b>ZKLFA...-2RS</b>
		<b>DKLFA...-2RS</b>
<b>For applications requiring very high accuracy and rigidity</b>		<b>ZARF (L)</b>
		<b>ZARN (L)</b>

Definition of symbols  
 +++ very good  
 ++ good  
 + satisfactory  
 – sufficient

### Caution!

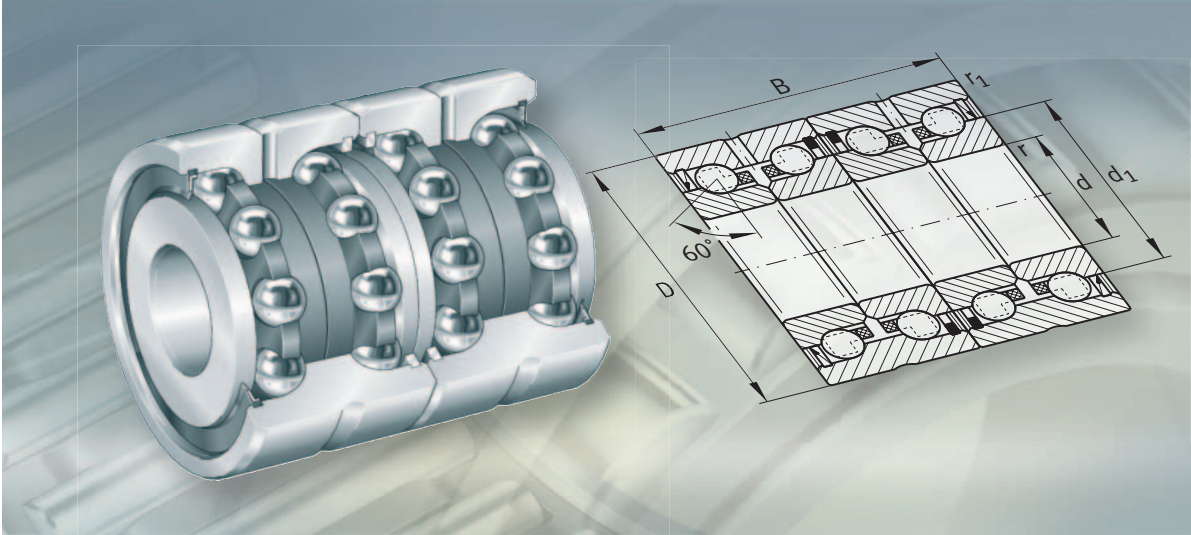
This selection matrix is a general overview for preliminary assessment of whether bearings can be considered for the required purpose.

For the specific application, the data in the product sections and the technical principles must always be taken into consideration.

Features	Characteristics					
	High runout accuracy	High speeds and low friction	High rigidity and load carrying capacity	Work on adjacent construction and mounting	Low lubricant consumption	For description, see page
<ul style="list-style-type: none"> <li>- Outer ring for flange mounting</li> <li>- Gap seals or contact seals on both sides</li> <li>- Greased, with relubrication facility</li> <li>- Most economical type of screw drive bearing arrangement</li> </ul>	++ ++ +	+++ ++ ++	+ + +	+++ +++ +++	++ ++ ++	<b>10</b>
<ul style="list-style-type: none"> <li>- As ZKLF, but in matched pair</li> <li>- Significantly higher load carrying capacity and rigidity than ZKLF</li> </ul>	++	++	++	++	++	<b>11</b>
<ul style="list-style-type: none"> <li>- Gap seals or contact seals on both sides</li> <li>- Greased, with relubrication facility</li> <li>- Easier to fit than single row bearings, e.g. for plummer block housings</li> </ul>	++ ++ +	+++ ++ ++	+ + +	+ + +	++ ++ ++	<b>12</b>
<ul style="list-style-type: none"> <li>- As ZKLN, but in matched pair</li> <li>- Significantly higher load carrying capacity and rigidity than ZKLN</li> </ul>	++	++	++	+	++	<b>12</b>
<ul style="list-style-type: none"> <li>- Open or sealed on both sides</li> <li>- Highly suitable for mounting in pairs to form wide range of contact angle combinations</li> </ul>	++ ++ ++ ++ ++	+++ ++ +++ ++ +++	+ + + + +	- - - - -	++ ++ ++ ++ ++	<b>14</b>
<ul style="list-style-type: none"> <li>- Particularly economical alternative to solutions comprising individual ball bearings</li> <li>- Gap seals or contact seals on both sides</li> <li>- Simple to fit</li> <li>- For applications with comparatively low loads, but high positional accuracy</li> </ul>	+ +	+++ ++	- -	+++ +++	++ ++	<b>15</b>
<ul style="list-style-type: none"> <li>- Outer ring for flange mounting</li> <li>- Stepped outer ring with flattened areas on both sides</li> <li>- Gap seals or contact seals on both sides</li> </ul>	++ ++	+++ ++	+ +	+++ +++	++ ++	<b>16</b>
<ul style="list-style-type: none"> <li>- Higher load carrying capacity on one side</li> <li>- Outer ring for flange mounting</li> <li>- Sealed on both sides</li> <li>- For vertical axes</li> <li>- For locating bearing arrangements on both sides</li> </ul>	+	++	++	+++	++	<b>16</b>
<ul style="list-style-type: none"> <li>- Outer ring for flange mounting</li> <li>- Very high accuracy, rigidity and load carrying capacity</li> <li>- Bearing prepared for sealing</li> </ul>	+++	+	+++	+	-	<b>61</b>
<ul style="list-style-type: none"> <li>- Very high accuracy, rigidity and load carrying capacity</li> <li>- Bearing prepared for sealing</li> </ul>	+++	+	+++	-	-	<b>62</b>



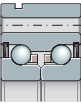
**FAG**



## **Axial angular contact ball bearings**

## Axial angular contact ball bearings

		Page
<b>Product overview</b>	Axial angular contact ball bearings.....	8
<b>Features</b>	Double row axial angular contact ball bearings, screw mounting	10
	Double row axial angular contact ball bearings, not screw mounting.....	12
	Single row axial angular contact ball bearings, for combination in pairs .....	14
	Angular contact ball bearing unit, screw mounting .....	15
	Double row axial angular contact ball bearings with flange, screw mounting.....	16
	Triple row axial angular contact ball bearings with flange, screw mounting.....	16
	Operating temperature .....	17
	Cages.....	17
	Suffixes.....	17
<b>Design and safety guidelines</b>	Basic rating life .....	18
	Static load safety factor.....	19
	Maximum radial load on screw connections for ZKLF .....	25
	Permissible static axial load for ZKLF .....	25
	Design of adjacent construction .....	26
	Speeds.....	26
	Friction.....	26
	Lubrication .....	27
	Mounting guidelines .....	28
<b>Dimension tables</b>	Axial angular contact ball bearings, screw mounting .....	32
	Axial angular contact ball bearings, screw mounting, less stringent tolerances .....	34
	Axial angular contact ball bearings, screw mounting, matched ..	36
	Axial angular contact ball bearings, not screw mounting.....	38
	Axial angular contact ball bearings, not screw mounting, less stringent tolerances .....	42
	Axial angular contact ball bearings, not screw mounting, matched.....	44
	Axial angular contact ball bearings, single direction, unsealed ..	46
	Axial angular contact ball bearings, single direction, sealed .....	50
	Angular contact ball bearing units, screw mounting.....	52
	Axial angular contact ball bearings, screw mounting .....	54
	Triple row angular contact ball bearings, screw mounting.....	56

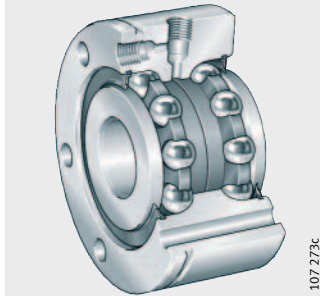




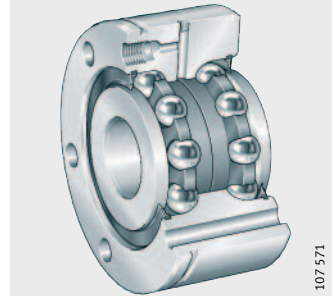
# Product overview – Axial angular contact ball bearings

**Double row,  
for screw mounting**  
Lip seals or gap seals

ZKLF..-2RS, ZKLF..-2Z

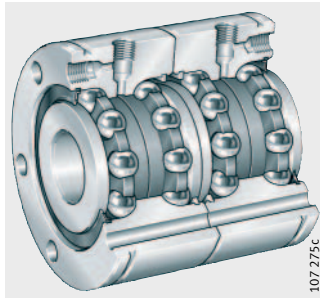


ZKLF..-2RS-PE



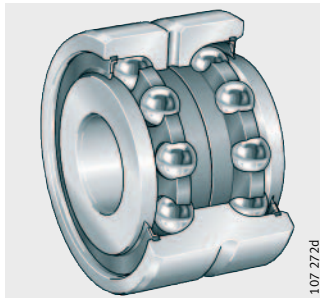
**Matched pair**

ZKLF..-2RS-2AP



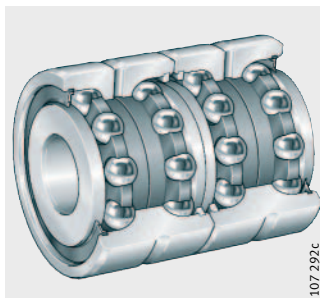
**Double row,  
not for screw mounting**  
Lip seals or gap seals

ZKLN..-2RS, ZKLN..-2Z  
ZKLN..-2RS-PE



**Matched pair**

ZKLN..-2RS-2AP



**Single row,  
for matching in pairs**  
With/without lip seals

**7602, 7603, BSB**



135 268a

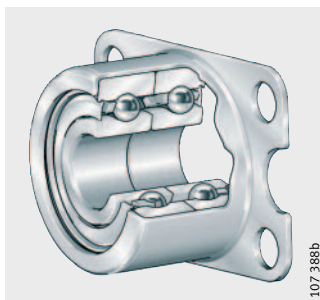
**7602..-2RS, 7603..-2RS,  
BSB..-2RS**



135 323

**Double row angular  
contact ball bearing unit,  
for screw mounting**  
Lip seals or gap seals

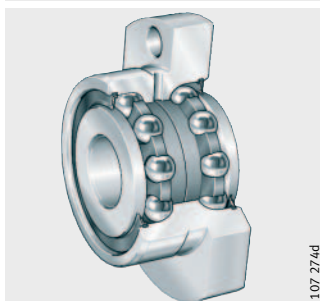
**ZKLR..-2RS  
ZKLR..-2Z**



107 388b

**Double or triple row,  
flange with flattened areas,  
for screw mounting**  
Double row  
Lip seals or gap seals

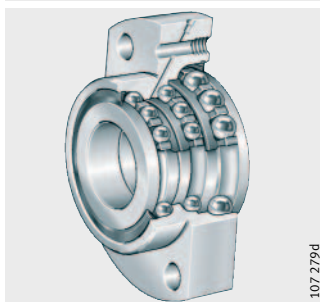
**ZKLFA..-2RS  
ZKLFA..-2Z**



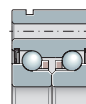
107 274d

**Triple row  
Lip seals**

**DKLFA..-2RS**



107 279d



# Axial angular contact ball bearings

## Features

Screw drive bearing arrangements are subjected to requirements that often cannot be optimally fulfilled by the design construction of conventional bearings. In order to design bearing arrangements for the highly dynamic operating conditions in screw drives that have high accuracy, high load carrying capacity, high rigidity, low friction, are easy to fit and maintenance-free or low-maintenance, INA/FAG has a wide range of axial angular contact ball bearings. With this well thought-out product range, ideal application-specific solutions can now be found to all the technical and economic demands placed on the bearing arrangements of screw drives.

## Multi-row designs

Axial angular contact ball bearings are available as single, double or triple row ready-to-fit units. They are self-retaining and comprise thick-walled, geometrically stable outer rings, ball and cage assemblies and one-piece or two-piece inner rings. In several series, the outer ring has through holes for simple flange mounting to the adjacent construction.

The bearing rings are matched to each other such that a defined preload is achieved when the rings are clamped in place using a precision locknut.

## Radial and axial load carrying capacity

Due to the 60° contact angle, the bearings can support high axial forces.

## Double row axial angular contact ball bearings, for screw mounting

Axial angular contact ball bearings ZKLF are screw mounted directly on the adjacent construction or in a radial locating bore, *Figure 1* and *Figure 2*. The cover that would otherwise be required and the associated matching work can therefore be dispensed with.

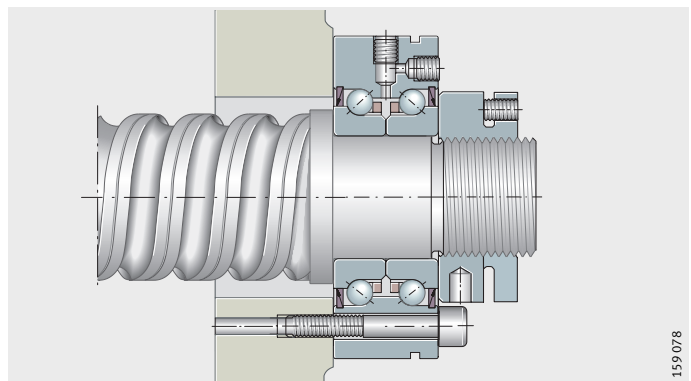
In order to aid removal of the bearings from a locating bore, the outer ring has a circumferential extraction slot.

Relubrication is facilitated by radial and axial threaded connectors with set screws.

ZKLF..-2RS  
ZKLF..-2Z

*Figure 1*

Outer ring screw mounted on flat adjacent construction, preloaded using locknut



## With less stringent tolerances

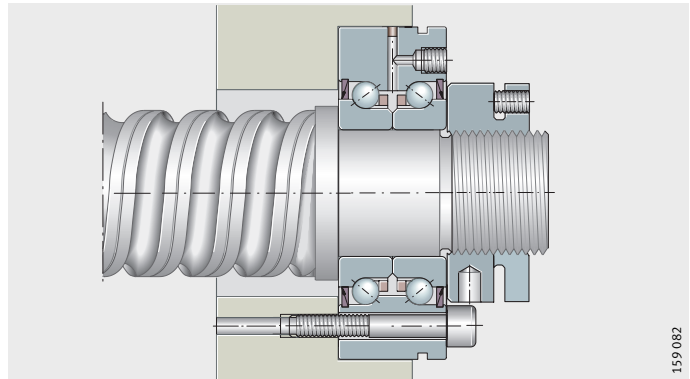
Axial angular contact ball bearings ZKLF..-2RS-PE correspond to series ZKLF but have a runout tolerance within P5 to DIN 620, less stringent diameter tolerances and the suffix PE. They are used where a lower positional accuracy is acceptable. As a result, the adjacent construction does not need to be as accurate with these bearings.

Relubrication is facilitated by an axial threaded connector. The radial lubrication duct is firmly closed off.

**ZKLF..-2RS-PE**

*Figure 2*

Outer ring screw mounted in bore, preloaded using locknut



**Heavy series**

Axial angular contact ball bearings ZKLF..-2RS and ZKLF..-2Z are also available in a heavy series. For the same shaft diameter, they have a larger cross-section and thus higher basic load ratings.

**Matched pairs**

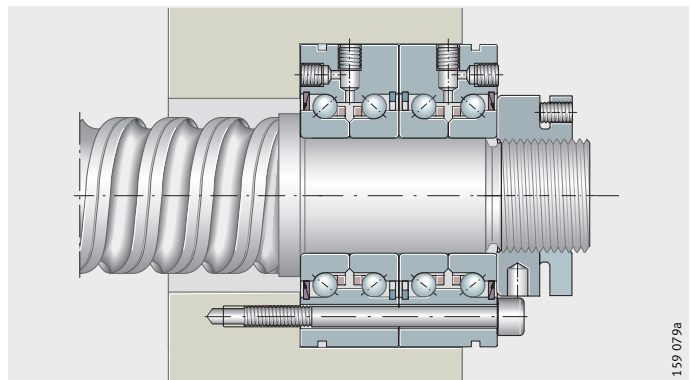
Bearings of series ZKLF..-2RS-2AP comprise a matched pair of bearings ZKLF..-2RS, *Figure 3*. The individual bearings are matched to each other.

Matched bearings have an arrow marking on the outside surface of the outer rings. When the bearings are arranged correctly, the lip seals face outwards. During fitting, the hole pattern of the two bearings must match, not the marking.

**ZKLF..-2RS-2AP**

*Figure 3*

Matched pair  
Outer ring screw mounted in bore, preloaded using locknut



**Sealing/lubricant**

Bearings with the suffix 2RS have lip seals and highly effective sealing.

Bearings with the suffix 2Z are sealed using gap seals and are suitable for higher speeds.

The bearings are greased using a lithium soap grease to GA28 and can be lubricated via the lubrication connectors in the outer ring (for information on GA28, see page 27).

For the majority of applications, the initial greasing is sufficient for the whole bearing operating life.

# Axial angular contact ball bearings

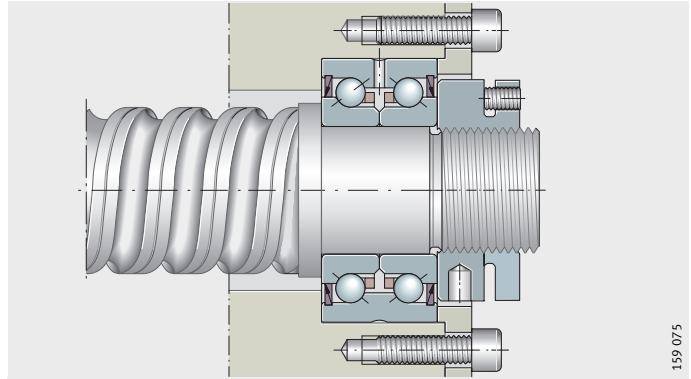
## Double row axial angular contact ball bearings, not for screw mounting

Axial angular contact ball bearings ZKLN are mounted in a housing bore, *Figure 4*. The bearing outer ring is axially located by a cover.

ZKLN..-2RS  
ZKLN..-2Z

*Figure 4*

Outer ring located using cover, preloaded using locknut



159 075

## With less stringent tolerances

Axial angular contact ball bearings ZKLN..-2RS-PE correspond to series ZKLN but have a runout tolerance within P5 to DIN 620, less stringent diameter tolerances and the suffix PE. They are used where a lower positional accuracy is acceptable. As a result, the adjacent construction does not need to be as accurate with these bearings.

## Heavy series

Axial angular contact ball bearings ZKLN..-2RS and ZKLN..-2Z are also available in a heavy series. For the same shaft diameter, they have a larger cross-section and thus higher basic load ratings.

## Matched pairs

Bearings of series ZKLN..-2RS-2AP comprise a matched pair of bearings ZKLN..-2RS, *Figure 5*. The individual bearings are matched to each other.

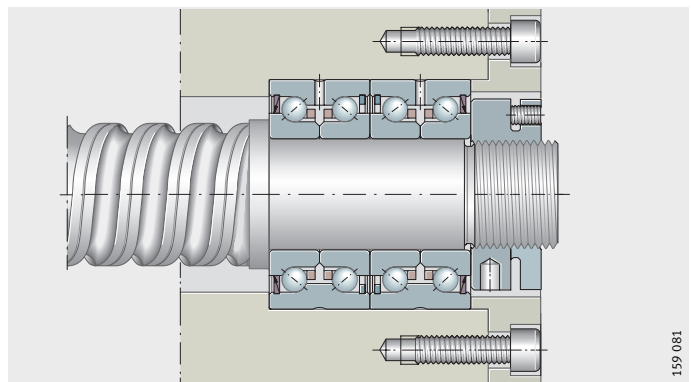
Matched bearings have an arrow marking on the outside surface of the outer rings. When the bearings are arranged correctly, the lip seals face outwards.

The bearing outer rings are axially clamped by a cover, *Figure 5*.

ZKLN..-2RS-2AP

*Figure 5*

Matched pair  
Outer rings located using cover,  
preloaded using locknut



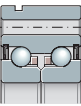
159 081

**Sealing/lubricant** Bearings with the suffix 2RS have lip seals and highly effective sealing.

Bearings with the suffix 2Z are sealed using gap seals and are suitable for higher speeds.

The bearings are greased using a lithium soap grease to GA28 and can be lubricated via a lubrication slot and lubrication holes in the outer ring (for information on GA28, see page 27).

For the majority of applications, the initial greasing is sufficient for the whole bearing operating life.



# Axial angular contact ball bearings

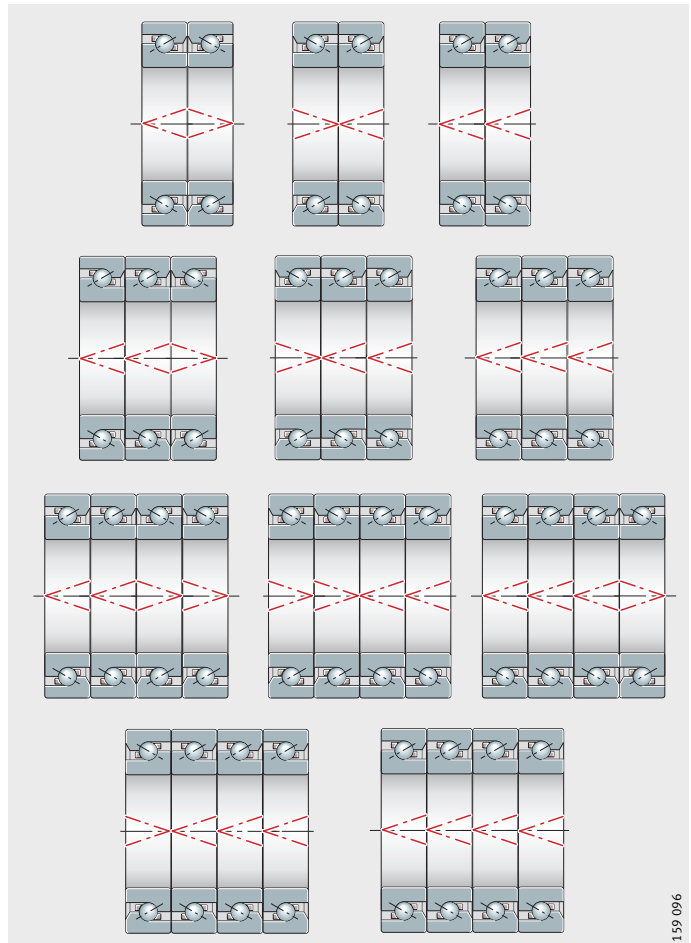
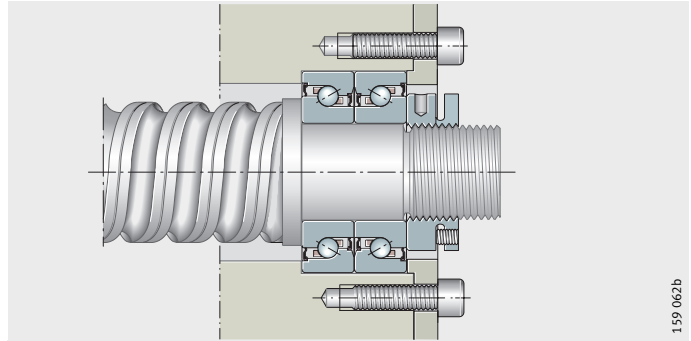
## Single row axial angular contact ball bearings, for combination in pairs

Bearings 7602, 7603 and BSB are designed as universal bearings, *Figure 6* and *Figure 7*. They can be combined in a wide range of sets for different requirements, *Figure 7*.

7602..-2RS, 7603..-2RS, BSB..-2RS

*Figure 6*

Single row axial angular contact ball bearings, two-bearing set in O arrangement



7602, 7603, BSB

*Figure 7*

Set combinations

## Sealing/lubricant

Single row axial angular contact ball bearings are not sealed and are not supplied greased. However, some sizes are fitted with seals. These bearings are greased for life using a lithium soap grease to GA28 (for information on GA28, see page 27).

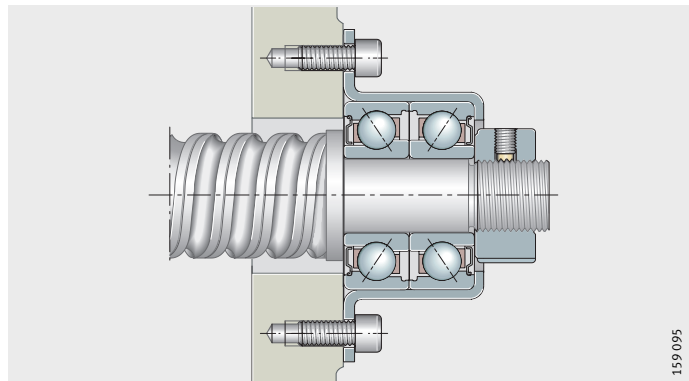
## Angular contact ball bearing unit, for screw mounting

Angular contact ball bearing units ZKLR are low-cost bearings and therefore particularly economical. They comprise a deep drawn sheet steel housing with an integral matched pair of angular contact ball bearings in an X arrangement, *Figure 8*. The housing has a Corrotect® coating and is thus protected against rust. The ball bearings are sealed on both sides by lip seals or gap seals. The bearing assembly is preloaded clearance-free.

ZKLR...-2RS  
ZKLR...-2Z

*Figure 8*

Angular contact ball bearing unit



### Particularly easy to fit

The units are particularly easy to fit. They:

- are directly flange mounted, for example on the milled face of the adjacent construction. This eliminates the need for precise, costly fits and additional flange covers for seating and axial location of the bearings
- require no additional parts for location of the bearings in the housing
- reduce errors in fitting due to the smaller number of components compared to conventional solutions
- are self-aligning by means of the screw drive nut during fitting. This effectively eliminates any warping due to misalignment of the bearing seats
- have a defined preload. It is not necessary to preload the bearing during fitting as is usually the case with screw drive bearing arrangements
- require only clearance-free axial location on the threaded spindle.

### Sealing/lubricant

Bearings with the suffix 2RS have lip seals and highly effective sealing. Bearings with the suffix 2Z are sealed using gap seals and are suitable for higher speeds. The bearings are greased using a lithium soap grease to DIN 51 825–K2N–40.

### Areas of application

The units are highly suitable, due to their dimensions and design, for space-saving and simple bearing arrangements in highly dynamic screw drives, for example:

- in inspection and measuring equipment
- in small machine tools
- in medical and laboratory equipment
- in precision engineering and productronics
- where complete units will give a simpler bearing arrangement.



# Axial angular contact ball bearings

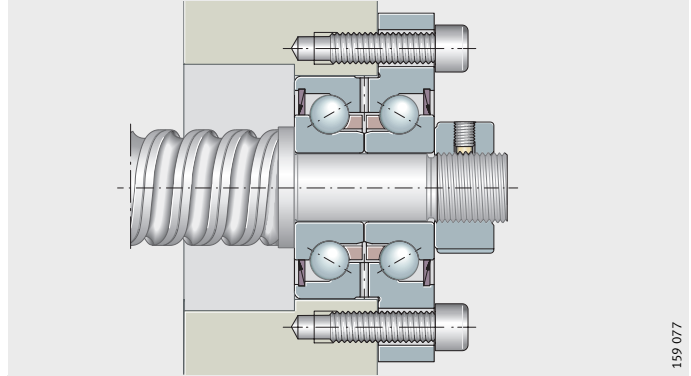
## Double row axial angular contact ball bearings with flange, for screw mounting

Series ZKLFA has a stepped outer ring. It can therefore be screw mounted easily on the adjacent construction, *Figure 9*. The flange has flattened areas on both sides, so the radial design envelope in the adjacent construction can be kept very small.

ZKLFA..-2RS  
ZKLFA..-2Z

*Figure 9*

Outer ring screw mounted on adjacent construction, preloaded using locknut



### Sealing/lubricant

Bearings with the suffix 2RS have lip seals and highly effective sealing. Bearings with the suffix 2Z are sealed using gap seals and are suitable for higher speeds.

The bearings are greased using a lithium soap grease to GA28 and can be lubricated via a lubrication slot and lubrication holes in the outer ring (for information on GA28, see page 27). For the majority of applications, the initial greasing is sufficient for the whole bearing operating life.

## Triple row axial angular contact ball bearings with flange, for screw mounting

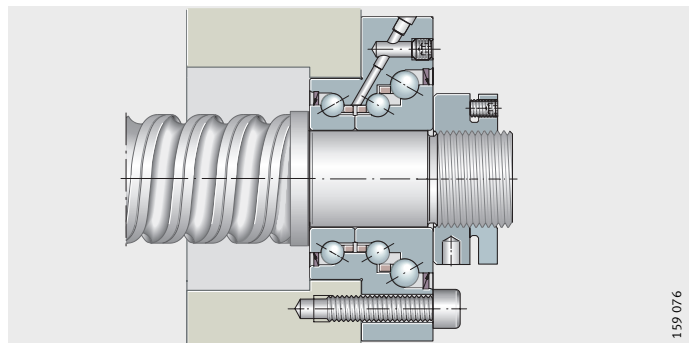
Axial angular contact ball bearings DKLFA..-2RS have, in addition to two rows of balls with a 60° contact angle in an O arrangement, an extra row of balls, *Figure 10*. Due to this additional row, the bearings can support higher axial loads in one direction.

Due to the stepped outer ring, the bearings can be easily flanged mounted on the adjacent construction. The flange has flattened areas on both sides. As a result, it requires only a small design envelope in the adjacent construction.

DKLFA..-2RS

*Figure 10*

Outer ring screw mounted on adjacent construction, preloaded using locknut



**Caution!** In order to make full use of the load carrying capacity of bearings DKLFA...-2RS, their design requires that they are subjected to continuous load in the main load direction. They are therefore used mainly in screw drives with a locating/locating bearing arrangement and tensioned spindles or in vertically arranged screw drive bearing arrangements.  
For design of the bearing arrangement, please contact INA/FAG.

**Sealing/lubricant** The bearings have lip seals on both sides.  
They are greased using a lithium soap grease to GA28 (for information on GA28, see page 27). If necessary, lubrication can be carried out via a threaded connector for central lubrication systems on the flange side.

**Caution!** For calculation of relubrication intervals based on a stated load spectrum (speed, load, operating duration, environmental conditions), please contact INA.



**Operating temperature** Sealed axial angular contact ball bearings are suitable for operating temperatures from -30 °C to +120 °C; this is limited by the grease, seal material and the plastic cages in the ball and cage assemblies.

**Caution!** The operating temperature influences the dynamic bearing characteristics. The values given in the dimension tables are based on a room temperature of +20 °C.

**Cages** The axial angular contact ball bearings have plastic cages. The cage design is not indicated in the suffix.  
In the series 7602, 7603 and BSB, the polyamide cages are indicated by the suffix T or TVP.

**Suffixes** Suffixes for the available designs: see table.

**Available designs**

Suffix	Description
PE	Less stringent bearing design
T, TVP	Polyamide cage, guided by balls
TN	Cages made from glass fibre reinforced polyamide 66
2AP	Axial angular contact ball bearings, matched pair (ZKLN, ZKLF)
2RS	Contact seals on both sides
2Z	Gap seals on both sides

# Axial angular contact ball bearings

## Design and safety guidelines

### Basic rating life

The decisive factors in determining the bearing size are the basic rating life, the static load safety factor and the axial limiting load. The basic rating life  $L$  and  $L_h$  are calculated as follows:

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

$$L_h = \frac{16666}{n} \cdot \left( \frac{C}{P} \right)^p$$

$L$   $10^6$  rev.

Basic rating life in millions of revolutions

$L_h$  h

Basic rating life in operating hours

$C_r, C_a$  N

Basic dynamic radial or axial load rating according to dimension table

$C_r$  is valid for a contact angle  $\alpha < 45^\circ$ ,  $C_a$  is valid for a contact angle  $\alpha > 45^\circ$

$P$  N

Equivalent dynamic bearing load

$p$  -

Life exponent  $p = 3$

$n$   $\text{min}^{-1}$

Operating speed.

### Resultant and equivalent bearing load $P$ for ZKLR

Bearing unit Designation	Factor $P$
ZKLR0624-2Z	$P = 140 + 0,13 F_a^{1,4} + 0,003 \cdot F_r^{1,9}$
ZKLR0828-2Z	$P = 210 + 0,28 F_a^{1,27} + 0,002 \cdot F_r^{1,9}$
ZKLR1035-2Z	$P = 240 + 0,47 F_a^{1,17} + 0,0015 \cdot F_r^{1,9}$
ZKLR1244-2RS	$P = 580 + 0,046 F_a^{1,3} + 0,076 \cdot F_r^{1,28}$
ZKLR1547-2RS	$P = 540 + 0,011 F_a^{1,5} + 0,022 \cdot F_r^{1,45}$
ZKLR2060-2RS	$P = 960 + 0,0082 F_a^{1,5} + 0,017 \cdot F_r^{1,45}$

### Static limiting load diagrams for ZKLR

The easy-to-use static limiting load diagrams allow quick verification of the bearing size of series ZKLR – as a function of the axial and radial operating load, *Figure 21* to *Figure 23*, page 24. The decisive requirement is that the intersection between the axial and radial load must be below the limit line.

Example: If the operating loads  $F_a$  and  $F_r$  are below the limit line, the bearing size is suitable for the application, see example *Figure 23*, page 24.

