HIWIN®

Ballscrews

& Accessories

HIWIN® INDUSTRIE 4.0 Best Partner

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Pick and place / Assembly / Packaging / Semiconductors / Electro-Optical Industry / Automotive Industry / Food Industry
- Articulated robot
- Delta Robot
- SCARA robot
- Wafer Robot
- Electric Pliers
- Integrated Electric Pliers
- Rotary Joint

Linear axes
Precision / Semiconductors / Medical / FPD
- KK, SK
- KS, KA
- KU, KE, KC

Medical equipment
Hospitals / Rehabilitation Centres
- Robotic Gait Training System
- Hygiene System
- Robotic Endoscope Holder

Ballscrews
Precision / Rolling
- Super S series
- Super T series
- Mini Roller
- High load series
- Ball Spline

Linear Guides
Automation / Semiconductors / Medical
- HG, EG, WE, MG, CG
- QH, QE, QW, QR
- RG, E1, PG, SE, RC

Rotary Tables
Aerospace / Medical / Automotive / Machine Tools / Industrial Machines
- RAB-800
- RAB-900

Bearings
Machine tools / Robots
- CRB Bearings
- Linear Bearings
- Supports

Drives and servo motors
Semiconductors / Packaging machines / SMT / Food industry / LCD
- D1, D1-N, D2T
- 50W ~ 2000W motors

Torque Motors
Inspection / Test equipment / Machine tools / Robots
- Rotary Tables -TMS, TMY, TMN
- TMRW Series

Systems with Linear Motors
Automatic transport / AOI application / Precision / Semiconductors
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Cutting machines / Traditional machines / Milling machines
- High resolution
- Signal transfer
- High precision
- High efficiency

Ballscrews

Ballscrews & Accessories

Ballscrews consist of a threaded shaft, a nut with integrated balls and a ball recirculation mechanism. Ballscrews are the most commonly used types of motion transmission in industrial and precision machinery. They are used to transform rotary motion into linear motion and vice versa, as they offer great precision and high efficiency. HIWIN offers a wide range of ballscrews to meet the most demanding applications.

HIWIN ballscrews are characterised by their precise and low-friction movement, as well as low torque, high stiffness and smooth motion, and are available in rolled, peeled and ground versions, making them the perfect product for any application.

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1. Product overview



Rolled Ballscrews Page 34

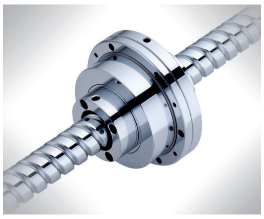
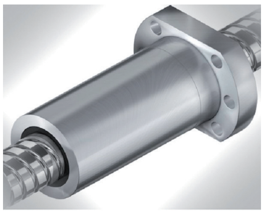
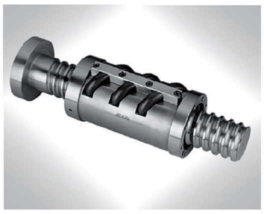
- Flanged and cylindrical nuts
- Reduced axial play
- Nominal diameter 6-80 mm
- Standard terminal processing


Peeled Ballscrews Page 42

- Flanged and cylindrical nuts
- Single and double nuts
- Nominal diameter 16-80 mm
- Standard terminal processing

Ground Ballscrews Page 49

- Flanged and cylindrical nuts
- Single and double nuts
- Nominal diameter 6 – 125 mm
- Preloaded or minimum axial play

Ballscrews for Special Applications Page 60

- Rotating nuts
- Safety nuts
- High-load screws

Supports and accessories Page 64

- Standard terminal processing
- Supports
- Rolling bearings
- Total Solution

2. General Information

2.1 Properties

HIWIN ballscrews offer numerous advantages, such as high levels of possible and simple efficiency, elimination of backlash, high stiffness, and maximum pitch accuracy. The basic features of HIWIN ballscrews and their advantages are explained in the following paragraphs.

2.1.1 High efficiency in both directions

Ballscrews can achieve an efficiency of up to 90% thanks to the rolling contact between the screw and the nut through the balls. The special surface finish on the raceway surface of HIWIN ballscrews further reduces friction due to contact between the balls and the raceway itself. Due to this increased efficiency, the ballscrew movement requires significantly less torque from the motor. Since less power is required, it is possible to reduce the size of the motor and consequently achieve lower operating costs.

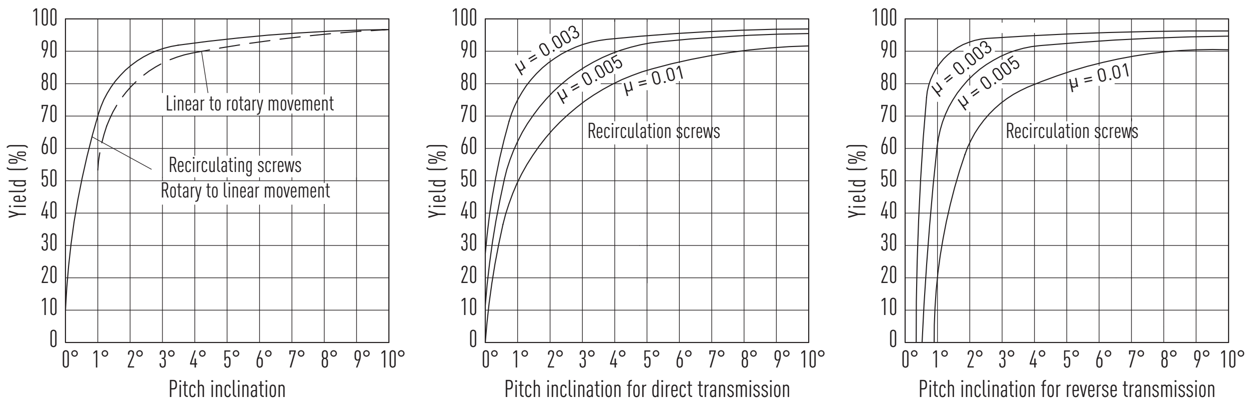


Fig. 2.1 **Mechanical efficiency of a ballscrew**

2.1.2 Backlash elimination and high stiffness

The gothic arch profile used by HIWIN for the shafts and ballscrew nuts allows the nut to be assembled without any play.
To achieve high overall stiffness and repeatable positioning, preloaded ballscrews are generally used.

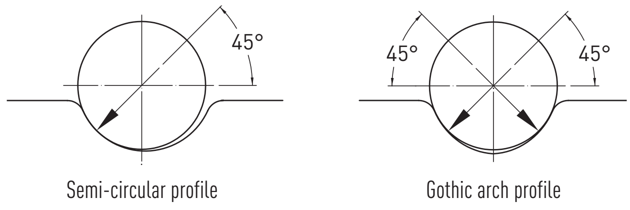


Fig. 2.2 **Contact types for ballscrews (semi-circular, gothic arch)**

2.1.3 Maximum pitch accuracy

HIWIN is able to produce components according to ISO and JIS standards, but also to customer-supplied specifications.
Accuracy is guaranteed by the use of the most precise measuring instruments and is then printed on test certificates.

