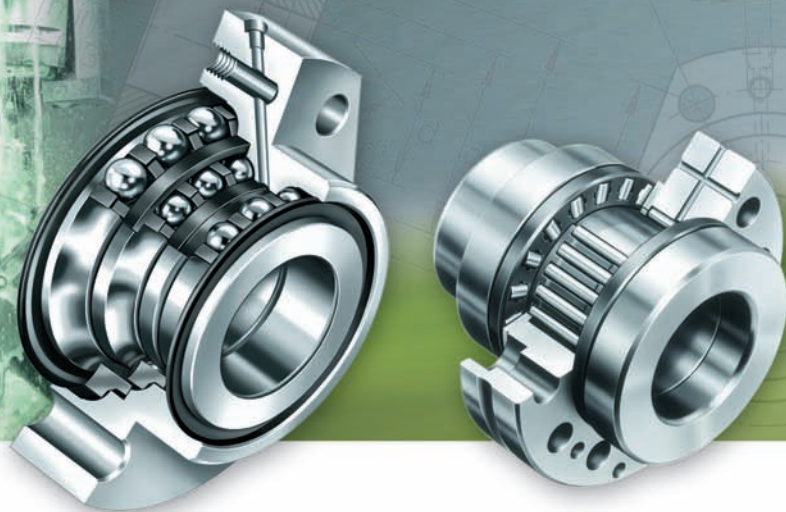




FAG

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 its forward-looking bearing arrangement solutions for feed spindles, main spindles, rotary tables and linear guidance units, Schaeffler KG has 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 benefited 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 for 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

Matrix for preselection of bearings	4
<hr/>	
Axial angular contact ball bearings	6
<hr/>	
Needle roller/axial cylindrical roller bearings	60
<hr/>	
Seal carrier assemblies Precision locknuts	88

The application-oriented matrix allows rapid preselection of the suitable bearing.

Axial angular contact ball bearings are precision bearings for screw drives. Depending on the series, they can support 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.

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.

For many applications, a bearing arrangement of lower precision is often sufficient. For this purpose, bearings with less stringent tolerances are available.

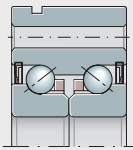
These bearings are double direction precision axial cylindrical roller bearings with a radial bearing component. The inner ring, outer ring and cylindrical roller and cage assemblies are matched to each other such that they can be set to a defined axial preload using a precision locknut.

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.

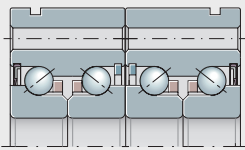
If the axial abutment of the shaft locating washer is not sufficient or a seal raceway is required, bearings with a stepped, extended shaft locating washer on one side are suitable.

Seal carrier assemblies DRS are complete sealing sets that are screw mounted on the outer ring of needle roller/axial cylindrical roller bearings ZARF(L). They are precisely centred in this position and seal the bearings against external influences.

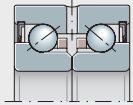
The precision locknuts AM, ZM, ZMA for axial or radial locking are used to set bearings for screw drives to a defined axial preload. They are also used where high axial forces must be supported and high runout accuracy and rigidity are required.



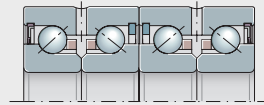
ZKLF



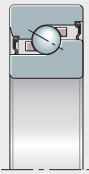
ZKLF..-2RS-2AP



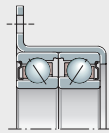
ZKLN



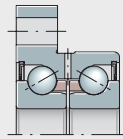
ZKLN..-2RS-2AP



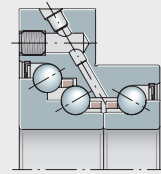
**7602, 7603,
BSB**



ZKLR

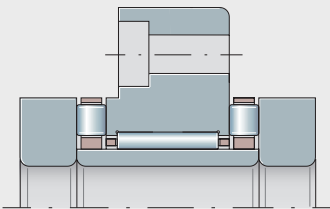


ZKLFA

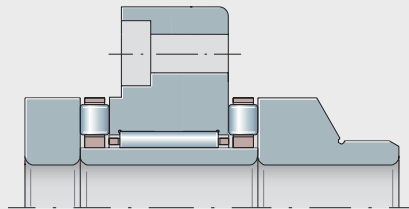


DKLFA

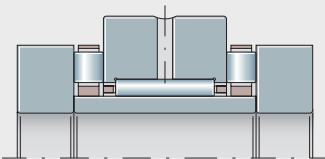
107 558a



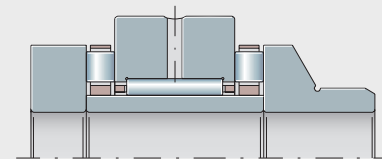
ZARF



ZARF..-L

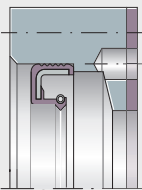


ZARN

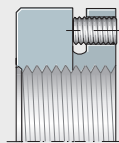


ZARN..-L

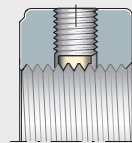
107 559



DRS



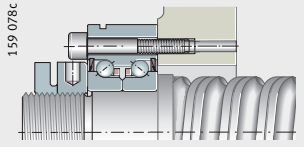
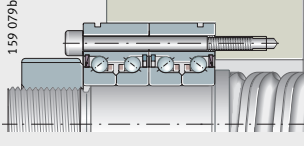
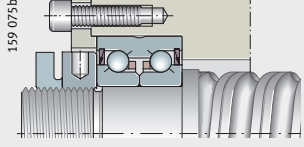
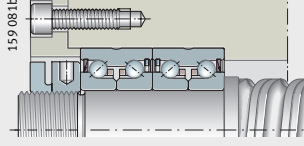
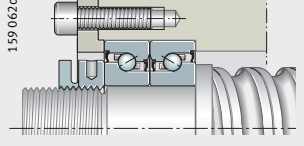
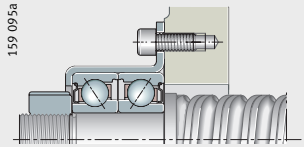
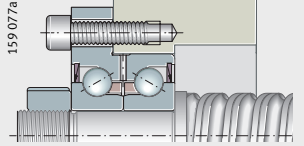
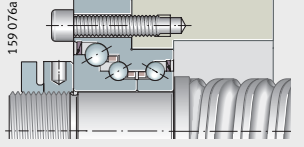
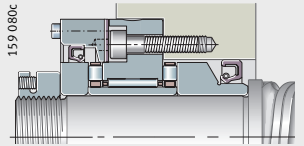
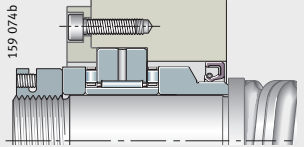
AM



ZM, ZMA

107 560

Matrix for preselection of bearings

Application	Series	
<p>For standard applications</p>	 <p>159 078c</p>	<p>ZKLF...-2Z ZKLF...-2RS ZKLF...-2RS-PE</p>
	 <p>159 079b</p>	<p>ZKLF...-2RS-2AP</p>
	 <p>159 075b</p>	<p>ZKLN...-2Z ZKLN...-2RS ZKLN...-2RS-PE</p>
	 <p>159 081b</p>	<p>ZKLN...-2RS-2AP</p>
	 <p>159 062c</p>	<p>7602 7602-2RS 7603 7603-2RS BSB BSB-2RS</p>
<p>For special applications</p>	 <p>159 095a</p>	<p>ZKLR...-2Z ZKLR...-2RS</p>
	 <p>159 077a</p>	<p>ZKLF...-2Z ZKLF...-2RS</p>
	 <p>159 076a</p>	<p>DKLFA...-2RS</p>
<p>For applications requiring very high accuracy and rigidity</p>	 <p>159 080c</p>	<p>ZARF (L)</p>
	 <p>159 074b</p>	<p>ZARN (L)</p>

Definition of symbols

- +++ very good
- ++ good
- + satisfactory
- sufficient

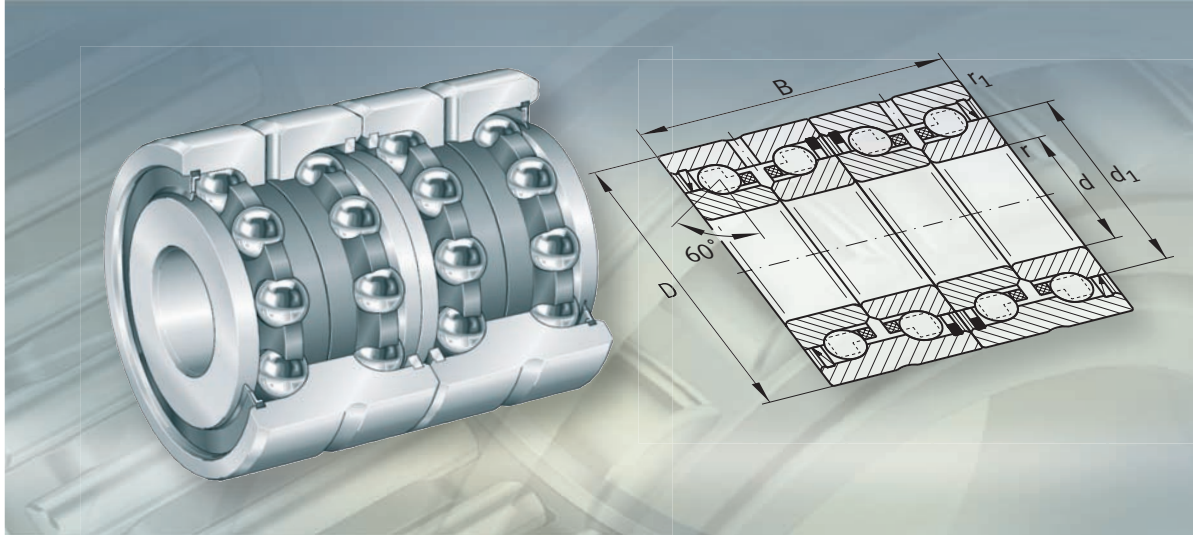
Attention!

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"> - Outer ring for flange mounting - Gap seals or contact seals on both sides - Greased, with relubrication facility - Most economical type of screw drive bearing arrangement 	++ ++ +	+++ ++ ++	+ + +	+++ +++ +++	++ ++ ++	10
<ul style="list-style-type: none"> - As ZKLF, but in matched pair - Significantly higher load carrying capacity and rigidity than ZKLF 	++	++	++	++	++	11
<ul style="list-style-type: none"> - Gap seals or contact seals on both sides - Greased, with relubrication facility - Easier to fit than single row bearings, e.g. for plummer block housings 	++ ++ +	+++ ++ ++	+ + +	+ + +	++ ++ ++	12
<ul style="list-style-type: none"> - As ZKLN, but in matched pair - Significantly higher load carrying capacity and rigidity than ZKLN 	++	++	++	+	++	13
<ul style="list-style-type: none"> - Open or sealed on both sides - Highly suitable for mounting in pairs to form wide range of contact angle combinations 	++ ++ ++ ++ ++ ++	+++ ++ +++ ++ +++ ++	+ + + + + +	- - - - - -	++ ++ ++ ++ ++ ++	14
<ul style="list-style-type: none"> - Particularly economical alternative to solutions with individual ball bearings - Gap seals or contact seals on both sides - Simple to fit - For applications with comparatively low loads, but high positional accuracy 	+ +	+++ ++	- -	+++ +++	++ ++	15
<ul style="list-style-type: none"> - Outer ring for flange mounting - Stepped outer ring with flattened areas on both sides - Gap seals or contact seals on both sides 	++ ++	+++ ++	+ +	+++ +++	++ ++	16
<ul style="list-style-type: none"> - Higher load capacity on one side - Outer ring for flange mounting - Sealed on both sides - For vertical axes - For locating/locating bearing arrangements 	+	++	++	+++	++	17
<ul style="list-style-type: none"> - Outer ring for flange mounting - Very high accuracy, rigidity and load carrying capacity - Bearing prepared for sealing 	+++	+	+++	+	-	63
<ul style="list-style-type: none"> - Very high accuracy, rigidity and load carrying capacity - Bearing prepared for sealing 	+++	+	+++	-	-	64



FAG



Axial angular contact ball bearings

Axial angular contact ball bearings

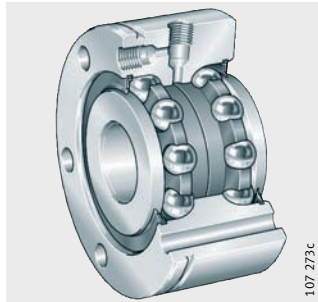
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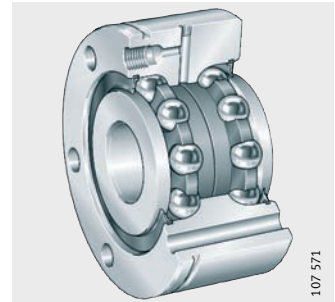
Product overview Axial angular contact ball bearings

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

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

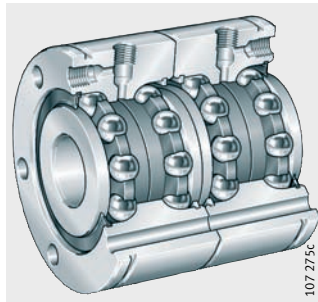


ZKLF...-2RS-PE



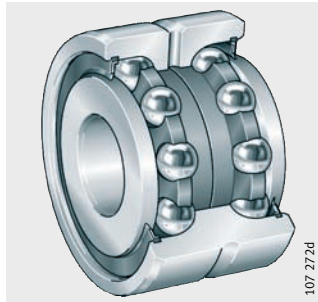
Matched pair

ZKLF...-2RS-2AP



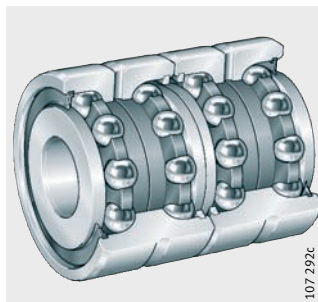
**Double row,
not for screw mounting**
Lip seals or gap seals

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



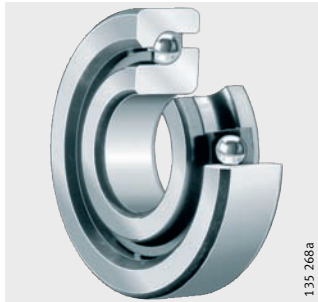
Matched pair

ZKLN...-2RS-2AP



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

7602, 7603, BSB

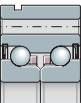
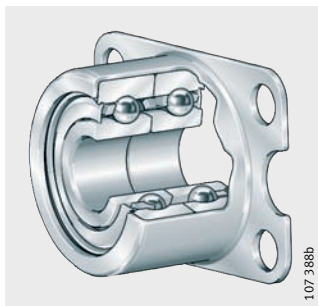


7602..-2RS, 7603..-2RS,
BSB..-2RS



**Angular contact
ball bearing unit,
for screw mounting**
Lip seals or gap seals

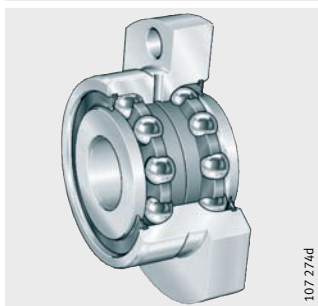
ZKLR..-2RS, ZKLR..-2Z



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

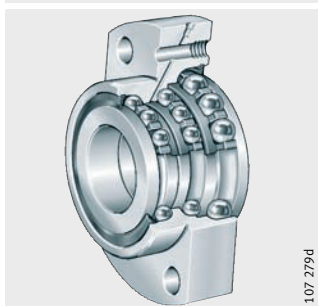
Double row
Lip seals or gap seals

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



Triple row
Lip seals

DKLFA..-2RS



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.

For the design of 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, there is a wide range of INA and FAG axial angular contact ball bearings. With this product range, solutions can be found to all the technical and economic demands placed on the bearing arrangements of screw drives.

Single row and 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 contact angle of 60° , the bearings can support not only radial forces but high axial forces as well.

Double row, for screw mounting

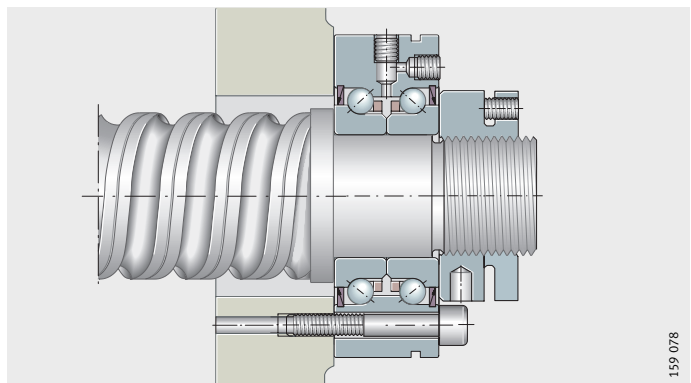
Axial angular contact ball bearings ZKLF are screw mounted directly on the adjacent construction or in a radial locating bore, *Figure 1* and *Figure 2*, page 11. The cover that would otherwise be required and the associated matching work can therefore be dispensed with.

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 detachable grub 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

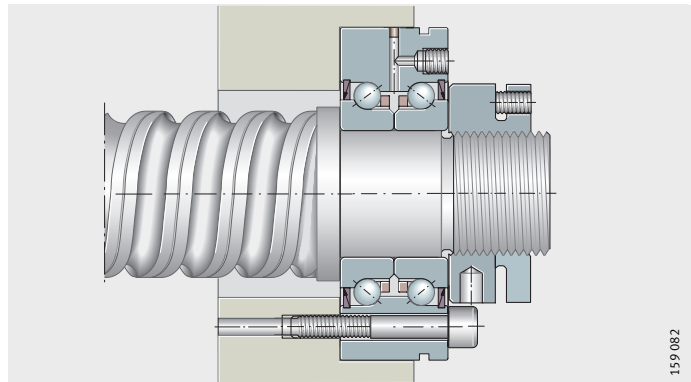


Figure 2
Outer ring screw mounted in bore,
preloaded using locknut

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

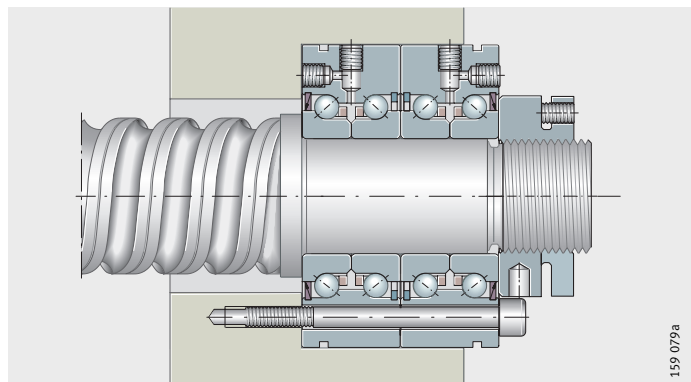


Figure 3
Matched pair,
outer ring screw mounted in bore,
preloaded using locknut

Axial angular contact ball bearings

Seals 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.

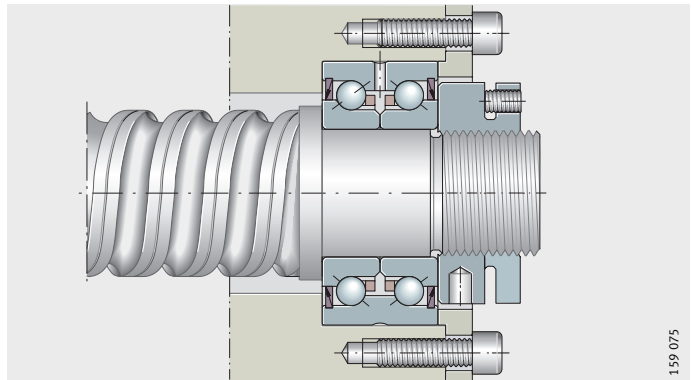
Lubrication The bearings are greased using a lithium soap grease to GA28 and can be lubricated via the lubrication connectors in the outer ring. For the majority of applications, the initial greasing is sufficient for the whole bearing operating life.

Double row, 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



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.

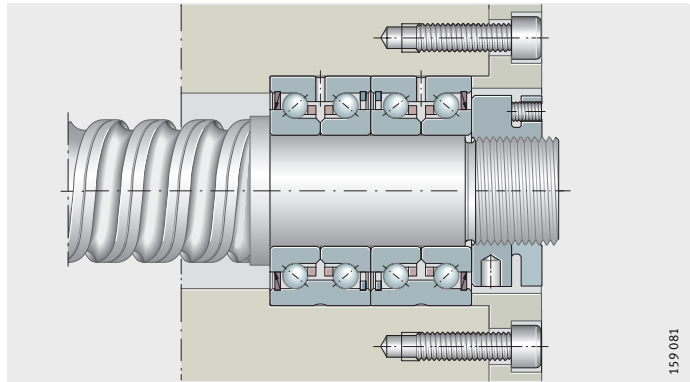
Matched pairs Bearings of series ZKLN..-2RS-2AP comprise a matched pair of bearings ZKLN..-2RS, *Figure 5*. The individual bearings are matched to each other.

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



Seals 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.

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

Axial angular contact ball bearings

**Single row,
for matching 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

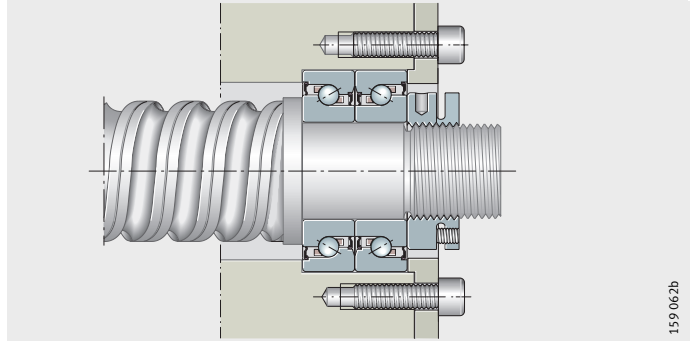
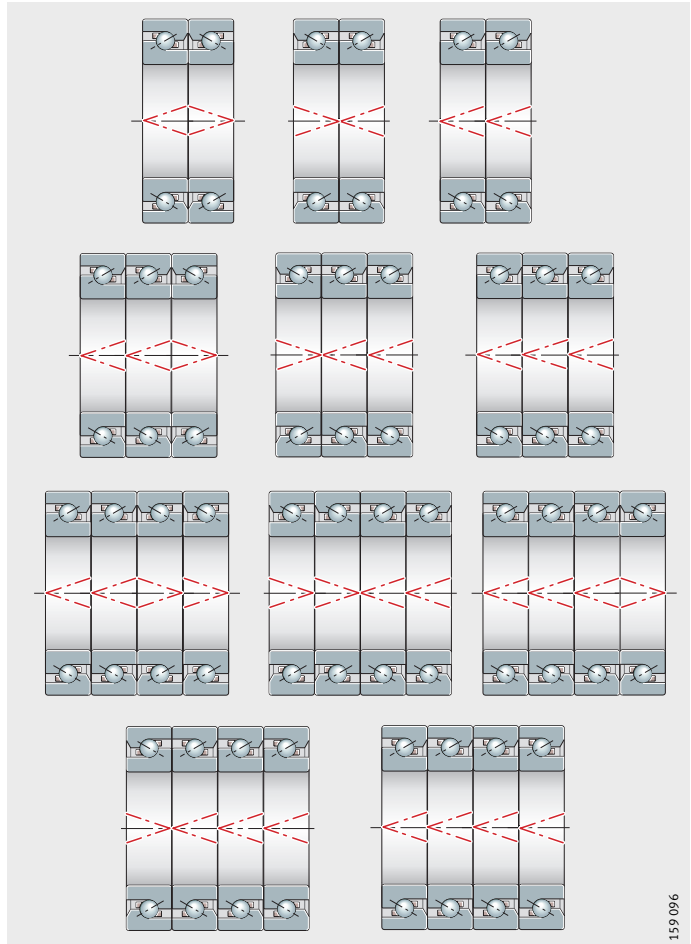


Figure 6
Single row axial angular
contact ball bearings,
two-bearing set in O arrangement

159 062b



7602, 7603, BSB

Figure 7
Set combinations

159 096

Seals Single row axial angular contact ball bearings for matching are bearings of the open basic design. However, some sizes are fitted with seals.

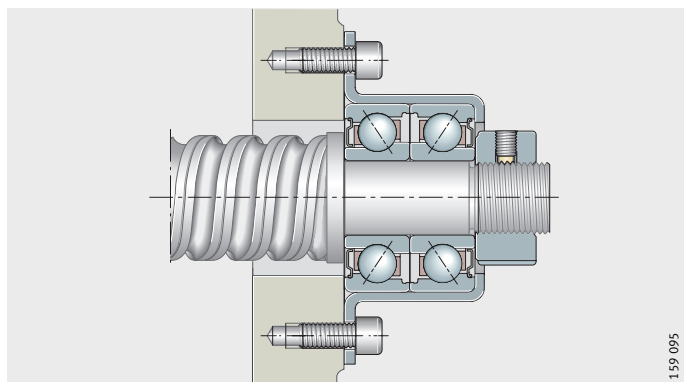
Lubrication Single row axial angular contact ball bearings of the open basic design are not supplied greased. The designs fitted with seals are greased for life with Arcanol L55.

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:

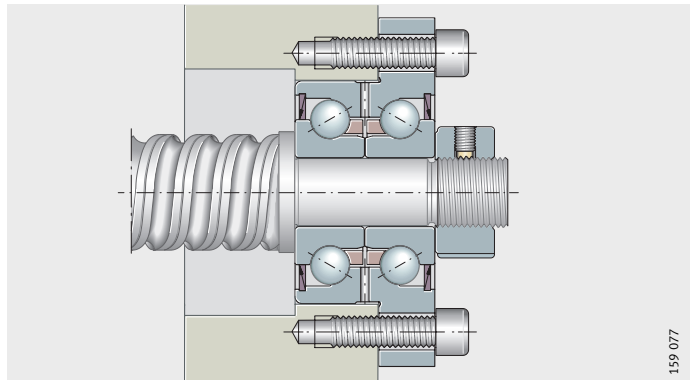
- are directly flange mounted, for example on the milled face of the adjacent construction. This eliminates the need for precise, costly fits and additional flange covers for seating and axial location of the bearings
- require no additional parts for location of the bearings in the housing
- reduce 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.

Axial angular contact ball bearings

- Seals** 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.
- Lubrication** The bearings are greased using a lithium soap grease to DIN 51825–K2N–40.
- Operating limits** 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 electronic components manufacture
 - where complete units will give a simpler bearing arrangement.
- Double row, 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



- Seals** 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.
- Lubrication** The bearings are greased using a lithium soap grease to GA28 and can be lubricated via a lubrication groove and lubrication holes in the outer ring. For the majority of applications, the initial greasing is sufficient for the whole bearing operating life.

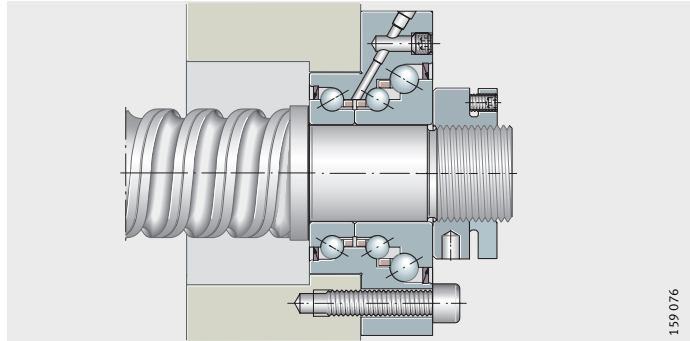
**Triple row,
with flange,
for screw mounting**

Axial angular contact ball bearings DKLFA..-2RS have, in addition to two rows of balls with a contact angle of 60° 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 flange 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



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 us.

Seals

Triple row axial angular contact ball bearings have lip seals on both sides.

Lubrication

The bearings are greased using a lithium soap grease to GA28. If necessary, lubrication can be carried out via a threaded connector for central lubrication systems on the flange side.



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

Axial angular contact ball bearings

Operating temperature

Sealed axial angular contact ball bearings are suitable for operating temperatures from -30 °C to $+120\text{ °C}$, restricted by the grease, the seal material and the plastic cages in the ball and cage assemblies.



The operating temperature influences the dynamic bearing characteristics. The values given in the dimension table are based on a room temperature of $+20\text{ °C}$.

Cages

The axial angular contact ball bearings have plastic cages. The cage design is not indicated in the suffix.

In series 7602, 7603 and BSB, the polyamide cages are indicated by the suffix TVP or T.

Suffixes

Suffixes for the available designs: see table.

Available designs

Suffix	Description	Design
PE	Less stringent bearing design	Standard
T, TVP	Polyamide cage, guided by balls	
2AP	Axial angular contact ball bearings, matched pair (ZKLN, ZKLF)	
2RS	Contact seals on both sides	
2Z	Gap seals on both sides	

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:

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

$$L_{10h} = \frac{16\,666}{n} \cdot \left(\frac{C}{P}\right)^p$$

L_{10} 10^6 revolutions
Basic rating life in millions of revolutions
 L_{10h} 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 $\alpha \leq 45^\circ$,
 C_a is valid for a contact angle $\alpha > 45^\circ$
 P N
Equivalent dynamic bearing load
 p –
Life exponent $p = 3$
 n 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 25.

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 25.

Axial angular contact ball bearings

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*, page 21, to *Figure 15*, page 22. For 7602, 7603 and BSB, the $F_{a\text{res}}$ diagrams are based on two-bearing sets in an O or X arrangement, see page 14. For calculation of other set combinations, please contact us.



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, P must be calculated as follows:

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

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

Factors 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

In this case, P and n are calculated as follows (q = time portion %):

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

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

Static load safety factor

The static load safety factor S_0 indicates the security against impermissible permanent deformations in the bearing:

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

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 $\alpha \leq 45^\circ$,
 C_{0a} is valid for a contact angle $\alpha > 45^\circ$
 P_0 – N Maximum static load of bearing.



In machine tools, S_0 should be ≥ 4 .

Resultant bearing load $F_{a\ res}$

Example (red lines)

Bearing ZKLN1545

Axial operating load $F_{aB} = 1500\text{ N}$

$F_{a\ res} \approx 1750\text{ N}$

Loading by operating load and preload

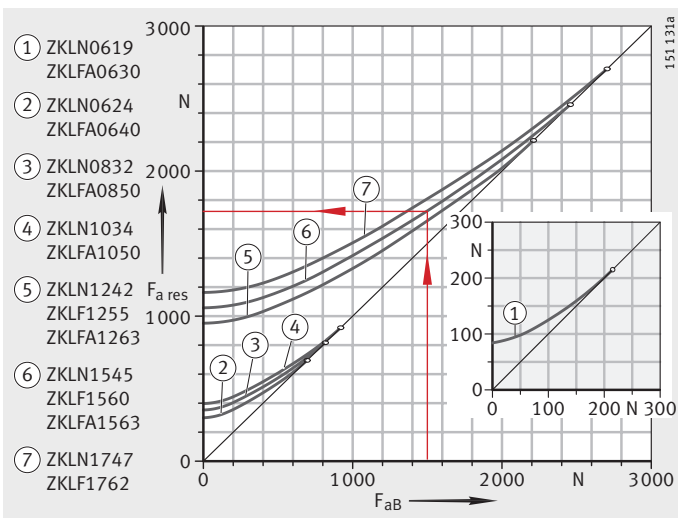
F_{aB} = operating load

$F_{a\ res}$ = resultant bearing load

° = limit value

Figure 11

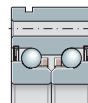
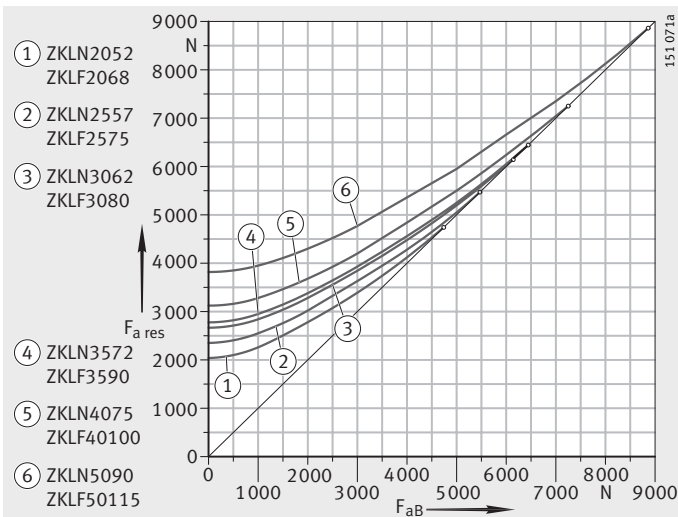
Resultant bearing load
ZKLN, ZKLF and ZKLFA,
up to $d = 17\text{ mm}$



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

Figure 12

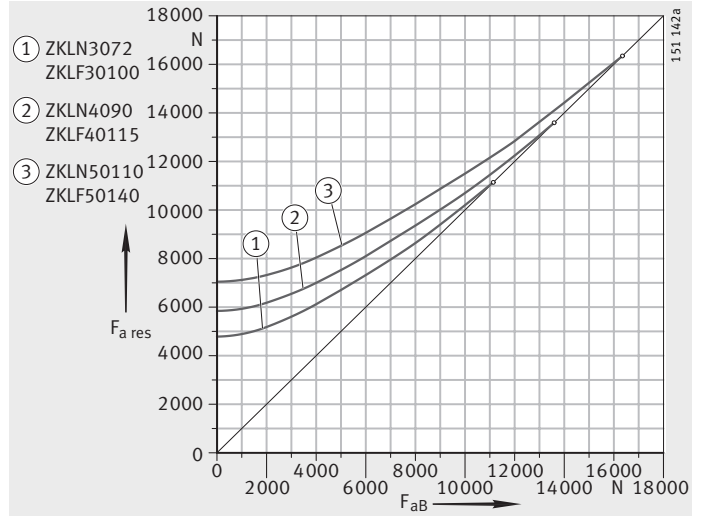
Resultant bearing load
ZKLN, ZKLF,
from $d = 20\text{ mm}$ to 50 mm



Axial angular contact ball bearings

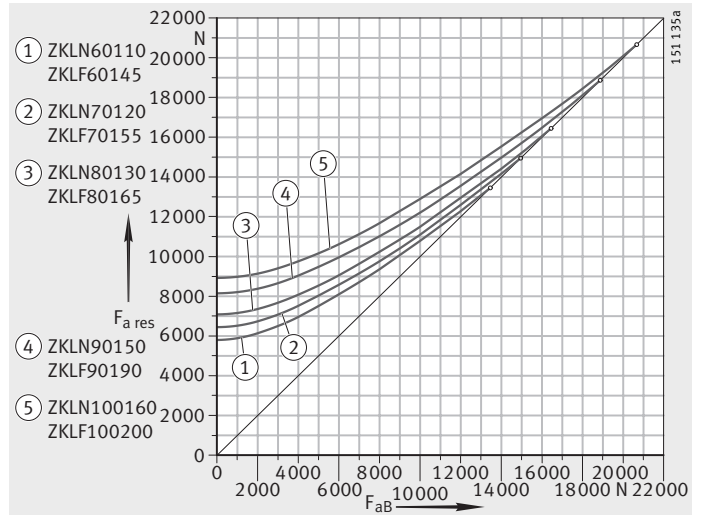
F_{aB} = operating load
 $F_{a\ res}$ = resultant bearing load
 \circ = limit value

Figure 13
 Resultant bearing load
 ZKLN, ZKLF, heavy series



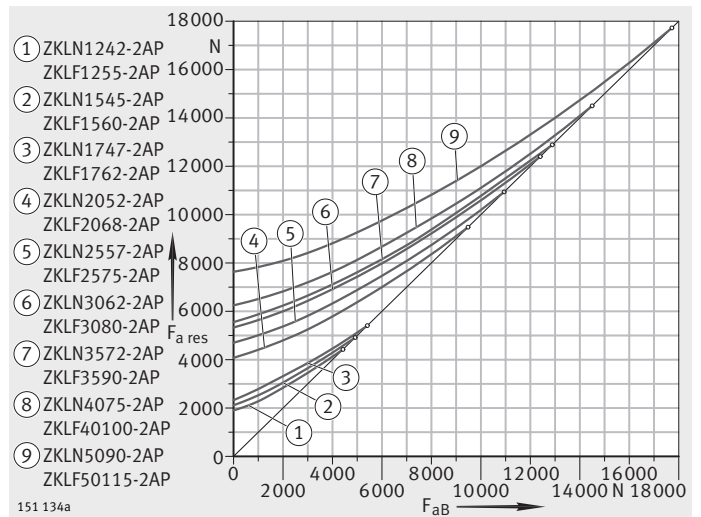
F_{aB} = operating load
 $F_{a\ res}$ = resultant bearing load
 \circ = limit value

Figure 14
 Resultant bearing load
 ZKLN, ZKLF, from d = 60 mm



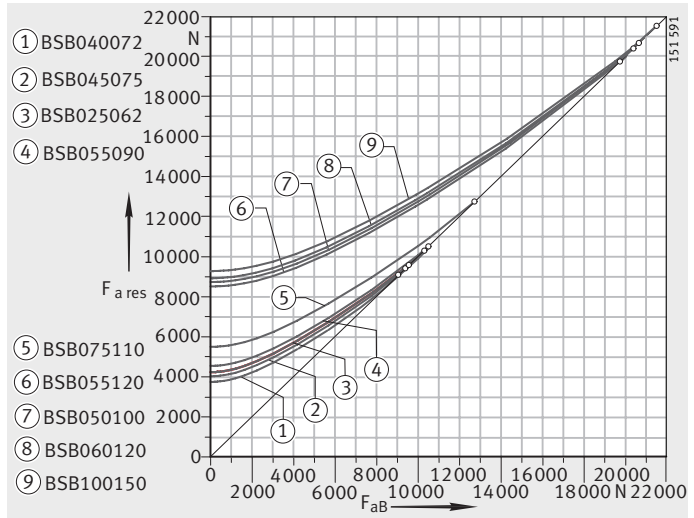
F_{aB} = operating load
 $F_{a\ res}$ = resultant bearing load
 \circ = limit value

Figure 15
 Resultant bearing load
 ZKLN...-2AP and ZKLF...-2AP



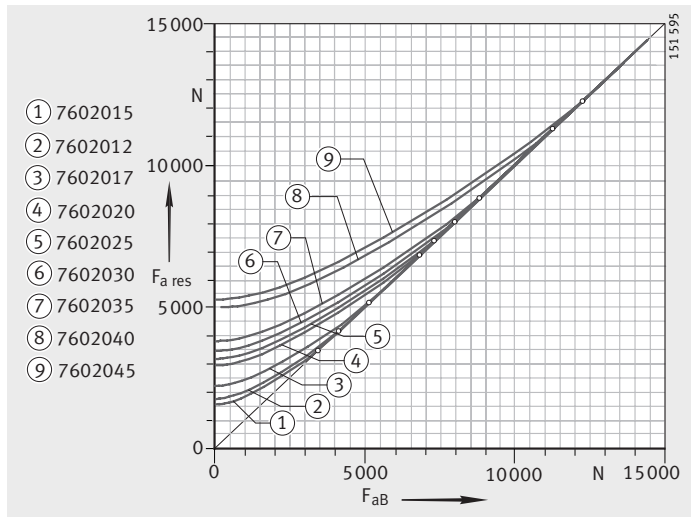
F_{aB} = operating load
 $F_{a\ res}$ = resultant bearing load
 ° = limit value

