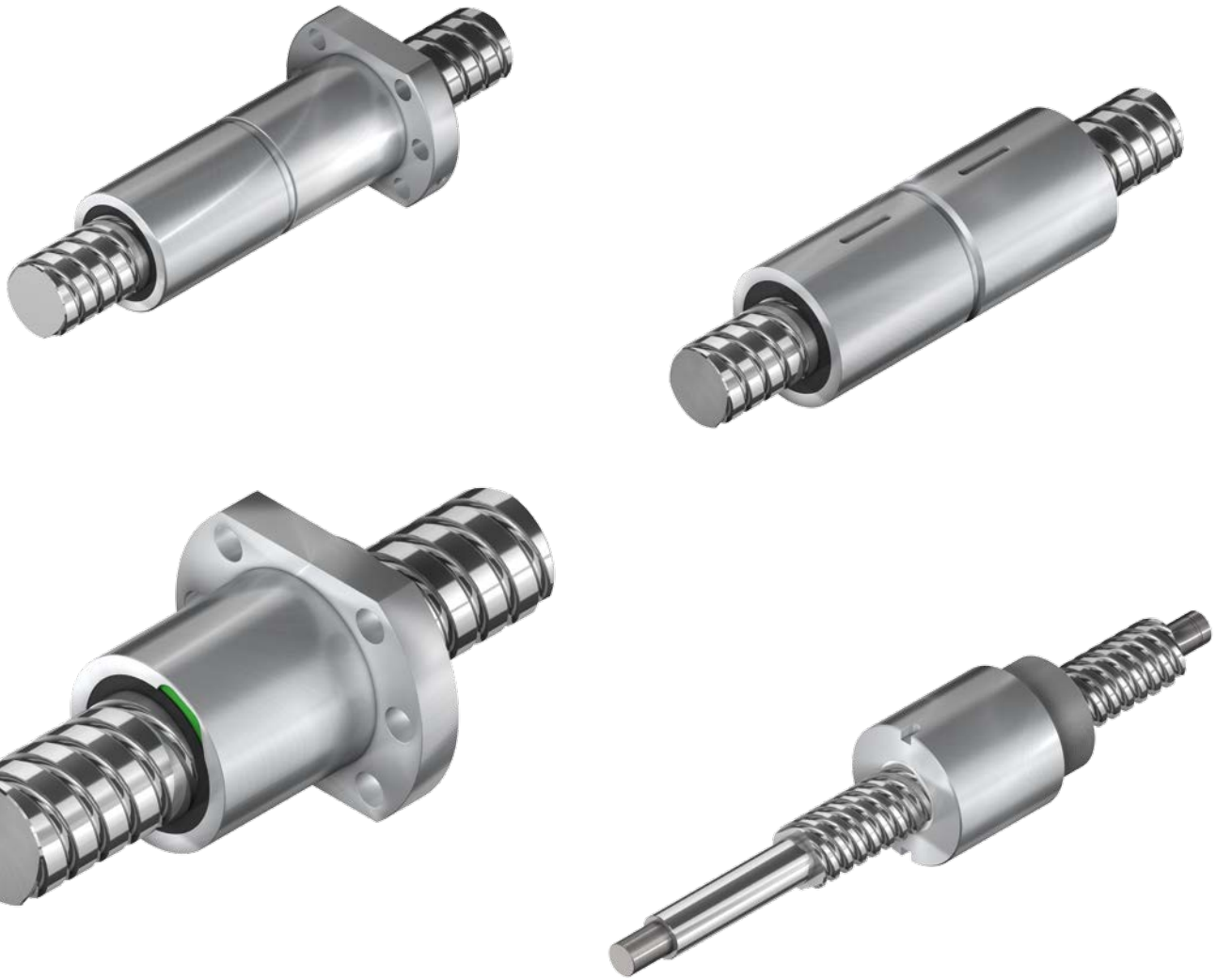
HIWIN®

Motion Control & Systems



Assembly instructions

Ballscrews

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Contents

1. Information about the document

These assembly instructions are intended for planners, developers and operators of systems who plan for and install linear ballscrews as machine elements. They are also intended for persons who perform the following tasks:

- Transportation
- Assembly
- Retrofitting or upgrading
- Setup
- Commissioning
- Operation
- Cleaning
- Maintenance
- Troubleshooting and error elimination
- Shutdown, disassembly and disposal

1.1 Applicability of these assembly instructions

These assembly instructions apply to all rolled, peeled and ground ballscrews from HIWIN.

1.2 Depiction of safety notices

Safety notices are always indicated using a signal word and sometimes also a symbol for the specific risk.
In these instructions, the following signal words and risk levels are used:

⚠ DANGER!

Imminent danger!
Non-compliance with the safety notices will result in serious injury or death!

⚠ WARNING!

Potentially dangerous situation!
Non-compliance with the safety notices runs the risk of serious injury or death!

⚠ CAUTION!

Potentially dangerous situation!
Non-compliance with the safety notices runs the risk of slight to moderate injury!

WARNING!

Potentially dangerous situation!
Non-compliance with the safety notices runs the risk of damage to property or environmental pollution!

1.3 Symbols used

The following symbols are used in these instructions.

NOTE **Note:** Describes general information and recommendations.

Instructions: Instructions are marked with the checklist symbol. The actions described must be carried out and adhered to in the sequence given.

2. Safety

⚠ WARNING!

This chapter serves to ensure the safety of everyone working with ballscrews and those who assemble, install, operate, maintain or disassemble them. Non-compliance with the following information results in dangerous working conditions.

2.1 Intended use

The ballscrew is a linear drive element, which converts a rotary movement into a lengthwise movement or vice versa and is used for the precise positioning in terms of time and location of fixed mounted loads, e.g. system components, within an automated system.

⚠ WARNING!

Danger of death and significant danger of injury from falling loads should the recirculation fail in vertical applications!

- In the case of vertical assembly, provide a suitable clamping or braking device!

The ballscrews are designed for installation and operation in horizontal and vertical positions. **In the case of vertical assembly, a suitable clamping or braking device must be provided in order to prevent unintended lowering of the load.** Ballscrews can only be loaded in an axial direction. Radial loads result in uneven loading and may cause the ballscrew to fail prematurely.
Ballscrews may only be used for the intended purpose as described.

2.2 Exclusion of liability in the event of alterations and improper use

No alterations may be made to the ballscrews that are not described in these assembly instructions. If it is necessary to alter the design, please contact the manufacturer.
In the event of alterations or improper assembly, installation, commissioning, operation, maintenance or repair, the manufacturer shall assume no liability.
Only original parts from HIWIN may be used as spare parts and accessories. Spare parts and accessories not supplied by HIWIN are not checked for operation with HIWIN ballscrews and may restrict operational safety. The manufacturer shall accept no liability for damage caused as a result of using non-approved spare parts and accessories.

2.3 Qualified trained staff

The ballscrew may only be assembled, integrated into higher-level systems, commissioned, operated and maintained by qualified personnel. Qualified personnel are those who:

- have received appropriate technical training
  and
- have received training from the machine operator concerning machine operation and the applicable safety guidelines, and can assess the risks to be expected
  and
- have read and understood these assembly instructions in their entirety and have access to them at all times.

2.4 General safety information

⚠ WARNING!

The following safety notices must be observed. Non-compliance with safety notices may endanger life and limb.

- Before and during all assembly, disassembly or repair work, the higher-level system must be disconnected from the power supply, and you must ensure that the power supply cannot be restored by anyone else. Otherwise, there is a danger of death and injury.
- During assembly and disassembly, the ballscrew must be transported horizontally. If this is not possible, a suitable holding device must be installed to prevent the ballscrew nut from coming off the ballscrew shaft.
- For long ballscrews, a hoist may be used for assembly.

2.5 Safety notices regarding storing the ballscrews

⚠ CAUTION!

Risk of crushing!
Only remove transportation safety device upon assembly!

If the ballscrews are to be put into storage, they must be kept in their transport packaging. They must be stored in a dry location with protection from impact.

2.6 Safety notices regarding transporting the ballscrews

WARNING!

Damage caused by tilting or falling!
If no transportation safety device is used, the ballscrew may tilt or fall over.
- Before transport, secure the ballscrew to prevent tilting!

Use suitable hoists to lift the ballscrews. Observe the applicable occupational health and safety regulations when handling suspended loads.
When transporting long ballscrews, use support at various points so that they do not bend. Bending during transport permanently compromises the function and precision of the ballscrews.

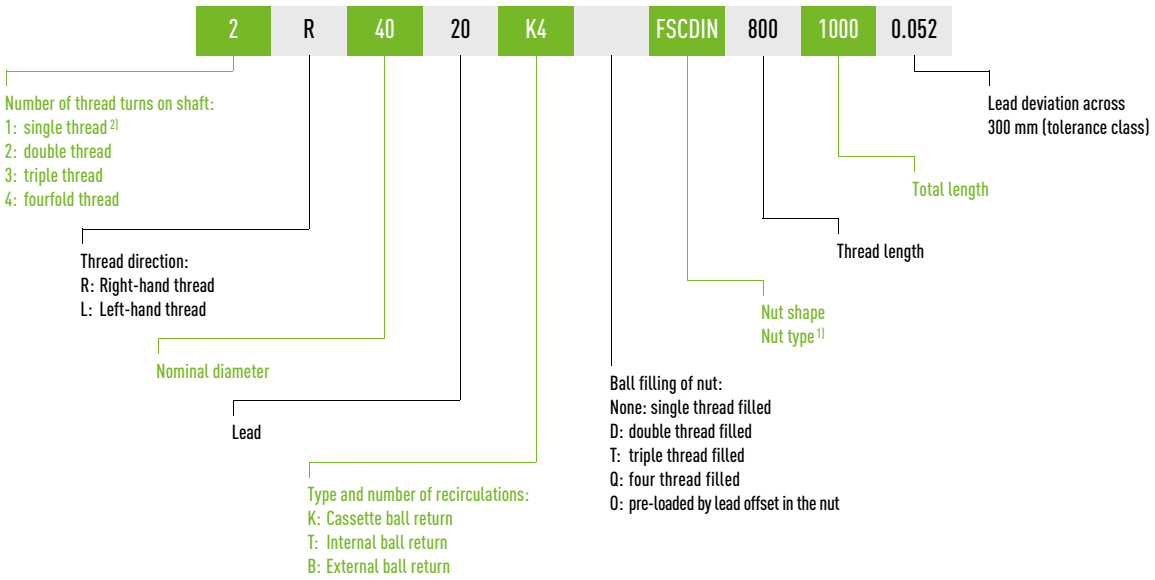
2.7 Additional information

If you have any questions, please contact our sales organisation:
Tel.: +49 (0) 781 / 9 32 78-0
Fax: +49 (0) 781 / 9 32 78-90
If you have questions, suggestions or corrections concerning the documentation, please send a fax to the following number:
+49 (0) 781 / 9 32 78-90

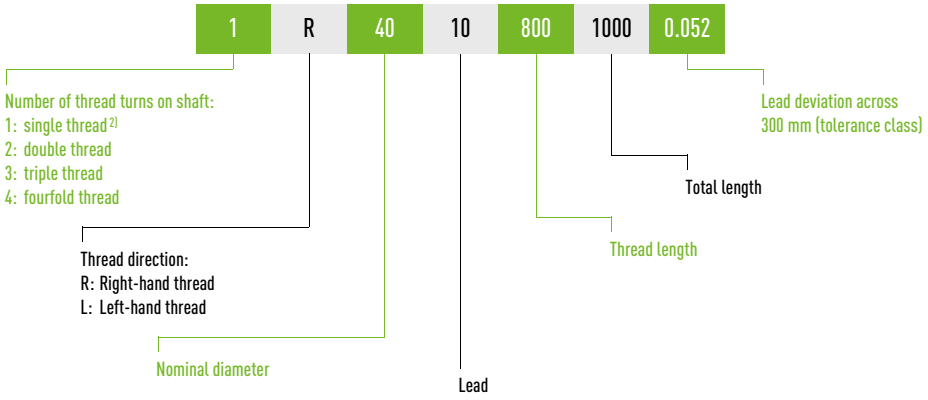
3. Product descriptions

3.1 Item numbers of the ballscrews

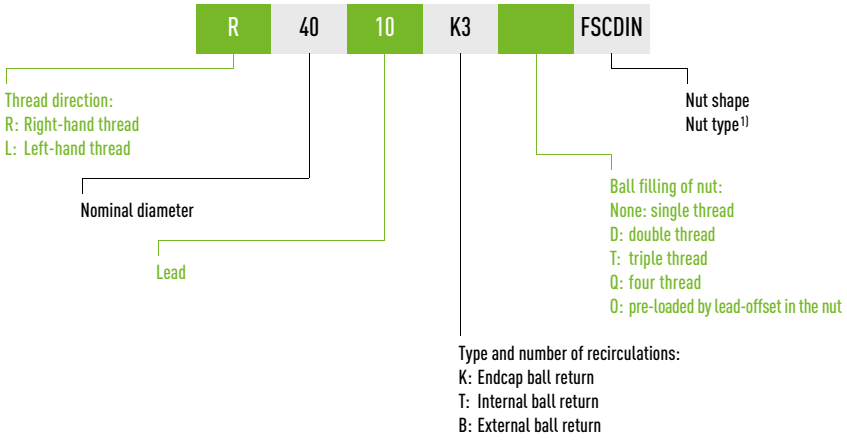
3.1.1 Item numbers of the ballscrews in full



3.1.2 Item numbers of ballscrew shaft



3.1.3 Item numbers of ballscrew nut



1) See Table 3.1
2) Standard; can be omitted with single-thread shafts

Table 3.1 **Overview of nut shapes**

Nut designation	Description
DEB	Flange single nut according to DIN69051, Part 5 for peeled ballscrew shafts
DDB	Flange double nut according to DIN69051, Part 5 for peeled ballscrew shafts
FSIDIN/FSCDIN	Flange single nut according to DIN69051, Part 5 for rolled and ground ballscrew shafts. The "DIN" addition is not used for customised flange nuts which do not correspond to DIN
RSI	Cylindrical single nut for rolled and ground ballscrew shafts
RSIT	Cylindrical single nut with screw-in thread for rolled ballscrew shafts
SE	Cylindrical single nut with screw-in thread for peeled ballscrew shafts
SEM	Flange single nut with integrated locking nut for peeled ballscrew shafts*
ZE	Cylindrical single nut for peeled ballscrew shafts
ZD	Cylindrical double nut for peeled ballscrew shafts
FSV	Nut with reinforced recirculation system for heavy-duty operation

* Simply using a safety nut does not provide sufficient protection against a load being lowered unintentionally. The safety guidelines valid for the application must be observed. The safety nut it is not a safety component according to the Machinery Directive.

3.2 Design and function of the ballscrew

The ballscrew essentially consists of the ballscrew shaft, ballscrew nut and the balls located between the shaft and nut. The balls in the ballscrew nut run around the shaft in a closed circuit and thereby convert the rotary motion of the ballscrew shaft into a linear movement of the ballscrew nut or vice versa.

4. Assembly

⚠ DANGER!

Before and during all assembly, disassembly or repair work, the higher-level system must be disconnected from the power supply, and you must ensure that the power supply cannot be restored by anyone else. Otherwise, there is a danger of death and significant danger of injury.

⚠ WARNING!

If required, use a suitable hoist for the assembly of ballscrews; lifting heavy loads without using tools may be harmful to health. Observe the applicable occupational health and safety regulations when handling suspended loads.

4.1 Assembling the ballscrew

⚠ WARNING!

Danger of death and significant danger of injury from falling loads should the recirculation fail in vertical applications!

- In the case of vertical assembly, provide a suitable clamping or braking device!

Ballscrews are delivered either fully assembled or with ballscrew nuts and shafts supplied separately. In order to avoid damaging the ballscrew, the following procedures must be adhered to.

- Only remove transport packaging directly before assembly.
- Only remove the transportation safety device from the nut after the ballscrew is assembled. If this isn't possible, ensure that the ballscrew nut does not run under from the ballscrew shaft. Even if the ballscrew nut only runs off the ballscrew shaft's thread at some points, there is a risk of balls coming out of the ballscrew nut and the function no longer being guaranteed.
- Ballscrews must be installed such that there are no radial or eccentric forces acting on the nut or shaft. Ballscrews are only suited to the transfer of axial forces.

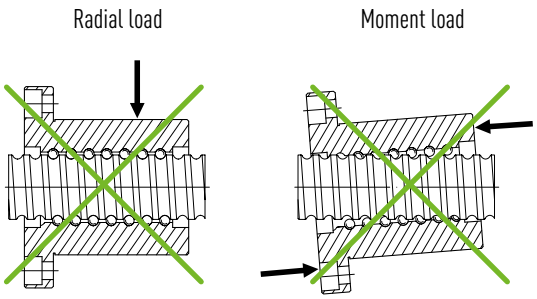


Fig. 4.1 **When installing the ballscrew, there must not be any radial or eccentric forces acting on the nuts or shafts.**

- Limit switches and stops should be provided on the machine to prevent the stroke distance from being exceeded and therefore damage to the unit. During assembly the nut must not be screwed out beyond the end of the shaft without an auxiliary device (assembly tube).
- Heavy ballscrews in particular must not be placed on the nut.
- The recirculation units visible from the outside must not be damaged. The recirculation units may only be disassembled in the factory.
- During installation, ensure that dirt does not accumulate on the ballscrew. Chippings and other contaminants can be removed using petroleum, thin oil or white spirit. Paint solvents and cold cleaning solvents damage the ballscrews and must therefore not be used.
- Ballscrews must be aligned perfectly flush with the guide.

4.2 Assembling and disassembling ballscrew nut on ballscrew shaft

4.2.1 Disassembling nut from ballscrew shaft

WARNING!

Damage will result from balls being lost if the nut is disassembled without an assembly tube!

- Always use an assembly tube to hold the nut!

NOTE

Note:
HIWIN ballscrews are generally supplied with the nut fitted. Should this have to be disassembled, please proceed as follows:

- Double nuts and preloaded single nuts must not be removed.
- Never remove recirculations.
- Do not replace missing balls with new ones. All the balls in a ballscrew nut must always be replaced at the same time.
- An assembly tube is needed to hold the nut. The outer diameter of the assembly tube is 0.1 to 0.2 mm less than the core diameter of the thread. It is slightly longer than the nut.
- Place assembly tube on start of thread and unscrew nut according to thread direction towards assembly tube. The assembly tube prevents the balls from falling out of the nut. **The nut can now be pulled off the shaft with the assembly tube.**

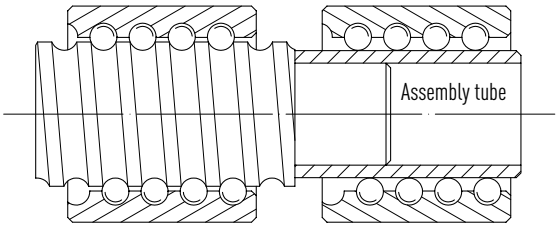


Fig. 4.2 **Removing nut from shaft using assembly tube**

4.2.2 Assembling nut on ballscrew shaft

The nut is assembled in reverse order. Force must not be applied, otherwise the nut will be damaged. The nut must be fully on the thread before the assembly tube is removed. Then move the nut onto the shaft by a distance of at least three times the nut length.
Only assemble the ballscrew nut with a suitable assembly tube. Inappropriate auxiliary devices may result in the entire ballscrew being damaged or destroyed. Unassembled ballscrew nuts are usually supplied on an assembly tube, which can be used for correct assembly. If a special assembly tube is needed, the outer diameter of this tube should be 0.1 – 0.2 mm smaller than the core diameter of the ballscrew. The assembly tube should be around 20 mm longer than the nut.

4.2.2.1 Assembling nuts with NBR or TPU wiper

Nuts with a NBR/TPU wiper have a sealing lip which has a sliding sealing effect. The wiper therefore very reliably prevents foreign objects from entering the nut and extends its life as a result. The sealing lip also greatly reduces the amount of lubricant which can escape via the thread groove.
The nut must be assembled correctly for the sealing lip to function properly. The following points should be, observed otherwise the function of the sealing lip may be impaired.

NOTE

Note:
Incorrect assembly may result in the ballscrew failing prematurely.

- The ballscrew shaft's thread should be bevelled, free of burrs and clean. Placing a small quantity of grease at the start of the thread or on the wiper makes assembly easier, protects the sealing lip and prevents damage.