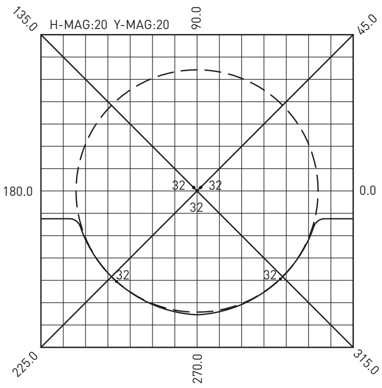
2.1.4 Foreseeable service life

While the service life of plain screws is determined by the wear of the contact surfaces, HIWIN ballscrews can generally be used as long as no failure occurs due to metal fatigue. Thanks to careful design, high quality materials, careful heat treatment and advanced manufacturing techniques, tests have shown that HIWIN ballscrews remain reliable and trouble-free for their entire rated lifetime. For each ballscrew, the service life depends on numerous factors, including the right choice, quality, maintenance and above all the dynamic load coefficient (c). The factors that most influence the dynamic axial load capacity are profile accuracy, material characteristics and surface hardness.

2.1.5 Low initial torque and fluidity of movement

Ballscrews require a very low starting force. To create precise raceways, HIWIN uses a special design (fit factor) and special production procedures. This ensures that the required drag torque will always remain within the specified torque range.

HIWIN is able to control the profile of each individual raceway during a particular stage of the manufacturing process. Figure 2.3 shows an example of a profile. HIWIN also uses computerised measuring equipment to accurately measure the friction torque of ballscrews. Fig. 2.4 shows a typical torque/stroke graph.



Working name:	SH	Method of measurement:	X pitch
		Catching radius:	0.0256mm
Model No:	001H-2-3	Horizontal load:	20,0000
Lot No. :	201536	Vertical load:	20,0000
Operator:	L.J.F.	Measurement track:	7,0000mm

No. of the current symbol code

32 292 X:	0.1816 mm	Z: 0.1980 mm	RC: 3.4438 mm
32 292 X:	−0.1911 mm	Z: 0.2022 mm	RC: 3.4532 mm
32 292 X:	−2.1464 mm	Z: −2.3399 mm	RC: −42.5259 mm
32 292 X:	2.1799 mm	Z: −2.3084 mm	RC: 43.3615 mm
32 292 X:	−0.0000 mm	Z: −0.0000 mm	RC: 3.1750 mm

Fig. 2.3 **HIWIN control of the profile arc**

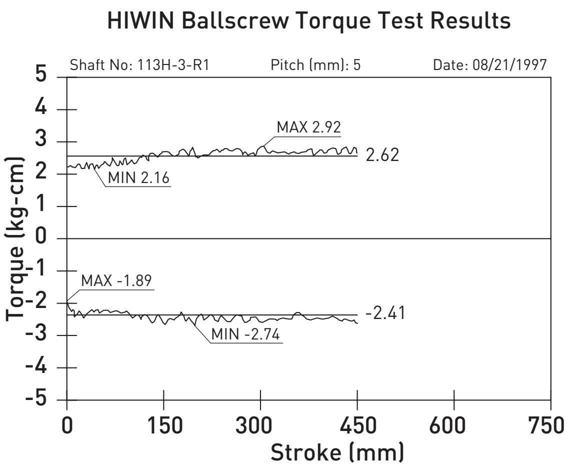


Fig. 2.4 **HIWIN preload control**

2.1.6 Special solutions

HIWIN manufactures ballscrews to customer design and/or with customised end machining. In order to be able to create the ballscrew, the requirements on the design drawing must be clear and checked. This ensures that the final product fully meets the requirements.

3. HIWIN ballscrew properties and selection

3.1 Design information

a) Choose ballscrews of the appropriate type for the application (see Table 3.5). The main requirements must already be considered before installation. For example, for precision-ground ballscrews for CNC machines, this means careful alignment and the corresponding type of installation; for applications requiring a lesser degree of precision, we recommend the use of rolled ballscrews, which require a more streamlined design in terms of both the type of errors permissible during assembly and the bearings to be used.

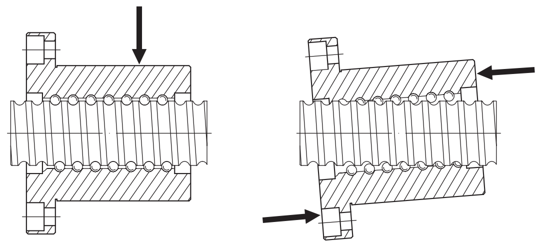


Fig. 3.1 **Unbalanced load distribution,** due to misalignment between the support bearings and the nut, too rough machining of the bearing surface and/or inaccurate inclination or alignment of the nut flange**.**

b) It is particularly important to eliminate or limit the misalignment between the centre distance of the bearing housing and the centre distance of the ballscrew, which would lead to unbalanced loads. Unbalanced loads can consist of radial loads and moment loads (Fig. 3.1), which can cause malfunctions and reduce service life (Fig. 3.2).

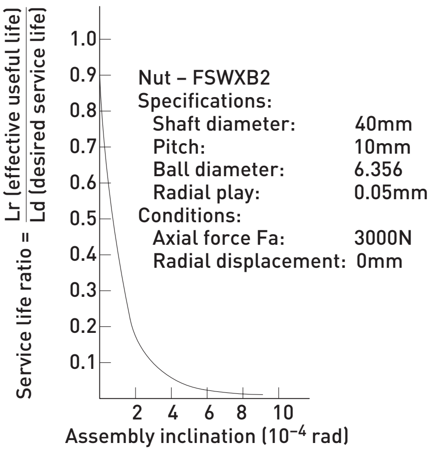


Fig. 3.2 **Impact on durability** of a radial load caused by misalignment

c) Choose bearings of an appropriate type for the shaft. For CNC machines, it is advisable to use angular contact ball bearings (60° angle), as they have a higher axial load capacity and can be assembled without play or preloaded. In particular, see the HIWIN BSB series bearings The types of terminal machining and the corresponding radial and fixed bearings are listed in Chapter 8.

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d) It is advisable to install a safety stop at the ends to prevent over-travel of the nut (Fig. 3.3), which could damage the ballscrew assembly, particularly before the screw has been assembled.

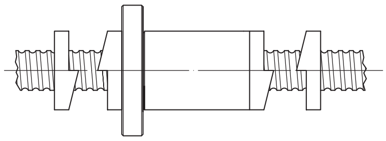

Fig. 3.3 **Mechanical stop to prevent over-travel of the nut**

e) In environments contaminated by dust or metal shavings, it is advisable to protect ballscrews by applying telescopic or bellows covers (see Fig.3.4).