Figure 16
 Resultant bearing load
 BSB



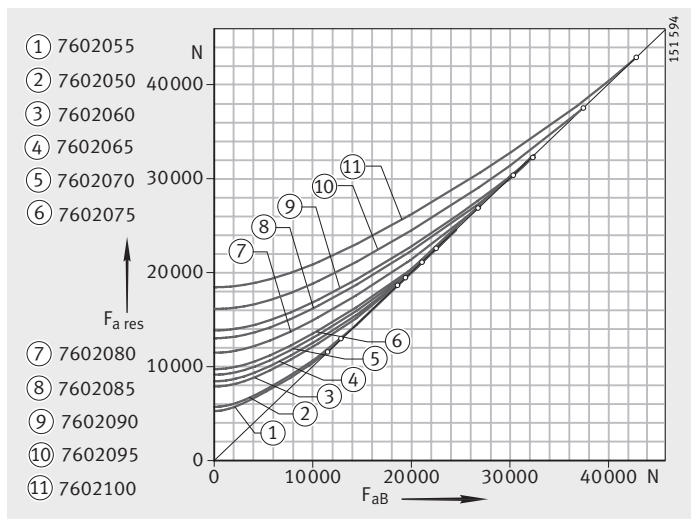
F_{aB} = operating load
 $F_{a\ res}$ = resultant bearing load
 ° = limit value

Figure 17
 Resultant bearing load
 7602012 to 7602045



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

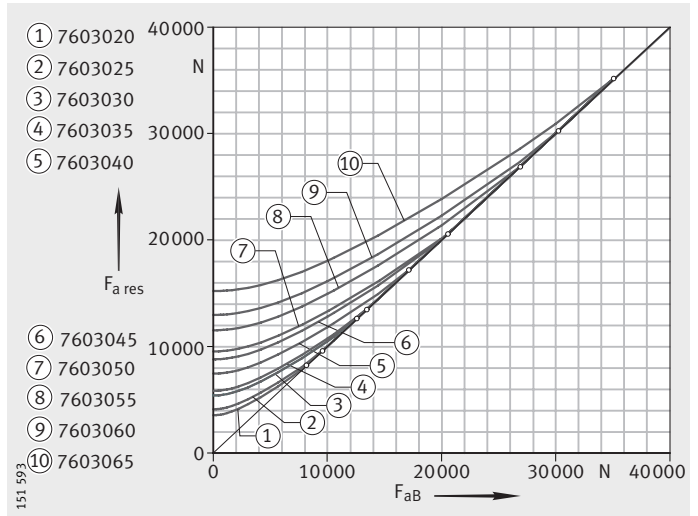
Figure 18
 Resultant bearing load
 7602050 to 7602100



Axial angular contact ball bearings

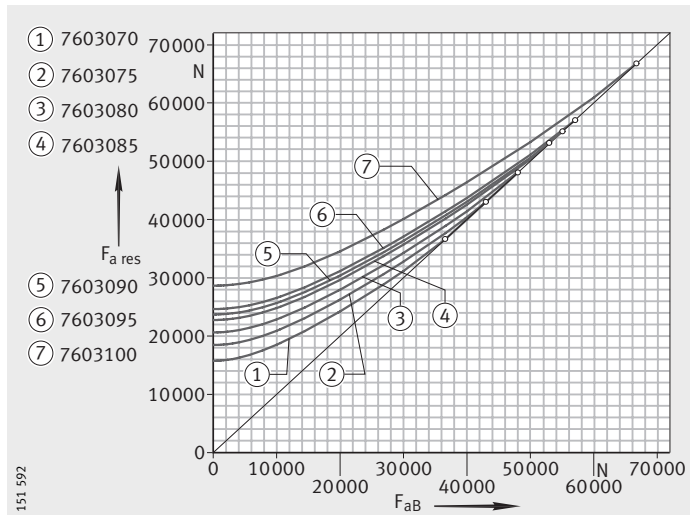
F_{aB} = operating load
 $F_{a\text{ res}}$ = resultant bearing load
 $^{\circ}$ = limit value

Figure 19
 Resultant bearing load
 7603020 to 7603065



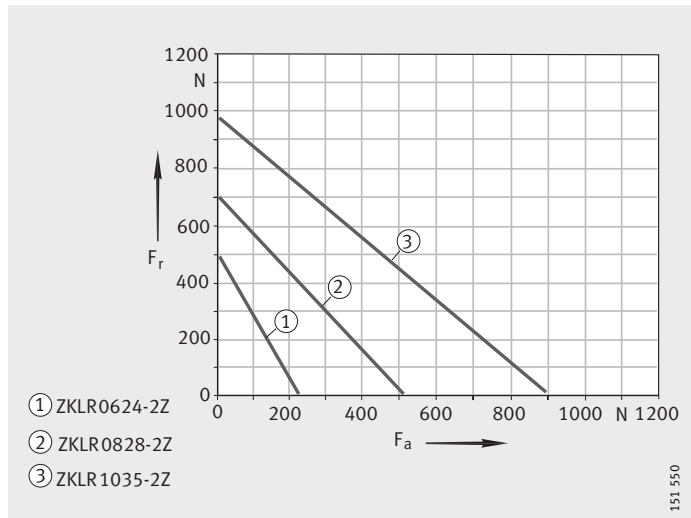
F_{aB} = operating load
 $F_{a\text{ res}}$ = resultant bearing load
 $^{\circ}$ = limit value

Figure 20
 Resultant bearing load
 7603070 to 7603100



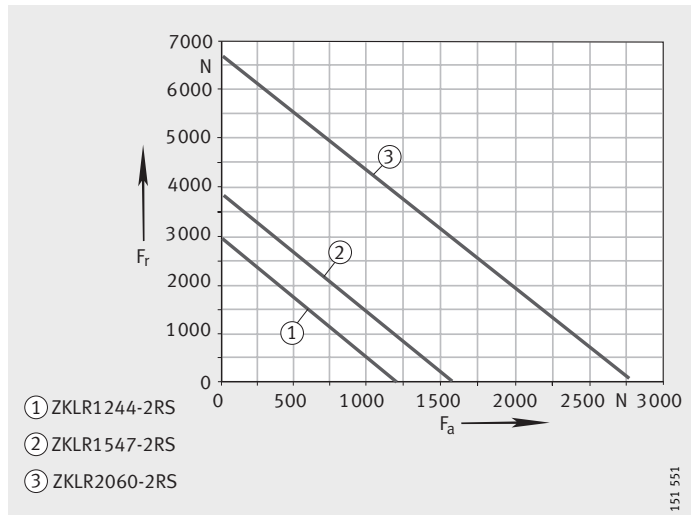
F_a = axial load
 F_r = radial load

Figure 21
 Static limiting load diagrams
 ZKLR



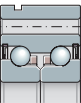
F_a = axial load
 F_r = radial load

Figure 22
 Static limiting load diagrams
 ZKLR



F_a = 300 N
 F_r = 600 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



Axial angular contact ball bearings

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 used are as stated in the dimension tables to DIN EN ISO 4 762, the maximum radial load that can be supported before the outer ring moves, in the case of dry components, is restricted to $\approx 0,1 \times C_{0a}$. If the outer ring is additionally bonded in place using, for example, Loctite 638, the maximum radial load that can be supported increases to approx. $\approx 0,5 \times C_{0a}$.

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 as restricted by the rolling element set.

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.

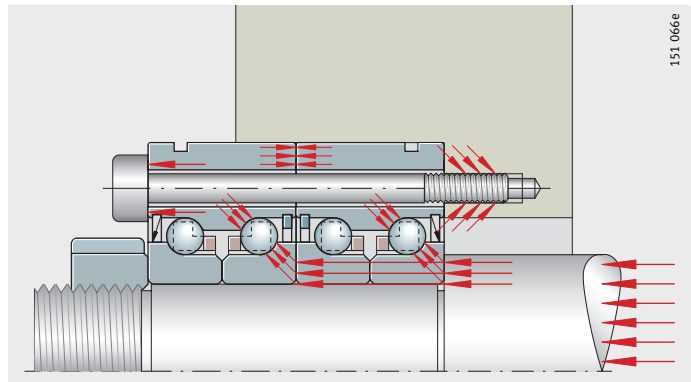


Figure 24
Static axial load in the direction of the screw connections

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.

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.



Matched bearings

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
- operating duration 25%
- max. equilibrium temperature +50 °C.

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.

Axial angular contact ball bearings

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 unsealed 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.

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	W
Frictional energy	
M_{RL}	Nm
Bearing frictional torque	
n	min^{-1}
Operating speed.	

In any analysis of the thermal balance, the various operating speeds n_i and their corresponding time portions q_i must be taken into consideration.

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.



For higher bearing temperatures and open bearings, recirculating oil lubrication should be used.

Grease lubrication Bearings with a relubrication facility of series ZKLN, ZKLF, ZKLFA and DKLFA are greased with a lithium soap grease to GA28 and are preferably run with grease lubrication. 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 us.

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



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 conditions, please contact us:

- if the bearings are stationary
- if vibration is present
- if very small oscillating movements occur.

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 of 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



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 us before carrying out any reassembly.

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

Axial angular contact ball bearings ZKLN, 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.

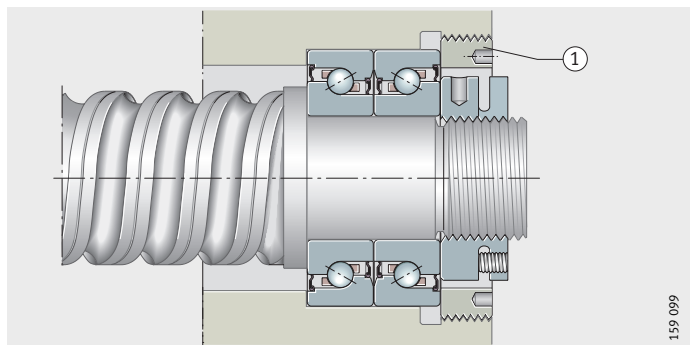
Outer rings are axially tensioned to the preload force given in the dimension table by means of a ring nut (not supplied), *Figure 25*. Secure the ring nut against loosening (using, for example, Loctite 638).

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.

ZKLN, 7602, 7603, BSB

① Ring nut

Figure 25
Two-bearing set in O arrangement, locknut, ring nut



159 099

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).

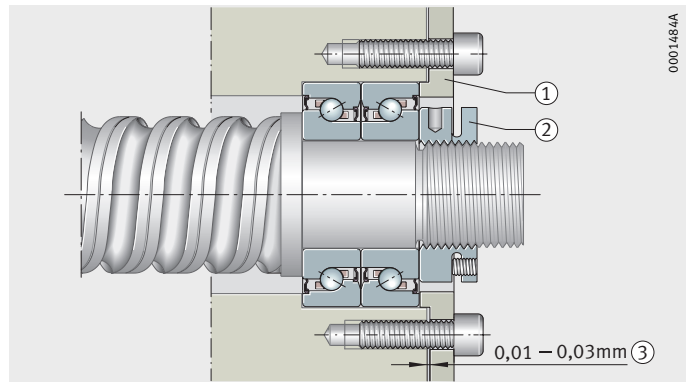


Observe the axial preload force in the dimension table. If other values are used, this will influence the bearing preload, bearing friction and heat generation in the bearing position.

ZKLN, 7602, 7603, BSB

- ① Cover
- ② Locknut
- ③ Gap before tightening of the cover fixing screws

Figure 26
Two-bearing set in O arrangement,
locknut, cover



Axial angular contact ball bearings

Location of inner ring using locknut

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

When preloading 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 contact 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 grub 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.



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 runout accuracy of the end face to the thread of 5 μm 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 proof stress.

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 pre-load after fitting. They can often therefore be located on the spindle simply by means of clearance-free clamping.



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.

Fitting

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

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

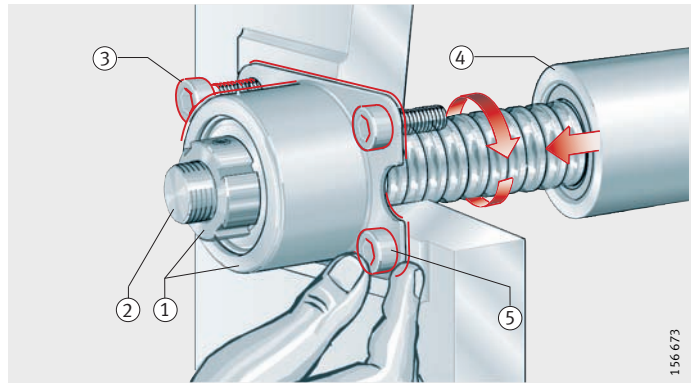
Move the screw drive nut ④ towards the bearing unit (the position of the screw drive is the datum for the linear guidance system, the nut serves as a functional element for alignment). The bearing will align itself to the optimum radial position (due to the constraining forces exerted by the datum).

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



ZKLR

- ① Locknut
- ② Threaded spindle
- ③ Tightening of fixing screws finger tight
- ④ Screw drive nut
- ⑤ Tightening of fixing screws

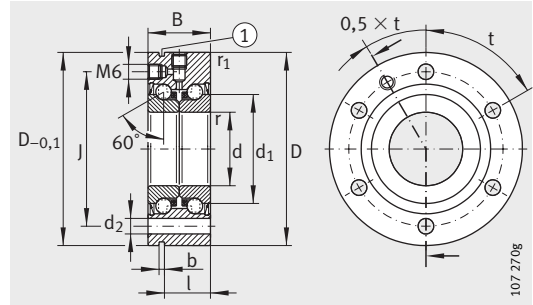


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Figure 27
Fitting of bearing unit

Axial angular contact ball bearings

For screw mounting



ZKLF..-2RS, ZKLF..-2Z (d ≤ 50 mm)

① Extraction slot

Dimension table - Dimensions in mm

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

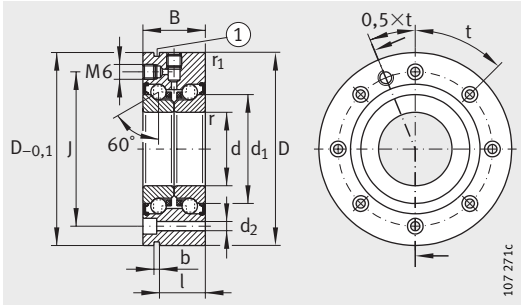
¹⁾ Tightening torque of fixing screws according to manufacturer's data. Screws are not included in the delivery.

²⁾ Mass moment of inertia for rotating inner ring.

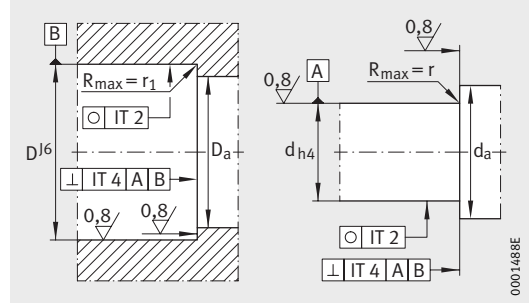
³⁾ Heavy series.

⁴⁾ Only valid in conjunction with INA precision locknuts.

⁵⁾ The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.



ZKL.-2Z, ($60 \text{ mm} \leq d \leq 100 \text{ mm}$)
 ① Extraction slot



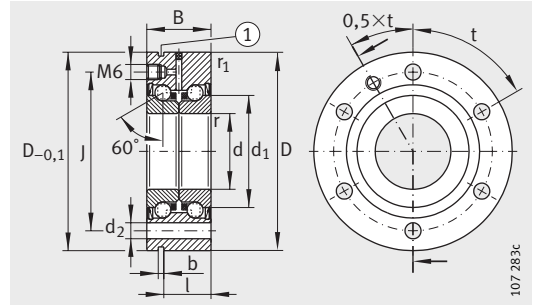
Design of adjacent construction

Pitch t	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 ²⁾ M_m	Axial run-out ⁵⁾	Recommended INA locknut; to be ordered separately			
	dyn. C_a	stat. C_{0a}							Designation	Tightening torque ⁴⁾ M_A Nm	Axial pre-load force N	
Quantity Xt	N	N	min^{-1}	Nm	$\text{N}/\mu\text{m}$	Nm/mrad	$\text{kg} \cdot \text{cm}^2$	μm				
3X120°	16900	24700	3800	0,16	375	50	0,068	2	ZM12	–	8	5038
3X120°	16900	24700	7600	0,08	375	50	0,068	2	ZM12	–	8	5038
3X120°	17900	28000	3500	0,2	400	65	0,102	2	ZM15	AM15	10	5484
3X120°	17900	28000	7000	0,1	400	65	0,102	2	ZM15	AM15	10	5484
3X120°	18800	31000	3300	0,24	450	80	0,132	2	ZM17	AM17	15	7157
3X120°	18800	31000	6600	0,12	450	80	0,132	2	ZM17	AM17	15	7157
4X 90°	26000	47000	3000	0,3	650	140	0,273	2	ZM20	AM20	18	9079
4X 90°	26000	47000	5400	0,15	650	140	0,273	2	ZM20	AM20	18	9079
4X 90°	27500	55000	2600	0,4	750	200	0,486	2	ZM25	AM25	25	9410
4X 90°	27500	55000	4700	0,2	750	200	0,486	2	ZM25	AM25	25	9410
6X 60°	29000	64000	2200	0,5	850	300	0,73	2,5	ZM30	AM30	32	10451
6X 60°	29000	64000	4300	0,25	850	300	0,73	2,5	ZM30	AM30	32	10451
8X 45°	59000	108000	2100	0,8	950	400	1,91	2,5	ZMA30/52	AM30	65	19509
8X 45°	59000	108000	4000	0,4	950	400	1,91	2,5	ZMA30/52	AM30	65	19509
4X 90°	41000	89000	2000	0,6	900	400	1,51	2,5	ZM35	AM35/58	40	10770
4X 90°	41000	89000	3800	0,3	900	400	1,51	2,5	ZM35	AM35/58	40	10770
4X 90°	43000	101000	1800	0,7	1000	550	2,26	2,5	ZM40	AM40	55	13412
4X 90°	43000	101000	3300	0,35	1000	550	2,26	2,5	ZM40	AM40	55	13412
12X 30°	72000	149000	1600	1,3	1200	750	5,5	2,5	ZMA40/62	AM40	110	25185
12X 30°	72000	149000	3100	0,65	1200	750	5,5	2,5	ZMA40/62	AM40	110	25185
6X 60°	46500	126000	1500	0,9	1250	1000	5,24	2,5	ZM50	AM50	85	17009
6X 60°	46500	126000	3000	0,45	1250	1000	5,24	2,5	ZM50	AM50	85	17009
12X 30°	113000	250000	1200	2,6	1400	1500	15,2	2,5	ZMA50/75	AM50	150	29436
12X 30°	113000	250000	2500	1,3	1400	1500	15,2	2,5	ZMA50/75	AM50	150	29436
8X 45°	84000	214000	3000	1	1300	1650	13,7	3	ZMA60/98	AM60	100	17893
8X 45°	88000	241000	2800	1,2	1450	2250	19,8	3	ZMA70/110	AM70	130	19717
8X 45°	91000	265000	2700	1,4	1600	3000	27,6	3	ZMA80/120	AM80	160	20604
8X 45°	135000	395000	2300	2,3	1700	4400	59,9	3	ZMA90/130	AM90	200	25198
8X 45°	140000	435000	2150	2,6	1900	5800	85,3	3	ZMA100/140	AM100	250	28760



Axial angular contact ball bearings

For screw mounting
Less stringent tolerances



ZKLF...-2RS-PE
① Extraction slot

Dimension table - Dimensions in mm

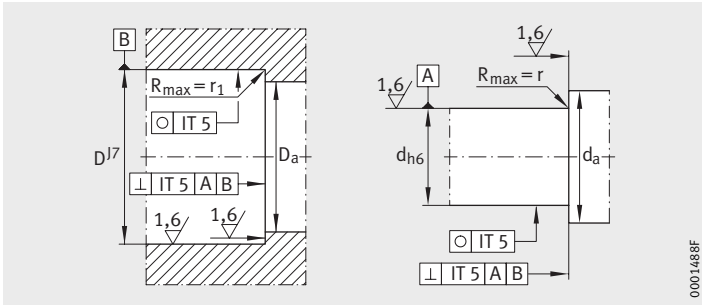
Designation	Mass m	Dimensions										Mounting dimensions		Fixing screws ¹⁾ DIN 912-10.9	
		d	D	B	d ₁	r	r ₁	J	d ₂	b	l	D _a	d _a	Size	Quantity
		≈kg	-0,01		-0,25		min.	min.					max.		
ZKLF1255-2RS-PE	0,37	12	55 _{-0,013}	25	25	0,3	0,6	42	6,8	3	17	33	16	M6	3
ZKLF1560-2RS-PE	0,43	15	60 _{-0,013}	25	28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

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

²⁾ Mass moment of inertia for rotating inner ring.

³⁾ Only valid in conjunction with INA precision locknuts.

⁴⁾ The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.



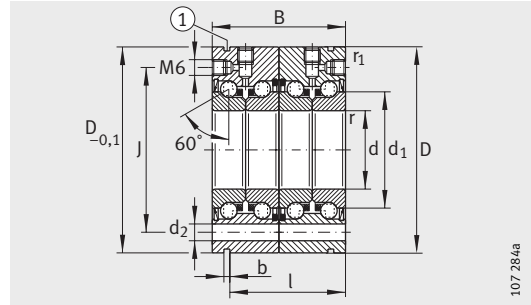
Design of adjacent construction

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 ²⁾ M_m	Axial run-out ⁴⁾ μm	Recommended INA locknut; to be ordered separately		
	dyn. C_a	stat. C_{0a}							Designation	Tightening torque ³⁾ M_A Nm	Axial preload force N
t	N	N	min^{-1}	Nm	N/ μm	Nm/mrad	$kg \cdot cm^2$	μm			
3X120°	16 900	24 700	3 800	0,16	375	50	0,068	5	ZM12 –	8	5 038
3X120°	17 900	28 000	3 500	0,2	400	65	0,102	5	ZM15 AM15	10	5 484
3X120°	18 800	31 000	3 300	0,24	450	80	0,132	5	ZM17 AM17	15	7 157
4X 90°	26 000	47 000	3 000	0,3	650	140	0,273	5	ZM20 AM20	18	9 079
4X 90°	27 500	55 000	2 600	0,4	750	200	0,486	5	ZM25 AM25	25	9 410
6X 60°	29 000	64 000	2 200	0,5	850	300	0,73	5	ZM30 AM30	32	10 451
4X 90°	41 000	89 000	2 000	0,6	900	400	1,51	5	ZM35 AM35/58	40	10 770
4X 90°	43 000	101 000	1 800	0,7	1 000	550	2,26	5	ZM40 AM40	55	13 412
6X 60°	46 500	126 000	1 500	0,9	1 250	1 000	5,24	5	ZM50 AM50	85	17 009



Axial angular contact ball bearings

For screw mounting
Matched pair



ZKL...-2RS-2AP
① Extraction slot

Dimension table - Dimensions in mm

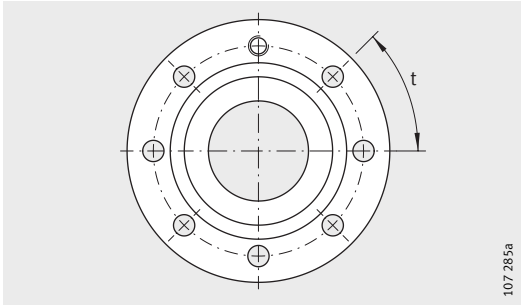
Designation	Mass m ≈kg	Dimensions											Mounting dimensions		Fixing screws ¹⁾ DIN 912-10.9	
		d	D	B	d ₁	r	r ₁	J	d ₂	l	b	D _a	d _a	Size	Quantity	
		-0,005	-0,010	-0,50		min.	min.					max.	min.			
ZKL1762-2RS-2AP	0,9	17	62	50	30	0,3	0,6	48	6,8	42	3	37	23	M6X60	5	
ZKL2068-2RS-2AP	1,22	20	68	56	34,5	0,3	0,6	53	6,8	47	3	43	25	M6X70	7	
ZKL2575-2RS-2AP	1,44	25	75	56	40,5	0,3	0,6	58	6,8	47	3	48	32	M6X70	7	
ZKL3080-2RS-2AP	1,56	30	80	56	45,5	0,3	0,6	63	6,8	47	3	53	40	M6X70	11	
ZKL3590-2RS-2AP	2,26	35	90	68	52	0,3	0,6	75	8,8	59	3	62	45	M8X80	7	
ZKL40100-2RS-2AP	2,92	40	100	68	58	0,3	0,6	80	8,8	59	3	67	50	M8X80	7	
ZKL50115-2RS-2AP	3,72	50	115	68	72	0,3	0,6	94	8,8	59	3	82	63	M8X80	11	

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

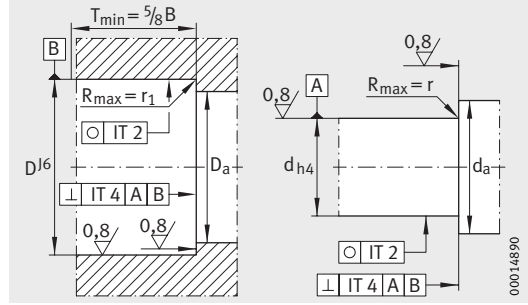
²⁾ Mass moment of inertia for rotating inner ring.

³⁾ Only valid in conjunction with INA precision locknuts.

⁴⁾ The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.



Hole pattern



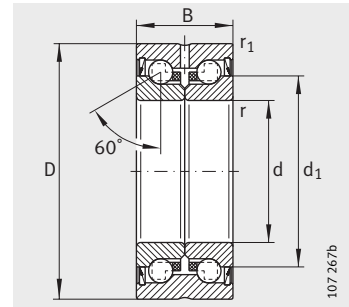
Design of adjacent construction

Pitch	Basic load ratings axial		Limiting speed	Bearing frictional torque	Rigidity axial	Tilting rigidity	Mass moment of inertia ²⁾	Axial run-out ⁴⁾	Recommended INA locknut; to be ordered separately		
	dyn. C _a	stat. C _{0a}							Designation	Tightening torque ³⁾	Axial preload force
t	N	N	n _G grease	M _{RL}	c _{aL}	c _{kL}	M _m	μm		M _A Nm	N
Quantity Xt	N	N	min ⁻¹	Nm	N/μm	Nm/mrad	kg · cm ²	μm			
6X60°	30 500	62 000	3 300	0,36	800	200	0,264	2	ZM17 AM17	15	7 157
8X45°	42 000	94 000	3 000	0,45	1 150	320	0,564	2	ZMA20/38 AM20	18	9 079
8X45°	44 500	111 000	2 600	0,6	1 300	450	0,972	2	ZMA25/45 AM25	25	9 410
12X30°	47 500	127 000	2 200	0,75	1 500	620	1,46	2,5	ZMA30/52 AM30	32	10 451
8X45°	66 000	177 000	2 000	0,9	1 600	900	3,02	2,5	ZMA35/58 AM35/58	40	10 770
8X45°	70 000	202 000	1 800	1,05	1 750	1 200	4,52	2,5	ZMA40/62 AM40	55	13 412
12X30°	76 000	250 000	1 500	1,35	2 200	2 250	10,48	2,5	ZMA50/75 AM50	85	17 009



Axial angular contact ball bearings

Not for screw mounting



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

Dimension table - Dimensions in mm

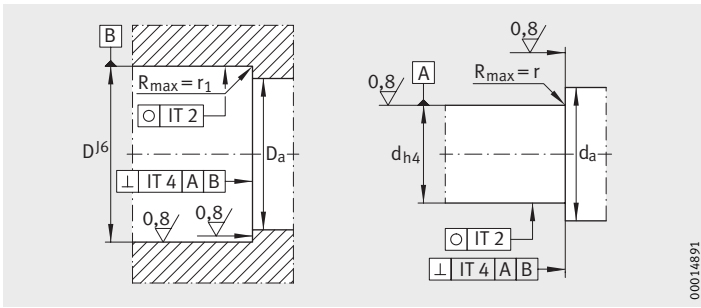
Designation	Mass m ≈kg	Dimensions						Mounting dimensions		Basic load ratings axial	
		d	D	B	d ₁	r	r ₁	D _a	d _a	dyn. C _a	stat. C _{0a}
		-0,005	-0,010	-0,25		min.	min.	max.	min.	N	N
ZKLN0619-2Z	0,02	6 ^{+0,002} _{-0,003}	19	12	12	0,3	0,3	16	9	4 900	6 100
ZKLN0624-2RS	0,03	6 ^{+0,002} _{-0,003}	24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

¹⁾ Mass moment of inertia for rotating inner ring.

²⁾ Heavy series.

³⁾ Only valid in conjunction with INA precision locknuts.

⁴⁾ The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.



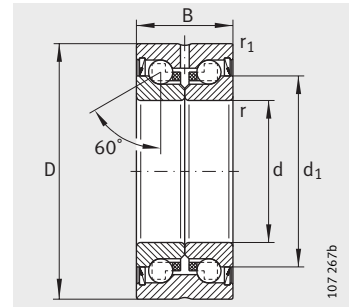
Design of adjacent construction

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



Axial angular contact ball bearings

Not for screw mounting



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

Dimension table (continued) · Dimensions in mm

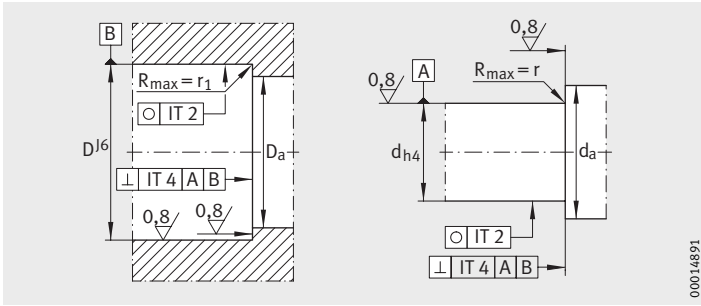
Designation	Mass m ≈ kg	Dimensions						Mounting dimensions		Basic load ratings axial	
		d	D	B	d ₁	r	r ₁	D _a max.	d _a min.	dyn. C _a N	stat. C _{0a} N
ZKLN4075-2RS	0,61	40_{-0,005}	75 _{-0,01}	34	58	0,3	0,6	67	50	43 000	101 000
ZKLN4075-2Z	0,61	40_{-0,005}	75 _{-0,01}	34	58	0,3	0,6	67	50	43 000	101 000
ZKLN4090-2RS²⁾	0,95	40_{-0,005}	90 _{-0,01}	46	65	0,6	0,6	80	56	72 000	149 000
ZKLN4090-2Z²⁾	0,95	40_{-0,005}	90 _{-0,01}	46	65	0,6	0,6	80	56	72 000	149 000
ZKLN5090-2RS	0,88	50_{-0,005}	90 _{-0,01}	34	72	0,3	0,6	82	63	46 500	126 000
ZKLN5090-2Z	0,88	50_{-0,005}	90 _{-0,01}	34	72	0,3	0,6	82	63	46 500	126 000
ZKLN50110-2RS²⁾	2,5	50_{-0,005}	110 _{-0,01}	54	80	0,6	0,6	98	63	113 000	250 000
ZKLN50110-2Z²⁾	2,5	50_{-0,005}	110 _{-0,01}	54	80	0,6	0,6	98	63	113 000	250 000
ZKLN60110-2Z	2,2	60_{-0,008}	110 _{-0,015}	45	85	0,6	0,6	100	82	84 000	214 000
ZKLN70120-2Z	2,4	70_{-0,008}	120 _{-0,015}	45	95	0,6	0,6	110	92	88 000	241 000
ZKLN80130-2Z	2,7	80_{-0,008}	130 _{-0,015}	45	105	0,6	0,6	120	102	91 000	265 000
ZKLN90150-2Z	4,5	90_{-0,008}	150 _{-0,015}	55	120	0,6	0,6	138	116	135 000	395 000
ZKLN100160-2Z	4,9	100_{-0,008}	160 _{-0,015}	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.

4) The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.



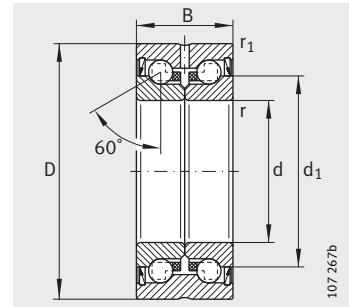
Design of adjacent construction

Limiting speed n_G grease min^{-1}	Bearing frictional torque M_{RL} Nm	Rigidity axial c_{aL} N/ μm	Tilting rigidity c_{kL} Nm/mrad	Mass moment of inertia ¹⁾ M_m kg · cm ²	Axial runout ⁴⁾ μm	Recommended INA locknut; to be ordered separately			
						Designation	Tightening torque ³⁾ M_A Nm	Axial preload force N	
1 800	0,7	1 000	550	2,26	2,5	ZM40	AM40	55	13 412
3 300	0,35	1 000	550	2,26	2,5	ZM40	AM40	55	13 412
1 600	1,3	1 200	750	5,5	2,5	ZMA40/62	AM40	110	25 185
3 100	0,65	1 200	750	5,5	2,5	ZMA40/62	AM40	110	25 185
1 500	0,9	1 250	1 000	5,24	2,5	ZM50	AM50	85	17 009
3 000	0,45	1 250	1 000	5,24	2,5	ZM50	AM50	85	17 009
1 200	2,6	1 400	1 500	15,2	2,5	ZMA50/75	AM50	150	29 436
2 500	1,3	1 400	1 500	15,2	2,5	ZMA50/75	AM50	150	29 436
3 000	1	1 300	1 650	13,7	3	ZMA60/98	AM60	100	17 893
2 800	1,2	1 450	2 250	19,8	3	ZMA70/110	AM70	130	19 171
2 700	1,4	1 600	3 000	27,6	3	ZMA80/120	AM80	160	20 604
2 300	2,3	1 700	4 400	59,9	3	ZMA90/130	AM90	200	25 198
2 150	2,6	1 900	5 800	85,3	3	ZMA100/140	AM100	250	28 760



Axial angular contact ball bearings

Not for screw mounting
Less stringent tolerances



ZKLN...-2RS-PE

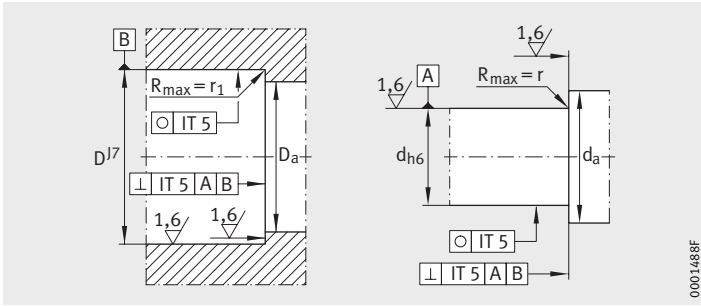
Dimension table - Dimensions in mm

Designation	Mass m ≈kg	Dimensions						Mounting dimensions		Basic load ratings axial	
		d	D	B	d ₁	r	r ₁	D _a	d _a	dyn. C _a	stat. C _{0a}
				-0,25		min.	min.	max.	min.	N	N
ZKLN0624-2RS-PE	0,03	6 ^{+0,003} _{-0,005}	24 _{-0,01}	15	14	0,3	0,6	19	9	6 900	8 500
ZKLN1034-2RS-PE	0,1	10 _{-0,008}	34 _{-0,011}	20	21	0,3	0,6	28	14	13 400	18 800
ZKLN1242-2RS-PE	0,2	12 _{-0,01}	42 _{-0,011}	25	25	0,3	0,6	33	16	16 900	24 700
ZKLN1545-2RS-PE	0,21	15 _{-0,01}	45 _{-0,011}	25	28	0,3	0,6	35	20	17 900	28 000
ZKLN1747-2RS-PE	0,22	17 _{-0,01}	47 _{-0,011}	25	30	0,3	0,6	37	23	18 800	31 000
ZKLN2052-2RS-PE	0,31	20 _{-0,01}	52 _{-0,013}	28	34,5	0,3	0,6	43	25	26 000	47 000
ZKLN2557-2RS-PE	0,34	25 _{-0,01}	57 _{-0,013}	28	40,5	0,3	0,6	48	32	27 500	55 000
ZKLN3062-2RS-PE	0,39	30 _{-0,01}	62 _{-0,013}	28	45,5	0,3	0,6	53	40	29 000	64 000
ZKLN3572-2RS-PE	0,51	35 _{-0,01}	72 _{-0,013}	34	52	0,3	0,6	62	45	41 000	89 000
ZKLN5090-2RS-PE	0,88	50 _{-0,01}	90 _{-0,015}	34	72	0,3	0,6	82	63	46 500	126 000

1) Mass moment of inertia for rotating inner ring.

2) Only valid in conjunction with INA precision locknuts.

3) The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.



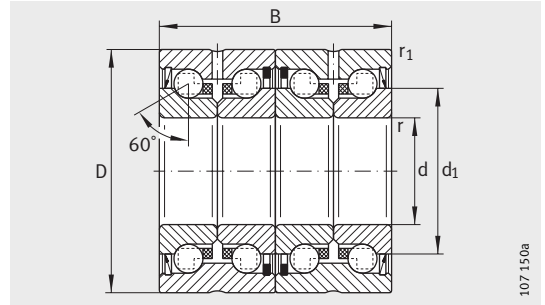
Design of adjacent construction

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



Axial angular contact ball bearings

Not for screw mounting
Matched pair

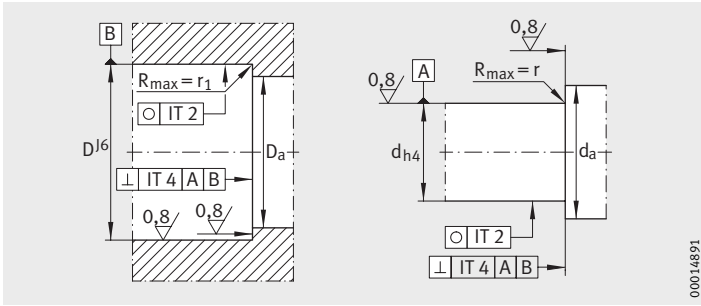


ZKLN...-2RS-2AP

Dimension table - Dimensions in mm

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

- 1) Mass moment of inertia for rotating inner ring.
- 2) Only valid in conjunction with INA precision locknuts.
- 3) The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.