**Resultant and equivalent bearing load P for ZKLN, ZKLF, ZKLFA, DKLFA, BSB, 7602, 7603**

The bearings are axially preloaded to a defined value if the recommended precision locknuts are used and the correct nut tightening torque is applied. The resultant axial bearing load  $F_{a\text{res}}$  is determined from the axial operating load  $F_{aB}$  and taking account of the axial preload according to *Figure 11* to *Figure 15*, page 20 and page 21. For series 7602, 7603 and BSB, the  $F_{a\text{res}}$  diagrams are based on two-bearing sets in an O or X arrangement, *Figure 7*, page 14. For calculation of other set combinations, please contact us.

**Caution!** A load in excess of the limit value will lead to the rolling element row without load lifting off the raceway. As a result, higher wear will occur under rapid acceleration. For extreme moment loads and statically overdefined systems (locating/locating bearing arrangements), please contact us. The calculation program BEARINX® can give a precise design in this case.



**Axial and radial operating loads**

Under purely axial load,  $P = F_{a\text{res}}$ . If additional radial operating loads are present, the equivalent bearing load P must be calculated using the following formula:

$$P = X \cdot F_r + Y \cdot F_{a\text{res}}$$

The values X and Y are given in the following table.

**Factors for X and Y**

Load ratio	Factor	
	X	Y
$\frac{F_{a\text{res}}}{F_r} \leq 2,17$	1,9	0,55
$\frac{F_{a\text{res}}}{F_r} > 2,17$	0,92	1

**Load varying in steps**

If the load values vary in steps, the equivalent load P and speed n are calculated using the following formulae (q = time duration %):

$$P = \sqrt[3]{\frac{q_1 \cdot n_1 \cdot P_1^3 + \dots + q_z \cdot n_z \cdot P_z^3}{q_1 \cdot n_1 + \dots + q_z \cdot n_z}}$$

$$n = \frac{q_1 \cdot n_1 + \dots + q_z \cdot n_z}{100}$$

**Static load safety factor**

The static load safety factor  $S_0$  indicates the security against permissible permanent deformations in the bearing.

It is determined using the following formula:

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

$S_0$  – Static load safety factor

$C_{0r}, C_{0a}$  – N

Basic static radial or axial load rating according to dimension table

$C_{0r}$  is valid for a contact angle  $\alpha < 45^\circ$ ,  $C_{0a}$  is valid for a contact angle  $\alpha > 45^\circ$

$P_0$  – N

Maximum static load P of bearing.

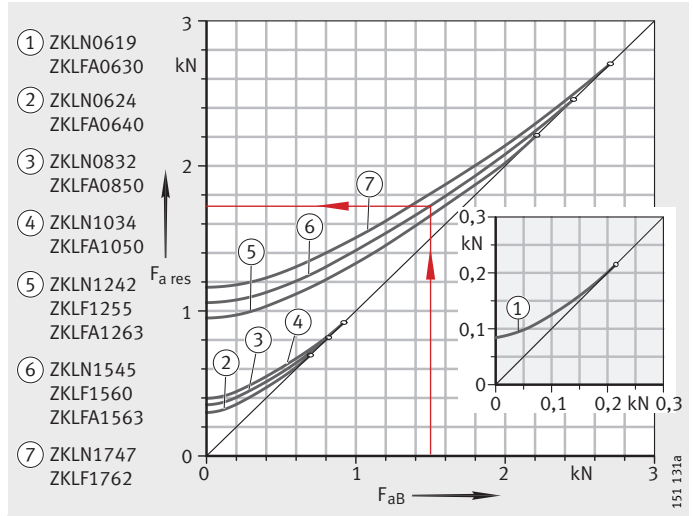
**Caution!** In machine tools,  $S_0$  should be  $> 4$ .

# Axial angular contact ball bearings

Example 1  
 Bearing ZKLN1545  
 Axial operating load  $F_{aB} = 1,5 \text{ kN}$   
 $F_{a \text{ res}} = \text{ca. } 1,75 \text{ kN}$   
 Loading by operating load and preload

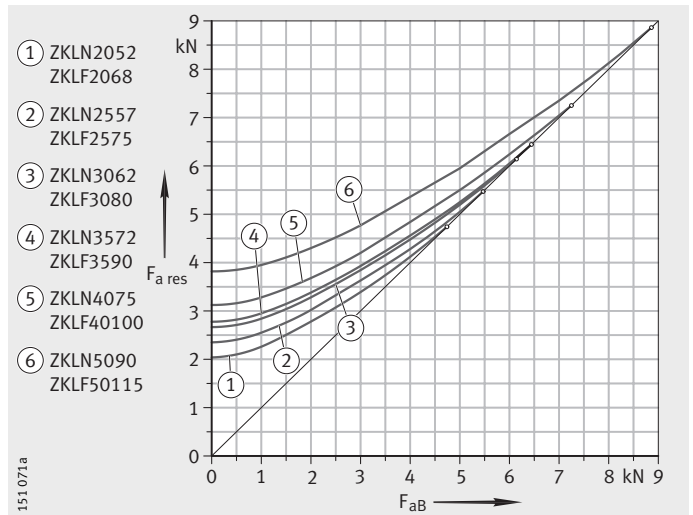
$F_{aB}$  = operating load  
 $F_{a \text{ res}}$  = resultant bearing load  
 ° = limit value

Figure 11  
 Resultant bearing load  
 with ZKLN, ZKLF und ZKLFA,  
 up to  $d = 17 \text{ mm}$



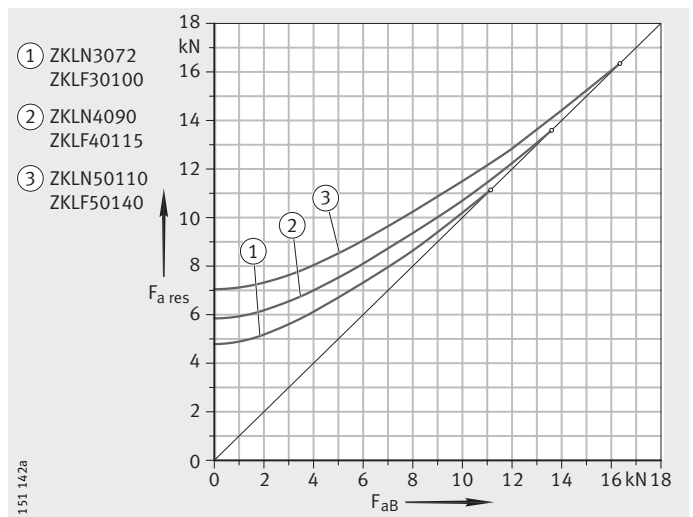
$F_{aB}$  = operating load  
 $F_{a \text{ res}}$  = resultant bearing load  
 ° = limit value

Figure 12  
 Resultant bearing load  
 with ZKLN, ZKLF,  
 from  $d = 20 \text{ mm}$  to  $50 \text{ mm}$



$F_{aB}$  = operating load  
 $F_{a \text{ res}}$  = resultant bearing load  
 ° = limit value

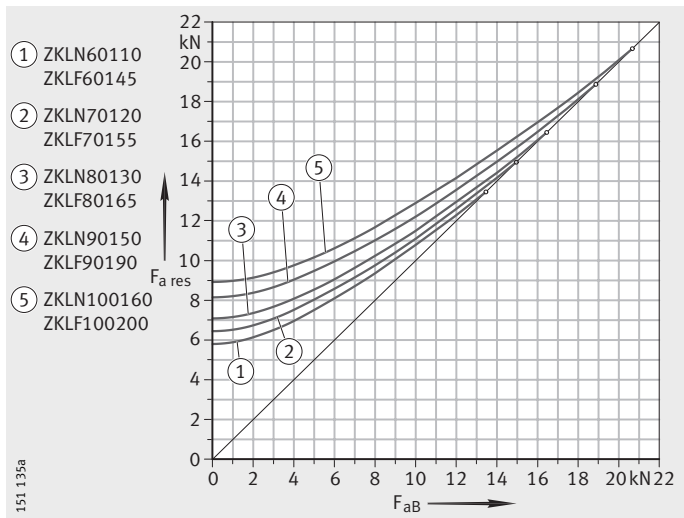
Figure 13  
 Resultant bearing load  
 with ZKLN, ZKLF,  
 heavy series



$F_{aB}$  = operating load  
 $F_{a\text{ res}}$  = resultant bearing load  
 $\circ$  = limit value

Figure 14

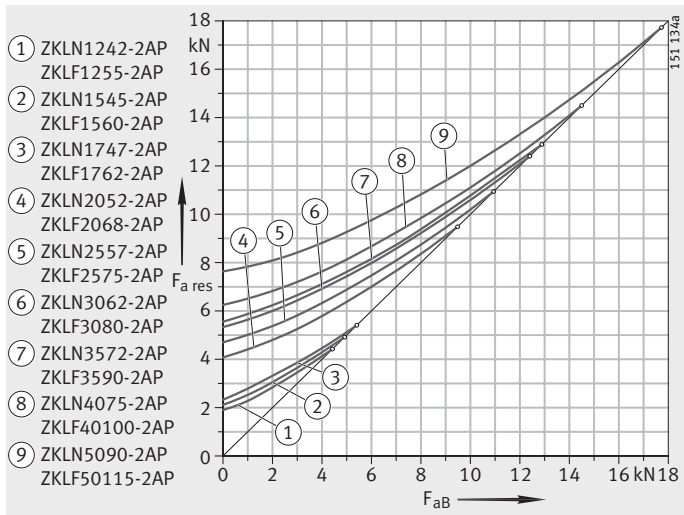
Resultant bearing load with ZKLN, ZKLF, from  $d = 60$  mm



$F_{aB}$  = operating load  
 $F_{a\text{ res}}$  = resultant bearing load  
 $\circ$  = limit value

Figure 15

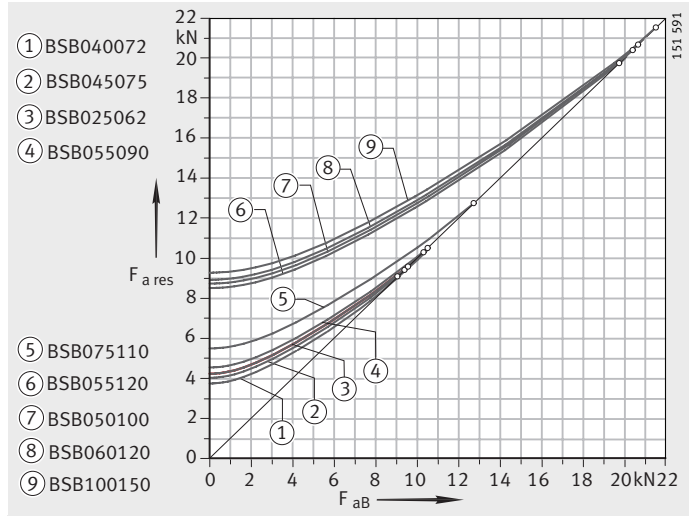
Resultant bearing load with ZKLN...-2AP and ZKLF...-2AP



# Axial angular contact ball bearings

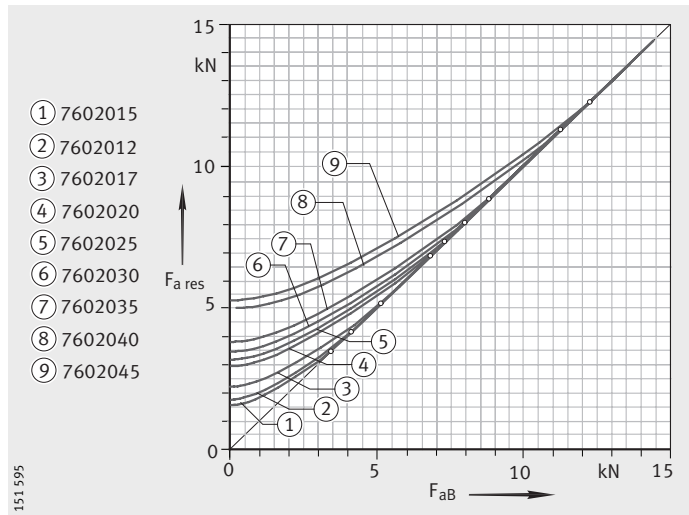
$F_{aB}$  = operating load  
 $F_{a\text{ res}}$  = resultant bearing load  
 $\circ$  = limit value

**Figure 16**  
 Resultant bearing load with BSB



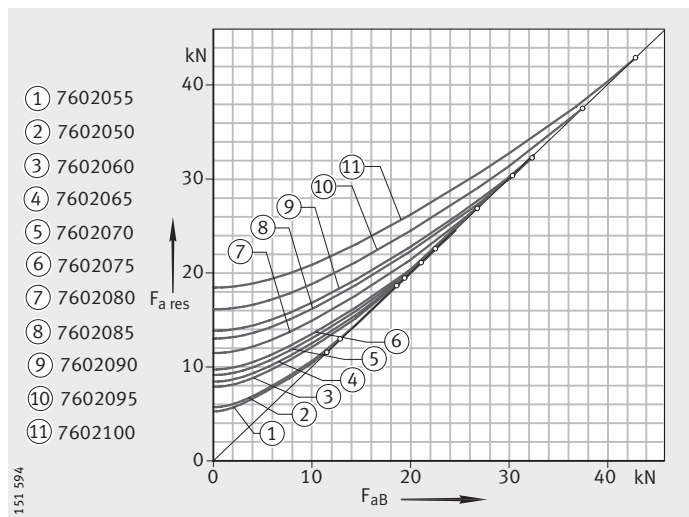
$F_{aB}$  = operating load  
 $F_{a\text{ res}}$  = resultant bearing load  
 $\circ$  = limit value

**Figure 17**  
 Resultant bearing load with 7602015 to 7602045



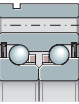
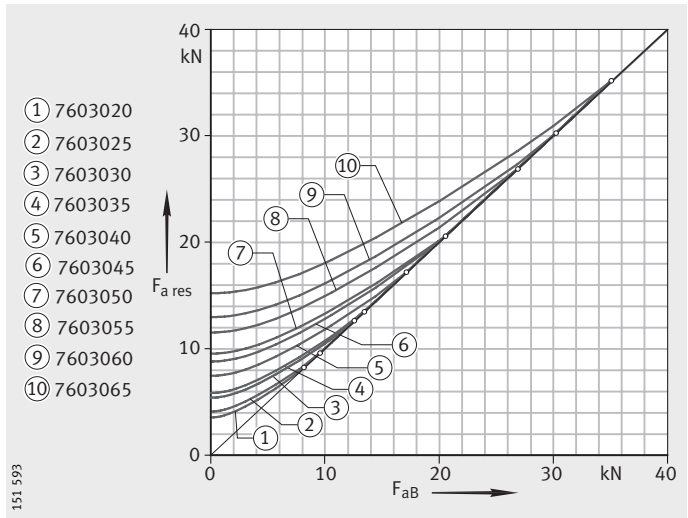
$F_{aB}$  = operating load  
 $F_{a\text{ res}}$  = resultant bearing load  
 $\circ$  = limit value

**Figure 18**  
 Resultant bearing load with 7602055 to 7602100



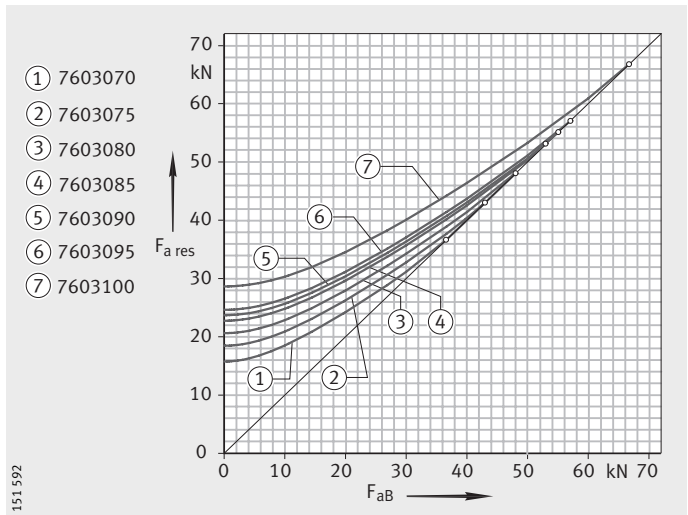
$F_{aB}$  = operating load  
 $F_{a\ res}$  = resultant bearing load  
 $\circ$  = limit value

**Figure 19**  
 Resultant bearing load  
 with 7603020 to 7603065



$F_{aB}$  = operating load  
 $F_{a\ res}$  = resultant bearing load  
 $\circ$  = limit value

**Figure 20**  
 Resultant bearing load  
 with 7603070 to 7603100

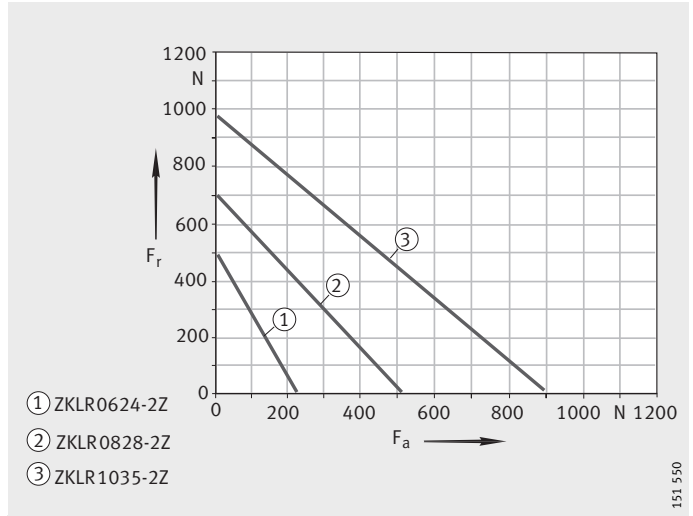




# Axial angular contact ball bearings

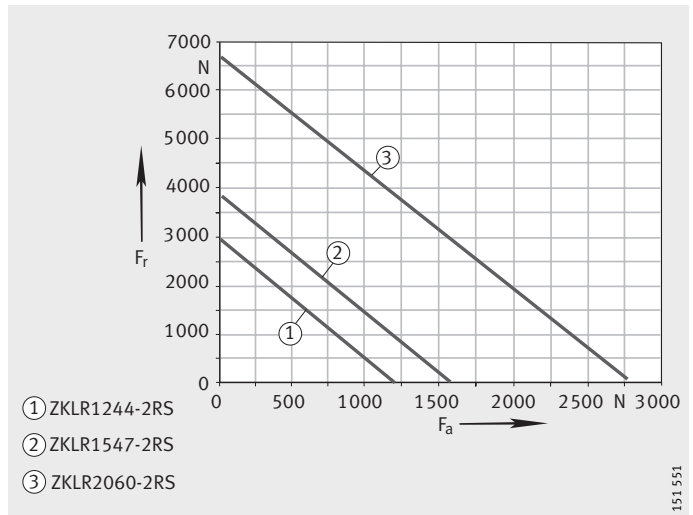
$F_r$  = radial load  
 $F_a$  = axial load

**Figure 21**  
 Static limiting load diagrams  
 for ZKLR



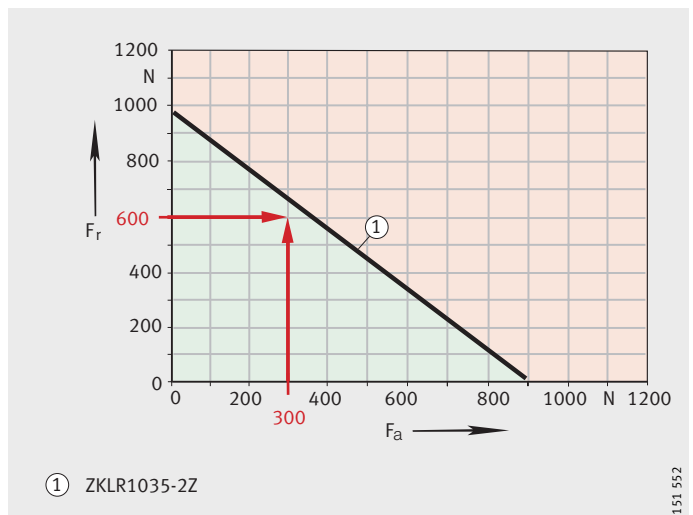
$F_r$  = radial load  
 $F_a$  = axial load

**Figure 22**  
 Static limiting load diagrams  
 for ZKLR



$F_r$  = 600 N  
 $F_a$  = 300 N  
 Bearing is suitable in static terms since  
 the intersection  $F_a/F_r$  is below the limit line.

**Figure 23**  
 Static limiting load diagram –  
 example ZKLR1035-2Z



## Maximum radial load on screw connections for ZKLF

If bearings of series ZKLF are screw mounted on a flat adjacent construction, the maximum radial load that can be supported by the screw connections must be taken into consideration.

If the screws to DIN 912-10.9 stated in the dimension tables are used, the maximum radial load that can be supported before the outer ring moves off-centre is restricted in the case of dry components to approx.  $0,1 \times C_{0a}$ . If the outer ring is additionally bonded in place, for example using Loctite 638, the maximum radial load that can be supported increases to approx.  $0,5 \times C_{0a}$ .

If the maximum radial loads that can be supported (without any axial load content) are considered in relation to the rolling element set, it can be seen that:

- With a static load safety factor of  $S_0 \geq 4$  as required for machine tools, the load that can be supported by the screw connections of the outer ring is in any case greater than the radial load restricted by the radial load.

This means that (at least in theory) radial loads can be supported that, in relation to the rolling element set, will lead to a static load safety factor of  $S_0 \leq 1$  (incipient plastic deformation of rolling elements), if the outer ring is additionally bonded in place.

This means that, under normal design criteria and with the decisive static load safety factor for the corresponding areas of application (e.g.  $S_0 = 4$  for machine tools), the rolling element set is always the decisive criterion.



## Permissible static axial load for ZKLF

For bearings of series ZKLF, the permissible static axial load in the direction of the screw connections, *Figure 24*, is:

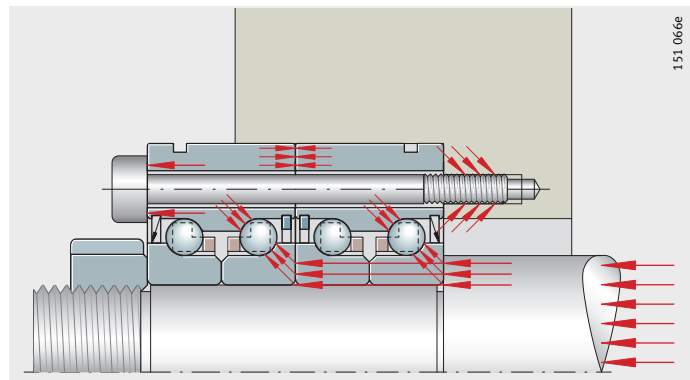
$$P_{0\text{per}} \leq \frac{C_{0a}}{2}$$

The basic static axial load rating  $C_{0a}$  is stated in the dimension tables.

ZKLF

*Figure 24*

Static axial load in the direction of the screw connections



# Axial angular contact ball bearings

## Design of adjacent construction

The adjacent construction (the shaft and housing) must be designed in accordance with the data in the dimension tables. The abutment diameters for the shaft and housing shoulders  $d_a$  and  $D_a$  must be in accordance with the dimension tables.

### Caution!

$D_a$  and  $d_a$  are recommended minimum abutment diameters. If these values are not used, the rib diameter  $d_1$  according to the dimension table must be observed.

In matched bearing pairs of series ZKLN and ZKLF, the depth of the housing bore must be defined such that the outer ring of the outermost bearing is radially supported to at least  $\frac{1}{4}$  of its width.

## Speeds

The limiting speeds  $n_G$  given in the dimension tables are based on the following conditions:

- bearing preloaded, no external operating load
- 25% operating duration
- max. equilibrium temperature +50 °C.

## Friction

In most applications, preloading of bearings by means of the locknut tightening torque gives sufficiently accurate setting values. The reference here is the tightening torque  $M_A$  according to the dimension table in conjunction with an INA precision locknut.

The frictional torque  $M_{RL}$  given in the dimension tables is a guide value. The frictional torques are based for bearings of series ZKLN, ZKLF, ZKLFA, DKLFA, 7602..-2RS, 7603..-2RS, BSB..-2RS and ZKLR on grease lubrication, measured at a speed of  $n = 5 \text{ min}^{-1}$ .

For bearings of series 7602, 7603 and BSB, the frictional torque  $M_{RL}$  is based on lightly oiled raceways.

For dimensioning of the drive, the starting frictional torque and the frictional torque at high speeds of  $2$  to  $3 \times M_{RL}$  must be taken into consideration.

## Seal friction

In axial angular contact ball bearings with contact seals (suffix 2RS), the extent of seal friction must not be neglected. Sealing influences the limiting speeds.

Under favourable environmental influences, a bearing with gap seals (suffix 2Z) can be used instead of contact seals. The limiting speed of these bearings is approximately twice that of axial angular contact ball bearings with contact seals.

## Frictional energy

The frictional energy  $N_R$  of the bearings can be calculated as follows:

$$N_R = \frac{M_{RL} \cdot n}{9,55}$$

$N_R$  Frictional energy  
 $M_{RL}$  Bearing frictional torque  
 $n$  Operating speed

In any analysis of the thermal balance, the various operating speeds  $n_i$  must be taken into consideration with their time durations  $q_i$ .

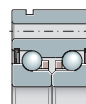
**Lubrication** Bearings for screw drives can be lubricated with grease or oil. In machine tools, however, the mean bearing temperature should not exceed +50 °C. If this is the case, a lubrication method without heat dissipation such as grease lubrication or oil impulse lubrication can be selected.

**Caution!** For higher bearing temperatures and unsealed bearings, recirculating oil lubrication should be used.

**Grease lubrication** Bearings of series ZKLN, ZKLF, ZKLFA and DKLFA with a relubrication facility are greased with a lithium soap grease to GA28 and are preferably run lubricated by grease. In most cases, the initial greasing is sufficient for the whole operating life of the bearing.

Under certain application conditions, relubrication may be necessary. In this case, Arcanol MULTITOP is suitable. The initial greasing is compatible with greases with a mineral oil base.

For checking by calculation of the grease operating life or relubrication interval, please contact INA/FAG.



**Grease Application Group GA28**

Designation	Classification	Type of grease	Operating temperature range °C	NLGI class	Speed parameter $n \cdot d_M$ $\text{min}^{-1} \cdot \text{mm}$	ISO VG class (base oil)
GA28	Screw drive bearing grease	Lithium soap ester oil	-30 to +160	2	600 000	15 to 100

**Relubrication interval** The relubrication intervals cannot be determined precisely in advance. They are dependent to a significant extent on the operating conditions and the environmental influences such as temperature, contamination, dust, water, etc.

**Caution!** Bearings must always be relubricated:

- before and after long stoppage periods
- in conditions of high humidity
- within the defined lubrication intervals as stated in the technical proposal letter.

For the following applications, please contact us:

- if the bearings are stationary
- for vibrations
- for very small oscillating movements.

**Relubrication quantity** If bearings of series ZKLN, ZKLF, ZKLFA and DKLFA must be relubricated due to the application conditions, please contact us regarding the relubrication quantities.

**Oil lubrication** Other lubrication methods such as oil impulse lubrication or recirculating oil lubrication are also possible. For oil lubrication, good results have been obtained with oils CLP to DIN 51 517 and HLP to DIN 51 524 in classes ISO VG 32 to ISO VG 100. If oil impulse lubrication is intended for series ZKLN and ZKLF, gap seals are advantageous. They prevent contamination entering the bearing and allow oil to leave the bearing. This prevents overlubrication.

# Axial angular contact ball bearings

## Mounting guidelines

### Caution!

Bearings should only be fitted and dismantled in accordance with the Fitting and Maintenance Manual TPI 100. This TPI is available upon request.

During fitting of bearings, mounting forces should be applied only to the bearing ring to be fitted. Mounting forces must never be directed through the rolling elements or sealing rings.

The characteristics of the bearings are only valid when used in combination with INA precision locknuts and the associated tightening torques given in the dimension tables.

Axial angular contact ball bearings are self-retaining and the individual bearing components are matched to each other. The inner rings must not be removed from the bearing during fitting and dismantling. If individual bearing components are removed from the bearing, please contact INA before carrying out any reassembly.

### Location of outer ring using ring nut for 7602, 7603, BSB

Axial angular contact ball bearings 7602, 7603 and BSB must be located clearance-free in the housing and on the shaft and must be axially preloaded during fitting. The axial preload force must be distributed evenly over the circumference in order to avoid deformation of the raceways.

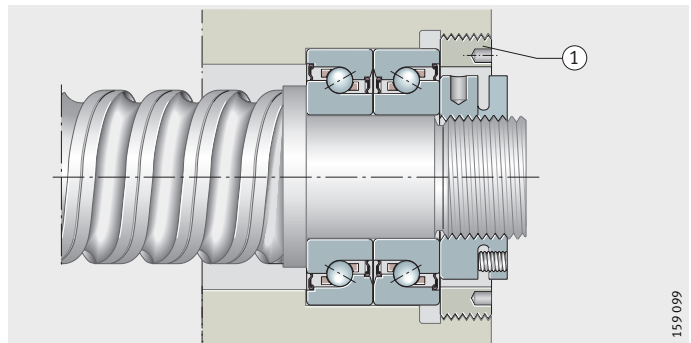
Outer rings are axially tensioned to the preload force given in the dimension table by means of a ring nut (not supplied by INA), *Figure 25*. The ring nut must be secured against loosening (e.g. using Loctite 638).

Ring nuts with a runout of max. 5 µm apply the preload force evenly over the bearing rings and should therefore be used in preference to location by means of a cover.

① Ring nut  
7602, 7603, BSB

*Figure 25*

Two-bearing set in O arrangement, locknut, ring nut



### Location of outer ring using a cover

Clamping of the outer rings using a cover and cap screws leads to deformation of the raceways, *Figure 26*. In order to minimise the deformation and achieve the calculated life:

- the cover should be designed with adequate rigidity
- the number of fixing screws should be selected in accordance with the load but at least four should be used
- the screws should be tightened in a cross-wise sequence in four stages (finger tight, 40%, 70%, 100% of  $M_A$ ).

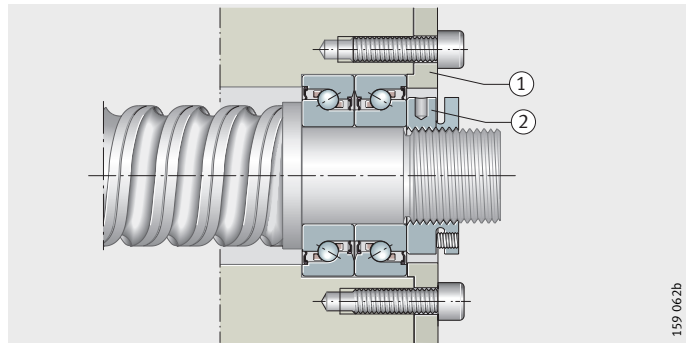
### Caution!

Observe the axial preload force in the dimension table. If other values are used, this will influence the bearing preload, bearing friction and heat generation in the bearing position.

① Cover  
 ② Locknut  
**7602, 7603, BSB**

Figure 26

Two-bearing set in O arrangement, locknut, cover



**Location of inner ring using locknut**

Axial angular contact ball bearings must be axially preloaded during fitting by means of a precision locknut.

When clamping the bearings by means of the bearing inner rings using the recommended precision locknut, the tightening torques given in the dimension tables must be observed. The tightening torques for the individual bearing sizes are only valid for the INA precision locknuts listed.

The preload force for series DKLFA is determined specifically on the basis of the operating conditions (load spectrum). Please consult us.

In order to counteract settling, it is recommended that the locknut should initially be tightened to twice the tightening torque  $M_A$  and then relieved of load again. It should only then be tightened again to the stated tightening torque  $M_A$ . Finally, the precision locknut should be secured against rotation by the torque-controlled tightening of the set screws.

The characteristics of the bearings are only valid if the preload forces specified in the dimension tables are observed.

The tightening torques for INA precision locknuts required for this purpose are also given in the dimension tables.

**Caution!** If other suitable locknuts are used, the manufacturer's guidance on calculation of the necessary tightening torque should be observed. Only locknuts with a minimum accuracy of the end face to the thread of 5  $\mu\text{m}$  should be used.

**Fixing screws**

The fixing screws for the outer ring must be tightened in a crosswise sequence. They may be loaded up to 70% of their elastic limit.

If the bearing outer ring is supported by an additional housing cover, it must be ensured that the fixing screws are sufficiently well dimensioned.

**Fitting of angular contact ball bearing units**

Angular contact ball bearing units ZKLR require no additional preload after fitting. They can often therefore be located on the spindle simply by means of clearance-free clamping.

**Caution!** The type of axial location depends on the load to be supported.

The adjacent construction can be a milled flat face or, if necessary, even an unmachined screw mounting surface without radial centring.