Fig. 4.3 **End of shaft before the NBR wiper is assembled**

- Before assembly check that the two wipers are seated correctly in the nut. The wipers are aligned using a nose in the nut and must not protrude beyond the nut housing.

Fig. 4.4 **Before assembly ensure that wipers are seated correctly**

- Place assembly tube on face end of ballscrew shaft. This makes it easier for the nut to be aligned with the shaft. During assembly, the nut must be aligned concentrically and flush with the shaft.

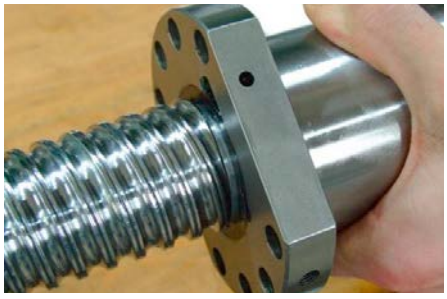


Fig. 4.5 **Nut – shaft alignment**

- Slide nut to start of thread and screw onto ballscrew shaft with a little pressure and a rotating movement. The wiper is then in the correct position in the thread groove. It must be possible for the nut to be screwed onto the shaft with little effort. Screw nut up to end of shaft.
  If the torque needed is considerably greater or if the nut jams, unscrew it and repeat the process.

Fig. 4.6 **Screw nut with wiper onto shaft**

- Slowly screw nut further onto shaft and use your finger or a suitable blunt tool to fix the wiper near the sealing lip (e.g. piping of a suitable diameter). This ensures that the sealing lip runs into the thread groove correctly.

NOTE

Note:
Do not use tools with points or sharp edges otherwise there is a risk of damaging the sealing lip.

Fig. 4.7 **Fixing the wiper while slowly screwing nut onto shaft**

- Screw nut all the way onto the shaft and move it back and forth at least 3 nut lengths. The nut must turn easily on the shaft. Check that both wipers are seated correctly.
- Before starting up, lubricate the ballscrew as described in the lubrication instructions.

4.2.3 Tolerance details and measuring methods for HIWIN ballscrews

Table 4.1 **Effective concentricity deviation of outer diameter with reference to AA' (measurement in accordance with DIN 69051)**

Nominal diameter [mm]		Reference length	t_{5P} [µm] HIWIN tolerance class						
above	up to	L5	T0	T1	T2	T3	T4	T5	T7
6	12	80	16	20	23	25	25	32	40
12	25	160							
25	50	315							
50	100	630							
100	200	1250							

Lt / do		t_{5max} [µm] (for Lt ≥ 4L5) HIWIN tolerance class						
above	up to	T0	T1	T2	T3	T4	T5	T7
	40	32	40	45	50	50	64	80
40	60	48	60	70	75	75	96	120
60	80	86	100	115	125	125	160	200
80	100	128	160	180	200	200	256	320

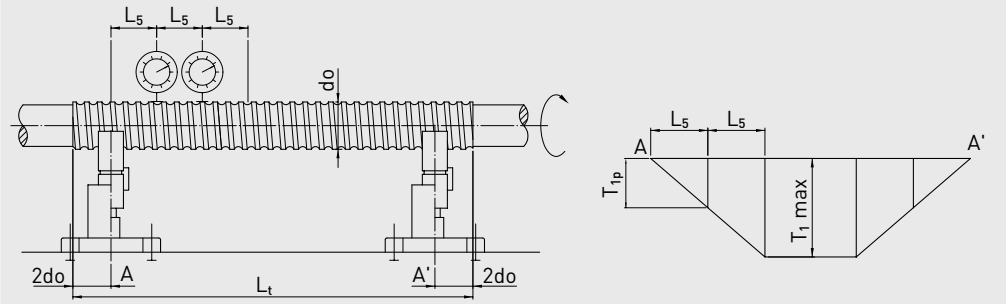


Table 4.2 **Concentricity deviation of bearing with reference to AA' (measurement in accordance with DIN 69051)**

Nominal diameter [mm]		Reference length	t_{6P} [µm] (for L1 ≤ Lr) HIWIN tolerance class						
above	up to	Lr	T0	T1	T2	T3	T4	T5	T7
6	20	80	6	10	11	12	12	20	40
20	50	125	8	12	14	16	16	25	50
50	125	200	10	16	18	20	20	32	63
125	200	315	–	–	20	25	25	40	80

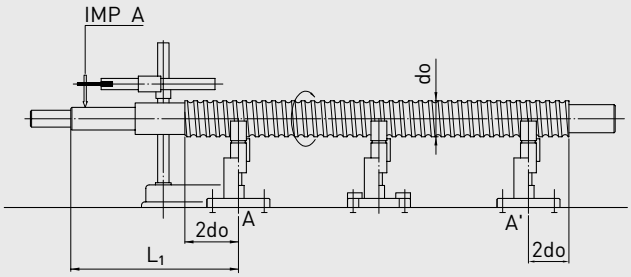


Table 4.3 **Coaxial deviation of drive journal with regard to bearing journal with reference to AA' (measurement in accordance with DIN 69051)**

Nominal diameter [mm]		Reference length	t_{7P} [µm] (for L2 ≥ Lr) HIWIN tolerance class						
above	up to	Lr	T0	T1	T2	T3	T4	T5	T7
6	20	80	4	5	6	6	6	8	12
20	50	125	5	6	7	8	8	10	16
50	125	200	6	8	8	10	10	12	20
125	200	315	–	–	10	12	12	16	25

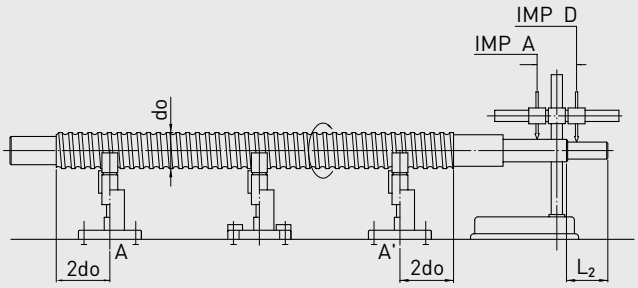


Table 4.4 **Axial runout deviation of bearing journal shoulder with reference to AA' (measurement in accordance with DIN 69051)**

Nominal diameter [mm]		t_{8P} [µm] – HIWIN tolerance class						
above	up to	T0	T1	T2	T3	T4	T5	T7
6	63	3	3	3	4	4	5	6
63	125	3	4	4	5	5	6	8
125	200	–	–	6	6	6	8	10

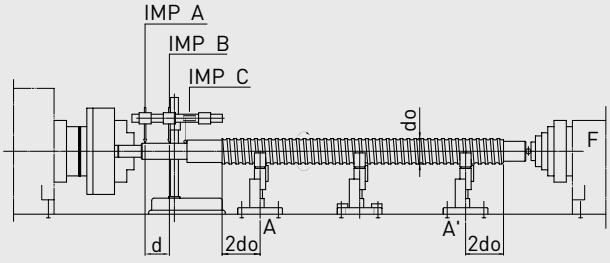


Table 4.5 **Axial runout deviation of installation surface of ballscrew nut (only for preloaded ballscrew nuts) with reference to BB' (measurement in accordance with DIN 69051)**

Flange diameter [mm]		t_{9P} [µm] – HIWIN tolerance class						
above	up to	T0	T1	T2	T3	T4	T5	T7
16	32	8	10	10	12	12	16	20
32	63	10	12	12	16	16	20	25
63	125	12	16	16	20	20	25	32
125	250	16	20	20	25	25	32	40
250	500	–	–	15	32	32	40	50

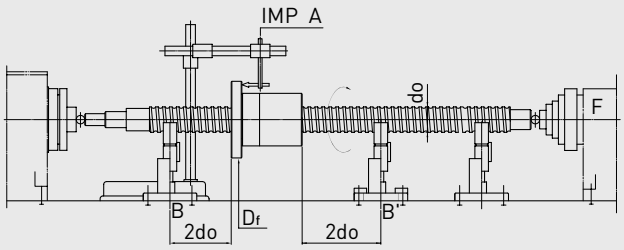


Table 4.6 **Concentricity deviation of outer diameter of threaded nut (only for preloaded and turning ballscrew nuts) with reference to BB' (measurement in accordance with DIN 69051)**

Diameter [mm] Nut body		t_{10P} [µm] HIWIN tolerance class						
above	up to	T0	T1	T2	T3	T4	T5	T7
16	32	8	10	10	12	12	16	20
32	63	10	12	12	16	16	20	25
63	125	12	16	16	20	20	25	32
125	250	16	20	20	25	25	32	40
250	500	–	–	–	32	32	40	50

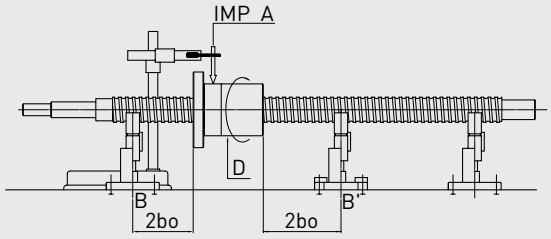
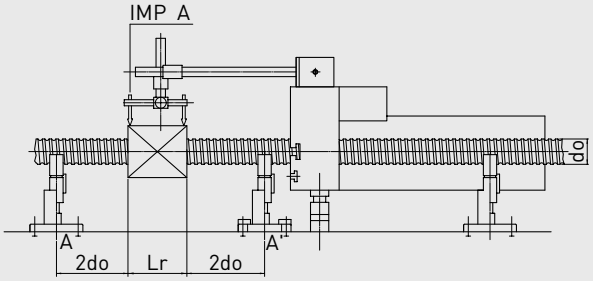


Table 4.7 **Parallelism deviation of a square ballscrew nut (only for preloaded ballscrew nuts) with reference to BB' (measurement in accordance with DIN 69051)**

t_{11P} [µm] / 100 mm, cumulative HIWIN tolerance class						
T0	T1	T2	T3	T4	T5	T7
14	16	16	20	20	25	32



5. Maintenance

⚠ DANGER!

Before and during any maintenance work on the ballscrew, the higher-level system must be disconnected from the power supply, and you must ensure that the power supply cannot be restored by anyone else. Otherwise, there is a danger of death and injury.

5.1 Cleaning

WARNING!

The legal regulations and the manufacturer's regulations concerning the use of cleaning agents must be observed.
Damage to the profile rail by pointed objects must be avoided in all circumstances.
When cleaning, please make sure that no metal particles end up or remain in the ballscrew.

- Ballscrews can be cleaned using white spirit and oil.
- Trichlorethylene or an equivalent cleaning agent can be used as a degreasing agent.
- In each case, the legal regulations and the manufacturer's regulations concerning the use of cleaning agents must be observed.
- In order to avoid corrosion, all parts must be dried and preserved/lubricated after cleaning.
- Damage to the ball track by pointed objects must be avoided in all circumstances.
- When cleaning, please make sure that no metal particles end up or remain in the ball track or ballscrew nut.

6. Lubrication

6.1 Fundamental information about lubrication

Ballscrews need a sufficient supply of lubricant to ensure their function and service life.
The specifications and information provided below are intended to help the user select an appropriate lubricant, the corresponding amount of lubricant and establish the lubrication intervals.
These lubrication instructions do not mean that the user does not have to check the defined lubrication intervals in reality and correct them if necessary. After every lubrication process check whether there is sufficient lubricant on the machine element (check for a film of lubricant).

Lubricants

- reduce wear
- protect against dirt
- prevent corrosion

The lubricant is a design element and should be taken into account when designing a machine. The operating temperature range and operating and ambient conditions should be considered when selecting the lubricant.

6.1.1 Safety

WARNING!

This chapter explains how to use lubricants safely. Improper handling of lubricants may endanger life and limb. It is essential that the following information is observed. Before handling lubricants, always note the associated safety data sheet.

6.1.2 Proper use of lubricants

Recurring contact with the skin over long periods should be avoided wherever possible. Clean wetted areas of skin with soap and water. Use skin protection during work and a moisturising cream afterwards. Wear oil-resistant protective clothing if necessary (e.g. gloves, apron). Do not clean your hands with petroleum, solvents or coolants that can be or are mixed with water. Oil mists must be extracted from their point of origin.

Wear safety goggles to avoid contact with the eyes. Should lubricants come into contact with the eyes, the areas affected should be rinsed with plenty of water. Seek the advice of an ophthalmologist if eyes feel irritated for long periods.

If swallowed by mistake, do not induce vomiting. Call the doctor immediately.

Safety data sheets in accordance with 91/155/EEC are generally available for lubricants. These contain detailed information about protecting your health and the environment and preventing accidents.

Lubricants are generally a risk to waterways. They must not therefore enter the ground, water or sewerage system.

6.1.3 Safety notices regarding storing lubricants

Store the lubricants in a cool and dry location in well-sealed containers. They should be protected from direct sunlight and frost. Lubricants must not be stored in the same place as foodstuffs. Lubricants must not be stored in the same place as oxidants.

The information in the safety data sheet provided by the lubricant manufacturer must be observed.

6.2 Lubricant provided upon delivery

HIWIN ballscrews are supplied preserved as standard. A mineral oil-based grease for rolling and slide bearings containing thickening agents in accordance with DIN 51825 (K2K), NLGI class 2 is used to preserve the ballscrews. Viscosity of base oil: 60 mm²/s. Initial lubrication should be undertaken before starting up for the first time (see section 6.7.1.1)

6.3 Selecting the lubricant

Oils, greases or even semi-fluid grease can be used.
The lubricants that you would use for a rolling bearing can be used. The choice of lubricant and type of supply can usually be adjusted to the lubrication used for the rest of the machine components.

Note: NOTE
Lubricants containing MoS_2 or graphite must not be used.

6.4 Miscibility

Check the miscibility of different lubricants. Mineral oil-based lubricant oils with the same classification (e.g. CL) and a similar viscosity (maximum of one class difference) can be mixed.
Greases are miscible when their base oil and thickening types are the same. The viscosity of the base oil must be similar. The NLGI class may differ by no more than one stage.
If lubricants other than those specified are used, shorter lubrication intervals and diminished performance should be expected. Potential chemical interactions between plastics, lubricants and preservatives must be expected.

6.5 Operating conditions

The choice of lubricant basically depends on operating temperature and various operating factors, such as level of loading, oscillations, vibrations or short-stroke applications. Special requirements, such as use in conjunction with strong or aggressive media applications, in clean rooms, in a vacuum or in the food industry are also taken into consideration.
Applications and suitable lubricants are listed in chapter 6.8. If in any doubt, contact the lubricant manufacturer to ensure optimum lubrication.

6.6 Use of greases and oils in central lubrication systems

When using a central lubrication system, it is recommended that the initial lubrication (see section 6.7.1.1) is carried out separately using a manual grease gun before connection to the system. Furthermore, make sure that all pipes and elements up to the user are filled with lubricant and that no air pockets are present.
Long pipelines and narrow pipe diameters are to be avoided. The pipes are to be installed on an incline.
The pulse count results from the partial quantities and the piston distributor sizes.
In addition, the lubrication system manufacturer's regulations must be observed.

6.7 Lubricating ballscrews

HIWIN ballscrews can be lubricated with grease, semi-fluid grease or oil depending on the application. The lubricant pressure required depends on the nominal diameter, lubricant, length of the feed pipe and the type of lubrication connection.

NOTE

Note:
Too high a lubrication pressure or too great a lubricant quantity may destroy the ballscrews.

In particular, for ballscrew nuts with felt or lip sealing, lubrication must be carried out very carefully, otherwise the seals may be damaged.

6.7.1 General information about lubricant quantities

6.7.1.1 Initial lubrication upon commissioning

HIWIN ballscrews are supplied preserved as standard. The initial lubrication takes place in three steps:
Supply the amount of grease stated for the range in the table. Move the nut three times by approx. three nut lengths. Repeat the aforementioned process twice more.

Initial lubrication for short-stroke applications:

Stroke < 2 × nut length: Provide lubricant connections on both sides of the nut and lubricate.
Stroke < 0.5 × nut length: Provide lubricant connections on both sides of the nut and lubricate. In doing so, move the ballscrew nut by two nut lengths several times. If this is not possible, please contact us.

The quantities stated in the corresponding tables should be doubled for short-stroke applications.
If nuts do not have a lubricant connection, supply via the shaft.

6.7.1.2 Relubrication

The lubrication intervals depend heavily on the operating conditions (nominal size, lead, speed, acceleration, loads, etc.) and environmental conditions (temperature, fluids etc.). Environmental influences such as high loads, vibrations and dirt shorten the lubrication intervals. For clean environmental conditions and light loads, the lubrication intervals can be extended.
If the ballscrews are fitted vertically, the relubrication quantities must be increased by roughly 50 %.
For normal operating conditions, the lubrication intervals provided shall apply.
Twice the amount of lubricant should be used for relubrication with short-stroke applications.

6.8 Lubricant recommendations

The choice of lubricant basically depends on operating temperature and various operating factors, such as level of loading, oscillations, vibrations or short-stroke applications. Special requirements, such as use in conjunction with strong or aggressive media applications, in clean rooms, in a vacuum or in the food industry are also taken into consideration.
Applications and suitable lubricants are listed below. If in any doubt, contact the lubricant manufacturer to ensure optimum lubrication.

6.8.1 Grease lubrication

For grease lubrication, we recommend mineral oil-based grease for rolling and slide bearings with thickening agents in accordance with DIN51825 (K1K, K2K). EP additives are needed for heavy-duty applications (KP1K, KP2K). NLGI class 1 or 2 and other consistency classes can be used following consultation with the lubricant manufacturer.

Note:
Greases containing solid lubricants such as graphite or MOS_2 must not be used.

NOTE

The following lubricant details are examples and should only be used to assist with selection. Other lubricants can be used once the application has been discussed with the lubricant supplier.

6.8.1.1 Standard applications

Load: max. 15 % of the dynamic load rating
Temperature range: –10 °C to + 80 °C
Specific speed value: < 120 000

Table 6.1 **Greases recommended for standard applications**

HIWIN	G05
Klüber	Klüberlub GL-261
Mobil	Mobilux EP1
Fuchs Lubritech	Lagermeister BF2
Lubcon	TURMOGREASE CAK 2502

6.8.1.2 Heavy-duty applications

Load: max. 50 % of the dynamic load rating
Temperature range: 0 °C to + 80 °C
Specific speed value: < 120 000

Table 6.2 **Greases recommended for heavy-duty applications**

HIWIN	G01
Klüber	Klüberlub BE 71-501
Fuchs Lubritech	Lagermeister EP2
Lubcon	TURMOGREASE Li 802EP

6.8.1.3 Clean room applications/vacuum

Load: max. 50 % of the dynamic load rating
Temperature range: –10 °C to + 80 °C
Specific speed value: < 120 000

Table 6.3 **Greases recommended for clean room applications/vacuum**

HIWIN	G02
Klüber	Klüberalfa HX 83-302
Fuchs Lubritech	gleitmo 591

6.8.1.4 Clean room applications/vacuum at high speeds

Load: max. 50 % of the dynamic load rating
Temperature range: –10 °C to + 80 °C
Specific speed value: > 120 000

Table 6.4 **Greases recommended for clean room applications/vacuum at high speeds**

HIWIN	G03
Klüber	Isoflex Topas NCA52

6.8.1.5 Applications at high speeds

Load: max. 50 % of the dynamic load rating
Temperature range: –10 °C to + 80 °C
Specific speed value: > 120 000

Table 6.5 **Greases recommended for applications at high speeds**

HIWIN	G04
Klüber	Isoflex NCA15
Lubcon	TURMOGREASE Highspeed L252

6.8.1.6 Foodstuff applications in accordance with USDA H1

Load: max. 15 % of the dynamic load rating
Temperature range: –10 °C to + 80 °C
Specific speed value: < 120 000

Table 6.6 **Greases recommended for foodstuff applications in accordance with USDA H1**

Klüber	Klübersynth UH1 14-151
Mobil	Mobilgrease FM102
Fuchs Lubritech	GERALYN 1

6.8.2 Semi-fluid grease lubrication

Semi-fluid greases are often used in central lubrication systems because their soft structure allows them to be better distributed.
Observe the information provided by the lubrication system manufacturer.
The following lubricant details are examples and should only be used to assist with selection. Other lubricants can be used once the application and central lubrication system used have been discussed with the lubricant supplier.
In addition, the lubrication system manufacturer's regulations must be observed.