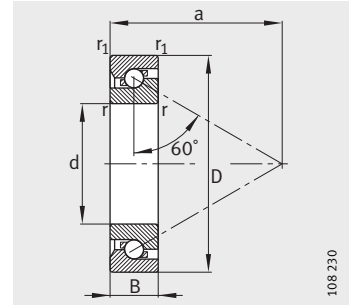
Design of adjacent construction

Limiting speed n_G grease min^{-1}	Bearing frictional torque M_{RL} Nm	Rigidity axial c_{aL} $\text{N}/\mu\text{m}$	Tilting rigidity c_{kL} Nm/mrad	Mass moment of inertia ¹⁾ M_m $\text{kg} \cdot \text{cm}^2$	Axial runout ³⁾ μm	Recommended INA locknut; to be ordered separately		
						Designation	Tightening torque ²⁾ M_A Nm	Axial preload force N
3 300	0,36	800	200	0,264	2	ZM17 AM17	15	7 157
3 000	0,45	1 150	320	0,546	2	ZMA20/38 AM20	18	9 079
2 600	0,6	1 300	450	0,972	2	ZMA25/45 AM25	25	9 410
2 200	0,75	1 500	620	1,46	2,5	ZMA30/52 AM30	32	10 451
2 000	0,9	1 600	900	3,02	2,5	ZMA35/58 AM35/58	40	10 770
1 800	1,05	1 750	1 200	4,52	2,5	ZMA40/62 AM40	55	13 412
1 500	1,35	2 200	2 250	10,48	2,5	ZMA50/75 AM50	85	17 009



Axial angular contact ball bearings

Single direction



7602, 7603, BSB

Dimension table - Dimensions in mm

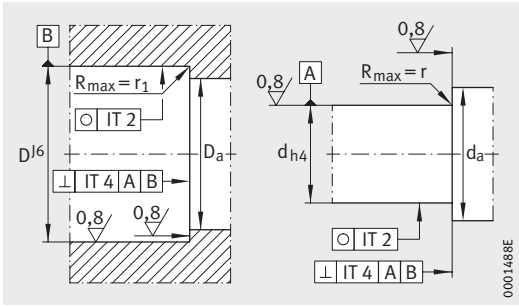
Designation	Mass m ≈kg	Dimensions					Mounting dimensions		Basic load ratings axial	
		d	D	B	r, r ₁ min.	a ≈	D _a H12	d _a h12	dyn. C _a N	stat. C _{0a} N
7602012-TVP	0,042	12 _{-0,004}	32 _{-0,006}	10 _{-0,08}	0,6	24	27	17	12 200	20 700
7602015-TVP	0,052	15 _{-0,004}	36 _{-0,006}	11 _{-0,08}	0,6	27,5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

4) The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.



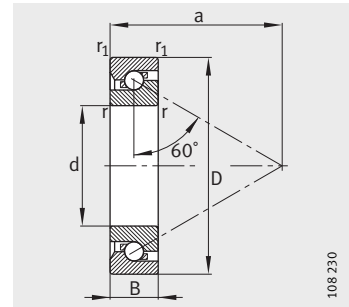
Design of adjacent construction

Limiting speed n_G grease min^{-1}	Bearing frictional torque ²⁾ M_{RL} Nm	Rigidity ¹⁾ axial c_{aL} N/ μm	Axial runout ⁴⁾ μm	Recommended INA locknut; to be ordered separately		
				Designation	Tightening torque ³⁾ M_A Nm	Axial preload force N
8 000	0,015	476	2	ZM12 AM12	8	6 110
6 700	0,02	516	2	ZM15 AM15	10	5 740
6 000	0,03	596	2	ZM17 AM17	15	8 060
5 000	0,05	703	2	ZM20 AM20	18	8 490
5 600	0,05	703	2	ZM20 AM20	18	8 490
4 500	0,06	787	2	ZM20 AM20	25	11 600
4 500	0,065	772	2	ZM25 AM25	25	9 430
4 300	0,085	917	2	ZM25 AM25	40	14 480
3 800	0,085	917	2	ZM25 AM25	40	14 480
4 200	0,085	893	2	ZM30 AM30	32	10 240
3 800	0,085	893	2	ZM30 AM30	32	10 240
3 200	0,13	1 073	2	ZM30 AM30	55	16 180
3 700	0,115	1 020	2	ZM35 AM35	40	11 310
3 200	0,115	1 020	2	ZM35 AM35	40	11 310
3 000	0,17	1 192	2	ZM35 AM35	65	17 380
3 500	0,115	1 016	2	ZM40 AM40	40	10 190
2 800	0,17	1 190	2	ZM40 AM40	55	13 330
3 100	0,225	1 292	2	ZM40 AM40	110	25 120
2 600	0,225	1 292	2	ZM40 AM40	110	25 120
3 300	0,13	1 072	2	ZM45 AM45	50	11 140
2 600	0,19	1 247	2	ZM45 AM45	65	14 410
2 700	0,3	1 473	2	ZM45 AM45	120	25 160
2 200	0,3	1 473	2	ZM45 AM45	120	25 160
2 400	0,23	1 360	2	ZM50 AM50	85	16 810
2 700	0,33	1 473	2	ZM50 AM50	120	23 770
2 000	0,36	1 601	2	ZM50 AM50	150	28 930
2 800	0,19	1 246	3	ZM55 AM55	60	12 040
2 200	0,25	1 394	3	ZM55 AM55	85	15 060
2 400	0,36	1 553	3	ZM55 AM55	110	20 070
1 900	0,46	1 723	3	ZM55 AM55	130	24 120



Axial angular contact ball bearings

Single direction



7602, 7603, BSB

Dimension table (continued) · Dimensions in mm

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

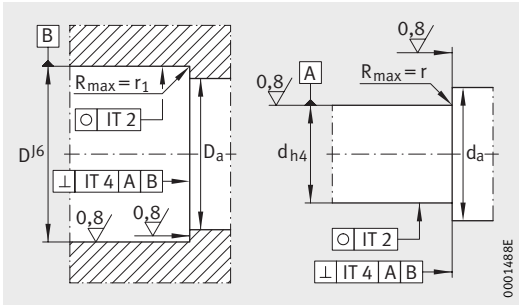
1) Valid for matched pair of bearings in O or X arrangement.

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.

5) The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.



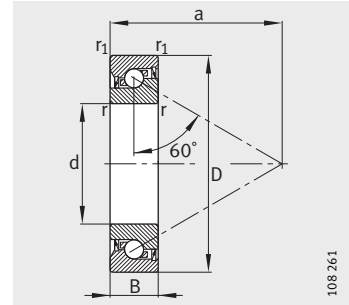
Design of adjacent construction

Basic load ratings axial		Limiting speed n_G grease	Bearing frictional torque ²⁾ M_{RL}	Rigidity ¹⁾ axial c_{aL}	Axial runout ⁵⁾ μm	Recommended INA locknut; to be ordered separately			
dyn. C_a	stat. C_{0a}					Designation	Tightening torque ³⁾ M_A Nm	Axial preload force N	
N	N	min^{-1}	Nm	N/ μm	μm				
58 000	183 000	2 000	0,35	1 623	3	ZM60	AM60	100	17 410
64 000	196 000	2 300	0,38	1 623	3	ZM60	AM60	120	20 020
92 000	270 000	1 800	0,54	1 840	3	ZM60	AM60	150	25 840
60 000	197 000	1 800	0,41	1 753	3	ZM65	AM65	110	17 680
106 000	330 000	1 600	0,7	2 052	3	ZM65	AM65	150	25 290
68 000	220 000	1 800	0,44	1 753	3	ZM70	AM70	115	17 300
117 000	360 000	1 600	0,76	2 108	3	ZM70	AM70	180	27 640
37 000	133 000	2 300	0,29	1 534	3	ZM75	AM75	140	18 560
70 000	236 000	1 600	0,48	1 888	3	ZM75	AM75	160	22 820
132 000	425 000	1 400	0,92	2 335	3	ZM75	AM75	200	29 360
81 000	275 000	1 500	0,6	2 047	3	ZM80	AM80	160	21 620
144 000	465 000	1 400	1,1	2 466	3	ZM80	AM80	220	31 020
95 000	340 000	1 400	0,76	2 209	3	ZM85	AM85	250	30 460
169 000	550 000	1 300	1,25	2 539	3	ZM85	AM85	280	36 310
102 000	365 000	1 400	0,79	2 275	3	ZM90	AM90	250	29 160
172 000	580 000	1 200	1,3	2 654	3	ZM90	AM90	300	37 360
116 000	410 000	1 300	0,95	2 435	3	–	–	–	31 700
175 000	600 000	1 200	1,45	2 770	3	–	–	–	38 280
73 000	265 000	1 800	0,6	2 052	3	ZM100	AM100	200	21 190
128 000	465 000	1 200	1,1	2 594	3	ZM100	AM100	255	29 150
201 000	700 000	1 100	1,7	2 965	3	ZM100	AM100	305	36 330



Axial angular contact ball bearings

Single direction
Sealed

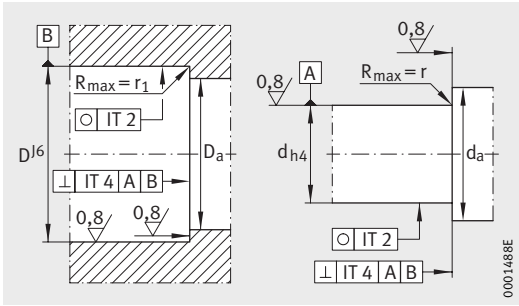


7602...-2RS, 7603...-2RS,
BSB...-2RS

Dimension table - Dimensions in mm

Designation	Mass m ≈kg	Dimensions					Mounting dimensions	
		d	D	B	r, r ₁ min.	a ≈	D _a H12	d _a h12
7602012-2RS-TVP	0,042	12_{-0,004}	32 _{-0,006}	10 _{-0,08}	0,6	24	27	17
7602015-2RS-TVP	0,052	15_{-0,004}	35 _{-0,006}	11 _{-0,08}	0,6	27,5	30	20,5
7602020-2RS-TVP	0,12	20_{-0,005}	47 _{-0,006}	14 _{-0,12}	1	36	39,5	27,5
7603020-2RS-TVP	0,17	20_{-0,005}	52 _{-0,007}	15 _{-0,12}	1,1	36,5	43,5	30,5
7602025-2RS-TVP	0,15	25_{-0,005}	52 _{-0,007}	15 _{-0,12}	1	41	45	32
BSB025062-2RS-T	0,24	25_{-0,005}	62 _{-0,007}	15 _{-0,12}	1	46,5	52	38
7603025-2RS-TVP	0,27	25_{-0,005}	62 _{-0,007}	17 _{-0,12}	1,1	47,5	52	38
BSB030062-2RS-T	0,22	30_{-0,005}	62 _{-0,007}	15 _{-0,12}	1	47,5	52,5	39,5
7602030-2RS-TVP	0,23	30_{-0,005}	62 _{-0,007}	16 _{-0,12}	1	48	52,5	39,5
BSB035072-2RS-T	0,3	35_{-0,006}	72 _{-0,007}	15 _{-0,12}	1	54	60,5	46,5
BSB040072-2RS-T	0,26	40_{-0,006}	72 _{-0,007}	15 _{-0,12}	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.
- 4) The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.



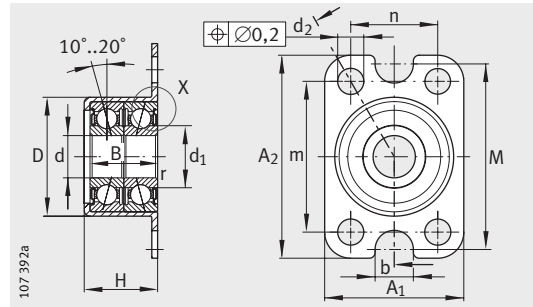
Design of adjacent construction

Basic load ratings axial		Limiting speed n_G grease	Bearing frictional torque ²⁾ M_{RL}	Rigidity ¹⁾ axial c_{aL}	Axial runout ⁴⁾ μm	Recommended INA locknut; to be ordered separately		
dyn. C_a	stat. C_{0a}					Designation	Tightening torque ³⁾ M_A Nm	Axial preload force N
N	N	min^{-1}	Nm	$\text{N}/\mu\text{m}$	μm			
12 200	20 700	8 000	0,018	476	2	ZM12 AM12	8	6 110
13 100	24 700	6 700	0,024	516	2	ZM15 AM15	10	5 740
19 100	38 000	5 000	0,06	703	2	ZM20 AM20	18	8 490
25 500	53 000	4 500	0,07	787	2	ZM20 AM20	18	11 600
23 200	50 000	3 800	0,08	772	2	ZM25 AM25	25	9 430
29 500	68 000	4 300	0,1	917	2	ZM25 AM25	40	14 480
29 500	68 000	3 800	0,1	917	2	ZM25 AM25	40	14 480
27 500	66 000	4 200	0,1	893	2	ZM30 AM30	32	10 240
27 500	66 000	3 800	0,1	893	2	ZM30 AM30	32	10 240
31 500	81 000	3 700	0,14	1 020	2	ZM35 AM35	40	11 310
29 500	82 000	3 500	0,14	1 016	2	ZM40 AM40	40	10 190



Angular contact ball bearing units

For screw mounting

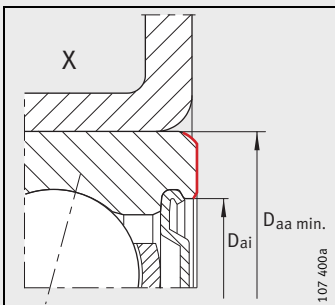


ZKLR0624-2Z, ZKLR0828-2Z

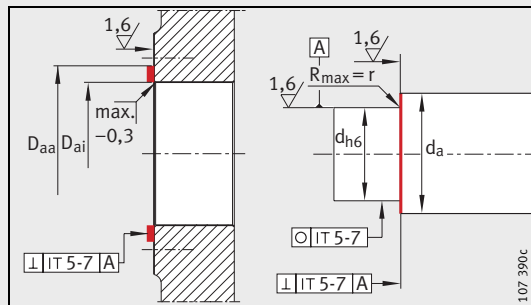
Dimension table - Dimensions in mm

Designation	Mass m ≈kg	Dimensions													
		d	A ₁	A ₂	D	B	d ₁	r	d ₂	b	m	n	M	H	d _a
ZKLR0624-2Z	0,023	6 _{-0,008}	24	35	20,5	12	10,4	0,3	4,5	6,6	26	15	32	13	8
ZKLR0828-2Z	0,03	8 _{-0,008}	28	35	23,9	14	11,8	0,3	4,5	6,6	26	20	35	15,5	10,4
ZKLR1035-2Z	0,05	10 _{-0,008}	35	35	28,14	16	14,7	0,3	4,5	-	26	26	-	17,5	12,4
ZKLR1244-2RS	0,12	12 _{-0,007}	44	50	35,45	20	16,6	0,3	6,6	-	38	32	-	22	14
ZKLR1547-2RS	0,14	15 _{-0,007}	47	51	38,45	22	18	0,3	6,6	-	39	35	-	24	17,5
ZKLR2060-2RS	0,3	20 _{-0,008}	60	60	50,45	28	24,4	0,3	6,6	-	47	47	-	30	24

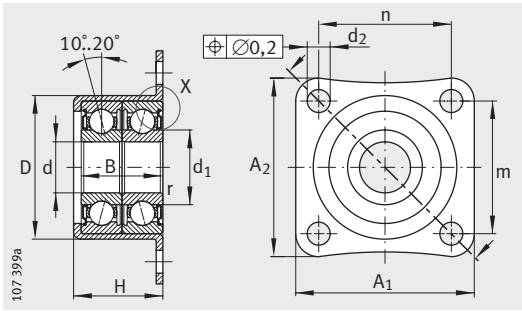
- 1) Tightening torque for the fixing screws as recommended by the manufacturer. Screws must be ordered separately.
- 2) Mass moment of inertia for rotating inner ring.
- 3) The locknut is only used to axially locate the bearing unit. It has no influence on the bearing preload.
- 4) Stated geometrical tolerances only required in diameter area between D_{ai} and D_{aa}.
- 5) Only valid in conjunction with INA precision locknuts.
- 6) Statistically determined mean values from measurements on the complete bearing.
- 7) The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.



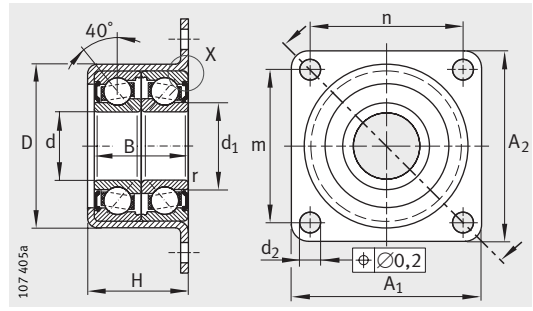
Axial abutment area of outer ring



Design of adjacent construction⁴⁾



ZKLR1035-2Z



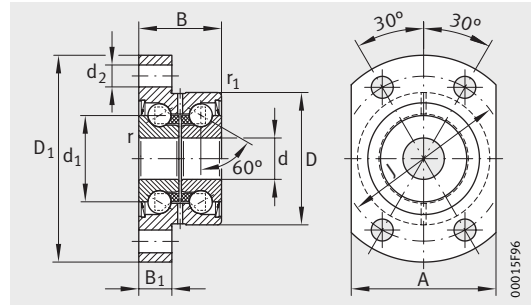
ZKLR1244-2RS, ZKLR1547-2RS, ZKLR2060-2RS

D _{ai}	D _{aa}	Fixing screws DIN 912 ¹⁾		Basic load ratings				Limiting speed n _G grease min ⁻¹	Bearing frictional torque M _{RL} Nm	Rigid- ity axial ⁶⁾ c _{aL} N/μm	Mass moment of inertia ²⁾ M _m kg · cm ²	Axial runout ⁷⁾ μm	Recommended INA locknut; to be ordered separately ³⁾	
				radial		axial							Design- ation	Tightening torque ⁵⁾ M _A Nm
				dyn. C _r N	stat. C _{0r} N	dyn. C _a N	stat. C _{0a} N							
16	19	M4	4	3 850	1 870	1 340	1 250	7 300	0,04	17	0,0014	7	ZM06	2
18	22	M4	4	4 900	2 280	1 810	1 520	6 200	0,08	20	0,0028	7	ZM08	4
22	26	M4	4	7 400	3 600	2 550	2 420	5 100	0,12	26	0,0075	7	ZM10	6
27	32	M6	4	13 600	8 500	13 200	17 900	3 700	0,16	170	0,0102	7	ZM12	8
29	35	M6	4	16 700	10 700	16 400	22 400	3 400	0,2	200	0,0178	7	ZM15	10
39	47	M6	4	28 000	19 100	27 500	40 000	2 800	0,3	250	0,263	8	ZM20	18



Double row axial angular contact ball bearings with flange

For screw mounting

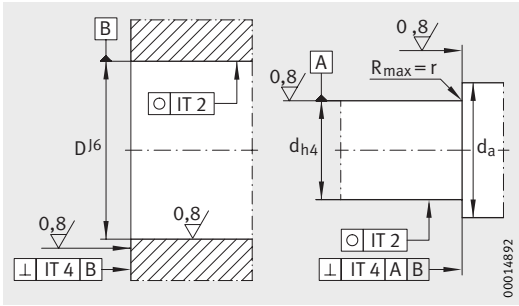


ZKLFA...-2RS, ZKLFA...-2Z

Dimension table - Dimensions in mm

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

- 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) Only valid in conjunction with INA precision locknuts.
- 4) The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.



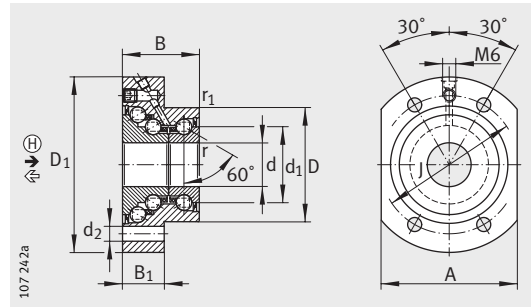
Design of adjacent construction

Fixing screws ¹⁾ DIN 912-10.9		Basic load ratings axial		Limiting speed n_G grease min^{-1}	Bearing frictional torque M_{RL} Nm	Rigid-ity axial c_{aL} $\text{N}/\mu\text{m}$	Tilting rigidity c_{kL} Nm/mrad	Mass moment of inertia ²⁾ M_m $\text{kg} \cdot \text{cm}^2$	Axial runout ⁴⁾ μm	Recommended INA locknut; to be ordered separately		
		dyn. C_a N	stat. C_{0a} N							Designation	Tight-ening torque ³⁾ M_A Nm	Axial pre-load force N
M3	4	4 900	6 100	14 000	0,01	150	4	0,0019	2	ZM06 –	2	916
M4	4	6 900	8 500	6 800	0,04	200	8	0,0044	2	ZM06 –	2	2 404
M4	4	6 900	8 500	12 000	0,02	200	8	0,0044	2	ZM06 –	2	2 404
M5	4	12 500	16 300	5 100	0,08	250	20	0,02	2	ZM08 –	4	2 216
M5	4	12 500	16 300	9 500	0,04	250	20	0,02	2	ZM08 –	4	2 216
M5	4	13 400	18 800	4 600	0,12	325	25	0,029	2	ZM10 –	6	4 891
M5	4	13 400	18 800	8 600	0,06	325	25	0,029	2	ZM10 –	6	4 891
M6	4	16 900	24 700	3 800	0,16	375	50	0,068	2	ZM12 –	8	5 038
M6	4	16 900	24 700	7 600	0,08	375	50	0,068	2	ZM12 –	8	5 038
M6	4	17 900	28 000	3 500	0,2	400	65	0,102	2	ZM15 AM15	10	5 484
M6	4	17 900	28 000	7 000	0,1	400	65	0,102	2	ZM15 AM15	10	5 484



Triple row axial angular contact ball bearings with flange

For screw mounting



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

Attention!

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

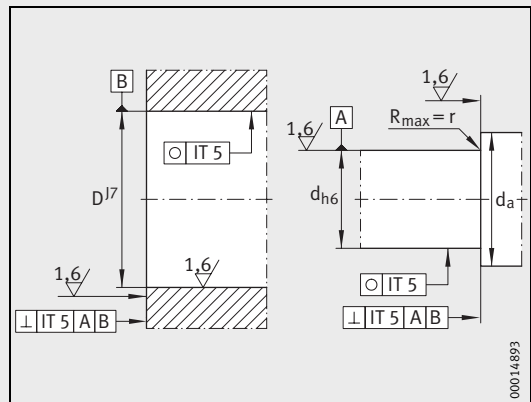
Dimension table - Dimensions in mm

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

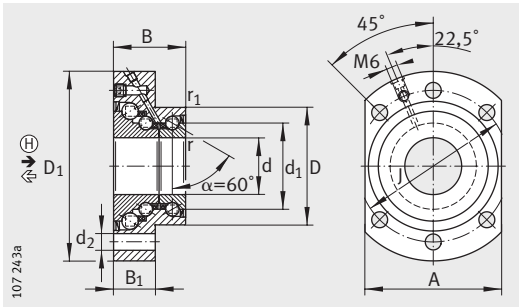
- 1) Tightening torque for the fixing screws as recommended by the manufacturer. Screws are not included in the delivery.
- 2) Mass moment of inertia for rotating inner ring.
- 3) Heavy series.
- 4) The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.

INA locknuts (accessories)

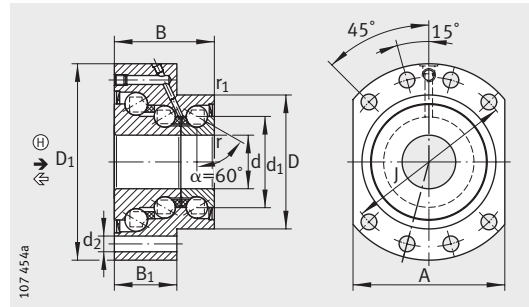
Triple row angular contact ball bearing Designation	Recommended INA locknut; to be ordered separately		
	①	②	
DKLFA1575-2RS	AM15	ZMA15/33	ZM17
DKLFA2080-2RS	AM20	ZMA20/38	ZM25
DKLFA2590-2RS	AM25	ZMA25/45	AM30
DKLFA30100-2RS	AM30	ZMA30/52	ZM35
DKLFA30110-2RS	AM30/65	-	ZM35
DKLFA40115-2RS	AM40	ZMA40/62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



Design of adjacent construction

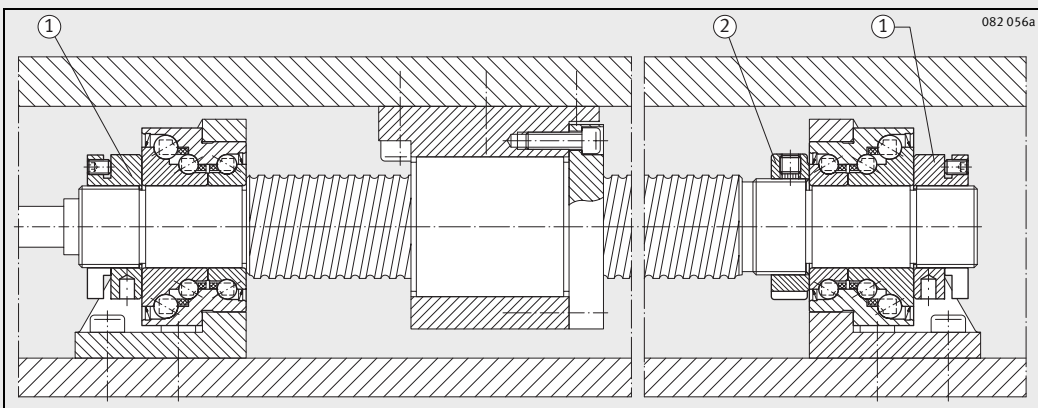


DKLFA..-2RS ($d \geq 25 \text{ mm}$)



DKLFA..-2RS
Heavy series

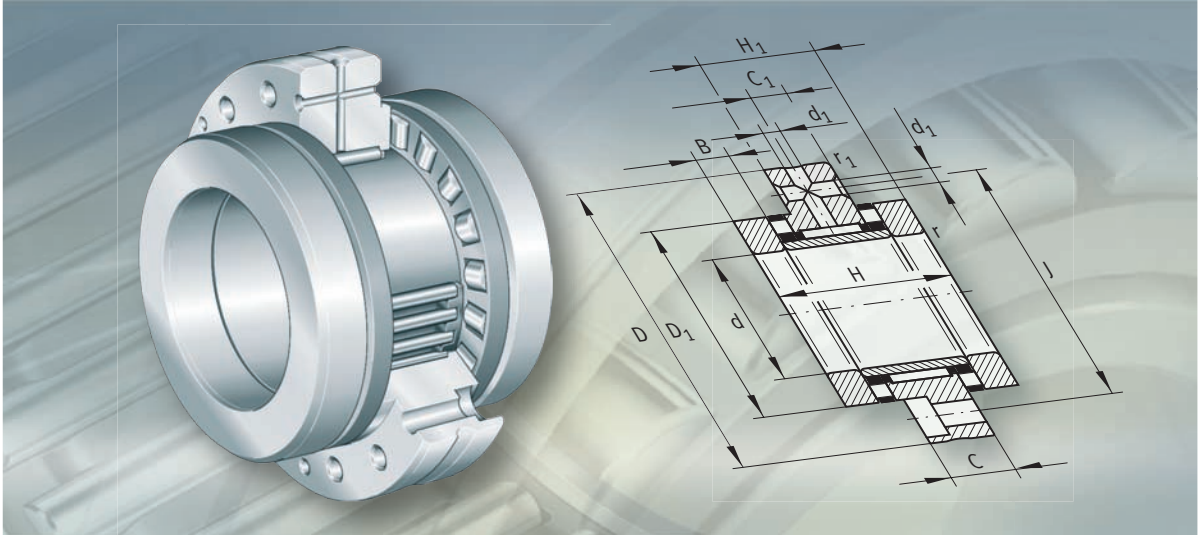
Size	Quantity	Basic load ratings				Limiting speed n_G grease min^{-1}	Bearing frictional torque M_{RL} Nm	Rigidity axial \leftarrow c_{aL} $\text{N}/\mu\text{m}$	Rigidity axial \rightarrow c_{aL} $\text{N}/\mu\text{m}$	Tilting rigidity c_{kL} Nm/mrad	Mass moment of inertia ²⁾ M_m $\text{kg} \cdot \text{cm}^2$	Axial run-out ⁴⁾ μm
		axial \leftarrow		axial \rightarrow								
		dyn. C_a	stat. C_{0a}	dyn. C_a	stat. C_{0a}							
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 spindle with locating bearing arrangement on both sides
Numbers in circles: see table INA locknuts (accessories), page 58



FAG



Needle roller/ axial cylindrical roller bearings

Needle roller/ axial cylindrical roller bearings

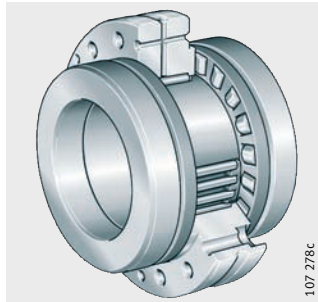
	Page
Product overview	Needle roller/axial cylindrical roller bearings 62
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	Operating temperature 64
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Product overview Needle roller/ axial cylindrical roller bearings

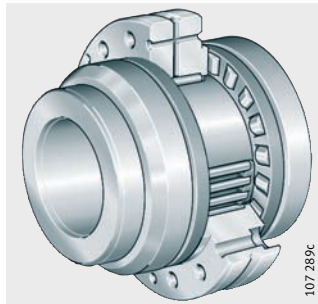
For screw mounting

ZARF



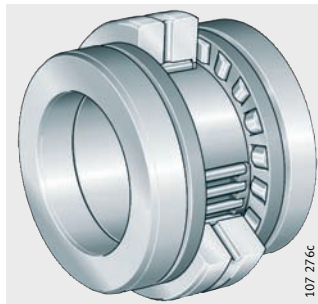
**With extended
shaft locating washer**

ZARF..-L



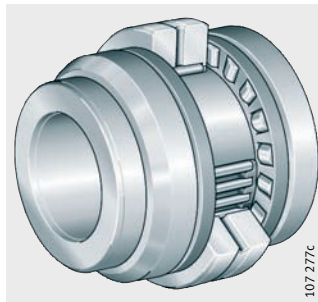
Not for screw mounting

ZARN



**With extended
shaft locating washer**

ZARN..-L



Needle roller/ axial cylindrical roller bearings

Features Needle roller/axial cylindrical roller bearings comprise an outer ring with radial and axial raceways, shaft locating washers, an inner ring, a radial needle roller and cage assembly and 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 and internal clearance The outer ring, 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.

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).

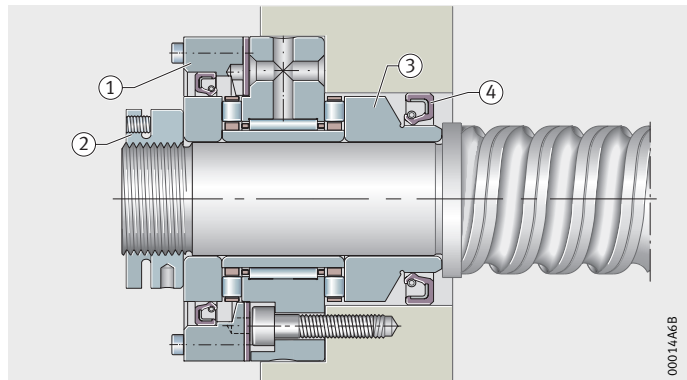
With seal carrier assembly In the interests of a simpler design, a seal carrier assembly DRS, *Figure 1*, ①, is recommended. The seal carrier assembly is centred on the outer ring and seals the bearing against outside influences.

ZARF..-L

- ① Seal carrier assembly DRS
- ② Locknut
- ③ Stepped shaft locating washer
- ④ Sealing ring

Figure 1
Stepped shaft locating washer
with sealing ring

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



Needle roller/ axial cylindrical roller bearings

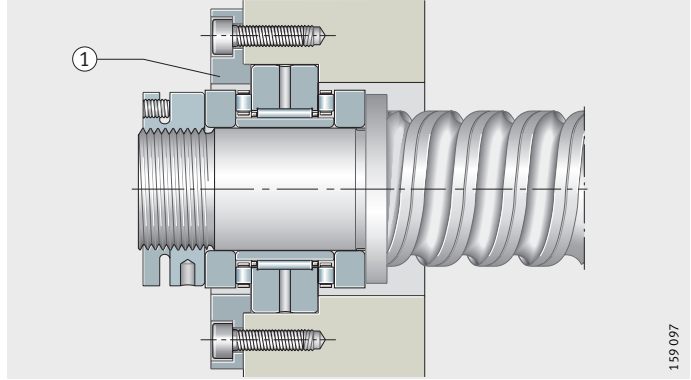
Bearings not for screw mounting

Bearings ZARN(L) are mounted in a housing bore and the outer ring is located using a cover, *Figure 2*. They are preloaded against the shaft shoulder by means of a precision locknut AM or ZM(A).

ZARN

① Cover

Figure 2
Bearing outer ring
located using cover



With extended shaft locating washer

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

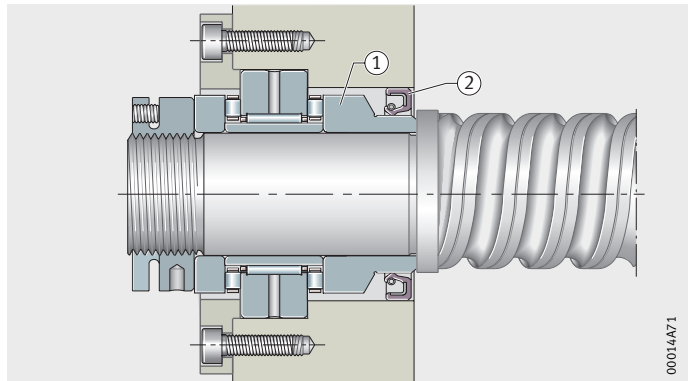
This series is used in preference where the shaft locating washer is not adequately supported axially by the shaft shoulder or the bearing unit cannot be sealed on the outside surface of the normal shaft locating washer due to space conditions in the adjacent construction.

ZARN..-L

① Stepped shaft locating washer

② Sealing ring

Figure 3
Stepped shaft locating washer with
sealing ring



Heavy series

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

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

Operating temperature

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

Suffixes

Suffixes for the available designs: see table.

Available designs

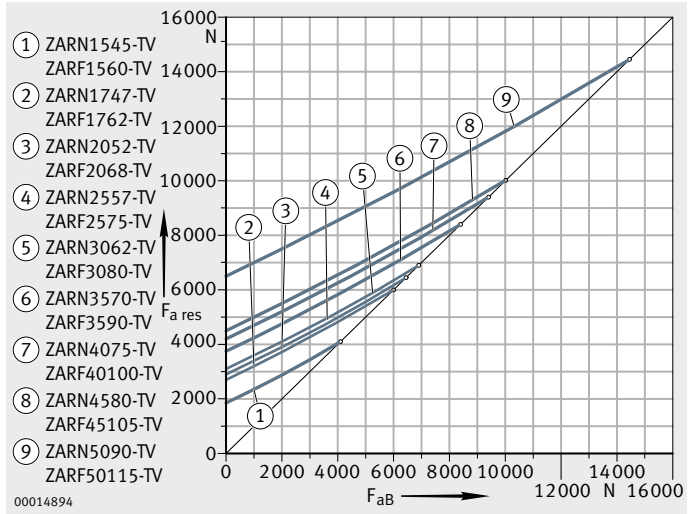
Suffix	Description	Design
L	Extended, stepped shaft locating washer	Standard
TV	Cages made from glass fibre reinforced polyamide 66	

Needle roller/ axial cylindrical roller bearings

Resultant bearing load $F_{a\ res}$

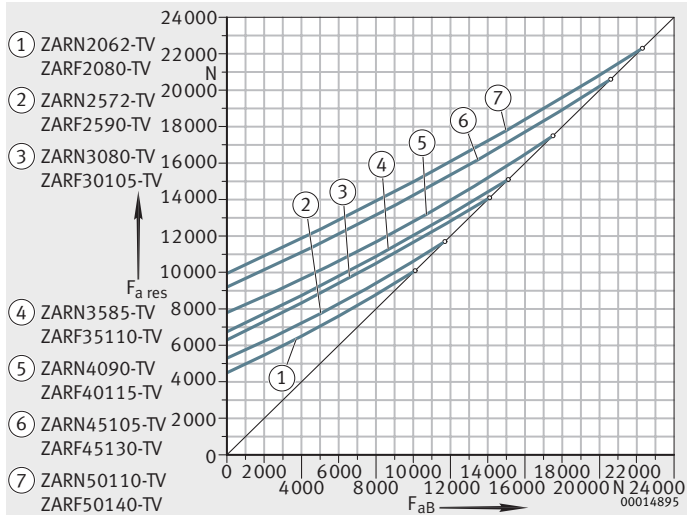
F_{aB} = operating load
 $F_{a\ res}$ = resultant bearing load
 $^{\circ}$ = limit value

Figure 4
 Resultant bearing load
 ZARN, ZARF, light series



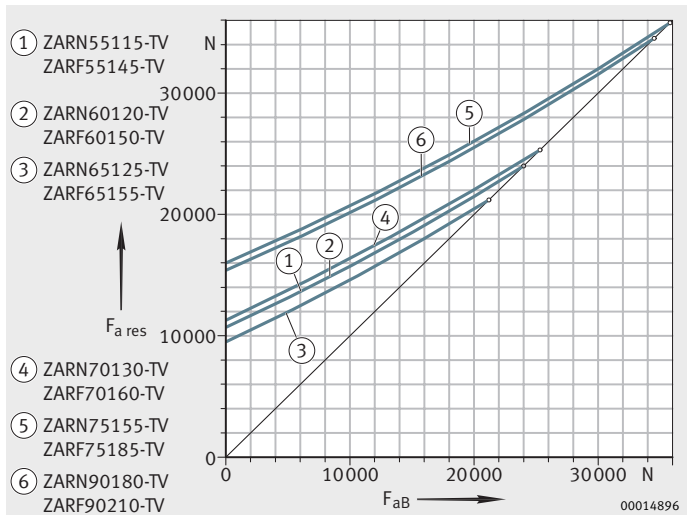
F_{aB} = operating load
 $F_{a\ res}$ = resultant bearing load
 $^{\circ}$ = limit value

Figure 5
 Resultant bearing load
 ZARN, ZARF,
 heavy series up to $d = 50$ mm



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

Figure 6
 Resultant bearing load
 ZARN, ZARF,
 heavy series from $d = 55$ 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.



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

Examples of possible lubricant feeds: see *Figure 7* and *Figure 8*, page 69.

Sealing of the bearing position

The bearings are sealed, *Figure 1*, page 63:

- 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
- operating duration 25%
- max. equilibrium temperature +50 °C.



The limiting speeds n_G are valid for oil lubrication with adequate cooling.



Needle roller/ axial cylindrical roller bearings

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 (for example 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	W
Frictional energy	
M_{RL}	Nm
Bearing frictional torque	
n	min^{-1}
Operating speed.	

In any analysis of the thermal balance, the various operating speeds n_i and their corresponding time portions q_i must be taken into consideration.

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 of 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*.