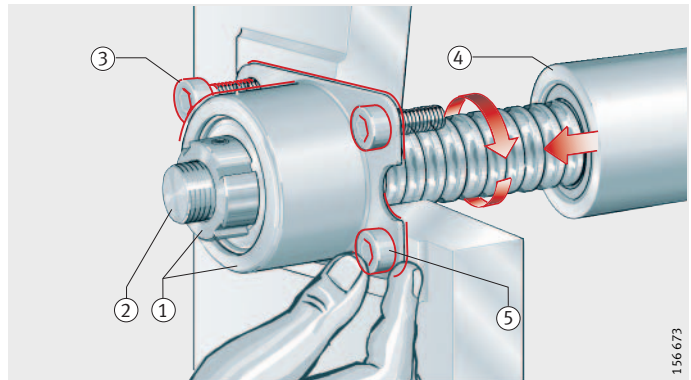
# Axial angular contact ball bearings

**Fitting** Location of the bearing unit using a locknut ① or clearance-free clamping on the spindle ②, *Figure 27*.

Screw mount the bearing unit on the adjacent construction; tighten the screws only finger tight ③.

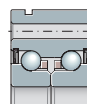
Move the screw drive nut ④ towards the bearing unit (the position of the screw drive is the datum for the linear guidance system, the nut serves as a functional element for alignment). The bearing will align itself to the optimum radial position (due to the constraining forces exerted by the datum).

Screw the bearing unit to the adjacent construction using the tightening torque specified in the assembly drawing ⑤.



ZKLR

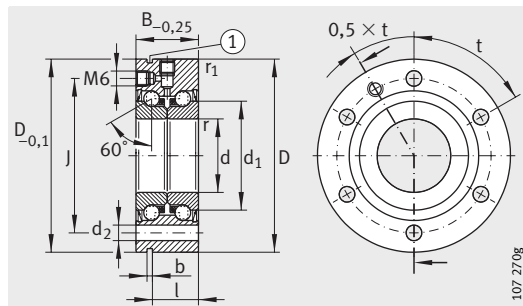
*Figure 27*  
Fitting of bearing unit





# Axial angular contact ball bearings

For screw mounting



ZKLF..-2RS, ZKLF..-2Z, ( $d \leq 50$  mm)

① Extraction slot

For pitch t, see dimension table

Dimension table · Dimensions in mm

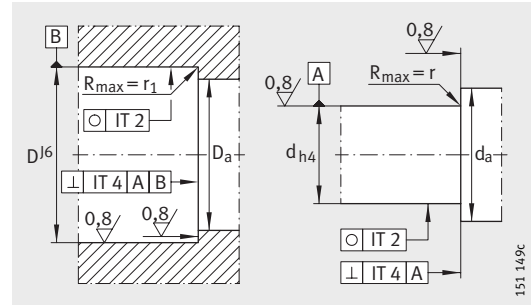
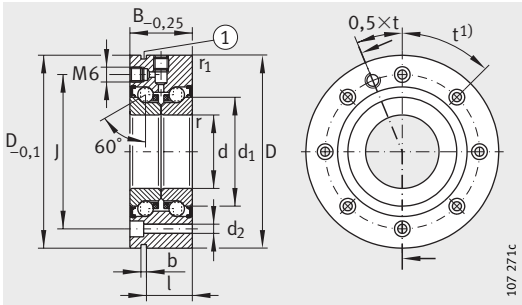
Designation	Mass ≈kg	Dimensions										Mounting dimensions		Fixing screws <sup>1)</sup> DIN 912-10.9	
		d	D	B	d <sub>1</sub>	r	r <sub>1</sub>	J	d <sub>2</sub>	b	l	D <sub>a</sub>	d <sub>a</sub>	Size	Quantity
				-0,25		min.	min.					max.	min.		
ZKLF1255-2RS	0,37	12 <sub>-0,005</sub>	55 <sub>-0,01</sub>	25	25	0,3	0,6	42	6,8	3	17	33	16	M6	3
ZKLF1255-2Z	0,37	12 <sub>-0,005</sub>	55 <sub>-0,01</sub>	25	25	0,3	0,6	42	6,8	3	17	33	16	M6	3
ZKLF1560-2RS	0,43	15 <sub>-0,005</sub>	60 <sub>-0,01</sub>	25	28	0,3	0,6	46	6,8	3	17	35	20	M6	3
ZKLF1560-2Z	0,43	15 <sub>-0,005</sub>	60 <sub>-0,01</sub>	25	28	0,3	0,6	46	6,8	3	17	35	20	M6	3
ZKLF1762-2RS	0,45	17 <sub>-0,005</sub>	62 <sub>-0,01</sub>	25	30	0,3	0,6	48	6,8	3	17	37	23	M6	3
ZKLF1762-2Z	0,45	17 <sub>-0,005</sub>	62 <sub>-0,01</sub>	25	30	0,3	0,6	48	6,8	3	17	37	23	M6	3
ZKLF2068-2RS	0,61	20 <sub>-0,005</sub>	68 <sub>-0,01</sub>	28	34,5	0,3	0,6	53	6,8	3	19	43	25	M6	4
ZKLF2068-2Z	0,61	20 <sub>-0,005</sub>	68 <sub>-0,01</sub>	28	34,5	0,3	0,6	53	6,8	3	19	43	25	M6	4
ZKLF2575-2RS	0,72	25 <sub>-0,005</sub>	75 <sub>-0,01</sub>	28	40,5	0,3	0,6	58	6,8	3	19	48	32	M6	4
ZKLF2575-2Z	0,72	25 <sub>-0,005</sub>	75 <sub>-0,01</sub>	28	40,5	0,3	0,6	58	6,8	3	19	48	32	M6	4
ZKLF3080-2RS	0,78	30 <sub>-0,005</sub>	80 <sub>-0,01</sub>	28	45,5	0,3	0,6	63	6,8	3	19	53	40	M6	6
ZKLF3080-2Z	0,78	30 <sub>-0,005</sub>	80 <sub>-0,01</sub>	28	45,5	0,3	0,6	63	6,8	3	19	53	40	M6	6
ZKLF30100-2RS <sup>3)</sup>	1,63	30 <sub>-0,005</sub>	100 <sub>-0,01</sub>	38	51	0,3	0,6	80	8,8	3	30	64	47	M8	8
ZKLF30100-2Z <sup>3)</sup>	1,63	30 <sub>-0,005</sub>	100 <sub>-0,01</sub>	38	51	0,3	0,6	80	8,8	3	30	64	47	M8	8
ZKLF3590-2RS	1,13	35 <sub>-0,005</sub>	90 <sub>-0,01</sub>	34	52	0,3	0,6	75	8,8	3	25	62	45	M8	4
ZKLF3590-2Z	1,13	35 <sub>-0,005</sub>	90 <sub>-0,01</sub>	34	52	0,3	0,6	75	8,8	3	25	62	45	M8	4
ZKLF40100-2RS	1,46	40 <sub>-0,005</sub>	100 <sub>-0,01</sub>	34	58	0,3	0,6	80	8,8	3	25	67	50	M8	4
ZKLF40100-2Z	1,46	40 <sub>-0,005</sub>	100 <sub>-0,01</sub>	34	58	0,3	0,6	80	8,8	3	25	67	50	M8	4
ZKLF40115-2RS <sup>3)</sup>	2,2	40 <sub>-0,005</sub>	115 <sub>-0,01</sub>	46	65	0,6	0,6	94	8,8	3	36	80	56	M8	12
ZKLF40115-2Z <sup>3)</sup>	2,2	40 <sub>-0,005</sub>	115 <sub>-0,01</sub>	46	65	0,6	0,6	94	8,8	3	36	80	56	M8	12
ZKLF50115-2RS	1,86	50 <sub>-0,005</sub>	115 <sub>-0,01</sub>	34	72	0,3	0,6	94	8,8	3	25	82	63	M8	6
ZKLF50115-2Z	1,86	50 <sub>-0,005</sub>	115 <sub>-0,01</sub>	34	72	0,3	0,6	94	8,8	3	25	82	63	M8	6
ZKLF50140-2RS <sup>3)</sup>	4,7	50 <sub>-0,005</sub>	140 <sub>-0,01</sub>	54	80	0,6	0,6	113	11	3	45	98	63	M10	12
ZKLF50140-2Z <sup>3)</sup>	4,7	50 <sub>-0,005</sub>	140 <sub>-0,01</sub>	54	80	0,6	0,6	113	11	3	45	98	63	M10	12
ZKLF60145-2Z	4,3	60 <sub>-0,005</sub>	145 <sub>-0,015</sub>	45	85	0,6	0,6	120	8,8	3	35	100	82	M8	8
ZKLF70155-2Z	4,9	70 <sub>-0,008</sub>	155 <sub>-0,015</sub>	45	85	0,6	0,6	130	8,8	3	35	110	92	M8	8
ZKLF80165-2Z	5,3	80 <sub>-0,008</sub>	165 <sub>-0,015</sub>	45	105	0,6	0,6	140	8,8	3	35	120	102	M8	8
ZKLF90190-2Z	8,7	90 <sub>-0,008</sub>	190 <sub>-0,015</sub>	55	120	0,6	0,6	165	11	3	45	138	116	M10	8
ZKLF100200-2Z	9,3	100 <sub>-0,008</sub>	200 <sub>-0,015</sub>	55	132	0,6	0,6	175	11	3	45	150	128	M10	8

<sup>1)</sup> Tightening torque of fixing screws according to manufacturer's data. Screws not included with delivery.

<sup>2)</sup> Mass moment of inertia for rotating inner ring.

<sup>3)</sup> Heavy series.

<sup>4)</sup> Only valid in conjunction with INA precision locknuts.



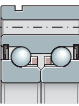
ZKLf.-2Z, (60 mm ≤ d ≤ 100 mm)

① Extraction slot

For pitch t, see dimension table

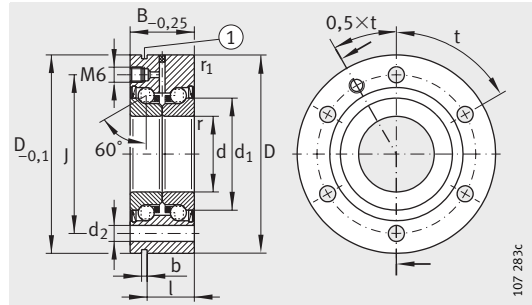
Design of adjacent construction

Pitch	Basic load ratings axial		Limiting speed $n_G$ grease	Bearing frictional torque $M_{RL}$	Rigidity axial $c_{aL}$	Tilting rigidity $c_{kL}$	Mass moment of inertia <sup>2)</sup> $M_m$	Run-out $\mu m$	Recommended INA locknut; to be ordered separately			
	dyn. $C_a$	stat. $C_{0a}$							Designation	Tightening torque <sup>4)</sup> $M_A$ Nm	Axial pre-load force N	
t			$min^{-1}$	Nm	N/ $\mu m$	Nm/rad	kg · cm <sup>2</sup>					
Quantity X t	N	N										
3X120°	16 900	24 700	3 800	0,16	375	50	0,068	2	<b>ZM12</b>	–	8	5038
3X120°	16 900	24 700	7 600	0,08	375	50	0,068	2	<b>ZM12</b>	–	8	5038
3X120°	17 900	28 000	3 500	0,2	400	65	0,102	2	<b>ZM15</b>	<b>AM15</b>	10	5484
3X120°	17 900	28 000	7 000	0,1	400	65	0,102	2	<b>ZM15</b>	<b>AM15</b>	10	5484
3X120°	18 800	31 000	3 300	0,24	450	80	0,132	2	<b>ZM17</b>	<b>AM17</b>	15	7157
3X120°	18 800	31 000	6 600	0,12	450	80	0,132	2	<b>ZM17</b>	<b>AM17</b>	15	7157
4X 90°	26 000	47 000	3 000	0,3	650	140	0,273	2	<b>ZM20</b>	<b>AM20</b>	18	9079
4X 90°	26 000	47 000	5 400	0,15	650	140	0,273	2	<b>ZM20</b>	<b>AM20</b>	18	9079
4X 90°	27 500	55 000	2 600	0,4	750	200	0,486	2	<b>ZM25</b>	<b>AM25</b>	25	9410
4X 90°	27 500	55 000	4 700	0,2	750	200	0,486	2	<b>ZM25</b>	<b>AM25</b>	25	9410
6X 60°	29 000	64 000	2 200	0,5	850	300	0,73	2,5	<b>ZM30</b>	<b>AM30</b>	32	10451
6X 60°	29 000	64 000	4 300	0,25	850	300	0,73	2,5	<b>ZM30</b>	<b>AM30</b>	32	10451
8X 45°	59 000	108 000	2 100	0,8	950	400	1,91	2,5	<b>ZMA30/52</b>	<b>AM30</b>	65	19509
8X 45°	59 000	108 000	4 000	0,4	950	400	1,91	2,5	<b>ZMA30/52</b>	<b>AM30</b>	65	19509
4X 90°	41 000	89 000	2 000	0,6	900	400	1,51	2,5	<b>ZM35</b>	<b>AM35/58</b>	40	10770
4X 90°	41 000	89 000	3 800	0,3	900	400	1,51	2,5	<b>ZM35</b>	<b>AM35/58</b>	40	10770
4X 90°	43 000	101 000	1 800	0,7	1 000	550	2,26	2,5	<b>ZM40</b>	<b>AM40</b>	55	13412
4X 90°	43 000	101 000	3 300	0,35	1 000	550	2,26	2,5	<b>ZM40</b>	<b>AM40</b>	55	13412
12X 30°	72 000	149 000	1 600	1,3	1 200	750	5,5	2,5	<b>ZMA40/62</b>	<b>AM40</b>	110	25185
12X 30°	72 000	149 000	3 100	0,65	1 200	750	5,5	2,5	<b>ZMA40/62</b>	<b>AM40</b>	110	25185
6X 60°	46 500	126 000	1 500	0,9	1 250	1 000	5,24	2,5	<b>ZM50</b>	<b>AM50</b>	85	17009
6X 60°	46 500	126 000	3 000	0,45	1 250	1 000	5,24	2,5	<b>ZM50</b>	<b>AM50</b>	85	17009
12X 30°	113 000	250 000	1 200	2,6	1 400	1 500	15,2	2,5	<b>ZMA50/75</b>	<b>AM50</b>	150	29436
12X 30°	113 000	250 000	2 500	1,3	1 400	1 500	15,2	2,5	<b>ZMA50/75</b>	<b>AM50</b>	150	29436
8X 45°	84 000	214 000	3 000	1	1 300	1 650	13,7	3	<b>ZMA60/98</b>	<b>AM60</b>	100	17893
8X 45°	88 000	241 000	2 800	1,2	1 450	2 250	19,8	3	<b>ZMA70/110</b>	<b>AM70</b>	130	19717
8X 45°	91 000	265 000	2 700	1,4	1 600	3 000	27,6	3	<b>ZMA80/120</b>	<b>AM80</b>	160	20604
8X 45°	135 000	395 000	2 300	2,3	1 700	4 400	59,9	3	<b>ZMA90/130</b>	<b>AM90</b>	200	25198
8X 45°	140 000	435 000	2 150	2,6	1 900	5 800	85,3	3	<b>ZMA100/140</b>	<b>AM100</b>	250	28760



# Axial angular contact ball bearings

For screw mounting  
Less stringent tolerances



ZKLF..-2RS-PE  
① Extraction slot  
For pitch t, see dimension table

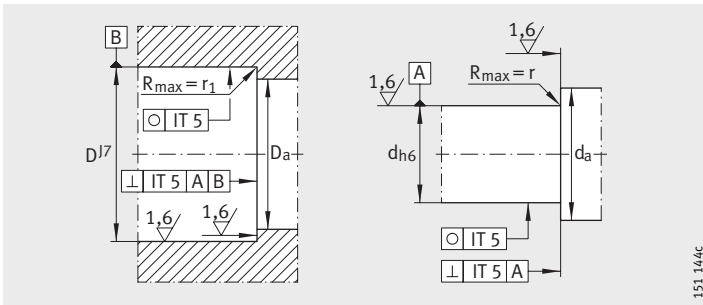
**Dimension table** · Dimensions in mm

Designation	Mass ≈kg	Dimensions											Mounting dimensions		Fixing screws <sup>1)</sup> DIN 912-10.9	
		d	D	B	d <sub>1</sub>	r	r <sub>1</sub>	J	d <sub>s</sub>	b	l	D <sub>a</sub>	d <sub>a</sub>	Size	Quantity	
		-0,01				min.	min.					max.	min.			
ZKLF1255-2RS-PE	0,37	12	55 <sub>-0,013</sub>	25	25	0,3	0,6	42	6,8	3	17	33	16	M6	3	
ZKLF1560-2RS-PE	0,43	15	60 <sub>-0,013</sub>	25	28	0,3	0,6	46	6,8	3	17	35	20	M6	3	
ZKLF1762-2RS-PE	0,45	17	62 <sub>-0,013</sub>	25	30	0,3	0,6	48	6,8	3	17	37	23	M6	3	
ZKLF2068-2RS-PE	0,61	20	68 <sub>-0,013</sub>	28	34,5	0,3	0,6	53	6,8	3	19	43	25	M6	4	
ZKLF2575-2RS-PE	0,72	25	75 <sub>-0,013</sub>	28	40,5	0,3	0,6	58	6,8	3	19	48	32	M6	4	
ZKLF3080-2RS-PE	0,78	30	80 <sub>-0,013</sub>	28	45,5	0,3	0,6	63	6,8	3	19	53	40	M6	6	
ZKLF3590-2RS-PE	1,13	35	90 <sub>-0,015</sub>	34	52	0,3	6,8	75	8,8	3	25	62	45	M8	4	
ZKLF40100-2RS-PE	1,46	40	100 <sub>-0,015</sub>	34	58	0,3	6,8	80	8,8	3	25	67	50	M8	4	
ZKLF50115-2RS-PE	1,86	50	115 <sub>-0,015</sub>	34	72	0,3	6,8	94	8,8	3	25	82	63	M8	6	

<sup>1)</sup> Tightening torque of fixing screws according to manufacturer's data. Screws not included with delivery.

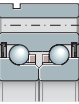
<sup>2)</sup> Mass moment of inertia for rotating inner ring.

<sup>3)</sup> Only valid in conjunction with INA precision locknuts.



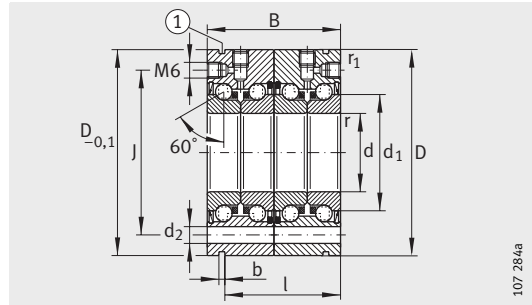
Design of adjacent construction

Pitch	Basic load ratings axial		Limiting speed $n_G$ grease	Bearing frictional torque $M_{RL}$	Rigidity axial $c_{aL}$	Tilting rigidity $c_{kL}$	Mass moment of inertia <sup>2)</sup> $M_m$	Run-out $\mu m$	Recommended INA locknut; to be ordered separately			
	dyn. $C_a$	stat. $C_{0a}$							Designation	Tightening torque <sup>3)</sup> $M_A$ Nm	Axial pre-load force N	
t	N	N	$min^{-1}$	Nm	$N/\mu m$	Nm/mrad	$kg \cdot cm^2$					
Quantity X t	N	N	$min^{-1}$	Nm	$N/\mu m$	Nm/mrad	$kg \cdot cm^2$	$\mu m$				
3X120°	16 900	24 700	3 800	0,16	375	50	0,068	5	<b>ZM12</b>	-	8	5 038
3X120°	17 900	28 000	3 500	0,2	400	65	0,102	5	<b>ZM15</b>	<b>AM15</b>	10	5 484
3X120°	18 800	31 000	3 300	0,24	450	80	0,132	5	<b>ZM17</b>	<b>AM17</b>	15	7 157
4X 90°	26 000	47 000	3 000	0,3	650	140	0,273	5	<b>ZM20</b>	<b>AM20</b>	18	9 079
4X 90°	27 500	55 000	2 600	0,4	750	200	0,486	5	<b>ZM25</b>	<b>AM25</b>	25	9 410
6X 60°	29 000	64 000	2 200	0,5	850	300	0,73	5	<b>ZM30</b>	<b>AM30</b>	32	10 451
4X 90°	41 000	89 000	2 000	0,6	900	400	1,51	5	<b>ZM35</b>	<b>AM35/58</b>	40	10 770
4X 90°	43 000	101 000	1 800	0,7	1 000	550	2,26	5	<b>ZM40</b>	<b>AM40</b>	55	13 412
6X 60°	46 500	126 000	1 500	0,9	1 250	1 000	5,24	5	<b>ZM50</b>	<b>AM50</b>	85	17 009



# Axial angular contact ball bearings

For screw mounting  
Matched pair



ZKL...-2RS-2AP  
① Extraction slot

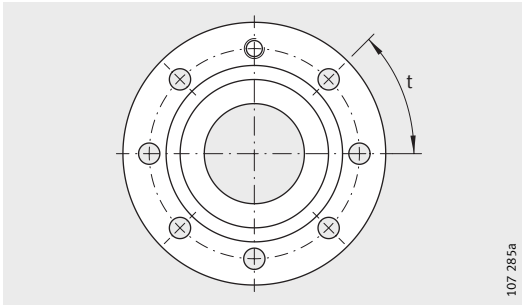
**Dimension table** · Dimensions in mm

Designation	Mass ≈kg	Dimensions											Mounting dimensions		Fixing screws <sup>1)</sup> DIN 912-10.9	
		d	D	B	d <sub>1</sub>	r	r <sub>1</sub>	J	d <sub>2</sub>	l	b	D <sub>a</sub>	d <sub>a</sub>	Size	Quantity	
		-0,005	-0,010	-0,50	min.	min.						max.	min.			
<b>ZKLF1762-2RS-2AP</b>	0,9	<b>17</b>	62	50	30	0,3	0,6	48	6,8	42	3	37	23	M6X60	5	
<b>ZKLF2068-2RS-2AP</b>	1,22	<b>20</b>	68	56	34,5	0,3	0,6	53	6,8	47	3	43	25	M6X70	7	
<b>ZKLF2575-2RS-2AP</b>	1,44	<b>25</b>	75	56	40,5	0,3	0,6	58	6,8	47	3	48	32	M6X70	7	
<b>ZKLF3080-2RS-2AP</b>	1,56	<b>30</b>	80	56	45,5	0,3	0,6	63	6,8	47	3	53	40	M6X70	11	
<b>ZKLF3590-2RS-2AP</b>	2,26	<b>35</b>	90	68	52	0,3	0,6	75	8,8	59	3	62	45	M8X80	7	
<b>ZKLF40100-2RS-2AP</b>	2,92	<b>40</b>	100	68	58	0,3	0,6	80	8,8	59	3	67	50	M8X80	7	
<b>ZKLF50115-2RS-2AP</b>	3,72	<b>50</b>	115	68	72	0,3	0,6	94	8,8	59	3	82	63	M8X80	11	

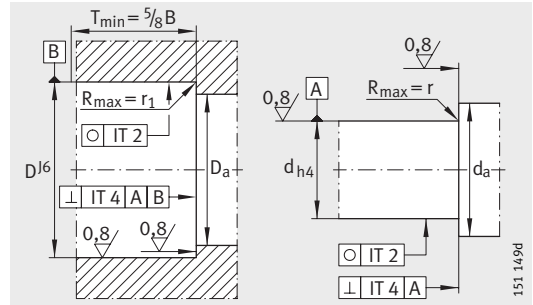
<sup>1)</sup> Tightening torque of fixing screws according to manufacturer's data. Screws not included with delivery.

<sup>2)</sup> Mass moment of inertia for rotating inner ring.

<sup>3)</sup> Only valid in conjunction with INA precision locknuts.

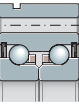


Hole pattern  
For pitch t, see dimension table



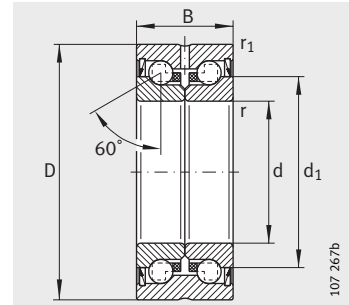
Design of adjacent construction

Pitch	Basic load ratings axial		Limiting speed $n_G$ grease	Bearing frictional torque $M_{RL}$	Rigidity axial $c_{aL}$	Tilting rigidity $c_{kL}$	Mass moment of inertia <sup>2)</sup> $M_m$	Run-out $\mu m$	Recommended INA locknut; to be ordered separately			
	dyn. $C_a$	stat. $C_{0a}$							Designation	Tightening torque <sup>3)</sup> $M_A$ Nm	Axial pre-load force N	
t	N	N	$min^{-1}$	Nm	N/ $\mu m$	Nm/mrad	$kg \cdot cm^2$					
Quantity X t	N	N	$min^{-1}$	Nm	N/ $\mu m$	Nm/mrad	$kg \cdot cm^2$	$\mu m$				
6X60°	30 500	62 000	3 300	0,36	800	200	0,264	2	<b>ZM17</b>	<b>AM17</b>	15	7 157
8X45°	42 000	94 000	3 000	0,45	1 150	320	0,564	2	<b>ZMA20/38</b>	<b>AM20</b>	18	9 079
8X45°	44 500	111 000	2 600	0,6	1 300	450	0,972	2	<b>ZMA25/45</b>	<b>AM25</b>	25	9 410
12X30°	47 500	127 000	2 200	0,75	1 500	620	1,46	2,5	<b>ZMA30/52</b>	<b>AM30</b>	32	10 451
8X45°	66 000	177 000	2 000	0,9	1 600	900	3,02	2,5	<b>ZMA35/58</b>	<b>AM35/58</b>	40	10 770
8X45°	70 000	202 000	1 800	1,05	1 750	1 200	4,52	2,5	<b>ZMA40/62</b>	<b>AM40</b>	55	13 412
12X30°	76 000	250 000	1 500	1,35	2 200	2 250	10,48	2,5	<b>ZMA50/75</b>	<b>AM50</b>	85	17 009



# Axial angular contact ball bearings

Not for screw mounting



ZKLN...-2RS  
ZKLN...-2Z

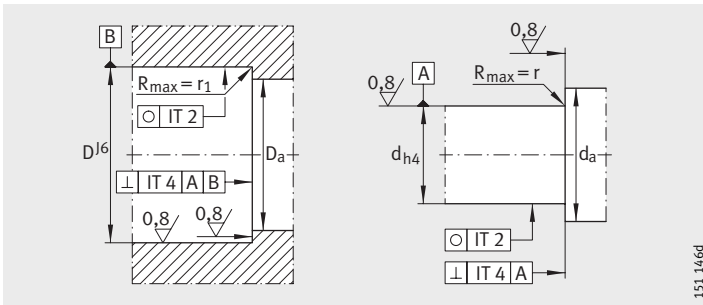
**Dimension table** · Dimensions in mm

Designation	Mass ≈kg	Dimensions						Mounting dimensions		Basic load ratings axial	
		d	D	B	d <sub>1</sub>	r	r <sub>1</sub>	D <sub>a</sub>	d <sub>a</sub>	dyn. C <sub>a</sub>	stat. C <sub>0a</sub>
		-0,005	-0,010	-0,25		min.	min.	max.	min.	N	N
ZKLN0619-2Z	0,02	<b>6</b> <sup>+0,002</sup> <sub>-0,003</sub>	19	12	12	0,3	0,3	16	9	4 900	6 100
ZKLN0624-2RS	0,03	<b>6</b> <sup>+0,002</sup> <sub>-0,003</sub>	24	15	14	0,3	0,6	19	9	6 900	8 500
ZKLN0624-2Z	0,03	<b>6</b> <sup>+0,002</sup> <sub>-0,003</sub>	24	15	14	0,3	0,6	19	9	6 900	8 500
ZKLN0832-2RS	0,09	<b>8</b>	32	20	19	0,3	0,6	26	11	12 500	16 300
ZKLN0832-2Z	0,09	<b>8</b>	32	20	19	0,3	0,6	26	11	12 500	16 300
ZKLN1034-2RS	0,1	<b>10</b>	34	20	21	0,3	0,6	28	14	13 400	18 800
ZKLN1034-2Z	0,1	<b>10</b>	34	20	21	0,3	0,6	28	14	13 400	18 800
ZKLN1242-2RS	0,2	<b>12</b>	42	25	25	0,3	0,6	33	16	16 900	24 700
ZKLN1242-2Z	0,2	<b>12</b>	42	25	25	0,3	0,6	33	16	16 900	24 700
ZKLN1545-2RS	0,21	<b>15</b>	45	25	28	0,3	0,6	35	20	17 900	28 000
ZKLN1545-2Z	0,21	<b>15</b>	45	25	28	0,3	0,6	35	20	17 900	28 000
ZKLN1747-2RS	0,22	<b>17</b>	47	25	30	0,3	0,6	37	23	18 800	31 000
ZKLN1747-2Z	0,22	<b>17</b>	47	25	30	0,3	0,6	37	23	18 800	31 000
ZKLN2052-2RS	0,31	<b>20</b>	52	28	34,5	0,3	0,6	43	25	26 000	47 000
ZKLN2052-2Z	0,31	<b>20</b>	52	28	34,5	0,3	0,6	43	26	26 000	47 000
ZKLN2557-2RS	0,34	<b>25</b>	57	28	40,5	0,3	0,6	48	32	27 500	55 000
ZKLN2557-2Z	0,34	<b>25</b>	57	28	40,5	0,3	0,6	48	32	27 500	55 000
ZKLN3062-2RS	0,39	<b>30</b>	62	28	45,5	0,3	0,6	53	40	29 000	64 000
ZKLN3062-2Z	0,39	<b>30</b>	62	28	45,5	0,3	0,6	53	40	29 000	64 000
ZKLN3072-2RS <sup>2)</sup>	0,72	<b>30</b>	72	38	51	0,3	0,6	64	47	59 000	108 000
ZKLN3072-2Z <sup>2)</sup>	0,72	<b>30</b>	72	38	51	0,3	0,6	64	47	59 000	108 000
ZKLN3572-2RS	0,51	<b>35</b>	72	34	52	0,3	0,6	62	45	41 000	89 000
ZKLN3572-2Z	0,51	<b>35</b>	72	34	52	0,3	0,6	62	45	41 000	89 000

<sup>1)</sup> Mass moment of inertia for rotating inner ring.

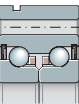
<sup>2)</sup> Heavy series.

<sup>3)</sup> Only valid in conjunction with INA precision locknuts.