6.8.2.1 Standard applications

Load: max. 15 % of the dynamic load rating
Temperature range: –10 °C to + 80 °C
Specific speed value: < 120 000

Table 6.7 **Semi-fluid greases recommended for standard applications**

Klüber	MICROLUBE GB 00
Mobil	Mobilux EP004
Fuchs Lubritech	GEARMASTER LI 400

6.8.2.2 Heavy-duty applications

Note: NOTE
We recommend contacting a lubricant manufacturer for advice on using semi-fluid greases for heavy-duty applications.

6.8.2.3 Clean room applications/vacuum

Note: NOTE
We recommend contacting a lubricant manufacturer for advice on using semi-fluid greases for clean room applications/ vacuum.

6.8.2.4 Applications at high speeds

Load: max. 50 % of the dynamic load rating
Temperature range: –10 °C to + 80 °C
Specific speed value: > 120 000

Table 6.8 **Semi-fluid greases recommended for applications at high speeds**

Klüber	Isoflex Topas NCA5051
Mobil	Mobilux EP004
Fuchs Lubritech	GEARMASTER LI 400

6.8.3.3 Foodstuff applications in accordance with USDA H1

Load: max. 15 % of the dynamic load rating
Temperature range: –10 °C to + 80 °C
Specific speed value: < 120 000

Table 6.11 **Semi-fluid greases recommended for foodstuff applications in accordance with USDA H1**

Klüber	Klübersynth UH1 14-1600
Mobil	Mobilgrese FM 003
Fuchs Lubritech	GERLYNN 00

6.8.3 Oil lubrication

The benefits of lubricating oils include more even distribution and better access to contact points. This does however mean that lubricating oils collect in the lower part of the product due to the force of gravity and get dirty more quickly. Larger amounts of oil are therefore needed than grease. Oil lubrication is usually only suited to use with central lubrication units or products fitted with a lubrication unit.
Observe the information provided by the lubrication system manufacturer.

The following lubricant details are examples and should only be used to assist with selection. Other lubricants can be selected once the application and central lubrication system used have been discussed with the lubricant supplier.

6.8.3.1 Standard applications

Load: max. 15 % of the dynamic load rating
Temperature range: –10 °C to + 80 °C
Specific speed value: < 120 000

Table 6.9 **Oils recommended for standard applications**

Klüber	Klüberoil GEM 1-150 N
Mobil	Mobilgear 630
Fuchs Lubritech	GEARMASTER CLP 320

6.8.2.5 Heavy-duty applications

NOTE

Note:
We recommend contacting a lubricant manufacturer for advice on using oils for heavy-duty applications.

6.8.3.2 Clean room applications/vacuum

Load: max. 50 % of the dynamic load rating
Temperature range: –10 °C to + 80 °C
Specific speed value: < 120 000

Table 6.10 **Oils recommended for clean room applications/vacuum**

Klüber	Tyreno Fluid E-95 V
Mobil	Mobilgear 626

6.8.3.4 Applications at high speeds

Load: max. 50 % of the dynamic load rating
Temperature range: –10 °C to + 80 °C
Specific speed value: > 120 000

Table 6.12 **Oil recommended for applications at high speeds**

Klüber	Klüberoil GEM 1-46 N

6.8.3.5 Foodstuff applications in accordance with USDA H1

Load: max. 15 % of the dynamic load rating
Temperature range: –10 °C to + 80 °C
Specific speed value: < 120 000

Table 6.13 **Oil recommended for foodstuff applications in accordance with USDA H1**

Klüber	Klüberoil 4 UH1-68 N

6.8.4 HIWIN lubricants

6.8.4.1 HIWIN greases

Table 6.14 **Overview of HIWIN greases**

Grease type	Application	Article number		
		Cartridge 70 g 	**Cartridge 400 g** 	**Can 1 kg** 
G01	Heavy-duty applications	20-000335	20-000336	20-000337
G02	Clean room applications	20-000338	20-000339	20-000340
G03	Clean room applications at high speeds	20-000341	20-000342	20-000343
G04	Applications with high speeds	20-000344	20-000345	20-000346
G05	Standard grease	20-000347	20-000348	20-000349

Table 6.15 **HIWIN grease guns**

Article no.	Description	Scope of delivery	Comment
5-12-0009	Grease gun GN-80M incl. set of lubrication adapter and nozzles (see Fig. 6.1)	Grease gun GN-80M consisting of: ○ Grease gun ○ Hydraulic coupling A1 suitable for conical grease nipples acc. to DIN 71412, outer diameter 15 mm ○ Hollow mouthpiece A2 suitable for conical or ball grease nipples acc. to DIN 71412/DIN 3402, outer diameter 10 mm ○ Set of lubrication adapter and nozzles	Suitable for 70 g cartridge or direct filling
5-12-0010	Grease gun GN-400C incl. set of lubrication adapter and nozzles (see Fig. 6.2)	Grease gun GN-400-C consisting of: ○ Grease gun ○ Hydraulic coupling A1 suitable for conical grease nipples acc. to DIN 71412, outer diameter 15 mm ○ Hollow mouthpiece A2 suitable for conical or ball grease nipples acc. to DIN 71412/DIN 3402, outer diameter 10 mm ○ Set of lubrication adapter and nozzles	Suitable for 400 g cartridge or direct filling
5-12-0035	Set of lubrication adapter and nozzles (see Fig. 6.3)	Set of lubrication adapter and nozzles consisting of: ○ Hollow mouthpiece A3 suitable for ball grease nipples acc. to DIN 3402, outer diameter 6 mm ○ Ball type mouthpiece A4 for funnel type grease nipples acc. to DIN 3405 outer diameter 6 mm ○ Tip mouthpiece A5 ○ Tip mouthpiece angled A6	

Fig. 6.1 **Grease gun GN-80M**

Fig. 6.2 **Grease gun GN-400C**

Fig. 6.3 **Set of lubrication adapter and nozzles**

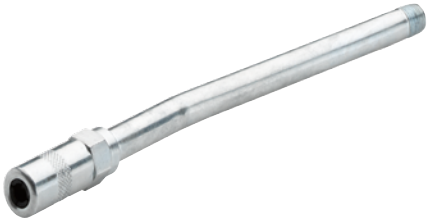


Fig. 6.4 **A1 – Hydraulic coupling**

Fig. 6.5 **A2 – Hollow mouthpiece 10 mm**

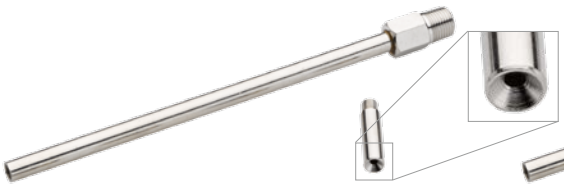


Fig. 6.6 **A3 – Hollow mouthpiece 6 mm**

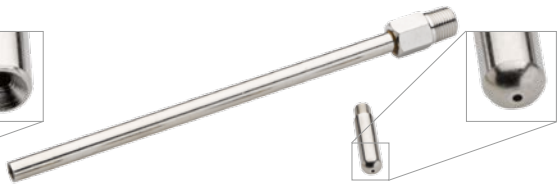


Fig. 6.7 **A4 – Ball type mouthpiece 6 mm**

Table 6.16 **Overview of grease nipples and recommended adapters for grease gun**

	Grease nipple	Recommended adapter for grease gun
	Ball-type grease nipple	
	M3 × 0,5 P	A2, A3 [1]
	M4 × 0,7 P	A2, A3 [1]
	Conical grease nipple	
	M6 × 0,75 P	A1, A2 [1]
	1/8 PT	A1, A2 [1]
	Funnel-type grease nipple	
	M3 × 0,5 P	A4
	M4 × 0,7 P	A4
	M6 × 0,75 P	A4

[1] optional for limited installation space

6.9 Lubricant quantities and lubrication intervals

WARNING!

Never commission ballscrews without initial lubrication.
In general, if lubricant quantities or lubrication pressure are too high, this can damage or destroy the product. The specified procedure must be observed in order to avoid damaging the product.

The lubricant quantities specified below are reference values that may fluctuate according to the environmental conditions.

6.9.1 Lubricant quantities and lubrication intervals for grease lubrication

Table 6.17 **Lubricant quantities for grease lubrication**

Nominal diameter × lead with type of recirculation	Single nut		Double nut	
	Lubricant quantity for initial lubrication [cm³]	**Lubricant quantity for relubrication [cm³]**	**Lubricant quantity for initial lubrication [cm³]**	**Lubricant quantity for relubrication [cm³]**
8 × 2.5	0.05 (3 ×)	0.1	–	–
10 × 2.5	0.1 (3 ×)	0.1	–	–
10 × 4	0.1 (3 ×)	0.2	–	–
12 × 4	0.1 (3 ×)	0.2	–	–
16 × 5	0.2 (3 ×)	0.4	0.8 (3 ×)	1.6
16 × 10K3	0.4 (3 ×)	0.8	–	–
16 × 16K2	0.3 (3 ×)	0.6	–	–
20 × 5T4	0.4 (3 ×)	0.8	0.9 (3 ×)	1.8
20 × 10K3	0.3 (3 ×)	0.6	–	–
20 × 20K2	0.5 (3 ×)	1.0	–	–
25 × 5T4	0.6 (3 ×)	1.2	1.3 (3 ×)	2.2
25 × 10K4	0.6 (3 ×)	1.2	–	–
25 × 10T3	0.7 (3 ×)	1.4	1.0 (3 ×)	2.0
25 × 25K2	0.8 (3 ×)	1.6	–	–
32 × 5T5	0.9 (3 ×)	1.8	1.7 (3 ×)	2.7
32 × 10K5	1.5 (3 ×)	2.0	–	–
32 × 10T4	3.5 (3 ×)	4.0	6.5 (3 ×)	9.0
32 × 20K3	1.5 (3 ×)	2.0	–	–
32 × 20T2	3.5 (3 ×)	4.0	7.5 (3 ×)	11.0
32 × 32K2	2.0 (3 ×)	3.0	–	–
40 × 5	1.5 (3 ×)	2.0	2.5 (3 ×)	4.0
40 × 10K4	3.0 (3 ×)	4.0	–	–
40 × 10T4	5.0 (3 ×)	7.5	9.5 (3 ×)	15.0
40 × 20K3	4.5 (3 ×)	5.5	–	–

Table 6.18 **Lubricant quantities for grease lubrication (continued)**

Nominal diameter × lead with type of recirculation	Single nut		Double nut	
	Lubricant quantity for initial lubrication [cm³]	**Lubricant quantity for relubrication [cm³]**	**Lubricant quantity for initial lubrication [cm³]**	**Lubricant quantity for relubrication [cm³]**
40 × 20T2	5.0 (3 ×)	7.5	10.0 (3 ×)	16
40 × 40K2	5.0 (3 ×)	7.5	–	–
50 × 5	1.5 (3 ×)	2.0	3.5 (3 ×)	5.0
50 × 10K6	5.5 (3 ×)	7.5	–	–
50 × 10T4	5.5 (3 ×)	7.5	11.5 (3 ×)	18
50 × 20K5	8.5 (3 ×)	12.0	–	–
50 × 20T3	8.5 (3 ×)	12.0	15.0 (3 ×)	22.0
50 × 40K3	8.5 (3 ×)	12.0	–	–
63 × 10	9.0 (3 ×)	15.0	17.0 (3 ×)	25.0
63 × 20T4	17.0 (3 ×)	25.0	30.0 (3 ×)	45.0
63 × 20T5	21.0 (3 ×)	30.0	–	–
63 × 20K6	35.0 (3 ×)	52.0	–	–
80 × 10	12.0 (3 ×)	18.0	20.0 (3 ×)	30.0
80 × 20T4	22.0 (3 ×)	33.0	37.0 (3 ×)	55.0
80 × 20T5	25.0 (3 ×)	37.0	–	–
80 × 10K5	40.0 (3 ×)	60.0	–	–
80 × 20K7	45.0 (3 ×)	68.0	–	–

Relubrication interval for grease lubrication
The relubrication intervals for grease lubrication under standard conditions are between 200 and 600 hours in a clean environment.

Standard conditions:
Load ratio: max. 20 % of the dynamic load rating
Temperature range: –10 °C to + 80 °C
Specific speed value: < 120 000
No impacts or vibrations
Deviating conditions and dirt reduce the relubrication intervals.

6.9.2 Lubricant quantities and lubrication intervals for semi-fluid grease lubrication

When using a central lubrication system, it is recommended that the initial lubrication is carried out separately using a manual grease gun before connection to the system.
Furthermore, make sure that all pipes and elements up to the user are filled with lubricant and that no air pockets are present. Long pipelines and narrow pipe diameters are to be avoided. The pipes are to be installed on an incline.
The pulse count results from the partial quantities and the piston distributor sizes.
In addition, the lubrication system manufacturer's regulations must be observed.

Lubricant quantities for semi-fluid grease lubrication:
The quantities for lubrication with semi-fluid grease are identical to those for grease lubrication.

Relubrication interval for semi-fluid grease lubrication:
The relubrication intervals for semi-fluid grease lubrication are reduced to 50 % of the relubrication intervals for grease lubrication.

6.9.3 Lubricant quantities and lubrication intervals for oil lubrication

When using a central lubrication system, make sure that all pipes and elements up to the user are filled with lubricant and that no air pockets are present. Long pipelines and narrow pipe diameters are to be avoided. The pipes are to be installed on an incline.
The pulse count results from the partial quantities and the piston distributor sizes.
In addition, the lubrication system manufacturer's regulations must be observed.

Table 6.18 **Lubricant quantities for oil lubrication**

Nominal diameter [mm]	Initial lubrication	Relubrication
	Partial oil quantity [cm³]	**Oil quantity [cm³]**
8	0.2 (3 ×)	0.1
10	0.2 (3 ×)	0.1
12	0.2 (3 ×)	0.1
16	0.3 (3 ×)	0.2
20	0.3 (3 ×)	0.3
25	0.5 (3 ×)	0.5
32	0.5 (3 ×)	0.5
40	0.9 (3 ×)	0.7
50	1.1 (3 ×)	1.0
63	2.0 (3 ×)	1.5
80	3.0 (3 ×)	2.0

Oil bath lubrication:
If using oil bath lubrication, the shaft should be 0.5 to 1 mm above the oil level.

Relubrication interval for semi-fluid grease lubrication:
The relubrication intervals for oil lubrication should not exceed 8 hours with the oil quantity stated above.

7. Incident procedures

7.1 Troubleshooting and error elimination

This chapter explains potential ballscrew malfunctions and how to avoid them. It also introduces several measuring devices which allow the user to localise the causes of excess clearance.

7.2 Causes of errors and error prevention

The main sources of error can be split into four categories:

7.2.1 Excess play

No preload or insufficient preload:
If the ballscrew is held vertically and the nut can be pulled down under its own weight and rotated around the shaft, the ballscrew has play or is slightly preloaded. Ballscrews without preload may have significant axial backlash; they are therefore used in applications which do not primarily require high accuracy levels.
HIWIN establishes the preload needed for the application and supplies the ballscrew with the necessary preload. A detailed and accurate description of the usage conditions is therefore very important for HIWIN ballscrew orders.

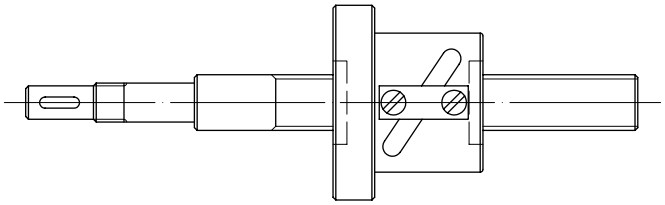


Fig. 7.1 **Structure of a ballscrew**

The following measurements can be taken to establish the reason behind abnormal play in the ballscrew:

1. Glue ball gauge in central hole at one end of ballscrew shaft. Use a dial gauge to measure the axial backlash of the ball gauge as you rotate the ballscrew shaft. (Fig. 7.2 (a)). It should not move any more than 0.003 mm if the bearing, ballscrew nut and nut housing are fitted correctly.
2. Use a dial gauge to measure the relative movement between the bearing housing and bearing seat as you rotate the ballscrew shaft (Fig. 7.2 (b)). Any measurement other than zero shows that the bearing is either not rigid enough or incorrectly mounted.
3. Check relative movement between machine bed and housing of ballscrew nut. (Fig. 7.2 (c)).
4. Check relative movement between housing of ballscrew nut and flange (Fig. 7.2 (d)).
   Contact HIWIN if the tests described do not yield anything but play is still present. The preload or rigidity of the ballscrew may have to be increased.

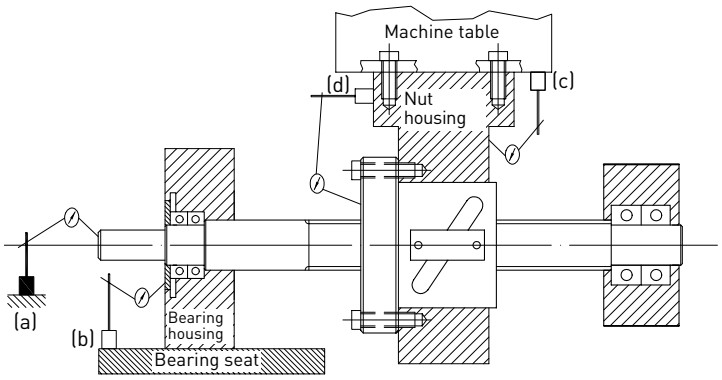


Fig. 7.2 **Establishing reason for abnormal play**

7.2.2 Excess torsional deformation

1. **Incorrect choice of material:**
   Table 7.1 is an overview of the materials to be used in ballscrews for shafts and nuts.

Table 7.1 **Material**

	Material numbers according to DIN EN 10027		
Component	**Rolled ballscrews**	**Peeled ballscrews**	**Ground ballscrews**
Shaft	1.1213	1.1213 1.7228	1.7228
Nut*	1.6523*		
Ball	1.3505		

* Special nuts 16MnCr5B

2. **Incorrect heat treatment:**
   Depth of heat-treated layer too shallow, uneven surface heat treatment, material too soft: The standard hardnesses for balls, nuts and shafts are listed in Table 7.2.

Table 7.2 **Standard hardnesses**

	Hardness
Shaft	56 – 62 HRC
Nut	56 – 62 HRC
Ball	62 – 66 HRC

3. **Design errors, ratio of length to diameter too large etc.:**
   The smaller the ratio of shaft length to diameter (L/D figure), the greater the rigidity. The recommended L/D figure is less than 60. Too high an L/D figure may result in significant torsional deformation. Wherever possible, assembly with bearings on one side should be avoided.

4. **Incorrect choice of bearings:**
   Ballscrews should be mounted with angular ball bearings; angular ball bearings designed especially for ballscrews are recommended in particular. When axial loads occur, normal ball bearings display considerable axial backlash; such bearings should not therefore be used for applications with axial loads.

5. **Nut housing or bearing housing is not rigid enough**
   The housing mounted on the ballscrew nut or on a bearing may twist under the weight of the components or machine load if not rigid enough. The test structure shown in Fig. 7.2 (d) can be used to test the rigidity of the nut housing. Similar test structures can be used to test the rigidity of bearing housings.

6. **Nut housing or bearing housing is not mounted correctly**
   - Vibration or a lack of dowel pins may cause the components to come loose. Fixed dowel pins and not clamping pins should be used to lock.
   - The screw connection on the ballscrew nut is not secure because the screws are too long and/or the threaded holes on the housing are too short.
   - Vibration and a lack of circlips causes the screws on the ballscrew nut to come loose.

7. **Housing surface is not parallel or flat enough**
   When the machine is assembled, spacers are often fitted between the housing and machine frame for adjustment. The dimensions of the mounting surface may vary at different points if the surface parallelism or evenness of the components is not within tolerance.

8. Motor and ballscrew are not fitted correctly

- If the coupling is not fitted securely or is not rigid enough, relative rotation results between the motor shaft and ballscrew shaft.
- Gear teeth do not mesh correctly or the driveline is not rigid enough. If the ballscrew is driven by a belt, a toothed belt should be used to avoid slipping.
- Feather key is loose in groove. Any incorrect combination of shaft, groove and feather key may cause play.

7.2.3 Uneven running

1. Production-related defects on ballscrew

- The race profile on the ballscrew shaft or nut is too rough.
- The bearing balls, ballscrew nut or shaft are out of round.
- The lead or lead circle diameter of ballscrew nut or shaft are outside tolerance.
- The ball return is not correctly fitted in the ballscrew nut.
- Uneven ball size or hardness.
  These problems should not arise with high-quality manufacturers.