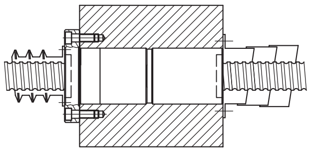

Fig. 3.4 **Shaft protection with telescopic or bellows covers**

f) If you choose a ballscrew with internal recirculation or end cap recirculation, you must machine the end of the shaft at the bottom of the raceway. The shank diameter should be approximately 0.5 - 1.0 mm smaller than the original diameter of the screw (Fig. 3.5).

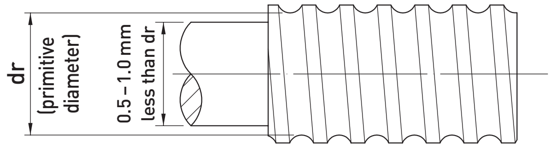

Fig. 3.5 **Machining the terminal of a ballscrew**

g) During the hardening of the shaft, the two or three steps immediately adjacent to the bearing ends on both sides will be of lower hardness, which may allow modifications to the shanks. In the HIWIN diagrams, these areas are marked with the symbol (see Fig. 3.6). If these areas have special requirements, please contact HIWIN technicians.

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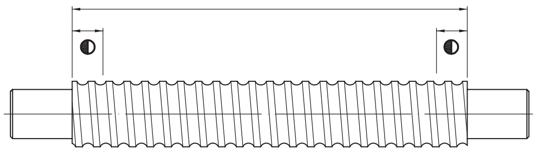


Fig. 3.6 **Hardening area on a ballscrew shaft**

h) Excessive preload increases friction torque, which in turn generates heat, and this reduces service life. However, insufficient preload reduces stiffness and increases the likelihood of backlash. For further details, please refer to paragraph 3.6

i) The shank for the fixed bearing must have a drainage groove to allow proper insertion and maintain proper alignment (see Fig. 3.7). HIWIN recommends discharge according to DIN 509 as a standard element (see Fig. 3.8). The screw thread for rolled and peeled shafts generally provides sufficient surface area for the bearing stop. In the worst cases, this striking surface becomes too small, especially where the propeller disappears. This results in a lack of guarantee of the required perpendicularity of the bearing. In such cases, a smaller shank diameter and consequently a smaller bearing or, for peeled or ground shafts, a smooth shaft part, can solve the problem. For rolled shafts, an alternative is the use of rings hot-moulded onto the shanks in order to offer complete surfaces in all cases.

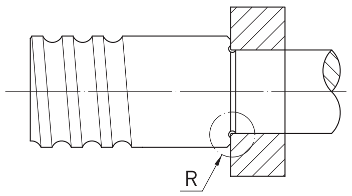


Fig. 3.7 **Drain R for bearing housing**

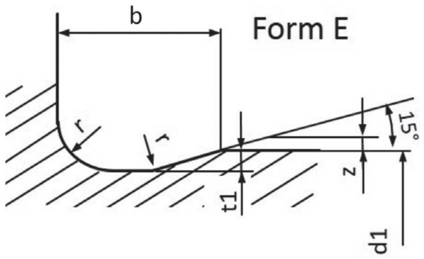


Fig. 3.8 **Recommended discharge size "R" in Fig. 3.7 referring to DIN 509 typology E**

Table 3 **Type E discharge table**

Discharge	r	t	b	d1
E 0.4x0.2	0.4	0.2	2	from 11 up to 18
E 0.6x0.2	0.6	0.2	2	from 19 up to 35
E 0.6x0.3	0.6	0.3	2.5	from 36 up to 80

Unit: [μm]

As far as discharge grooves are concerned, there may be differences depending on the production site of the screws. The standard alternative to the above dimensions are DIN 509 deferred discharge grooves in form E (E 0.4x0.2 to E 0.6x0.3 depending on the screw diameter). In contrast to type F, form E offers the possibility of recovering a little more usable area.
If there is a shank part with a thread, the groove will refer to DIN 76 in form B.

3.2 Ballscrew selection procedure

Table 3.1 shows the procedure for selecting a ballscrew. The conditions of use (A) can be used as a reference for selecting the appropriate parameter for the ballscrew (B). Follow the selection procedure step by step using the reference formula to check the correctness of the choice (C) .

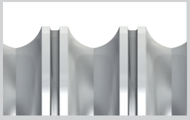
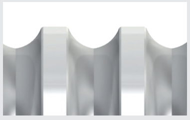
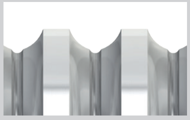
Table 3.1 **Ballscrew selection procedure**

Passages	Conditions of use (A)	Screw parameter (B)	Reference formula (C)
1	Positioning accuracy	Pitch accuracy	Table 4.1, Table 5.1, Table 6.1
2	Speed	Screw pitch	$p = \frac{v_{max}}{n_{max}}$
3	Total distance travelled	Total thread length	Total length = Thread length + Terminal length Thread length = Stroke+Nut length
4	1 Load condition[%] 2 Speed [%] (optimal value ≤1/5 C)	Average axial load Average speed	Formula F 3.4 – F 3.9
5	Average axial load	Preload	Formula F 3.5
6	1 Expected service life 2 Average axial load 3 Average speed	Dynamic load coefficient	Chapter 3.7.2, "Expected duration"
7	1 Dynamic load 2 Screw pitch 3 Critical speed 4 Speed limited byDm-Nvalue	Shaft diameter and nut type	Chapter 3.7.2, "Service Life"
8	1 Screw diameter 2 Nut type 3 Preload 4 Dynamic load coefficient	Stiffness	Chapter 3.7.7, "Stiffness"
9	1 Working temperature 2 Length of ballscrew	Thermal variation and expected value of the cumulative error (T) on the pitch	Chapter 3.7.8, "Thermal expansion"
10	1 Stiffness of the threaded shaft 2 Thermal deformation	Preload	Chapter 3.7.8, "Thermal expansion"
11	1 Maximum speed 2 Global cyclic 3 Screw configuration	Maximum torque and motor specifications	Chapter 3.7.3, "Torque and power to the motor"

3.3 Ballscrew shaft

HIWIN supplies rolled, peeled and ground ballscrews - depending on the application.
Table 3.2 shows the specifications for selecting the most suitable shaft.

Table 3.2 **Ballscrew selection procedure**

	Rolled shaft	Peeled shaft	Ground shaft
Profile			
Construction process	Plastic deformation process	Cutting process	Removal and grinding process
Applications	Transport and processing	Transport, processing and positioning	Processing and positioning
Tolerance classes	ISO 5 - ISO 7	ISO 5 - ISO 7	ISO 0 - ISO 5
Nominal Diameter	6-80	16-80	6-120
Max. shaft length 1) [mm]	500-5,600	3,300-6,500	110-10,000
Nut shape	Flanged and cylindrical nuts	Flanged and cylindrical nuts, single and double	Single and double flanged and cylindrical nuts
Availability	In stock and on request	In stock and on request	In stock and on request

1) Depends on diameter and tolerance class

3.4 Recirculation systems

Three different recirculation systems are available for HIWIN ballscrews.