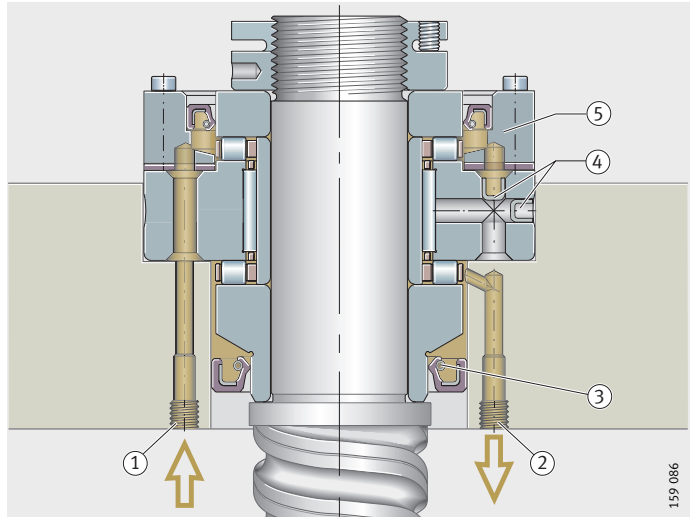


Before initial operation, it must be ensured that all raceways are adequately supplied with lubricant.

ZARF.-L

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

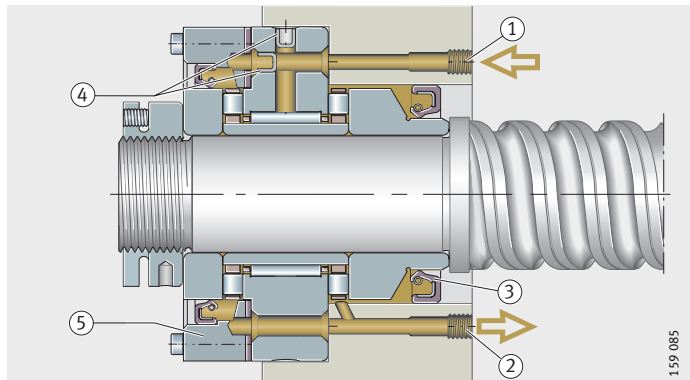
Figure 7
Lubricant feed for
vertical mounting position



ZARF.-L

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

Figure 8
Lubricant feed for
horizontal mounting position



Needle roller/ axial cylindrical roller bearings

Mounting guidelines



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. Mounting 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



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

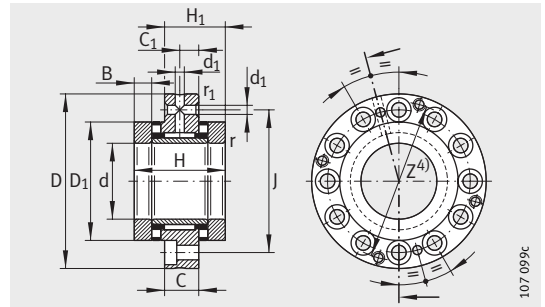
Accuracy Dimensional and geometrical accuracy (DIN 620):

- axial P4
- radial P6.



Needle roller/ axial cylindrical roller bearings

Light series
For screw mounting

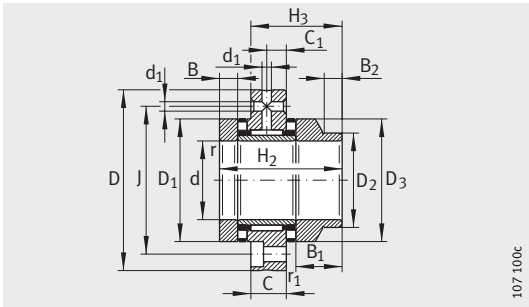


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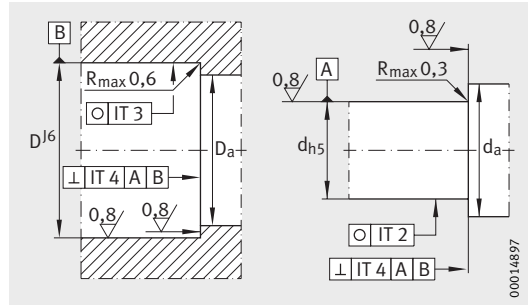
Dimension table - Dimensions in mm

Designation	Mass m ≈kg	Dimensions																	
		d	D	H	H ₁	H ₂	H ₃	C	C ₁	D ₁	D ₂	D ₃	B	B ₁	B ₂	r	r ₁	d ₁	J
																	min.	min.	
ZARF1560-TV	0,42	15	60	40	26	-	-	14	8	35	-	-	7,5	-	-	0,3	0,6	3,2	46
ZARF1560-L-TV	0,45	15	60	-	-	53	39	14	8	35	24	34	7,5	20,5	11	0,3	0,6	3,2	46
ZARF1762-TV	0,49	17	62	43	27,5	-	-	14	8	38	-	-	9	-	-	0,3	0,6	3,2	48
ZARF1762-L-TV	0,52	17	62	-	-	57	41,5	14	8	38	28	38	9	23	11	0,3	0,6	3,2	48
ZARF2068-TV	0,56	20	68	46	29	-	-	14	8	42	-	-	10	-	-	0,3	0,6	3,2	53
ZARF2068-L-TV	0,61	20	68	-	-	60	43	14	8	42	30	40	10	24	11	0,3	0,6	3,2	53
ZARF2575-TV	0,78	25	75	50	33	-	-	18	10	47	-	-	10	-	-	0,3	0,6	3,2	58
ZARF2575-L-TV	0,84	25	75	-	-	65	48	18	10	47	36	45	10	25	11	0,3	0,6	3,2	58
ZARF3080-TV	0,85	30	80	50	33	-	-	18	10	52	-	-	10	-	-	0,3	0,6	3,2	63
ZARF3080-L-TV	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 are not included in the delivery.
- 3) Mass moment of inertia for rotating inner ring.
- 4) Mounting dimension for seal carrier assembly DRS.
Seal carrier assemblies: see page 91 and page 97.
- 5) Only valid in conjunction with INA precision locknuts.
- 6) The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.



ZARF..L



Design of adjacent construction

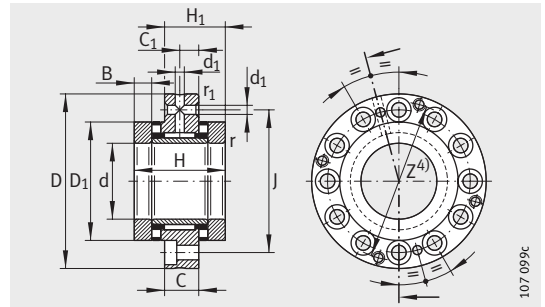
Mounting dimensions ¹⁾		Basic load ratings				Limiting speeds		Bearing frictional torque	Rigidity axial	Tilting rigidity	Mass moment of inertia ³⁾	Axial runout ⁶⁾
		axial		radial								
D _a	d _a	dyn. C _a	stat. C _{0a}	dyn. C _r	stat. C _{0r}	n _G oil	n _G grease	M _{RL}	c _{aL}	c _{kL}	M _m	
max.	min.	N	N	N	N	min ⁻¹	min ⁻¹	Nm	N/μm	Nm/mrad	kg · cm ²	μm
36	28	24 900	53 000	13 000	17 500	8 500	2 200	0,35	1 400	110	0,24	1
36	22	24 900	53 000	13 000	17 500	8 500	2 200	0,35	1 400	110	0,274	1
39	28	26 000	57 000	14 000	19 900	7 800	2 100	0,4	1 600	160	0,373	1
39	26	26 000	57 000	14 000	19 900	7 800	2 100	0,4	1 600	160	0,464	1
43	33	33 500	76 000	14 900	22 400	7 000	2 000	0,5	1 800	230	0,615	1
43	28	33 500	76 000	14 900	22 400	7 000	2 000	0,5	1 800	230	0,683	1
48	39	35 500	86 000	22 600	36 000	6 000	1 900	0,55	1 900	350	0,989	1
48	34	35 500	86 000	22 600	36 000	6 000	1 900	0,55	1 900	350	1,15	1
53	44	39 000	101 000	24 300	41 500	5 500	1 800	0,65	2 200	520	1,46	1
53	38	39 000	101 000	24 300	41 500	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	Fixing screws ²⁾ DIN 912-10.9	
	Designation	Tightening torque ⁵⁾	Axial preload force	Size		Quantity	
							M _A Nm
ZARF1560-TV	ZMA15/33	AM15	10	6 506	–	M6	6
ZARF1560-L-TV	ZMA15/33	AM15	10	6 506	24X35X7	M6	6
ZARF1762-TV	ZM17	AM17	12	7 078	–	M6	6
ZARF1762-L-TV	ZM17	AM17	12	7 078	28X40X7	M6	6
ZARF2068-TV	ZMA20/38	AM20	18	9 376	–	M6	8
ZARF2068-L-TV	ZMA20/38	AM20	18	9 376	30X42X7	M6	8
ZARF2575-TV	ZMA25/45	AM25	25	10 470	–	M6	8
ZARF2575-L-TV	ZMA25/45	AM25	25	10 470	36X47X7	M6	8
ZARF3080-TV	ZMA30/52	AM30	32	11 091	–	M6	12
ZARF3080-L-TV	ZMA30/52	AM30	32	11 091	40X52X7	M6	12



Needle roller/ axial cylindrical roller bearings

Light series
For screw mounting

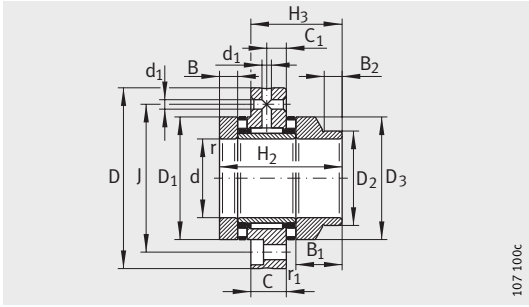


ZARF

Dimension table (continued) · Dimensions in mm

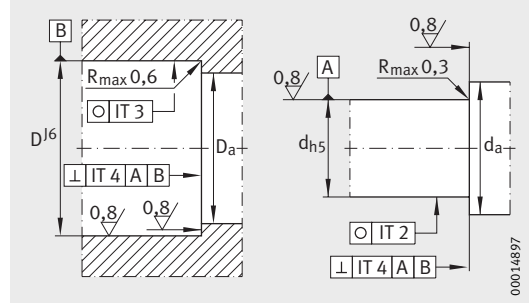
Designation	Mass m ≈kg	Dimensions																	
		d	D	H	H ₁	H ₂	H ₃	C	C ₁	D ₁	D ₂	D ₃	B	B ₁	B ₂	r	r ₁	d ₁	J
																min.	min.		
ZARF3590-TV	1,12	35	90	54	35	–	–	18	10	60	–	–	11	–	–	0,3	0,6	3,2	73
ZARF3590-L-TV	1,25	35	90	–	–	70	51	18	10	60	45	58	11	27	12	0,3	0,6	3,2	73
ZARF40100-TV	1,35	40	100	54	35	–	–	18	10	65	–	–	11	–	–	0,3	0,6	3,2	80
ZARF40100-L-TV	1,45	40	100	–	–	70	51	18	10	65	50	63	11	27	12	0,3	0,6	3,2	80
ZARF45105-TV	1,7	45	105	60	40	–	–	22,5	12,5	70	–	–	11,5	–	–	0,3	0,6	6	85
ZARF45105-L-TV	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-TV	2,1	50	115	60	40	–	–	22,5	12,5	78	–	–	11,5	–	–	0,3	0,6	6	94
ZARF50115-L-TV	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 are not included in the delivery.
- 3) Mass moment of inertia for rotating inner ring.
- 4) Mounting dimension for seal carrier assembly DRS.
Seal carrier assemblies: see page 91 and page 97.
- 5) Only valid in conjunction with INA precision locknuts.
- 6) The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.



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ZARF..L



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Design of adjacent construction

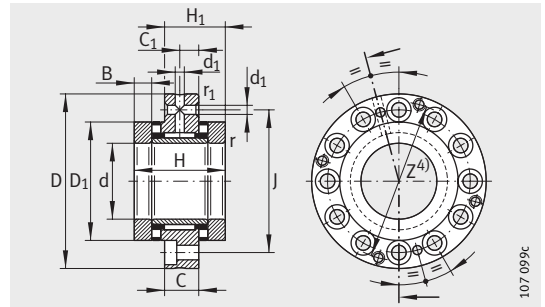
Mounting dimensions ¹⁾		Basic load ratings				Limiting speeds		Bearing frictional torque	Rigidity axial	Tilting rigidity	Mass moment of inertia ³⁾	Axial runout ⁶⁾
		axial		radial								
D _a	d _a	dyn. C _a	stat. C _{0a}	dyn. C _r	stat. C _{0r}	n _G oil	n _G grease	M _{RL}	c _{aL}	c _{kL}	M _m	
max.	min.	N	N	N	N	min ⁻¹	min ⁻¹	Nm	N/μm	Nm/mrad	kg·cm ²	μm
61	50	56 000	148 000	26 000	47 000	4 800	1 700	0,9	2 600	740	2,8	1
61	43	56 000	148 000	26 000	47 000	4 800	1 700	0,9	2 600	740	3,21	1
66	55	59 000	163 000	27 500	53 000	4 400	1 600	1	2 800	1 030	3,78	1
66	48	59 000	163 000	27 500	53 000	4 400	1 600	1	2 800	1 030	4,35	1
71	60	61 000	177 000	38 000	74 000	4 000	1 500	1,2	3 000	1 340	5,33	1
71	54	61 000	177 000	38 000	74 000	4 000	1 500	1,2	3 000	1 340	6,03	1
79	67	90 000	300 000	40 000	82 000	3 600	1 200	2,2	4 800	2 470	8,42	1
79	58	90 000	300 000	40 000	82 000	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	Fixing screws ²⁾ DIN 912-10.9	
	Designation	Tightening torque ⁵⁾ M _A Nm	Axial preload force N		Size	Quantity
ZARF3590-TV	ZMA35/58 AM35/58	42	12 486	—	M6	12
ZARF3590-L-TV	ZMA35/58 AM35/58	42	12 486	45X60X8	M6	12
ZARF40100-TV	ZMA40/62 AM40	55	14 240	—	M8	8
ZARF40100-L-TV	ZMA40/62 AM40	55	14 240	50X65X8	M8	8
ZARF45105-TV	ZMA45/68 AM45	65	15 765	—	M8	8
ZARF45105-L-TV	ZMA45/68 AM45	65	15 765	56X70X8	M8	8
ZARF50115-TV	ZMA50/75 AM50	85	18 410	—	M8	12
ZARF50115-L-TV	ZMA50/75 AM50	85	18 410	60X80X8	M8	12

Needle roller/ axial cylindrical roller bearings

Heavy series
For screw mounting

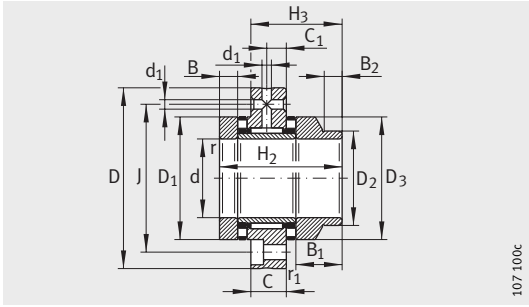


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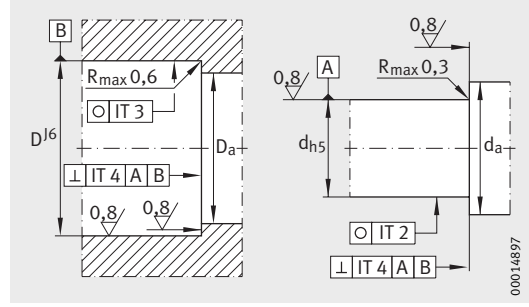
Dimension table - Dimensions in mm

Designation	Mass m ≈kg	Dimensions																
		d	D	H	H ₁	H ₂	H ₃	C	C ₁	D ₁	D ₂	D ₃	B	B ₁	B ₂	r	r ₁	
																	min.	min.
ZARF2080-TV	1,1	20	80	60	38	–	–	18	10	52	–	–	12,5	–	–	0,3	0,6	
ZARF2080-L-TV	1,22	20	80	–	–	75	53	18	10	52	40	50	12,5	27,5	11	0,3	0,6	
ZARF2590-TV	1,6	25	90	60	38	–	–	18	10	62	–	–	12,5	–	–	0,3	0,6	
ZARF2590-L-TV	1,75	25	90	–	–	75	53	18	10	62	48	60	12,5	27,5	11	0,3	0,6	
ZARF30105-TV	1,95	30	105	66	41	–	–	18	10	68	–	–	14	–	–	0,3	0,6	
ZARF30105-L-TV	2,15	30	105	–	–	82	57	18	10	68	52	66	14	30	12	0,3	0,6	
ZARF35110-TV	1,6	35	110	66	41	–	–	18	10	73	–	–	14	–	–	0,3	0,6	
ZARF35110-L-TV	1,85	35	110	–	–	82	57	18	10	73	60	73	14	30	12	0,3	0,6	
ZARF40115-TV	2,7	40	115	75	47,5	–	–	22,5	12,5	78	–	–	16	–	–	0,3	0,6	
ZARF40115-L-TV	3	40	115	–	–	93	65,5	22,5	12,5	78	60	78	16	34	12	0,3	0,6	
ZARF45130-TV	3,9	45	130	82	51	–	–	22,5	12,5	90	–	–	17,5	–	–	0,3	0,6	
ZARF45130-L-TV	4,3	45	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 are not included in the delivery.
- 3) Mass moment of inertia for rotating inner ring.
- 4) Mounting dimension for seal carrier assembly DRS.
Seal carrier assemblies: see page 91 and page 97.
- 5) Only valid in conjunction with INA precision locknuts.
- 6) The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.



ZARF..L



Design of adjacent construction

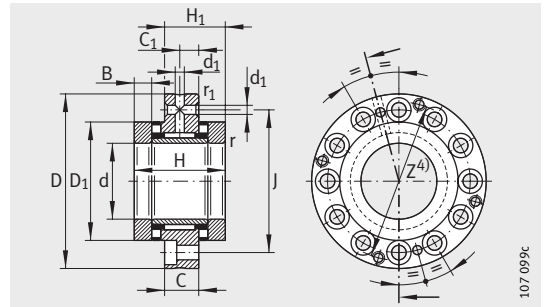
		Mounting dimensions ¹⁾		Basic load ratings				Limiting speeds		Bearing frictional torque M_{RL} Nm	Rigidity axial c_{aL} N/ μ m	Tilting rigidity c_{kL} Nm/mrad	Mass moment of inertia ³⁾ M_m kg · cm ²	Axial run-out ⁶⁾ μ m
d_1	J	D_a max.	d_a min.	dyn. C_a N	stat. C_{0a} N	dyn. C_r N	stat. C_{0r} N	n_G oil min ⁻¹	n_G grease min ⁻¹					
3,2	63	53	38	64 000	141 000	22 600	36 000	6 000	1 500	1,3	2 300	400	1,98	1
3,2	63	53	38	64 000	141 000	22 600	36 000	6 000	1 500	1,3	2 300	400	2,27	1
3,2	73	63	45	80 000	199 000	24 300	41 500	4 900	1 400	1,6	3 000	800	3,88	1
3,2	73	63	45	80 000	199 000	24 300	41 500	4 900	1 400	1,6	3 000	800	4,51	1
3,2	85	69	52	107 000	265 000	26 000	47 000	4 400	1 300	2,1	3 300	1 100	6,53	1
3,2	85	69	50	107 000	265 000	26 000	47 000	4 400	1 300	2,1	3 300	1 100	7,43	1
3,2	88	74	60	105 000	265 000	27 500	53 000	4 000	1 250	2,3	2 500	1 300	8,47	1
3,2	88	74	58	105 000	265 000	27 500	53 000	4 000	1 250	2,3	3 500	1 300	10,4	1
6	94	79	65	117 000	315 000	38 000	74 000	3 700	1 200	2,5	3 800	1 800	13,3	1
6	94	79	58	117 000	315 000	38 000	74 000	3 700	1 200	2,5	3 800	1 800	15,5	1
6	105	91	70	154 000	405 000	40 000	82 000	3 300	1 150	3,5	4 000	2 100	23,7	1
6	105	91	68	154 000	405 000	40 000	82 000	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	Fixing screws ²⁾ DIN 912-10.9	
	Designation	Tightening torque ⁵⁾ M_A Nm	Axial preload force N		Size	Quantity
ZARF2080-TV	ZMA20/52	AM20	38	18 448	–	M6 12
ZARF2080-L-TV	ZMA20/52	AM20	38	18 448	40X52X7	M6 12
ZARF2590-TV	ZMA25/58	AM25	55	20 790	–	M6 12
ZARF2590-L-TV	ZMA25/58	AM25	55	20 790	48X62X8	M6 12
ZARF30105-TV	ZMA30/65	AM30	75	24 287	–	M8 12
ZARF30105-L-TV	ZMA30/65	AM30	75	24 287	52X68X8	M8 12
ZARF35110-TV	ZMA35/70	AM35	100	27 480	–	M8 12
ZARF35110-L-TV	ZMA35/70	AM35	100	27 480	60X75X8	M8 12
ZARF40115-TV	ZMA40/75	AM40	120	29 834	–	M8 12
ZARF40115-L-TV	ZMA40/75	AM40	120	29 834	60X80X8	M8 12
ZARF45130-TV	ZMA45/85	AM45	150	33 549	–	M8 12
ZARF45130-L-TV	ZMA45/85	AM45	150	33 549	70X90X10	M8 12



Needle roller/ axial cylindrical roller bearings

Heavy series
For screw mounting

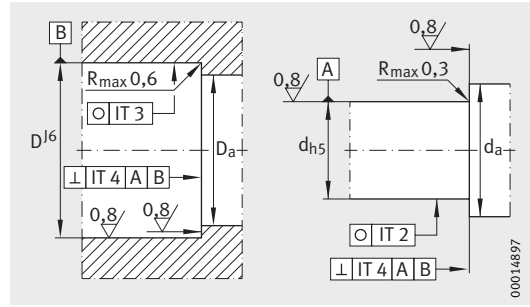
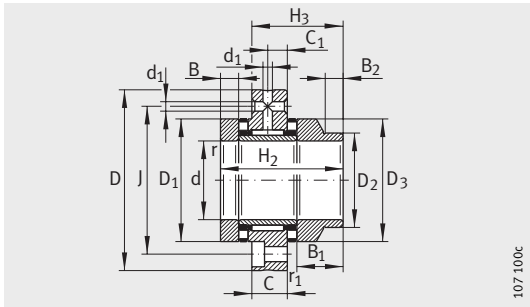


ZARF

Dimension table (continued) · Dimensions in mm

Designation	Mass m ≈kg	Dimensions																	
		d	D	H	H ₁	H ₂	H ₃	C	C ₁	D ₁	D ₂	D ₃	B	B ₁	B ₂	r	r ₁	d ₁	J
ZARF50140-TV	4,2	50	140	82	51	–	–	22,5	12,5	95	–	–	17,5	–	–	0,3	0,6	6	113
ZARF50140-L-TV	4,65	50	140	–	–	103	72	22,5	12,5	95	75	93	17,5	38,5	14	0,3	0,6	6	113
ZARF55145-TV	4,5	55	145	82	51	–	–	22,5	12,5	100	–	–	17,5	–	–	0,3	0,6	6	118
ZARF55145-L-TV	5	55	145	–	–	103	72	22,5	12,5	100	80	98	17,5	38,5	14	0,3	0,6	6	118
ZARF60150-TV	4,7	60	150	82	51	–	–	22,5	12,5	105	–	–	17,5	–	–	0,3	0,6	6	123
ZARF60150-L-TV	5,35	60	150	–	–	103	72	22,5	12,5	105	90	105	17,5	38,5	16	0,3	0,6	6	123
ZARF65155-TV	5,1	65	155	82	51	–	–	22,5	12,5	110	–	–	17,5	–	–	0,3	0,6	6	128
ZARF65155-L-TV	5,7	65	155	–	–	103	72	22,5	12,5	110	90	108	17,5	38,5	16	0,3	0,6	6	128
ZARF70160-TV	5,2	70	160	82	51	–	–	22,5	12,5	115	–	–	17,5	–	–	0,3	0,6	6	133
ZARF70160-L-TV	5,95	70	160	–	–	103	72	22,5	12,5	115	100	115	17,5	38,5	16	0,3	0,6	6	133
ZARF75185-TV	9,4	75	185	100	62	–	–	27	15	135	–	–	21	–	–	0,3	1	6	155
ZARF75185-L-TV	10,6	75	185	–	–	125	87	27	15	135	115	135	21	46	16	0,3	1	6	155
ZARF90210-TV	13,7	90	210	110	69,5	–	–	32	17,5	160	–	–	22,5	–	–	0,3	1	8	180
ZARF90210-L-TV	15,1	90	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 are not included in the delivery.
- 3) Mass moment of inertia for rotating inner ring.
- 4) Mounting dimension for seal carrier assembly DRS.
Seal carrier assemblies: see page 91 and page 97.
- 5) Only valid in conjunction with INA precision locknuts.
- 6) The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.



ZARF..L

Design of adjacent construction

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

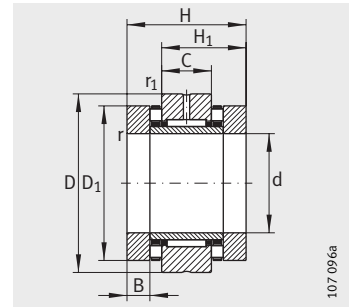
Designation	Recommended INA locknut; to be ordered separately			Rotary shaft seal to DIN 3 760; to be ordered separately	Fixing screws ²⁾ DIN 912-10.9	
	Designation	Tightening torque ⁵⁾ M_A Nm	Axial preload force N		Size	Quantity
ZARF50140-TV	ZMA50/92 AM50	180	37 109	-	M10	12
ZARF50140-L-TV	ZMA50/92 AM50	180	37 109	75X95X10	M10	12
ZARF55145-TV	ZMA55/98 AM55	220	40 772	-	M10	12
ZARF55145-L-TV	ZMA55/98 AM55	220	40 772	80X100X10	M10	12
ZARF60150-TV	ZMA60/98 AM60	250	42 190	-	M10	12
ZARF60150-L-TV	ZMA60/98 AM60	250	42 190	90X110X12	M10	12
ZARF65155-TV	ZMA65/105 AM65	270	41 778	-	M10	12
ZARF65155-L-TV	ZMA65/105 AM65	270	41 778	90X110X12	M10	12
ZARF70160-TV	ZMA70/110 AM70	330	47 692	-	M10	12
ZARF70160-L-TV	ZMA70/110 AM70	330	47 692	100X120X12	M10	12
ZARF75185-TV	ZMA75/125 AM75	580	76 339	-	M12	12
ZARF75185-L-TV	ZMA75/125 AM75	580	76 339	115X140X12	M12	12
ZARF90210-TV	ZMA90/155 AM90	960	102 468	-	M12	16
ZARF90210-L-TV	ZMA90/155 AM90	960	102 468	130X160X12	M12	16



Needle roller/ axial cylindrical roller bearings

Light series

Not for screw mounting



ZARN

Dimension table - Dimensions in mm

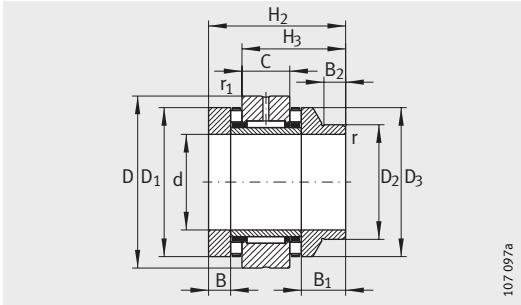
Designation	Mass m ≈kg	Dimensions														
		d	D	H	H ₁	H ₂	H ₃	C	D ₁	D ₂	D ₃	B	B ₁	B ₂	r	r ₁
															min.	min.
ZARN1545-TV	0,34	15	45	40	28	–	–	16	35	–	–	7,5	–	–	0,3	0,6
ZARN1545-L-TV	0,37	15	45	–	–	53	41	16	35	24	34	7,5	20,5	11	0,3	0,6
ZARN1747-TV	0,37	17	47	43	29,5	–	–	16	38	–	–	9	–	–	0,3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

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

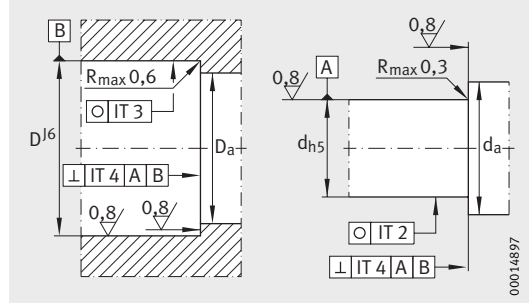
2) Mass moment of inertia for rotating inner ring.

3) Only valid in conjunction with INA precision locknuts.

4) The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.



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Design of adjacent construction

Mounting dimensions ¹⁾		Basic load ratings				Limiting speeds		Bearing frictional torque M_{RL}	Rigidity axial c_{aL}	Tilting rigidity c_{kL}	Mass moment of inertia ²⁾ M_m	Axial runout ⁴⁾ μm
D_a	d_a	axial		radial		n_G oil	n_G grease					
max.	min.	dyn. C_a	stat. C_{0a}	dyn. C_r	stat. C_{0r}	min^{-1}	min^{-1}	Nm	N/ μm	Nm/mrad	kg · cm ²	
36	28	24 900	53 000	13 000	17 500	8 500	2 200	0,35	1 400	110	0,24	1
36	22	24 900	53 000	13 000	17 500	8 500	2 200	0,35	1 400	110	0,274	1
39	28	26 000	57 000	14 000	19 900	7 800	2 100	0,4	1 600	160	0,373	1
39	26	26 000	57 000	14 000	19 900	7 800	2 100	0,4	1 600	160	0,464	1
43	33	33 500	76 000	14 900	22 400	7 000	2 000	0,5	1 800	230	0,615	1
43	28	33 500	76 000	14 900	22 400	7 000	2 000	0,5	1 800	230	0,683	1
48	39	35 500	86 000	22 600	36 000	6 000	1 900	0,55	1 900	350	0,989	1
48	34	35 500	86 000	22 600	36 000	6 000	1 900	0,55	1 900	350	1,15	1
53	44	39 000	101 000	24 300	41 500	5 500	1 800	0,65	2 200	520	1,46	1
53	38	39 000	101 000	24 300	41 500	5 500	1 800	0,65	2 200	520	1,7	1

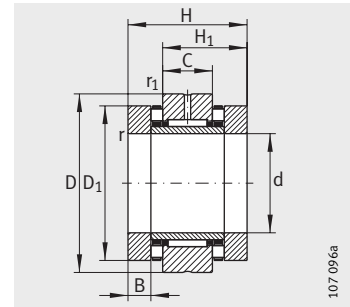
Designation	Recommended INA locknut; to be ordered separately			Rotary shaft seal to DIN 3 760; to be ordered separately
	Designation	Tightening torque ³⁾ M_A Nm	Axial preload force N	
ZARN1545-TV	ZMA15/33 AM15	10	6 506	–
ZARN1545-L-TV	ZMA15/33 AM15	10	6 506	24X35X7
ZARN1747-TV	ZM17 AM17	12	7 078	–
ZARN1747-L-TV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



Needle roller/ axial cylindrical roller bearings

Light series

Not for screw mounting

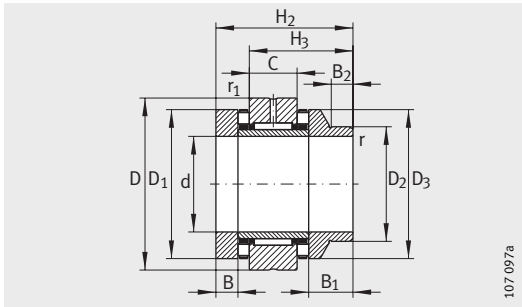


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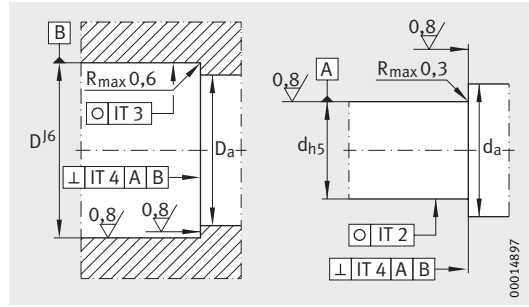
Dimension table (continued) · Dimensions in mm

Designation	Mass m ≈kg	Dimensions															
		d	D	H	H ₁	H ₂	H ₃	C	D ₁	D ₂	D ₃	B	B ₁	B ₂	r	r ₁	
																min.	min.
ZARN3570-TV	0,8	35	70	54	37	–	–	20	60	–	–	11	–	–	0,3	0,6	
ZARN3570-L-TV	0,93	35	70	–	–	70	53	20	60	45	58	11	27	12	0,3	0,6	
ZARN4075-TV	0,9	40	75	54	37	–	–	20	65	–	–	11	–	–	0,3	0,6	
ZARN4075-L-TV	1	40	75	–	–	70	53	20	65	50	63	11	27	12	0,3	0,6	
ZARN4580-TV	1,12	45	80	60	42,5	–	–	25	70	–	–	11,5	–	–	0,3	0,6	
ZARN4580-L-TV	1,27	45	80	–	–	75	57,5	25	70	56	68	11,5	26,5	12	0,3	0,6	
ZARN5090-TV	1,43	50	90	60	42,5	–	–	25	78	–	–	11,5	–	–	0,3	0,6	
ZARN5090-L-TV	1,78	50	90	–	–	78	60,5	25	78	60	78	11,5	29,5	12	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.
- 4) The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.



ZARN..L



Design of adjacent construction

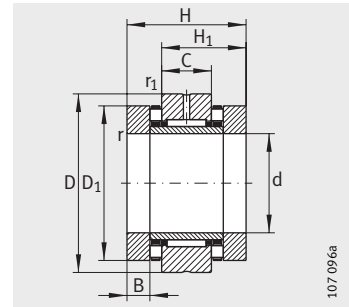
Mounting dimensions ¹⁾		Basic load ratings				Limiting speeds		Bearing frictional torque	Rigidity axial	Tilting rigidity	Mass moment of inertia ²⁾	Axial runout ⁴⁾
		axial		radial								
Da	da	dyn. Ca	stat. C _{0a}	dyn. C _r	stat. C _{0r}	n _G oil	n _G grease	M _{RL}	c _{aL}	c _{kL}	M _m	
max.	min.	N	N	N	N	min ⁻¹	min ⁻¹	Nm	N/μm	Nm/mrad	kg·cm ²	μm
61	50	56 000	148 000	26 000	47 000	4 800	1 700	0,9	2 600	740	2,8	1
61	43	56 000	148 000	26 000	47 000	4 800	1 700	0,9	2 600	740	3,21	1
66	55	59 000	163 000	27 500	53 000	4 400	1 600	1	2 800	1 030	3,78	1
66	48	59 000	163 000	27 500	53 000	4 400	1 600	1	2 800	1 030	4,35	1
71	60	61 000	177 000	38 000	74 000	4 000	1 500	1,2	3 000	1 340	5,33	1
71	54	61 000	177 000	38 000	74 000	4 000	1 500	1,2	3 000	1 340	6,03	1
79	67	90 000	300 000	40 000	82 000	3 600	1 200	2,2	4 800	2 470	8,42	1
79	58	90 000	300 000	40 000	82 000	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 ³⁾ M _A Nm	
ZARN3570-TV	ZMA35/58	AM35/58	42	12 486
ZARN3570-L-TV	ZMA35/58	AM35/58	42	12 486
ZARN4075-TV	ZMA40/62	AM40	55	14 240
ZARN4075-L-TV	ZMA40/62	AM40	55	14 240
ZARN4580-TV	ZMA45/68	AM45	65	15 765
ZARN4580-L-TV	ZMA45/68	AM45	65	15 765
ZARN5090-TV	ZMA50/75	AM50	85	18 410
ZARN5090-L-TV	ZMA50/75	AM50	85	18 410

Needle roller/ axial cylindrical roller bearings

Heavy series
Not for screw mounting

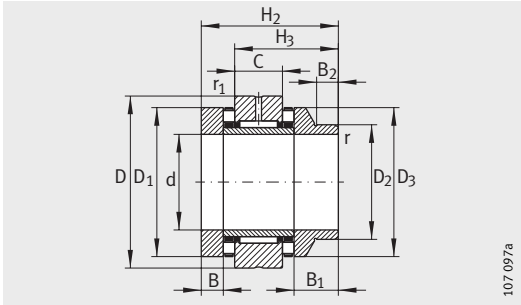


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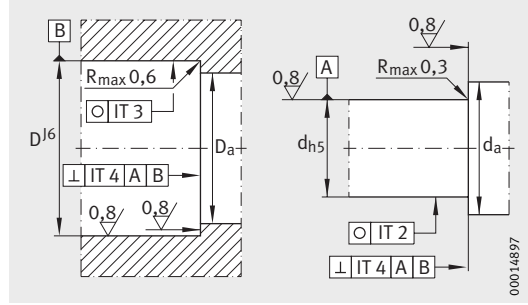
Dimension table - Dimensions in mm

Designation	Mass m ≈kg	Dimensions														
		d	D	H	H ₁	H ₂	H ₃	C	D ₁	D ₂	D ₃	B	B ₁	B ₂	r	r ₁
															min.	min.
ZARN2062-TV	0,87	20	62	60	40	–	–	20	52	–	–	12,5	–	–	0,3	0,6
ZARN2062-L-TV	0,99	20	62	–	–	75	55	20	52	40	50	12,5	27,5	11	0,3	0,6
ZARN2572-TV	1,17	25	72	60	40	–	–	20	62	–	–	12,5	–	–	0,3	0,6
ZARN2572-L-TV	1,32	25	72	–	–	75	55	20	62	48	60	12,5	27,5	11	0,3	0,6
ZARN3080-TV	1,5	30	80	66	43	–	–	20	68	–	–	14	–	–	0,3	0,6
ZARN3080-L-TV	1,7	30	80	–	–	82	59	20	68	52	66	14	30	12	0,3	0,6
ZARN3585-TV	1,65	35	85	66	43	–	–	20	73	–	–	14	–	–	0,3	0,6
ZARN3585-L-TV	1,8	35	85	–	–	82	59	20	73	60	73	14	30	12	0,3	0,6
ZARN4090-TV	2,09	40	90	75	50	–	–	25	78	–	–	16	–	–	0,3	0,6
ZARN4090-L-TV	2,39	40	90	–	–	93	68	25	78	60	78	16	34	12	0,3	0,6
ZARN45105-TV	3,02	45	105	82	53,5	–	–	25	90	–	–	17,5	–	–	0,3	0,6
ZARN45105-L-TV	3,42	45	105	–	–	103	74,5	25	90	70	88	17,5	38,5	14	0,3	0,6
ZARN50110-TV	3,3	50	110	82	53,5	–	–	25	95	–	–	17,5	–	–	0,3	0,6
ZARN50110-L-TV	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.
- 4) The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.