Design of adjacent construction

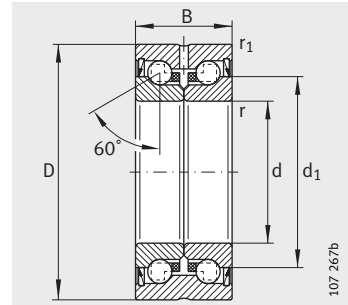
Limiting speed $n_G$ grease $\text{min}^{-1}$	Bearing frictional torque $M_{RL}$ Nm	Rigidity axial $C_{aL}$ N/ $\mu\text{m}$	Tilting rigidity $C_{kL}$ Nm/mrad	Mass moment of inertia <sup>1)</sup> $M_m$ kg · cm <sup>2</sup>	Run-out $\mu\text{m}$	Recommended INA locknut; to be ordered separately			
						Designation	Tightening torque <sup>3)</sup> $M_A$ Nm	Axial preload force N	
14 000	0,01	150	4	0,0019	2	<b>ZM06</b>	–	2	916
6 800	0,04	200	8	0,0044	2	<b>ZM06</b>	–	2	2 404
12 000	0,02	200	8	0,0044	2	<b>ZM06</b>	–	2	2 404
5 100	0,08	250	20	0,02	2	<b>ZM08</b>	–	4	2 216
9 500	0,04	250	20	0,02	2	<b>ZM08</b>	–	4	2 216
4 600	0,12	325	25	0,029	2	<b>ZM10</b>	–	6	4 891
8 600	0,06	325	25	0,029	2	<b>ZM10</b>	–	6	4 891
3 800	0,16	375	50	0,068	2	<b>ZM12</b>	–	8	5 038
7 600	0,08	375	50	0,068	2	<b>ZM12</b>	–	8	5 038
3 500	0,2	400	65	0,102	2	<b>ZM15</b>	<b>AM15</b>	10	5 484
7 000	0,1	400	65	0,102	2	<b>ZM15</b>	<b>AM15</b>	10	5 484
3 300	0,24	450	80	0,132	2	<b>ZM17</b>	<b>AM17</b>	15	7 157
6 600	0,12	450	80	0,132	2	<b>ZM17</b>	<b>AM17</b>	15	7 157
3 000	0,3	650	140	0,273	2	<b>ZM20</b>	<b>AM20</b>	18	9 079
5 400	0,15	650	140	0,273	2	<b>ZM20</b>	<b>AM20</b>	18	9 079
2 600	0,4	750	200	0,486	2	<b>ZM25</b>	<b>AM25</b>	25	9 410
4 700	0,2	750	200	0,486	2	<b>ZM25</b>	<b>AM25</b>	25	9 410
2 200	0,5	850	300	0,73	2,5	<b>ZM30</b>	<b>AM30</b>	32	10 451
4 300	0,25	850	300	0,73	2,5	<b>ZM30</b>	<b>AM30</b>	32	10 451
2 100	0,8	950	400	1,91	2,5	<b>ZMA30/52</b>	<b>AM30</b>	65	19 509
4 000	0,4	950	400	1,91	2,5	<b>ZMA30/52</b>	<b>AM30</b>	65	19 509
2 000	0,6	900	400	1,51	2,5	<b>ZM35</b>	<b>AM35/58</b>	40	10 770
3 800	0,3	900	400	1,51	2,5	<b>ZM35</b>	<b>AM35/58</b>	40	10 770





# Axial angular contact ball bearings

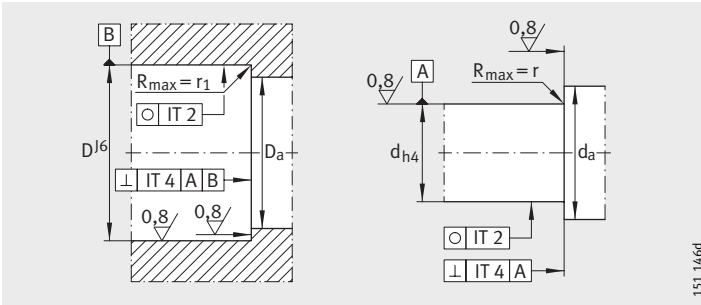
Not for screw mounting



ZKLN...-2RS  
ZKLN...-2Z

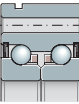
Dimension table (continued) · Dimensions in mm											
Designation	Mass ≈kg	Dimensions						Mounting dimensions		Basic load ratings axial	
		d	D	B	d <sub>1</sub>	r	r <sub>1</sub>	D <sub>a</sub>	d <sub>a</sub>	dyn. C <sub>a</sub>	stat. C <sub>0a</sub>
				-0,25		min.	min.	max.	min.	N	N
ZKLN4075-2RS	0,61	40 <sub>-0,005</sub>	75 <sub>-0,01</sub>	34	58	0,3	0,6	67	50	43 000	101 000
ZKLN4075-2Z	0,61	40 <sub>-0,005</sub>	75 <sub>-0,01</sub>	34	58	0,3	0,6	67	50	43 000	101 000
ZKLN4090-2RS <sup>2)</sup>	0,95	40 <sub>-0,005</sub>	90 <sub>-0,01</sub>	46	65	0,6	0,6	80	56	72 000	149 000
ZKLN4090-2Z <sup>2)</sup>	0,95	40 <sub>-0,005</sub>	90 <sub>-0,01</sub>	46	65	0,6	0,6	80	56	72 000	149 000
ZKLN5090-2RS	0,88	50 <sub>-0,005</sub>	90 <sub>-0,01</sub>	34	72	0,3	0,6	82	63	46 500	126 000
ZKLN5090-2Z	0,88	50 <sub>-0,005</sub>	90 <sub>-0,01</sub>	34	72	0,3	0,6	82	63	46 500	126 000
ZKLN50110-2RS <sup>2)</sup>	2,5	50 <sub>-0,005</sub>	110 <sub>-0,01</sub>	54	80	0,6	0,6	98	63	113 000	250 000
ZKLN50110-2Z <sup>2)</sup>	2,5	50 <sub>-0,005</sub>	110 <sub>-0,01</sub>	54	80	0,6	0,6	98	63	113 000	250 000
ZKLN60110-2Z	2,2	60 <sub>-0,008</sub>	110 <sub>-0,015</sub>	45	85	0,6	0,6	100	82	84 000	214 000
ZKLN70120-2Z	2,4	70 <sub>-0,008</sub>	120 <sub>-0,015</sub>	45	95	0,6	0,6	110	92	88 000	241 000
ZKLN80130-2Z	2,7	80 <sub>-0,008</sub>	130 <sub>-0,015</sub>	45	105	0,6	0,6	120	102	91 000	265 000
ZKLN90150-2Z	4,5	90 <sub>-0,008</sub>	150 <sub>-0,015</sub>	55	120	0,6	0,6	138	116	135 000	395 000
ZKLN100160-2Z	4,9	100 <sub>-0,008</sub>	160 <sub>-0,015</sub>	55	132	0,6	0,6	150	128	140 000	435 000

- 1) Mass moment of inertia for rotating inner ring.
- 2) Heavy series.
- 3) Only valid in conjunction with INA precision locknuts.



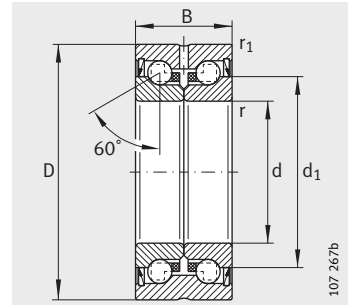
Design of adjacent construction

Limiting speed $n_G$ grease $\text{min}^{-1}$	Bearing frictional torque $M_{RL}$ Nm	Rigidity axial $C_{aL}$ N/ $\mu\text{m}$	Tilting rigidity $C_{kL}$ Nm/mrad	Mass moment of inertia <sup>1)</sup> $M_m$ kg · cm <sup>2</sup>	Run-out $\mu\text{m}$	Recommended INA locknut; to be ordered separately			
						Designation	Tightening torque <sup>3)</sup> $M_A$ Nm	Axial preload force N	
1 800	0,7	1 000	550	2,26	2,5	<b>ZM40</b>	<b>AM40</b>	55	13 412
3 300	0,35	1 000	550	2,26	2,5	<b>ZM40</b>	<b>AM40</b>	55	13 412
1 600	1,3	1 200	750	5,5	2,5	<b>ZMA40/62</b>	<b>AM40</b>	110	25 185
3 100	0,65	1 200	750	5,5	2,5	<b>ZMA40/62</b>	<b>AM40</b>	110	25 185
1 500	0,9	1 250	1 000	5,24	2,5	<b>ZM50</b>	<b>AM50</b>	85	17 009
3 000	0,45	1 250	1 000	5,24	2,5	<b>ZM50</b>	<b>AM50</b>	85	17 009
1 200	2,6	1 400	1 500	15,2	2,5	<b>ZMA50/75</b>	<b>AM50</b>	150	29 436
2 500	1,3	1 400	1 500	15,2	2,5	<b>ZMA50/75</b>	<b>AM50</b>	150	29 436
3 000	1	1 300	1 650	13,7	3	<b>ZMA60/98</b>	<b>AM60</b>	100	17 893
2 800	1,2	1 450	2 250	19,8	3	<b>ZMA70/110</b>	<b>AM70</b>	130	19 717
2 700	1,4	1 600	3 000	27,6	3	<b>ZMA80/120</b>	<b>AM80</b>	160	20 604
2 300	2,3	1 700	4 400	59,9	3	<b>ZMA90/130</b>	<b>AM90</b>	200	25 198
2 150	2,6	1 900	5 800	85,3	3	<b>ZMA100/140</b>	<b>AM100</b>	250	28 760



# Axial angular contact ball bearings

Not for screw mounting  
Less stringent tolerances



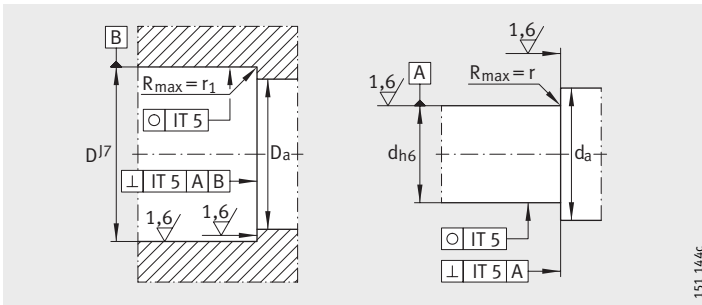
ZKLN...-2RS-PE

**Dimension table** · Dimensions in mm

Designation	Mass ≈kg	Dimensions						Mounting dimensions		Basic load ratings axial	
		d -0,01	D	B	d <sub>1</sub>	r min.	r <sub>1</sub> min.	D <sub>a</sub> max.	d <sub>a</sub> min.	dyn. C <sub>a</sub> N	stat. C <sub>0a</sub> N
ZKLN0624-2RS-PE	0,03	<b>6</b>	24 <sub>-0,01</sub>	15	14	0,3	0,6	19	9	6 900	8 500
ZKLN1034-2RS-PE	0,1	<b>10</b>	34 <sub>-0,01</sub>	20	21	0,3	0,6	28	14	13 400	18 800
ZKLN1242-2RS-PE	0,2	<b>12</b>	42 <sub>-0,01</sub>	25	25	0,3	0,6	33	16	16 900	24 700
ZKLN1545-2RS-PE	0,21	<b>15</b>	45 <sub>-0,01</sub>	25	28	0,3	0,6	35	20	17 900	28 000
ZKLN1747-2RS-PE	0,22	<b>17</b>	47 <sub>-0,01</sub>	25	30	0,3	0,6	37	23	18 800	31 000
ZKLN2052-2RS-PE	0,31	<b>20</b>	52 <sub>-0,01</sub>	28	34,5	0,3	0,6	43	25	26 000	47 000
ZKLN2557-2RS-PE	0,34	<b>25</b>	57 <sub>-0,01</sub>	28	40,5	0,3	0,6	48	32	27 500	55 000
ZKLN3062-2RS-PE	0,39	<b>30</b>	62 <sub>-0,01</sub>	28	45,5	0,3	0,6	53	40	29 000	64 000
ZKLN3572-2RS-PE	0,51	<b>35</b>	72 <sub>-0,011</sub>	34	52	0,3	0,6	62	45	41 000	89 000
ZKLN5090-2RS-PE	0,88	<b>50</b>	90 <sub>-0,011</sub>	34	72	0,3	0,6	82	63	46 500	126 000

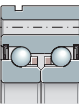
<sup>1)</sup> Mass moment of inertia for rotating inner ring.

<sup>2)</sup> Only valid in conjunction with INA precision locknuts.



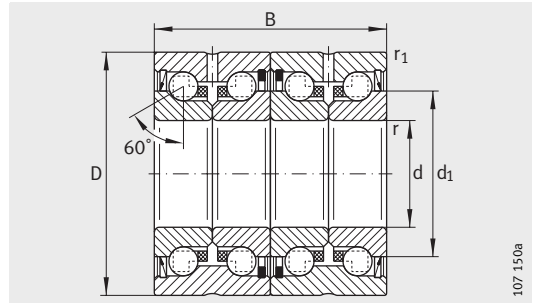
Design of adjacent construction

Limiting speed $n_G$ grease $\text{min}^{-1}$	Bearing frictional torque $M_{RL}$ Nm	Rigidity axial $c_{aL}$ $\text{N}/\mu\text{m}$	Tilting rigidity $c_{kL}$ $\text{Nm}/\text{mrad}$	Mass moment of inertia <sup>1)</sup> $M_m$ $\text{kg} \cdot \text{cm}^2$	Run-out $\mu\text{m}$	Recommended INA locknut; to be ordered separately		
						Designation	Tightening torque <sup>2)</sup> $M_A$ Nm	Axial preload force N
6 800	0,04	200	8	0,0044	2	<b>ZM06</b> –	2	2 404
4 600	0,12	325	25	0,029	2	<b>ZM10</b> –	6	4 891
3 800	0,16	375	50	0,068	2	<b>ZM12</b> –	8	5 038
3 500	0,2	400	65	0,102	2	<b>ZM15</b> <b>AM15</b>	10	5 484
3 300	0,24	450	80	0,132	2	<b>ZM17</b> <b>AM17</b>	15	7 157
3 000	0,3	650	140	0,273	2	<b>ZM20</b> <b>AM20</b>	18	9 079
2 600	0,4	750	200	0,486	2	<b>ZM25</b> <b>AM25</b>	25	9 410
2 200	0,5	850	300	0,73	2,5	<b>ZM30</b> <b>AM30</b>	32	10 451
2 000	0,6	900	400	1,51	2,5	<b>ZM35</b> <b>AM35/38</b>	40	10 770
1 500	0,9	1 250	1 000	5,24	2,5	<b>ZM50</b> <b>AM50</b>	85	17 009



# Axial angular contact ball bearings

Not for screw mounting  
Matched pair



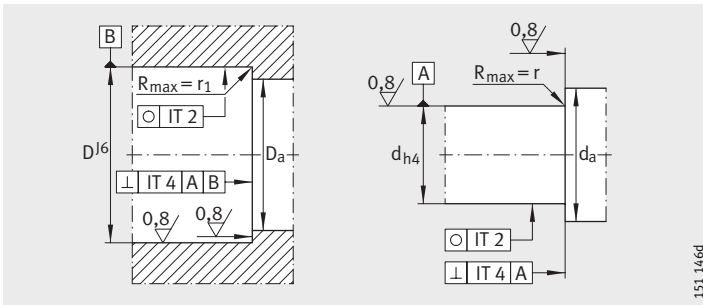
ZKLN...-2RS-2AP

**Dimension table** · Dimensions in mm

Designation	Mass ≈kg	Dimensions						Mounting dimensions		Basic load ratings axial	
		d	D	B	d <sub>1</sub>	r	r <sub>1</sub>	D <sub>a</sub>	d <sub>a</sub>	dyn. C <sub>a</sub>	stat. C <sub>0a</sub>
		-0,005	-0,01	-0,5		min.	min.	max.	min.	N	N
<b>ZKLN1747-2RS-2AP</b>	0,44	<b>17</b>	47	50	30	0,3	0,6	37	23	30 500	62 000
<b>ZKLN2052-2RS-2AP</b>	0,62	<b>20</b>	52	56	34,5	0,3	0,6	43	25	42 000	94 000
<b>ZKLN2557-2RS-2AP</b>	0,68	<b>25</b>	57	56	40,5	0,3	0,6	48	32	44 500	111 000
<b>ZKLN3062-2RS-2AP</b>	0,78	<b>30</b>	62	56	45,5	0,3	0,6	53	40	47 500	127 000
<b>ZKLN3572-2RS-2AP</b>	1,02	<b>35</b>	72	68	52	0,3	0,6	62	45	66 000	177 000
<b>ZKLN4075-2RS-2AP</b>	1,22	<b>40</b>	75	68	58	0,3	0,6	67	50	70 000	202 000
<b>ZKLN5090-2RS-2AP</b>	1,76	<b>50</b>	90	68	72	0,3	0,6	82	63	76 000	250 000

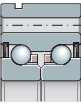
<sup>1)</sup> Mass moment of inertia for rotating inner ring.

<sup>2)</sup> Only valid in conjunction with INA precision locknuts.



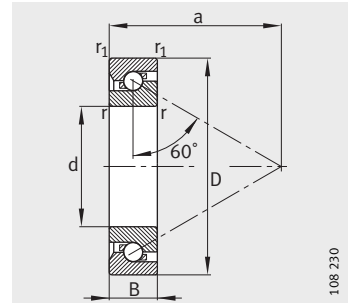
Design of adjacent construction

Limiting speed $n_G$ grease $\text{min}^{-1}$	Bearing frictional torque $M_{RL}$ Nm	Rigidity axial $C_{aL}$ N/ $\mu\text{m}$	Tilting rigidity $C_{kL}$ Nm/mrad	Mass moment of inertia <sup>1)</sup> $M_m$ kg · cm <sup>2</sup>	Run-out $\mu\text{m}$	Recommended INA locknut; to be ordered separately			
						Designation		Tightening torque <sup>2)</sup> $M_A$ Nm	Axial preload force N
3300	0,36	800	200	0,264	2	<b>ZM17</b>	<b>AM17</b>	15	7 157
3000	0,45	1150	320	0,546	2	<b>ZMA20/38</b>	<b>AM20</b>	18	9 079
2600	0,6	1300	450	0,972	2	<b>ZMA25/45</b>	<b>AM25</b>	25	9 410
2200	0,75	1500	620	1,46	2,5	<b>ZMA30/52</b>	<b>AM30</b>	32	10 451
2000	0,9	1600	900	3,02	2,5	<b>ZMA35/58</b>	<b>AM35/58</b>	40	10 770
1800	1,05	1750	1200	4,52	2,5	<b>ZMA40/62</b>	<b>AM40</b>	55	13 412
1500	1,35	2200	2250	10,48	2,5	<b>ZMA50/75</b>	<b>AM50</b>	85	17 009



# Axial angular contact ball bearings

Single direction  
Not sealed



7602, 7603, BSB

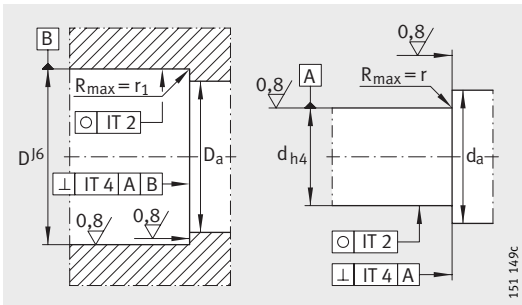
Dimension table · Dimensions in mm

Designation	Mass ≈kg	Dimensions					Mounting dimensions		Basic load ratings axial	
		d	D	B	r, r <sub>1</sub> min.	a ≈	D <sub>a</sub> H12	d <sub>a</sub> h12	dyn. C <sub>a</sub> N	stat. C <sub>0a</sub> N
7602012-TVP	0,042	12 <sub>-0,004</sub>	32 <sub>-0,006</sub>	10 <sub>-0,08</sub>	0,6	24	27	17	12 200	20 700
7602015-TVP	0,052	15 <sub>-0,004</sub>	35 <sub>-0,006</sub>	11 <sub>-0,08</sub>	0,6	27,5	30	20,5	13 100	24 700
7602017-TVP	0,074	17 <sub>-0,004</sub>	40 <sub>-0,006</sub>	12 <sub>-0,08</sub>	0,6	31	34,5	23	17 200	32 500
7602020-TVP	0,139	20 <sub>-0,005</sub>	47 <sub>-0,006</sub>	14 <sub>-0,12</sub>	1	36	39,5	27,5	19 100	38 000
BSB020047-T	0,13	20 <sub>-0,005</sub>	47 <sub>-0,006</sub>	15 <sub>-0,12</sub>	1	36,5	39,5	27,5	20 800	43 000
7603020-TVP	0,17	20 <sub>-0,005</sub>	52 <sub>-0,007</sub>	15 <sub>-0,12</sub>	1,1	39,5	43,5	30,5	25 500	53 000
7602025-TVP	0,147	25 <sub>-0,005</sub>	52 <sub>-0,007</sub>	15 <sub>-0,12</sub>	1	41	45	32	23 200	50 000
BSB025062-T	0,24	25 <sub>-0,005</sub>	62 <sub>-0,007</sub>	15 <sub>-0,12</sub>	1	46,5	52	38	29 500	68 000
7603025-TVP	0,275	25 <sub>-0,005</sub>	62 <sub>-0,007</sub>	17 <sub>-0,12</sub>	1,1	47,5	52	38	29 500	68 000
BSB030062-T	0,22	30 <sub>-0,005</sub>	62 <sub>-0,007</sub>	15 <sub>-0,12</sub>	1	47,5	52,5	39,5	27 500	66 000
7602030-TVP	0,232	30 <sub>-0,005</sub>	62 <sub>-0,007</sub>	16 <sub>-0,12</sub>	1	48	52,5	39,5	27 500	66 000
7603030-TVP	0,409	30 <sub>-0,005</sub>	72 <sub>-0,007</sub>	19 <sub>-0,12</sub>	1,1	55,5	61	45	36 500	89 000
BSB035072-T	0,3	35 <sub>-0,006</sub>	72 <sub>-0,007</sub>	15 <sub>-0,12</sub>	1	54	60,5	46,5	31 500	81 000
7602035-TVP	0,339	35 <sub>-0,006</sub>	72 <sub>-0,007</sub>	17 <sub>-0,12</sub>	1,1	55	60,5	46,5	31 500	81 000
7603035-TVP	0,546	35 <sub>-0,006</sub>	80 <sub>-0,007</sub>	21 <sub>-0,12</sub>	1,5	61,5	67	51	38 000	100 000
BSB040072-T	0,26	40 <sub>-0,006</sub>	72 <sub>-0,007</sub>	15 <sub>-0,12</sub>	1	56	62,5	49	29 500	82 000
7602040-TVP	0,418	40 <sub>-0,006</sub>	80 <sub>-0,007</sub>	18 <sub>-0,12</sub>	1,1	62,5	69,5	53,5	39 000	106 000
BSB040090-T	0,65	40 <sub>-0,006</sub>	90 <sub>-0,008</sub>	20 <sub>-0,12</sub>	1,5	67	75,5	56,5	52 000	138 000
7603040-TVP	0,751	40 <sub>-0,006</sub>	90 <sub>-0,008</sub>	23 <sub>-0,12</sub>	1,5	68,5	75,5	56,5	52 000	138 000
BSB045075-T	0,26	45 <sub>-0,006</sub>	75 <sub>-0,007</sub>	15 <sub>-0,12</sub>	1	59,5	68	52	30 000	85 000
7602045-TVP	0,488	45 <sub>-0,006</sub>	85 <sub>-0,008</sub>	19 <sub>-0,12</sub>	1,1	66	73	57	39 500	111 000
BSB045100-T	0,81	45 <sub>-0,006</sub>	100 <sub>-0,008</sub>	20 <sub>-0,12</sub>	1,5	75	85,5	64,5	62 000	172 000
7603045-TVP	0,992	45 <sub>-0,006</sub>	100 <sub>-0,008</sub>	25 <sub>-0,12</sub>	1,5	77,5	85,5	64,5	62 000	172 000
7602050-TVP	0,557	50 <sub>-0,006</sub>	90 <sub>-0,008</sub>	20 <sub>-0,12</sub>	1,1	71,5	79	63	41 000	122 000
BSB050100-T	0,75	50 <sub>-0,006</sub>	100 <sub>-0,008</sub>	20 <sub>-0,12</sub>	1,5	75	85,5	64,5	62 000	172 000
7603050-TVP	1,29	50 <sub>-0,006</sub>	110 <sub>-0,008</sub>	27 <sub>-0,12</sub>	2	85,5	94	72	72 000	203 000
BSB055090-T	0,38	55 <sub>-0,007</sub>	90 <sub>-0,008</sub>	15 <sub>-0,15</sub>	1,0	70,5	80	65	33 500	98 000
7602055-TVP	0,74	55 <sub>-0,007</sub>	100 <sub>-0,008</sub>	21 <sub>-0,15</sub>	1,5	77,5	85,5	69,5	42 000	132 000
BSB055120-T	1,2	55 <sub>-0,007</sub>	120 <sub>-0,008</sub>	20 <sub>-0,15</sub>	2,0	86	97,5	77	63 000	188 000
7603055-TVP	1,67	55 <sub>-0,007</sub>	120 <sub>-0,008</sub>	29 <sub>-0,15</sub>	2	91,5	101	77	85 000	255 000

1) Valid for matched pair of bearings in O or X arrangement.

2) Valid for individual bearing with stated preload force, bearing lightly oiled.

3) Only valid in conjunction with INA precision locknuts.



Design of adjacent construction

Limiting speed $n_G$ grease $\text{min}^{-1}$	Rigidity <sup>1)</sup> axial $C_{aL}$ $\text{N}/\mu\text{m}$	Bearing frictional torque <sup>2)</sup> $M_{RL}$ $\text{Nm}$	Runout $\mu\text{m}$	Recommended INA locknut; to be ordered separately			
				Designation	Tightening torque <sup>3)</sup> $M_A$ $\text{Nm}$	Axial preload force $\text{N}$	
8 000	476	0,015	2	<b>ZM12</b>	<b>AM12</b>	8	5 676
6 700	516	0,02	2	<b>ZM15</b>	<b>AM15</b>	10	5 777
6 000	596	0,03	2	<b>ZM17</b>	<b>AM17</b>	15	7 888
5 000	703	0,05	2	<b>ZM20</b>	<b>AM20</b>	18	8 387
5 600	703	0,05	2	<b>ZM20</b>	<b>AM20</b>	18	8 387
4 500	787	0,06	2	<b>ZM20</b>	<b>AM20</b>	25	9 423
4 500	772	0,065	2	<b>ZM25</b>	<b>AM25</b>	25	9 341
4 300	917	0,085	2	<b>ZM25</b>	<b>AM25</b>	40	11 837
3 800	917	0,085	2	<b>ZM25</b>	<b>AM25</b>	40	11 837
4 200	893	0,085	2	<b>ZM30</b>	<b>AM30</b>	32	10 200
3 800	893	0,085	2	<b>ZM30</b>	<b>AM30</b>	32	10 200
3 200	1 073	0,13	2	<b>ZM30</b>	<b>AM30</b>	55	13 517
3 700	1 020	0,115	2	<b>ZM35</b>	<b>AM35</b>	40	11 064
3 200	1 020	0,115	2	<b>ZM35</b>	<b>AM35</b>	40	11 064
3 000	1 192	0,17	2	<b>ZM35</b>	<b>AM35</b>	65	12 781
3 500	1 016	0,115	2	<b>ZM40</b>	<b>AM40</b>	40	11 214
2 800	1 190	0,17	2	<b>ZM40</b>	<b>AM40</b>	55	12 943
3 100	1 292	0,225	2	<b>ZM40</b>	<b>AM40</b>	110	20 710
2 600	1 292	0,225	2	<b>ZM40</b>	<b>AM40</b>	110	20 710
3 300	1 072	0,13	2	<b>ZM45</b>	<b>AM45</b>	50	9 799
2 600	1 247	0,19	2	<b>ZM45</b>	<b>AM45</b>	65	14 970
2 700	1 473	0,3	2	<b>ZM45</b>	<b>AM45</b>	120	19 287
2 200	1 473	0,3	2	<b>ZM45</b>	<b>AM45</b>	120	19 287
2 400	1 360	0,23	2	<b>ZM50</b>	<b>AM50</b>	85	16 535
2 700	1 473	0,33	2	<b>ZM50</b>	<b>AM50</b>	120	17 670
2 000	1 601	0,36	2	<b>ZM50</b>	<b>AM50</b>	150	28 928
2 800	1 246	0,19	3	<b>ZM55</b>	<b>AM55</b>	60	11 369
2 200	1 394	0,25	3	<b>ZM55</b>	<b>AM55</b>	85	15 647
2 400	1 553	0,36	3	<b>ZM55</b>	<b>AM55</b>	110	16 361
1 900	1 723	0,46	3	<b>ZM55</b>	<b>AM55</b>	130	31 446

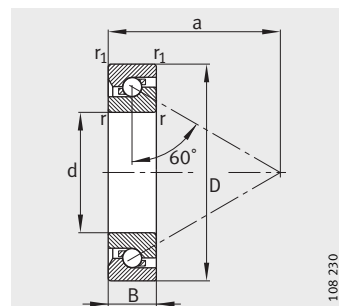




# Axial angular contact ball bearings

Single direction

Not sealed



7602, 7603, BSB

108 230

Dimension table · Dimensions in mm

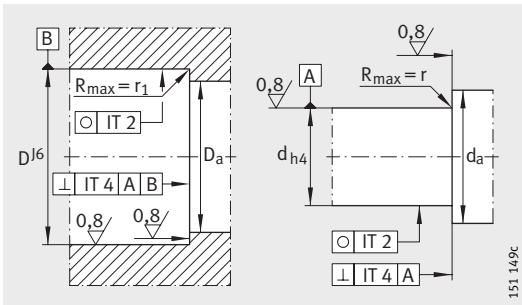
Designation <sup>4)</sup>	Mass ≈kg	Dimensions					Mounting dimensions	
		d	D	B	r, r <sub>1</sub> min.	a ≈	D <sub>a</sub> H12	d <sub>a</sub> h12
<b>7602060-TVP</b>	0,94	<b>60</b> <sub>-0,007</sub>	110 <sub>-0,008</sub>	22 <sub>-0,15</sub>	1,5	86	96	77
<b>BSB060120-T</b>	1,1	<b>60</b> <sub>-0,007</sub>	120 <sub>-0,008</sub>	20 <sub>-0,15</sub>	1,5	88	100,5	79,5
<b>7603060-TVP</b>	2,08	<b>60</b> <sub>-0,007</sub>	130 <sub>-0,009</sub>	31 <sub>-0,15</sub>	2,1	98	107,5	82,5
<b>7602065-TVP</b>	1,19	<b>65</b> <sub>-0,007</sub>	120 <sub>-0,008</sub>	23 <sub>-0,15</sub>	1,5	92,5	103	84
<b>7603065-TVP</b>	2,58	<b>65</b> <sub>-0,007</sub>	140 <sub>-0,009</sub>	33 <sub>-0,15</sub>	2,1	107,5	118,5	91,5
<b>7602070-TVP</b>	1,3	<b>70</b> <sub>-0,007</sub>	125 <sub>-0,009</sub>	24 <sub>-0,15</sub>	1,5	96,5	108	87
<b>7603070-TVP</b>	3,16	<b>70</b> <sub>-0,007</sub>	150 <sub>-0,009</sub>	35 <sub>-0,15</sub>	2,1	113	124,5	95,5
<b>BSB075110-T</b>	0,47	<b>75</b> <sub>-0,007</sub>	110 <sub>-0,008</sub>	15 <sub>-0,15</sub>	1,5	87,5	99,5	85
<b>7602075-TVP</b>	1,42	<b>75</b> <sub>-0,007</sub>	130 <sub>-0,009</sub>	25 <sub>-0,15</sub>	1,5	102,5	114,5	93,5
<b>7603075-TVP</b>	3,74	<b>75</b> <sub>-0,007</sub>	160 <sub>-0,01</sub>	37 <sub>-0,15</sub>	2,1	123	135,5	105,5
<b>7602080-TVP</b>	1,72	<b>80</b> <sub>-0,007</sub>	140 <sub>-0,009</sub>	26 <sub>-0,15</sub>	2	109	122	100
<b>7603080-TVP</b>	4,5	<b>80</b> <sub>-0,007</sub>	170 <sub>-0,01</sub>	39 <sub>-0,15</sub>	2,1	129,5	143	111
<b>7602085-TVP</b>	2,17	<b>85</b> <sub>-0,008</sub>	150 <sub>-0,009</sub>	28 <sub>-0,2</sub>	2	117	131	107
<b>7603085-TVP</b>	5,24	<b>85</b> <sub>-0,008</sub>	180 <sub>-0,01</sub>	41 <sub>-0,2</sub>	3	136	151	116
<b>7602090-TVP</b>	2,67	<b>90</b> <sub>-0,008</sub>	160 <sub>-0,01</sub>	30 <sub>-0,2</sub>	2	124	138,5	113,5
<b>7603090-TVP</b>	6,18	<b>90</b> <sub>-0,008</sub>	190 <sub>-0,011</sub>	43 <sub>-0,2</sub>	3	142,5	157,5	122,5
<b>7602095-TVP</b>	3,25	<b>95</b> <sub>-0,008</sub>	170 <sub>-0,01</sub>	32 <sub>-0,2</sub>	2,1	131	146,5	119,5
<b>7603095-TVP</b>	7,22	<b>95</b> <sub>-0,008</sub>	200 <sub>-0,011</sub>	45 <sub>-0,2</sub>	3	150	165	130
<b>BSB100150-T</b>	1,4	<b>100</b> <sub>-0,008</sub>	150 <sub>-0,009</sub>	22,5 <sub>-0,2</sub>	2	119,5	135	114,5
<b>7602100-TVP</b>	3,9	<b>100</b> <sub>-0,008</sub>	180 <sub>-0,01</sub>	34 <sub>-0,2</sub>	2,1	138	154,5	125,5
<b>7603100-TVP</b>	8,78	<b>100</b> <sub>-0,008</sub>	215 <sub>-0,011</sub>	47 <sub>-0,2</sub>	3	161	178	140

1) Valid for matched pair of bearings in O or X arrangement.

2) Valid for individual bearing with stated preload force, bearing lightly oiled.

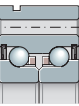
3) Only valid in conjunction with INA precision locknuts.

4) Available by agreement.