The external recirculation system consists of recirculation pipes and a fixing plate. The balls are introduced into the raceway in the space between the threaded shaft and the ballscrew. At the end of the spiral, they exit the raceway and are brought back by a special recirculation tube, in order to form and close a circuit. (see Fig. 3.9).

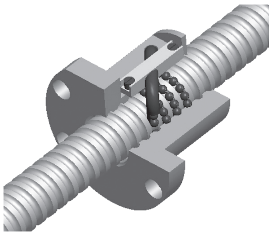


Fig. 3.9 **External recirculating screw**

If the screw is of the internal recirculating type, the balls are returned to the beginning of a revolution around the threaded shaft with the help of deflectors. The balls only complete one revolution around the threaded shaft. The circuit is closed by a deflector, located inside the ballscrew, which allows the balls to return to the starting point of that circuit. Since the ball deflectors are located inside the nut body, this type of ballscrew is called an internal recirculating screw (see Fig. 3.10). The deflectors can be positioned in series, directly influencing the length of the nut.

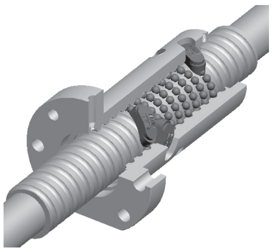


Fig. 3.10 **Recirculating screw**

The third type is a recirculation in the nut body and is illustrated in Fig. 3.11. This recirculation system uses the same basic scheme as the nut with external recirculation, the difference being that the balls return via a through-hole in the nut. The balls travel the entire circuit of the raceway inside the ballscrew, on one or more principles. The passage between the shaft raceways and the crossing of the nut body is either through the entire end-cap or through special front deflectors called cassettes.

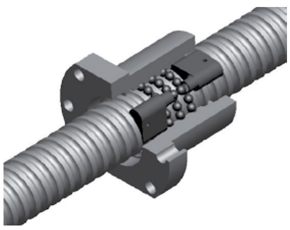
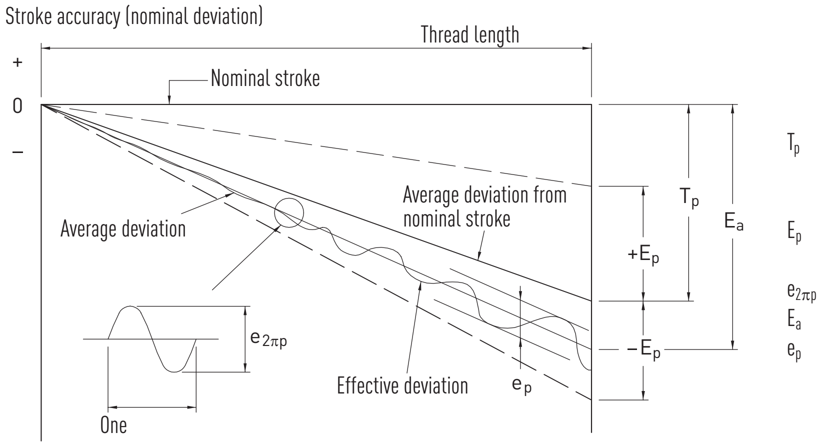


Fig. 3.11 **Nut with recirculation in the nut body**

3.5 Accuracy classes

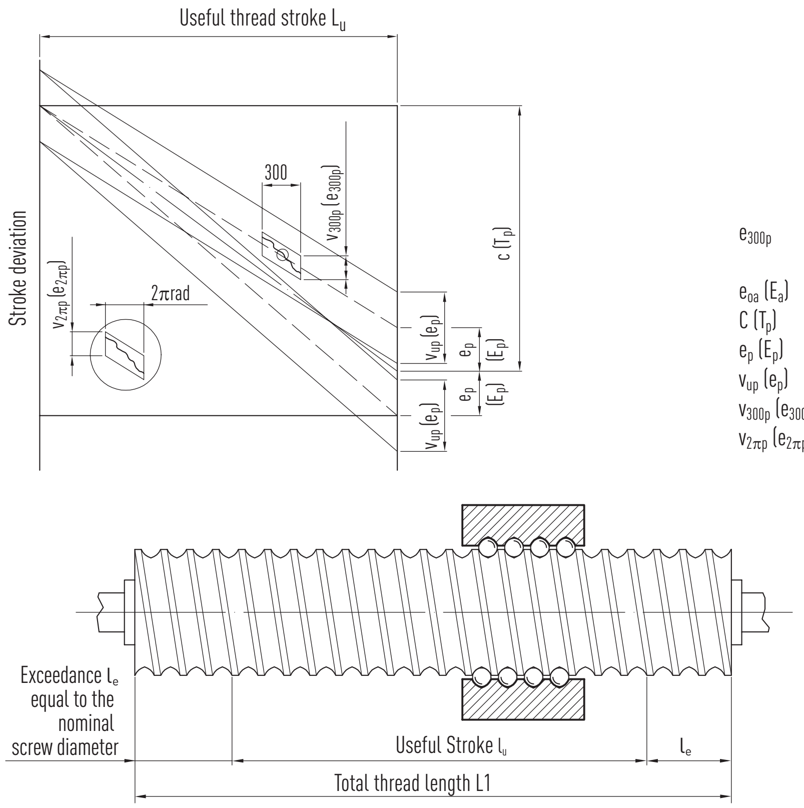
3.5.1 Tolerance classes

HIWIN ballscrews are produced in various tolerance classes according to the precision requirements of the application.