2. Foreign objects in ball race profile

- Packaging material jammed in ball race profile. Before being shipped, ballscrews are packaged with various packaging materials and oil paper. These materials and other objects may jam in the ball race profile if care is not exercised when assembling and aligning the ballscrew. This may cause the balls to slide rather than roll or even jam completely.
- Machine chips enter the ball track. Chips or dust from machine operations may enter the ball track if wipers are not used to keep items away from the ballscrew's race profiles. This causes uneven running, reduced accuracy and a shortened life.

3. Operation beyond the maximum useful path

Travel beyond the maximum useful path may damage or even destroy the recirculation system. If this happens, the balls are no longer able to circulate evenly. In the worst cases, they may break and the race profile on the ballscrew shaft or nut be damaged. Operation beyond the maximum useful path may occur when setting up, as a result of limit switch failure or due to collisions in the machine. To avoid further damage, after exceeding the path, a ballscrew must be checked and repaired by the manufacturer before being used again.

4. Ball return damaged

The ball return may be damaged and cause the problems described above if it experiences severe impact during assembly.

5. Incorrect alignment

If the axles of the ballscrew nut housing and the shaft bearing don't fully match, radial load occurs. The ballscrew may bend if the load is excessive. Even if the axle error is so minor as to cause no discernible bending, it will still cause increased wear. If incorrectly aligned, the ballscrew accuracy will quickly deteriorate. The greater the ballscrew nut preload, the greater the need for the ballscrew to be accurately aligned.

6. Ballscrew nut not correctly mounted on housing

If the ballscrew nut is mounted at an angle or poorly aligned, eccentric loads occur. If this happens, the motor input current may fluctuate during operation.

7. Transport damage to ballscrew

7.2.4 Breakage

1. **Broken ball**
   Cr-Mo steel is the material most commonly used for bearing balls. A load of 1400 – 1600 kg is needed to break a ball with a diameter of 3.175 mm. The temperature of a ball with insufficient or no lubrication rises continuously during operation. This increase in temperature can make the balls brittle and cause them to break, which then results in damage to the race profile in the ballscrew nut and on the shaft. The process of topping up lubricant should therefore be taken into account at the design stage. If an automatic lubrication system cannot be used, regular lubricant top-ups should be included in the maintenance schedule.

2. **Pressed-in or broken ball return**
   If the ballscrew nuts travel beyond the permissible path or impact against the ball return, the return may be pressed in or broken. This blocks the path for the balls, so they simply slide and ultimately break.

3. **Bearing journal breakage on shaft**
   - Incorrect design:
     Sharp edges should be avoided on the shaft's bearing journal to avoid local peaks in stress. (Fig. 7.3) shows useful design features for the bearing journal.
   - Bending strain on the bearing journal:
     The bearing's mounting surface and the bearing lug's axle are not perpendicular to one another or the opposite sides of the bearing lug are not parallel to one another. The bearing journal is thereby bent and may ultimately break. The deviation in the bearing journal position before and after the bearing lug is tightened should not exceed 0.01 mm.
   - Radial load or load fluctuations:
     Incorrect alignment during ballscrew assembly causes abnormal fluctuating shearing loads and therefore premature ballscrew failure.

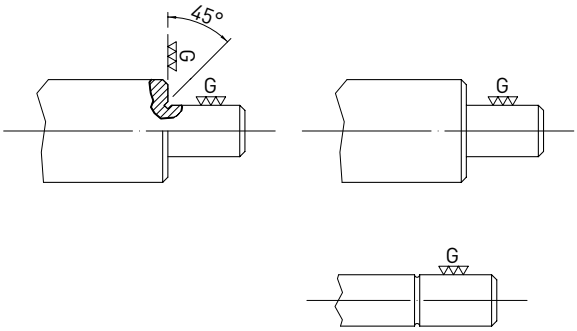


Fig. 7.3 **Recesses for avoiding peaks in stress**

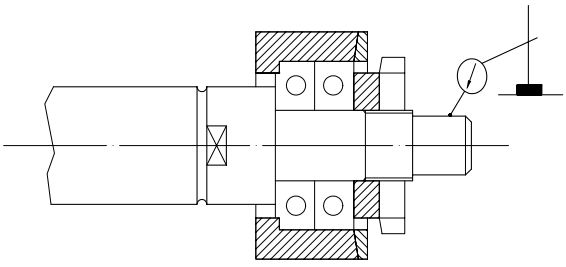


Fig. 7.4 **Concentricity check on drive journal**

Table 7.3 **Fault table**

Fault	Possible cause	Remedy
High level of operating noise while the ballscrew is running	Ballscrew speed too high	Check the permissible specific speed value
	Insufficient lubrication	Lubricate the ballscrew as specified in the lubrication instructions
	Ballscrew is not mounted axially parallel with the guides	Align the ballscrew
	Nut, shaft or balls displaying traces of wear	Replace the ballscrew
Ballscrew nut is sluggish near the mounting	Ballscrew is not mounted axially parallel with the guides	Align the ballscrew
Ballscrew nut is sluggish over its entire travel distance	Ballscrew nut has radial load or is not axially parallel with the shaft	Check alignment of nut housing to ballscrew mounting
	Dirt has entered the nut and is making it sluggish	Check the wipers Replace and check the ballscrew
	One or more of the ballscrew components are damaged	Replace the ballscrew
Ballscrew nut is heating up a lot	Ballscrew nut has radial load or is not axially parallel with the shaft	Check alignment of nut housing to ballscrew mounting
	Insufficient lubrication	Lubricate the ballscrew as specified in the lubrication instructions

8. Disposal

WARNING!

Danger caused by environmentally hazardous substances!
The danger to the environment depends on the type of substance used.
- Clean contaminated parts thoroughly before disposal!
- Clarify the requirements for safe disposal with disposal companies and, where appropriate, with the competent authorities!

Fluids	
Lubricants	dispose of as hazardous waste in an environmentally friendly way
Soiled cleaning cloths	dispose of as hazardous waste in an environmentally friendly way
Nut	
Steel components	dispose of separately
Plastic components	dispose of as residual waste
Shaft	
Steel components	dispose of separately
Balls	
Steel components	dispose of separately

9. Appendix

9.1 Buckling load and critical speed

9.1.1 Buckling load

F 9.1

$$F_k = 4{,}072 \times 10^5 \left(\frac{f_k \times {d_k}^4}{{l_s}^2} \right)$$

F 9.2

$$F_{kmax} = 0{,}5 \times F_k$$

F_k Permissible load [N]
F_{kmax} Max. permissible load [N]
d_k Core diameter of threaded shaft [mm]
l_s Unsupported shaft length [mm]
f_k Factor for different types of assembly (buckling load)

Fixed bearing – fixed bearing	$f_k = 1.0$
Fixed bearing – supported bearing	$f_k = 0.5$
Supported bearing – supported bearing	$f_k = 0.25$
Fixed bearing – no bearing	$f_k = 0.0625$

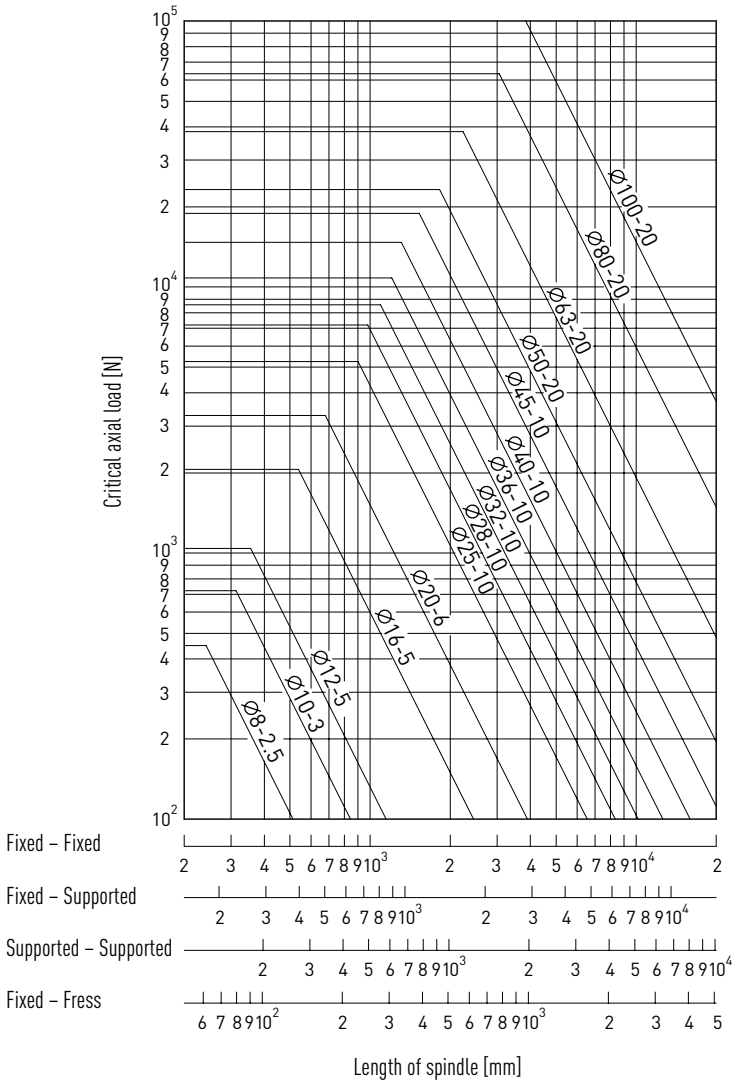


Fig. 9.1 **Buckling load for different diameters and lengths of threaded shafts**

9.1.2 Critical speed

F 9.3

$$n_k = 2{,}71 \times 10^8 \left(\frac{f_n \times d_k}{l_s^2} \right)$$

F 9.4

$$n_{kmax} = 0{,}8 \times n_k$$

n_k	Critical speed [rpm]
n_{kmax}	Max. permissible speed [rpm]
d_k	Core diameter of threaded shaft [mm]
l_s	Unsupported shaft length [mm]
f_n	Factor for different types of assembly (critical speed)

Fixed bearing – fixed bearing	$f_n = 1.0$
Fixed bearing – supported bearing	$f_n = 0.692$
Supported bearing – supported bearing	$f_n = 0.446$
Fixed bearing – no bearing	$f_n = 0.147$

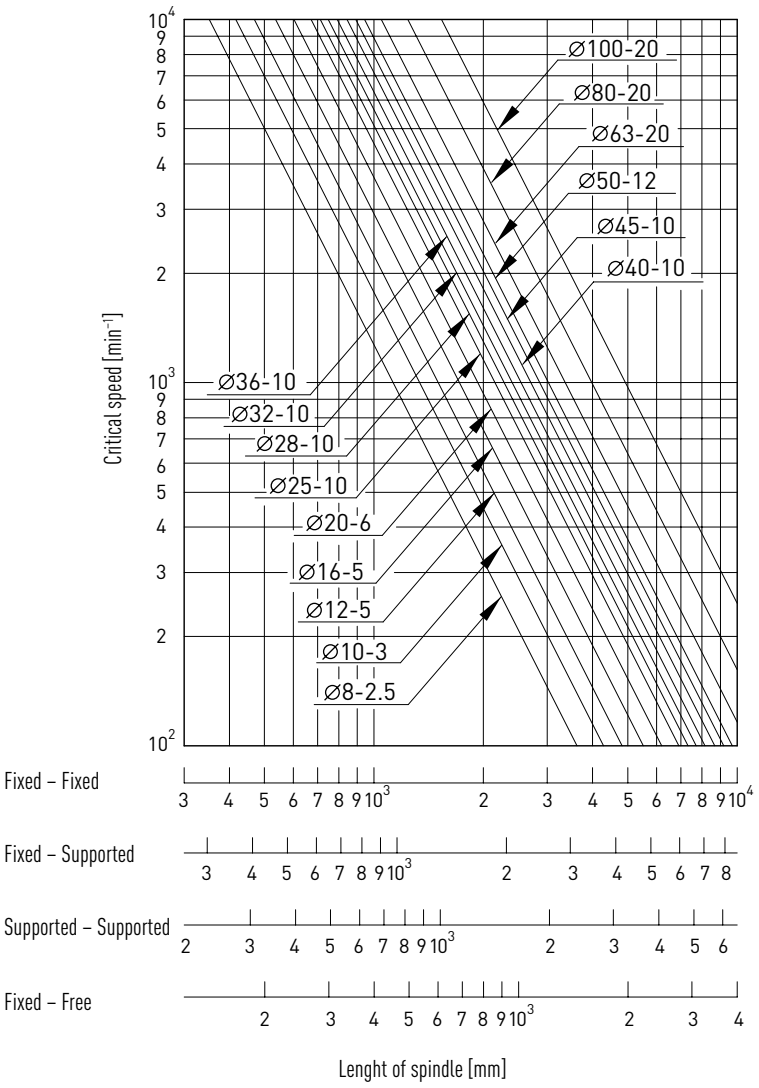
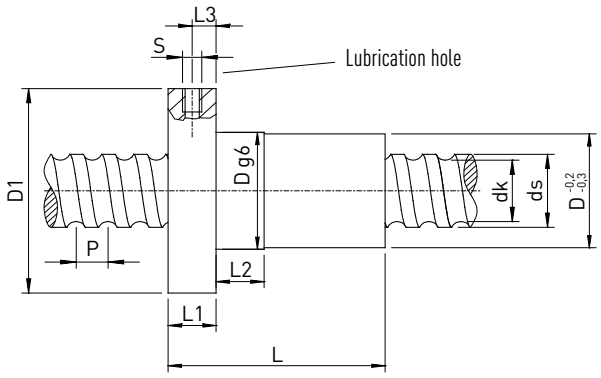


Fig. 9.2 **Critical speed for different diameters and lengths of threaded shafts**

9.2 Technical data

9.2.1 Rolled ballscrews

9.2.1.1 Flange single nut FSC DIN (DIN 69051 Part 5) with total recirculation
Flange single nut FSI DIN (DIN 69051 Part 5) with single recirculation



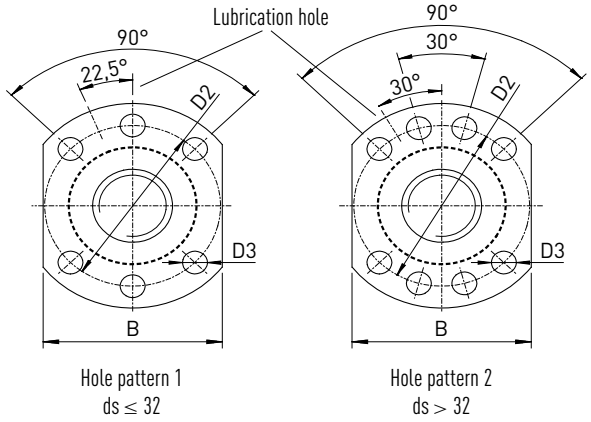


Table 9.1 **Nut dimensions**

Article number	ds ± 0.1	P	D g6	D1	D2	D3	Hole pattern	L	L1	L2	L3	S	B	dk	C_{dyn} [N]	C_0 [N]	Axial play max. [mm]	Mass [kg/item]
R15-05K4-FSCDIN	13.8	5	28	48	38	5.5	1	38	10	10	5	M6	40	11.8	12600	21000	0.04	0.17
R16-05T3-FSIDIN	15.5	5	28	48	38	5.5	1	40	10	10	5	M6	40	12.9	7320	12470	0.04	0.17
R16-10K3-FSCDIN	14.6	10	28	48	38	5.5	1	45	10	10	5	M6	40	12.5	9100	19300	0.04	0.19
R16-16K3-FSCDIN	14.4	16	28	48	38	5.5	1	61	12	20	6	M6	40	13.0	9100	19300	0.04	0.30
R20-05K4-FSCDIN	19.5	5	36	58	47	6.6	1	40	10	10	5	M6	44	16.9	13400	32740	0.04	0.29
R20-10K3-FSCDIN	19.3	10	36	58	47	6.6	1	48	10	10	5	M6	44	16.6	10000	23500	0.04	0.32
R20-20K2-FSCDIN	19.5	20	36	58	47	6.6	1	57	10	10	5	M6	44	17.1	6800	15300	0.04	0.36
R20-20K4-DFSCDIN	19.5	20	36	58	47	6.6	1	57	10	10	5	M6	44	17.1	12300	30500	0.04	0.36
R25-05K4-FSCDIN	24.9	5	40	62	51	6.6	1	43	10	12	5	M6	48	22.3	14900	41500	0.04	0.31
R25-10K4-FSCDIN	24.4	10	40	62	51	6.6	1	61	10	16	5	M6	48	21.8	16100	40400	0.04	0.39
R25-25K2-FSCDIN	24.7	25	40	62	51	6.6	1	70	10	16	5	M6	48	22.1	7400	19100	0.04	0.43
R25-25K4-DFSCDIN	24.7	25	40	62	51	6.6	1	70	10	16	5	M6	48	22.1	13500	38200	0.04	0.43
R32-05K6-FSCDIN	31.7	5	50	80	65	9	1	48	12	10	6	M6	62	29.1	23900	81900	0.04	0.59
R32-10K5-FSCDIN	31.8	10	50	80	65	9	1	77	12	16	6	M6	62	28.6	31500	80100	0.04	1.02
R32-20K3-FSCDIN	31.8	20	50	80	65	9	1	88	12	16	7	M6	62	28.6	17000	48500	0.04	1.02
R32-32K2-FSCDIN	31.9	32	50	80	65	9	1	88	12	20	6	M6	62	28.7	11600	31800	0.04	1.20
R32-32K4-DFSCDIN	31.9	32	50	80	65	9	1	88	12	20	6	M6	62	28.7	20600	62200	0.04	1.33
R40-05K6-FSCDIN	39.4	5	63	93	78	9	2	50	14	10	7	M8 × 1	70	36.8	25900	100600	0.04	1.10
R40-10K4-FSCDIN	37.8	10	63	93	78	9	2	70	14	16	7	M8 × 1	70	32.8	45000	123000	0.04	1.25
R40-20K3-FSCDIN	37.8	20	63	93	78	9	2	88	14	16	7	M8 × 1	70	32.8	34850	90000	0.07	1.45
R40-40K2-FSCDIN	37.8	40	63	93	78	9	2	102	14	16	7	M8 × 1	70	32.9	23000	58400	0.07	1.60
R40-40K4-DFSCDIN	37.8	40	63	93	78	9	2	102	14	16	7	M8 × 1	70	32.9	41500	115800	0.07	1.60
R50-05K6-FSCDIN	49.3	5	75	110	93	11	2	50	16	10	8	M8 × 1	85	46.8	28300	127200	0.07	1.30
R50-10K6-FSCDIN	47.9	10	75	110	93	11	2	90	16	20	8	M8 × 1	85	42.9	74500	250000	0.07	2.20
R50-20K5-FSCDIN	48	20	75	110	93	11	2	132	18	25	9	M8 × 1	85	42.9	67200	217500	0.07	2.50
R50-40K3-FSCDIN	50.3	40	75	110	93	11	2	149	18	45	9	M8 × 1	85	45.0	39000	123000	0.07	3.30
R50-40K6-DFSCDIN	50.3	40	75	110	93	11	2	149	18	45	9	M8 × 1	85	45.0	70300	242600	0.07	3.37
R63-10T6-FSIDIN	63.1	10	90	125	108	11	2	120	18	16	9	M8 × 1	95	58.0	61920	214090	0.07	3.10

9.2.1.2 Cylindrical single nut with screw-in thread RSIT

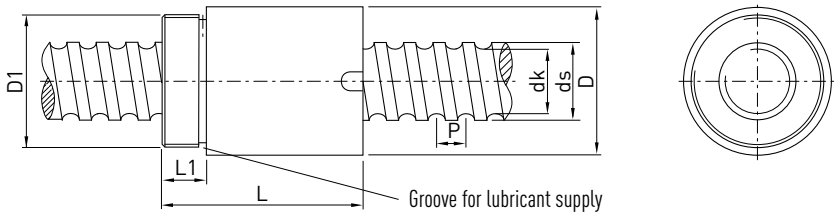


Table 9.2 **Nut dimensions**

Article number	ds ± 0,1	P	D -0,2	D1	L -0,5	L1	dk	Dynamic load rating C_{dyn} [N]	Static load rating C_0 [N]	Axial play max. [mm]	Mass [kg/item]
R08-02,5T2-RSIT**	7.7	2.5	17.5	M15 × 1	27.5	7.5	6.1	1200	3360	0.04	0.04
R10-02,5T2-RSIT*	9.3	2.5	19.5	M17 × 1	25	7.5	8.1	1780	2630	0.04	0.06
R10-04T2-RSIT*	9.7	4.0	24	M22 × 1	32	10.0	7.7	1980	2820	0.04	0.08
R12-04B1-RSIT**	11.9	4.0	25.5	M20 × 1	34	10.0	9.5	3000	5700	0.04	0.10