ZARN..L



Design of adjacent construction

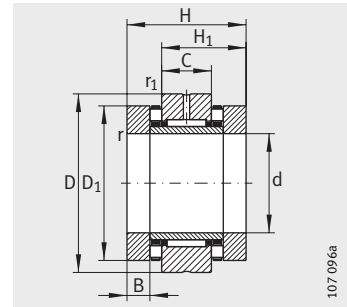
Mounting dimensions ¹⁾		Basic load ratings				Limiting speeds		Bearing frictional torque M_{RL}	Rigidity axial c_{aL}	Tilting rigidity c_{kL}	Mass moment of inertia ²⁾ M_m	Axial runout ⁴⁾
D_a	d_a	axial		radial		n_G oil	n_G grease					
max.	min.	dyn. C_a	stat. C_{0a}	dyn. C_r	stat. C_{0r}	min^{-1}	min^{-1}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

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



Needle roller/ axial cylindrical roller bearings

Heavy series
Not for screw mounting

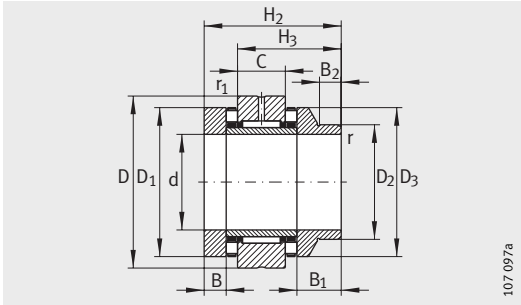


ZARN

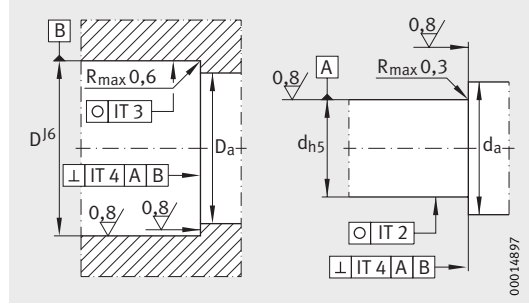
Dimension table (continued) · Dimensions in mm

Designation	Mass m ≈kg	Dimensions														
		d	D	H	H ₁	H ₂	H ₃	C	D ₁	D ₂	D ₃	B	B ₁	B ₂	r	r ₁
															min.	min.
ZARN55115-TV	3,5	55	115	82	53,5	–	–	25	100	–	–	17,5	–	–	0,3	0,6
ZARN55115-L-TV	4	55	115	–	–	103	74,5	25	100	80	98	17,5	38,5	14	0,3	0,6
ZARN60120-TV	3,7	60	120	82	53,5	–	–	25	105	–	–	17,5	–	–	0,3	0,6
ZARN60120-L-TV	4,85	60	120	–	–	103	74,5	25	105	90	105	17,5	38,5	16	0,3	0,6
ZARN65125-TV	4	65	125	82	53,5	–	–	25	110	–	–	17,5	–	–	0,3	0,6
ZARN65125-L-TV	4,6	65	125	–	–	103	74,5	25	110	90	108	17,5	38,5	16	0,3	0,6
ZARN70130-TV	4,1	70	130	82	53,5	–	–	25	115	–	–	17,5	–	–	0,3	0,6
ZARN70130-L-TV	4,85	70	130	–	–	103	74,5	25	115	100	115	17,5	38,5	16	0,3	0,6
ZARN75155-TV	7,9	75	155	100	65	–	–	30	135	–	–	21	–	–	0,3	1
ZARN75155-L-TV	9,1	75	155	–	–	125	90	30	135	115	135	21	46	16	0,3	1
ZARN90180-TV	11,8	90	180	110	72,5	–	–	35	160	–	–	22,5	–	–	0,3	1
ZARN90180-L-TV	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.
- 4) The axial runout data for screw drive bearing arrangements are based on the rotating inner ring.



ZARN..L



Design of adjacent construction

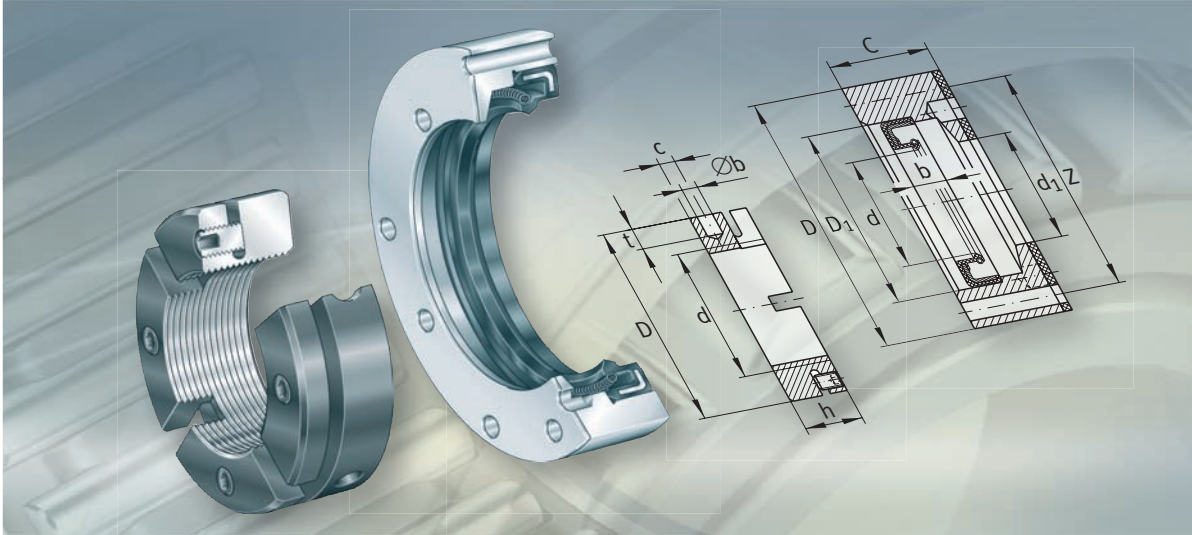
Mounting dimensions ¹⁾		Basic load ratings				Limiting speeds		Bearing frictional torque	Rigidity axial	Tilting rigidity	Mass moment of inertia ²⁾	Axial runout ⁴⁾
		axial		radial								
Da	da	dyn. Ca	stat. C0a	dyn. Cr	stat. C0r	nG oil	nG grease	MRL	caL	ckL	Mm	
max.	min.	N	N	N	N	min ⁻¹	min ⁻¹	Nm	N/μm	Nm/mrad	kg·cm ²	μm
101	85	177 000	500 000	44 000	98 000	2 900	1 000	4	4 900	3 600	36,1	1
101	78	177 000	500 000	44 000	98 000	2 900	1 000	4	4 900	3 600	43	1
106	90	187 000	550 000	44 500	92 000	2 700	950	4,2	5 300	4 300	43,8	1
106	88	187 000	550 000	44 500	92 000	2 700	950	4,2	5 300	4 300	54,5	1
111	97	172 000	500 000	54 000	104 000	2 600	900	4	4 800	4 000	51	1
111	88	172 000	500 000	54 000	104 000	2 600	900	4	4 800	4 000	60,1	1
116	100	201 000	630 000	56 000	119 000	2 400	800	4,8	5 800	6 000	62,2	1
116	98	201 000	630 000	56 000	119 000	2 400	800	4,8	5 800	6 000	77,3	1
136	113	290 000	890 000	72 000	132 000	2 100	700	8	6 600	8 500	149	2
136	110	290 000	890 000	72 000	132 000	2 100	700	8	6 600	8 500	188	2
161	130	325 000	1 030 000	98 000	210 000	1 800	700	10,5	7 700	14 500	312	2
161	125	325 000	1 030 000	98 000	210 000	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 ³⁾	Axial preload force	
		MA Nm	N	
ZARN55115-TV	ZMA55/98 AM55	220	40 772	–
ZARN55115-L-TV	ZMA55/98 AM55	220	40 772	80X100X10
ZARN60120-TV	ZMA60/98 AM60	250	42 190	–
ZARN60120-L-TV	ZMA60/98 AM60	250	42 190	90X110X12
ZARN65125-TV	ZMA65/105 AM65	270	41 778	–
ZARN65125-L-TV	ZMA65/105 AM65	270	41 778	90X110X12
ZARN70130-TV	ZMA70/110 AM70	330	47 692	–
ZARN70130-L-TV	ZMA70/110 AM70	330	47 692	100X120X12
ZARN75155-TV	ZMA75/125 AM75	580	76 339	–
ZARN75155-L-TV	ZMA75/125 AM75	580	76 339	115X140X12
ZARN90180-TV	ZMA90/155 AM90	960	102 246	–
ZARN90180-L-TV	ZMA90/155 AM90	960	102 246	130X160X12





FAG



Seal carrier assemblies Precision locknuts

Seal carrier assemblies Precision locknuts

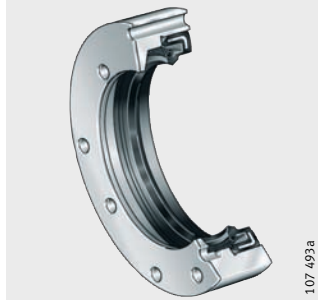
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Product overview	Seal carrier assemblies, precision locknuts 90
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Design and safety guidelines	Breakaway torque..... 94
	Ultimate axial load 94
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Product overview Seal carrier assemblies Precision locknuts

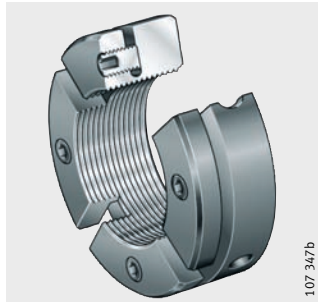
Seal carrier assemblies

DRS



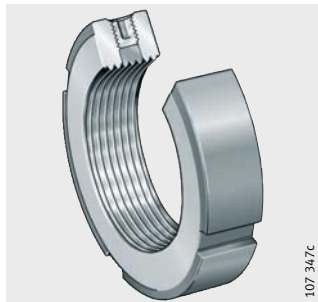
Precision locknuts For axial locking

AM



For radial locking

ZM, ZMA



Seal carrier assemblies

Precision locknuts

Features

Seal carrier assemblies

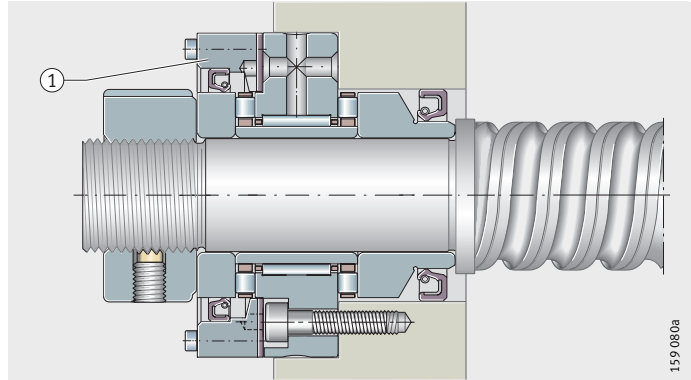
Seal carrier assemblies DRS are screw mounted to the outer ring of needle roller/axial cylindrical roller bearings ZARF(L) and precisely centred in this position, *Figure 1*, ①. They seal the bearings against outside influences.

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.

DRS
ZMA
ZARF.-L

① Seal carrier assembly DRS

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 $+120\text{ }^{\circ}\text{C}$, restricted 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, *Figure 3*, page 93, 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.

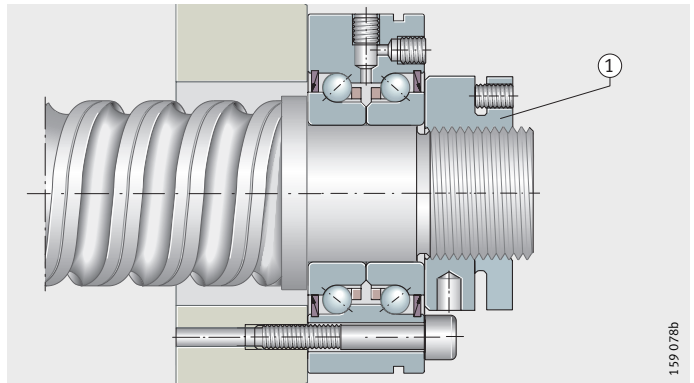
Axial locking by segments

Locknuts of series AM are divided into several segments for applying the locking forces. When the hexagonal socket grub 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.

AM
ZKLF.-2RS

① Precision locknut AM

Figure 2
Axial angular contact ball bearings

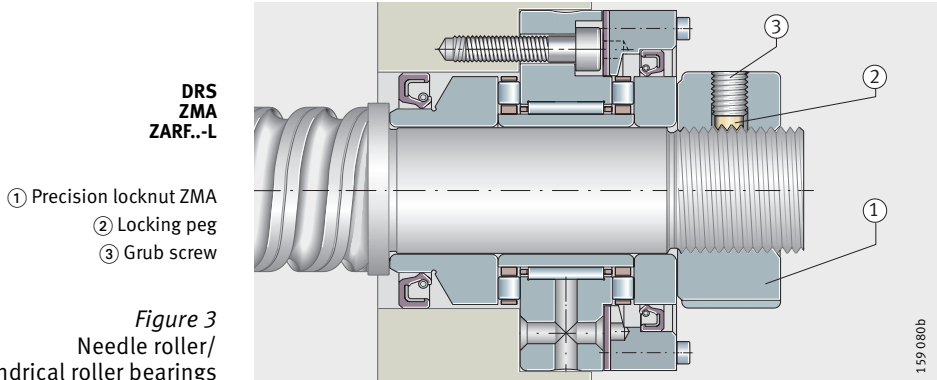


Locking by radial locking pegs

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 grub screws with a hexagonal socket arranged concentrically over the locking pegs, *Figure 3*, ③.



Seal carrier assemblies

Precision locknuts

Design and safety guidelines

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

Recommended shaft thread

Shaft thread	
Tolerance class "medium"	Tolerance class "fine"
6g DIN 13 T21-24	4h DIN 13 T21-24



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 axial ultimate loads F_{aB} are valid for a journal thread with a tolerance 6g or better and a minimum strength of 700 N/mm². For dynamic loading, the permissible value can be taken as 75% of the ultimate load F_{aB} .

Fitting and dismantling



For the fitting and dismantling of bearings and precision locknuts, the information in the INA Fitting and maintenance manual, TPI 100 must be observed.

Locknuts must be fully screwed onto the shaft thread.

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 grub screws are then tightened in a crosswise sequence to the specified tightening torque M_A using an Allen key.

Dismantling is carried out by uniformly loosening the grub screws of all segments in order to prevent a single segment being left tensioned.



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 table, page 99.

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 grub 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_A 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 grub screws are then tightened alternately to the specified tightening torque M_A using an Allen key; for M_A , see dimension tables for the bearings.

For dismantling, the two grub 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

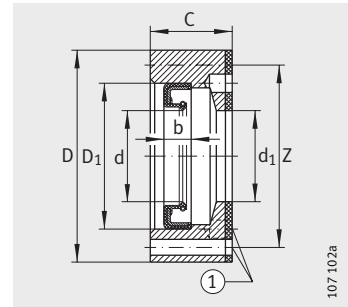
Accuracy of precision locknuts, see table.

Axial runout

Axial runout of face to thread ¹⁾ μm	Metric ISO thread "fine"
5	5H, DIN 13 T21-24

¹⁾ The face and thread are machined in a single clamping operation in order to achieve the highest accuracy. Before measurement, the precision locknut is clamped on a threaded mandrel with a defined tightening torque against a rigid shoulder. The grub screws are left untightened.

Seal carrier assemblies



DRS¹⁾
 ① 4 holes, offset by 90°

107 102a

Dimension table - Dimensions in mm

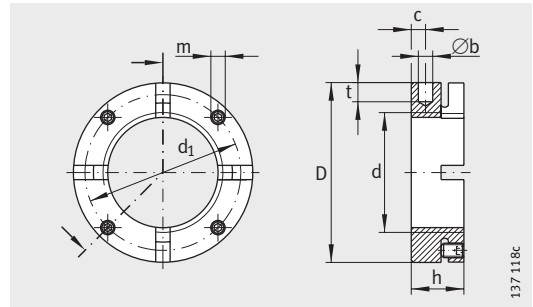
Designation	Mass m ≈kg	Dimensions				Rotary shaft seal				Corresponding bearing in standard or L design Designation
		D	C	d ₁	Z ²⁾	d	D ₁	b	Socket head screws DIN 912 4 each	
DRS1560	0,16	60	14	35	52,4	35	45	7	M3X20	ZARF1560-TV
DRS1762	0,18	62	15,5	38	54,4	38	47	7	M3X25	ZARF1762-TV
DRS2068	0,11	68	17	42	60,4	42	55	8	M3X25	ZARF2068-TV
DRS2080	0,2	80	22	52	73,4	52	68	8	M3X30	ZARF2080-TV
DRS2575	0,16	75	17	47	67,4	47	62	6	M3X25	ZARF2575-TV
DRS2590	0,3	90	22	62	81	62	75	10	M3X30	ZARF2590-TV
DRS3080	0,15	80	17	52	73,4	52	68	8	M3X25	ZARF3080-TV
DRS30105	0,35	105	25	68	95	68	85	10	M4X35	ZARF30105-TV
DRS3590	0,15	90	19	60	80	60	72	8	M4X25	ZARF3590-TV
DRS35110	0,3	110	25	73	101	73	95	10	M3X30	ZARF35110-TV
DRS40100	0,25	100	19	65	90	65	80	8	M4X30	ZARF40100-TV
DRS40115	0,5	115	27,5	78	106	78	100	10	M3X35	ZARF40115-TV
DRS45105	0,3	105	20	70	95	70	85	8	M4X30	ZARF45105-TV
DRS45130	0,7	130	31	90	120	90	110	12	M4X40	ZARF45130-TV
DRS50115	0,2	115	20	78	106	78	100	10	M3X30	ZARF50115-TV
DRS50140	0,8	140	30	95	127,5	95	115	13	M5X40	ZARF50140-TV
DRS55145	0,9	145	30	100	132,5	100	120	12	M5X40	ZARF55145-TV
DRS60150	0,9	150	30	105	137,5	105	125	12	M5X40	ZARF60150-TV
DRS65155	1	155	30	110	142,5	110	130	12	M5X40	ZARF65155-TV
DRS70160	1	160	30	115	147,5	115	135	13	M5X40	ZARF70160-TV
DRS75185	1,8	185	36	135	172,5	135	160	15	M5X50	ZARF75185-TV
DRS90210	2,7	210	38	160	194	160	180	15	M5X50	ZARF90210-TV

1) The seal carrier assembly is supplied as a kit comprising:
 – seal carrier
 – rotary shaft seal
 – flange seal
 – socket head screws.

2) Four holes offset by 90°.



Precision locknuts



AM15 to AM40 with 4 segments
 AM45 to AM90 with 6 segments
 AM100 to AM130 with 8 segments

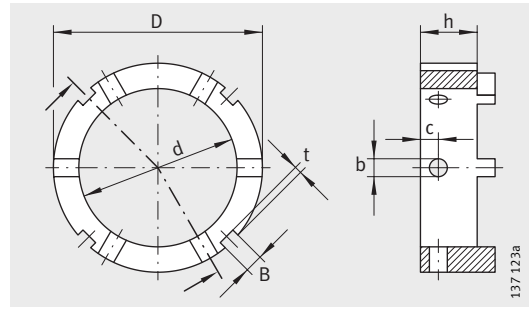
Dimension table - Dimensions in mm

Designation	Nut thread	Mass m ≈kg	Dimensions								Grub screw Tightening torque M _A Nm	Locknut ¹⁾			
			D	h	b H11	t	d ₁	c	m	Axial rupture load F _{aB} N		Break-away torque M _L at Nm	Reference tightening torque M _{AL} Nm	Mass moment of inertia M _M kg · cm ²	
															d
AM15	M15X1	0,06	30	18	4	5	24	5	M5	3	100 000	20	10	0,09	
AM17	M17X1	0,07	32	18	4	5	26	5	M5	3	120 000	25	15	0,11	
AM20	M20X1	0,13	38	18	4	6	31	5	M6	5	145 000	45	18	0,23	
AM25	M25X1,5	0,16	45	20	5	6	38	6	M6	5	205 000	60	25	0,49	
AM30	M30X1,5	0,20	52	20	5	7	45	6	M6	5	250 000	70	32	0,86	
AM30/65	M30X1,5	0,50	65	30	6	8	45	6	M6	5	400 000	70	32	2,8	
AM35/58	M35X1,5	0,23	58	20	5	7	51	6	M6	5	280 000	90	40	1,3	
AM35	M35X1,5	0,33	65	22	6	8	58	6	M6	5	330 000	100	40	2,4	
AM40	M40X1,5	0,30	65	22	6	8	58	6	M6	5	350 000	120	55	2,3	
AM40/85	M40X1,5	0,75	85	32	6	8	58	6	M6	5	570 000	120	55	7,6	
AM45	M45X1,5	0,34	70	22	6	8	63	6	M6	5	360 000	220	65	2,9	
AM50	M50X1,5	0,43	75	25	6	8	68	8	M6	5	450 000	280	85	4,3	
AM55	M55X2	0,60	85	26	6	8	75	8	M8	15	520 000	320	95	7,7	
AM60	M60X2	0,65	90	26	6	8	80	8	M8	15	550 000	365	100	9,4	
AM65	M65X2	0,83	100	26	8	10	88	8	M8	15	560 000	400	120	14,6	
AM70	M70X2	0,79	100	28	8	10	90	9	M8	15	650 000	450	130	14,7	
AM75	M75X2	1,23	115	30	8	10	102	10	M10	20	750 000	610	150	29	
AM80	M80X2	0,93	110	30	8	10	98	10	M10	20	670 000	770	160	21,3	
AM85	M85X2	0,97	115	30	8	10	102	10	M10	20	690 000	930	180	24,8	
AM90	M90X2	1,53	130	32	8	10	118	13	M10	20	900 000	1 100	200	48	
AM100	M100X2	1,12	130	30	8	10	118	10	M10	20	740 000	1 200	250	38	
AM110	M110X2	1,22	140	30	8	10	128	10	M10	20	770 000	1 300	250	48	
AM120	M120X2	1,56	155	30	8	10	142	10	M10	20	880 000	1 450	250	75	
AM130	M130X2	1,67	165	30	8	10	152	10	M10	20	900 000	1 600	250	92	

¹⁾ 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



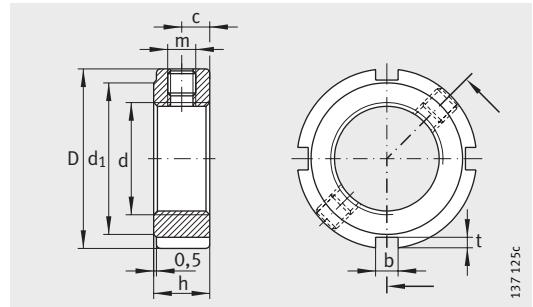
AMS

Dimension table · Dimensions in mm

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



Precision locknuts



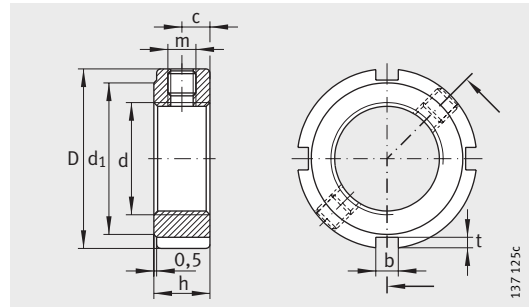
ZM, ZMA

Dimension table - Dimensions in mm

Designation	Thread	Mass m ≈ kg	Dimensions							Grub screw Tightening torque M _A Nm	Locknut			
			D	h	b	t	d ₁	c	m		Axial rupture load F _{aB} N	Break-away torque M _L at Nm	Reference tightening torque M _{AL} Nm	Mass moment of inertia M _M kg · cm ²
ZM06	M6X0,5	0,01	16	8	3	2	11	4	M4	1	17 000	20	2	0,004
ZM08 ¹⁾	M8X0,75	0,01	16	8	3	2	11	4	M4	1	23 000	25	4	0,004
ZM10 ¹⁾	M10X1	0,01	18	8	3	2	14	4	M4	1	31 000	30	6	0,006
ZM12	M12X1	0,015	22	8	3	2	18	4	M4	1	38 000	30	8	0,013
ZM15	M15X1	0,018	25	8	3	2	21	4	M4	1	50 000	30	10	0,021
ZMA15/33	M15X1	0,08	33	16	4	2	28	8	M5	3	106 000	30	10	0,14
ZM17	M17X1	0,028	28	10	4	2	23	5	M5	3	57 000	30	15	0,401
ZM20	M20X1	0,035	32	10	4	2	27	5	M5	3	69 000	40	18	0,068
ZMA20/38	M20X1	0,12	38	20	5	2	33	10	M5	3	174 000	40	18	0,297
ZMA20/52	M20X1	0,32	52	25	5	2	47	12,5	M5	3	218 000	40	18	1,38
ZM25	M25X1,5	0,055	38	12	5	2	33	6	M6	5	90 000	60	25	0,157
ZMA25/45	M25X1,5	0,16	45	20	5	2	40	10	M6	5	211 000	60	25	0,572
ZMA25/58	M25X1,5	0,43	58	28	6	2,5	52	14	M6	5	305 000	60	25	2,36
ZM30	M30X1,5	0,075	45	12	5	2	40	6	M6	5	112 000	70	32	0,304
ZMA30/52	M30X1,5	0,22	52	22	5	2	47	11	M6	5	270 000	70	32	1,1
ZMA30/65	M30X1,5	0,55	65	30	6	2,5	59	15	M6	5	390 000	70	32	3,94
ZM35	M35X1,5	0,099	52	12	5	2	47	6	M6	5	134 000	80	40	0,537
ZMA35/58	M35X1,5	0,26	58	22	6	2,5	52	11	M6	5	300 000	80	40	1,66
ZMA35/70	M35X1,5	0,61	70	30	6	2,5	64	15	M6	5	460 000	80	40	5,2
ZM40	M40X1,5	0,14	58	14	6	2,5	52	7	M6	5	157 000	95	55	0,945
ZMA40/62	M40X1,5	0,27	62	22	6	2,5	56	11	M8	15	310 000	95	55	2,07
ZMA40/75	M40X1,5	0,67	75	30	6	2,5	69	15	M8	15	520 000	95	55	6,72
ZM45	M45X1,5	0,17	65	14	6	2,5	59	7	M6	5	181 000	110	65	1,48
ZMA45/68	M45X1,5	0,35	68	24	6	2,5	62	12	M8	15	360 000	110	65	3,2
ZMA45/85	M45X1,5	0,92	85	32	7	3	78	16	M8	15	630 000	110	65	11,9
ZM50	M50X1,5	0,19	70	14	6	2,5	64	7	M6	5	205 000	130	85	1,92
ZMA50/75	M50X1,5	0,43	75	25	6	2,5	68	12,5	M8	15	415 000	130	85	4,89
ZMA50/92	M50X1,5	1,06	92	32	8	3,5	84	16	M8	15	680 000	130	85	16,1
ZM55	M55X2	0,23	75	16	7	3	68	8	M6	5	229 000	150	95	2,77
ZMA55/98	M55X2	1,17	98	32	8	3,5	90	16	M8	15	620 000	150	95	20,5

¹⁾ When clamped, the grub screw protrudes by approx. 0,5 mm.

Precision locknuts



ZM, ZMA

137 125c

Dimension table (continued) - Dimensions in mm

Designation	Thread	Mass m ≈kg	Dimensions							Grub screw Tight- ening torque M _A Nm	Locknut			
			D	h	b	t	d ₁	c	m		Axial rupture load F _{aB} N	Break- away torque M _L at Nm	Reference tightening torque M _{AL} Nm	Mass moment of inertia M _M kg · cm ²
ZM60	M60X2	0,25	80	16	7	3	73	8	M6	5	255 000	180	100	3,45
ZMA60/98	M60X2	1,07	98	32	8	3,5	90	16	M8	15	680 000	180	100	19,6
ZM65	M65X2	0,27	85	16	7	3	78	8	M6	5	280 000	200	120	4,24
ZMA65/105	M65X2	1,21	105	32	8	3,5	97	16	M8	15	750 000	200	120	25,6
ZM70	M70X2	0,36	92	18	8	3,5	85	9	M8	15	305 000	220	130	6,61
ZMA70/110	M70X2	1,4	110	35	8	3,5	102	17,5	M8	15	810 000	220	130	33
ZM75	M75X2	0,4	98	18	8	3,5	90	9	M8	15	331 000	260	150	8,41
ZMA75/125	M75X2	2,11	125	38	8	3,5	117	19	M8	15	880 000	260	150	62,2
ZM80	M80X2	0,46	105	18	8	3,5	95	9	M8	15	355 000	285	160	11,2
ZMA80/120	M80X2	1,33	120	35	8	4	105	17,5	M8	15	810 000	285	160	44,6
ZM85	M85X2	0,49	110	18	8	3,5	102	9	M8	15	385 000	320	190	13,1
ZM90	M90X2	0,7	120	20	10	4	108	10	M8	15	410 000	360	200	21,8
ZMA90/130	M90X2	2,01	130	38	10	4	120	19	M8	15	910 000	360	200	64,1
ZMA90/155	M90X2	3,36	155	38	10	4	146	19	M8	15	1 080 000	360	200	150
ZM100	M100X2	0,77	130	20	10	4	120	10	M8	15	465 000	425	250	28,6
ZMA100/140	M100X2	2,23	140	38	12	5	128	19	M10	20	940 000	425	250	82,8
ZM105	M105X2	1,05	140	22	12	5	126	11	M10	20	495 000	475	300	44,5
ZM110	M110X2	1,09	145	22	12	5	133	11	M10	20	520 000	510	350	50,1
ZM115	M115X2	1,13	150	22	12	5	137	11	M10	20	550 000	550	400	56,2
ZM120	M120X2	1,28	155	24	12	5	138	12	M10	20	580 000	600	450	68,4
ZM125	M125X2	1,33	160	24	12	5	148	12	M10	20	610 000	640	500	76,1
ZM130	M130X2	1,36	165	24	12	5	149	12	M10	20	630 000	700	550	84,3
ZM140	M140X2	1,85	180	26	14	6	160	13	M12	38	690 000	800	600	133
ZM150	M150X2	2,24	195	26	14	6	171	13	M12	38	750 000	900	650	188



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TPI 123 GB-D



Ball screw drive KGT
Ball screw spindle KGS
Ball screw nut KGF(M)

Date: July 2012

Technical introduction

Axial clearance and preload

Schaeffler ball screw drives have a contact angle of 45° . Due to external drive forces and internal drive forces, an axial force is generated F_a that results in axial deflection as a function of the preload.

The axial clearance that results from the clear spacing between the rolling element and rolling element raceway can be eliminated by the preload force P , thus increasing the positional accuracy and rigidity of the ball screw drive.

The preload force P can be influenced by the use of a preloaded double or single nut (Figure 1 and 2, Table 1).

Double nut

The fitting of a spacer to give an O arrangement of the two nuts results in preloading of the double nut.

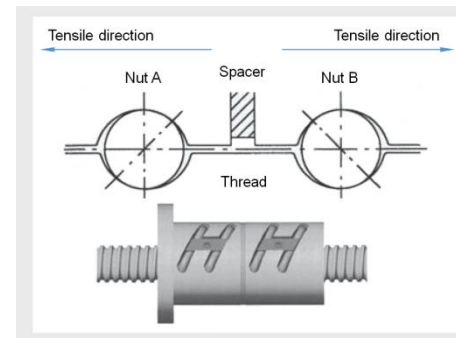


Figure 1

Single nut

The fitting of oversize rolling elements results in the preloading of the single nut.

This gives four contact points per rolling element.

This gives four contact points per rolling element.

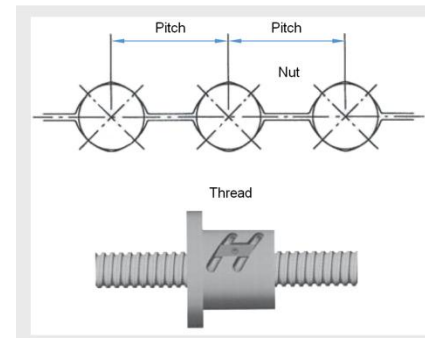


Figure 2

Technical introduction

Preload

Preload classes of Schaeffler ball screw drives according to the table

Spindle diameter d_w	V0 Standard Max. axial clearance mm	V1 Clearance-free mm	V2 Preloaded mm
06	0.05	0	Approx. 3% x C
08			
10			
12			
14			
16	0.08		
20			
25			
32			
40	0.12		
50			
63			
80			

Table 1

Technical introduction

Accuracy

Depending on the operating parameters and application, different requirements are placed on the accuracy of ball screw drives.

Schaeffler ball screw drives are available as standard in the accuracy class T7.

Optionally, the class T5 is available by agreement.

Accuracy class of rolled ball screw drives

	T5	T7 (standard)
Variation over 300mm axial travel	23 μm	52μm

Other tolerances in accordance with DIN 69051 Part 3

Technical introduction

Operating temperature

Ball screw drives from Schaeffler can be used at operating temperatures from -10°C to +80°C.

For short periods, a maximum operating temperature of 100°C is possible, measured on the outside surface of the screw nut.

Sealing

The screw nuts in Schaeffler ball screw drives are protected against contamination by a gap seal or labyrinth seal (depending on the screw nut design, see table). (Exceptions: see table in appendix)

Contact seals are – for some designs - available as an option.

If there is a risk that dust or foreign matter could enter the screw nut, additional sealing measures must be implemented for protection.

Lubrication

Schaeffler ball screw drives must be lubricated.

Whether lubrication is carried out using oil or grease is determined by technical, economic and ecological factors.

The screw nut is pregreased as standard with a high quality lubricant.

Grease lubrication:

For relubrication, lithium soap or lithium complex soap greases with a mineral oil base are recommended.

The base oil viscosity should be between ISO-VG 68 and ISO-VG 100.

Oil lubrication:

If Schaeffler ball screw drives are to be lubricated using oil, please consult Schaeffler first.