T_p	Difference between nominal stroke and actual stroke. This value can be determined by the various requirements of the customer's application.
E_p	Maximum permissible stroke deviation from the nominal stroke, over the complete distance
$e_{2\pi p}$	Stroke deviation within a rotation
E_a	Actual stroke, determined by laser measurement
e_p	Actual stroke deviation. Maximum deviation of the total effective stroke from the total effective rated stroke in the corresponding area

Fig. 3.12 **HIWIN pitch error measurement for precision ballscrews**



e_{300p}	Effective stroke deviation at 300mm. Effective stroke deviation over 300 mm at any position along the thread
e_{oa} (E_a)	Average stroke deviation from useful stroke l_u
C (T_p)	Stroke compensation in relation to useful stroke l_u
e_p (E_p)	Nominal stroke limit tolerance
v_{up} (e_p)	Permitted deviation of stroke from useful stroke l_u
v_{300p} (e_{300p})	Permissible stroke deviation along a 300 mm stroke
$v_{2\pi p}$ ($e_{2\pi p}$)	Permitted travel deviation on one rotation

Fig. 3.13 **DIN ISO pitch error measurement for ballscrews**

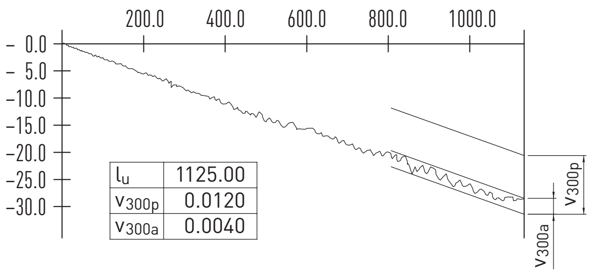
3.5.2 Travel variations over a distance of 300 mm

As an international company, HIWIN produces ballscrews according to the DIN ISO 3408 standard in tolerance classes 0, 1, 3, 5, 7 and 10 and according to the Japanese JIS standard in tolerance classes 0, 2 and 4. The tolerance classes and permissible deviation v300p on a 300 mm stroke are listed in Table 3.3.

Table 3.3 **International Standards for Tolerance Classes for Ballscrews**

HIWIN tolerance classes		T0	T1	T2	T3	T4	T5	T7	T10
v_{300p}	DIN ISO	3.5	6	–	12	–	23	52	210
	JIS	3.5	–	8	–	18	–	–	–

Unit: [μm]



v_{300a} Permissible deviation over a distance of 300 mm in any position (measured according to DIN 69051-3-3)

Fig. 3.14 **Travel variation over a useful stroke of 300 mm**

3.5.3 Permissible travel deviation and tolerance.

For High Precision Screws (peeled and ground)

For the positioning of ballscrews (peeled and ground), the permissible stroke deviations from the useful stroke lu are listed in Table 3.4.

Table 3.4 **Tolerance classes for High Precision ballscrews (peeled and ground)**

HIWIN tolerance classes		T0		T1		T2		T3		T4		T5	
Useful stroke l_u		e_p	v_{up}	e_p	v_{up}	e_p	v_{up}	e_p	v_{up}	e_p	v_{up}	e_p	v_{up}
FROM	UP TO												
–	315	4	3.5	6	6	12	8	12	12	23	18	23	23
315	400	5	3.5	7	6	13	10	13	12	25	20	25	25
400	500	6	4.0	8	7	15	10	15	13	27	20	27	26
500	630	6	4.0	9	7	16	12	16	14	30	23	32	29
630	800	7	5.0	10	8	18	13	18	16	35	25	36	31
800	1,000	8	6.0	11	9	21	15	21	17	40	27	40	34
1,000	1,250	9	6.0	13	10	24	16	24	19	46	30	47	39
1,250	1,600	11	7.0	15	11	29	18	29	22	54	35	55	44
1,600	2,000	13		18	13	35	21	35	25	65	40	65	51
2,000	2,500	15		22	15	41	24	41	29	77	46	78	59
2,500	3,150	18		26	17	50	29	50	34	93	54	96	69
3,150	4,000			32	21	60	35	62	41	115	65	115	82
4,000	5,000			39		72	41	76	49	140	77	140	99
5,000	6,300			48		90	50	92		170	93	170	119
6,300	8,000					110	60					210	130
8,000	10,000											260	145
10,000	12,000											320	180

e_p [μm] Nominal stroke limit tolerance
v_{up} [μm] Permissible stroke deviation from useful stroke L_U

Precision rolled screws

For precision rolled ballscrews, the permissible stroke error with respect to the desired stroke is calculated using formula F3.1.

F 3.1

$$e_p = \pm \frac{l_u}{300} \times v_{300p}$$

e_p Nominal stroke limit tolerance
l_u Useful stroke
v_{300p} Permitted deviation from 300mm stroke

Pitch accuracy curves measured with a laser device according to DIN ISO 3408

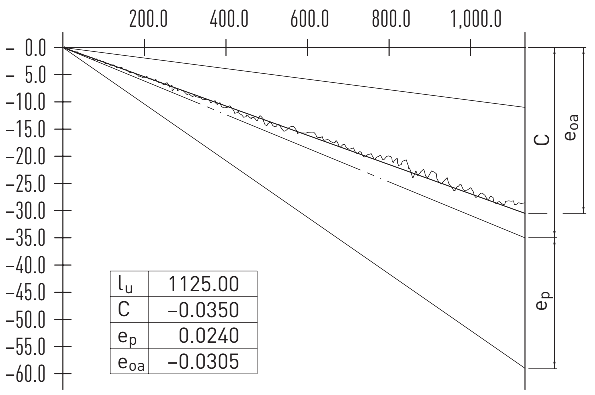


Fig. 3.15 **Limit tolerance and average error on useful stroke l_u**

l_u Useful stroke
C Travel compensation
e_p Nominal stroke limit tolerance
e_{oa} Average error on useful stroke $\mathbf{l_u}$

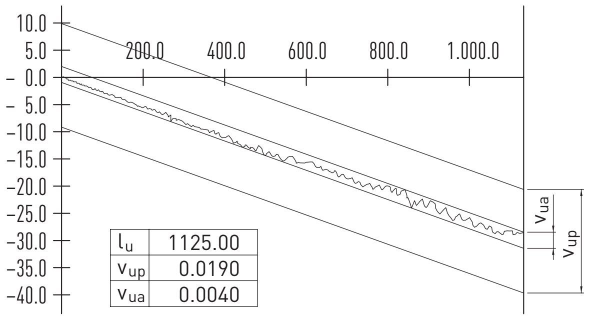


Fig. 3.16 **Permitted deviation from useful stroke l_u**

l_u Useful stroke
v_{up} Permitted deviation from useful stroke
v_{ua} Actual deviation from useful stroke

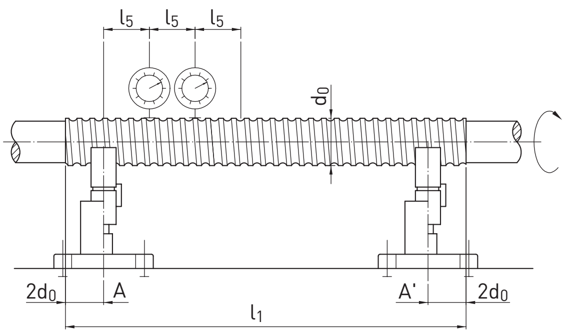
Table 3.5 **Recommended accuracy classes for different applications**