* Without dirt wiper
** Polyamide wiper on one side

Cylindrical single nut RSI

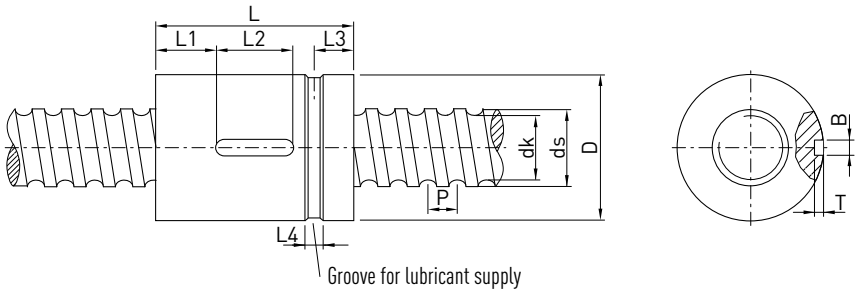


Table 9.3 **Nut dimensions**

Article number	ds	P	D g7	L ±0,2	L1	L2	L3	L4	T +0,1	B P9	dk	Dynamic load rating C_{dyn} [N]	Static load rating C_0 [N]	Axial play max. [mm]	Mass [kg/item]
R16-10T3-RSI	15,3	10	28	60	8	20	9,5	5	2,5	4	12,9	6100	10800	0,04	0,19
R20-10T3-RSI	19,8	10	34	60	20	20	12.0	4	2.0	5	17,5	8100	12600	0,04	0,26

9.2.2 Peeled ballscrews

9.2.2.1 Flange single nut DEB (DIN 69051 Part 5)

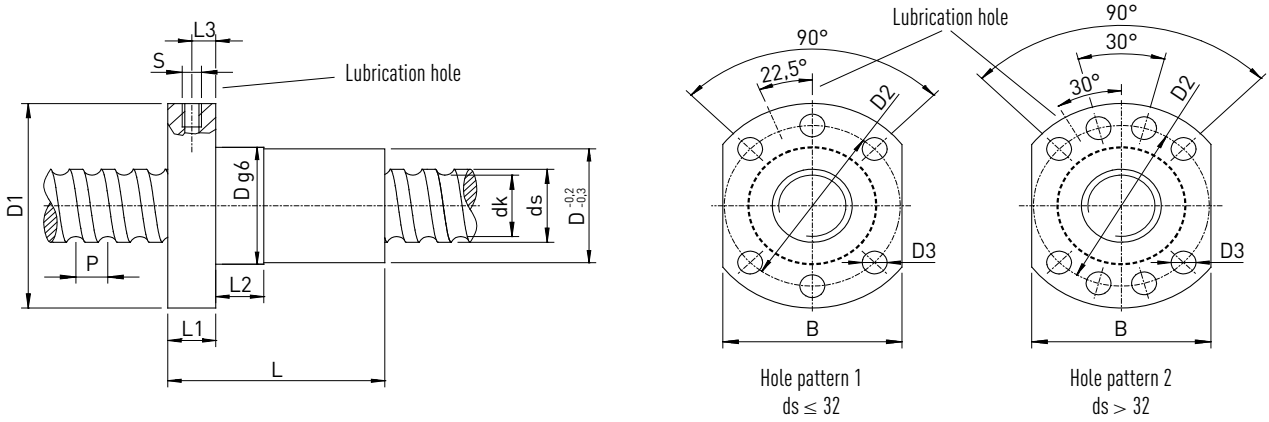


Table 9.4 **Nut dimensions**

Article number	ds h6	P	Dg6	D1	D2	D3	L	L1	L2	L3	S	B	dk	Dynamic load rating C_{dyn} [N]	Static load rating C_0 [N]	Axial play max. [mm]	Mass [kg/item]
R16-05T3-DEB	16	5	28	48	38	5.5	40	10	10	5.0	M6	40	13.5	9600	12700	0.02	0.17
R20-05T4-DEB	20	5	36	58	47	6.6	52	10	10	5.0	M6	44	17.5	13900	21800	0.02	0.31
R25-05T4-DEB	25	5	40	62	51	6.6	52	10	10	5.0	M6	48	22.5	15600	27900	0.02	0.32
R25-10T3-DEB	25	10	40	62	51	6.6	65	10	16	5.0	M6	48	21.0	24100	36200	0.02	0.35
R32-05T5-DEB	32	5	50	80	65	9.0	60	12	10	6.0	M6	62	29.5	20700	43900	0.02	0.68
R32-10T4-DEB	32	10	50	80	65	9.0	85	14	16	7.0	M6	62	27.8	40900	63200	0.02	0.82
R32-20T2-DEB	32	20	50	80	65	9.0	80	14	16	7.0	M6	62	27.8	20300	26800	0.02	0.68
R40-05T5-DEB	40	5	63	93	78	9.0	69	14	10	7.0	M8 × 1	70	37.5	22500	54600	0.02	1.13
R40-10T4-DEB	40	10	63	93	78	9.0	88	14	16	7.0	M8 × 1	70	35.8	46800	82600	0.02	1.13
R40-20T2-DEB	40	20	63	93	78	9.0	88	14	16	7.0	M8 × 1	70	35.8	23800	36400	0.03	1.14
R50-05T5-DEB	50	5	75	110	93	11.0	69	16	10	8.0	M8 × 1	85	47.5	24900	69800	0.02	1.45
R50-10T4-DEB	50	10	75	110	93	11.0	98	16	16	8.0	M8 × 1	85	45.8	52800	106800	0.02	1.65
R50-20T3-DEB	50	20	75	110	93	11.0	114	16	16	8.0	M8 × 1	85	45.8	40000	76200	0.03	1.95
R63-10T6-DEB	63	10	90	125	108	11.0	120	18	16	9.0	M8 × 1	95	58.8	84700	210800	0.04	3.05
R63-20T4-DEB	63	20	95	135	115	13.5	150	20	25	10.0	M8 × 1	100	55.4	105000	250000	0.04	3.85
R63-20T5-DEB	63	20	95	135	115	13.5	175	20	25	10.0	M8 × 1	100	55.4	125000	300000	0.04	4.30
R63-20K6-DEBH	63	20	125	165	145	13.5	170	25	25	12.0	M8 × 1	130	50.2	245700	783300	0.04	13.60
R80-10T6-DEB	80	10	105	145	125	13.5	120	20	16	10.0	M8 × 1	110	75.8	93400	269200	0.04	3.20
R80-20T4-DEB	80	20	125	165	145	13.5	160	25	25	12.0	M8 × 1	130	72.4	135000	322000	0.05	8.95
R80-20T5-DEB	80	20	125	165	145	13.5	175	25	25	12.0	M8 × 1	130	72.4	161500	398000	0.05	9.25
R80-20K6-DEBH	78	20	135	175	155	13.5	170	25	25	12.5	M8 × 1	140	68.2	280000	720000	0.05	13.00
R80-20K7-DEBH	78	20	135	175	155	13.5	190	25	25	12.5	M8 × 1	140	68.2	320000	820000	0.05	14.30

9.2.2.2 Flange double nut DDB (DIN 69051 Part 5)

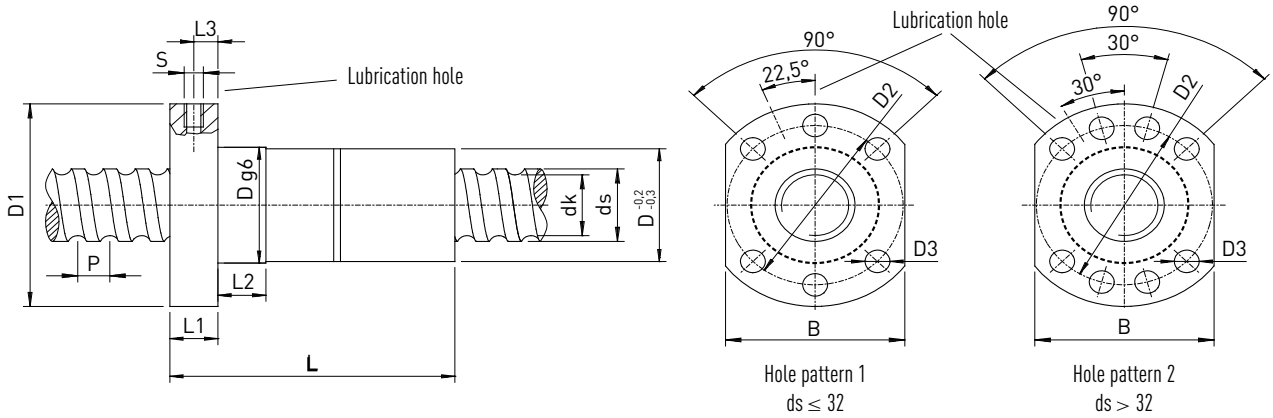


Table 9.5 **Nut dimensions**

Article number	ds h6	P	Dg6	D1	D2	D3	L	L1	L2	L3	S	B	dk	Dynamic load rating C_{dyn} [N]	Static load rating C_0 [N]	Mass [kg/item]
R16-05T3-DDB	16	5	28	48	38	5.5	80	10	10	5	M6	40	13.5	9600	12700	0.36
R20-05T4-DDB	20	5	36	58	47	6.6	82	10	10	5	M6	44	17.5	13900	21800	0.45
R25-05T4-DDB	25	5	40	62	51	6.6	95	10	10	5	M6	48	22.5	15600	27900	0.55
R25-10T3-DDB	25	10	40	62	51	6.6	115	10	16	5	M6	48	21	24100	36200	0.60
R32-05T5-DDB	32	5	50	80	65	9	95	12	10	6	M6	62	29.5	20700	43900	0.97
R32-10T4-DDB	32	10	50	80	65	9	138	14	16	7	M6	62	27.8	40900	63200	1.03
R32-20T2-DDB	32	20	50	80	65	9	138	14	16	7	M6	62	27.8	20300	26800	1.02
R40-05T5-DDB	40	5	63	93	78	9	109	14	10	7	M8 × 1	70	37.5	22500	54600	1.55
R40-10T4-DDB	40	10	63	93	78	9	150	14	16	7	M8 × 1	70	35.8	46800	82600	2.15
R40-20T2-DDB	40	20	63	93	78	9	150	14	16	7	M8 × 1	70	35.8	23800	36400	1.8
R50-05T5-DDB	50	5	75	110	93	11	112	16	10	8	M8 × 1	85	47.5	24900	69800	2.16
R50-10T4-DDB	50	10	75	110	93	11	164	16	16	8	M8 × 1	85	45.8	52800	106800	2.5
R50-20T3-DDB	50	20	75	110	93	11	196	16	16	8	M8 × 1	85	45.8	40000	76200	4.34
R63-10T6-DDB	63	10	90	125	108	11	205	18	16	9	M8 × 1	95	58.8	84700	210800	4.40
R63-20T4-DDB	63	20	95	135	115	13.5	270	20	25	10	M8 × 1	100	55.4	105000	250000	6.95
R80-10T6-DDB	80	10	105	145	125	13.5	205	20	16	10	M8 × 1	110	75.8	93400	269200	4.75
R80-20T4-DDB	80	20	125	165	145	13.5	280	25	25	12	M8 × 1	130	72.4	135000	322000	13.85

Cylindrical single nut ZE

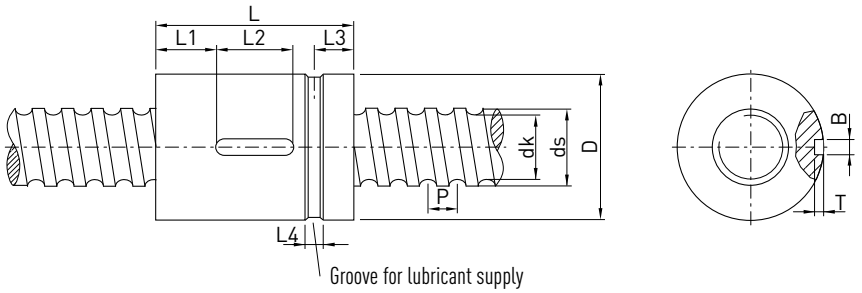


Table 9.6 **Nut dimensions**

Article number	ds h6	P	D g7	L ±0.2	L1	L2	L3	L4	T +0.1	B P9	dk	Dynamic load rating C_{dyn} [N]	Static load rating C_0 [N]	Axial play max. [mm]	Mass [kg/item]
R16-05T3-ZE	16	5	28	40	12	16	9	4	2.4	4	13.5	9600	12700	0.02	0.10
R20-05T4-ZE	20	5	36	51	15	20	10	4	2.4	4	17.5	13900	21800	0.02	0.23
R25-05T4-ZE	25	5	40	60	20	20	12	5	2.4	4	22.5	15600	27900	0.02	0.29
R25-10T3-ZE	25	10	48	65	22	20	15	5	2.4	4	21.0	24100	36200	0.02	0.50
R32-05T5-ZE	32	5	48	60	20	20	12	5	2.4	4	29.5	20700	43900	0.02	0.38
R32-10T4-ZE	32	10	56	80	27	25	15	5	2.4	4	27.8	40900	63200	0.02	0.74
R32-20T2-ZE	32	20	56	80	27	25	15	5	2.4	4	27.8	20300	26800	0.02	0.70
R40-05T5-ZE	40	5	56	68	24	20	15	6	2.4	4	37.5	22500	54600	0.02	0.44
R40-10T4-ZE	40	10	62	88	31	25	15	6	2.4	4	35.8	46800	82600	0.02	0.85
R40-20T2-ZE	40	20	62	88	31	25	15	6	2.4	4	35.8	23800	36400	0.03	0.88
R50-05T5-ZE	50	5	68	69	24	20	15	6	2.4	4	47.5	24900	69800	0.02	0.72
R50-10T4-ZE	50	10	72	100	37	25	17	6	2.4	4	45.8	52800	106800	0.02	1.04
R50-20T3-ZE	50	20	72	114	44	25	17	6	2.4	4	45.8	40000	76200	0.03	1.10
R63-10T6-ZE	63	10	85	120	44	32	17	6	3.5	6	58.8	84700	210800	0.04	1.73
R63-20T4-ZE	63	20	95	135	52	32	17	6	3.5	6	55.4	105000	250000	0.04	3.80
R80-10T6-ZE	80	10	105	120	44	32	17	8	3.5	6	75.8	93400	269200	0.04	2.80
R80-20T4-ZE	80	20	125	150	52	45	17	8	3.5	6	72.4	135000	322000	0.05	7.80
R80-20T6-ZEH	78	20	130	182	68.5	45	19	8	4.0	8	68.2	200000	510000	0.05	11.05

Cylindrical double nut ZD

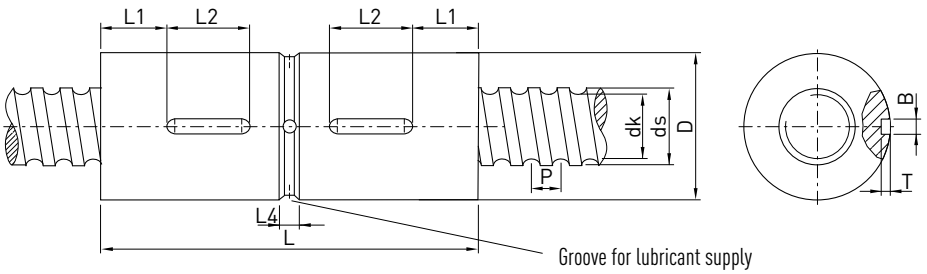


Table 9.7 **Nut dimensions**

Article number	ds h6	P	D g7	L	L1	L2	L4	T +0.1	B P9	dk	Dynamic load rating C_{dyn} [N]	Static load rating C_0 [N]	Mass [kg/item]
R16-05T3-ZD	16	5	28	72	14	16	4	2.4	4	13.5	9600	12700	0.20
R20-05T4-ZD	20	5	36	86	15	20	4	2.4	4	17.5	13900	21800	0.39
R25-05T4-ZD	25	5	40	100	20	20	5	2.4	4	22.5	15600	27900	0.48
R25-10T3-ZD	25	10	48	115	20	20	5	2.4	4	21.0	24100	36200	0.80
R32-05T5-ZD	32	5	48	100	20	20	5	2.4	4	29.5	20700	43900	0.63
R32-10T4-ZD	32	10	56	136	25	25	6	2.4	4	27.8	32000	47500	1.30
R32-20T2-ZD	32	20	56	142	28	25	6	2.4	4	27.8	20300	26800	1.30
R40-05T5-ZD	40	5	56	108	20	20	6	2.4	4	37.5	22500	54600	0.78
R40-10T4-ZD	40	10	62	142	28	25	6	2.4	4	35.8	46500	82600	1.34
R40-20T2-ZD	40	20	62	146	30	25	6	2.4	4	35.8	23800	36400	1.51
R50-05T5-ZD	50	5	68	108	20	20	6	2.4	4	47.5	24900	69800	1.40
R50-10T4-ZD	50	10	72	168	35	25	8	2.4	4	45.8	52800	106800	1.72
R50-20T3-ZD	50	20	72	190	47	25	6	2.4	4	45.8	40000	76200	1.95
R63-10T6-ZD	63	10	85	208	44	32	6	3.5	6	58.8	84700	210800	2.81
R63-20T4-ZD	63	20	95	260	65	32	6	3.5	6	55.4	105000	250000	7.30
R80-10T6-ZD	80	10	105	208	44	32	6	3.5	6	75.8	93400	269200	5.50
R80-20T4-ZD	80	20	125	285	55	32	8	4.1	8	72.4	135000	322000	14.90

Cylindrical single nut with screw-in thread SE

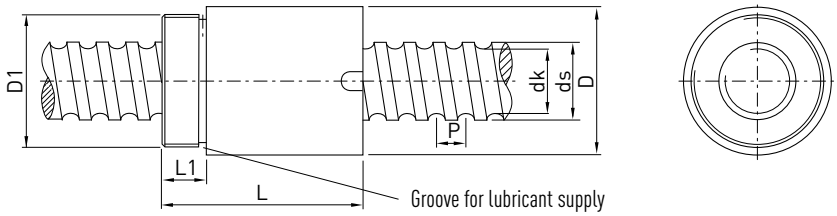


Table 9.8 **Nut dimensions**

Article number	ds h6	P	D -0.2	D1	L -0.5	L1	dk	Dynamic load rating C_{dyn} [N]	Static load rating C_0 [N]	Axial play max. [mm]	Mass [kg/item]
R16-05T3-SE	16	5	36	M30 × 1.5	42	12	13.5	9600	12700	0.02	0.45
R20-05T4-SE	20	5	40	M35 × 1.5	52	12	17.5	13900	21800	0.02	0.53
R25-05T4-SE	25	5	45	M40 × 1.5	60	15	22.5	15600	27900	0.02	0.82
R25-10T3-SE	25	10	48	M45 × 1.5	70	15	21.0	24100	36200	0.02	1.00
R32-05T5-SE	32	5	52	M48 × 1.5	60	15	29.5	20700	43900	0.02	1.13
R32-10T3-SE	32	10	56	M52 × 1.5	80	15	27.8	34100	56100	0.02	1.62
R32-20T2-SE	32	20	56	M52 × 1.5	80	15	27.8	20300	26800	0.02	1.44
R40-05T5-SE	40	5	65	M60 × 1.5	68	18	37.5	22500	54600	0.02	1.63
R40-10T4-SE	40	10	65	M60 × 1.5	88	18	35.8	46800	82600	0.02	1.75
R40-20T2-SE	40	20	65	M60 × 1.5	88	18	35.8	23800	36400	0.03	1.75
R50-10T4-SE	50	10	80	M75 × 1.5	100	20	45.8	52800	106800	0.02	2.96
R50-20T3-SE	50	20	80	M75 × 1.5	114	20	45.8	40000	76200	0.03	3.15
R63-10T6-SE	63	10	95	M85 × 2.0	120	20	58.8	84700	210800	0.04	4.37
R63-20T3-SE	63	20	95	M85 × 2.0	138	20	55.4	96000	189000	0.04	4.40

Safety nut SEM

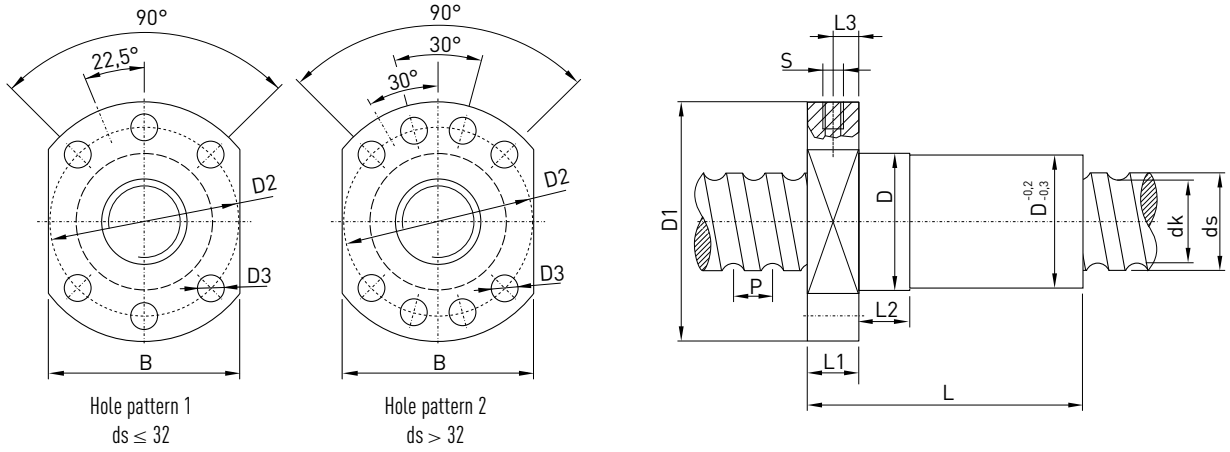


Table 9.9 **Safety nut dimensions**

Article number	ds h6	P	D g7	D1	D2	D3	Hole pattern	L	L1	L2	L3	S	L4	dk	Dynamic load rating C_{dyn} [N]	Static load rating C_0 [N]
R32-10T4-SEM	32	10	56	86	70	9.0	1	130	15	16	7.5	M6	66	27.8	40900	63200
R40-10T4-SEM	40	10	63	93	78	9.0	2	130	15	16	7.5	M8 × 1	70	35.8	46800	82500
R40-20T2-SEM	40	20	63	93	78	9.0	2	140	15	16	7.5	M8 × 1	70	35.8	23800	36400
R50-10T5-SEM	50	10	75	110	93	11.0	2	145	16	16	8.0	M8 × 1	85	45.8	63900	133300
R63-20T4-SEM	63	20	95	135	115	13.5	2	205	20	25	10.0	M8 × 1	100	55.4	105000	250000
R80-20T5-SEM	80	20	125	165	145	13.5	2	230	25	25	12.5	M8 × 1	130	72.4	161500	398000

Simply using a safety nut does not provide sufficient protection against a load being lowered unintentionally. The safety guidelines valid for the application must be observed. The safety nut it is not a safety component according to the Machinery Directive.