Technical introduction

Ordering example

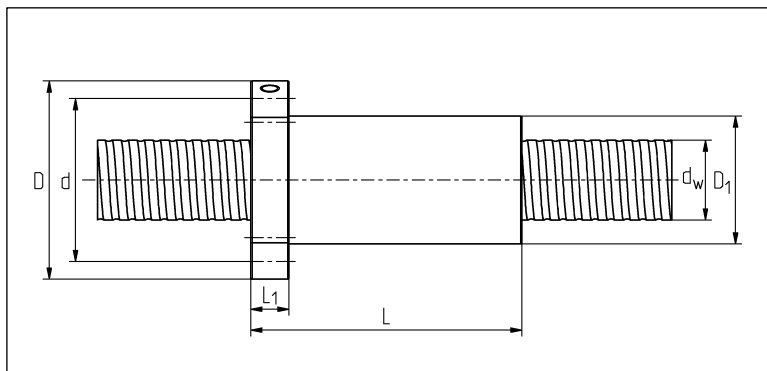
Ball screw drive KGT: **(KGT80x20-RH-2A3-00-T7-V0-1720-MTO-MTO-1-0-1)**

Ball screw drive	KGT
Size (nominal thread diameter)	80
Pitch of threaded spindle	20
Right hand thread	RH
Screw nut design (flanged nut)	2A3
Sealing (no seals left and right)	00
Type (transport ball screw drive)	T
Accuracy	7
Preload (with clearance)	V0
Length of screw spindle	1720
Spindle ends according to customer drawing	
- left	MTO
- right	MTO
Lubrication (standard)	1
Coating (none)	0
Documentation (according to drawing)	1

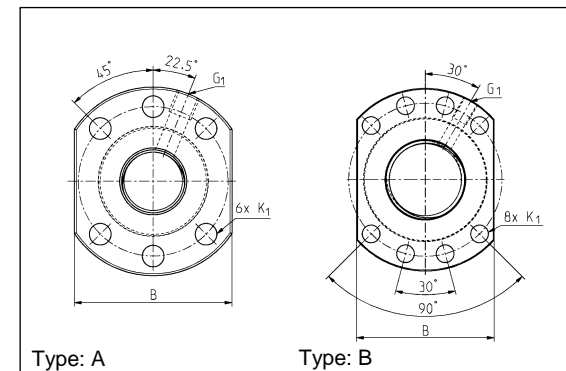
Ball screw drive

With flanged nut

KGF-2A



KGF...-2A



Type: A

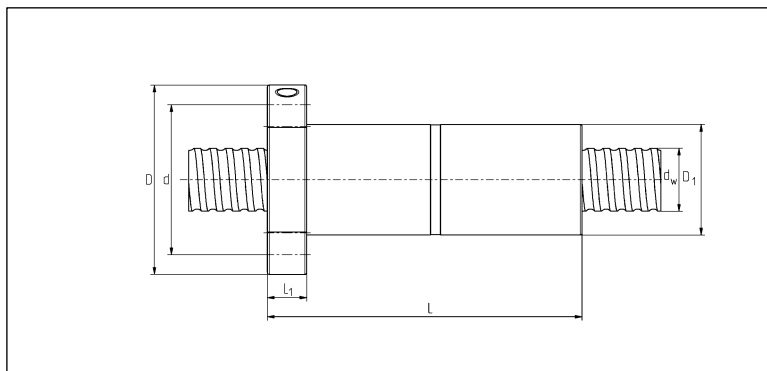
Type: B

KGF...-2A

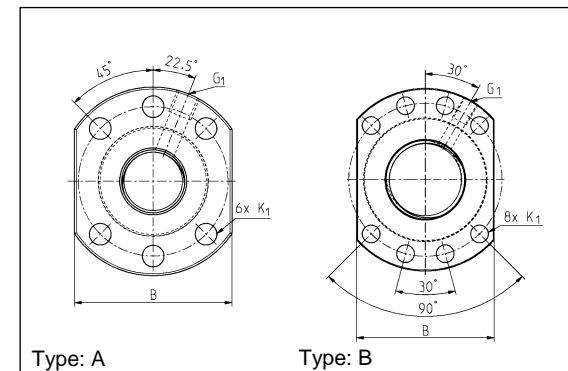
Dimension table · Dimensions in mm													
Designation	Pitch P	Type	Dimensions			Mounting dimensions				Location		Basic load ratings	
			d _w	D	L	B	D ₁	L ₁	d	K ₁	G ₁	dyn. C _a kN	stat. C ₀ kN
KGF16x05-RH-2A3	5	A	16	48	42	40	28	10	38	5.5	M6	9.14	17.04
KGF16x05-RH-2A4	5	A			50							11.84	22.73
KGF16x10-RH-2A3	10	A			65							12	17.28
KGF20x05-RH-2A4	5	A	20	58	53	44	36	10	47	6.6	M6	13.00	28.15
KGF20x10-RH-2A3	10	A			68							13.80	27.10
KGF25x04-RH-2A4	4	A	25	62	46	48	40	11	51	6.6	M6	9.64	26.00
KGF25x05-RH-2A4	5	A			53			10				14.30	34.91
KGF25x10-RH-2A4	10	A			85			12				25.02	53.34
KGF32x05-RH-2A4	5	A	32	80	53	62	50	12	65	9	M6	15.90	44.40
KGF32x10-RH-2A3	10	A			77.5			16				31.82	68.20
KGF32x10-RH-2A4	10	A			90			16				41.23	90.93
KGF40x05-RH-2A4	5	B	40	93	56	70	63	16	78	9	M8	17.50	55.25
KGF40x06-RH-2A4	6	B			60			14				23.75	69.38
KGF40x10-RH-2A4	10	B			93			18				45.29	112.57
KGF50x10-RH-2A4	10	B	50	110	93	85	75	18	93	11	M8	49.80	139.66
KGF63x10-RH-2A4	10	B	63	125	98	95	90	18	108	11	M8	54.98	174.90
KGF63x20-RH-2A3	20	B		135	138	100	95	20	115	13.5		74.11	199.52
KGF80x10-RH-2A4	10	B		80	145	98	110	105	20	125	13.5	M8	60.95
KGF80x20-RH-2A3	20	B	165		143	130	125	25	145	82.02			251.25

Ball screw drive

With flanged double nut
KGF-2B



KGF...-2B



Type: A

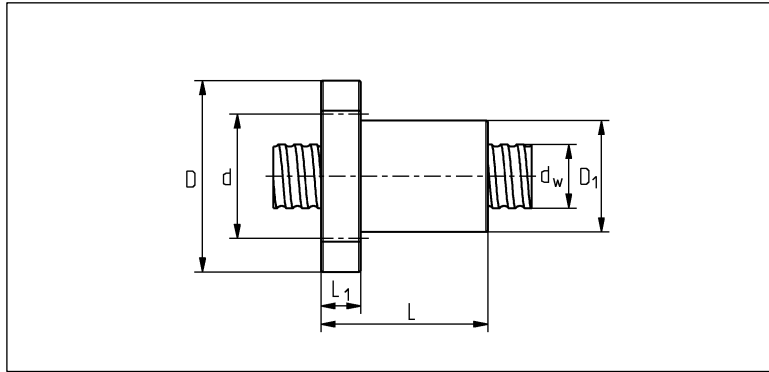
Type: B

KGF...-2B

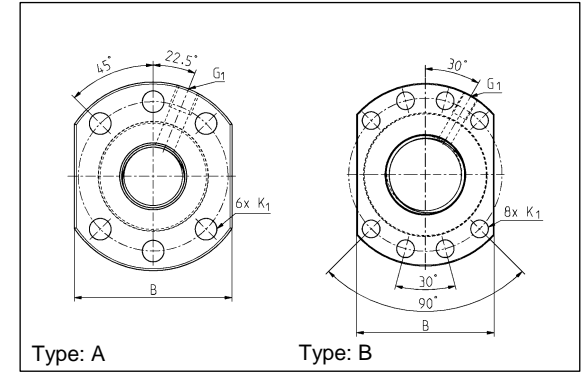
Dimension table · Dimensions in mm													
Designation	Pitch P	Type	Dimensions			Mounting dimensions				Location		Basic load ratings	
			d _w	D	L	B	D ₁	L ₁	d	K ₁	G ₁	dyn. C _a kN	stat. C ₀ kN
KGF16x05-RH-2B3	5	A	16	28	80	40	28	10	38	5,5	M6	9,14	17,04
KGF20x05-RH-2B4	5	A	20	36	92	44	36	12	47	6,6	M6	13,00	28,15
KGF25x05-RH-2B4	5	A	25	40	92	48	40	12	51	6,6	M6	14,30	34,91
KGF25x10-RH-2B4	10	A			153							25,02	53,34
KGF32x05-RH-2B4	5	A	32	50	92	62	50	12	65	9	M6	15,90	44,40
KGF32x10-RH-2B4	10	A			160			16				41,23	90,93
KGF40x05-RH-2B4	5	B	40	63	96	70	63	15	78	9	M8	17,50	55,25
KGF40x10-RH-2B4	10	B			162			18				45,29	112,57
KGF50x10-RH-2B4	10	B	50	75	162	85	75	16	93	11	M8	49,80	139,66
KGF63x10-RH-2B4	10	B	63	90	182	95	90	18	108	11	M8	54,98	174,90
KGF63x20-RH-2B3	20	B		95	253	100	95	20	115	13,5		74,11	199,52
KGF80x10-RH-2B4	10	B	80	105	182	110	105	20	125	13,5	M8	60,95	221,02
KGF80x20-RH-2B3	20	B		125	253	130	125	25	145			82,02	251,25

Ball screw drive

With flanged nut
KGF-2C



KGF..-2C



Type: A

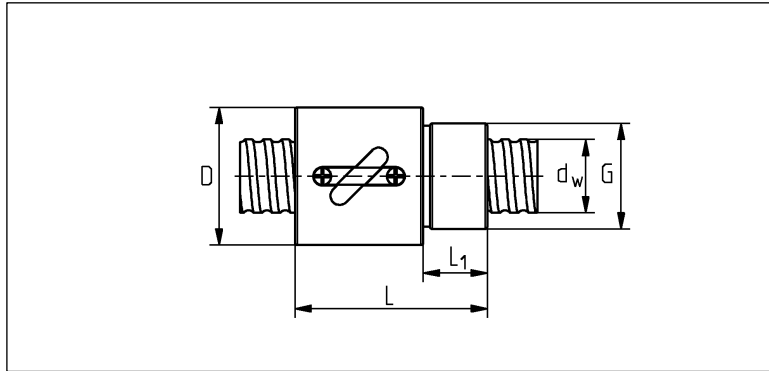
Type: B

KGF..-2C

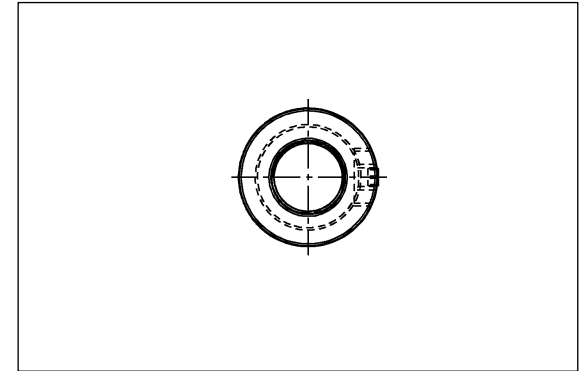
Dimension table · Dimensions in mm													
Designation	Pitch P	Type	Dimensions			Mounting dimensions				Location		Basic load ratings	
			d _w	D	L	B	D ₁	L ₁	d	K ₁	G ₁	dyn. C _a kN	stat. C ₀ kN
KGF16x16-RH-2C3	16	A	16	48	61	40	28	12	38	5.5	M6	9.31	17.75
KGF20x20-RH-2C4	20	A	20	58	55	44	36	10	47	6.6	M6	13.25	29.36
KGF25x25-RH-2C4	25	A	25	74	67	56	47	12	60	6.6	M6	19.80	45.88
KGF32x20-RH-2C3	20	A	32	80	78	62	50	13	65	9	M6	16.79	42.57
KGF32x32-RH-2C4	32	A		92	82	68	58	15	74			28.25	70.32
KGF40x20-RH-2C3	20	B	40	93	83	70	63	15	78	9	M8	29.21	74.23
KGF40x40-RH-2C4	40	B		95	100	72	65	18	80			46.14	117.44
KGF50x20-RH-2C5	20	B	50	110	121	85	75	18	93	11	M8	61.03	175.58

Ball screw drive

With cylindrical nut
KGM-2E



KGM..-2E

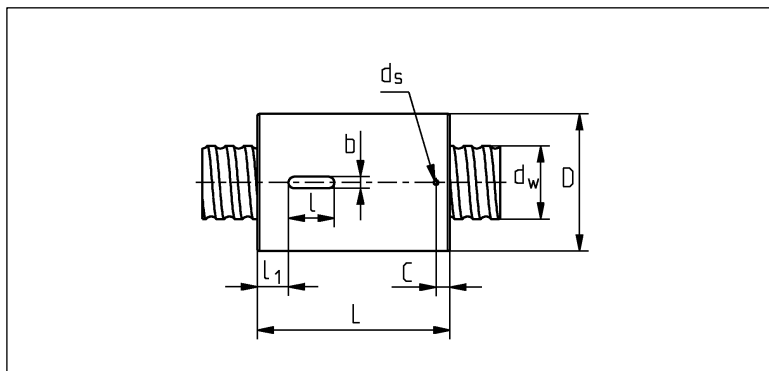


KGM..-2E

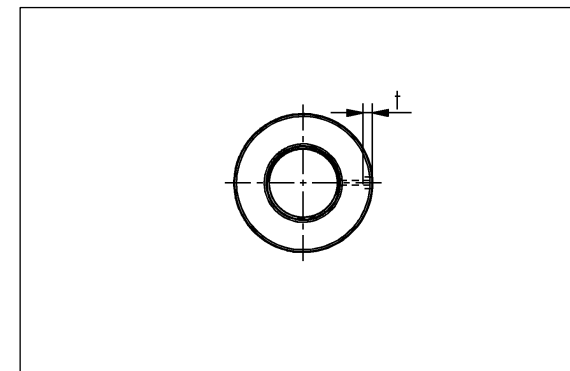
Dimension table · Dimensions in mm								
Designation	Pitch P	Dimensions			Mounting dimensions		Basic load ratings	
		d _w	D h10	L	L ₁	G	dyn. C _a kN	stat. C ₀ kN
KGM08x2.5-RH-2E2.5	2.5	8	17.5	23.5	7.5	M15x1	1.52	2.66
KGM10x3-RH-2E2.5	3	10	21	29	9	M18x1	2.91	5.01
KGM12x5-RH-2E3.5	5	12	25.5	39	10	M20x1	4.93	9.38
KGM16x5-RH-2E2.5	5	16	32.5	42	12	M26x1,5	7.76	14.21

Ball screw drive

With cylindrical nut
KGM-2D



KGM..-2D

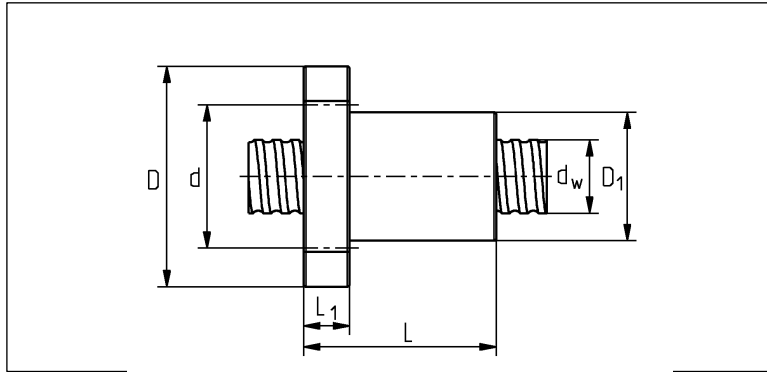


KGM..-2D

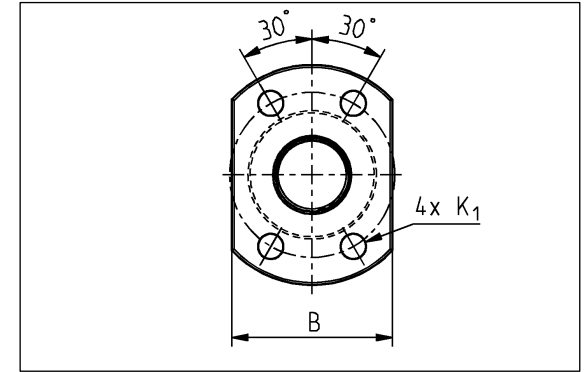
Dimension table · Dimensions in mm													
Designation	Pitch P	Dimensions				Mounting dimensions						Basic load ratings	
		d _w	D	L	C	b	l	l ₁	t	d _s	dyn. C _a kN	stat. C ₀ kN	
KGM16x05-RH-2D4	5	16	28	50	7	5	17	16.5	2	3	11.84	22.73	
KGM20x05-RH-2D4	5	20	36	53	7	5	17	18	2	3	13.00	28.15	
KGM25x05-RH-2D4	5	25	40	53	7	5	17	18	2	3	14.30	34.91	
KGM25x10-RH-2D3	10			54			20				12.5	29.11	
KGM32x05-RH-2D4	5	32	50	53	7	6	30	11.5	2.5	3	15.90	44.40	
KGM32x10-RH-2D3	10			70	8			15			31.82	68.20	
KGM32x20-RH-2D3	20			78	7			24			16.79	42.57	
KGM40x05-RH-2D4	5	40	63	56	6	6	30	13	2.5	3	17.50	55.25	
KGM40x10-RH-2D3	10			80	8			15			34.96	84.43	
KGM40x20-RH-2D3	20			83	9			20			29.21	74.23	
KGM50x10-RH-2D3	10	50	75	82	8	6	36	23	2.5	3	38.44	104.74	
KGM63x10-RH-2D4	10	60	85	90	14	6	32	29	3.5	3	54.98	174.90	

Ball screw drive

With flanged nut
KGF-2F



KGF...-2F

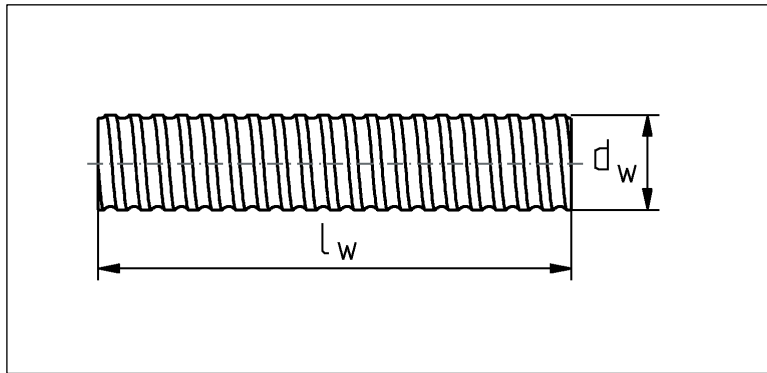


KGF...-2F

Dimension table · Dimensions in mm												
Designation	Pitch P	Type	Dimensions			Mounting dimensions				Location	Basic load ratings	
			d _w	D	L	B	D ₁	L ₁	d	K ₁	dyn. C _a kN	stat. C ₀ kN
KGF06x01-RH-2F3	1	A	6	24	15	16	12	3.5	18	3.4	0.90	1.59
KGF08x01-RH-2F4	1	A	8	27	16	18	14	4	21	3.4	1.02	2.10
KGF08x02-RH-2F3	2	A		29		20	16		23		1.24	2.13
KGF08x2.5-RH-2F3	2.5	A		26	16	1.78	3.19					
KGF10x02-RH-2F3	2	A	10	35	28	22	18	5	27	4.5	1.96	3.95
KGF10x04-RH-2F3	4	A		46	34	28	26	10	36		3.97	6.74
KGF12x02-RH-2F4	2	A	12	37	28	24	20	5	29	4.5	2.75	6.30
KGF14x02-RH-2F3	2	A	14	40	23	26	21	6	31	5.5	2.27	5.49

Ball screw spindle

KGS



KGS..

Dimension table · Dimensions in mm															
Designation	Dimensions		Pitch P ¹⁾												
	d_w	l_w max.	1	2	2.5	3	4	5	6	10	16	20	25	32	40
KGS..	06	900	○												
	08	1200	○	○	○										
	10	1200		○		○	○								
	12	3000		○				○							
	14	3000		○											
	16	3000						○ X		○	○				
	20	3000						○ X				○			
	25	6000					○	○ X		○			○		
	32	6000						○ X		○	○	○		○	
	40	6000						○ X	○	○	○	○			○
	50	6000								○		○			
	63	7200								○		○			
80	7600								○		○				

¹⁾ ○ = right hand thread
 X = optionally with left hand thread

Sealing

Sealing variants: 0 = without seal, 1 = gap seal, 2 = abrasive seal

Designation spindle KGS	Pitch P	screw nut																	
		KGF 2A						KGM 2D						KGF 2F					
		0	1	2	0	1	2	0	1	2	0	1	2	0	1	2			
KGS06	1																	●	■
KGS08	1																	●	■
	2																	●	■
	2,5																●	●	■
KGS10	2																	●	■
	3																	●	
	4																	●	■
KGS12	2																	●	■
	5																	●	
KGS14	2																	●	■
KGS16	5	■	●	■	■	●	■				■	●	■	●					
	10	■		●															
	16							■		●									
KGS20	5	■	●				●				■	●	■						
	10	■	●																
	20							■		●									
KGS25	4	■	●																
	5	■	●	■							■	●	■						
	10	■	●	■	■	●	■				■	●							
	25							■		●									
KGS32	5	■	●	■	■	●	■				■		●						
	10	■	●	■	■	●	■												
	20							■		●	■		●						
	32							■		●									
KGS40	5	■	●	■	■	●	■				■		●						
	6	■		●															
	10	■	●	■	■	●	■				■	●	■						
	20							■		●	■		●						
	40							■		●									
KGS50	10	■	●	■	■	●	■				■	●	■						
	20							■		●									
KGS63	10	■	●		■	●					■	●							
	20	■	●		■	●													
KGS80	10	■	●		■	●													
	20	■	●		■	●													

● = standard
■ = optional

Ordering designation

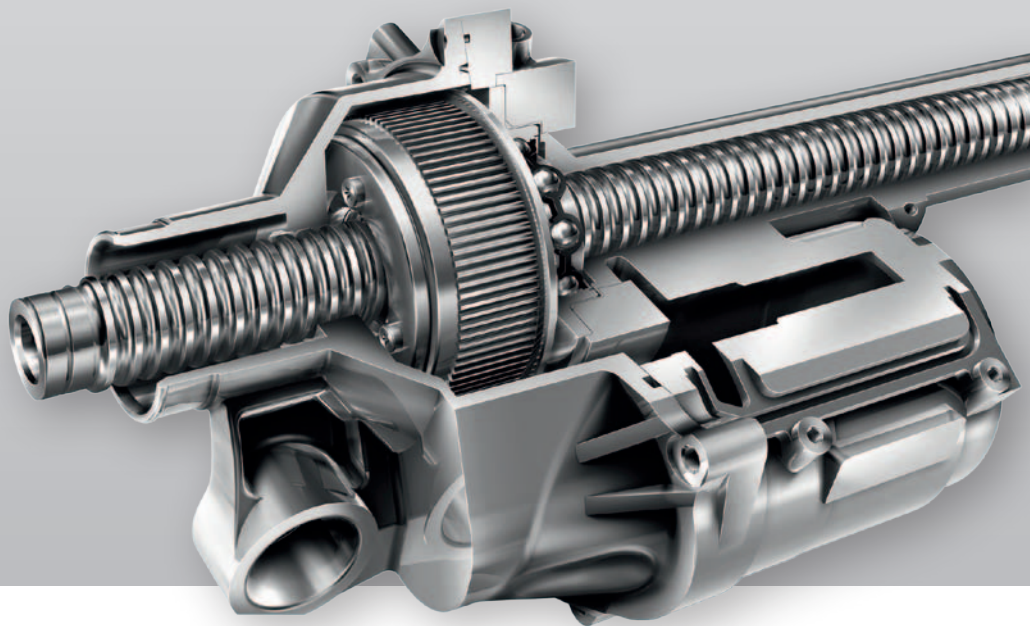
Design	Ball screw drive	Short designation and suffix KGT																																				
Size	Size		06	08		10			12	14	16		20			25			32				40			50		63		80								
Spindle	Pitch	P	1	1	2	2.5	2	3	4	2	5	2	5	10	16	5	10	20	4	5	10	25	5	10	20	32	5	6	10	20	40	10	20	10	20	10	20	
Thread direction	Right hand thread	RH	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
	Left hand thread	LH											■			■					■					■												
Screw nut	Design	Flanged nut	2A										●	●		●	●	●	●	●	●		●	●			●	●	●			●	●	●	●	●		
		Flanged double nut	2B											●			●			●		●	●		●	●		●	●			●	●	●	●	●		
		Flanged nut	2C												●					●			●			●	●			●	●							
		Cylindrical nut	2E				●		●					●										●	●		●	●		●	●			●	●	●	●	●
		Cylindrical nut	2D												●			●					●	●		●	●		●	●			●	●	●	●	●	
Flanged nut	2F	●	●	●	●	●		●	●		●																											
Rolling element turns in screw nut	Number		2,5, 3 or 4, depending on the type and length of screw nut																																			
Sealing	Without seals	0	See table Sealing variants																																			
	Gap seals	1																																				
	Contact seals	2																																				
Type	Transport ball screw drive		T																																			
Accuracy			T7 = standard (T5 optional)																																			
Preload	Clearance	V0	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
	Clearance-free	V1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
	Preloaded	V2	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Lengths	Total length of screw spindle		Value in mm																																			
Special lubrication			By agreement																																			
Coating			By agreement																																			
Documentation			By agreement																																			

● = standard
■ = optional

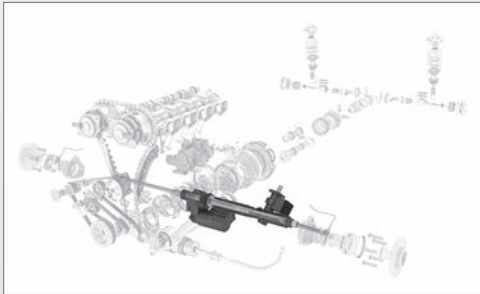
Engine
Chassis
Transmission
E-Mobility

SCHAEFFLER

Ball Screw Drive



Ball Screw Drive (KGT) for Electromechanical Steering



Description

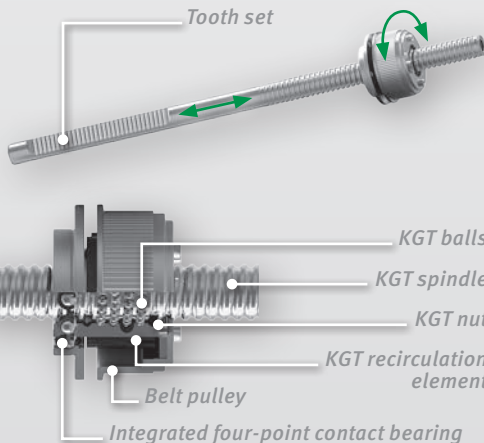
- Conversion of rotational motion of an electric motor into translational motion of the steering system
- Conversion of small drive torques into high output forces
- KGT and toothed rack integrated in one component
- With integrated four-point contact bearing (solution with optimized design envelope)
- KGT with high precision forming technology for very high system requirements

Advantages

- High efficiency, minimum friction
- Reduction in CO₂ emissions and fuel consumption compared to a conventional hydraulic steering system
- High performance density
- Design with optimized noise characteristics
- Flexible design envelope configuration by means of different ball recirculation concepts
- Clearance-free adjustment facility as required
- Maintenance-free throughout operating life
- Comfort functions can be integrated in the steering system (parking assist, side-wind compensation and lane assist)

Advantages of 48V architecture

- Higher tie rod forces can be implemented
- Higher drive torques are possible (higher pitch can be implemented with lower friction)





Precision Rolled Ball Screw Drives

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Precision Rolled Ball Screw Drives

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Product Description

Ball Screw Assembly KGT

A precision rolled ball screw assembly KGT consists of at least one KGF or KGM nut on a screw shaft KGS.

The thread design is a right hand, gothic arch profile. KGT Ball screw assemblies are available in various metric diameter-lead combinations.

Ball Screw Shaft KGS

Series KGS precision rolled metric ball screw shafts are manufactured from high strength steel, Cf53 (SAE 1055). The thread surface is induction hardened to 60 HRC (1.5 mm case depth), min.

Lead accuracies of 23µm/300mm and 50µm/300mm are offered.

Single and multi-start thread designs are used. The number of starts is determined by the diameter-lead combination, and is listed in the dimensional chart for each size.

Standard machined end configurations are offered. Screws can also be machined to customer specifications (drawing required).

Operating Limits

The maximum rotational speed for INA ball screw drives is 4500 rpm. Application specific parameters, such as critical speed may further reduce the speed limit; verification is required.

The permissible operating temperature range is from -30° to +80° C, and up to 110° C for short periods. This assumes proper lubrication.

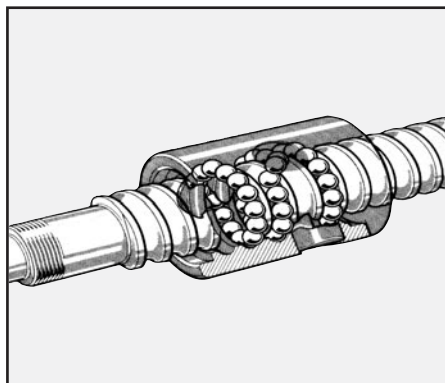


Figure 1
Button-type Segment Ball Return System.
Used On Single Start 5 and 10mm leads

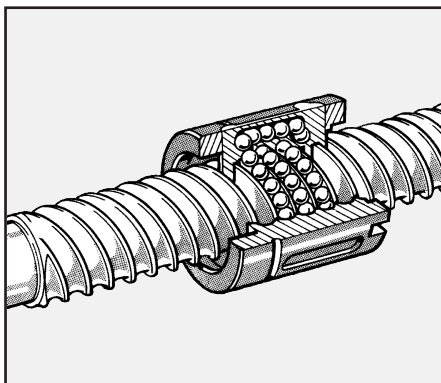


Figure 2
Duct-type Ball Return System.
Used On Dual Start 10mm Leads

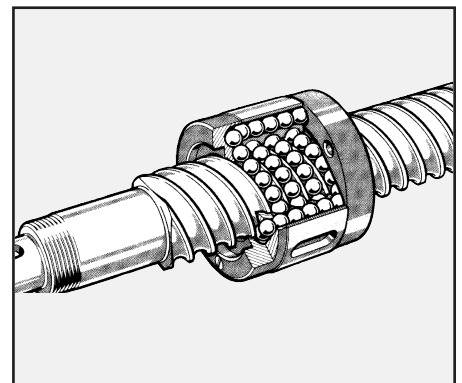


Figure 3
Endcap Ball Return System.
Used On High-helix, Multi-start Leads

Table 1 • INA Ball Screw Drive Assemblies

Series	Description
KGT..F	Ball screw assembly, KGS screw with single flanged nut KGF
KGT..M	Ball screw assembly, KGS screw with single cylindrical nut KGM
KGT..FM	Ball screw assembly, KGS screw with double preloaded nut unit (1 KGF, 1 KGM)
KGT..MM	Ball screw assembly, KGS screw with double preloaded nut unit (2 KGM)

Table 2 • INA Ball Screw Drive Components

Series	Description
KGS	Ball Screw Shaft
KGF	Flanged Ball Nut
KGM	Cylindrical Ball Nut

Ball Nuts

Flanged Ball Nut KGF

Cylindrical Ball Nut KGM

Series KGF and KGM ball nuts are manufactured from high quality bearing steel, 100Cr6 (SAE 52100). After hardening, the locating surfaces and raceways are precision ground in a single setting to assure accuracy.

INA ball nuts use internal ball return systems. The result is an easy to install compact design.

KGF and KGM ball nuts are offered with Nitrile contact seals on each end face (Suffix EE). The end seals prevent the ingress of contamination and escape of lubrication from the nut.

Preloaded Ball Nuts

Due to low friction and high accuracy, INA ball nuts can be preloaded or assembled to reduce backlash. Two methods are employed to reduce backlash or establish preload:

The most cost-effective method is to reduce or eliminate clearance in the ballnut by ball size selection. This method may result in increased friction in the unloaded state due to four-point ball contact. However, as soon as axial load is applied, normal two-point contact conditions are established and the ballnut operates efficiently, without backlash upon load reversal. The standard preload for this method is 2% of the dynamic load rating [C].

For applications demanding optimum stiffness, INA ball nuts can also be combined to create a preloaded double-nut assembly. The preload is achieved by tensioning the two nuts against each other in conjunction with a ground spacer ring. The total nut length can be enlarged up to 10mm as a consequence of the applied pretensioning ring.

The standard preload for a double-nut assembly is 10% of the dynamic load rating [C]. Other preload values, ranging from 0% to 30% C can be provided upon request.

NOTE: Double-nut preloading is only possible with 5mm and 10mm leads. Leads of 20mm, 25mm, 40mm and 50mm can only be set to low backlash or preloaded by ball selection. Please consult INA Engineering to determine the correct preload for your application.

Preload Variants

KGT-MM

A preloaded nut unit per variation MM consists of two KGM cylindrical nuts and a pretensioning ring.

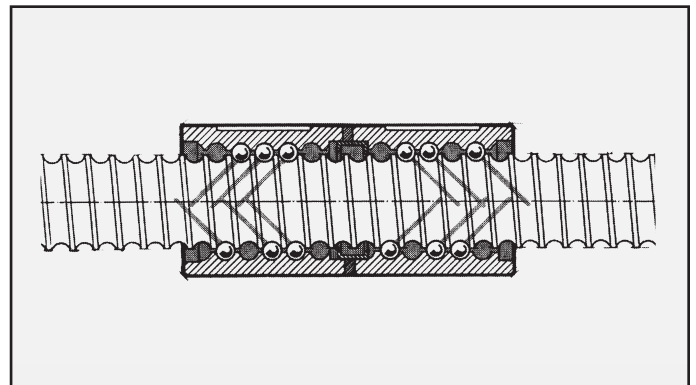


Figure 4

KGT-FM

A preloaded nut unit per variation FM consists of one KGF flanged nut, one KGM cylindrical nut and a pretensioning ring.

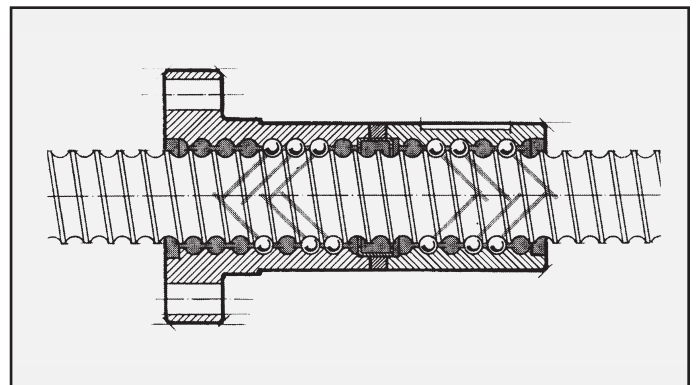


Figure 5

Load Rating And Life

Dynamic Load Rating, C

The dynamic load Rating, C, is the axial load under which 90% of a significantly large group of apparently identical ball screws will reach or exceed 1,000,000 revolutions before the first evidence of material fatigue occurs.

Static Load Rating, Co

The static load rating, Co, is the axial load under which permanent deformation of the raceways or balls occurs in the magnitude of 1/10,000 of the original ball diameter.

Basic Life Rating

The basic life rating can be calculated by using the following equations:

$$L_{10} = \left(\frac{C}{P} \right)^3 \cdot 10^6 \quad (1)$$

$$L_h = \frac{16,666}{n} \cdot \left(\frac{C}{P} \right)^3 \quad (2)$$

L_{10} revolutions
Basic life rating in revolutions

L_h hours
Basic life rating in operating hours

C N
Dynamic load rating

P N
Equivalent axial load

n rpm
Equivalent speed

Equivalent load and equivalent speed

If ball screws are subject to alternating loads and/or alternating speeds, equivalent values must be calculated for use in the basic life calculation.

The equations for equivalent load and equivalent speed are as follows:

$$P_a = \sqrt[3]{\frac{q_1 \cdot n_1 \cdot F_1^3 + q_2 \cdot n_2 \cdot F_2^3 + \dots + q_z \cdot n_z \cdot F_z^3}{q_1 \cdot n_1 + q_2 \cdot n_2 + \dots + q_z \cdot n_z}} \quad (3)$$

$$n = \frac{q_1 \cdot n_1 + q_2 \cdot n_2 + \dots + q_z \cdot n_z}{100} \quad (4)$$

P N
Equivalent axial load

$F_{1...z}$ N
Constant operating load within a time interval

$n_{1...z}$ rpm
Constant speed within a time interval

$q_{1...z}$ %
Duration of time interval

N rpm
Equivalent speed

Critical Speed And Buckling Load

Critical Speed

The critical speed of a shaft is the rotational speed at which the shaft becomes dynamically unstable due to resonance of the rotational imbalances with the natural frequency of the shaft. At the critical speed, the shaft can vibrate and deflect in large magnitudes which could result in damage to the shaft and to the machine of which it is part.

It is recommended that the maximum rotational speed of a ball screw be limited to 80% of the critical speed. The equations to calculate critical speed and maximum speed of INA ball screws are as follows:

$$n_{crit} = \frac{k_n \cdot d_2}{L^2} \cdot 10^7 \quad (5)$$

$$n_{max} = 0.8 \cdot n_{crit} \quad (6)$$

n_{crit} rpm
Critical speed of screw shaft

k_n mm/min⁻¹
Factor from Table 1 for the type of support bearing arrangement

d_2 mm
Root diameter of screw shaft listed in dimension table

L mm
Unsupported shaft length according to Table 1

n_{max} rpm
Maximum permissible shaft speed

Buckling Load

A shaft under compressive axial load is subject to potential buckling. It is recommended that the maximum axial load on the ball screw be limited to 50% of the buckling load. Limits due to static and dynamic load ratings must be observed as well.

The equations to calculate buckling load and permissible axial load of INA ball screws are as follows:

$$F_{buckling} = \frac{k_k \cdot d_2^4}{L^2} \cdot 10^4 \quad (7)$$

$$F_{perm} = 0.5 \cdot F_{buckling} \quad (8)$$

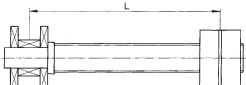


$F_{buckling}$ N
Buckling load of screw shaft

k_k N/mm²
Factor from Table 1 for the type of support bearing arrangement

d_r mm
Root diameter of screw shaft listed in dimension table

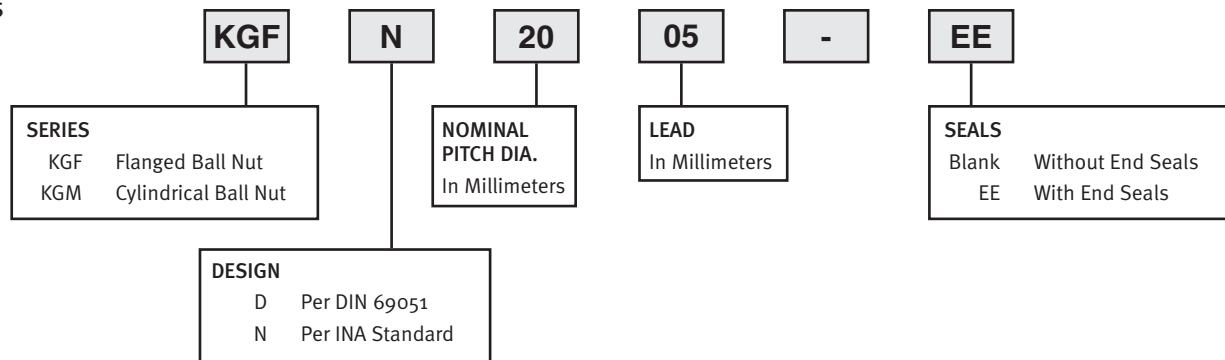
L mm
Unsupported shaft length according to Table 1

Table 3 • Coefficients k_n and k_k

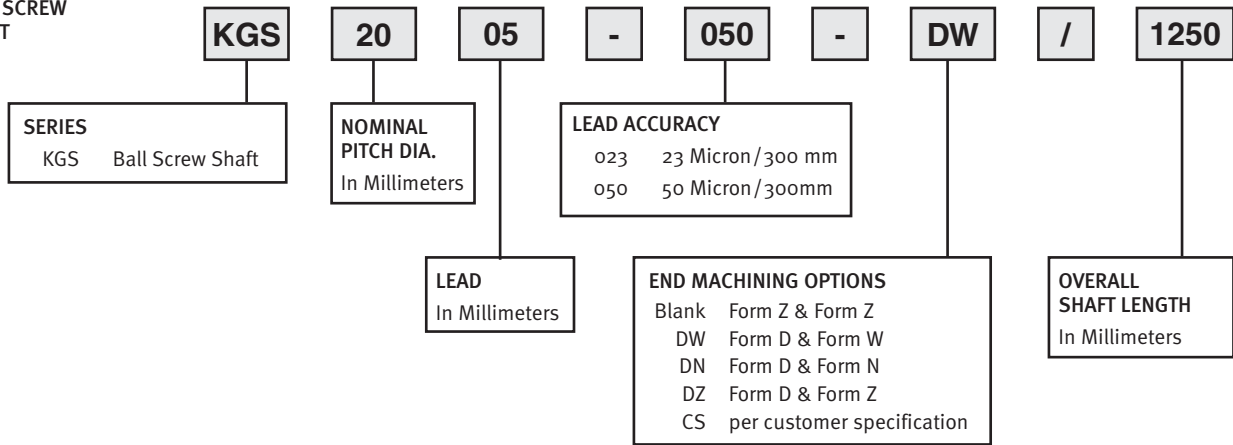
Of Support Bearing Arrangement	Critical Speed Factor k_n	Buckling Load Factor k_k
Fixed-Free 	3.5	0.84
Fixed-Supported 	15.3	7
Fixed-Fixed 	22.3	13.7

Ordering Designations

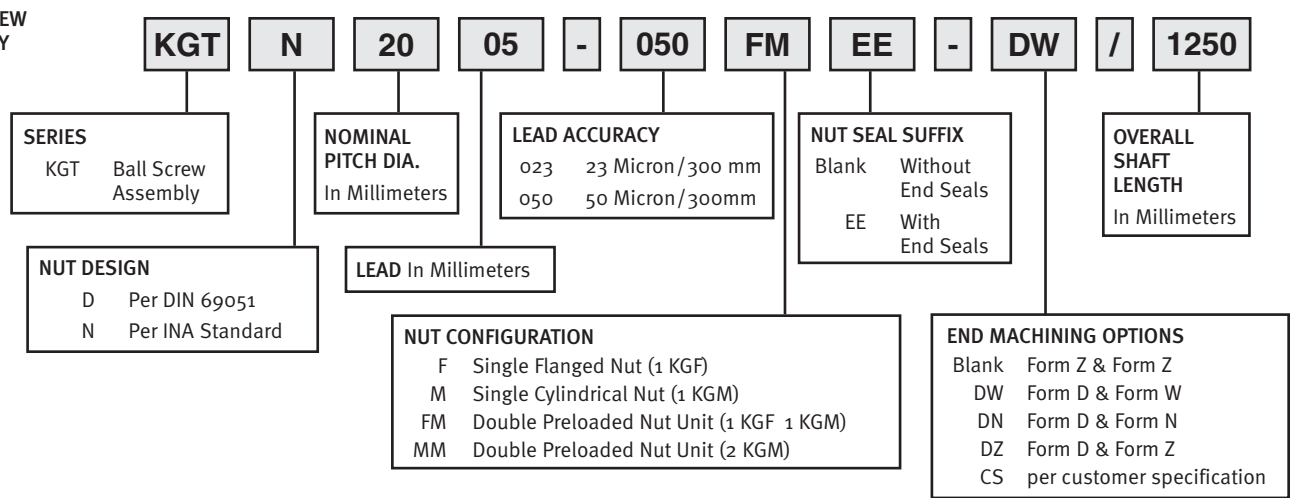
BALL NUTS



BALL SCREW SHAFT



BALL SCREW ASSEMBLY



Rolled Ball Screws

Series KGS

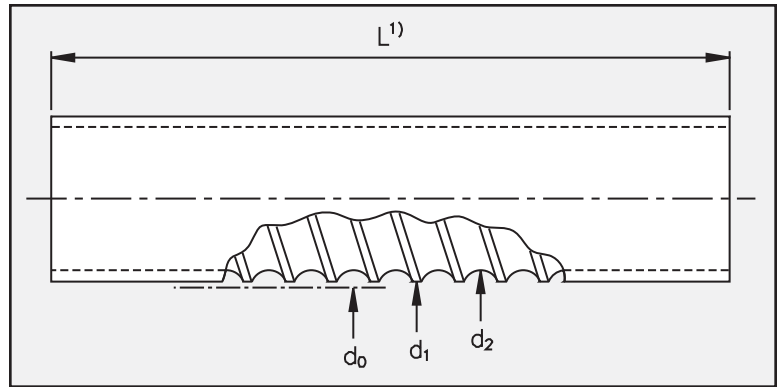


Figure 6 • KGS Rolled Ball Screw

Nominal Pitch Diameter d_0	Designation	Accuracy Class ($\mu\text{m}/300\text{ mm}$)	Dimensions in (mm)					Mass (kg/m)	
			d_0	Lead P	d_1 (h_{11})	d_2	Number Of Starts		$L_{\text{max}1}$
16	KGS 1605	23 / 50	16	5	15.5	12.9	1	5600	1.26
	KGS 1610	23 / 50	16	10	15.4	13.0	2	5600	1.26
20	KGS 2005	23 / 50	20	5	19.5	16.9	1	5600	2.04
	KGS 2020	23 / 50	20	20	19.5	16.9	4	5600	2.07
	KGS 2050	23 / 50	20	50	19.1	16.5	5	5600	2.04
25	KGS 2505	23 / 50	25	5	24.5	21.9	1	5600	3.33
	KGS 2510	23 / 50	25	10	24.5	21.9	1	5600	3.33
	KGS 2520	23 / 50	25	20	24.6	22.0	4	5600	3.33
	KGS 2525	23 / 50	25	25	24.5	22.0	5	5600	3.33
	KGS 2550	23 / 50	25	50	24.5	21.5	5	5600	3.33
32	KGS 3205	23 / 50	32	5	31.5	28.9	1	5600	5.61
	KGS 3210	23 / 50	32	10	32.7	27.3	1	5600	5.60
	KGS 3220	23 / 50	32	20	31.7	27.9	2	5600	5.61
	KGS 3240	23 / 50	32	40	30.9	28.3	4	5600	5.61
40	KGS 4005	23 / 50	40	5	39.5	36.9	1	5600	9.03
	KGS 4010	23 / 50	40	10	39.5	34.1	2	5600	8.33
	KGS 4020	23 / 50	40	20	39.7	35.9	2	5600	9.01
	KGS 4040	23 / 50	40	40	38.9	36.3	4	5600	9.01
50	KGS 5010	50	50	10	49.5	44.1	1	5600	13.48
	KGS 5020	50	50	20	49.5	44.1	2	5600	13.50
63	KGS 6310	50	63	10	62.5	57.1	1	5600	22.04

Notes

i) For 5600mm, delivered length is 6000 mm with both ends soft-annealed over a length of 200 mm.