	Application	Axis	Precision class						
			T0	**T1**	**T2**	**T3**	**T4**	**T5**	**T7**
CNC machines	Lathes	X	o	o	o	o			
		Z				o	o	o	
	Milling machines Counterbore machines	X		o	o	o	o	o	
		Y		o	o	o	o	o	
		Z			o	o	o	o	
	Machining centres	X		o	o	o	o		
		Y		o	o	o	o		
		Z			o	o	o		
	Boring machines	X	o	o					
		Y	o	o					
		Z	o	o					
	Drilling machines	X				o	o	o	
		Y				o	o	o	
		Z					o	o	o
	Grinding machines	X	o	o	o				
		Y		o	o	o			
	Plunge EDM	X		o	o	o			
		Y		o	o	o			
		Z			o	o	o	o	
	Wire EDM	X		o	o	o			
		Y		o	o	o			
		U		o	o	o	o		
		V		o	o	o	o		
	Laser cutting machines	X			o	o	o		
		Y			o	o	o		
		Z			o	o	o		
Generic machines	Punching machines	X				o	o	o	
		Y				o	o	o	
	Woodworking machines								o
	Precision industrial robots			o	o	o	o		
	Industrial robots							o	o
	Coordinate measuring machines		o	o	o				
	CNC machines					o	o	o	
	Transport systems						o	o	o
	X-Y tables			o	o	o	o	o	
	Linear actuators							o	o
	Landing gear for aircraft							o	o
	Aerodynamic control							o	o
	Gate valves								o
	Power steering								o
	Glass processing machines				o	o	o	o	o
	Surface grinding machines						o	o	
	Induction hardening machines								o
	Electromechanical machines			o	o	o	o	o	o

3.5.4 Tolerances and measuring methods for machined HIWIN ballscrews

Table 3.6 **Radial deviation t5 of outer diameter compared to AA' from l_5 intervals (standard DIN ISO 3408)**

Nominal diameter d_0 [mm]		Reference range (mm)	t_{5p} value for precision class							
From	up to	l_5	T0	T1	T2	T3	T4	T5	T7	T10
6	12	80	16	20	23	25	25	32	40	80
12	25	160	16	20	23	25	25	32	40	80
25	50	315	16	20	23	25	25	32	40	80
50	100	630	16	20	23	25	25	32	40	80



l_1 / d_0		Tolerance class t_{5pmax} [µm] for $l_1 > 4l_5$							
From	up to	T0	T1	T2	T3	T4	T5	T7	T10
-	40	32	40	45	50	50	64	80	160
40	60	48	60	70	75	75	96	120	240
60	80	80	100	115	125	125	160	200	400
80	100	128	160	180	200	200	256	320	640

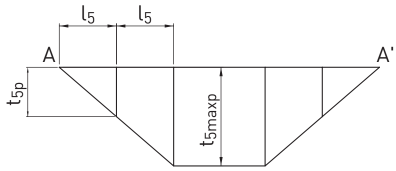


Table 3.7 **Radial deflection $t_{6.1}$ of bearing seat relative to AA' at a distance l_6 (DIN ISO 3408)**

Nominal diameter d_0 [mm]		Distance l_6 from support	$t_{6.1p}$ value [µm] for precision class							
From	up to	l	T0	T1	T2	T3	T4	T5	T7	T10
6	20	80	6	10	11	12	12	20	40	63
20	50	125	8	12	14	16	16	25	50	80
50	125	200	10	16	18	20	20	32	63	100
125	200	315	-	-	20	25	25	40	80	125

if $l_6 < l$ then the deviation must be $\leq t_{6,1p} \cdot \frac{l_6}{l}$

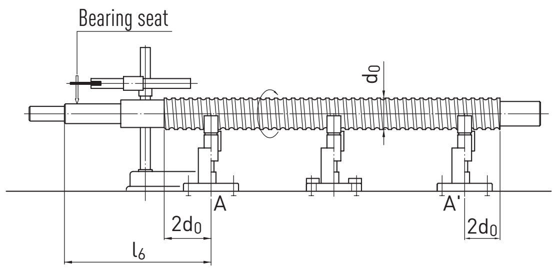


Table 3.8 **Radial deviation $t_{7.1}$ of shank diameter from bearing seat (standard DIN ISO 3408)**

Nominal diameter d_0 [mm]		Distance L_7 =L [mm] from the support	$t_{7.1p}$ [µm] value for tolerance class							
from	up to	l	T0	T1	T2	T3	T4	T5	T7	T10
6	20	80	4	5	6	6	6	8	12	16
20	50	125	5	6	7	8	8	10	16	20
50	125	200	6	8	8	10	10	12	20	25
125	200	315	-	-	10	12	12	16	25	32

if $l_7 > l$ then the relative deviation must be $\leq t_{7.1} \cdot \frac{l_7}{l}$

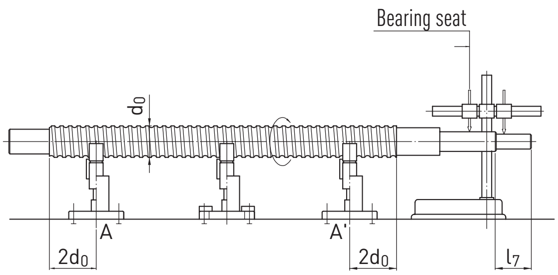


Table 3.9 **Axial deviation $t_{8.1}$ of the shaft faces with respect to AA' (measured according to DIN ISO 3408)**

Nominal diameter d_0 [mm]		$t_{8.1p}$ [µm] value for tolerance class							
From	up to	T0	T1	T2	T3	T4	T5	T7	T10
6	63	3	3	3	4	4	5	6	10
63	125	3	4	4	5	5	6	8	12
125	200	-	-	6	6	6	8	10	16

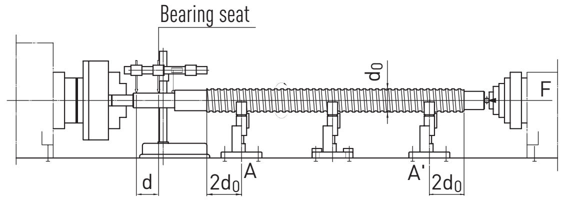


Table 3.10 **Axial deviation t_9 inner face of nut in relation to AA' (only for preloaded nuts) (Standard DIN ISO 3408)**

Flange diameter D_2 [mm]		t_{9p} [µm] value for tolerance class							
From	up to	T0	T1	T2	T3	T4	T5	T7	T10
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	-

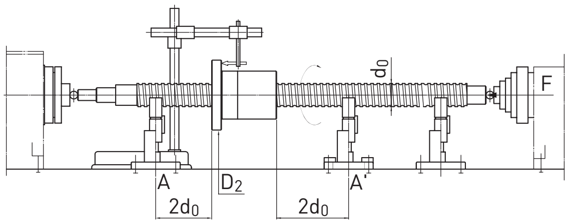
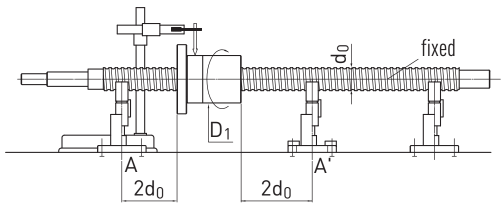