9.2.3 Nut unit which can be driven AME

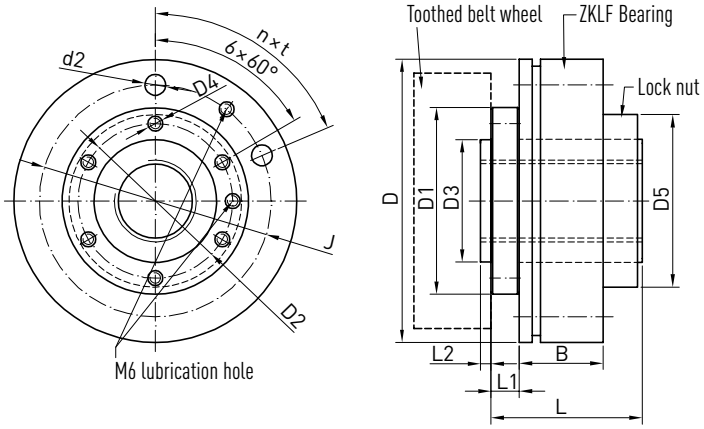


Table 9.10 **Nut dimensions**

Article no.	Shaft dimensions			Nut dimensions								Bearing dimensions					Dynamic load rating C_{dyn} [N]	Static load rating C_0 [N]	n max. [rpm]
	ds h6	P	dk	D1	D2	D3 h8	D4	D5	L	L1	L2	D -0.01	J	n × t	d2	B			
R16-05T3-AME	16	5	13.5	50	40	30	M6	47	50	10	3	80	63	6 × (60°)	6.5	28	9600	12700	4000
R20-05T4-AME	20	5	17.5	63	52	40	M6	60	60	12	5	100	80	4 × (90°)	8.5	34	13900	21800	3300
R25-05T4-AME	25	5	22.5	76	60	50	M6	72	63	15	5	115	94	6 × (60°)	8.5	34	15600	27900	3000
R25-10T3-AME	25	10	21	76	60	50	M6	72	74	15	5	115	94	6 × (60°)	8.5	34	24100	36200	3000
R32-05T5-AME	32	5	29.5	76	62	50	M8	72	70	15	5	115	94	6 × (60°)	8.5	34	20700	43900	3000
R32-10T4-AME	32	10	27.8	76	62	50	M8	72	105	15	5	115	94	6 × (60°)	8.5	34	40900	63200	3000
R32-20T2-AME	32	20	27.8	76	62	50	M8	72	100	15	5	115	94	6 × (60°)	8.5	34	20300	26800	3000
R40-05T5-AME	40	5	37.5	90	70	60	M8	82	76	15	5	145	120	8 × (45°)	8.5	45	22500	54600	2400
R40-10T3-AME	40	10	35.8	90	70	60	M8	82	85	15	5	145	120	8 × (45°)	8.5	45	37100	61900	2400
R40-20T2-AME	40	20	35.8	90	70	60	M8	82	105	15	5	145	120	8 × (45°)	8.5	45	23800	36400	2400
R50-05T5-AME	50	5	47.5	100	84	70	M10	94	78	15	5	155	130	8 × (45°)	8.5	45	24900	69800	2200
R50-10T4-AME	50	10	45.8	100	84	70	M10	94	95	15	5	155	130	8 × (45°)	8.5	45	52800	106800	2200
R50-20T3-AME	50	20	45.8	100	84	70	M10	94	120	15	5	155	130	8 × (45°)	8.5	45	40000	76200	2200
R63-10T6-AME	63	10	58.8	130	110	90	M10	122	120	20	7	190	165	8 × (45°)	10.5	55	84700	210800	1800

9.2.4 Ballscrew for heavy-duty operation

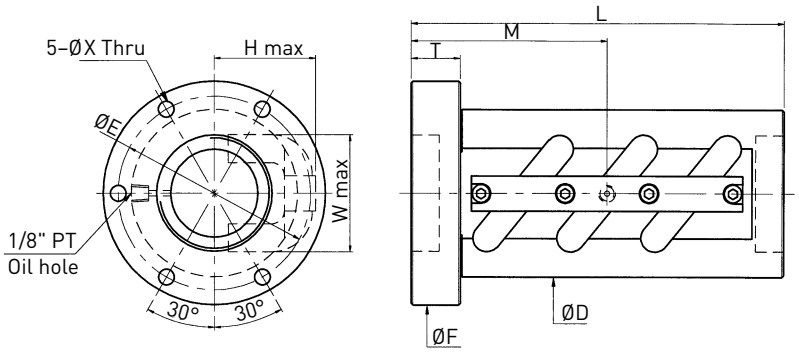


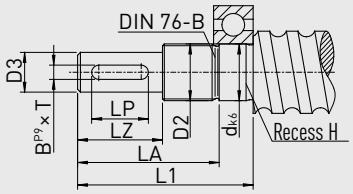
Table 9.11 **Nut dimensions**

Model	Nominal diameter	Lead	Circuits	Dynamic load rating C_{dyn} [kN]	Static load rating C_0 [kN]	D	L	F	T	E	X	H	W
R45-10B3-FSV	45	10	2.5 × 3	145	488	70	143	104	18	87	9	47	52
R50-12B3-FSV	50	12	2.5 × 3	175	602	77	171	111	22	94	9	52	59
R50-16B3-FSV	50	16	2.5 × 3	330	971	95	223	129	28	112	9	68	66
R55-16B3-FSV	55		2.5 × 3	343	1054	99	223	133	28	116	9	70	70
R63-16B3-FSV	63		2.5 × 3	368	1217	105	223	139	28	122	9	72.5	76
R80-16B3-FSV	80		2.5 × 3	409	1543	120	227	154	32	137	9	80	92
R80-25B3-FSV		25	2.5 × 3	714	2366	145	338	185	40	165	11	102	100
R100-16B3-FSV	100	16	2.5 × 3	453	1949	145	227	185	32	165	11	91	109
R100-25B3-FSV		25	2.5 × 3	788	2920	159	338	199	40	179	11	108.5	118
R120-25B3-FSV	120	25	2.5 × 3	850	3473	173	338	213	40	193	11	116	135

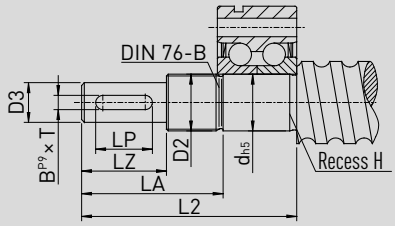
9.2.5 Shaft ends and accessories

9.2.5.1 Shaft ends and bearing configuration

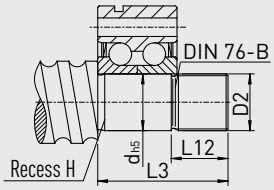
Table 9.12 **Overview of standard shaft ends for SFA, SLA bearing series**



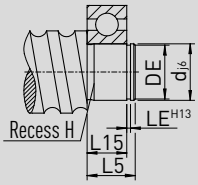
Type S1
Bearing: Deep groove ball bearing 60.. or 62.. For SLA bearing unit



Type S2
Bearing: ZKLF.. or ZKLN.. For SFA bearing unit



Type S3
Bearing: ZKLF.. or ZKLN.. For SFA bearing unit



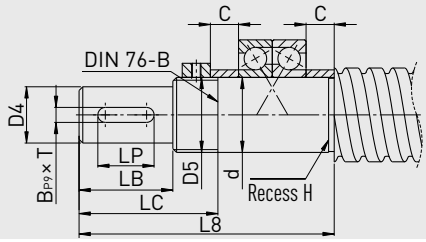
Type S5
Bearing: Deep groove ball bearing 62.. For SLA bearing unit

Table 9.13 **Dimensions of standard shaft ends for SFA, SLA bearing series**

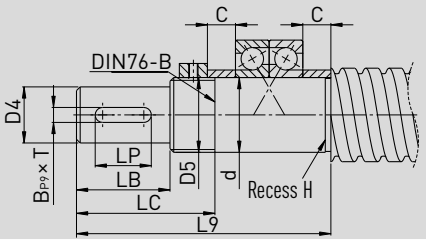
Shaft end type	BS nominal Ø	d	D2	D3	L1	L2	L3	L5	L12	L15	DE	LE	LA	LP	LZ	B^{P9} × T	Recess H
S_-06	12	6	M6 × 0.5	5 j6	31	37	–	8	–	6	5.7 h10	0.8	26	–	16	–	10002475
S_-10	15, 16	10	M10 × 0.75	8 j6	39	50	30	12	12	9	9.6 h10	1.1	32	14	20	2 × 1.2	10002475
S_-12	20	12	M12 × 1	10 j6	43	58	35	13	12	10	11.5 h11	1.1	35	16	23	3 × 1.8	10002475
S_-17	25	17	M17 × 1	14 j6	60	73	43	15	20	12	16.2 h11	1.1	50	20	30	5 × 3	10002475
S_-20	25*, 32	20	M20 × 1	14 j6	62	76	46	17	20	14	19 h12	1.3	50	20	30	5 × 3	DIN509-E0.6 × 0.3
S_-25	32**, 40	25	M25 × 1.5	20 j6	83	96	46	19	20	15	23.9 h12	1.3	71	36	50	6 × 3.5	DIN509-E0.6 × 0.3
S_-30	40	30	M30 × 1.5	25 j6	95	108	48	20	22	16	28.6 h12	1.6	82	45	60	8 × 4	10002476
S_-40	50	40	M40 × 1.5	32 k6	119	135	55	22	24	18	37.5 h12	1.85	104	56	80	10 × 5	DIN509-E0.6 × 0.3
S_-50	63	50	M50 × 1.5	40 k6	142	155	55	25	24	20	47 h12	2.15	124	70	100	12 × 5	10002476
S_-60	80	60	M60 × 2	50 k6	155	177	67	28	25	22	57 h12	2.15	135	70	110	14 × 5.5	10002476

Unit: mm
* depending on actual shaft outer diameter $d_{s\,min}$ = 24.5
** depending on actual shaft outer diameter $d_{s\,min}$ = 31.5

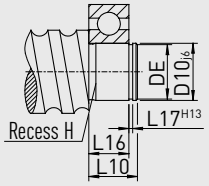
Table 9.14 **Overview of standard shaft ends for EK, BK, FK, EF, BF, FF bearing series**



Type E8
Bearing: 70.. For EK, FK bearing units



Type E9
Bearing: 72.. For BK bearing unit



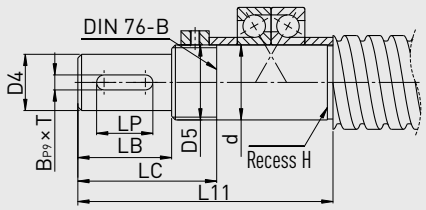
Type E10
Bearing: Deep groove ball bearing 60.. or 62.. For EF, BF, FF bearing unit

Table 9.15 **Dimensions of standard shaft ends for EK, BK, FK, EF, BF, FF bearing series**

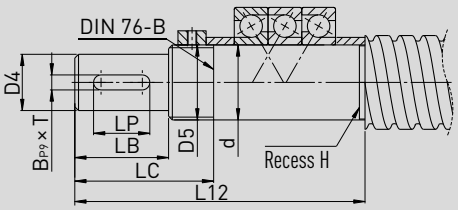
Shaft end type	BS nominal Ø	d h6	D4 j6	D5	D10 j6	L8	L9	L10	L16	L17	DE$^{0}_{-0.2}$	LB	LC	LP	B^{p9} × T	C	Recess H
E_-08	12	8	6	M8 × 1	6	41	–	9	6	0.8	5.8	9	19	–	–	5.5	DIN509-E0.6 × 0.2
E_-10	15, 16	10	8	M10 × 1	8	56	–	10	7	0.9	7.7	20	31	14	2 × 1.2	5.5	DIN509-E0.6 × 0.2
E_10-12 **E_08-12**	16*	12	10	M12 × 1	10	59	–	11	8	1.15	9.6	23	34	16	3 × 1.8	5.5	10002475 DIN509-E0.6 × 0.2
E_-15	20	15	12	M15 × 1	15	70	–	13	9	1.15	14.3	23	36	16	4 × 2.5	10	DIN509-E0.6 × 0.2
E_-20	25	20	17	M20 × 1	20	92	–	19	14	1.35	19.0	30	47	20	5 × 3.0	11	DIN509-E0.6 × 0.3
E_-25	32	25	20	M25 × 1.5	25	126	115	20	15	1.35	23.9	50	70 (68)[2)]	36	6 × 3.5	15 (9)[2)]	DIN509-E0.8 × 0.3
E_-30	40	30	25	M30 × 1.5	30	132	132	21	16	1.75	28.6	60	85	45	8 × 4.0	9	10002476
E_-40	50	40	35[1)]	M40 × 1.5	40	–	173	23	18	1.95	38.0	80	115	56	10 × 5	15	DIN509-E0.8 × 0.3

Unit: mm
* depending on actual shaft outer diameter $d_{s\,min}$ = 15.5
[1)] Tolerance k6
[2)] for BK 25
It goes without saying that we also machine the shaft ends to your drawings and individual requirements.

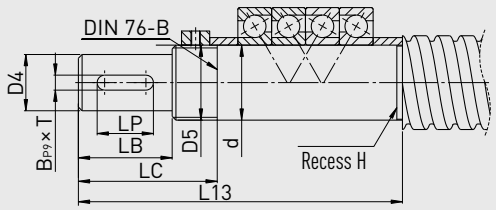
Table 9.16 **Overview of standard shaft ends for WBK bearing series**



Type W1
Bearing: BSB.. For WBK_DF bearing unit



Type W2
Bearing: BSB.. For WBK_DFD bearing unit



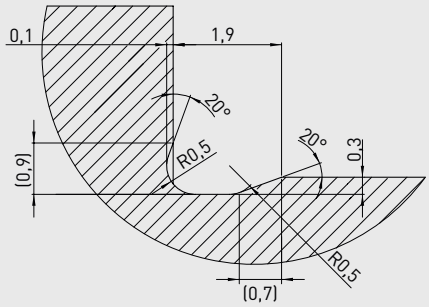
Type W3
Bearing: BSB.. For WBK_DFF bearing unit

Table 9.17 **Dimensions of standard shaft ends for WBK bearing series**

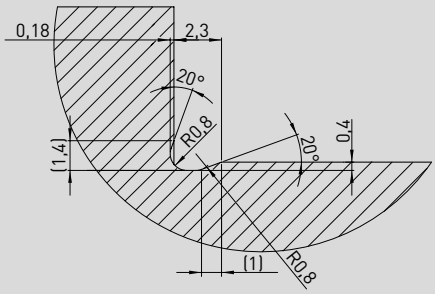
Shaft end type	BS nominal Ø	d h6	D4 j6	D5	L11	L12	L13	LB	LC	LP	B × T	Recess H
W_-15	20	15	12	M15 × 1	104	–	–	23	46	16	4 × 2.5	DIN509-E0.6 × 0.2
W_-17	25	17	14	M17 × 1	111	–	–	30	53	20	5 × 3.0	10002475
W_-20*	25	20	17	M20 × 1	111	–	–	30	53	20	5 × 3.0	DIN509-E0.6 × 0.3
W_-25**	32	25	20	M25 × 1.5	139	154	–	50	76	36	6 × 3.5	DIN509-E0.8 × 0.3
W_-30	40	30	25	M30 × 1.5	149	164	–	60	86	45	8 × 4.0	10002476
W_-35	45	35	30	M35 × 1.5	152	167	182	60	90	45	8 × 4.0	DIN509-E0.8 × 0.3
W_-40	50	40	35 [1)]	M40 × 1.5	172	187	202	80	110	56	10 × 5.0	DIN509-E0.8 × 0.3

Unit: mm
[1)] Tolerance k6
It goes without saying that we also machine the shaft ends to your drawings and individual requirements.
* depending on actual shaft outer diameter $d_{s\,min}$ = 24.5
** depending on actual shaft outer diameter $d_{s\,min}$ = 31.5

9.2.5.2 HIWIN recesses



HIWIN recess 10002475



HIWIN recess 10002476

9.2.5.3 Bearing types and associated end machining

Table 9.18 **Overview of bearing type and associated end machining for SLA, SFA bearing units**

BS nominal diameter	Fixed bearing		Supported bearing	
	Pillow block	**End machining**	**Pillow block**	**End machining**
12	SFA06	S2-06 / S3-06	SLA06	S1-06 / S5-06
15, 16	SFA10	S2-10 / S3-10	SLA10	S1-10 / S5-10
20	SFA12	S2-12 / S3-12	SLA12	S1-12 / S5-12
25	SFA17	S2-17 / S3-17	SLA17	S1-17 / S5-17
32	SFA20	S2-20 / S3-20	SLA20	S1-20 / S5-20
40	SFA30	S2-30 / S3-30	SLA30	S1-30 / S5-30
50	SFA40	S2-40 / S3-40	SLA40	S1-40 / S5-40

Table 9.19 **Overview of bearing type and associated end machining for EK, BK, FK, EF, BF, FF bearing units**