Flanged Ball Nuts

Series KGF

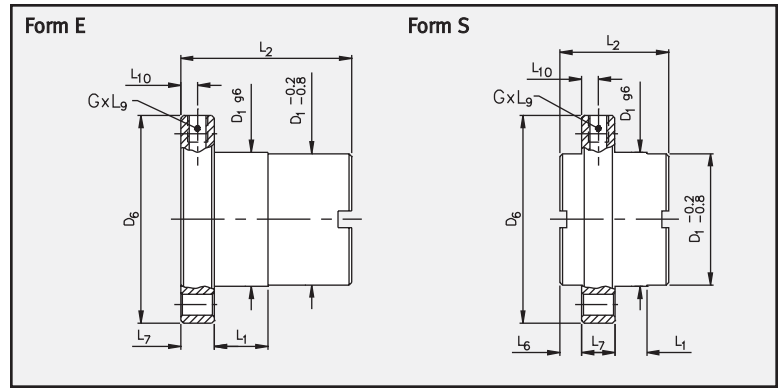


Figure 7 • KGF Flanged Ball Nuts

Nomina Pitch Diameter d_o	Designation d_o Lead	Seal Suffix	Form	Hole Pattern	Dimensions in (mm)										Lube Hole G	Axial Backlash Max	Load Rating		
					D_1	D_4	D_5	D_6	L_1	L_2	L_6	L_7	L_8	L_9			L_{10}	Dyn C (kN)	Stat C_o (kN)
16	KGF D 16 05	EE	E	1	28	38	5.5	48	10	42	-	10	40	10	5	M6	0.08	12.0	12.7
	KGF D 16 10	EE	E	1	28	38	5.5	48	10	55	-	10	40	10	5	M6	0.08	23.0	26.0
20	KGF N 20 05	EE	E	3	32	45	7	55	8	44	-	12	-	8	6	M6	0.08	14.0	17.0
	KGF N 20 20	EE	S	3	35	50	7	62	4	30	8	10	-	8	5	M6	0.08	12.0	19.2
	KGF N 20 50	EE	S	3	35	50	7	62	10	56	9	10	-	8	5	M6	0.15	18.0	22.0
25	KGF D 25 05	EE	E	1	40	51	6.6	62	10	42	-	10	48	10	5	M6	0.08	15.0	22.4
	KGF D 25 10	EE	E	1	40	51	6.6	62	16	55	-	10	48	10	5	M6	0.08	17.5	25.0
	KGF D 25 20	EE	S	1	40	51	6.6	62	4	35	10.5	10	48	8	5	M6	0.15	19.0	23.5
	KGF D 25 25	EE	S	1	40	51	6.6	62	9	35	8	10	.1)	8	5	M6	0.08	21.0	31.0
	KGF D 25 50	EE	S	1	40	51	6.6	62	10	58	10.5	10	48	8	5	M6	0.15	22.5	29.0
32	KGF N 32 05	EE	E	3	45	58	7	70	10	59	-	16	-	8	8	M6	0.08	24.0	49.0
	KGF N 32 10	EE	E	3	53	68	7	80	10	73	-	16	-	8	8	M8x1	0.08	44.0	53.0
	KGF D 32 20	EE	E	1	53	65	9	80	16	80	-	12	62	10	6	M6	0.08	42.5	61.0
	KGF N 32 40	EE	S	3	53	68	7	80	14	45	7.5	16	-	10	8	M6	0.08	17.0	32.0
40	KGF D 40 05	EE	E	2	63	78	9	93	10	57	-	14	70	10	7	M6	0.08	26.0	63.5
	KGF D 40 10	EE	E	2	63	78	9	95	16	71	-	14	70	10	7	M8x1	0.08	50.0	70.0
	KGF D 40 20	EE	E	2	63	78	9	93	16	80	-	14	70	10	7	M8x1	0.08	44.5	77.0
	KGF D 40 40	EE	S	2	63	78	9	93	16	85	7.5	14	.1)	10	7	M8x1	0.08	42.0	93.0
50	KGF D 50 10	EE	E	2	75	93	11	110	16	95	-	16	85	10	8	M8x1	0.08	78.0	153.0
	KGF D 50 20	EE	E	2	85	103	11	125	22	95	-	18	95	10	9	M8x1	0.08	82.0	137.0
63	KGF N 63 10	EE	E	3	85	105	11	125	10	99	-	20	-	8	10	M8x1	0.08	86.0	200.0

Notes

1) Round flange.

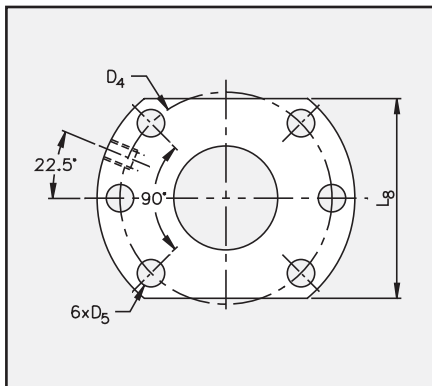


Figure 8 • Hole Pattern 1

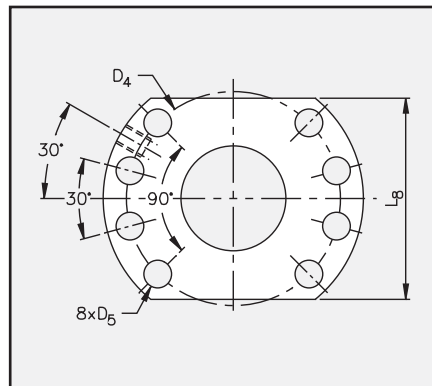


Figure 9 • Hole Pattern 2

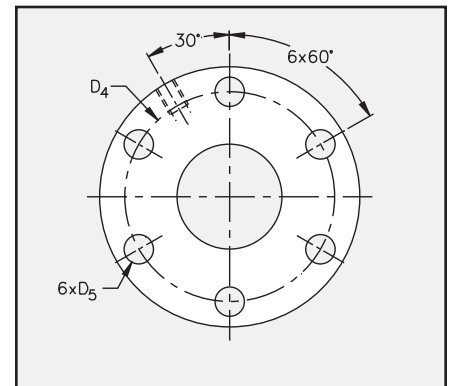


Figure 10 • Hole Pattern 3

Cylindrical Ball Nuts

Series KGM

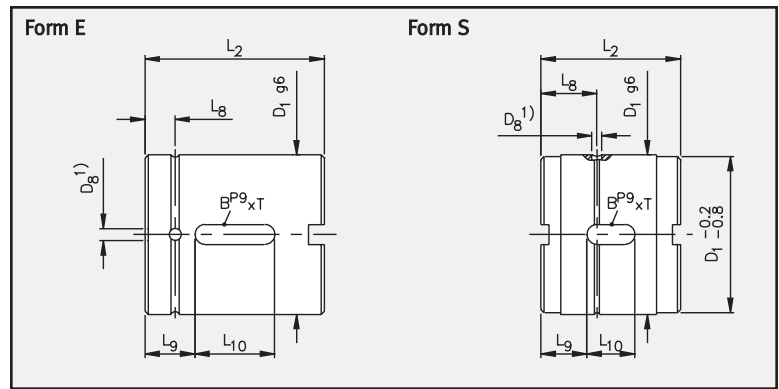


Figure 11 • KGM Cylindrical Ball Nuts

Nominal Pitch Diameter d_0	Designation		Seal Suffix	Form	Dimensions in (mm)							Axial Backlash Max	Dyn C (kN)	Stat C_0 (kN)
	d_0	Lead			D_1	$D_8^{1)}$	L_2	L_8	L_9	L_{10}	BxT			
16	KGM D	16 05	EE	E	28	3	34	7	7	20	5X2	0.08	12.5	12.7
	KGM D	16 10	EE	E	28	3	50	7	15	20	5X2	0.08	23.0	26.0
20	KGM N	20 05	EE	E	32	3	34	7	7	20	5X2	0.08	14.0	17.0
	KGM N	20 20	EE	S	35	1.5	30	11.5	9	12	5X3	0.08	12.0	19.2
	KGM N	20 50	EE	S	35	1.5	56	16	18	20	5X3	0.15	18.0	22.0
25	KGM D	25 05	EE	E	40	3	34	7	7	20	5X2	0.08	15.0	22.4
	KGM D	25 10	EE	E	40	3	45	7.5	12.5	20	5X2	0.08	17.5	25.0
	KGM D	25 20	EE	S	40	1.5	35	14	11.5	12	5X3	0.15	19.0	23.5
	KGM D	25 25	EE	S	40	1.5	35	11.5	11	13	5X3	0.08	21.0	31.0
	KGM D	25 50	EE	S	40	1.5	58	17	19	20	5X3	0.15	22.5	29.0
32	KGM N	32 05	EE	E	45	3	45	7.5	8	30	6X2.5	0.08	24.0	49.0
	KGM N	32 10	EE	E	53	4	60	10	15	30	6X2.5	0.08	44.0	53.0
	KGM N	32 20	EE	E	53	3	70	7.5	20	30	6X2.5	0.08	42.5	61.0
	KGM N	32 40	EE	S	53 ²⁾	1.5	45	13	10	25	6X4	0.08	17.0	32.0
40	KGM D	40 05	EE	E	63	3	45	7.5	8	30	6X2.5	0.08	26.0	63.5
	KGM D	40 10	EE	E	63	4	60	10	15	30	6X2.5	0.08	50.0	70.0
	KGM D	40 20	EE	E	63	3	70	7.5	20	30	6X2.5	0.08	44.5	77.0
	KGM D	40 40	EE	S	63	1.5	85	15	27.5	30	6X3.5	0.08	42.0	93.0
50	KGM D	50 10	EE	E	75	4	82	11	23	36	6X2.5	0.08	78.0	153.0
	KGM N	50 20	EE	E	85	4	82	10	23	36	6X2.5	0.08	82.0	137.0
63	KGM N	63 10	EE	E	85	4	82	11	23	36	6X2.5	0.08	86.0	200.0

Notes

1) Position of lubrication hole not defined on circumference.

2) $D_1 -0.2/-0.8$ is $D_1 -1/-1.5$

Standard Screw Ends

Form D

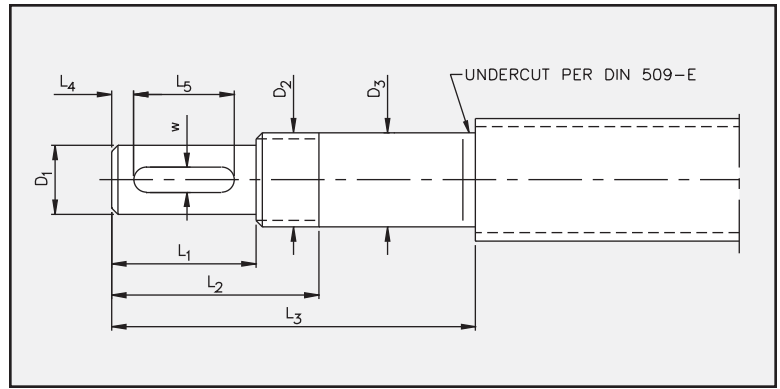


Figure 12 • Standard Screw End - Form D

Nominal Pitch Diameter d_0	Dimensions in (mm)							Keyway to DIN 6885 $w \times \text{depth} \times L_6$
	D_1^{h6}	D_2	D_3^{h6}	L_1	L_2	L_3	L_4	
16	9	M12x1	12	20	30	55	2.5	3 x 1.8 x 16
20	11	M15x1	15	23	33	58	3.5	4 x 2.5 x 16
25	14	M20x1	20	30	42	70	4	5 x 3 x 22
32	19	M25x1.5	25	40	54	82	6	6 x 3.5 x 28
40	24	M30x1.5	30	50	64	92	7	8 x 4 x 36
50	36	M40x1.5	40	60	84	117	10	10 x 5 x 40
63	40	M50x1.5	50	80	111	144	12	12 x 5 x 56

Nominal Pitch Diameter d_0	Dimensions in (mm)							N x S	Bearing	Locknut
	D_4	D_5	D_6	D_7	L_6	L_7				
16	55	42	22	42	8	25	3 x M6	ZKLF 1255-2RS-PE	ZKLN 1242-2RS-PE	ZM12
20	60	46	25	45	8	25	3 x M6	ZKLF 1560-2RS-PE	ZKLN 1545-2RS-PE	ZM15
25	68	53	32	52	10	28	4 x M6	ZKLF 2068-2RS-PE	ZKLN 2052-2RS-PE	ZM20
32	75	58	38	57	12	28	4 x M6	ZKLF 2575-2RS-PE	ZKLN 2557-2RS-PE	ZM25
40	80	63	45	62	12	28	6 x M6	ZKLF 3080-2RS-PE	ZKLN 3062-2RS-PE	ZM30
50	100	80	58	75	14	34	4 x M8	ZKLF 40100-2RS-PE	ZKLN 4075-2RS-PE	ZM40
63	115	94	70	90	14	34	6 x M8	ZKLF 50115-2RS-PE	ZKLN 5090-2RS-PE	ZM50

Notes

Bearings and locknut must be ordered separately. For more information, see INA publication TPI 123 Bearings For Screw Drives

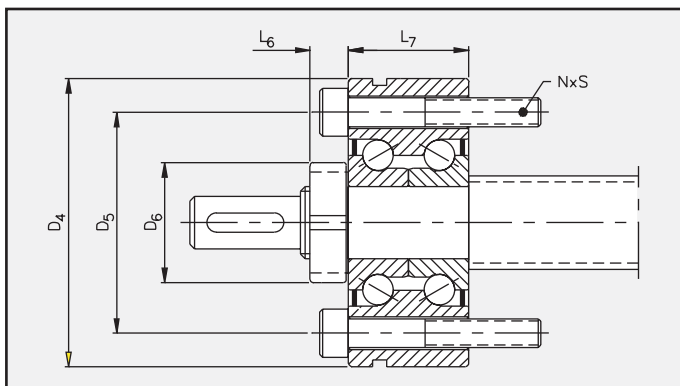


Figure 13 • Standard Screw End - Form D With ZKLF & ZM

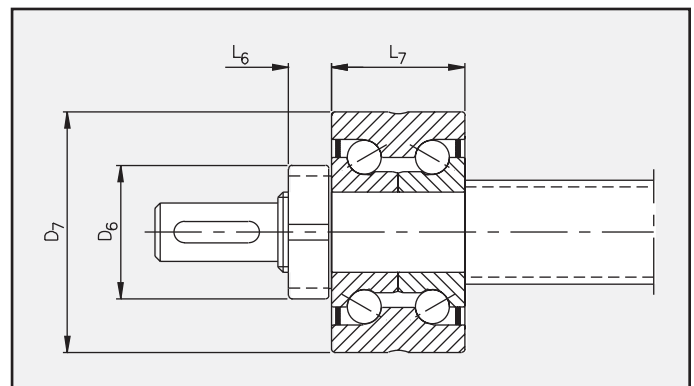


Figure 14 • Standard Screw End - Form D With ZKLN & ZM

Standard Screw Ends

Forms W, N and Z

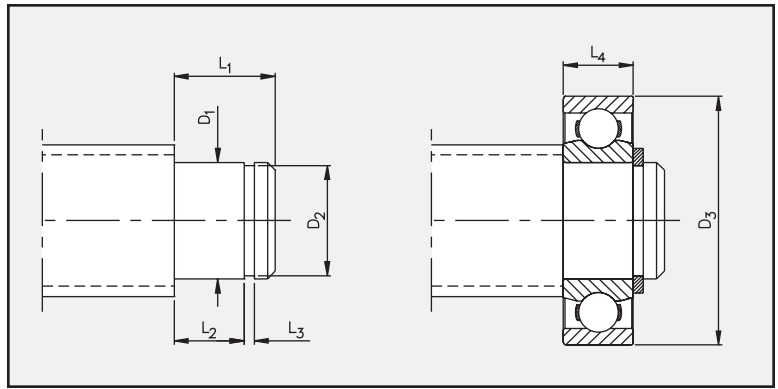


Figure 15 • Standard Screw End - Form W

Form W

Nominal Pitch Diameter d_0	Dimensions in (mm)							Bearing	Shaft Ring Per DIN 471
	D_1^{j6}	D_2	D_3	L_1	L_2	L_3	L_4		
16	12	11.5	28	12	8	1.1	8	6001-2RSR	12X1
20	15	14.2	32	13	9	1.3	9	6002-2RSR	15X1
25	20	18.8	42	16	12	1.3	12	6004-2RSR	20X1.2
32	25	23.7	52	20	15	1.3	15	6205-2RSR	25X1.2
40	30	28.6	62	21	16	1.6	16	6206-2RSR	30X1.5
50	40	38.5	80	25	18	1.85	18	6208-2RSR	40X1.75
63	55	52	100	29	21	2.15	21	6211-2RSR	55X2

Notes

Bearings must be ordered separately. For more information, see INA publication 901.
Shaft rings not included.

Form N

Nominal Pitch Diameter d_0	Dimensions in (mm)							INA Needle Roller Bearing	INA Snap Ring
	D_1^{j6}	D_2	D_3	L_1	L_2	L_3	L_4		
16	12	11.5	24	18	14	1.1	13	NA 4901-2RSR	WR 12
20	15	14.4	28	18	14	1.3	13	NA 4902-2RSR	WR 15
25	20	19.2	37	22	18	1.3	17	NA 4904-2RSR	WR 20
32	25	24	42	23	18	1.3	17	NA 4905-2RSR	WR 25
40	30	29	47	23	18	1.6	17	NA 4906-2RSR	WR 30
50	40	38.5	62	30	23	1.6	22	NA 4908-2RSR	WR 40
63	50	48.5	62	30.5	23	1.6	22	NA 4910-2RSR	WR 50

Notes

Bearings must be ordered separately. For more information, see INA publication 901.
Shaft rings not included.

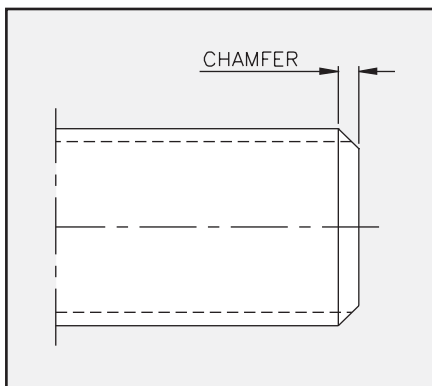


Figure 16 • Standard Screw End - Form Z

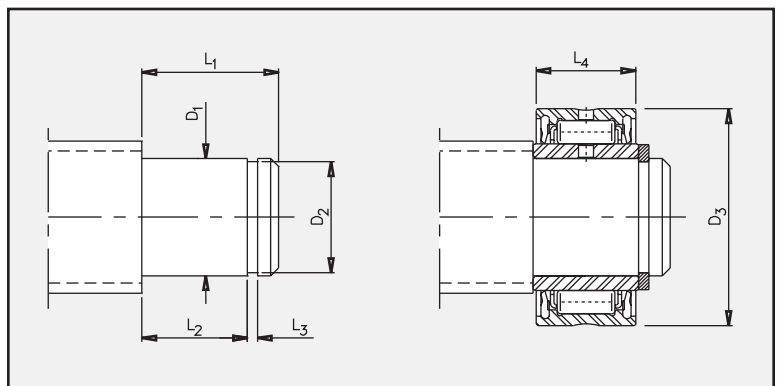
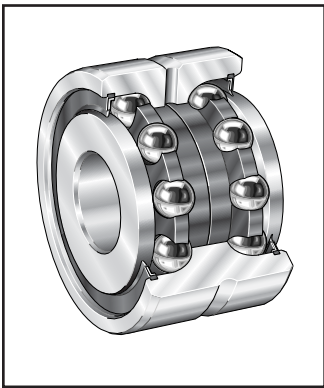


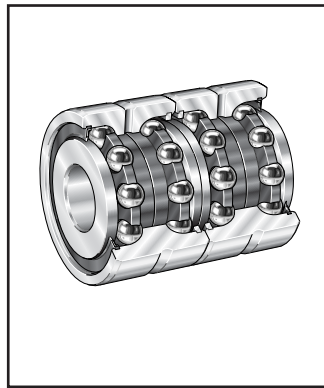
Figure 17 • Standard Screw End - Form N

Bearing Components For Screw Drives

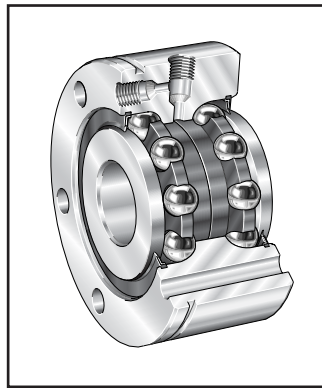
INA manufactures a complete line of ball screw support bearings and precision lock nuts. INA ball screws can be machined to accommodate numerous bearing arrangements. For more information see publication TPI123, Bearings For Screw Drives



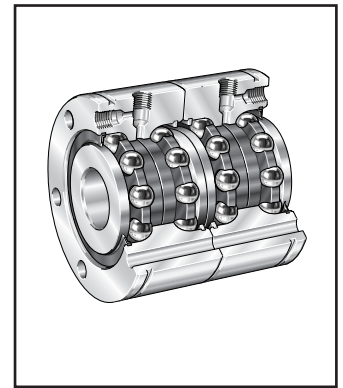
ZKLN



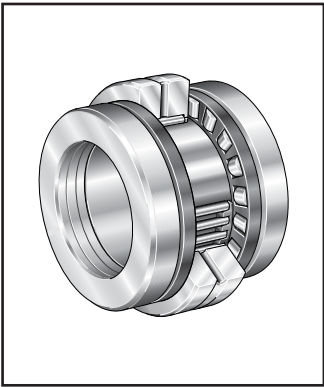
ZKLN..2AP



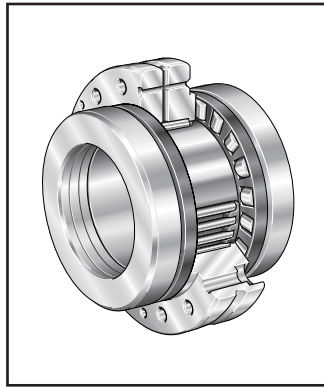
ZKLF



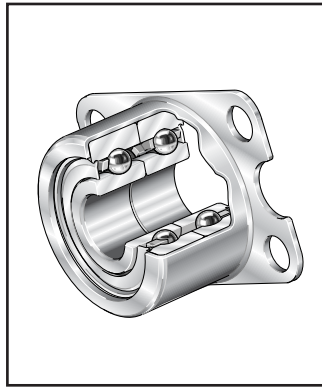
ZKLF..2AP



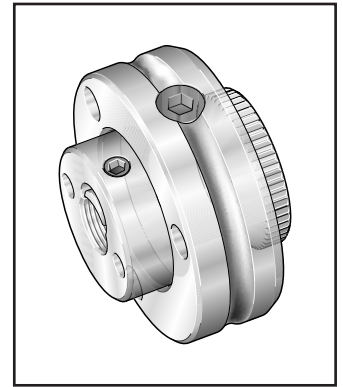
ZARN



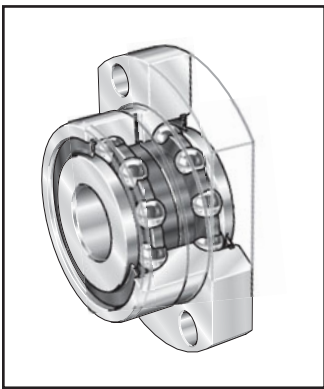
ZARF



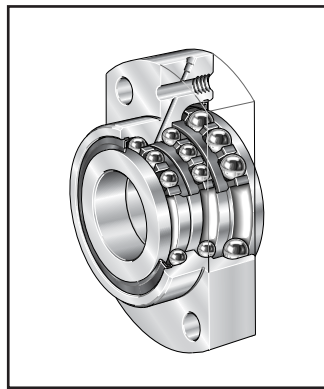
ZKLR



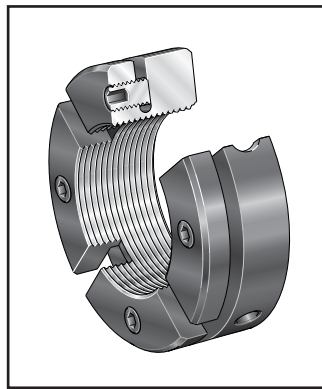
ZAXFM



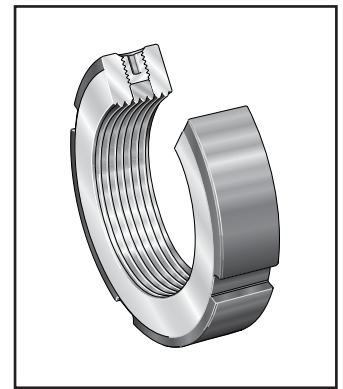
ZKLFA



DKLFA



AM



ZM, ZMA

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Ball screw drive KGT
Ball screw spindle KGS
Ball screw nut KGF(M)

Date: July 2012

Technical introduction

Axial clearance and preload

Schaeffler ball screw drives have a contact angle of 45° . Due to external drive forces and internal drive forces, an axial force is generated F_a that results in axial deflection as a function of the preload.

The axial clearance that results from the clear spacing between the rolling element and rolling element raceway can be eliminated by the preload force P , thus increasing the positional accuracy and rigidity of the ball screw drive.

The preload force P can be influenced by the use of a preloaded double or single nut (Figure 1 and 2, Table 1).

Double nut

The fitting of a spacer to give an O arrangement of the two nuts results in preloading of the double nut.

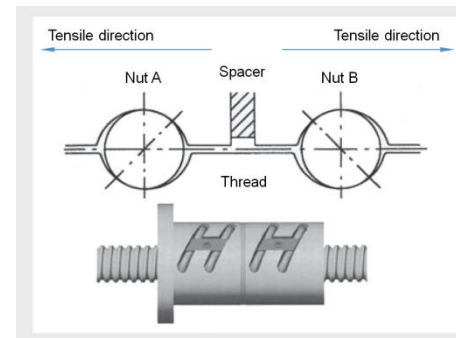


Figure 1

Single nut

The fitting of oversize rolling elements results in the preloading of the single nut.

This gives four contact points per rolling element.

This gives four contact points per rolling element.

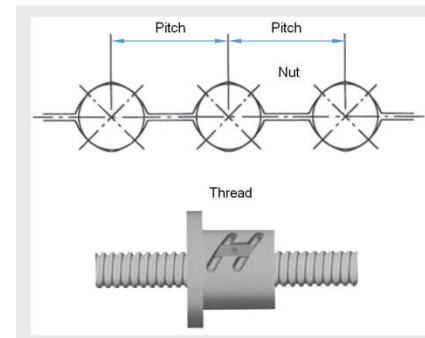


Figure 2

Technical introduction

Preload

Preload classes of Schaeffler ball screw drives according to the table

Spindle diameter d_w	V0 Standard Max. axial clearance mm	V1 Clearance-free mm	V2 Preloaded mm
06	0.05	0	Approx. 3% x C
08			
10			
12			
14			
16	0.08		
20			
25			
32			
40	0.12		
50			
63			
80			

Table 1

Technical introduction

Accuracy

Depending on the operating parameters and application, different requirements are placed on the accuracy of ball screw drives.

Schaeffler ball screw drives are available as standard in the accuracy class T7.

Optionally, the class T5 is available by agreement.

Accuracy class of rolled ball screw drives

	T5	T7 (standard)
Variation over 300mm axial travel	23 μm	52μm

Other tolerances in accordance with DIN 69051 Part 3

Technical introduction

Operating temperature

Ball screw drives from Schaeffler can be used at operating temperatures from -10°C to +80°C.

For short periods, a maximum operating temperature of 100°C is possible, measured on the outside surface of the screw nut.

Sealing

The screw nuts in Schaeffler ball screw drives are protected against contamination by a gap seal or labyrinth seal (depending on the screw nut design, see table). (Exceptions: see table in appendix)

Contact seals are – for some designs - available as an option.

If there is a risk that dust or foreign matter could enter the screw nut, additional sealing measures must be implemented for protection.

Lubrication

Schaeffler ball screw drives must be lubricated.

Whether lubrication is carried out using oil or grease is determined by technical, economic and ecological factors.

The screw nut is pregreased as standard with a high quality lubricant.

Grease lubrication:

For relubrication, lithium soap or lithium complex soap greases with a mineral oil base are recommended.

The base oil viscosity should be between ISO-VG 68 and ISO-VG 100.

Oil lubrication:

If Schaeffler ball screw drives are to be lubricated using oil, please consult Schaeffler first.

Technical introduction

Ordering example

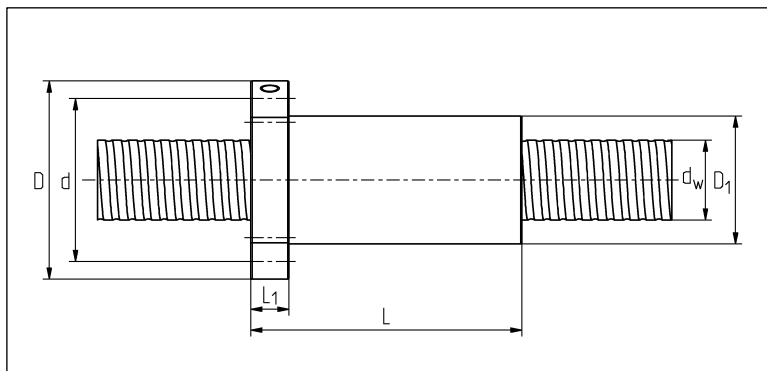
Ball screw drive KGT: **(KGT80x20-RH-2A3-00-T7-V0-1720-MTO-MTO-1-0-1)**

Ball screw drive	KGT
Size (nominal thread diameter)	80
Pitch of threaded spindle	20
Right hand thread	RH
Screw nut design (flanged nut)	2A3
Sealing (no seals left and right)	00
Type (transport ball screw drive)	T
Accuracy	7
Preload (with clearance)	V0
Length of screw spindle	1720
Spindle ends according to customer drawing	
- left	MTO
- right	MTO
Lubrication (standard)	1
Coating (none)	0
Documentation (according to drawing)	1

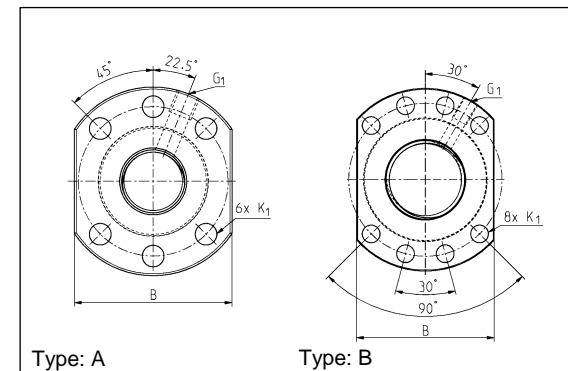
Ball screw drive

With flanged nut

KGF-2A



KGF...-2A



Type: A

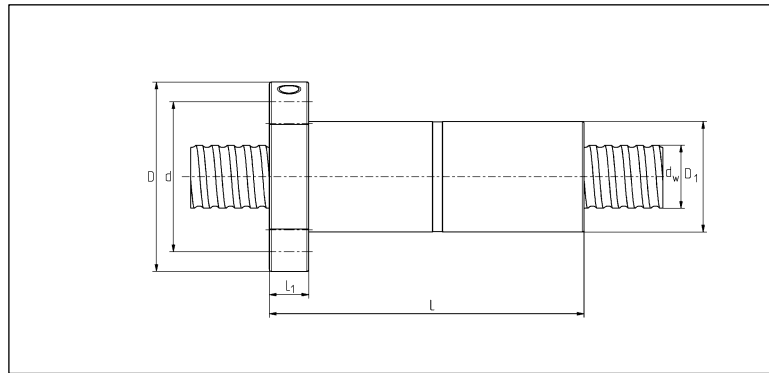
Type: B

KGF...-2A

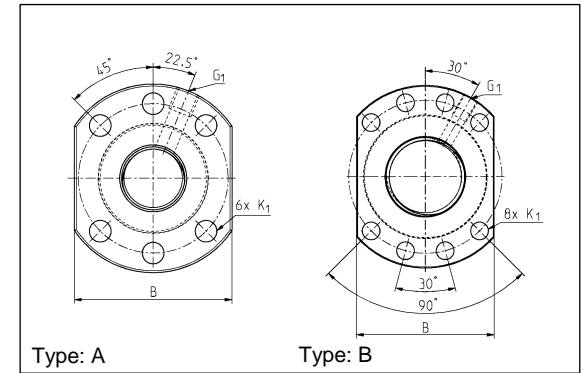
Dimension table · Dimensions in mm													
Designation	Pitch P	Type	Dimensions			Mounting dimensions				Location		Basic load ratings	
			d _w	D	L	B	D ₁	L ₁	d	K ₁	G ₁	dyn. C _a kN	stat. C ₀ kN
KGF16x05-RH-2A3	5	A	16	48	42	40	28	10	38	5.5	M6	9.14	17.04
KGF16x05-RH-2A4	5	A			50							11.84	22.73
KGF16x10-RH-2A3	10	A			65							12	9.19
KGF20x05-RH-2A4	5	A	20	58	53	44	36	10	47	6.6	M6	13.00	28.15
KGF20x10-RH-2A3	10	A			68							13.80	27.10
KGF25x04-RH-2A4	4	A	25	62	46	48	40	11	51	6.6	M6	9.64	26.00
KGF25x05-RH-2A4	5	A			53			10				14.30	34.91
KGF25x10-RH-2A4	10	A			85			12				25.02	53.34
KGF32x05-RH-2A4	5	A	32	80	53	62	50	12	65	9	M6	15.90	44.40
KGF32x10-RH-2A3	10	A			77.5			16				31.82	68.20
KGF32x10-RH-2A4	10	A			90			16				41.23	90.93
KGF40x05-RH-2A4	5	B	40	93	56	70	63	16	78	9	M8	17.50	55.25
KGF40x06-RH-2A4	6	B			60			14				23.75	69.38
KGF40x10-RH-2A4	10	B			93			18				45.29	112.57
KGF50x10-RH-2A4	10	B	50	110	93	85	75	18	93	11	M8	49.80	139.66
KGF63x10-RH-2A4	10	B	63	125	98	95	90	18	108	11	M8	54.98	174.90
KGF63x20-RH-2A3	20	B		135	138	100	95	20	115	13.5		74.11	199.52
KGF80x10-RH-2A4	10	B		80	145	98	110	105	20	125	13.5	M8	60.95
KGF80x20-RH-2A3	20	B	165		143	130	125	25	145	82.02			251.25

Ball screw drive

With flanged double nut
KGF-2B



KGF...-2B



Type: A

Type: B

KGF...-2B

Dimension table · Dimensions in mm													
Designation	Pitch P	Type	Dimensions			Mounting dimensions				Location		Basic load ratings	
			d _w	D	L	B	D ₁	L ₁	d	K ₁	G ₁	dyn. C _a kN	stat. C ₀ kN
KGF16x05-RH-2B3	5	A	16	28	80	40	28	10	38	5,5	M6	9,14	17,04
KGF20x05-RH-2B4	5	A	20	36	92	44	36	12	47	6,6	M6	13,00	28,15
KGF25x05-RH-2B4	5	A	25	40	92	48	40	12	51	6,6	M6	14,30	34,91
KGF25x10-RH-2B4	10	A			153							25,02	53,34
KGF32x05-RH-2B4	5	A	32	50	92	62	50	12	65	9	M6	15,90	44,40
KGF32x10-RH-2B4	10	A			160			16				41,23	90,93
KGF40x05-RH-2B4	5	B	40	63	96	70	63	15	78	9	M8	17,50	55,25
KGF40x10-RH-2B4	10	B			162			18				45,29	112,57
KGF50x10-RH-2B4	10	B	50	75	162	85	75	16	93	11	M8	49,80	139,66
KGF63x10-RH-2B4	10	B	63	90	182	95	90	18	108	11	M8	54,98	174,90
KGF63x20-RH-2B3	20	B		95	253	100	95	20	115	13,5		74,11	199,52
KGF80x10-RH-2B4	10	B	80	105	182	110	105	20	125	13,5	M8	60,95	221,02
KGF80x20-RH-2B3	20	B		125	253	130	125	25	145			82,02	251,25



Ball screw drive KGT
Ball screw spindle KGS
Ball screw nut KGF(M)

Date: July 2012

Technical introduction

Axial clearance and preload

Schaeffler ball screw drives have a contact angle of 45° . Due to external drive forces and internal drive forces, an axial force is generated F_a that results in axial deflection as a function of the preload.