Design of adjacent construction

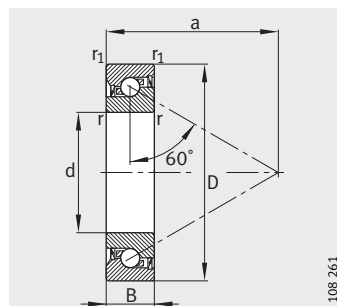
Basic load ratings axial		Limiting speed $n_G$ grease	Rigidity <sup>1)</sup> axial $C_{aL}$	Bearing frictional torque <sup>2)</sup> $M_{RL}$	Run-out $\mu\text{m}$	Recommended INA locknut; to be ordered separately		
dyn. $C_a$	stat. $C_{0a}$					Designation	Tightening torque <sup>3)</sup> $M_A$ Nm	Axial preload force N
N	N	$\text{min}^{-1}$	N/ $\mu\text{m}$	Nm				
58 000	183 000	2 000	1 623	0,35	3	<b>ZM60</b> <b>AM60</b>	100	17 273
64 000	196 000	2 300	1 623	0,38	3	<b>ZM60</b> <b>AM60</b>	120	15 356
92 000	270 000	1 800	1 840	0,54	3	<b>ZM60</b> <b>AM60</b>	150	27 145
60 000	197 000	1 800	1 753	0,41	3	<b>ZM65</b> <b>AM65</b>	110	18 203
106 000	330 000	1 600	2 052	0,7	3	<b>ZM65</b> <b>AM65</b>	150	27 725
68 000	220 000	1 800	1 753	0,44	3	<b>ZM70</b> <b>AM70</b>	115	19 632
117 000	360 000	1 600	2 108	0,76	3	<b>ZM70</b> <b>AM70</b>	180	30 071
37 000	133 000	2 300	1 534	0,29	3	<b>ZM75</b> <b>AM75</b>	140	12 357
70 000	236 000	1 600	1 888	0,48	3	<b>ZM75</b> <b>AM75</b>	160	19 819
132 000	425 000	1 400	2 335	0,92	3	<b>ZM75</b> <b>AM75</b>	200	32 191
81 000	275 000	1 500	2 047	0,6	3	<b>ZM80</b> <b>AM80</b>	160	21 867
144 000	465 000	1 400	2 466	1,1	3	<b>ZM80</b> <b>AM80</b>	220	33 617
95 000	340 000	1 400	2 209	0,76	3	<b>ZM85</b> <b>AM85</b>	250	23 249
169 000	550 000	1 300	2 539	1,25	3	<b>ZM85</b> <b>AM85</b>	280	36 911
102 000	365 000	1 400	2 275	0,79	3	<b>ZM90</b> <b>AM90</b>	250	24 552
172 000	580 000	1 200	2 654	1,3	3	<b>ZM90</b> <b>AM90</b>	300	37 503
116 000	410 000	1 300	2 435	0,95	3	–	–	27 457
175 000	600 000	1 200	2 770	1,45	3	–	–	38 299
73 000	265 000	1 800	2 052	0,6	3	<b>ZM100</b> <b>AM100</b>	200	16 937
128 000	465 000	1 200	2 594	1,1	3	<b>ZM100</b> <b>AM100</b>	255	28 724
201 000	700 000	1 100	2 965	1,7	3	<b>ZM100</b> <b>AM100</b>	305	45 106



# Axial angular contact ball bearings

Single direction

Sealed on both sides



7602..-2RS  
7603..-2RS  
BSB..-2RS

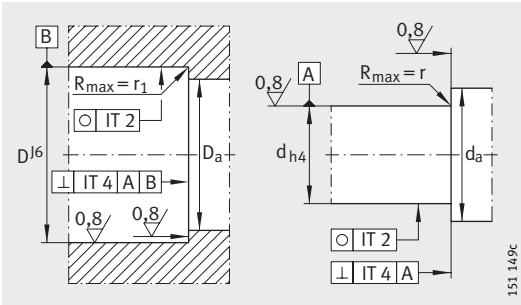
**Dimension table** · Dimensions in mm

Designation	Mass  ≈kg	Dimensions					Mounting dimensions	
		d	D	B	r, r <sub>1</sub>  min.	a  ≈	D <sub>a</sub> H12	d <sub>a</sub> h12
<b>7602012-2RS-TVP</b>	0,042	<b>12</b> <sub>-0,004</sub>	32 <sub>-0,006</sub>	10 <sub>-0,08</sub>	0,6	24	27	17
<b>7602015-2RS-TVP</b>	0,052	<b>15</b> <sub>-0,004</sub>	35 <sub>-0,006</sub>	11 <sub>-0,08</sub>	0,6	27,5	30	20,5
<b>7602020-2RS-TVP</b>	0,12	<b>20</b> <sub>-0,005</sub>	47 <sub>-0,006</sub>	14 <sub>-0,12</sub>	1	36	39,5	27,5
<b>7603020-2RS-TVP</b>	0,17	<b>20</b> <sub>-0,005</sub>	52 <sub>-0,007</sub>	15 <sub>-0,12</sub>	1,1	39,5	43,5	30,5
<b>7602025-2RS-TVP</b>	0,15	<b>25</b> <sub>-0,005</sub>	52 <sub>-0,007</sub>	15 <sub>-0,12</sub>	1	41	45	32
<b>BSB025062-2RS-T</b>	0,24	<b>25</b> <sub>-0,005</sub>	62 <sub>-0,007</sub>	15 <sub>-0,12</sub>	1	46,5	52	38
<b>7603025-2RS-TVP</b>	0,27	<b>25</b> <sub>-0,005</sub>	62 <sub>-0,007</sub>	17 <sub>-0,12</sub>	1,1	47,5	52	38
<b>BSB030062-2RS-T</b>	0,22	<b>30</b> <sub>-0,005</sub>	62 <sub>-0,007</sub>	15 <sub>-0,12</sub>	1	47,5	52,5	39,5
<b>7602030-2RS-TVP</b>	0,23	<b>30</b> <sub>-0,005</sub>	62 <sub>-0,007</sub>	16 <sub>-0,12</sub>	1	48	52,5	39,5
<b>BSB035072-2RS-T</b>	0,3	<b>35</b> <sub>-0,006</sub>	72 <sub>-0,007</sub>	15 <sub>-0,12</sub>	1	54	60,5	46,5
<b>BSB040072-2RS-T</b>	0,26	<b>40</b> <sub>-0,006</sub>	72 <sub>-0,007</sub>	15 <sub>-0,12</sub>	1	56	62,5	49

1) Valid for matched pair of bearings in O or X arrangement.

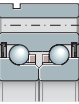
2) Valid for individual bearing with stated preload force, bearing lightly oiled.

3) Only valid in conjunction with INA precision locknuts.



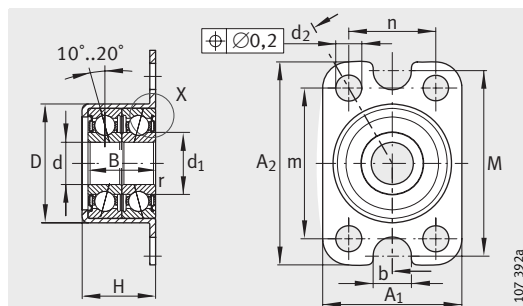
Design of adjacent construction

Basic load ratings axial		Limiting speed $n_G$ grease	Rigidity <sup>1)</sup> axial $C_{aL}$	Bearing frictional torque <sup>2)</sup> $M_{RL}$	Run- out $\mu m$	Recommended INA locknut; to be ordered separately		
dyn. $C_a$	stat. $C_{0a}$					Designation	Tightening torque <sup>3)</sup> $M_A$ Nm	Axial preload force N
N	N	$min^{-1}$	N/ $\mu m$	Nm				
12 200	20 700	8 000	476	0,018	2	<b>ZM12</b> <b>AM12</b>	8	5 676
13 100	24 700	6 700	516	0,024	2	<b>ZM15</b> <b>AM15</b>	10	5 777
19 100	38 000	5 000	703	0,06	2	<b>ZM20</b> <b>AM20</b>	18	8 387
25 500	53 000	4 500	787	0,07	2	<b>ZM20</b> <b>AM20</b>	18	8 387
23 200	50 000	3 800	772	0,08	2	<b>ZM25</b> <b>AM25</b>	25	9 341
29 500	68 000	4 300	917	0,1	2	<b>ZM25</b> <b>AM25</b>	40	11 837
29 500	68 000	3 800	917	0,1	2	<b>ZM25</b> <b>AM25</b>	40	11 837
27 500	66 000	4 200	893	0,1	2	<b>ZM30</b> <b>AM30</b>	32	10 200
27 500	66 000	3 800	893	0,1	2	<b>ZM30</b> <b>AM30</b>	32	10 200
31 500	81 000	3 700	1 020	0,14	2	<b>ZM35</b> <b>AM35</b>	40	11 064
29 500	82 000	3 500	1 016	0,14	2	<b>ZM40</b> <b>AM40</b>	40	11 214



# Angular contact ball bearing units

For screw mounting

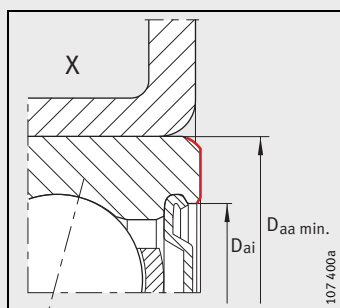


ZKLR0624-2Z, ZKLR0828-2Z

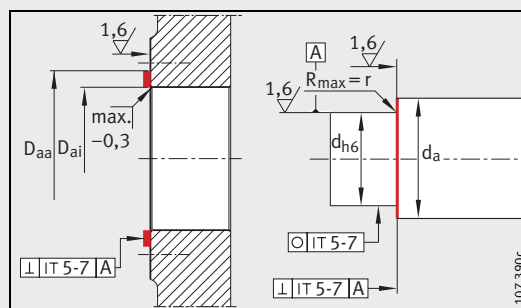
Dimension table · Dimensions in mm

Designation	Mass ≈kg	Dimensions												
		d	A <sub>1</sub>	A <sub>2</sub>	D	B	d <sub>1</sub>	r	d <sub>2</sub>	b	m	n	M	H
ZKLR0624-2Z	23	6 <sub>-0,008</sub>	24	35	20,5 <sub>+0,03 -0,01</sub>	12 <sub>-0,25</sub>	10,4	0,3 <sub>min.</sub>	4,5	6,6	26	15	32	13
ZKLR0828-2Z	30	8 <sub>-0,008</sub>	28	35	23,9	14	11,8	0,3	4,5	6,6	26	20	35	15,5
ZKLR1035-2Z	50	10 <sub>-0,008</sub>	35	35	28,14	16	14,7	0,3	4,5	—	26	26	—	17,5
ZKLR1244-2RS	120	12 <sub>-0,007</sub>	44	50	35,45	20	16,6	0,3	6,6	—	38	32	—	22
ZKLR1547-2RS	140	15 <sub>-0,007</sub>	47	51	38,45	22	18	0,3	6,6	—	39	35	—	24
ZKLR2060-2RS	300	20 <sub>-0,008</sub>	60	60	50,45	28	24,4	0,3	6,6	—	47	47	—	30

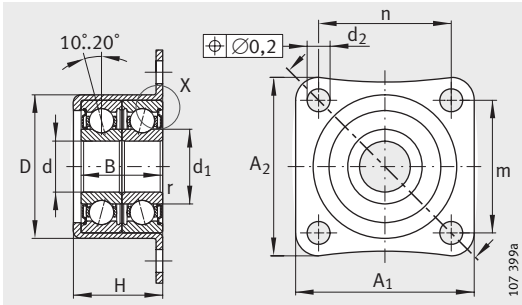
- 1) Tightening torque for the fixing screws as recommended by the manufacturer. Screws are not included in the delivery.
- 2) Mass moment of inertia for rotating inner ring.
- 3) The locknut is only used to axially locate the bearing unit. It has no influence on the bearing preload.
- 4) Stated geometrical tolerances only required in diameter area between D<sub>ai</sub> and D<sub>aa</sub>.
- 5) Only valid in conjunction with INA precision locknuts.



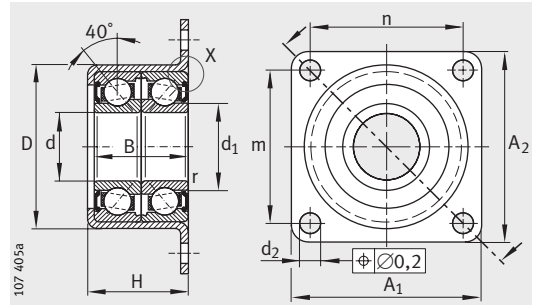
Axial abutment area of outer ring



Design of adjacent construction<sup>4)</sup>

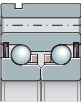


ZKLR1035-2Z



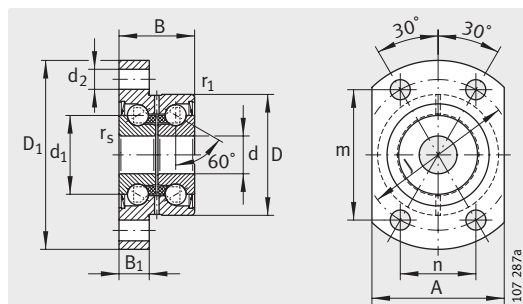
ZKLR1244-2RS, ZKLR1547-2RS, ZKLR2060-2RS

d <sub>a</sub>	D <sub>ai</sub>	D <sub>aa</sub>	Fixing screws DIN 912 <sup>1)</sup>		Basic load ratings				Bearing frictional torque  M <sub>RL</sub>	Rigid- ity axial  C <sub>aL</sub>	Mass moment of inertia <sup>2)</sup>  M <sub>M</sub>	Recommended INA locknut; to be ordered separately <sup>3)</sup>	
			Size	Quan- tity	radial		axial					Design- ation	Tightening torque <sup>5)</sup>  M <sub>A</sub>
					dyn. C <sub>r</sub>	stat. C <sub>0r</sub>	dyn. C <sub>a</sub>	stat. C <sub>0a</sub>					
					N	N	N	N					
8	16	19	M4 M6	4 2	3 850	1 870	1 340	1 250	0,04	17	0,0014	<b>ZM06</b>	2
10,4	18	22	M4 M6	4 2	4 900	2 280	1 810	1 520	0,08	20	0,0028	<b>ZM08</b>	4
12,4	22	26	M4	4	7 400	3 600	2 550	2 420	0,12	26	0,0075	<b>ZM10</b>	6
14	27	32	M6	4	13 600	8 500	13 200	17 900	0,16	200	0,0102	<b>ZM12</b>	8
17,5	29	35	M6	4	16 700	10 700	16 400	22 400	0,2	130	0,0178	<b>ZM15</b>	10
24	39	47	M6	4	28 000	19 100	27 500	40 000	0,3	250	0,263	<b>ZM20</b>	18



# Axial angular contact ball bearings

For screw mounting



ZKLFA...2RS,  
ZKLFA...2Z

**Dimension table** · Dimensions in mm

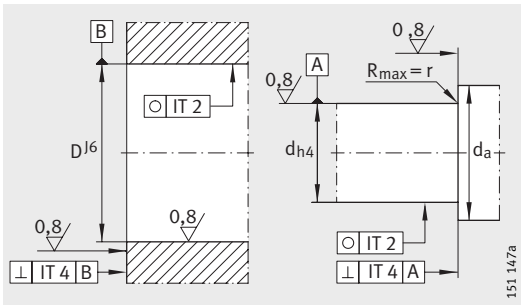
Designation	Mass ≈kg	Dimensions													Mounting dimensions	
		d	D	B	d <sub>1</sub>	D <sub>1</sub>	r	r <sub>1</sub>	B <sub>1</sub>	d <sub>2</sub>	m	J	n	A	d <sub>a</sub>	
		-0,005	-0,01	-0,25			min.	min.							min.	max.
<b>ZKLFA0630-2Z</b>	0,05	<b>6</b>	19	12	12	30	0,3	0,3	5	3,5	21	24	12	22	9	15
<b>ZKLFA0640-2RS</b>	0,08	<b>6</b>	24	15	14	40	0,3	0,6	6	4,5	27,5	32	16	27	9	18
<b>ZKLFA0640-2Z</b>	0,08	<b>6</b>	24	15	14	40	0,3	0,6	6	4,5	27,5	32	16	27	9	18
<b>ZKLFA0850-2RS</b>	0,17	<b>8</b>	32	20	19	50	0,3	0,6	8	5,5	34,5	40	20	35	11	25
<b>ZKLFA0850-2Z</b>	0,17	<b>8</b>	32	20	19	50	0,3	0,6	8	5,5	34,5	40	20	35	11	25
<b>ZKLFA1050-2RS</b>	0,18	<b>10</b>	32	20	21	50	0,3	0,6	8	5,5	34,5	40	20	35	14	27
<b>ZKLFA1050-2Z</b>	0,18	<b>10</b>	32	20	21	50	0,3	0,6	8	5,5	34,5	40	20	35	14	27
<b>ZKLFA1263-2RS</b>	0,3	<b>12</b>	42	25	25	63	0,3	0,6	10	6,8	46	53	26,5	45	16	31
<b>ZKLFA1263-2Z</b>	0,3	<b>12</b>	42	25	25	63	0,3	0,6	10	6,8	46	53	26,5	45	16	31
<b>ZKLFA1563-2RS</b>	0,31	<b>15</b>	42	25	28	63	0,3	0,6	10	6,8	46	53	26,5	45	20	34
<b>ZKLFA1563-2Z</b>	0,31	<b>15</b>	42	25	28	63	0,3	0,6	10	6,8	46	53	26,5	45	20	34

<sup>1)</sup> Tightening torque for the fixing screws as recommended by the manufacturer.

Screws are not included in the delivery.

<sup>2)</sup> Mass moment of inertia for rotating inner ring.

<sup>3)</sup> Only valid in conjunction with INA precision locknuts.



Design of adjacent construction

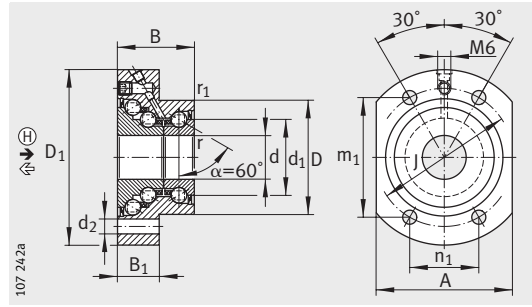
Fixing screws <sup>1)</sup> DIN 912-10.9		Basic load ratings axial		Limiting speed	Bearing frictional torque	Rigidity axial	Tilting rigidity	Mass moment of inertia <sup>2)</sup>	Run-out	Recommended INA locknut; to be ordered separately			
										dyn. C <sub>a</sub>	stat. C <sub>0a</sub>	n <sub>G</sub> grease	M <sub>RL</sub>
		N	N	min <sup>-1</sup>	Nm	N/μm	Nm/mrad	kg · cm <sup>2</sup>	M <sub>A</sub> Nm				
M3	4	4 900	6 100	14 000	0,01	150	4	0,0019	2	<b>ZM06</b>	–	2	916
M4	4	6 900	8 500	6 800	0,04	200	8	0,0044	2	<b>ZM06</b>	–	2	2 404
M4	4	6 900	8 500	12 000	0,02	200	8	0,0044	2	<b>ZM06</b>	–	2	2 404
M5	4	12 500	16 300	5 100	0,08	250	20	0,02	2	<b>ZM08</b>	–	4	2 216
M5	4	12 500	16 300	9 500	0,04	250	20	0,02	2	<b>ZM08</b>	–	4	2 216
M5	4	13 400	18 800	4 600	0,12	325	25	0,029	2	<b>ZM10</b>	–	6	4 891
M5	4	13 400	18 800	8 600	0,06	325	25	0,029	2	<b>ZM10</b>	–	6	4 891
M6	4	16 900	24 700	3 800	0,16	375	50	0,068	2	<b>ZM12</b>	–	8	5 038
M6	4	16 900	24 700	7 600	0,08	375	50	0,068	2	<b>ZM12</b>	–	8	5 038
M6	4	17 600	27 500	3 500	0,2	400	65	0,102	2	<b>ZM15</b>	<b>AM15</b>	10	5 484
M6	4	17 900	28 000	7 000	0,1	400	65	0,102	2	<b>ZM15</b>	<b>AM15</b>	10	5 484





# Triple row angular contact ball bearings

For screw mounting



DKLFA..-2RS ( $d \leq 20 \text{ mm}$ )

## Caution!

The bearings require continuous load in the main load direction  $\oplus$ .

### Dimension table · Dimensions in mm

Designation	Mass  ≈kg	Dimensions											Mounting dimensions	
		d	D	B	d <sub>1</sub>	D <sub>1</sub>	r	r <sub>1</sub>	B <sub>1</sub>	d <sub>2</sub>	J	A	d <sub>a</sub>	
		-0,010	-0,013	-0,25			min.	min.					min.	max.
<b>DKLFA1575-2RS</b>	0,53	<b>15</b>	45	32	28	75	0,3	0,6	18	6,8	58	55	20	35
<b>DKLFA2080-2RS</b>	0,7	<b>20</b>	52	35	34,5	80	0,3	0,6	19	6,8	63	62	25	43
<b>DKLFA2590-2RS</b>	0,9	<b>25</b>	57	38	40,5	90	0,3	0,6	22	8,8	75	70	32	48
<b>DKLFA30100-2RS</b>	1	<b>30</b>	62	38	45,5	100	0,3	0,6	22	8,8	80	72	40	53
<b>DKLFA30110-2RS<sup>3)</sup></b>	2,5	<b>30</b>	75	56	51	110	0,3	0,6	35	8,8	95	85	47	64
<b>DKLFA40115-2RS</b>	1,5	<b>40</b>	72	42	58	115	0,3	0,6	23	8,8	94	90	50	67
<b>DKLFA40140-2RS<sup>3)</sup></b>	4,2	<b>40</b>	90	60	65	140	0,3	0,6	35	11	118	110	56	80

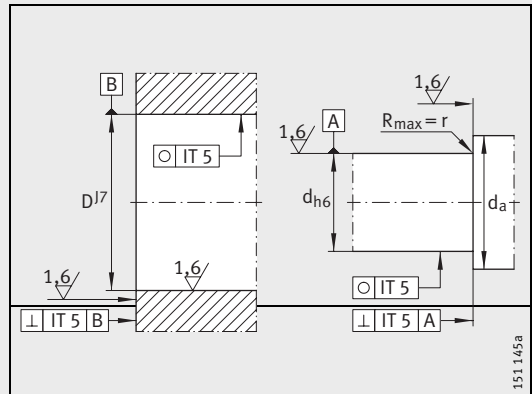
1) Tightening torque of fixing screws according to manufacturer's data.  
Screws not included with delivery.

2) Mass moment of inertia for rotating inner ring.

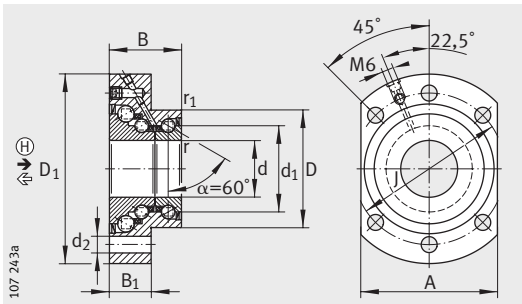
3) Heavy series.

### INA locknut accessories

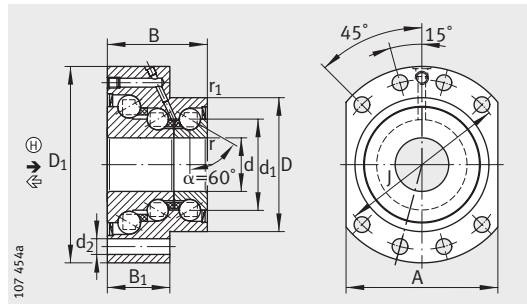
Triple row angular contact ball bearing Designation	Recommended INA locknut; to be ordered separately Designation		
	①	②	
<b>DKLFA1575-2RS</b>	<b>AM15</b>	<b>ZMA15/33</b>	<b>ZM17</b>
<b>DKLFA2080-2RS</b>	<b>AM20</b>	<b>ZMA20/38</b>	<b>ZM25</b>
<b>DKLFA2590-2RS</b>	<b>AM25</b>	<b>ZMA25/45</b>	<b>AM30</b>
<b>DKLFA30100-2RS</b>	<b>AM30</b>	<b>ZMA30/52</b>	<b>ZM35</b>
<b>DKLFA30110-2RS</b>	<b>AM30/65</b>	-	<b>ZM35</b>
<b>DKLFA40115-2RS</b>	<b>AM40</b>	<b>ZMA40/62</b>	<b>ZM45</b>
<b>DKLFA40140-2RS</b>	<b>AM40/85</b>	-	<b>ZM45</b>



Design of adjacent construction

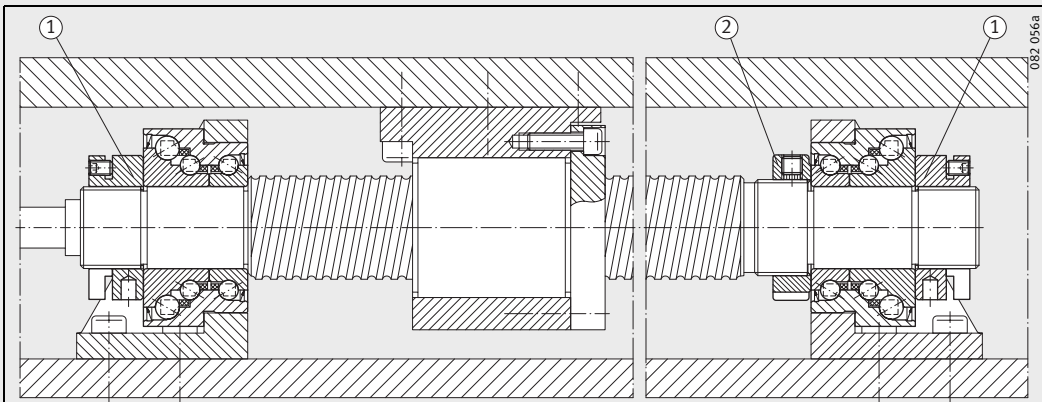


DKLFA..-2RS ( $d \geq 25 \text{ mm}$ )



DKLFA..-2RS  
Heavy series

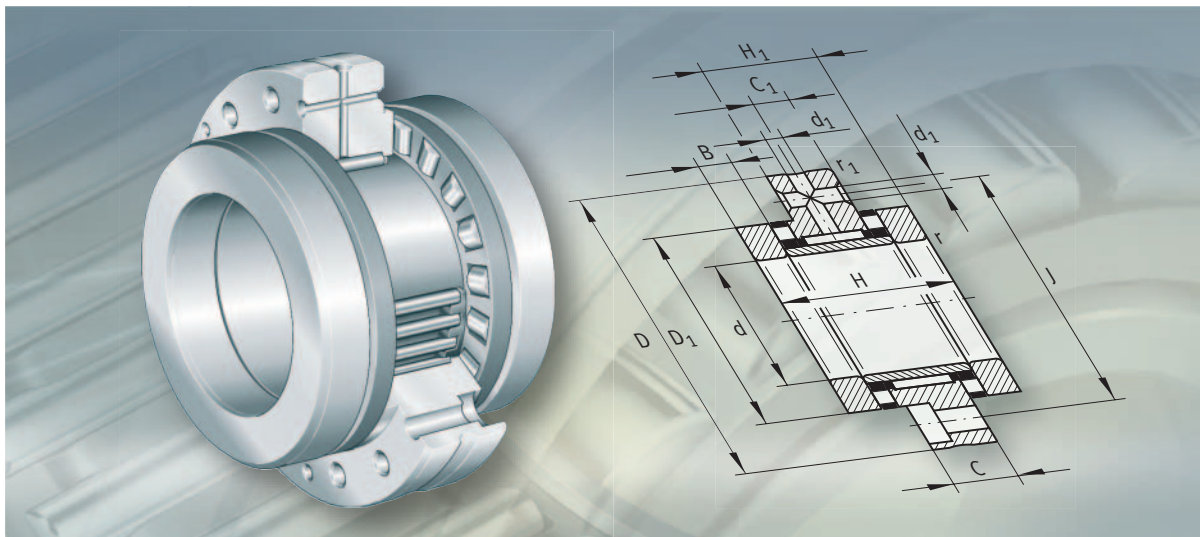
Fixing screws <sup>1)</sup> DIN 912-10.9		Basic load ratings				Limiting speed $n_G$ grease $\text{min}^{-1}$	Bearing frictional torque $M_{RL}$ Nm	Rigidity axial $\leftarrow$ $c_{aL}$ N/ $\mu\text{m}$	Rigidity axial $\rightarrow$ $c_{aL}$ N/ $\mu\text{m}$	Tilting rigidity $c_{kL}$ Nm/mrad	Mass moment of inertia <sup>2)</sup> $M_m$ kg · cm <sup>2</sup>	Run-out $\mu\text{m}$
		axial $\leftarrow$		axial $\rightarrow$								
		dyn. $C_a$	stat. $C_{0a}$	dyn. $C_a$	stat. $C_{0a}$							
Size	Quantity	N	N	N	N							
M6	4	17 900	28 000	37 000	83 000	2 600	0,35	500	950	140	0,278	5
M6	4	26 000	47 000	44 500	110 000	2 200	0,45	750	1 100	260	0,553	5
M8	6	27 500	55 000	52 000	144 000	2 000	0,6	850	1 200	370	1,12	5
M8	6	29 000	64 000	55 000	165 000	1 800	0,75	900	1 400	500	1,7	5
M8	8	59 000	108 000	106 000	257 000	1 600	1,5	1 300	1 600	650	3,23	5
M8	6	43 000	101 000	73 000	227 000	1 500	1	1 100	1 700	1 000	4,23	5
M10	8	72 000	149 000	126 000	363 000	1 200	2,5	1 800	2 000	1 370	9,32	5



Ball screw drive with locating bearing arrangement on both sides



**FAG**



## Needle roller/ axial cylindrical roller bearings

# Needle roller/ axial cylindrical roller bearings

Page

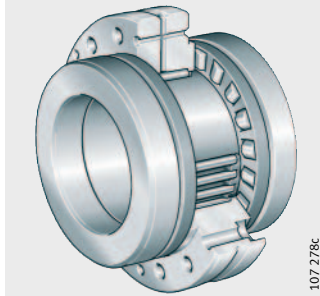
<b>Product overview</b>	Needle roller/axial cylindrical roller bearings.....	60
<b>Features</b>	Needle roller/axial cylindrical roller bearings, for screw mounting.....	61
	Needle roller/axial cylindrical roller bearings, not for screw mounting.....	62
	Operating temperature .....	62
	Suffixes .....	62
<b>Design and safety guidelines</b>	Basic rating life .....	63
	Resultant and equivalent bearing load .....	63
	Static load safety factor.....	63
	Design of adjacent construction .....	65
	Speeds.....	65
	Friction .....	65
	Lubrication .....	66
	Mounting guidelines .....	67
<b>Dimension tables</b>	Needle roller/axial cylindrical roller bearings, light series, for screw mounting.....	68
	Needle roller/axial cylindrical roller bearings, heavy series, for screw mounting.....	72
	Needle roller/axial cylindrical roller bearings, light series.....	76
	Needle roller/axial cylindrical roller bearings, heavy series.....	80



## Product overview – Needle roller/ axial cylindrical roller bearings

**For screw mounting**

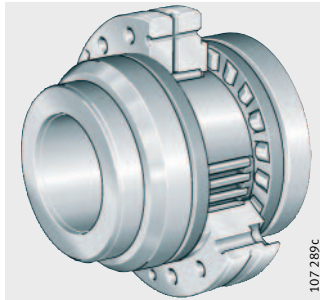
**ZARF**



107 278c

**With extended  
shaft locating washer**

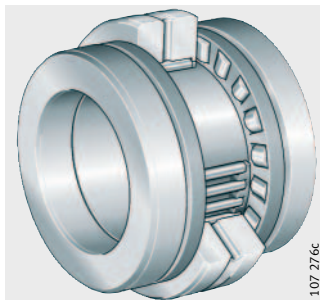
**ZARF..-L**



107 289c

**Not for screw mounting**

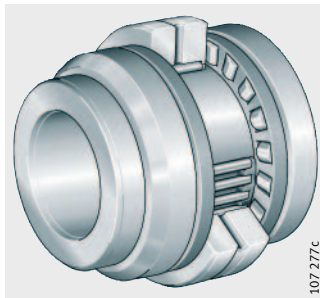
**ZARN**



107 276c

**With extended  
shaft locating washer**

**ZARN..-L**



107 277c

# Needle roller/ axial cylindrical roller bearings

**Features** Needle roller/axial cylindrical roller bearings comprise an outer ring with radial and axial raceways, two shaft locating washers, an inner ring, a radial needle roller and cage assembly and two axial cylindrical roller and cage assemblies. The bearings are available in versions for screw mounting and not for screw mounting.

**Radial and axial load carrying capacity** In addition to radial forces, the bearings can also support axial forces from both directions and tilting moments.

**Preload/internal clearance** The central washer, inner ring and axial cages are matched to each other such that the bearing is axially clearance-free after preloading by means of an INA precision locknut. The radial internal clearance is C2 according to DIN 620.

**Needle roller/axial cylindrical roller bearings, for screw mounting** Needle roller/axial cylindrical roller bearings ZARF(L) have holes in the outer ring. These are used for screw mounting directly on the adjacent construction or in a radial locating bore, *Figure 1*. Due to screw mounting of the outer ring, the cover that would otherwise be required and the matching work can therefore be dispensed with.

The bearings are preloaded against the shaft shoulder by means of a precision locknut AM or ZM(A).

**With seal carrier assembly** In the interests of a simpler design, a seal carrier assembly DRS, *Figure 1*, ① is recommended. The seal carrier assembly is centred on the outer ring and seals the bearing against outside influences.

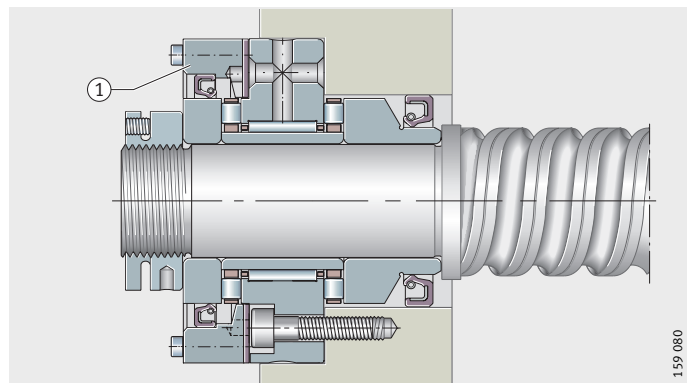
① Seal carrier assembly

ZARF..-L

*Figure 1*

With DRS

Outer ring screw mounted in bore, preloaded using locknut. Stepped shaft locating washer with seal



**With extended shaft locating washer** ZARF..-L has an extended and stepped shaft locating washer, *Figure 1*. These series are used in preference where the shaft locating washers are not adequately supported axially by the shaft shoulder or the bearing unit cannot be sealed on the outside surface of the normal shaft locating washer due to space conditions in the adjacent construction.

**Heavy series** ZARF(L) is also available in a heavy series.

The heavy series has a larger cross-section for the same shaft diameter and therefore higher basic load ratings.