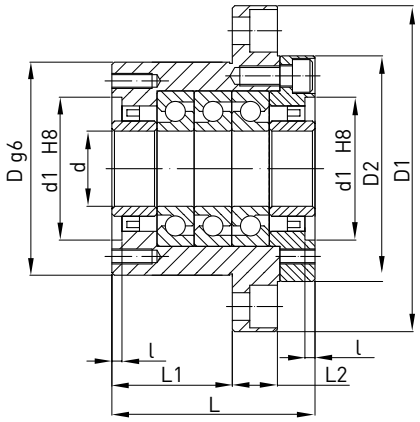
BS nominal diameter	Fixed bearing				Supported bearing			
	Pillow block	**End machining**	**Flange bearing**	**End machining**	**Pillow block**	**End machining**	**Flange bearing**	**End machining**
12	EK08	E8-08	FK08	E8-08	EF08	E10-08	–	–
15, 16	EK10	E8-10	FK10	E8-10	EF10	E10-10	FF10	E10-10
16*	EK12	E8-12	FK12	E8-12	EF12	E10-12	FF12	E10-12
20	EK15	E8-15	FK15	E8-15	EF15	E10-15	FF15	E10-15
25	EK20	E8-20	FK20	E8-20	EF20	E10-20	FF20	E10-20
32	BK25	E9-25	FK25	E8-25	BF25	E10-25	FF25	E10-25
40	BK30	E9-30	FK30	E8-30	BF30	E10-30	FF30	E10-30
50	BK40	E9-40	–	–	BF40	E10-40	–	–

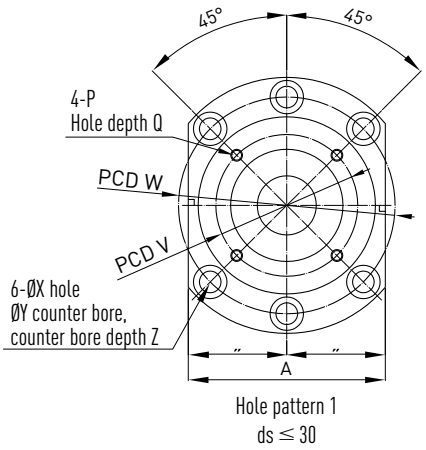
* depending on actual shaft outer diameter $d_{s\ min}$ = 15.5

Table 9.20 **Overview of bearing type and associated end machining for WBK bearing unit**

BS nominal diameter	Flange bearing	end machining
20	WBK 15 DF	W1-15
25	WBK 17 DF	W1-17
25	WBK 20 DF	W1-20
32	WBK 25 DF	W1-25
32	WBK 25 DFD	W2-25
40	WBK 30 DF	W1-30
40	WBK 30 DFD	W2-30
45	WBK 35 DF	W1-35
45	WBK 35 DFD	W2-35
45	WBK 35 DFF	W3-35
50	WBK 40 DF	W1-40
50	WBK 40 DFD	W2-40
50	WBK 40 DFF	W3-40

9.2.5.4 WBK bearing series





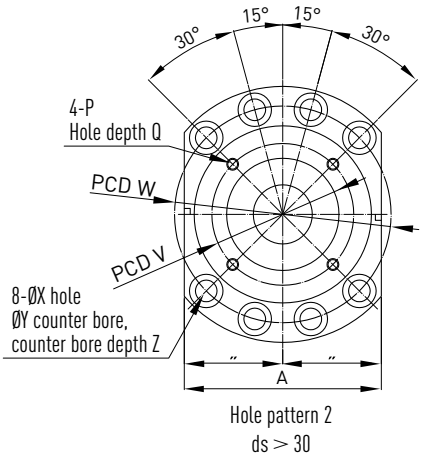
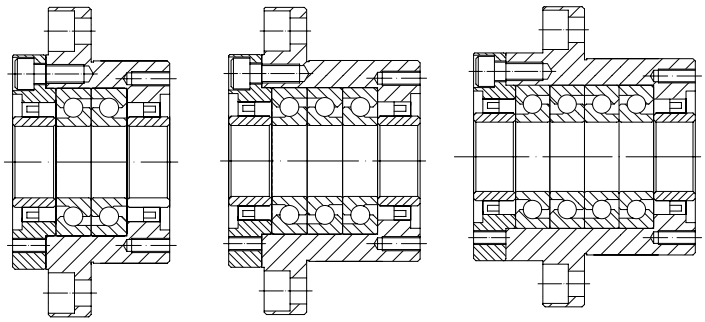


Table 9.21 **Bearing unit dimensions**

Article no.	Shaft nominal Ø	d	D	D1	D2	L	L1	L2	A	W	X	Y	Z	d1	l	V	P	Q
WBK 15 DF	20	15	70	106	72	60	32	15	80	88	9	14	8,5	45	3	58	M5	10
WBK 17 DF	25	17	70	106	72	60	32	15	80	88	9	14	8,5	45	3	58	M5	10
WBK 20 DF	25	20	70	106	72	60	32	15	80	88	9	14	8,5	45	3	58	M5	10
WBK 25 DF	32	25	85	130	90	66	33	18	100	110	11	17,5	11	57	4	70	M6	12
WBK 25 DFD	32	25	85	130	90	81	48	18	100	110	11	17,5	11	57	4	70	M6	12
WBK 30 DF	40	30	85	130	90	66	33	18	100	110	11	17,5	11	57	4	70	M6	12
WBK 30 DFD	40	30	85	130	90	81	48	18	100	110	11	17,5	11	57	4	70	M6	12
WBK 35 DF	45	35	95	142	102	66	33	18	106	121	11	17,5	11	69	4	80	M6	12
WBK 35 DFD	45	35	95	142	102	81	48	18	106	121	11	17,5	11	69	4	80	M6	12
WBK 35 DFF	45	35	95	142	102	96	48	18	106	121	11	17,5	11	69	4	80	M6	12
WBK 40 DF	50	40	95	142	102	66	33	18	106	121	11	17,5	11	69	4	80	M6	12
WBK 40 DFD	50	40	95	142	102	81	48	18	106	121	11	17,5	11	69	4	80	M6	12
WBK 40 DFF	50	40	95	142	102	96	48	18	106	121	11	17,5	11	69	4	80	M6	12

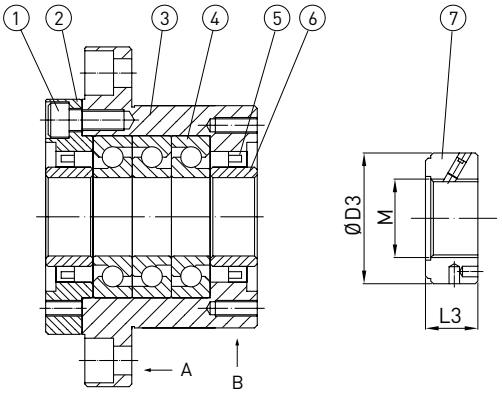
Unit: mm

Bearing arrangements



DF Type DFD Type DFF Type

Bearing structure



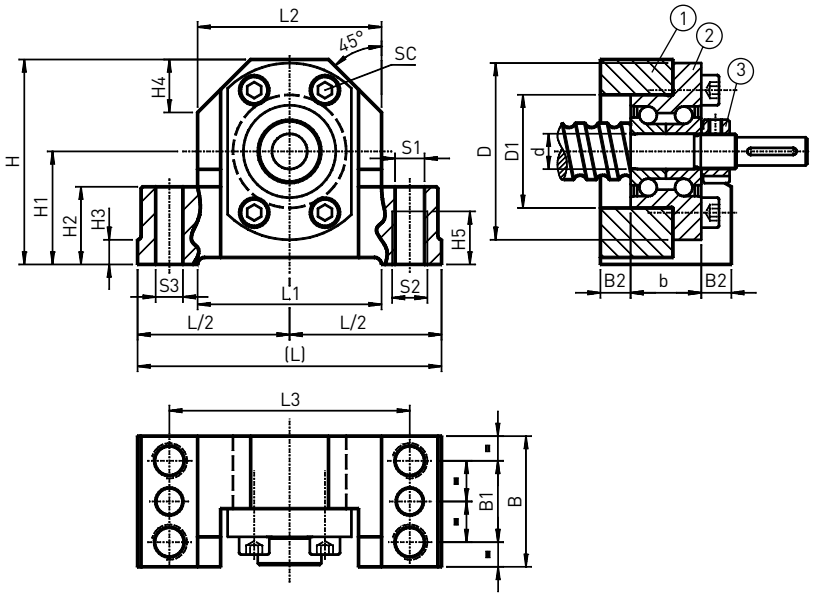
(1) Mounting bolt, (2) Bearing cover, (3) Bearing housing, (4) Bearing, (5) Seal, (6) Spacer, (7) Lock nut

Table 9.22 **Technical data of the bearing**

Article no.	Dynamic load rating [kN]	Permissible axial load [kN]	Preload [kN]	Axial rigidity [N/µm]	Starting torque [Nm]	Lock nut				Weight [kg]
						M	**D3**	**L3**	**Nut tightening torque [Nm]**	
WBK 15 DF	21.9	26.6	2.15	750	0.19	M15 × 1	30	14	52	1.9
WBK 17 DF	21.9	26.6	2.15	750	0.19	M17 × 1	32	16	74	1.9
WBK 20 DF	21.9	26.6	2.15	750	0.19	M20 × 1	38	16	118	1.9
WBK 25 DF	28.5	40.5	3.15	1000	0.29	M25 × 1.5	38	18	188	3.1
WBK 25 DFD	46.5	81.5	4.3	1470	0.39	M25 × 1.5	38	18	188	3.4
WBK 30 DF	29.2	43.0	3.35	1030	0.30	M30 × 1.5	45	18	260	3.0
WBK 30 DFD	47.5	86.0	4.5	1520	0.40	M30 × 1.5	45	18	260	3.3
WBK 35 DF	31.0	50.0	3.8	1180	0.34	M35 × 1.5	52	18	340	3.4
WBK 35 DFD	50.5	100.0	5.2	1710	0.45	M35 × 1.5	52	18	340	4.3
WBK 35 DFF	50.5	100.0	7.65	2350	0.59	M35 × 1.5	52	18	340	5.0
WBK 40 DF	31.5	52.0	3.9	1230	0.36	M40 × 1.5	58	20	500	3.6
WBK 40 DFD	51.5	104.0	5.3	1810	0.47	M40 × 1.5	58	20	500	4.2
WBK 40 DFF	51.5	104.0	7.85	2400	0.61	M40 × 1.5	58	20	500	4.7

9.2.5.5 SFA fixed bearing

SFA06, SFA10



(1) Steel pillow block housing, (2) Bearing, (3) Lock nut

Table 9.23 **Bearing unit dimensions**

Article no.	Shaft nominal Ø	L	L/2 js9	L1	L2	L3	H	H1 js9	H2	H3	H4	H5	d	D	D1	b
SFA06	**12**	62	31	34	38	50	41	22	13	5	11	9	6	30	19	12
SFA10	**16**	86	43	52	52	68	58	32	22	7	15	15	10	50	32	20

Unit: mm

Table 9.24 **Bearing unit dimensions**

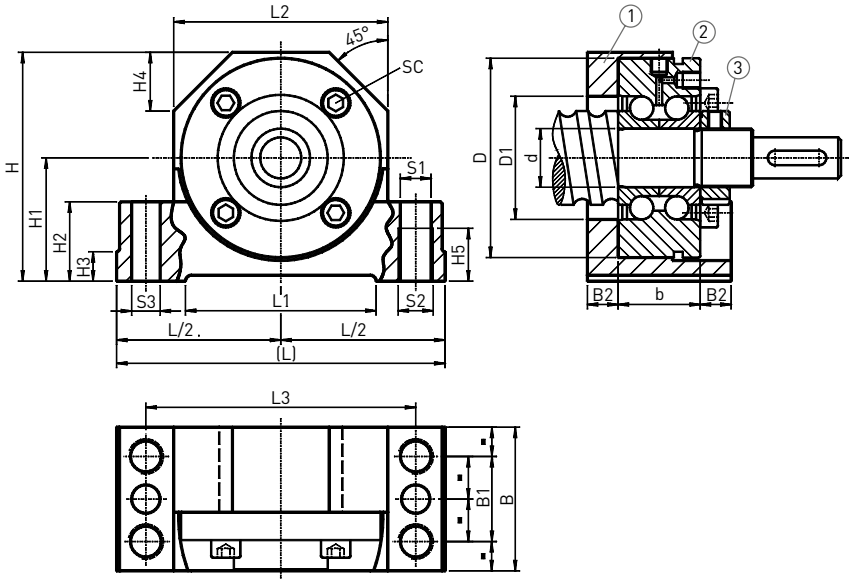
Article no.	Shaft nominal Ø	B	B1	B2	S1 H12	S2	S3	SC ISO 4762-10.9
SFA06	**12**	32	16	10.0	5.3	M6	3.7	4 × M3 × 12
SFA10	**16**	37	23	8.5	8.4	M10	7.7	4 × M5 × 20

Unit: mm

Table 9.25 **Technical data of the bearing**

Article no.	Bearing type	C_0 axial [N]	C_{dyn} axial [N]	Max. speed [n/min]	Lock nut			
					Type	Nut tightening torque [Nm]	Screw size	Screw tightening torque [Nm]
SFA06	ZKLFA0630.2Z	6100	4900	14000	HIR 06	2	M4	1
SFA10	ZKLFA1050.2RS	8500	6900	6800	HIR 10	6	M4	1

SFA-12 – SFA-40



(1) Steel pillow block housing, (2) bearing, (3) lock nut

Table 9.26 **Bearing unit dimensions**

Article no.	Shaft nominal Ø	L	L/2 js9	L1	L2	L3	H	H1 js9	H2	H3	H4	H5	d	D	D1	b
SFA12	**20**	94	47	52	60	77	64	34	22	7	17	15	12	55	32	25
SFA17	**25**	108	54	65	66	88	72	39	27	10	19	18	17	62	36	25
SFA20	**32**	112	56	65	73	92	78	42	27	10	20	18	20	68	42	28
SFA30	**40**	126	63	82	84	105	92	50	32	13	23	21	30	80	52	28
SFA40	**50**	146	73	82	104	125	112	60	32	13	30	21	40	100	66	34

Unit: mm

Table 9.27 **Bearing unit dimensions**

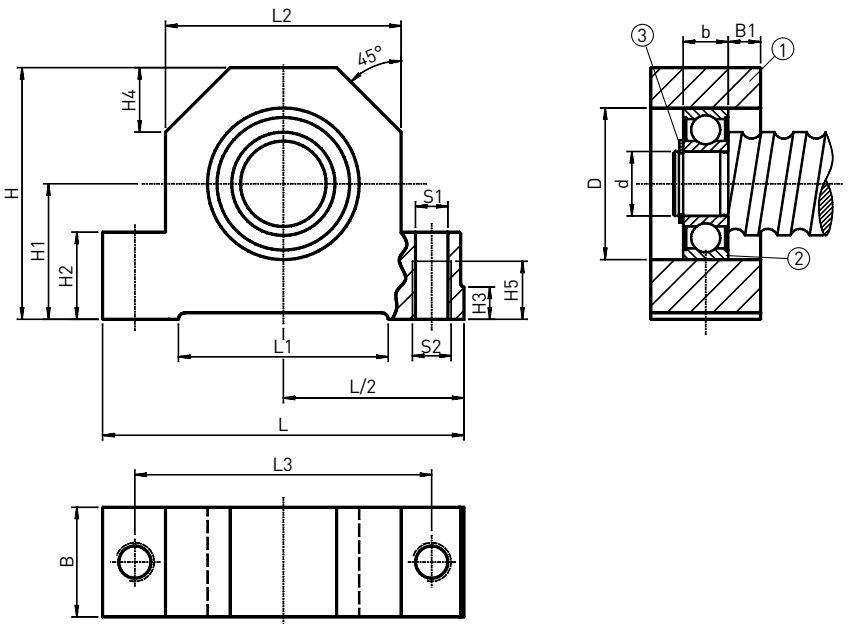
Article no.	Shaft nominal Ø	B	B1	B2	S1 H12	S2	S3	SC ISO 4762-10.9
SFA12	**20**	42	25	8.5	8.4	M10	7.7	3 × M6 × 35
SFA17	**25**	46	29	10.5	10.5	M12	9.7	3 × M6 × 35
SFA20	**32**	49	29	10.5	10.5	M12	9.7	4 × M6 × 40
SFA30	**40**	53	32	12.5	12.6	M14	9.7	6 × M6 × 40
SFA40	**50**	59	34	12.5	12.6	M14	9.7	4 × M8 × 50

Unit: mm

Table 9.28 **Technical data of the bearing**

Article no.	Bearing type	C_0 axial [N]	C_{dyn} axial [N]	Max. speed [n/min]	Lock nut			
					Type	**Nut tightening torque [Nm]**	**Screw size**	**Screw tightening torque [Nm]**
SFA12	ZKLF1255.2RS	24700	17000	3800	HIR 12	8	M4	1
SFA17	ZKLF1762.2RS	31000	18800	3300	HIR 17	15	M5	3
SFA20	ZKLF2068.2RS	47000	26000	3000	HIR 20 × 1	18	M5	3
SFA30	ZKLF3080.2RS	64000	29000	2200	HIR 30	32	M6	5
SFA40	ZKLF40100.2RS	101000	43000	1800	HIR 40	55	M6	5

9.2.5.6 SLA bearing series



(1) Steel pillow block housing, (2) bearing, (3) lock nut

Table 9.29 **Bearing unit dimensions**

Article no.	Shaft nominal Ø	L	L/2 js9	L1	L2	L3	H	H1 js9	H2	H3	H4	H5	b
SLA06	**12**	62	31	34	38	50	41	22	13	5	11	9	6
SLA10	**16**	86	86	52	52	68	58	32	22	7	15	15	9
SLA12	**20**	94	47	52	60	77	64	34	22	7	17	15	10
SLA17	**25**	108	54	65	66	88	72	39	27	10	19	18	12
SLA20	**32**	112	56	65	73	92	78	42	27	10	20	18	14
SLA30	**40**	126	63	82	84	105	92	50	32	13	23	21	16
SLA40	**50**	146	73	82	104	125	112	60	32	13	30	21	18

Unit: mm

Table 9.30 **Bearing unit dimensions**

Article no.	Shaft nominal Ø	B	B1	S1 H12	S2	d	D H6	Circlip DIN 471	Deep groove ball bearing DIN 625
SLA06	**12**	15	4,5	5,3	M6	6	19	6 × 0,7	626.2RS
SLA10	**16**	24	7,5	8,4	M10	10	30	10 × 1	6200.2RS
SLA12	**20**	26	8	8,4	M10	12	32	12 × 1	6201.2RS
SLA17	**25**	28	8	10,5	M12	17	40	17 × 1	6203.2RS
SLA20	**32**	34	10	10,5	M12	20	47	20 × 1,2	6204.2RS
SLA30	**40**	38	11	12,6	M14	30	62	30 × 1,5	6206.2RS
SLA40	**50**	44	13	12,6	M14	40	80	40 × 1,75	6208.2RS

Unit: mm

9.2.5.7 Housing for flange nuts (DIN 69051 Part 5)

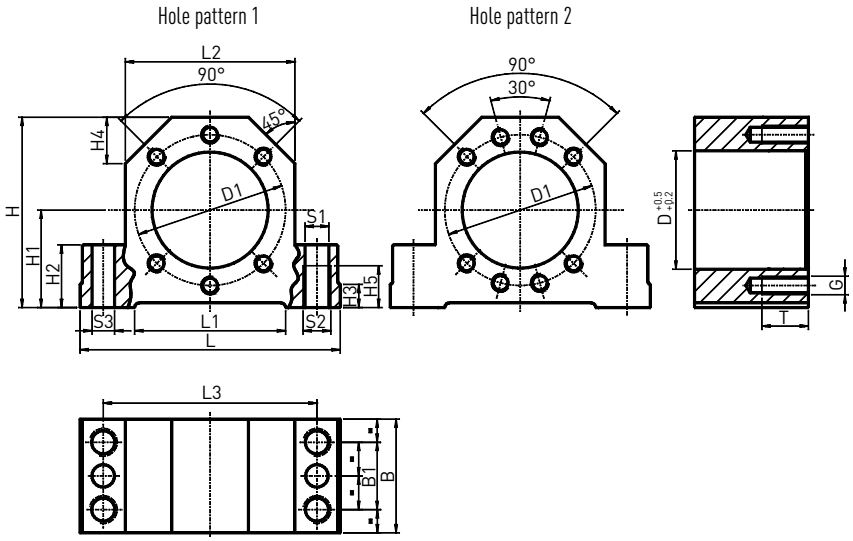


Table 9.31 **Housing dimensions**

Article no.	Shaft nominal Ø	L	L1	L2	L3	H	H1 js9	H2	H3	H4	H5
GFD16	**16**	86	52	52	68	58	32	22	7	15	15
GFD20	**20**	94	52	60	77	64	34	22	7	17	15
GFD-5	**25**	108	65	66	88	72	39	27	10	19	18
GFD32	**32**	112	65	72	92	82	42	27	10	19	18
GFD40	**40**	126	82	84	105	97	50	32	13	23	21
GFD50	**50**	146	82	104	125	115	60	32	13	30	21