The axial clearance that results from the clear spacing between the rolling element and rolling element raceway can be eliminated by the preload force P , thus increasing the positional accuracy and rigidity of the ball screw drive.

The preload force P can be influenced by the use of a preloaded double or single nut (Figure 1 and 2, Table 1).

Double nut

The fitting of a spacer to give an O arrangement of the two nuts results in preloading of the double nut.

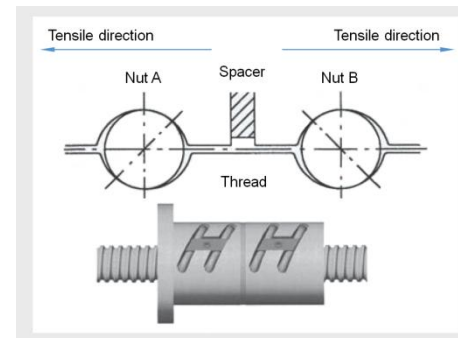


Figure 1

Single nut

The fitting of oversize rolling elements results in the preloading of the single nut.

This gives four contact points per rolling element.

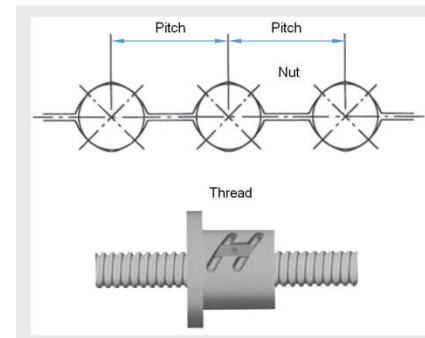


Figure 2

Technical introduction

Preload

Preload classes of Schaeffler ball screw drives according to the table

Spindle diameter d_w	V0 Standard Max. axial clearance mm	V1 Clearance-free mm	V2 Preloaded mm
06	0.05	0	Approx. 3% x C
08			
10			
12			
14			
16	0.08		
20			
25			
32			
40	0.12		
50			
63			
80			

Table 1

Technical introduction

Accuracy

Depending on the operating parameters and application, different requirements are placed on the accuracy of ball screw drives.

Schaeffler ball screw drives are available as standard in the accuracy class T7.

Optionally, the class T5 is available by agreement.

Accuracy class of rolled ball screw drives

	T5	T7 (standard)
Variation over 300mm axial travel	23 μm	52μm

Other tolerances in accordance with DIN 69051 Part 3

Technical introduction

Operating temperature

Ball screw drives from Schaeffler can be used at operating temperatures from -10°C to +80°C.

For short periods, a maximum operating temperature of 100°C is possible, measured on the outside surface of the screw nut.

Sealing

The screw nuts in Schaeffler ball screw drives are protected against contamination by a gap seal or labyrinth seal (depending on the screw nut design, see table). (Exceptions: see table in appendix)

Contact seals are – for some designs - available as an option.

If there is a risk that dust or foreign matter could enter the screw nut, additional sealing measures must be implemented for protection.

Lubrication

Schaeffler ball screw drives must be lubricated.

Whether lubrication is carried out using oil or grease is determined by technical, economic and ecological factors.

The screw nut is pregreased as standard with a high quality lubricant.

Grease lubrication:

For relubrication, lithium soap or lithium complex soap greases with a mineral oil base are recommended.

The base oil viscosity should be between ISO-VG 68 and ISO-VG 100.

Oil lubrication:

If Schaeffler ball screw drives are to be lubricated using oil, please consult Schaeffler first.

Technical introduction

Ordering example

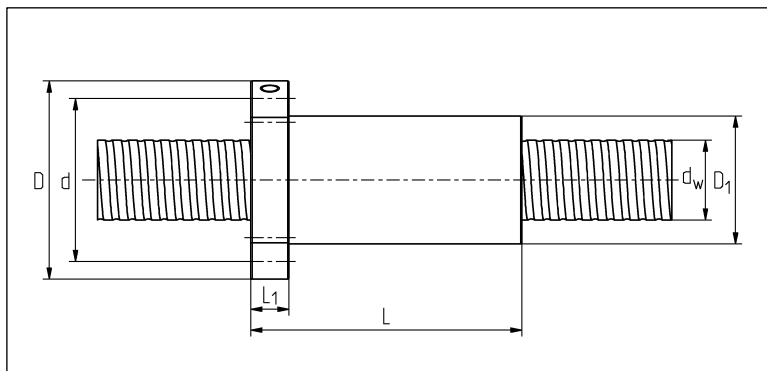
Ball screw drive KGT: **(KGT80x20-RH-2A3-00-T7-V0-1720-MTO-MTO-1-0-1)**

Ball screw drive	KGT
Size (nominal thread diameter)	80
Pitch of threaded spindle	20
Right hand thread	RH
Screw nut design (flanged nut)	2A3
Sealing (no seals left and right)	00
Type (transport ball screw drive)	T
Accuracy	7
Preload (with clearance)	V0
Length of screw spindle	1720
Spindle ends according to customer drawing	
- left	MTO
- right	MTO
Lubrication (standard)	1
Coating (none)	0
Documentation (according to drawing)	1

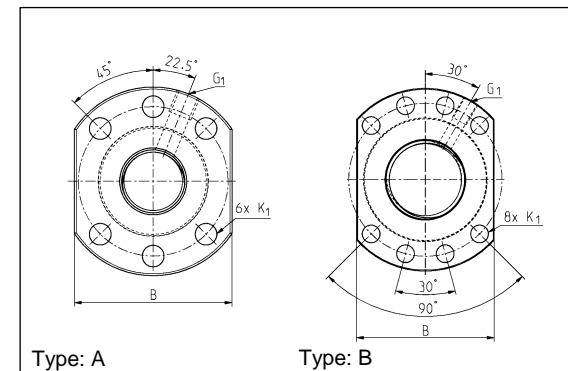
Ball screw drive

With flanged nut

KGF-2A



KGF...-2A



Type: A

Type: B

KGF...-2A

Dimension table · Dimensions in mm													
Designation	Pitch P	Type	Dimensions			Mounting dimensions				Location		Basic load ratings	
			d _w	D	L	B	D ₁	L ₁	d	K ₁	G ₁	dyn. C _a kN	stat. C ₀ kN
KGF16x05-RH-2A3	5	A	16	48	42	40	28	10	38	5.5	M6	9.14	17.04
KGF16x05-RH-2A4	5	A			50							11.84	22.73
KGF16x10-RH-2A3	10	A			65							9.19	17.28
KGF20x05-RH-2A4	5	A	20	58	53	44	36	10	47	6.6	M6	13.00	28.15
KGF20x10-RH-2A3	10	A			68							13.80	27.10
KGF25x04-RH-2A4	4	A	25	62	46	48	40	11	51	6.6	M6	9.64	26.00
KGF25x05-RH-2A4	5	A			53			14.30				34.91	
KGF25x10-RH-2A4	10	A			85			25.02				53.34	
KGF32x05-RH-2A4	5	A	32	80	53	62	50	12	65	9	M6	15.90	44.40
KGF32x10-RH-2A3	10	A			77.5			31.82				68.20	
KGF32x10-RH-2A4	10	A			90			41.23				90.93	
KGF40x05-RH-2A4	5	B	40	93	56	70	63	16	78	9	M8	17.50	55.25
KGF40x06-RH-2A4	6	B			60			23.75				69.38	
KGF40x10-RH-2A4	10	B			93			45.29				112.57	
KGF50x10-RH-2A4	10	B	50	110	93	85	75	18	93	11	M8	49.80	139.66
KGF63x10-RH-2A4	10	B	63	125	98	95	90	18	108	11	M8	54.98	174.90
KGF63x20-RH-2A3	20	B		135	138	100	95	20	115	13.5		74.11	199.52
KGF80x10-RH-2A4	10	B		80	145	98	110	105	20	125	13.5	M8	60.95
KGF80x20-RH-2A3	20	B	165		143	130	125	25	145	82.02			251.25



Ball screw drive KGT
Ball screw spindle KGS
Ball screw nut KGF(M)

Date: July 2012

Technical introduction

Axial clearance and preload

Schaeffler ball screw drives have a contact angle of 45° . Due to external drive forces and internal drive forces, an axial force is generated F_a that results in axial deflection as a function of the preload.

The axial clearance that results from the clear spacing between the rolling element and rolling element raceway can be eliminated by the preload force P , thus increasing the positional accuracy and rigidity of the ball screw drive.

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Double nut

The fitting of a spacer to give an O arrangement of the two nuts results in preloading of the double nut.

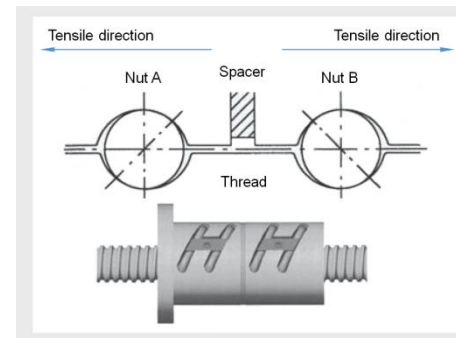


Figure 1

Single nut

The fitting of oversize rolling elements results in the preloading of the single nut.

This gives four contact points per rolling element.

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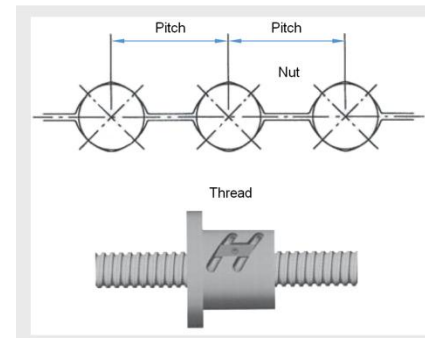


Figure 2

Technical introduction

Preload

Preload classes of Schaeffler ball screw drives according to the table

Spindle diameter d_w	V0 Standard Max. axial clearance mm	V1 Clearance-free mm	V2 Preloaded mm
06	0.05	0	Approx. 3% x C
08			
10			
12			
14			
16	0.08		
20			
25			
32			
40	0.12		
50			
63			
80			

Table 1

Technical introduction

Accuracy

Depending on the operating parameters and application, different requirements are placed on the accuracy of ball screw drives.

Schaeffler ball screw drives are available as standard in the accuracy class T7.

Optionally, the class T5 is available by agreement.

Accuracy class of rolled ball screw drives

	T5	T7 (standard)
Variation over 300mm axial travel	23 μm	52μm

Other tolerances in accordance with DIN 69051 Part 3

Technical introduction

Operating temperature

Ball screw drives from Schaeffler can be used at operating temperatures from -10°C to +80°C.

For short periods, a maximum operating temperature of 100°C is possible, measured on the outside surface of the screw nut.

Sealing

The screw nuts in Schaeffler ball screw drives are protected against contamination by a gap seal or labyrinth seal (depending on the screw nut design, see table). (Exceptions: see table in appendix)

Contact seals are – for some designs - available as an option.

If there is a risk that dust or foreign matter could enter the screw nut, additional sealing measures must be implemented for protection.

Lubrication

Schaeffler ball screw drives must be lubricated.

Whether lubrication is carried out using oil or grease is determined by technical, economic and ecological factors.

The screw nut is pregreased as standard with a high quality lubricant.

Grease lubrication:

For relubrication, lithium soap or lithium complex soap greases with a mineral oil base are recommended.

The base oil viscosity should be between ISO-VG 68 and ISO-VG 100.

Oil lubrication:

If Schaeffler ball screw drives are to be lubricated using oil, please consult Schaeffler first.

Technical introduction

Ordering example

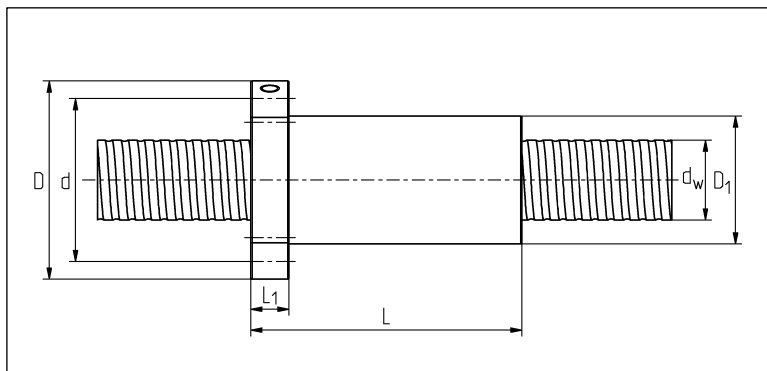
Ball screw drive KGT: **(KGT80x20-RH-2A3-00-T7-V0-1720-MTO-MTO-1-0-1)**

Ball screw drive	KGT
Size (nominal thread diameter)	80
Pitch of threaded spindle	20
Right hand thread	RH
Screw nut design (flanged nut)	2A3
Sealing (no seals left and right)	00
Type (transport ball screw drive)	T
Accuracy	7
Preload (with clearance)	V0
Length of screw spindle	1720
Spindle ends according to customer drawing	
- left	MTO
- right	MTO
Lubrication (standard)	1
Coating (none)	0
Documentation (according to drawing)	1

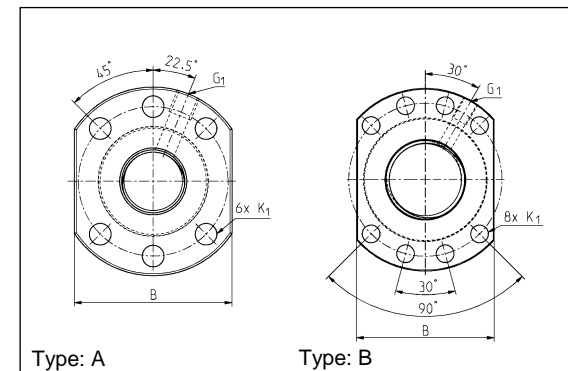
Ball screw drive

With flanged nut

KGF-2A



KGF...-2A



Type: A

Type: B

KGF...-2A

Dimension table · Dimensions in mm													
Designation	Pitch P	Type	Dimensions			Mounting dimensions				Location		Basic load ratings	
			d _w	D	L	B	D ₁	L ₁	d	K ₁	G ₁	dyn. C _a kN	stat. C ₀ kN
KGF16x05-RH-2A3	5	A	16	48	42	40	28	10	38	5.5	M6	9.14	17.04
KGF16x05-RH-2A4	5	A			50							11.84	22.73
KGF16x10-RH-2A3	10	A			65							9.19	17.28
KGF20x05-RH-2A4	5	A	20	58	53	44	36	10	47	6.6	M6	13.00	28.15
KGF20x10-RH-2A3	10	A			68							13.80	27.10
KGF25x04-RH-2A4	4	A	25	62	46	48	40	11	51	6.6	M6	9.64	26.00
KGF25x05-RH-2A4	5	A			53			14.30				34.91	
KGF25x10-RH-2A4	10	A			85			25.02				53.34	
KGF32x05-RH-2A4	5	A	32	80	53	62	50	12	65	9	M6	15.90	44.40
KGF32x10-RH-2A3	10	A			77.5			31.82				68.20	
KGF32x10-RH-2A4	10	A			90			41.23				90.93	
KGF40x05-RH-2A4	5	B	40	93	56	70	63	16	78	9	M8	17.50	55.25
KGF40x06-RH-2A4	6	B			60			23.75				69.38	
KGF40x10-RH-2A4	10	B			93			45.29				112.57	
KGF50x10-RH-2A4	10	B	50	110	93	85	75	18	93	11	M8	49.80	139.66
KGF63x10-RH-2A4	10	B	63	125	98	95	90	18	108	11	M8	54.98	174.90
KGF63x20-RH-2A3	20	B		135	138	100	95	20	115	13.5		74.11	199.52
KGF80x10-RH-2A4	10	B	80	145	98	110	105	20	125	13.5	M8	60.95	221.02
KGF80x20-RH-2A3	20	B		165	143	130	125	25	145			82.02	251.25



Ball screw drive KGT
Ball screw spindle KGS
Ball screw nut KGF(M)

Date: July 2012

Technical introduction

Axial clearance and preload

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Double nut

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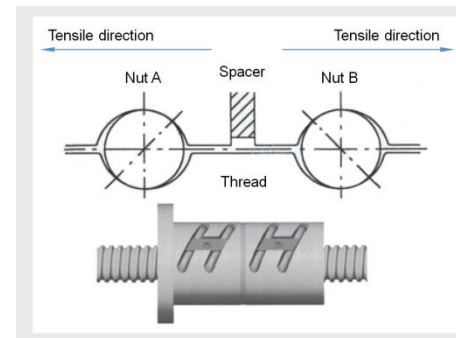


Figure 1

Single nut

The fitting of oversize rolling elements results in the preloading of the single nut.

This gives four contact points per rolling element.

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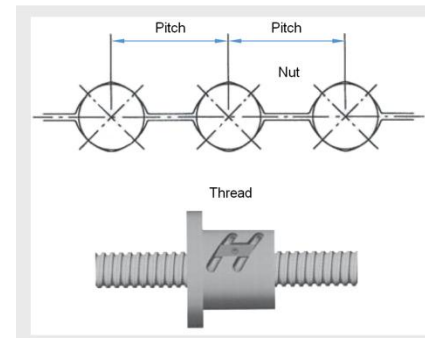


Figure 2

Technical introduction

Preload

Preload classes of Schaeffler ball screw drives according to the table

Spindle diameter d_w	V0 Standard Max. axial clearance mm	V1 Clearance-free mm	V2 Preloaded mm
06	0.05	0	Approx. 3% x C
08			
10			
12			
14			
16	0.08		
20			
25			
32			
40	0.12		
50			
63			
80			

Table 1

Technical introduction

Accuracy

Depending on the operating parameters and application, different requirements are placed on the accuracy of ball screw drives.

Schaeffler ball screw drives are available as standard in the accuracy class T7.

Optionally, the class T5 is available by agreement.

Accuracy class of rolled ball screw drives

	T5	T7 (standard)
Variation over 300mm axial travel	23 μm	52μm

Other tolerances in accordance with DIN 69051 Part 3

Technical introduction

Operating temperature

Ball screw drives from Schaeffler can be used at operating temperatures from -10°C to +80°C.

For short periods, a maximum operating temperature of 100°C is possible, measured on the outside surface of the screw nut.

Sealing

The screw nuts in Schaeffler ball screw drives are protected against contamination by a gap seal or labyrinth seal (depending on the screw nut design, see table). (Exceptions: see table in appendix)

Contact seals are – for some designs - available as an option.

If there is a risk that dust or foreign matter could enter the screw nut, additional sealing measures must be implemented for protection.

Lubrication

Schaeffler ball screw drives must be lubricated.

Whether lubrication is carried out using oil or grease is determined by technical, economic and ecological factors.

The screw nut is pregreased as standard with a high quality lubricant.

Grease lubrication:

For relubrication, lithium soap or lithium complex soap greases with a mineral oil base are recommended.

The base oil viscosity should be between ISO-VG 68 and ISO-VG 100.

Oil lubrication:

If Schaeffler ball screw drives are to be lubricated using oil, please consult Schaeffler first.

Technical introduction

Ordering example

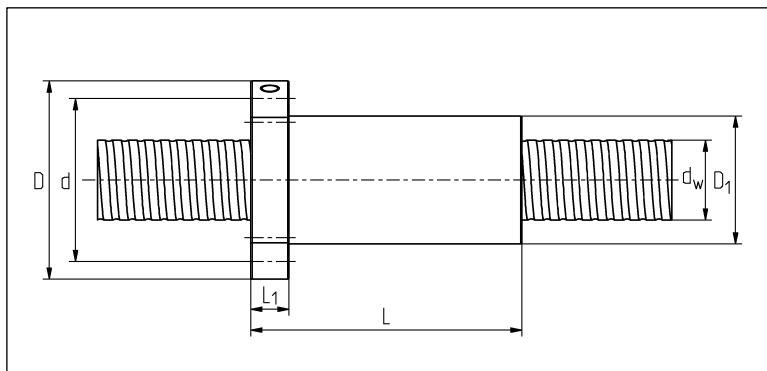
Ball screw drive KGT: **(KGT80x20-RH-2A3-00-T7-V0-1720-MTO-MTO-1-0-1)**

Ball screw drive	KGT
Size (nominal thread diameter)	80
Pitch of threaded spindle	20
Right hand thread	RH
Screw nut design (flanged nut)	2A3
Sealing (no seals left and right)	00
Type (transport ball screw drive)	T
Accuracy	7
Preload (with clearance)	V0
Length of screw spindle	1720
Spindle ends according to customer drawing	
- left	MTO
- right	MTO
Lubrication (standard)	1
Coating (none)	0
Documentation (according to drawing)	1

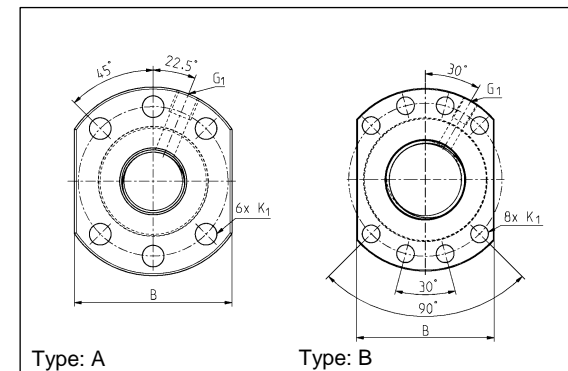
Ball screw drive

With flanged nut

KGF-2A



KGF...-2A



Type: A

Type: B

KGF...-2A

Dimension table · Dimensions in mm													
Designation	Pitch P	Type	Dimensions			Mounting dimensions				Location		Basic load ratings	
			d _w	D	L	B	D ₁	L ₁	d	K ₁	G ₁	dyn. C _a kN	stat. C ₀ kN
KGF16x05-RH-2A3	5	A	16	48	42	40	28	10	38	5.5	M6	9.14	17.04
KGF16x05-RH-2A4	5	A			50							11.84	22.73
KGF16x10-RH-2A3	10	A			65							12	9.19
KGF20x05-RH-2A4	5	A	20	58	53	44	36	10	47	6.6	M6	13.00	28.15
KGF20x10-RH-2A3	10	A			68							13.80	27.10
KGF25x04-RH-2A4	4	A	25	62	46	48	40	11	51	6.6	M6	9.64	26.00
KGF25x05-RH-2A4	5	A			53			10				14.30	34.91
KGF25x10-RH-2A4	10	A			85			12				25.02	53.34
KGF32x05-RH-2A4	5	A	32	80	53	62	50	12	65	9	M6	15.90	44.40
KGF32x10-RH-2A3	10	A			77.5			16				31.82	68.20
KGF32x10-RH-2A4	10	A			90			16				41.23	90.93
KGF40x05-RH-2A4	5	B	40	93	56	70	63	16	78	9	M8	17.50	55.25
KGF40x06-RH-2A4	6	B			60			14				23.75	69.38
KGF40x10-RH-2A4	10	B			93			18				45.29	112.57
KGF50x10-RH-2A4	10	B	50	110	93	85	75	18	93	11	M8	49.80	139.66
KGF63x10-RH-2A4	10	B	63	125	98	95	90	18	108	11	M8	54.98	174.90
KGF63x20-RH-2A3	20	B		135	138	100	95	20	115	13.5		74.11	199.52
KGF80x10-RH-2A4	10	B		145	98	110	105	20	125	13.5		M8	60.95
KGF80x20-RH-2A3	20	B	165	143	130	125	25	145	82.02		251.25		

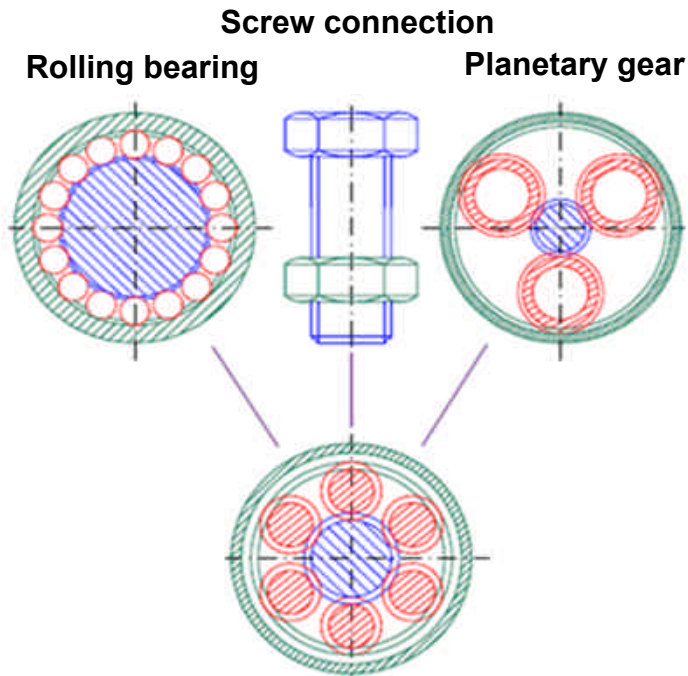
Innovative solutions for Linear Technology

Drive unit: Planetary Roller Screw PWG

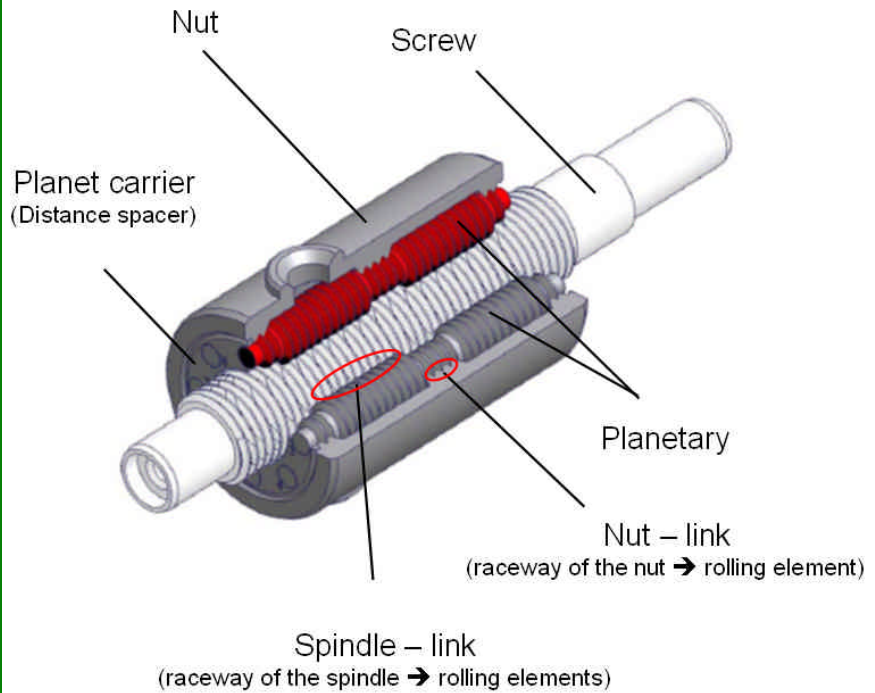


PWG – Modular system Functional principles

Planetary roller screw



The screw corresponds to the threaded bolt, the nut meets- the threaded nut and the ring gear. The needle rollers are represented by the planetary.



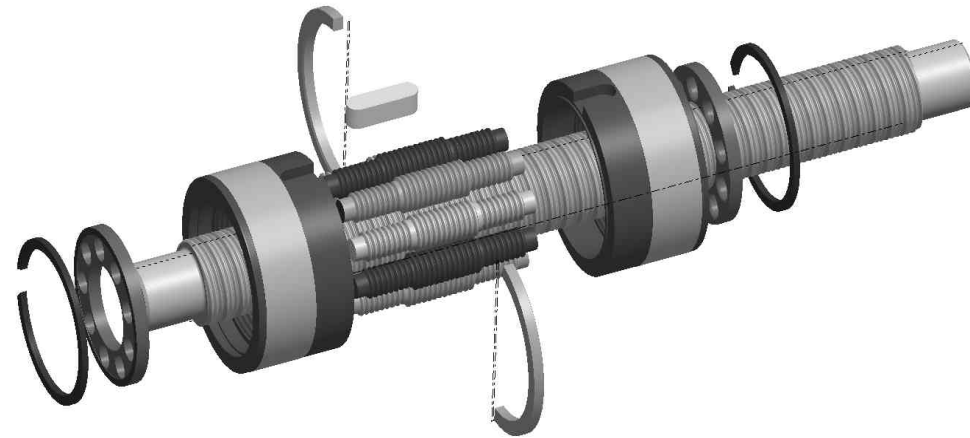
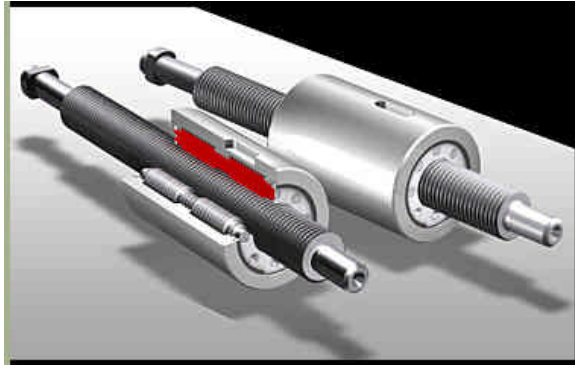
Innovative solutions for Linear Technology

Drive unit: Planetary Roller Screw PWG

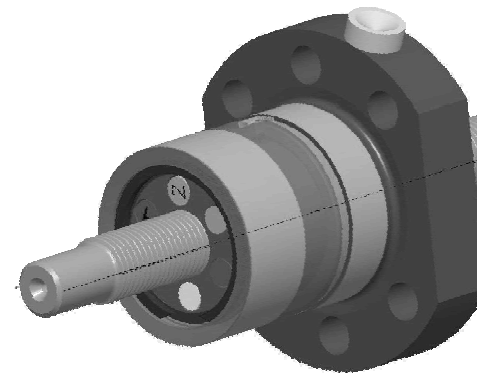


PWG – Modular system

Features






- Cost effective drive unit
- Highest load ratings
- High efficiency
- High axial stiffness
- Small pitches (0,01-10)
- Robustness
- Low noise



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Comparison and conclusion



		C0 [kN]	Cdyn [kN]	L (Mutter) [mm]
	KGT 63mm	214	89	200
	RGT 63mm	330	146	200
	PWG 63mm	420	250	200



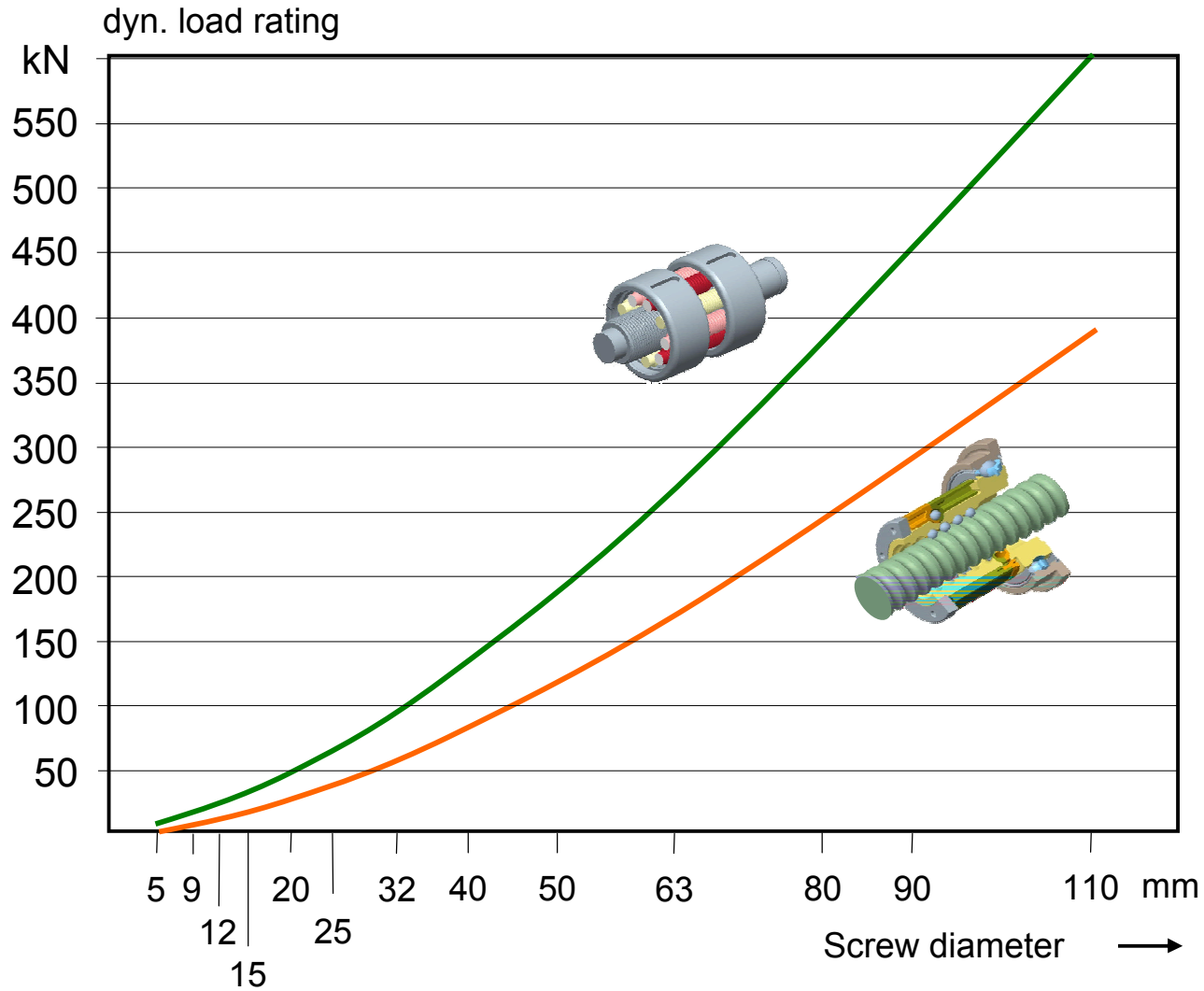
PWG construction kit will start with size PWG 9mm and PWG 15mm

PWG 9mm can replace KGT up to 25mm

PWG 15mm can replace KGT up to 32mm

Always on the move – actuator solutions

Dynamic load rating of drive screws



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Catalogue series / next steps



d x p	zg	Cdyn	Co	η [%]	slippage [%]	
5 x 0,80	1	8000	10000	64	0,26	Typ I
9 x 0,75	1	16000	18000	57	0,10	
12 x 0,72	1	25000	28000	52	0,08	
15 x 2,11	3	34000	38000	71	0,26	
20 x 2,70	4	39000	44000	72	0,25	
25 x 1,31	2	43000	50000	51	0,07	
32 x 1,77	2	84000	95000	61	0,07	Typ II
40 x 2,60	3	94000	105000	64	0,08	Typ II
40 x 0,87	1	189000	235000	43	0,03	Typ III
50 x 2,55	3	197000	300000	66	0,05	
63 x 2,66	2	256000	370000	53	0,03	Typ IV
80 x 1,21	1	389000	650000	48	0,02	
90 x 2,40	2	500000	1000000	64	0,02	
110 x 2,36	2	550000	1300000	59	0,015	

red colored lines are priority-types due to we have pre-development with customer

**Market launch with the sizes 5 to 25 (green marked)
cover ~ 80% of the market volume**

Always on the move – actuator solutions

Components of linear actuators

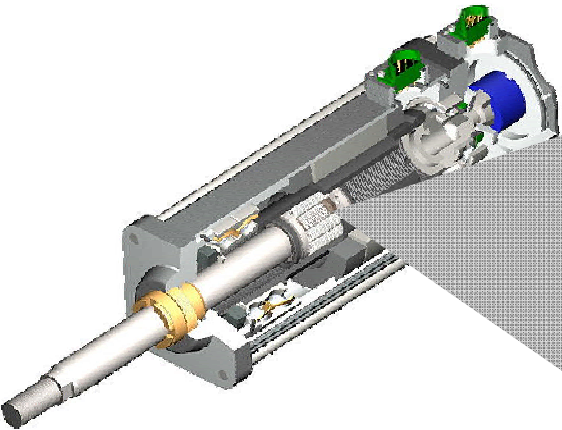
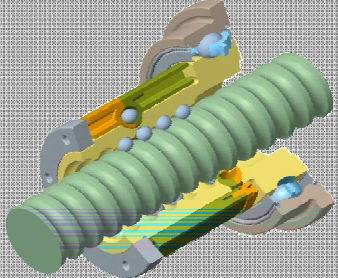
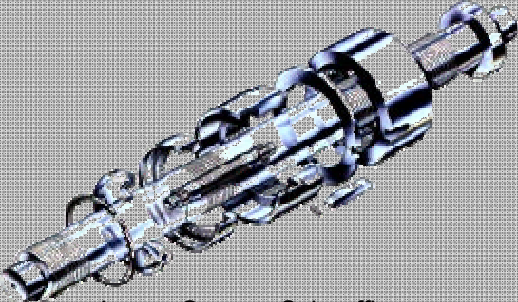


Image Source: Exlar



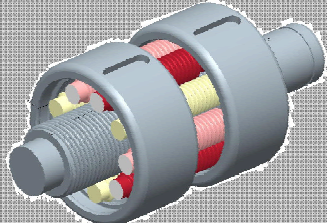
Ball Screw
(KGT)

Image Source: Schaeffler



Planetary Roller Screw
with internal gearing
(RGT)

Image Source: Schaeffler

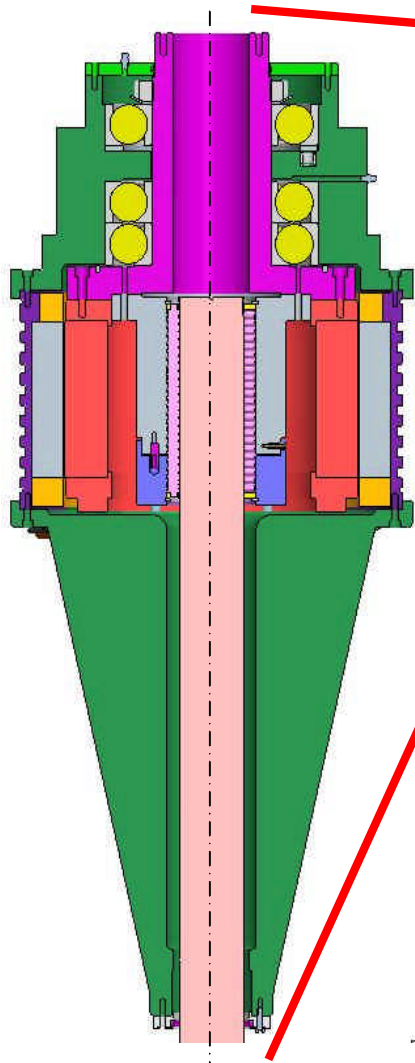


Planetary Roller Screw
without internal
gearing (PWG)

Image Source: Schaeffler

- Actor for presses

Solution Ideas



PWG 63 x 15
 $C_{dyn} = 350 \text{ kN}$
 $C_0 = 650 \text{ kN}$

Application: Electro-mechanical drive system



Force	: 300 kN / Aktor
Stroke	: 445 mm
Speed	: 220 mm/s
Solution	: Complete actor
Motor	: Direct drive