# Needle roller/ axial cylindrical roller bearings

## Needle roller/axial cylindrical roller bearings, not for screw mounting

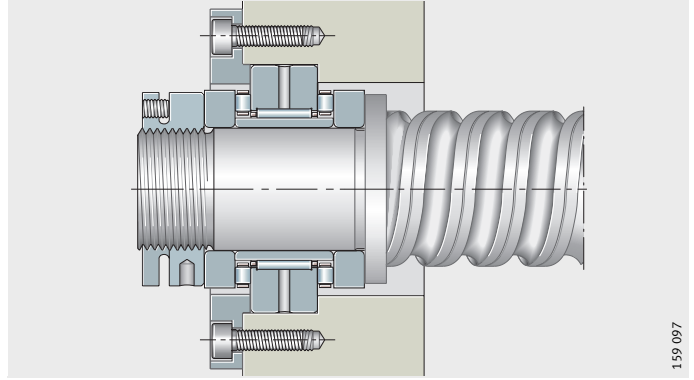
Series ZARN(L) is mounted in a housing bore and the outer ring is located using a cover, *Figure 2*.

The bearings are preloaded against the shaft shoulder by means of a precision locknut AM or ZM(A).

**ZARN**

*Figure 2*

Outer ring located using cover, preloaded using locknut



159 097

## With extended shaft locating washer

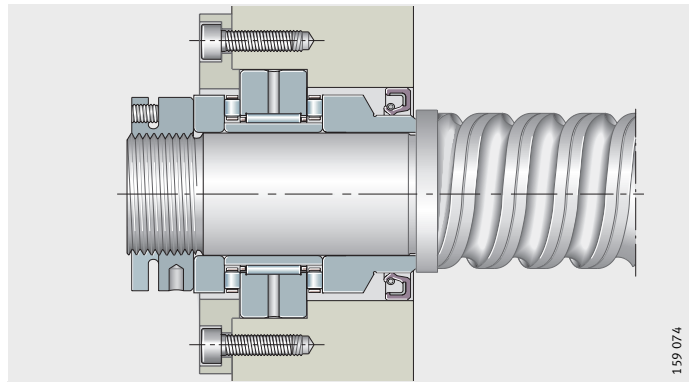
ZARN..-L has an extended and stepped shaft locating washer, *Figure 3*.

This series is used in preference where the shaft locating washer is not adequately supported axially by the shaft shoulder or the bearing unit cannot be sealed on the outside surface of the normal shaft locating washer due to space conditions in the adjacent construction.

**ZARN..-L**

*Figure 3*

Outer ring located using cover, preloaded using locknut. Stepped shaft locating washer with sealing ring



159 074

## Heavy series

ZARN(L) is also available in a heavy series.

The heavy series has a larger cross-section for the same shaft diameter and therefore higher basic load ratings.

## Operating temperature

The bearings are suitable for operating temperatures from  $-30\text{ °C}$  to  $+120\text{ °C}$ .

## Suffixes

Suffixes for the available designs: see table.

## Available designs

Suffix	Description
L	Extended, stepped shaft locating washer
TN	Cages made from glass fibre reinforced polyamide 66

## Design and safety guidelines

### Basic rating life

The decisive factors in determining the bearing size are the basic rating life, the static load safety factor and the axial limiting load. The basic rating life  $L$  and  $L_h$  are calculated as follows:

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

$$L_h = \frac{16666}{n} \cdot \left( \frac{C}{P} \right)^p$$

$L$   $10^6$  rev.

Basic rating life in millions of revolutions

$L_h$  h

Basic rating life in operating hours

$C_r, C_a$  N

Basic dynamic radial or axial load rating according to dimension table

$P$  N

Equivalent dynamic bearing load

$p$  -

Life exponent  $p = 10/3$

$n$   $\text{min}^{-1}$

Operating speed.

### Resultant and equivalent bearing load

The resultant axial bearing load  $F_{a \text{ res}}$  is determined from the axial operating load  $F_{aB}$  and taking account of the axial preload, *Figure 4* to *Figure 6*, page 64.

Under purely axial load,  $P = F_{a \text{ res}}$ . If additional radial operating loads are present, these must be calculated separately using the radial basic load ratings.

The limit values up to which the axial load can be supported clearance-free are shown, *Figure 4* to *Figure 6*.

#### Caution!

A load in excess of the limit value will lead to the rolling element row without load lifting off the raceway. As a result, higher wear will occur under rapid acceleration. For extreme moment loads and statically overdefined systems (locating/locating bearing arrangements), please contact us. The calculation program BEARINX® can give a precise design in this case.



### Load varying in steps

If the load values vary in steps, the equivalent load  $P$  and speed  $n$  are calculated using the following formulae ( $q$  = time duration %):

$$P = \sqrt[p]{\frac{q_1 \cdot n_1 \cdot P_1^p + \dots + q_z \cdot n_z \cdot P_z^p}{q_1 \cdot n_1 + \dots + q_z \cdot n_z}}$$

$$n = \frac{q_1 \cdot n_1 + \dots + q_z \cdot n_z}{100}$$

### Static load safety factor

The static load safety factor  $S_0$  is calculated using the following formula (see also page 19):

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

#### Caution!

In machine tools,  $S_0$  should be  $> 4$ .

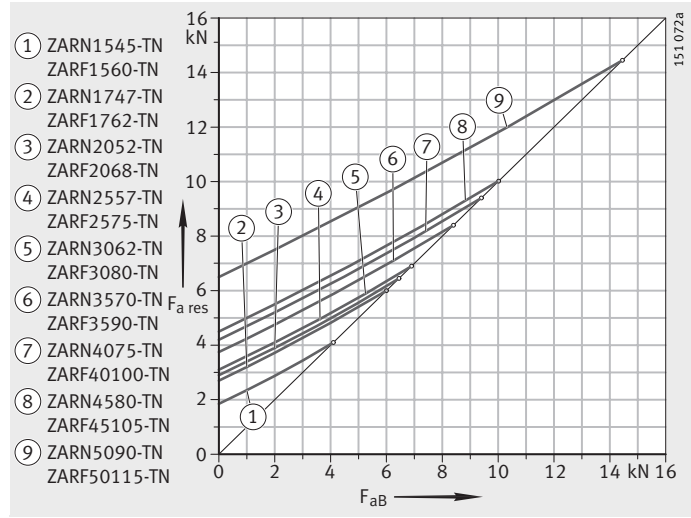


# Needle roller/ axial cylindrical roller bearings

$F_{aB}$  = operating load  
 $F_{a\text{ res}}$  = resultant bearing load  
 ° = limit value

Figure 4

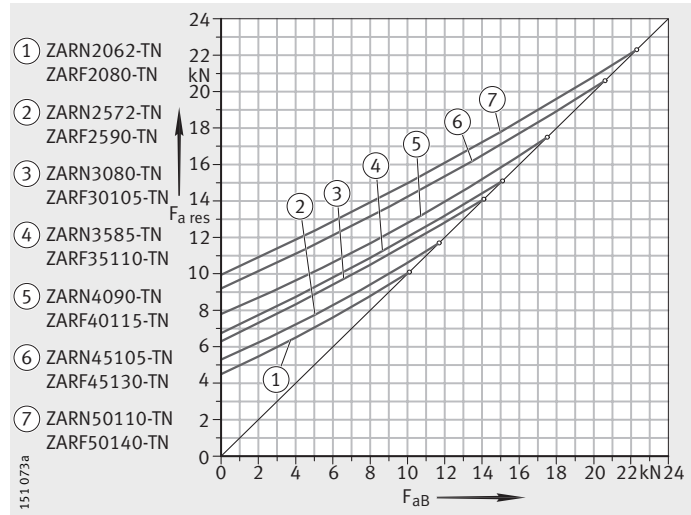
Resultant bearing load  
 with ZARN, ZARF,  
 light series



$F_{aB}$  = operating load  
 $F_{a\text{ res}}$  = resultant bearing load  
 ° = limit value

Figure 5

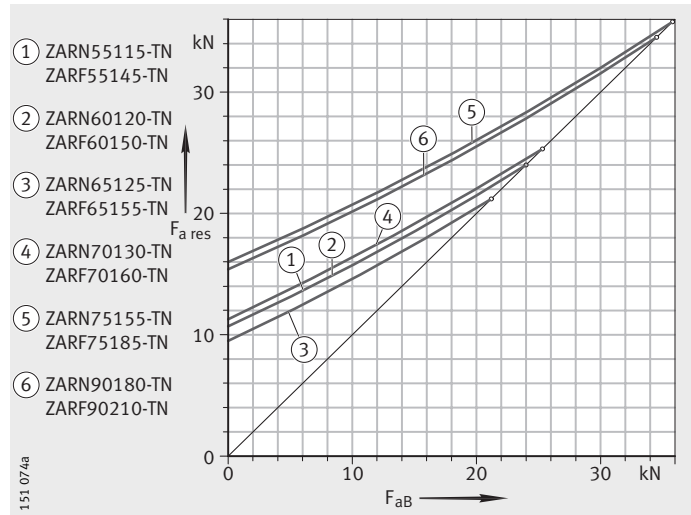
Resultant bearing load  
 with ZARN, ZARF,  
 heavy series up to  $d = 50$  mm



$F_{aB}$  = operating load  
 $F_{a\text{ res}}$  = resultant bearing load  
 ° = limit value

Figure 6

Resultant bearing load  
 with ZARN, ZARF,  
 heavy series from  $d = 50$  mm



## Design of adjacent construction

The adjacent construction (the shaft and housing) must be designed in accordance with the data in the dimension tables. The abutment diameters for the shaft and housing shoulders  $d_a$  and  $D_a$  must be in accordance with the dimension tables.

**Caution!** The permissible contact pressure for the adjacent construction must be observed.

Examples of possible lubricant feeds: see *Figure 7* and *Figure 8*, page 66.

## Sealing of the bearing position

The bearings are sealed, *Figure 1*, page 61:

- in the direction of the spindle by a rotary shaft seal on the outside surface machined free from spiral marks of the extended shaft locating washer (ZARN...-L, ZARF...-L)
- in the direction of the drive by the seal carrier assembly DRS.

## Speeds

The limiting speeds  $n_G$  given in the dimension tables are based on the following conditions:

- bearing preloaded, no external operating load
- 25% operating duration
- max. equilibrium temperature +50 °C.

**Caution!** The limiting speeds  $n_G$  are valid for oil lubrication with adequate cooling.

## Friction

In most applications, preloading of bearings by means of the locknut tightening torque gives sufficiently accurate setting values. The reference here is the tightening torque  $M_A$  according to the dimension tables in conjunction with an INA precision locknut.

The frictional torque  $M_{RL}$  given in the dimension tables is a guide value. It is based on lightly oiled bearings, measured at a speed of  $n = 5 \text{ min}^{-1}$ .

For dimensioning of the drive, the starting frictional torque and the frictional torque at high speeds of 2 to  $3 \times M_{RL}$  must be taken into consideration.

## Frictional torque and bearing preload

For applications in which the frictional torque is decisive (e.g. temperature development, frictional torque compensation between different bearing positions, etc.), it is recommended that the bearing preload should be set in accordance with the bearing frictional torque  $M_{RL}$ .

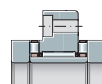
## Frictional energy

The frictional energy  $N_R$  of the bearings can be calculated as follows:

$$N_R = \frac{M_{RL} \cdot n}{9,55}$$

$N_R$  Frictional energy  
 $M_{RL}$  Bearing frictional torque  
 $n$  Operating speed.

In any analysis of the thermal balance, the various operating speeds  $n_i$  must be taken into consideration with their time durations  $q_i$ .



# Needle roller/ axial cylindrical roller bearings

## Lubrication

Needle roller/axial cylindrical roller bearings can be relubricated via the outer ring. They are supplied with oil-based or dry preservative and should preferably be lubricated with oil.

Good results have been obtained with oils CLP to DIN 51 517 and HLP to DIN 51 524 in classes ISO VG 32 to ISO VG 100.

## Relubrication for grease lubrication

Relubrication should be carried out with the bearing rotating and still warm from operation in order to achieve good replacement and distribution of grease.

The relubrication interval and quantity can only be determined under operating conditions since it is not possible to calculate all the influences in advance. Relubrication: see INA Fitting and Maintenance Manual, TPI 100.

Where a vertical axis of rotation is used in conjunction with automatic lubrication systems, the lubrication impulse should be selected such that the supply to the upper axial bearing is sufficient.

## Lubricant feed

Examples of lubricant feeds for ZARF(L) are shown in *Figure 7*, *Figure 8*.

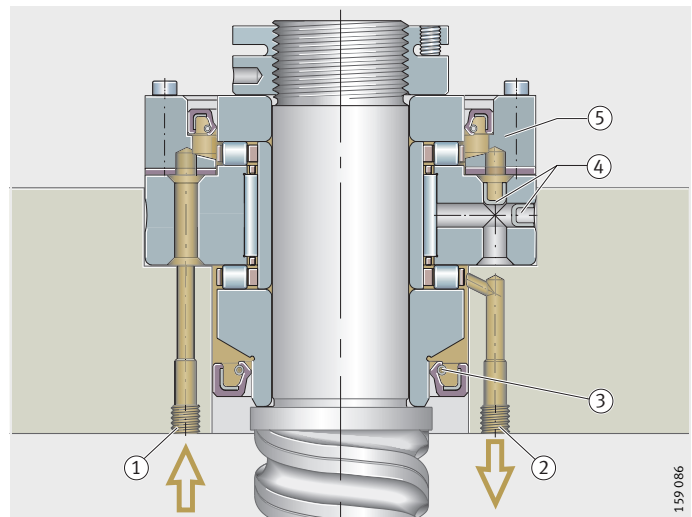
### Caution!

Before initial operation, it must be ensured that all raceways are adequately supplied with lubricant.

- ① Oil inlet
- ② Oil outlet
- ③ Rotary shaft seal
- ④ Cover
- ⑤ Seal carrier assembly

### ZARF..-L

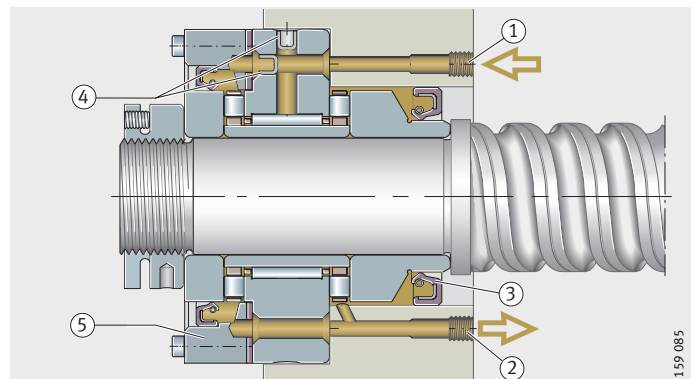
*Figure 7*  
Lubricant feed for vertical mounting position



- ① Oil inlet
- ② Oil outlet
- ③ Rotary shaft seal
- ④ Cover
- ⑤ Seal carrier assembly

### ZARF..-L

*Figure 8*  
Lubricant feed for horizontal mounting position



## Mounting guidelines

**Caution!** Bearings should only be fitted and dismantled in accordance with INA Fitting and Maintenance Manual TPI 100. This TPI is available upon request.

During fitting of bearings, mounting forces should be applied only to the bearing ring to be fitted. Fitting forces must never be directed through the rolling elements!

The characteristics of the bearings are only valid when used in combination with INA precision locknuts and the associated tightening torques given in the dimension tables.

ZARN and ZARF are not self-retaining. The individual bearing components are matched to each other. The individual parts of different bearings must not be interchanged during fitting.

## Setting the axial preload

**Caution!** The preload in the axial component of ZARF (L) bearings is decisive for the function. It must therefore be set with sufficient accuracy.

Since direct force measurement of these values in fitting is not cost-effective, the axial preload is set indirectly using the following methods:

- either by means of the tightening torque  $M_A$  of the precision locknut. The frictional torque may deviate from the value given in the dimension table
- or by means of the bearing frictional torque  $M_{RL}$ .

## Preloading by locknut

Needle roller/axial cylindrical roller bearings must be axially preloaded during fitting by means of a precision locknut.

When preloading the bearing unit by means of the bearing inner rings using the recommended precision locknut, the tightening torques given in the dimension tables must be observed or the preload must be set using the bearing frictional torque given in the dimension tables. The tightening torques given for the individual bearing sizes are only valid for the INA precision locknuts listed.

In order to counteract settling, it is recommended that the locknut should initially be tightened to twice the tightening torque  $M_A$  and then relieved of load again. It should only then be tightened again to the stated tightening torque  $M_A$ . Finally, the precision locknut should be secured against rotation by the torque-controlled tightening of the set screws.



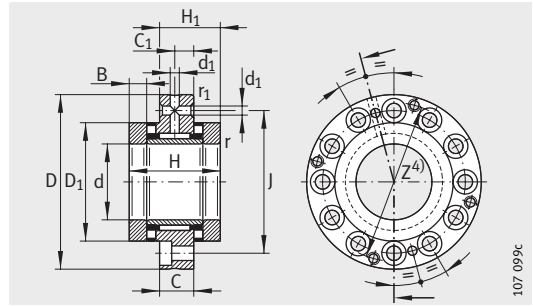
## Fixing screws

The fixing screws for the outer ring must be tightened in a crosswise sequence. They may be loaded up to 70% of their elastic limit.

If the bearing outer ring is supported by an additional housing cover, it must be ensured that the fixing screws are sufficiently well dimensioned.

# Needle roller/ axial cylindrical roller bearings

Light series  
For screw mounting

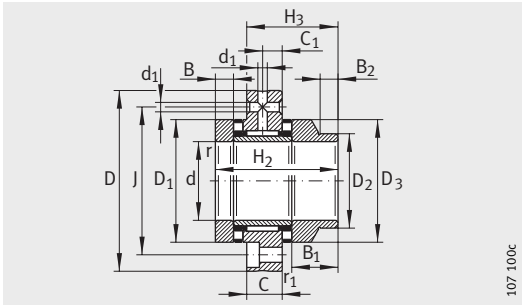


ZARF

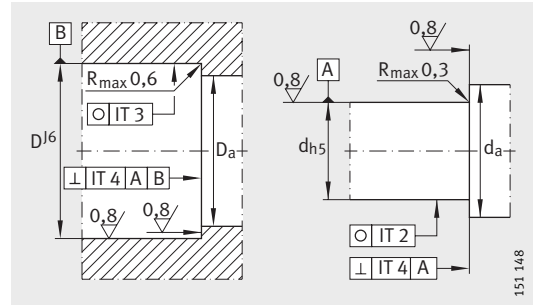
**Dimension table** - Dimensions in mm

Designation	Mass  ≈ kg	Dimensions																	
		d	D	H	H <sub>1</sub>	H <sub>2</sub>	H <sub>3</sub>	C	C <sub>1</sub>	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	B	B <sub>1</sub>	B <sub>2</sub>	r	r <sub>1</sub>	d <sub>1</sub>	J
ZARF1560-TN	0,42	15	60	40	26	-	-	14	8	35	-	-	7,5	-	-	0,3	0,6	3,2	46
ZARF1560-L-TN	0,45	15	60	-	-	53	39	14	8	35	24	34	7,5	20,5	11	0,3	0,6	3,2	46
ZARF1762-TN	0,49	17	62	43	27,5	-	-	14	8	38	-	-	9	-	-	0,3	0,6	3,2	48
ZARF1762-L-TN	0,52	17	62	-	-	57	41,5	14	8	38	28	38	9	23	11	0,3	0,6	3,2	48
ZARF2068-TN	0,56	20	68	46	29	-	-	14	8	42	-	-	10	-	-	0,3	0,6	3,2	53
ZARF2068-L-TN	0,61	20	68	-	-	60	43	14	8	42	30	40	10	24	11	0,3	0,6	3,2	53
ZARF2575-TN	0,78	25	75	50	33	-	-	18	10	47	-	-	10	-	-	0,3	0,6	3,2	58
ZARF2575-L-TN	0,84	25	75	-	-	65	48	18	10	47	36	45	10	25	11	0,3	0,6	3,2	58
ZARF3080-TN	0,85	30	80	50	33	-	-	18	10	52	-	-	10	-	-	0,3	0,6	3,2	63
ZARF3080-L-TN	0,9	30	80	-	-	65	48	18	10	52	40	50	10	25	11	0,3	0,6	3,2	63

- 1) If rotary shaft seals are used, the outside diameter of the sealing ring must be taken into consideration.
- 2) Tightening torque of fixing screws according to manufacturer's data.  
Screws not included with delivery.
- 3) Mass moment of inertia for rotating inner ring.
- 4) Mounting dimension for seal carrier assembly DRS.  
For seal carrier assemblies, see page 87 and page 91.
- 5) Only valid in conjunction with INA precision locknuts.



ZARF..-L



Design of adjacent construction

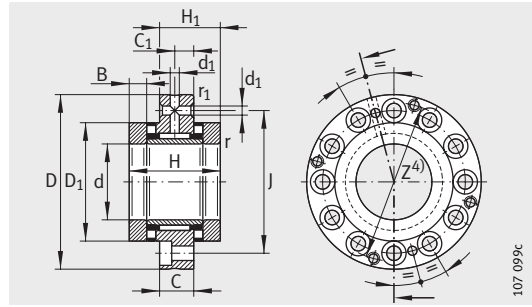
Mounting dimensions <sup>1)</sup>		Fixing screws <sup>2)</sup> DIN 912-10.9		Basic load ratings				Limiting speeds		Bearing frictional torque	Rigidity axial	Tilting rigidity	Mass moment of inertia <sup>3)</sup>	Run-out
D <sub>a</sub> max.	d <sub>a</sub> min.	Size	Quantity	axial		radial		n <sub>G</sub> oil min <sup>-1</sup>	n <sub>G</sub> grease min <sup>-1</sup>	M <sub>RL</sub> Nm	C <sub>aL</sub> N/μm	C <sub>kL</sub> Nm/mrad	M <sub>m</sub> kg·cm <sup>2</sup>	μm
				dyn. C <sub>a</sub> kN	stat. C <sub>0a</sub> kN	dyn. C <sub>r</sub> kN	stat. C <sub>0r</sub> kN							
36	28	M6	6	24,9	53	13	17,5	8 500	2 200	0,35	1 400	110	0,24	1
36	22	M6	6	24,9	53	13	17,5	8 500	2 200	0,35	1 400	110	0,274	1
39	28	M6	6	26	57	14	19,9	7 800	2 100	0,4	1 600	160	0,373	1
39	26	M6	6	26	57	14	19,9	7 800	2 100	0,4	1 600	160	0,464	1
43	33	M6	8	33,5	76	14,9	22,4	7 000	2 000	0,5	1 800	230	0,615	1
43	28	M6	8	33,5	76	14,9	22,4	7 000	2 000	0,5	1 800	230	0,683	1
48	39	M6	8	35,5	86	22,6	36	6 000	1 900	0,55	1 900	350	0,989	1
48	34	M6	8	35,5	86	22,6	36	6 000	1 900	0,55	1 900	350	1,15	1
53	44	M6	12	39	101	24,3	41,5	5 500	1 800	0,65	2 200	520	1,46	1
53	38	M6	12	39	101	24,3	41,5	5 500	1 800	0,65	2 200	520	1,7	1



Designation	Recommended INA locknut; to be ordered separately			Rotary shaft seal to DIN 3 760; to be ordered separately	
	Designation	Tightening torque <sup>5)</sup> M <sub>A</sub> Nm	Axial preload force N		
ZARF1560-TN	ZMA15/33	AM15	10	6 506	–
ZARF1560-L-TN	ZMA15/33	AM15	10	6 506	24X35X7
ZARF1762-TN	ZM17	AM17	12	7 078	–
ZARF1762-L-TN	ZM17	AM17	12	7 078	28X40X7
ZARF2068-TN	ZMA20/38	AM20	18	9 376	–
ZARF2068-L-TN	ZMA20/38	AM20	18	9 376	30X42X7
ZARF2575-TN	ZMA25/45	AM25	25	10 470	–
ZARF2575-L-TN	ZMA25/45	AM25	25	10 470	36X47X7
ZARF3080-TN	ZMA30/52	AM30	32	11 091	–
ZARF3080-L-TN	ZMA30/52	AM30	32	11 091	40X52X7

# Needle roller/ axial cylindrical roller bearings

Light series  
For screw mounting

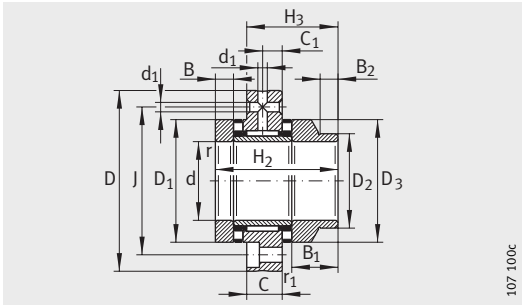


ZARF

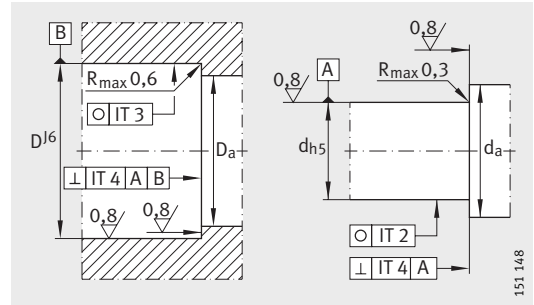
Dimension table (continued) · Dimensions in mm

Designation	Mass ≈kg	Dimensions																	
		d	D	H	H <sub>1</sub>	H <sub>2</sub>	H <sub>3</sub>	C	C <sub>1</sub>	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	B	B <sub>1</sub>	B <sub>2</sub>	r	r <sub>1</sub>	d <sub>1</sub>	J
ZARF3590-TN	1,12	35	90	54	35	-	-	18	10	60	-	-	11	-	-	0,3	0,6	3,2	73
ZARF3590-L-TN	1,25	35	90	-	-	70	51	18	10	60	45	58	11	27	12	0,3	0,6	3,2	73
ZARF40100-TN	1,35	40	100	54	35	-	-	18	10	65	-	-	11	-	-	0,3	0,6	3,2	80
ZARF40100-L-TN	1,45	40	100	-	-	70	51	18	10	65	50	63	11	27	12	0,3	0,6	3,2	80
ZARF45105-TN	1,7	45	105	60	40	-	-	22,5	12,5	70	-	-	11,5	-	-	0,3	0,6	6	85
ZARF45105-L-TN	1,85	45	105	-	-	75	55	22,5	12,5	70	56	68	11,5	26,5	12	0,3	0,6	6	85
ZARF50115-TN	2,1	50	115	60	40	-	-	22,5	12,5	78	-	-	11,5	-	-	0,3	0,6	6	94
ZARF50115-L-TN	2,45	50	115	-	-	78	58	22,5	12,5	78	60	78	11,5	29,5	12	0,3	0,6	6	94

- 1) If rotary shaft seals are used, the outside diameter of the sealing ring must be taken into consideration.
- 2) Tightening torque of fixing screws according to manufacturer's data.  
Screws not included with delivery.
- 3) Mass moment of inertia for rotating inner ring.
- 4) Mounting dimension for seal carrier assembly DRS.  
For seal carrier assemblies, see page 87 and page 91.
- 5) Only valid in conjunction with INA precision locknuts.



ZARF.-L



Design of adjacent construction

Mounting dimensions <sup>1)</sup>		Fixing screws <sup>2)</sup> DIN 912-10.9		Basic load ratings				Limiting speeds		Bearing frictional torque	Rigidity axial	Tilting rigidity	Mass moment of inertia <sup>3)</sup>	Run-out
D <sub>a</sub>	d <sub>a</sub>	Size	Quantity	dyn. C <sub>a</sub>	stat. C <sub>0a</sub>	dyn. C <sub>r</sub>	stat. C <sub>0r</sub>	n <sub>G</sub> oil	n <sub>G</sub> grease	M <sub>RL</sub>	c <sub>aL</sub>	c <sub>kL</sub>	M <sub>m</sub>	
max.	min.			kN	kN	kN	kN	min <sup>-1</sup>	min <sup>-1</sup>	Nm	N/μm	Nm/mrad	kg·cm <sup>2</sup>	μm
61	50	M6	12	56	148	26	47	4 800	1 700	0,9	2 600	740	2,8	1
61	43	M6	12	56	148	26	47	4 800	1 700	0,9	2 600	740	3,21	1
66	55	M8	8	59	163	27,5	53	4 400	1 600	1	2 800	1 030	3,78	1
66	48	M8	8	59	163	27,5	53	4 400	1 600	1	2 800	1 030	4,35	1
71	60	M8	8	61	177	38	74	4 000	1 500	1,2	3 000	1 340	5,33	1
71	54	M8	8	61	177	38	74	4 000	1 500	1,2	3 000	1 340	6,03	1
79	67	M8	12	90	300	40	82	3 600	1 200	2,2	4 800	2 470	8,42	1
79	58	M8	12	90	300	40	82	3 600	1 200	2,2	4 800	2 470	10,46	1

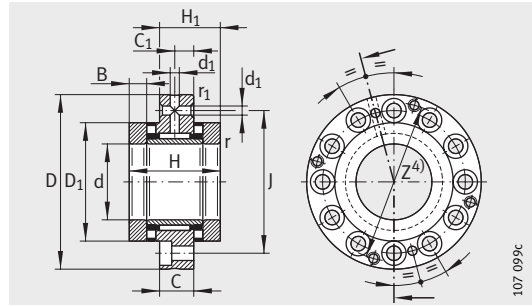


Designation	Recommended INA locknut; to be ordered separately			Rotary shaft seal to DIN 3 760; to be ordered separately	
	Designation	Tightening torque <sup>5)</sup> M <sub>A</sub> Nm	Axial preload force N		
ZARF3590-TN	ZMA35/58	AM35/58	42	12 486	–
ZARF3590-L-TN	ZMA35/58	AM35/58	42	12 486	45X60X8
ZARF40100-TN	ZMA40/62	AM40	55	14 240	–
ZARF40100-L-TN	ZMA40/62	AM40	55	14 240	50X65X8
ZARF45105-TN	ZMA45/68	AM45	65	15 765	–
ZARF45105-L-TN	ZMA45/68	AM45	65	15 765	56X70X8
ZARF50115-TN	ZMA50/75	AM50	85	18 410	–
ZARF50115-L-TN	ZMA50/75	AM50	85	18 410	60X80X8



# Needle roller/ axial cylindrical roller bearings

Heavy series  
For screw mounting

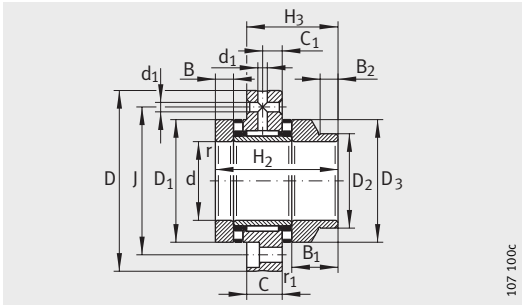


ZARF

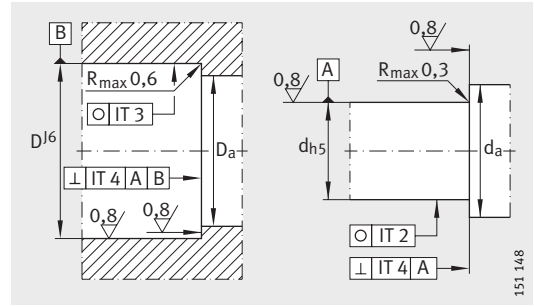
**Dimension table** · Dimensions in mm

Designation	Mass ≈kg	Dimensions															
		d	D	H	H <sub>1</sub>	H <sub>2</sub>	H <sub>3</sub>	C	C <sub>1</sub>	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	B	B <sub>1</sub>	B <sub>2</sub>	r	r <sub>1</sub>
		min.															
ZARF2080-TN	1,1	<b>20</b>	80	60	38	-	-	18	10	52	-	-	12,5	-	-	0,3	0,6
ZARF2080-L-TN	1,22	<b>20</b>	80	-	-	75	53	18	10	52	40	50	12,5	27,5	11	0,3	0,6
ZARF2590-TN	1,6	<b>25</b>	90	60	38	-	-	18	10	62	-	-	12,5	-	-	0,3	0,6
ZARF2590-L-TN	1,75	<b>25</b>	90	-	-	75	53	18	10	62	48	60	12,5	27,5	11	0,3	0,6
ZARF30105-TN	1,95	<b>30</b>	105	66	41	-	-	18	10	68	-	-	14	-	-	0,3	0,6
ZARF30105-L-TN	2,15	<b>30</b>	105	-	-	82	57	18	10	68	52	66	14	30	12	0,3	0,6
ZARF35110-TN	1,6	<b>35</b>	110	66	41	-	-	18	10	73	-	-	14	-	-	0,3	0,6
ZARF35110-L-TN	1,85	<b>35</b>	110	-	-	82	57	18	10	73	60	73	14	30	12	0,3	0,6
ZARF40115-TN	2,7	<b>40</b>	115	75	47,5	-	-	22,5	12,5	78	-	-	16	-	-	0,3	0,6
ZARF40115-L-TN	3	<b>40</b>	115	-	-	93	65,5	22,5	12,5	78	60	78	16	34	12	0,3	0,6
ZARF45130-TN	3,9	<b>45</b>	130	82	51	-	-	22,5	12,5	90	-	-	17,5	-	-	0,3	0,6
ZARF45130-L-TN	4,3	<b>45</b>	130	-	-	103	72	22,5	12,5	90	70	88	17,5	38,5	14	0,3	0,6

- 1) If rotary shaft seals are used, the outside diameter of the sealing ring must be taken into consideration.
- 2) Tightening torque of fixing screws according to manufacturer's data.  
Screws not included with delivery.
- 3) Mass moment of inertia for rotating inner ring.
- 4) Mounting dimension for seal carrier assembly DRS.  
For seal carrier assemblies, see page 87 and page 91.
- 5) Only valid in conjunction with INA precision locknuts.