Unit: mm

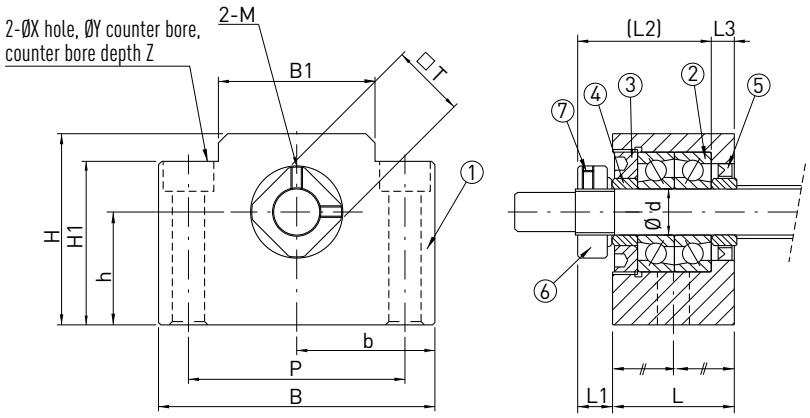
Table 9.32 **Housing dimensions**

Article no.	Shaft nominal Ø	D	D1	B	B1	S1 H12	S2	S3	Hole pattern	G	T
GFD16	**16**	28	38	37	23	8.4	M10	7.7	1	M5	12
GFD20	**20**	36	47	42	25	8.4	M10	7.7	1	M6	15
GFD25	**25**	40	51	46	29	10.5	M12	9.7	1	M6	15
GFD32	**32**	50	65	49	29	10.5	M12	9.7	1	M8	20
GFD40	**40**	63	78	53	32	12.6	M14	9.7	2	M8	20
GFD50	**50**	75	93	59	34	12.6	M14	9.7	2	M10	25

Unit: mm

9.2.5.8 EK fixed bearing

EK08



(1) Housing, (2) bearing, (3) retaining cover, (4) support ring, (5) seal, (6) clamping nut, (7) Allen set screw

Table 9.33 **Bearing unit dimensions**

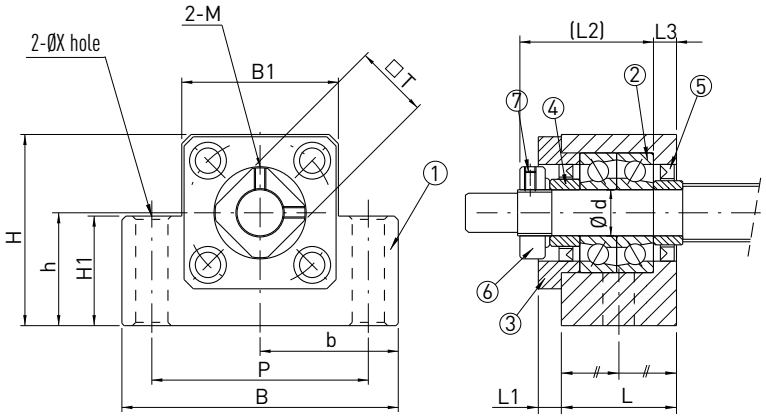
Article no.	Shaft nominal Ø	d	L	L1	L2	L3	B	H	b ± 0.02	h ± 0.02	B1	H1	P	X	Y	Z	M	T
EK08	**12**	8	23	7	26	4	52	32	26	17	25	26	38	6,6	11	12	M3	14

Unit: mm

Table 9.34 **Technical data of the bearing**

Article no.	Bearing type	C_0 axial [N]	C_{dyn} axial [N]	Max. permissible axial load [N]	Max. speed [n/min]	Lock nut			
						Type	**Nut tightening torque [Nm]**	**Screw size**	**Screw tightening torque [Nm]**
EK08	708	4800	2800	1100	40000	RN8	2.5	M3	0.6

EK10 – EK20



(1) Housing, (2) bearing, (3) retaining cover, (4) support ring, (5) seal, (6) clamping nut, (7) Allen set screw

Table 9.35 **Bearing unit dimensions**

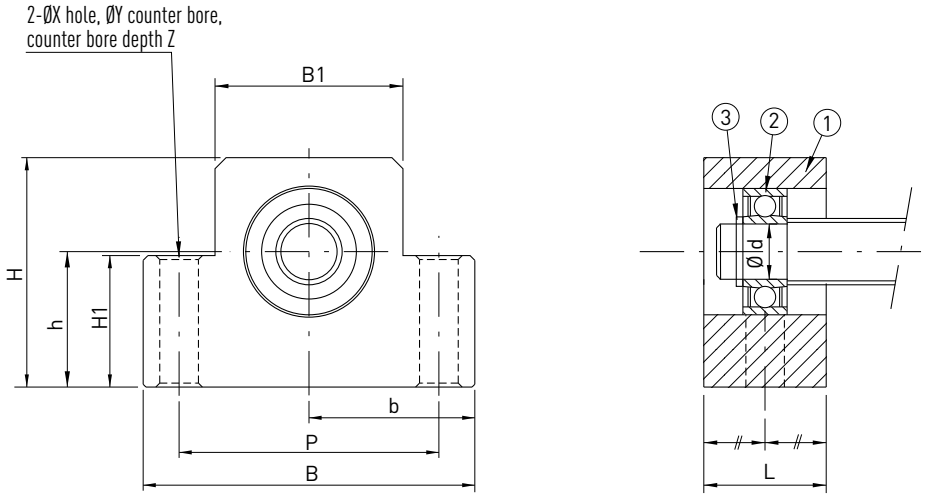
Article no.	Shaft nominal Ø	d	L	L1	L2	L3	B	H	b ± 0.02	h ± 0.02	B1	H1	P	X	Y	Z	M	T
EK10	**16**	10	24	6	29.5	6	70	43	35	25	36	24	52	9	–	–	M3	16
EK12	**16***	12	24	6	29.5	6	70	43	35	25	36	24	52	9	–	–	M4	19
EK15	**20**	15	25	6	36	5	80	49	40	30	41	25	60	11	–	–	M4	22
EK20	**25**	20	42	10	50	10	95	58	47,5	30	56	25	75	11	–	–	M4	30

Unit: mm
* depending on actual shaft outer diameter $d_{s\,min}$ = 15.5

Table 9.36 **Technical data of the bearing**

Article no.	Bearing type	C_0 axial [N]	C_{dyn} axial [N]	Max. permissible axial load [N]	Max. speed [n/min]	Lock nut			
						Type	**Nut tightening torque [Nm]**	**Screw size**	**Screw tightening torque [Nm]**
EK10	7000A P0	8800	5200	2000	24000	RN10	2.9	M3	0.6
EK12	7001A P0	9400	6000	2200	22000	RN12	6.4	M4	1.5
EK15	7002A P0	10000	6900	2400	19000	RN15	7.9	M4	1.5
EK20	7204B P0	21600	15200	6800	9500	RN20	16.7	M4	1.5

9.2.5.9 EF supported bearing



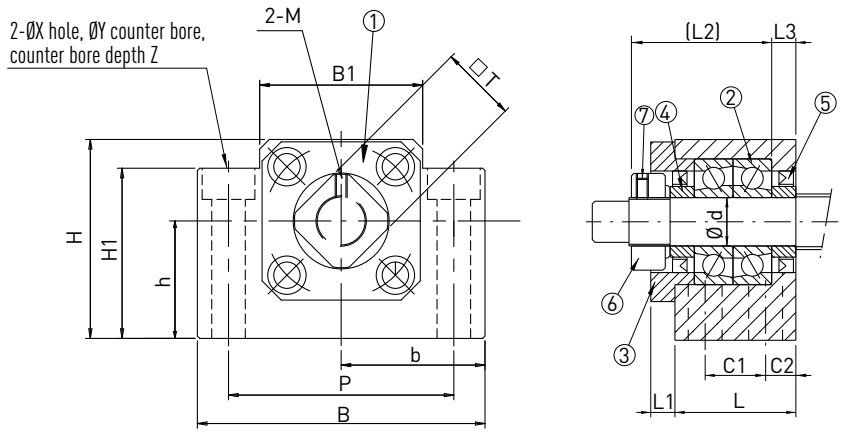
(1) Housing, (2) bearing, (3) circlip

Table 9.37 **Bearing unit dimensions**

Article number	Shaft nominal Ø	d	L	B	H	b ± 0.02	h ± 0.02	B1	H1	P	X	Y	Z	Bearing	Circlip
EF08	**12**	6	14	52	32	26	17	25	26	38	6,6	11	12	606ZZ	S 06
EF10	**16**	8	20	70	43	35	25	36	24	52	9	–	–	608ZZ	S 08
EF12	**16***	10	20	70	43	35	25	36	24	52	9	–	–	6000ZZ	S 10
EF15	**20**	15	20	80	49	40	30	41	25	60	9	–	–	6002ZZ	S 15
EF20	**25**	20	26	95	58	47.5	30	56	25	75	11	–	–	6204ZZ	S 20

Unit: mm
* depending on actual shaft outer diameter $d_{s\,min}$ = 15.5

9.2.5.10 Fixed bearing BK



(1) Housing, (2) bearing, (3) retaining cover, (4) support ring, (5) seal, (6) clamping nut, (7) Allen set screw

Table 9.39 **Bearing unit dimensions**

Article no.	Nominal shaft Ø	d	L	L1	L2	L3	B	H	b ± 0.02	h ± 0.02
BK25	**32**	25	42	12	54	9	106	80	53	48
BK30	**40**	30	45	14	61	9	128	89	64	51
BK40	**50**	40	61	18	76	15	160	110	80	60

Unit: mm

Table 9.40 **Bearing unit dimensions**

Article no.	Nominal shaft Ø	B1	H1	P	C1	C2	X	Y	Z	M	T
BK25	**32**	64	70	85	22	10	11	17	11	M5	35
BK30	**40**	76	78	102	23	11	14	20	13	M6	40
BK40	**50**	100	90	130	33	14	18	26	17.5	M8	50

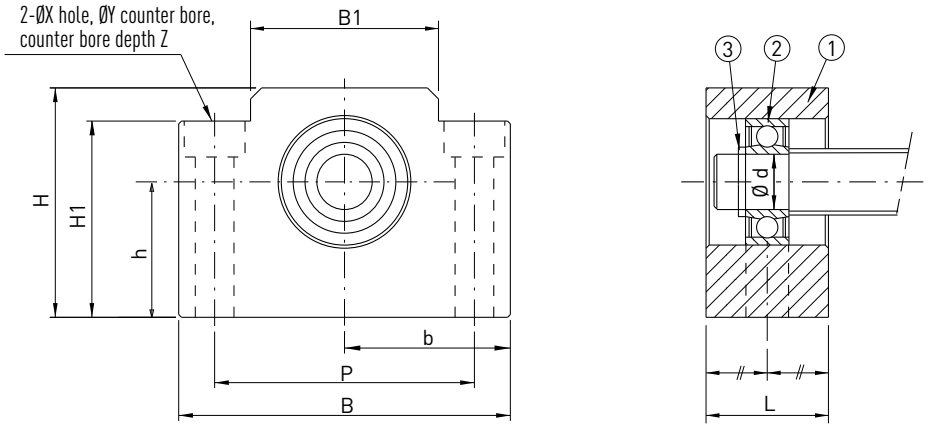
Unit: mm

Table 9.38 **Technical data of the bearing**

Article no.	Bearing type	C_0 axial [N]	C_{dyn} axial [N]	Max. permissible axial load [N]	Max. speed [n/min]	Lock nut			
						Type	**Nut tightening torque [Nm]**	**Screw size**	**Screw tightening torque [Nm]**
BK25	7205A P0	26300	20500	7000	12000	RN25	21	M6	5
BK30	7206B P0	33500	27000	10600	7100	RN30	31	M6	5
BK40	7208B P0	52000	46100	18000	5300	RN40	71	M6	5

Note: BK25, BK30, BK40 with optional lubrication connection

9.2.5.11 Supported bearing BF



(1) Housing, (2) bearing, (3) circlip

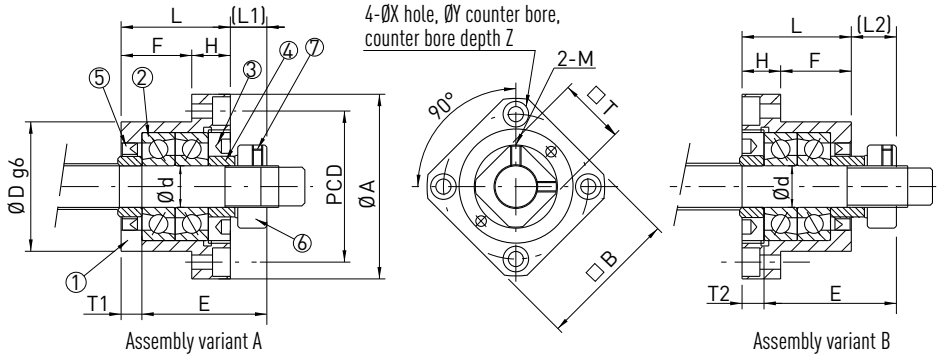
Table 9.41 **Bearing unit dimensions**

Article no.	Shaft nominal Ø	d	L	B	H	b ± 0.02	h ± 0.02	B1	H1	P	X	Y	Z	Bearing	Circlip
BF25	**32**	25	30	106	80	53	48	64	70	85	11	17	11	6205ZZ	S 25
BF30	**40**	30	32	128	89	64	51	76	78	102	14	20	12	6206ZZ	S 30
BF40	**50**	40	37	160	110	80	60	100	90	130	18	26	17.5	6208ZZ	S 40

Unit: mm

9.2.5.12 Fixed bearing FK

FK08



(1) Housing, (2) bearing, (3) retaining cover, (4) support ring, (5) seal, (6) clamping nut, (7) Allen set screw

Table 9.42 **Bearing unit dimensions**

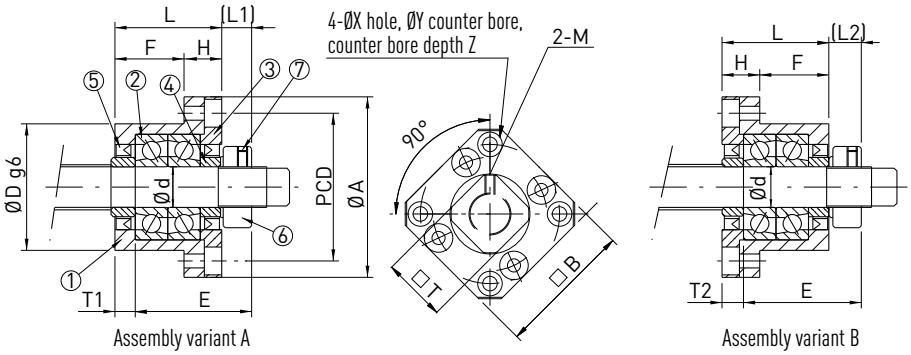
Article no.	Shaft nominal Ø	d	L	H	F	E	Dg6	A	PCD	B	Assembly variant A		Assembly variant B		X	Y	Z	M	T	G	Q
											L1	T1	L2	T2							
FK08	**12**	8	23	9	14	26	28	43	35	35	7	4	8	5	3.4	6.5	4	M3	14	—	—

Unit: mm

Table 9.43 **Technical data of the bearing**

Article number	Bearing type	C_0 axial [N]	C_{dyn} axial [N]	Max. permissible axial load [N]	Max. speed [n/min]	Lock nut			
						Type	Nut tightening torque [Nm]	Screw size	Screw tightening torque [Nm]
FK08	708	4800	2800	1000	40000	RN8	2.5	M3	0.6

FK08



(1) Housing, (2) bearing, (3) retaining cover, (4) support ring, (5) seal, (6) clamping nut, (7) Allen set screw

Table 9.44 **Bearing unit dimensions**

Article no.	Nominal shaft diameter	d	L	H	F	E	Dg6	A	PCD	B	Assembly variant A		Assembly variant B		X	Y	Z	M	T
											L1	T1	L2	T2					
FK10	**16**	10	27	10	17	29.5	34	52	42	42	7.5	5	8.5	6	4.5	8	4	M3	16
FK12	**16***	12	27	10	17	29.5	36	54	44	44	7.5	5	8.5	6	4.5	8	4	M4	19
FK15	**20**	15	32	15	17	36	40	63	50	52	10	6	12	8	5.5	9.5	6	M4	22
FK20	**25**	20	52	22	30	50	57	85	70	68	8	10	12	14	6.6	11	10	M4	30
FK25	**32**	25	57	27	30	59	63	98	80	79	13	10	20	17	9	15.0	13	M5	35
FK30	**40**	30	62	30	32	61	75	117	95	93	11	12	17	18	11	17.5	15	M6	40

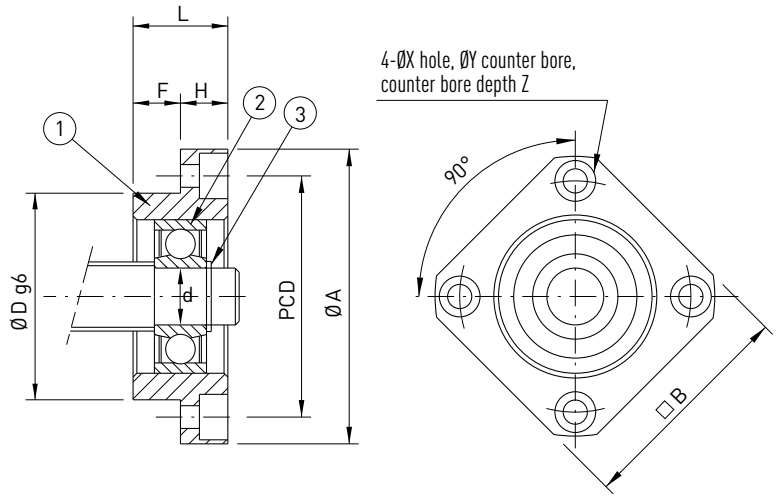
Unit: mm
* depending on actual shaft outer diameter $d_{s\,min}$ = 15.5

Note: FK10, FK12, FK15, FK20, FK25, FK30 optional with lubrication connection

Table 9.45 **Technical data of the bearing**

Article number	Bearing type	C_0 axial [N]	C_{dyn} axial [N]	Max. permissible axial load [N]	Max. speed [n/min]	Lock nut			
						Type	Nut tightening torque [Nm]	Screw size	Screw tightening torque [Nm]
FK10	7000A P0	8800	5200	1900	24000	RN10	2.9	M3	0.6
FK12	7001A P0	9400	6000	2200	22000	RN12	6.4	M4	1.5
FK15	7002A P0	10000	6900	2400	19000	RN15	7.9	M4	1.5
FK20	7204B P0	21600	15300	6800	9500	RN20	16.7	M4	1.5
FK25	7205B P0	24000	19000	8100	8500	RN25	20.6	M6	4.9
FK30	7206B P0	33500	27000	10600	7100	RN30	31.4	M6	4.9

9.2.5.13 FF supported bearing



(1) Housing, (2) bearing, (3) circlip

Table 9.46 **Bearing unit dimensions**

Article no.	Shaft nominal Ø	d	L	H	F	Dg6	A	PCD	B	X	Y	Z	Bearing	Circlip
FF10	**16**	8	12	7	5	28	43	35	35	3,4	6,5	4	608ZZ	S 08
FF12	**16***	10	15	7	8	34	52	42	42	4,5	8	4	6000ZZ	S 10
FF15	**20**	15	17	9	8	40	63	50	52	5,5	9,5	5,5	6002ZZ	S 15
FF20	**25**	20	20	11	9	57	85	70	68	6,6	11	6,5	6204ZZ	S 20
FF25	**32**	25	24	14	10	63	98	80	79	9	14	8,5	6205ZZ	S 25
FF30	**40**	30	27	18	9	75	117	95	93	11	17	11	6206ZZ	S 30

Unit: mm
* depending on actual shaft outer diameter $d_{s\ min}$ = 15.5

Notes

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Ballscrews

Linear Motor Systems

Linear Axes with Ballscrews

Linear Actuators

Ball Bearings

Linear Motor Components

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