Table 3.11 **Radial deviation t10 nut body diameter in relation to AA' (only for nuts with rotating preload with fixed shaft) (Standard DIN ISO 3408)**

Diameter D_1 of the nut [mm]		t_{10p} [µm] value for tolerance class							
From	up to	T0	T1	T2	T3	T4	T5	T7	T10
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	-



3.6 Preload and play

The axial force F_a due to an external force or an internal preload force results in two types of displacement. First, there is the normal axial displacement Sa, due to the play between the raceway and the ball. Secondly, there is a deformation $\Delta\ell$, caused by the normal force Fn, perpendicular to the point of contact in relation to the diameter of the sphere and the curvature of the arc as shown in the graph in fig. 3.17. Normally, rolled (and sometimes peeled) ballscrews have a slight play. This is ideal for most applications, because it has the advantage that the balls crews operate smoothly while requiring a low starting force. If the requirements for positioning accuracy and stiffness are more stringent, a ballscrew without backlash or with preload must be used. There are several methods of preloading, which are described below.

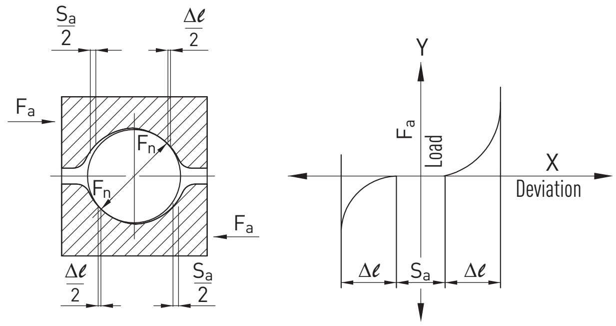


Fig. 3.17 **Gothic arch profile and preload**

3.6.1 HIWIN preload types

The preload is always achieved by using double nuts or a single nut with a pitch offset or, in the case of a single nut, by adjusting the ball size by increasing it.

Table 3.6.1 **Maximum play for precision-rolled screws** Units of measurement: (mm)

Ball diameter	3 or 3.175	3969	4763	6.35	9525
Axial play	0.04	0.04	0.05	0.05	0.07

We can produce assembled ballscrews with controlled backlash (almost zero) or slight preload (for ISO 5 screws). See order code

SINGLE NUT PRELOAD

❶ Preload with increased balls

The preloading of a single nut can therefore be done in two ways. The first is called the "increased ball preload method". This method involves using balls that are slightly larger than those of the track, so that four contact points are created (see Fig. 3.18).

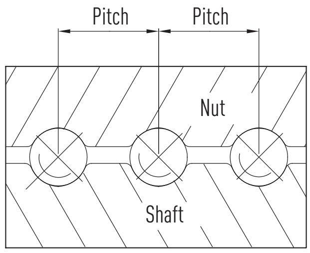


Fig. 3.18 **Preload with increased balls**

❷ Preload with pitch offset

The second is called the "pitch offset preload method" (see Fig. 3.19). The nut is machined so that the pitch is offset from the centre line. This method replaces the traditional double nut preloading method, resulting in a compact single nut with a higher preload force and consequently higher stiffness. However, it should not be used under heavy preload and long wheelbase conditions.

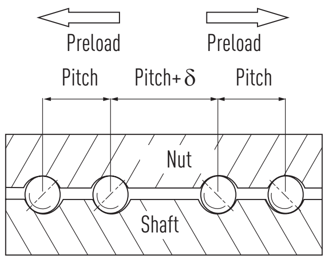


Fig. 3.19 **Preload with pitch offset**

PRELOAD WITH DOUBLE NUT
Preload is achieved by inserting a shim between the 2 nuts (Fig. 3.20).
The generally used O-ball preload is achieved by inserting a shim between the two nuts, which thus form two points of contact each.

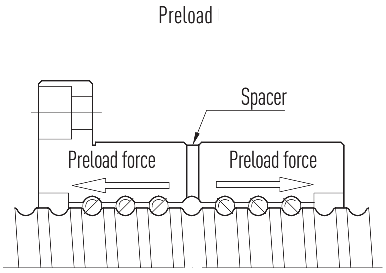


Fig. 3.20 **Double nut preload**

3.6.2 Effects of preload
Preloading increases the torque acting on the shaft and consequently causes an increase in temperature during movement. To ensure a long service life and avoid excessive thermal increases, the maximum preload must not exceed 5% of the dynamic load for single nuts and 10% for double nuts.
In addition, preload affects performance. In addition to increasing torque in general, it can lead to variations in no-load torque along the stroke, especially for rolled ballscrews where the accuracy classes used are the highest. (see Chapter 3.6.3).
Basically, ballscrews should only be preloaded when this is absolutely necessary, i.e. where the application never allows the slightest backlash, particularly when reversing motion.

3.6.3 Variation of preload torque

(1) Method of measurement
The preload generates a frictional torque between the nut and the threaded shaft. This torque is measured by moving the threaded shaft at a constant speed while preventing the nut from rotating by means of a locking device (see Fig. 3.21).
The force FPr measured by the force sensor is used to calculate the shaft torque due to preload alone.

F 3.2

$$T_d = \frac{K_p \times F_{pr} \times P}{2000 \times \pi}$$

T_d Torque due to preload alone
F_{Pr} Preload force
P Pitch
K_P Preload friction coefficient

$K_P = \frac{1}{\eta_1} - \eta_2$ (between 0.1 and 0.3)

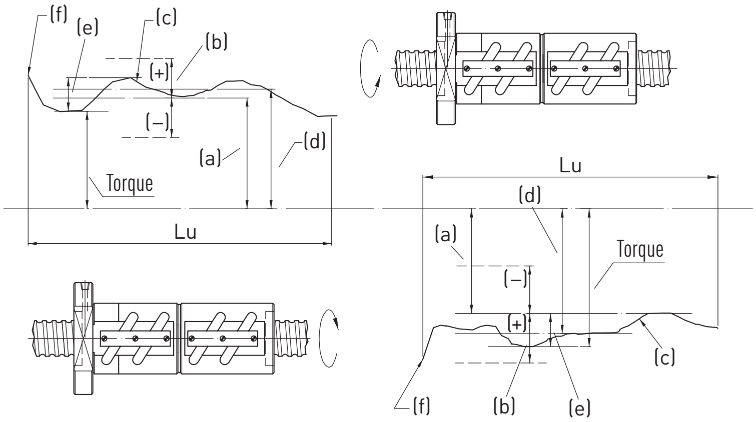
η_1, η_2 are the mechanical efficiencies of the ballscrew

(2) Measuring conditions
1. Without oil scraper
2. Speed: 100 rpm
3. Dynamic lubricant viscosity 61.2 – 74.8 cSt [mm/s] at 40 °C, according to ISO VG 68 or JIS K2001

(3) The measurement result is shown by the standard representation of the preload torque; the nomenclature is shown in Fig. 3.21

(4) Torque variations due to preload

(included in the definition of tolerance class) are listed in Table 3.12.