ZARF.-L



Design of adjacent construction

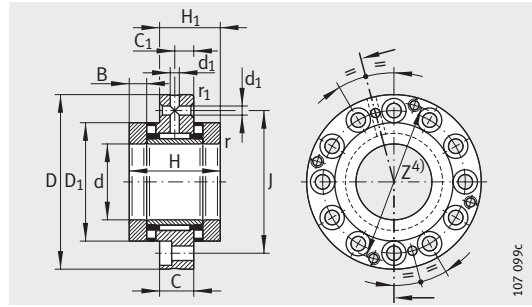
d <sub>1</sub>	J	Mounting dimensions <sup>1)</sup>		Fixing screws <sup>2)</sup> DIN 912-10.9		Basic load ratings				Limiting speeds		Bearing frictional torque M <sub>RL</sub>	Rigidity axial C <sub>aL</sub>	Tilting rigidity C <sub>kL</sub>	Mass moment of inertia <sup>3)</sup> M <sub>m</sub>	Run-out μm
		D <sub>a</sub> max.	d <sub>a</sub> min.	Size	Quantity	axial		radial		n <sub>G</sub> oil min <sup>-1</sup>	n <sub>G</sub> grease min <sup>-1</sup>					
						dyn. C <sub>a</sub>	stat. C <sub>0a</sub>	dyn. C <sub>r</sub>	stat. C <sub>0r</sub>							
3,2	63	53	38	M6	12	64	141	22,6	36	6 000	1 500	1,3	2 300	400	1,98	1
3,2	63	53	38	M6	12	64	141	22,6	36	6 000	1 500	1,3	2 300	400	2,27	1
3,2	73	63	45	M6	12	80	199	24,3	41,5	4 900	1 400	1,6	3 000	800	3,88	1
3,2	73	63	45	M6	12	80	199	24,3	41,5	4 900	1 400	1,6	3 000	800	4,51	1
3,2	85	69	52	M8	12	107	265	26	47	4 400	1 300	2,1	3 300	1 100	6,53	1
3,2	85	69	50	M8	12	107	265	26	47	4 400	1 300	2,1	3 300	1 100	7,43	1
3,2	88	74	60	M8	12	105	265	27,5	53	4 000	1 250	2,3	2 500	1 300	8,47	1
3,2	88	74	58	M8	12	105	265	27,5	53	4 000	1 250	2,3	3 500	1 300	10,4	1
6	94	79	65	M8	12	117	315	38	74	3 700	1 200	2,5	3 800	1 800	13,3	1
6	94	79	58	M8	12	117	315	38	74	3 700	1 200	2,5	3 800	1 800	15,5	1
6	105	91	70	M8	12	154	405	40	82	3 300	1 150	3,5	4 000	2 100	23,7	1
6	105	91	68	M8	12	154	405	40	82	3 300	1 150	3,5	4 000	2 100	28,1	1



Designation	Recommended INA locknut; to be ordered separately			Rotary shaft seal to DIN 3 760; to be ordered separately
	Designation	Tightening torque <sup>3)</sup> M <sub>A</sub> Nm	Axial preload force N	
ZARF2080-TN	ZMA20/52 AM20	38	18 448	—
ZARF2080-L-TN	ZMA20/52 AM20	38	18 448	40X52X7
ZARF2590-TN	ZMA25/58 AM25	55	20 790	—
ZARF2590-L-TN	ZMA25/58 AM25	55	20 790	48X62X8
ZARF30105-TN	ZMA30/65 AM30	75	24 287	—
ZARF30105-L-TN	ZMA30/65 AM30	75	24 287	52X68X8
ZARF35110-TN	ZMA35/70 AM35	100	27 480	—
ZARF35110-L-TN	ZMA35/70 AM35	100	27 480	60X75X8
ZARF40115-TN	ZMA40/75 AM40	120	29 834	—
ZARF40115-L-TN	ZMA40/75 AM40	120	29 834	60X80X8
ZARF45130-TN	ZMA45/85 AM45	150	33 549	—
ZARF45130-L-TN	ZMA45/85 AM45	150	33 549	70X90X10

# Needle roller/ axial cylindrical roller bearings

Heavy series  
For screw mounting

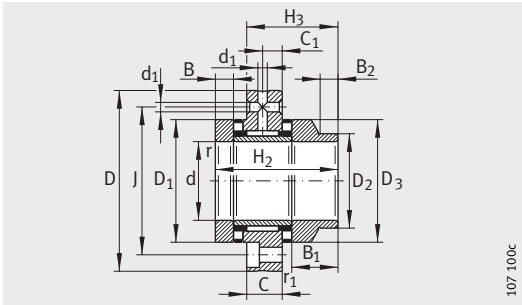


ZARF

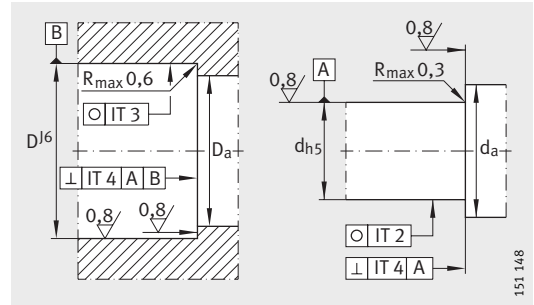
Dimension table (continued) · Dimensions in mm

Designation	Mass ≈kg	Dimensions																	
		d	D	H	H <sub>1</sub>	H <sub>2</sub>	H <sub>3</sub>	C	C <sub>1</sub>	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	B	B <sub>1</sub>	B <sub>2</sub>	r	r <sub>1</sub>	d <sub>1</sub>	J
																	min.	min.	
ZARF50140-TN	4,2	<b>50</b>	140	82	51	–	–	22,5	12,5	95	–	–	17,5	–	–	0,3	0,6	6	113
ZARF50140-L-TN	4,65	<b>50</b>	140	–	–	103	72	22,5	12,5	95	75	93	17,5	38,5	14	0,3	0,6	6	113
ZARF55145-TN	4,5	<b>55</b>	145	82	51	–	–	22,5	12,5	100	–	–	17,5	–	–	0,3	0,6	6	118
ZARF55145-L-TN	5	<b>55</b>	145	–	–	103	72	22,5	12,5	100	80	98	17,5	38,5	14	0,3	0,6	6	118
ZARF60150-TN	4,7	<b>60</b>	150	82	51	–	–	22,5	12,5	105	–	–	17,5	–	–	0,3	0,6	6	123
ZARF60150-L-TN	5,35	<b>60</b>	150	–	–	103	72	22,5	12,5	105	90	105	17,5	38,5	16	0,3	0,6	6	123
ZARF65155-TN	5,1	<b>65</b>	155	82	51	–	–	22,5	12,5	110	–	–	17,5	–	–	0,3	0,6	6	128
ZARF65155-L-TN	5,7	<b>65</b>	155	–	–	103	72	22,5	12,5	110	90	108	17,5	38,5	16	0,3	0,6	6	128
ZARF70160-TN	5,2	<b>70</b>	160	82	51	–	–	22,5	12,5	115	–	–	17,5	–	–	0,3	0,6	6	133
ZARF70160-L-TN	5,95	<b>70</b>	160	–	–	103	72	22,5	12,5	115	100	115	17,5	38,5	16	0,3	0,6	6	133
ZARF75185-TN	9,4	<b>75</b>	185	100	62	–	–	27	15	135	–	–	21	–	–	0,3	1	6	155
ZARF75185-L-TN	10,6	<b>75</b>	185	–	–	125	87	27	15	135	115	135	21	46	16	0,3	1	6	155
ZARF90210-TN	13,7	<b>90</b>	210	110	69,5	–	–	32	17,5	160	–	–	22,5	–	–	0,3	1	8	180
ZARF90210-L-TN	15,1	<b>90</b>	210	–	–	135	94,5	32	17,5	160	130	158	22,5	47,5	16	0,3	1	8	180

- 1) If rotary shaft seals are used, the outside diameter of the sealing ring must be taken into consideration.
- 2) Tightening torque of fixing screws according to manufacturer's data.  
Screws not included with delivery.
- 3) Mass moment of inertia for rotating inner ring.
- 4) Mounting dimension for seal carrier assembly DRS.  
For seal carrier assemblies, see page 87 and page 91.
- 5) Only valid in conjunction with INA precision locknuts.



ZARF.-L



Design of adjacent construction

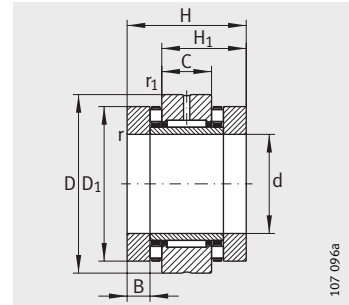
Mounting dimensions <sup>1)</sup>		Fixing screws <sup>2)</sup> DIN 912-10.9		Basic load ratings				Limiting speeds		Bearing frictional torque $M_{RL}$	Rigidity axial $c_{aL}$	Tilting rigidity $c_{kL}$	Mass moment of inertia <sup>3)</sup> $M_m$	Run-out
				axial		radial		$n_G$ oil	$n_G$ grease					
$D_a$	$d_a$	Size	Quantity	dyn. $C_a$	stat. $C_{0a}$	dyn. $C_r$	stat. $C_{0r}$	$n_G$ oil	$n_G$ grease	Nm	N/ $\mu$ m	Nm/mrad	kg · cm <sup>2</sup>	$\mu$ m
max.	min.			kN	kN	kN	kN	min <sup>-1</sup>	min <sup>-1</sup>					
96	75	M10	12	172	480	42	90	3 100	1 100	3,8	4 600	2 900	29,8	1
96	73	M10	12	172	480	42	90	3 100	1 100	3,8	4 600	2 900	35,3	1
101	85	M10	12	177	500	44	98	2 900	1 000	4	4 900	3 600	36,1	1
101	78	M10	12	177	500	44	98	2 900	1 000	4	4 900	3 600	43	1
106	90	M10	12	187	550	44,5	92	2 700	950	4,2	5 300	4 300	43,8	1
106	88	M10	12	187	550	44,5	92	2 700	950	4,2	5 300	4 300	54,5	1
111	97	M10	12	172	500	54	104	2 600	900	4	4 800	4 000	51	1
111	88	M10	12	172	500	54	104	2 600	900	4	4 800	4 000	60,1	1
100	116	M10	12	201	630	56	119	2 400	800	4,8	5 800	6 000	62,2	1
116	98	M10	12	201	630	56	119	2 400	800	4,8	5 800	6 000	77,3	1
136	113	M12	12	290	890	72	132	2 100	700	8	6 600	8 500	149	2
136	110	M12	12	290	890	72	132	2 100	700	8	6 600	8 500	188	2
161	130	M12	16	325	1 030	98	210	1 800	700	10,5	7 700	14 500	312	2
161	125	M12	16	325	1 030	98	210	1 800	700	10,5	7 700	14 500	372	2

Designation	Recommended INA locknut; to be ordered separately			Rotary shaft seal to DIN 3 760; to be ordered separately	
	Designation	Tightening torque <sup>5)</sup> $M_A$ Nm	Axial preload force N		
ZARF50140-TN	ZMA50/92	AM50	180	37 109	–
ZARF50140-L-TN	ZMA50/92	AM50	180	37 109	75X95X10
ZARF55145-TN	ZMA55/98	AM55	220	40 772	–
ZARF55145-L-TN	ZMA55/98	AM55	220	40 772	80X100X10
ZARF60150-TN	ZMA60/98	AM60	250	42 190	–
ZARF60150-L-TN	ZMA60/98	AM60	250	42 190	90X110X12
ZARF65155-TN	ZMA65/105	AM65	270	41 778	–
ZARF65155-L-TN	ZMA65/105	AM65	270	41 778	90X110X12
ZARF70160-TN	ZMA70/110	AM70	330	47 692	–
ZARF70160-L-TN	ZMA70/110	AM70	330	47 692	100X120X12
ZARF75185-TN	ZMA75/125	AM75	580	76 339	–
ZARF75185-L-TN	ZMA75/125	AM75	580	76 339	115X140X12
ZARF90210-TN	ZMA90/155	AM90	960	102 468	–
ZARF90210-L-TN	ZMA90/155	AM90	960	102 468	130X160X12



# Needle roller/ axial cylindrical roller bearings

Light series



ZARN

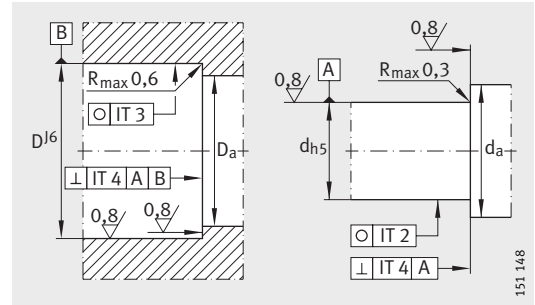
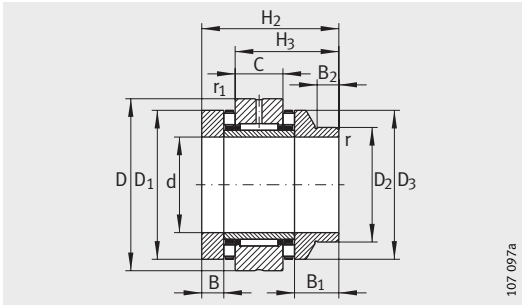
**Dimension table** · Dimensions in mm

Designation	Mass ≈ kg	Dimensions														
		d	D	H	H <sub>1</sub>	H <sub>2</sub>	H <sub>3</sub>	C	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	B	B <sub>1</sub>	B <sub>2</sub>	r	r <sub>1</sub>
															min.	min.
ZARN1545-TN	0,34	15	45	40	28	–	–	16	35	–	–	7,5	–	–	0,3	0,6
ZARN1545-L-TN	0,37	15	45	–	–	53	41	16	35	24	34	7,5	20,5	11	0,3	0,6
ZARN1747-TN	0,37	17	47	43	29,5	–	–	16	38	–	–	9	–	–	0,3	0,6
ZARN1747-L-TN	0,41	17	47	–	–	57	43,5	16	38	28	38	9	23	11	0,3	0,6
ZARN2052-TN	0,41	20	52	46	31	–	–	16	42	–	–	10	–	–	0,3	0,6
ZARN2052-L-TN	0,46	20	52	–	–	60	45	16	42	30	40	10	24	11	0,3	0,6
ZARN2557-TN	0,53	25	57	50	35	–	–	20	47	–	–	10	–	–	0,3	0,6
ZARN2557-L-TN	0,59	25	57	–	–	65	50	20	47	36	45	10	25	11	0,3	0,6
ZARN3062-TN	0,6	30	62	50	35	–	–	20	52	–	–	10	–	–	0,3	0,6
ZARN3062-L-TN	0,75	30	62	–	–	65	50	20	52	40	50	10	25	11	0,3	0,6

<sup>1)</sup> If rotary shaft seals are used, the outside diameter of the sealing ring must be taken into consideration.

<sup>2)</sup> Mass moment of inertia for rotating inner ring.

<sup>3)</sup> Only valid in conjunction with INA precision locknuts.



ZARN..L

Design of adjacent construction

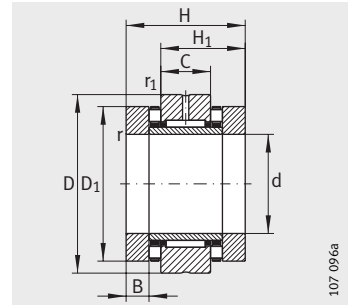
Mounting dimensions <sup>1)</sup>		Basic load ratings				Limiting speeds		Bearing frictional torque $M_{RL}$	Rigidity axial $c_{aL}$	Tilting rigidity $c_{kL}$	Mass moment of inertia <sup>2)</sup> $M_m$	Run-out
		axial		radial		$n_G$ oil	$n_G$ grease					
$D_a$	$d_a$	dyn. $C_a$	stat. $C_{0a}$	dyn. $C_r$	stat. $C_{0r}$	$min^{-1}$	$min^{-1}$	Nm	N/ $\mu m$	Nm/mrad	kg · cm <sup>2</sup>	$\mu m$
max.	min.	kN	kN	kN	kN							
36	28	24,9	53	13	17,5	8 500	2 200	0,35	1 400	110	0,24	1
36	22	24,9	53	13	17,5	8 500	2 200	0,35	1 400	110	0,274	1
39	28	26	57	14	19,9	7 800	2 100	0,4	1 600	160	0,373	1
39	26	26	57	14	19,9	7 800	2 100	0,4	1 600	160	0,464	1
43	33	33,5	76	14,9	22,4	7 000	2 000	0,5	1 800	230	0,615	1
43	28	33,5	76	14,9	22,4	7 000	2 000	0,5	1 800	230	0,683	1
48	39	35,5	86	22,6	36	6 000	1 900	0,55	1 900	350	0,989	1
48	34	35,5	86	22,9	36	6 000	1 900	0,55	1 900	350	1,15	1
53	44	39	101	24,3	41,5	5 500	1 800	0,65	2 200	520	1,46	1
53	38	39	101	24,3	41,5	5 500	1 800	0,65	2 200	520	1,7	1



Designation	Recommended INA locknut; to be ordered separately			Rotary shaft seal to DIN 3 760; to be ordered separately	
	Designation	Tightening torque <sup>3)</sup> $M_A$ Nm	Axial preload force N		
ZARN1545-TN	ZMA15/33	AM15	10	6 506	–
ZARN1545-L-TN	ZMA15/33	AM15	10	6 506	24X35X7
ZARN1747-TN	ZM17	AM17	12	7 078	–
ZARN1747-L-TN	ZM17	AM17	12	7 078	28X40X7
ZARN2052-TN	ZMA20/38	AM20	18	9 376	–
ZARN2052-L-TN	ZMA20/38	AM20	18	9 376	30X42X7
ZARN2557-TN	ZMA25/45	AM25	25	10 470	–
ZARN2557-L-TN	ZMA25/45	AM25	25	10 470	36X47X7
ZARN3062-TN	ZMA30/52	AM30	32	11 091	–
ZARN3062-L-TN	ZMA30/52	AM30	32	11 091	40X52X7

# Needle roller/ axial cylindrical roller bearings

Light series



ZARN

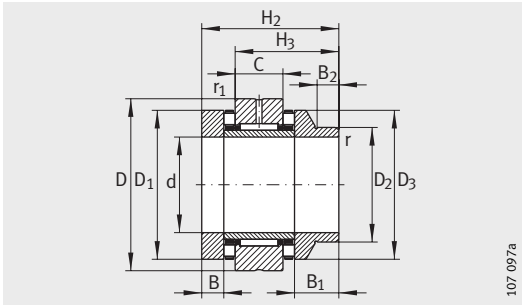
Dimension table (continued) · Dimensions in mm

Designation	Mass ≈ kg	Dimensions														
		d	D	H	H <sub>1</sub>	H <sub>2</sub>	H <sub>3</sub>	C	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	B	B <sub>1</sub>	B <sub>2</sub>	r	r <sub>1</sub>
															min.	min.
ZARN3570-TN	0,8	35	70	54	37	–	–	20	60	–	–	11	–	–	0,3	0,6
ZARN3570-L-TN	0,93	35	70	–	–	70	53	20	60	45	58	11	27	12	0,3	0,6
ZARN4075-TN	0,9	40	75	54	37	–	–	20	65	–	–	11	–	–	0,3	0,6
ZARN4075-L-TN	1	40	75	–	–	70	53	20	65	50	63	11	27	12	0,3	0,6
ZARN4580-TN	1,12	45	80	60	42,5	–	–	25	70	–	–	11,5	–	–	0,3	0,6
ZARN4580-L-TN	1,27	45	80	–	–	75	57,5	25	70	56	68	11,5	26,5	12	0,3	0,6
ZARN5090-TN	1,43	50	90	60	42,5	–	–	25	78	–	–	11,5	–	–	0,3	0,6
ZARN5090-L-TN	1,78	50	90	–	–	78	60,5	25	78	60	78	11,5	29,5	12	0,3	0,6

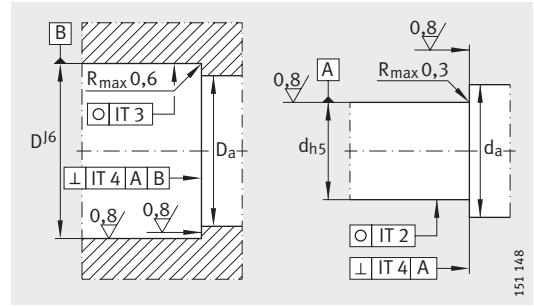
<sup>1)</sup> If rotary shaft seals are used, the outside diameter of the sealing ring must be taken into consideration.

<sup>2)</sup> Mass moment of inertia for rotating inner ring.

<sup>3)</sup> Only valid in conjunction with INA precision locknuts.



ZARN..L



Design of adjacent construction

Mounting dimensions <sup>1)</sup>		Basic load ratings				Limiting speeds		Bearing frictional torque $M_{RL}$	Rigidity axial $c_{aL}$	Tilting rigidity $c_{kL}$	Mass moment of inertia <sup>2)</sup> $M_m$	Run-out
		axial		radial		$n_G$ oil	$n_G$ grease					
$D_a$	$d_a$	dyn. $C_a$	stat. $C_{0a}$	dyn. $C_r$	stat. $C_{0r}$	$min^{-1}$	$min^{-1}$	Nm	$N/\mu m$	Nm/mrad	$kg \cdot cm^2$	$\mu m$
max.	min.	kN	kN	kN	kN							
61	50	56	148	26	47	4 800	1 700	0,9	2 600	740	2,8	1
61	43	56	148	26	47	4 800	1 700	0,9	2 600	740	3,21	1
66	55	59	163	27,5	53	4 400	1 600	1	2 800	1 030	3,78	1
66	48	59	163	27,5	53	4 400	1 600	1	2 800	1 030	4,35	1
71	60	61	177	38	74	4 000	1 500	1,2	3 000	1 340	5,33	1
71	54	61	177	38	74	4 000	1 500	1,2	3 000	1 340	6,03	1
79	67	90	300	40	82	3 600	1 200	2,2	4 800	2 470	8,42	1
79	58	90	300	40	82	3 600	1 200	2,2	4 800	2 470	10,46	1

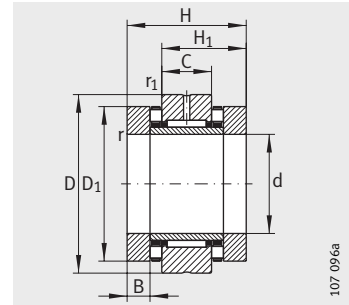


Designation	Recommended INA locknut; to be ordered separately			Rotary shaft seal to DIN 3 760; to be ordered separately	
	Designation	Tightening torque <sup>3)</sup> $M_A$ Nm	Axial preload force N		
ZARN3570-TN	ZMA35/58 AM35/58	42	12 486	-	
ZARN3570-L-TN	ZMA35/58 AM35/58	42	12 486	45X60X8	
ZARN4075-TN	ZMA40/62 AM40	55	14 240	-	
ZARN4075-L-TN	ZMA40/62 AM40	55	14 240	50X65X8	
ZARN4580-TN	ZMA45/68 AM45	65	15 765	-	
ZARN4580-L-TN	ZMA45/68 AM45	65	15 765	56X70X8	
ZARN5090-TN	ZMA50/75 AM50	85	18 410	-	
ZARN5090-L-TN	ZMA50/75 AM50	85	18 410	60X80X8	



# Needle roller/ axial cylindrical roller bearings

Heavy series



ZARN

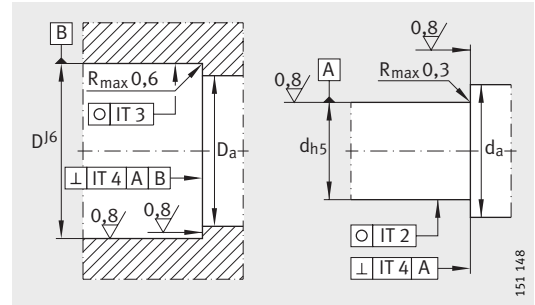
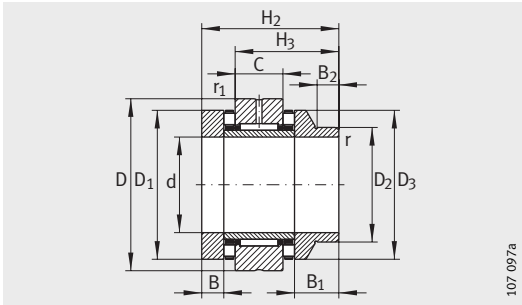
Dimension table · Dimensions in mm

Designation	Mass  ≈ kg	Dimensions															
		d	D	H	H <sub>1</sub>	H <sub>2</sub>	H <sub>3</sub>	C	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	B	B <sub>1</sub>	B <sub>2</sub>	r	r <sub>1</sub>	
																min.	min.
ZARN2062-TN	0,87	20	62	60	40	–	–	20	52	–	–	12,5	–	–	0,3	0,6	
ZARN2062-L-TN	0,99	20	62	–	–	75	55	20	52	40	50	12,5	27,5	11	0,3	0,6	
ZARN2572-TN	1,17	25	72	60	40	–	–	20	62	–	–	12,5	–	–	0,3	0,6	
ZARN2572-L-TN	1,32	25	72	–	–	75	55	20	62	48	60	12,5	27,5	11	0,3	0,6	
ZARN3080-TN	1,5	30	80	66	43	–	–	20	68	–	–	14	–	–	0,3	0,6	
ZARN3080-L-TN	1,7	30	80	–	–	82	59	20	68	52	66	14	30	12	0,3	0,6	
ZARN3585-TN	1,65	35	85	66	43	–	–	20	73	–	–	14	–	–	0,3	0,6	
ZARN3585-L-TN	1,8	35	85	–	–	82	59	20	73	60	73	14	30	12	0,3	0,6	
ZARN4090-TN	2,09	40	90	75	50	–	–	25	78	–	–	16	–	–	0,3	0,6	
ZARN4090-L-TN	2,39	40	90	–	–	93	68	25	78	60	78	16	34	12	0,3	0,6	
ZARN45105-TN	3,02	45	105	82	53,5	–	–	25	90	–	–	17,5	–	–	0,3	0,6	
ZARN45105-L-TN	3,42	45	105	–	–	103	74,5	25	90	70	88	17,5	38,5	14	0,3	0,6	
ZARN50110-TN	3,3	50	110	82	53,5	–	–	25	95	–	–	17,5	–	–	0,3	0,6	
ZARN50110-L-TN	3,75	50	110	–	–	103	74,5	25	95	75	93	17,5	38,5	14	0,3	0,6	

1) If rotary shaft seals are used, the outside diameter of the sealing ring must be taken into consideration.

2) Mass moment of inertia for rotating inner ring.

3) Only valid in conjunction with INA precision locknuts.



ZARN..L

Design of adjacent construction

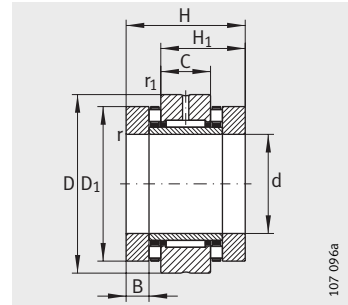
Mounting dimensions <sup>1)</sup>		Basic load ratings				Limiting speeds		Bearing frictional torque $M_{RL}$	Rigidity axial $c_{aL}$	Tilting rigidity $c_{kL}$	Mass moment of inertia <sup>2)</sup> $M_m$	Run-out
		axial		radial		$n_G$ oil	$n_G$ grease					
$D_a$	$d_a$	dyn. $C_a$	stat. $C_{0a}$	dyn. $C_r$	stat. $C_{0r}$	$min^{-1}$	$min^{-1}$	Nm	N/ $\mu m$	Nm/mrad	kg · cm <sup>2</sup>	$\mu m$
max.	min.	kN	kN	kN	kN							
53	38	64	141	22,6	36	6 000	1 500	1,3	2 300	400	1,98	1
53	38	64	141	26,6	36	6 000	1 500	1,3	2 300	400	2,27	1
63	45	80	199	24,3	41,5	4 900	1 400	1,6	3 000	800	3,88	1
63	45	80	199	24,3	41,5	4 900	1 400	1,6	3 000	800	4,51	1
69	52	107	265	26	47	4 400	1 300	2,1	3 300	1 100	6,53	1
69	50	107	265	26	47	4 400	1 300	2,1	3 300	1 100	7,43	1
74	60	105	265	27,5	53	4 000	1 250	2,3	3 500	1 300	8,47	1
74	58	105	265	27,5	53	4 000	1 250	2,3	3 500	1 300	10,4	1
79	65	117	315	38	74	3 700	1 200	2,5	3 800	1 800	13,3	1
79	58	117	315	38	74	3 700	1 200	2,5	3 800	1 800	15,5	1
91	70	154	405	40	82	3 300	1 150	3,5	4 000	2 100	23,7	1
91	68	154	405	40	82	3 300	1 150	3,5	4 000	2 100	28,1	1
96	75	172	480	42	90	3 100	1 100	3,8	4 600	2 900	29,8	1
96	73	172	480	42	90	3 100	1 100	3,8	4 600	2 900	35,3	1

Designation	Recommended INA locknut; to be ordered separately			Rotary shaft seal to DIN 3 760; to be ordered separately	
	Designation	Tightening torque $M_A$ Nm	Axial preload force N		
ZARN2062-TN	ZMA20/52 AM20	38	18 448		–
ZARN2062-L-TN	ZMA20/52 AM20	38	18 448		40X52X7
ZARN2572-TN	ZMA25/58 AM25	55	20 790		–
ZARN2572-L-TN	ZMA25/58 AM25	55	20 790		48X62X8
ZARN3080-TN	ZMA30/65 AM30	75	24 287		–
ZARN3080-L-TN	ZMA30/65 AM30	75	24 287		52X68X8
ZARN3585-TN	ZMA35/70 AM35	100	27 480		–
ZARN3585-L-TN	ZMA35/70 AM35	100	27 480		60X75X8
ZARN4090-TN	ZMA40/75 AM40	120	29 834		–
ZARN4090-L-TN	ZMA40/75 AM40	120	29 834		60X80X8
ZARN45105-TN	ZMA45/85 AM45	150	33 549		–
ZARN45105-L-TN	ZMA45/85 AM45	150	33 549		70X90X10
ZARN50110-TN	ZMA50/92 AM50	180	37 109		–
ZARN50110-L-TN	ZMA50/92 AM50	180	37 109		75X95X10



# Needle roller/ axial cylindrical roller bearings

Heavy series



ZARN

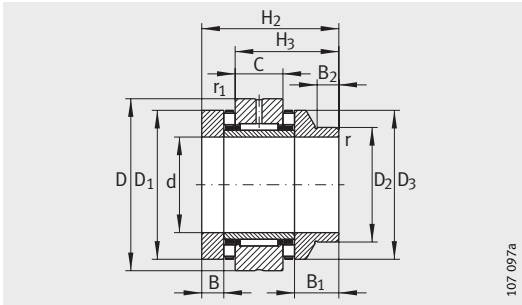
Dimension table (continued) · Dimensions in mm

Designation	Mass ≈kg	Dimensions														
		d	D	H	H <sub>1</sub>	H <sub>2</sub>	H <sub>3</sub>	C	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	B	B <sub>1</sub>	B <sub>2</sub>	r	r <sub>1</sub>
															min.	min.
ZARN55115-TN	3,5	55	115	82	53,5	–	–	25	100	–	–	17,5	–	–	0,3	0,6
ZARN55115-L-TN	4	55	115	–	–	103	74,5	25	100	80	98	17,5	38,5	14	0,3	0,6
ZARN60120-TN	3,7	60	120	82	53,5	–	–	25	105	–	–	17,5	–	–	0,3	0,6
ZARN60120-L-TN	4,85	60	120	–	–	103	74,5	25	105	90	105	17,5	38,5	16	0,3	0,6
ZARN65125-TN	4	65	125	82	53,5	–	–	25	110	–	–	17,5	–	–	0,3	0,6
ZARN65125-L-TN	4,6	65	125	–	–	103	74,5	25	110	90	108	17,5	38,5	16	0,3	0,6
ZARN70130-TN	4,1	70	130	82	53,5	–	–	25	115	–	–	17,5	–	–	0,3	0,6
ZARN70130-L-TN	4,85	70	130	–	–	103	74,5	25	115	100	115	17,5	38,5	16	0,3	0,6
ZARN75155-TN	7,9	75	155	100	65	–	–	30	135	–	–	21	–	–	0,3	1
ZARN75155-L-TN	9,1	75	155	–	–	125	90	30	135	115	135	21	46	16	0,3	1
ZARN90180-TN	11,8	90	180	110	72,5	–	–	35	160	–	–	22,5	–	–	0,3	1
ZARN90180-L-TN	13,2	90	180	–	–	135	97,5	35	160	130	158	22,5	47,5	16	0,3	1

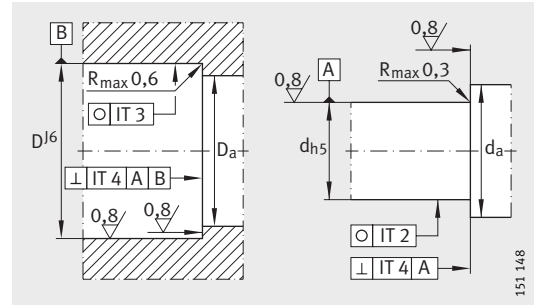
1) If rotary shaft seals are used, the outside diameter of the sealing ring must be taken into consideration.

2) Mass moment of inertia for rotating inner ring.

3) Only valid in conjunction with INA precision locknuts.



ZARN..-L



Design of adjacent construction

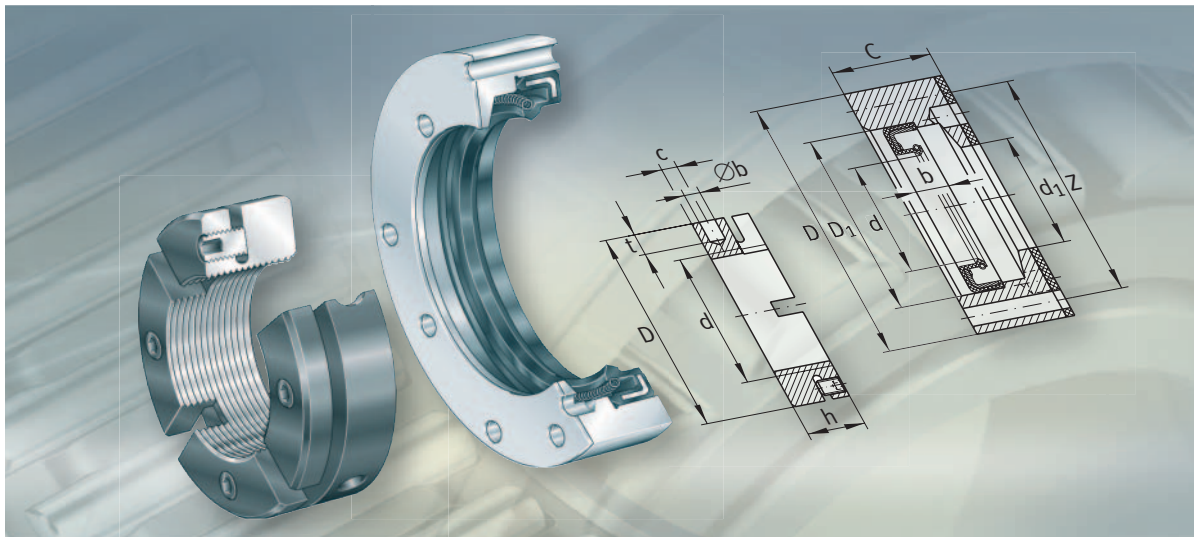
Mounting dimensions <sup>1)</sup>		Basic load ratings				Limiting speeds		Bearing frictional torque M <sub>RL</sub>	Rigidity axial C <sub>aL</sub>	Tilting rigidity C <sub>kL</sub>	Mass moment of inertia <sup>2)</sup> M <sub>m</sub>	Run-out
		axial		radial		n <sub>G</sub> oil	n <sub>G</sub> grease					
D <sub>a</sub>	d <sub>a</sub>	dyn. C <sub>a</sub>	stat. C <sub>0a</sub>	dyn. C <sub>r</sub>	stat. C <sub>0r</sub>	min <sup>-1</sup>	min <sup>-1</sup>	Nm	N/μm	Nm/mrad	kg · cm <sup>2</sup>	μm
max.	min.	kN	kN	kN	kN							
101	85	177	500	44	98	2 900	1 000	4	4 900	3 600	36,1	1
101	78	177	500	44	98	2 900	1 000	4	4 900	3 600	43	1
106	90	187	550	44,5	92	2 700	950	4,2	5 300	4 300	43,8	1
106	88	187	550	44,5	92	2 700	950	4,2	5 300	4 300	54,5	1
111	97	172	500	54	104	2 600	900	4	4 800	4 000	51	1
111	88	172	500	54	104	2 600	900	4	4 800	4 000	60,1	1
116	100	201	630	56	119	2 400	800	4,8	5 800	6 000	62,2	1
116	98	201	630	56	119	2 400	800	4,8	5 800	6 000	77,3	1
136	113	290	890	72	132	2 100	700	8	6 600	8 500	149	2
136	110	290	890	72	132	2 100	700	8	6 600	8 500	188	2
161	130	325	1 030	98	210	1 800	700	10,5	7 700	14 500	312	2
161	125	325	1 030	98	210	1 800	700	10,5	7 700	14 500	372	2



Designation	Recommended INA locknut; to be ordered separately			Rotary shaft seal to DIN 3 760; to be ordered separately	
	Designation	Tightening torque <sup>3)</sup> M <sub>A</sub> Nm	Axial preload force N		
ZARN55115-TN	ZMA55/98 AM55	220	40 772	-	
ZARN55115-L-TN	ZMA55/98 AM55	220	40 772	80X100X10	
ZARN60120-TN	ZMA60/98 AM60	250	42 190	-	
ZARN60120-L-TN	ZMA60/98 AM60	250	42 190	90X110X12	
ZARN65125-TN	ZMA65/105 AM65	270	41 778	-	
ZARN65125-L-TN	ZMA65/105 AM65	270	41 778	90X110X12	
ZARN70130-TN	ZMA70/110 AM70	330	47 692	-	
ZARN70130-L-TN	ZMA70/110 AM70	330	47 692	100X120X12	
ZARN75155-TN	ZMA75/125 AM75	580	76 339	-	
ZARN75155-L-TN	ZMA75/125 AM75	580	76 339	115X140X12	
ZARN90180-TN	ZMA90/155 AM90	960	102 246	-	
ZARN90180-L-TN	ZMA90/155 AM90	960	102 246	130X160X12	



**FAG**



## Seal carrier assemblies Precision locknuts

## Seal carrier assemblies Precision locknuts

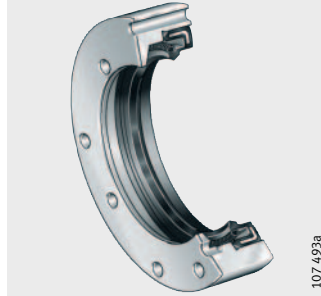
	Page
<b>Product overview</b>	Seal carrier assemblies, precision locknuts ..... 86
<b>Features</b>	Seal carrier assemblies ..... 87
	Operating temperature ..... 87
	Precision locknuts ..... 88
<b>Design and safety guidelines</b>	Breakaway torque ..... 89
	Ultimate axial load ..... 89
	Fitting and dismantling..... 89
<b>Accuracy</b>	..... 90
<b>Dimension tables</b>	Seal carrier assemblies DRS ..... 91
	Precision locknuts AM ..... 92
	Adapters AMS ..... 93
	Precision locknuts ZM, ZMA..... 94



# Product overview – Seal carrier assemblies, precision locknuts

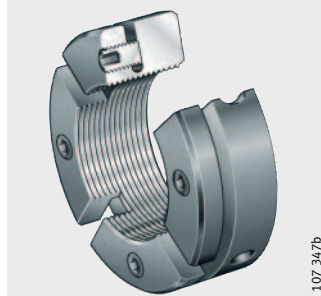
## Seal carrier assemblies

DRS



## Precision locknuts For axial locking

AM



## For radial locking

ZM, ZMA



# Seal carrier assemblies Precision locknuts

## Features

### Seal carrier assemblies

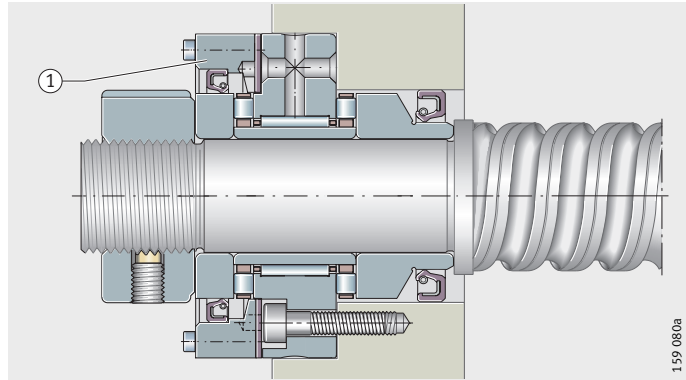
Seal carrier assemblies DRS are screw mounted on the central washer of needle roller/axial cylindrical roller bearings ZARF(L) and precisely centred in this position, *Figure 1*, ①. They seal the bearings against outside influences.

The sealing elements are supplied as a complete kit and comprise a seal carrier with an integral rotary shaft seal, a gasket and hexagonal socket cap screws for fixing the carrier to the central washer of the bearing.

① Seal carrier assembly

**DRS**  
**ZMA**  
**ZARF..-L**

*Figure 1*  
Needle roller/  
axial cylindrical roller bearing,  
seal carrier assembly, locknut



### Operating temperature

Seal carrier assemblies are suitable for operating temperatures from  $-30\text{ }^{\circ}\text{C}$  to  $+120\text{ }^{\circ}\text{C}$ , limited by the seal material.





# Seal carrier assemblies

## Precision locknuts

### Precision locknuts

Precision locknuts are used where high axial forces must be supported and high runout accuracy and rigidity are required, *Figure 2*, ①.

The thread and the axial face of the locknut in contact with the rolling bearing are produced in a single clamping operation. This allows very high runout accuracy to be achieved.

Locknuts are available in the designs AM, ZM and ZMA. If handled correctly, they can be reused several times.

### Axial locking by segments

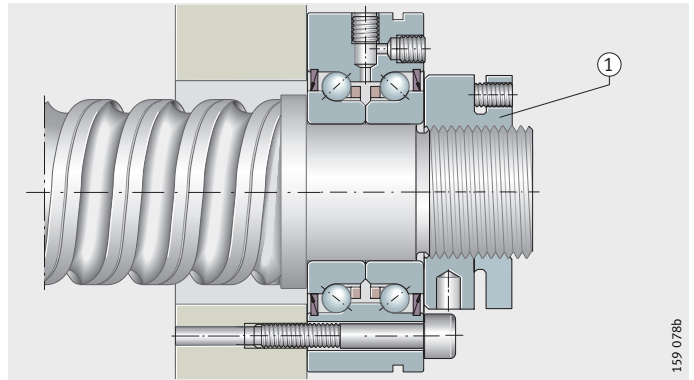
Locknuts of series AM are divided into several segments for applying the locking forces. When the hexagonal socket set screws are tightened, the segments are elastically deformed. As a result, the thread flanks of the segments are pressed against the flanks of the shaft thread and give a high frictional force that acts to prevent loosening of the nut. The runout of the nut is not affected by this method of locking.

① Precision locknut AM

**AM**  
**ZKLF..-2RS**

*Figure 2*

Axial angular contact ball bearing with locknut



### Locking by radial locking pegs

Locknuts ZM and ZMA are secured against rotation by means of two radially acting locking pegs, *Figure 3*, ①. ZMA is the heavy series.

The locking pegs are manufactured together with the internal thread of the locknut. They mesh in the thread of the shaft without affecting the runout or damaging the thread, *Figure 3*, ②.

The locking pegs are secured by set screws with a hexagonal socket arranged concentrically over the locking pegs, *Figure 3*, ③.

① Precision locknut ZMA

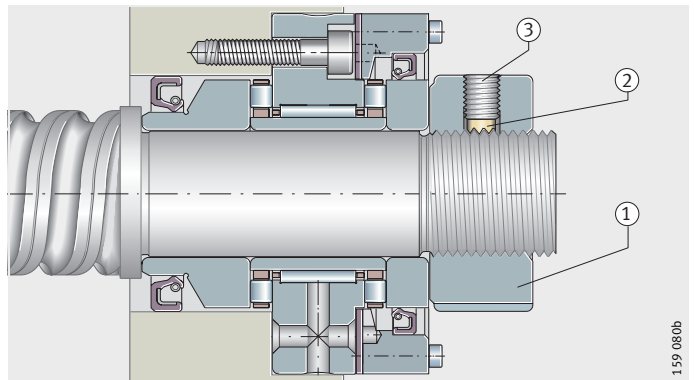
② Locking peg

③ Set screw

**DRS**  
**ZMA**  
**ZARF..-L**

*Figure 3*

Needle roller/axial cylindrical roller bearing with seal carrier assembly, locknut



## Design and safety guidelines

### Recommended shaft thread

Shaft threads for the precision locknuts must be precision machined. For data see table.

Shaft thread	
Tolerance class "medium"	Tolerance class "fine"
6g DIN 13 Part 21-24	4h DIN 13 Part 21-24

**Caution!** The journal thread must support the locknut over its whole width.

### Breakaway torque

The breakaway torques  $M_L$  given in the dimension tables are based on a locknut tightened against a rigid shaft shoulder to the reference tightening torque  $M_{AL}$  and secured.

### Ultimate axial load

The ultimate axial loads  $F_{aB}$  are valid for a journal thread with a tolerance of 6g or better as well as a minimum strength of 700 N/mm<sup>2</sup>.

For dynamic loading, the permissible value can be taken as 75% of the ultimate axial load  $F_{aB}$ .

### Fitting and dismantling

**Caution!** For the fitting and dismantling of bearings and precision locknuts, the information in Fitting and Maintenance Manual TPI 100 must be observed.

Locknuts must be fully screwed onto the shaft thread.

In order to counteract settling, it is recommended that the locknut should initially be tightened to twice the tightening torque  $M_A$  and then relieved of load again. It should only then be tightened again to the stated tightening torque  $M_A$ .

### Precision locknuts with axial locking

Locknuts AM can be tightened using a hook wrench to DIN 1810B that engages in four, six or eight holes around the circumference.

The set screws are then tightened in a crosswise sequence to the specified tightening torque  $M_m$  using an Allan key. Dismantling is carried out by uniformly loosening the set screws of all segments in order to prevent a single segment being left tensioned.

**Caution!** Tightening by means of just one segment is not permissible. For tightening, an adapter of series AMS can be used that ensures uniform loading of all segments. The adapter AMS must be ordered separately, see dimension tables, page 93.

For tightening using the adapter AMS, a hook wrench to DIN 1810A or to DIN 1810B can be used.

If precision locknuts AM are fitted using the adapter AMS, a maximum tightening torque of twice the value given in the dimension table for the bearing is permissible.

Segments can be axially deformed if the set screws are not tightened uniformly in a crosswise sequence or the locknut AM is not fully screwed onto the shaft thread. The specified tightening torque  $M_m$  according to the dimension table must be observed.



## Seal carrier assemblies

### Precision locknuts

#### Precision locknuts with radial locking

Locknuts ZM and ZMA can be tightened using a hook wrench to DIN 1810A that engages in one of the four slots around the circumference.

The two set screws are then tightened alternately to the specified tightening torque  $M_m$  using an Allan key; for  $M_m$ , see dimension tables for the bearings.

For dismantling, the two set screws are first loosened and the locking pegs loosened by light impacts with a plastic hammer on the outside surface of the locknut (in the vicinity of the screw holes).

The locknut can then be easily unscrewed without damaging the journal thread.

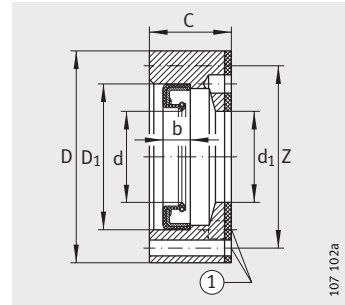
#### Accuracy

The accuracy of the precision locknuts is shown in the table.

#### Runout/thread

Runout Thread/axial face	Metric ISO thread
$\mu\text{m}$	"fine"
5	5H, DIN 13 Part 21-24

# Seal carrier assemblies



DRS<sup>1)</sup>

① 4 holes, offset by 90 degrees

107 102a

**Dimension table** · Dimensions in mm

Designation	Mass ≈kg	Dimensions				Rotary shaft seal				Corresponding bearing in standard or ..L version  Designation
		D	C	d <sub>1</sub>	Z <sup>2)</sup>	d	D <sub>1</sub>	b	Cap screws DIN 912 4 each	
<b>DRS1560</b>	0,16	60	14	35	52,4	35	45	7	M3X20	<b>ZARF1560-TN</b>
<b>DRS1762</b>	0,18	62	15,5	38	54,4	38	47	7	M3X25	<b>ZARF1762-TN</b>
<b>DRS2068</b>	0,11	68	17	42	60,4	42	55	8	M3X25	<b>ZARF2068-TN</b>
<b>DRS2080</b>	0,2	80	22	52	73,4	52	68	8	M3X30	<b>ZARF2080-TN</b>
<b>DRS2575</b>	0,16	75	17	47	67,4	47	62	6	M3X25	<b>ZARF2575-TN</b>
<b>DRS2590</b>	0,3	90	22	62	81	62	75	10	M3X30	<b>ZARF2590-TN</b>
<b>DRS3080</b>	0,15	80	17	52	73,4	52	68	8	M3X25	<b>ZARF3080-TN</b>
<b>DRS30105</b>	0,35	105	25	68	95	68	85	10	M4X35	<b>ZARF30105-TN</b>
<b>DRS3590</b>	0,15	90	19	60	80	60	72	8	M4X30	<b>ZARF3590-TN</b>
<b>DRS35110</b>	0,3	110	25	73	101	73	95	10	M3X30	<b>ZARF35110-TN</b>
<b>DRS40100</b>	0,25	100	19	65	90	65	80	8	M4X30	<b>ZARF40100-TN</b>
<b>DRS40115</b>	0,5	115	27,5	78	106	78	100	10	M3X35	<b>ZARF40115-TN</b>
<b>DRS45105</b>	0,3	105	20	70	95	70	85	8	M4X30	<b>ZARF45105-TN</b>
<b>DRS45130</b>	0,7	130	31	90	120	90	110	12	M4X40	<b>ZARF45130-TN</b>
<b>DRS50115</b>	0,2	115	20	78	106	78	100	10	M3X30	<b>ZARF50115-TN</b>
<b>DRS50140</b>	0,8	140	30	95	127,5	95	115	13	M5X40	<b>ZARF50140-TN</b>
<b>DRS55145</b>	0,9	145	30	100	132,5	100	120	12	M5X40	<b>ZARF55145-TN</b>
<b>DRS60150</b>	0,9	150	30	105	137,5	105	125	12	M5X40	<b>ZARF60150-TN</b>
<b>DRS65155</b>	1	155	30	110	142,5	110	130	12	M5X40	<b>ZARF65155-TN</b>
<b>DRS70160</b>	1	160	30	115	147,5	115	135	13	M5X40	<b>ZARF70160-TN</b>
<b>DRS75185</b>	1,8	185	36	135	172,5	135	160	15	M5X50	<b>ZARF75185-TN</b>
<b>DRS90210</b>	2,7	210	38	160	194	160	180	15	M5X50	<b>ZARF90210-TN</b>

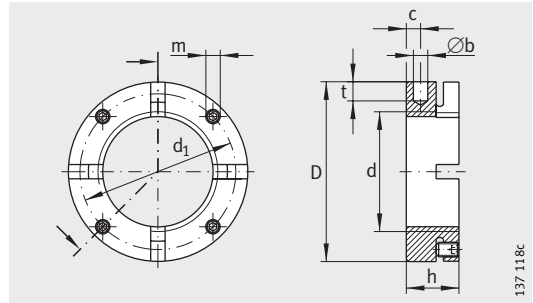
1) The seal carrier assembly is supplied as a kit of individual parts comprising:

- seal carrier
- rotary shaft seal
- gasket
- fixing screws.

2) Four holes, offset by 90 degrees.



# Precision locknuts



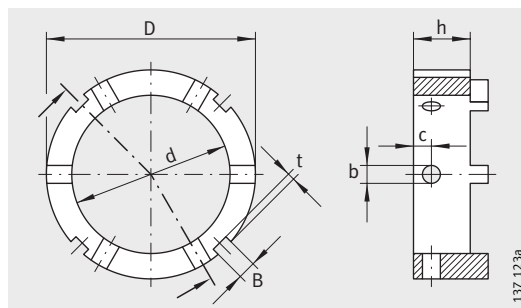
AM 15 to AM 40 with 4 segments  
 AM 45 to AM 90 with 6 segments  
 AM100 to AM130 with 8 segments

Dimension table - Dimensions in mm														
Designation	Nut thread	Mass	Dimensions							Set screw	Locknut <sup>1)</sup>			
			D	h	b H11	t	d <sub>1</sub>	c	m		Tightening torque	Ultimate axial load	Break-away torque	Reference tightening torque
	d	≈kg								M <sub>m</sub> Nm	F <sub>aB</sub> kN	M <sub>L</sub> for Nm	M <sub>AL</sub> Nm	M <sub>m</sub> kg · cm <sup>2</sup>
AM15	M15X1	0,06	30	18	4	5	24	5	M5	3	100	20	10	0,09
AM17	M17X1	0,07	32	18	4	5	26	5	M5	3	120	25	15	0,11
AM20	M20X1	0,13	38	18	4	6	31	5	M6	5	145	45	18	0,23
AM25	M25X1,5	0,16	45	20	5	6	38	6	M6	5	205	60	25	0,49
AM30	M30X1,5	0,20	52	20	5	7	45	6	M6	5	250	70	32	0,86
AM30/65	M30X1,5	0,50	65	30	6	8	45	6	M6	5	400	70	32	2,8
AM35/58	M35X1,5	0,23	58	20	5	7	51	6	M6	5	280	90	40	1,3
AM35	M35X1,5	0,33	65	22	6	8	58	6	M6	5	330	100	40	2,4
AM40	M40X1,5	0,30	65	22	6	8	58	6	M6	5	350	120	55	2,3
AM40/85	M40X1,5	0,75	85	32	6	8	58	6	M6	5	570	120	55	7,6
AM45	M45X1,5	0,34	70	22	6	8	63	6	M6	5	360	220	65	2,9
AM50	M50X1,5	0,43	75	25	6	8	68	8	M6	5	450	280	85	4,3
AM55	M55X2	0,60	85	26	6	8	75	8	M8	15	520	320	95	7,7
AM60	M60X2	0,65	90	26	6	8	80	8	M8	15	550	365	100	9,4
AM65	M65X2	0,83	100	26	8	10	88	8	M8	15	560	400	120	14,6
AM70	M70X2	0,79	100	28	8	10	90	9	M8	15	650	450	130	14,7
AM75	M75X2	1,23	115	30	8	10	102	10	M10	20	750	610	150	29
AM80	M80X2	0,93	110	30	8	10	98	10	M10	20	670	770	160	21,3
AM85	M85X2	0,97	115	30	8	10	102	10	M10	20	690	930	180	24,8
AM90	M90X2	1,53	130	32	8	10	118	13	M10	20	900	1100	200	48
AM100	M100X2	1,12	130	30	8	10	118	10	M10	20	740	1200	250	38
AM110	M110X2	1,22	140	30	8	10	128	10	M10	20	770	1300	250	48
AM120	M120X2	1,56	155	30	8	10	142	10	M10	20	880	1450	250	75
AM130	M130X2	1,67	165	30	8	10	152	10	M10	20	900	1600	250	92

<sup>1)</sup> Caution!

If precision locknuts AM are fitted using the adapter AMS, a maximum tightening torque of twice the value given in the dimension table for the bearing is permissible.

# Adapters

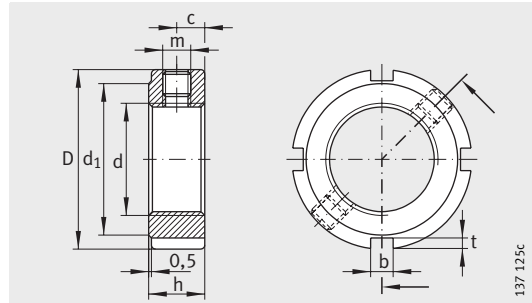


AMS

Dimension table · Dimensions in mm									
Designation	Mass ≈kg	Dimensions							For precision locknuts
		D	h	d	b H11	c	B	t	
<b>AMS20</b>	0,047	32	14	22	4	5	4	2	<b>AM15, AM17, AM20</b>
<b>AMS30</b>	0,093	45	15	35	5	5	5	2	<b>AM25, AM30, AM35/58, AM30/65</b>
<b>AMS40</b>	0,217	65	16	45	6	6	6	2,5	<b>AM35, AM40</b>
<b>AMS50</b>	0,245	70	19	53	6	6	6	2,5	<b>AM45, AM50</b>
<b>AMS60</b>	0,37	85	20	65	6	6	7	3	<b>AM55, AM60</b>
<b>AMS70</b>	0,615	98	25	75	8	10	8	3,5	<b>AM65, AM70</b>
<b>AMS80</b>	0,755	110	25	85	8	10	8	3,5	<b>AM75, AM80, AM85</b>
<b>AMS90</b>	1,215	130	25	95	8	10	10	4	<b>AM90</b>
<b>AMS110</b>	0,74	130	25	110	8	10	10	4	<b>AM100, AM110</b>
<b>AMS130</b>	1,485	155	25	130	8	10	12	5	<b>AM120, AM130</b>



# Precision locknuts

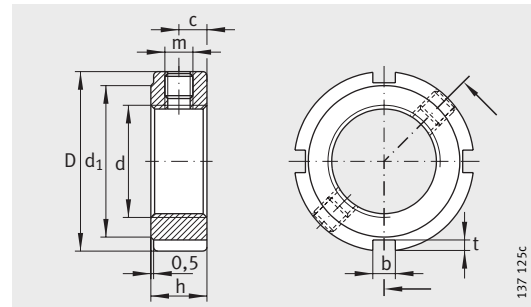


ZM, ZMA

Dimension table · Dimensions in mm														
Designation	Thread	Mass ≈kg	Dimensions						Set screw Tightening torque M <sub>m</sub> Nm	Locknut				
			D	h	b	t	d <sub>1</sub>	c		m	Ultimate axial load F <sub>aB</sub> kN	Break-away torque M <sub>L</sub> for Nm	Reference tightening torque M <sub>AL</sub> Nm	Mass moment of inertia M <sub>m</sub> kg · cm <sup>2</sup>
ZM06	M6X0,5	0,01	16	8	3	2	11	4	M4	1	17	20	2	0,004
ZM08 <sup>1)</sup>	M8X75	0,01	16	8	3	2	11	4	M4	1	23	25	4	0,004
ZM10 <sup>1)</sup>	M10X1	0,01	18	8	3	2	14	4	M4	1	31	30	6	0,006
ZM12	M12X1	0,015	22	8	3	2	18	4	M4	1	38	30	8	0,013
ZM15	M15X1	0,018	25	8	3	2	21	4	M4	1	50	30	10	0,021
ZMA15/33	M15X1	0,08	33	16	4	2	28	8	M5	3	106	30	10	0,14
ZM17	M17X1	0,028	28	10	4	2	23	5	M5	3	57	30	15	0,401
ZM20	M20X1	0,035	32	10	4	2	27	5	M5	3	69	40	18	0,068
ZMA20/38	M20X1	0,12	38	20	5	2	33	10	M5	3	174	40	18	0,297
ZMA20/52	M20X1	0,32	52	25	5	2	47	12,5	M5	3	218	40	18	1,38
ZM25	M25X1,5	0,055	38	12	5	2	33	6	M6	5	90	60	25	0,157
ZMA25/45	M25X1,5	0,16	45	20	5	2	40	10	M6	5	211	60	25	0,572
ZMA25/58	M25X1,5	0,43	58	28	6	2,5	52	14	M6	5	305	60	25	2,36
ZM30	M30X1,5	0,075	45	12	5	2	40	6	M6	5	112	70	32	0,304
ZMA30/52	M30X1,5	0,22	52	22	5	2	47	11	M6	5	270	70	32	1,1
ZMA30/65	M30X1,5	0,55	65	30	6	2,5	59	15	M6	5	390	70	32	3,94
ZM35	M35X1,5	0,099	52	12	5	2	47	6	M6	5	134	80	40	0,537
ZMA35/58	M35X1,5	0,26	58	22	6	2,5	52	11	M6	5	300	80	40	1,66
ZMA35/70	M35X1,5	0,61	70	30	6	2,5	64	15	M6	5	460	80	40	5,2
ZM40	M40X1,5	0,14	58	14	6	2,5	52	7	M6	5	157	95	55	0,945
ZMA40/62	M40X1,5	0,27	62	22	6	2,5	56	11	M8	15	310	95	55	2,07
ZMA40/75	M40X1,5	0,67	75	30	6	2,5	69	15	M8	15	520	95	55	6,72
ZM45	M45X1,5	0,17	65	14	6	2,5	59	7	M6	5	181	110	65	1,48
ZMA45/68	M45X1,5	0,35	68	24	6	2,5	62	12	M8	15	360	110	65	3,2
ZMA45/85	M45X1,5	0,92	85	32	7	3	78	16	M8	15	630	110	65	11,9
ZM50	M50X1,5	0,19	70	14	6	2,5	64	7	M6	5	205	130	85	1,92
ZMA50/75	M50X1,5	0,43	75	25	6	2,5	68	12,5	M8	15	415	130	85	4,89
ZMA50/92	M50X1,5	1,06	92	32	8	3,5	84	16	M8	15	680	130	85	16,1
ZM55	M55X2	0,23	75	16	7	3	68	8	M6	5	229	150	95	2,77
ZMA55/98	M55X2	1,17	98	32	8	3,5	90	16	M8	15	620	150	95	20,5

<sup>1)</sup> When clamped, the set screws protrude by approx. 0,5 mm.

# Precision locknuts



ZM, ZMA

137 125c

**Dimension table** (continued) · Dimensions in mm

Designation	Thread	Mass ≈kg	Dimensions							Set screw Tightening torque M <sub>m</sub> Nm	Locknut			
			D	h	b	t	d <sub>1</sub>	c	m		Ultimate axial load F <sub>aB</sub> kN	Break- away torque M <sub>L</sub> for Nm	Reference tightening torque M <sub>AL</sub> Nm	Mass moment of inertia M <sub>m</sub> kg · cm <sup>2</sup>
<b>ZM60</b>	<b>M60X2</b>	0,25	80	16	7	3	73	8	M6	5	255	180	100	3,45
<b>ZMA60/98</b>	<b>M60X2</b>	1,07	98	32	8	3,5	90	16	M8	15	680	180	100	19,6
<b>ZM65</b>	<b>M65X2</b>	0,27	85	16	7	3	78	8	M6	5	280	200	120	4,24
<b>ZMA65/105</b>	<b>M65X2</b>	1,21	105	32	8	3,5	97	16	M8	15	750	200	120	25,6
<b>ZM70</b>	<b>M70X2</b>	0,36	92	18	8	3,5	85	9	M8	15	305	220	130	6,61
<b>ZMA70/110</b>	<b>M70X2</b>	1,4	110	35	8	3,5	102	17,5	M8	15	810	220	130	33
<b>ZM75</b>	<b>M75X2</b>	0,4	98	18	8	3,5	90	9	M8	15	331	260	150	8,41
<b>ZMA75/125</b>	<b>M75X2</b>	2,11	125	38	8	3,5	117	19	M8	15	880	260	150	62,2
<b>ZM80</b>	<b>M80X2</b>	0,46	105	18	8	3,5	95	9	M8	15	355	285	160	11,2
<b>ZMA80/120</b>	<b>M80X2</b>	1,33	120	35	8	4	105	17,5	M8	15	810	285	160	44,6
<b>ZM85</b>	<b>M85X2</b>	0,49	110	18	8	3,5	102	9	M8	15	385	320	190	13,1
<b>ZM90</b>	<b>M90X2</b>	0,7	120	20	10	4	108	10	M8	15	410	360	200	21,8
<b>ZMA90/130</b>	<b>M90X2</b>	2,01	130	38	10	4	120	19	M8	15	910	360	200	64,1
<b>ZMA90/155</b>	<b>M90X2</b>	3,36	155	38	10	4	146	19	M8	15	1080	360	200	150
<b>ZM100</b>	<b>M100X2</b>	0,77	130	20	10	4	120	10	M8	15	465	425	250	28,6
<b>ZMA100/140</b>	<b>M100X2</b>	2,23	140	38	12	5	128	19	M10	20	940	425	250	82,8
<b>ZM105</b>	<b>M105X2</b>	1,05	140	22	12	5	126	11	M10	20	495	475	300	44,5
<b>ZM110</b>	<b>M110X2</b>	1,09	145	22	12	5	133	11	M10	20	520	510	350	50,1
<b>ZM115</b>	<b>M115X2</b>	1,13	150	22	12	5	137	11	M10	20	550	550	400	56,2
<b>ZM120</b>	<b>M120X2</b>	1,28	155	24	12	5	138	12	M10	20	580	600	450	68,4
<b>ZM125</b>	<b>M125X2</b>	1,33	160	24	12	5	148	12	M10	20	610	640	500	76,1
<b>ZM130</b>	<b>M130X2</b>	1,36	165	24	12	5	149	12	M10	20	630	700	550	84,3
<b>ZM140</b>	<b>M140X2</b>	1,85	180	26	14	6	160	13	M12	38	690	800	600	133
<b>ZM150</b>	<b>M150X2</b>	2,24	195	26	14	6	171	13	M12	38	750	900	650	188





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