(a) Torque calculated with 3.2
(b) Torque variations see table 3.12
(c) Measured resistant torque
(d) Average resistant torque
(e) Measured first breakaway torque
(f) Maximum resistant torque in both directions
Lu Useful stroke of the nut

Fig. 3.21 **Nomenclature for measuring resistant torques**

Table 3.12 **Variation of preload torque in % (according to DIN ISO 3408)**

Resistant pair T_{p0} [Nm]		Useful stroke length of the threaded part[mm]																				
		no more than 4,000mm														over 4,000 mm						
		Length/diameter ratio ≤ 40 Tolerance class							Length/diameter ratio > 40 Tolerance class							Tolerance class						
From	**Up to**	**T0**	**T1**	**T2**	**T3**	**T4**	**T5**	**T7**	**T0**	**T1**	**T2**	**T3**	**T4**	**T5**	**T7**	**T0**	**T1**	**T2**	**T3**	**T4**	**T5**	**T7**
0.2	**0.4**	30	35	40	40	45	50	-	40	40	50	50	60	60	-	-	-	-	-	-	-	-
0.4	**0.6**	25	30	35	35	40	40	-	35	35	40	40	45	45	-	-	-	-	-	-	-	-
0.6	**1.0**	20	25	30	30	35	35	40	30	30	35	35	40	40	45	-	-	-	40	43	45	50
1.0	**2.5**	15	20	25	25	30	30	35	25	25	30	30	35	35	40	-	-	-	35	38	40	45
2.5	**6.3**	10	15	20	20	25	25	30	20	20	25	25	30	30	35	-	-	-	30	33	35	40
6.3	**10.0**	-	-	15	15	20	20	30	-	-	20	20	25	25	35	-	-	-	25	23	30	35

Note:
1. To calculate idle torque, use Formula F 3.2
2. For further information, please contact HIWIN.

3.7 Calculation

Basis of calculation according to DIN ISO 3408.

3.7.1 Load coefficients

Dynamic load coefficients C_{dyn} (theoretical)

The dynamic load coefficient describes the load at which 90% of the ballscrews in the same batch achieve a service life of 1 x 10^6 revolutions (C). The reliability factor can be determined according to Table 3.17. The dynamic load is given in the dimensional tables for each type of nut.

Static load coefficient C_0

Static load is the load that causes a plastic deformation on the raceway greater than 0.00001 the diameter of the ball. To calculate the maximum permissible static load of a ballscrew, the static safety factor S_0 of the application conditions must be taken into account.

F 3.3

$$S_0 \times F_{amax} < C_0$$

S_0 Static safety factor
C_0 Static load coefficient (given in the dimensional table for each nut type)
F_{amax} Maximum static axial load

3.7.2 Expected duration

a) Average speed n_m

F 3.4

$$n_m = n_1 \times \frac{t_1}{100} + n_2 \times \frac{t_2}{100} + n_3 \times \frac{t_3}{100} + \ldots$$

n_m Total average speed [rpm]
n_n Average speed in the n-th phase [rpm]
t_n Duration in the n-th phase [%]

b) Preload

F 3.5

$$F_{pr} = \frac{f_{pr}}{100\,\%} \times C_{dyn}$$

F 3.6

$$F_{lim} = 2^{3/2} \times F_{pr}$$

F_{pr} Preload force
C_{dyn} Dynamic load coefficient
f_{pr} Preload factor in %
Single nut $f_{pr} \leq 5\,\%$
Double nut $f_{pr} \leq 10\,\%$
F_{lim} Limit force of preload loss

Two cases can be distinguished:

$F_n > F_{lim}$ No influence of preload: $F_{bn} = F_n$
$F_n < F_{lim}$ Influence of preload: Formula F 3.7

F 3.7

$$F_{bn} = \left(1 + \frac{F_n}{2^{3/2} \times F_{pr}}\right)^{3/2} \times F_{pr}$$

F_n Axial load in the n-th phase
F_{bn} Axial load in the n-th phase

F_n must be calculated for all n phases and used in the Formula F 3.7.

c) Average operating load F_{bm}

- With variable load and constant speed

F 3.8

$$F_{bm} = \sqrt[3]{F_{b1}^3 \times \frac{t_1}{100} \times f_{p1}^3 + F_{b2}^3 \times \frac{t_2}{100} \times f_{p2}^3 + F_{b3}^3 \times \frac{t_3}{100} \times f_{p3}^3 \ldots}$$

F_{bm} Average working load [N]
F_{bn} Working load in the n-th phase
f_p Operating condition factor where f_p applies
1.1 – 1.2 application without impact
1.3 – 1.8 application under normal conditions
2.0 – 3.0 impact and vibration applications
3.0 - 5.0 short stroke applications less than 3 times the nut length) and/or high frequency

- With variable load and variable speed:

F 3.9

$$F_{bm} = \sqrt[3]{F_{b1}^3 \times \frac{n_1}{n_m} \times \frac{t_1}{100} \times f_{p1}^3 + F_{b2}^3 \times \frac{n_2}{n_m} \times \frac{t_2}{100} \times f_{p2}^3 + F_{b3}^3 \times \frac{n_3}{n_m} \times \frac{t_3}{100} \times f_{p3}^3 \ldots}$$

d) Duration with loads in both directions:

- Service life expressed in number of revolutions

F 3.10

$$L_1 = \left(\frac{C_{dyn}}{F_{bm1}}\right)^3 \times 10^6 \qquad L_2 = \left(\frac{C_{dyn}}{F_{bm2}}\right)^3 \times 10^6$$

F 3.11

$$L = \left(L_1^{-10/9} + L_2^{-10/9}\right)^{-9/10}$$

L_1 Service life expressed in number of revolutions, movement in one direction
L_2 Service life expressed in number of revolutions, movement in direction opposite to the former
C_{dyn} Dynamic load coefficient [N]]
F_{bm1} Average working load, one-way movement
F_{bm2} Average working load, opposite direction movement
L Service life in rpm

- Conversion of service life into working hours

F 3.12

$$L_h = \frac{L}{n_m \times 60}$$

L_h Service life in working hours
n_m Average speed [rpm], see Formula

- Conversion of distance travelled [km] into working hours

F 3.13

$$L_h = \left(\frac{L_{km} \times 10^6}{P}\right) \times \frac{1}{n_m \times 60}$$

L_h Service life in working hours
L_{km} Service life in distance travelled [km]
P Pitch [mm]
n_m Average speed [rpm]

- The modified service life based on reliability factors is calculated with

F 3.14

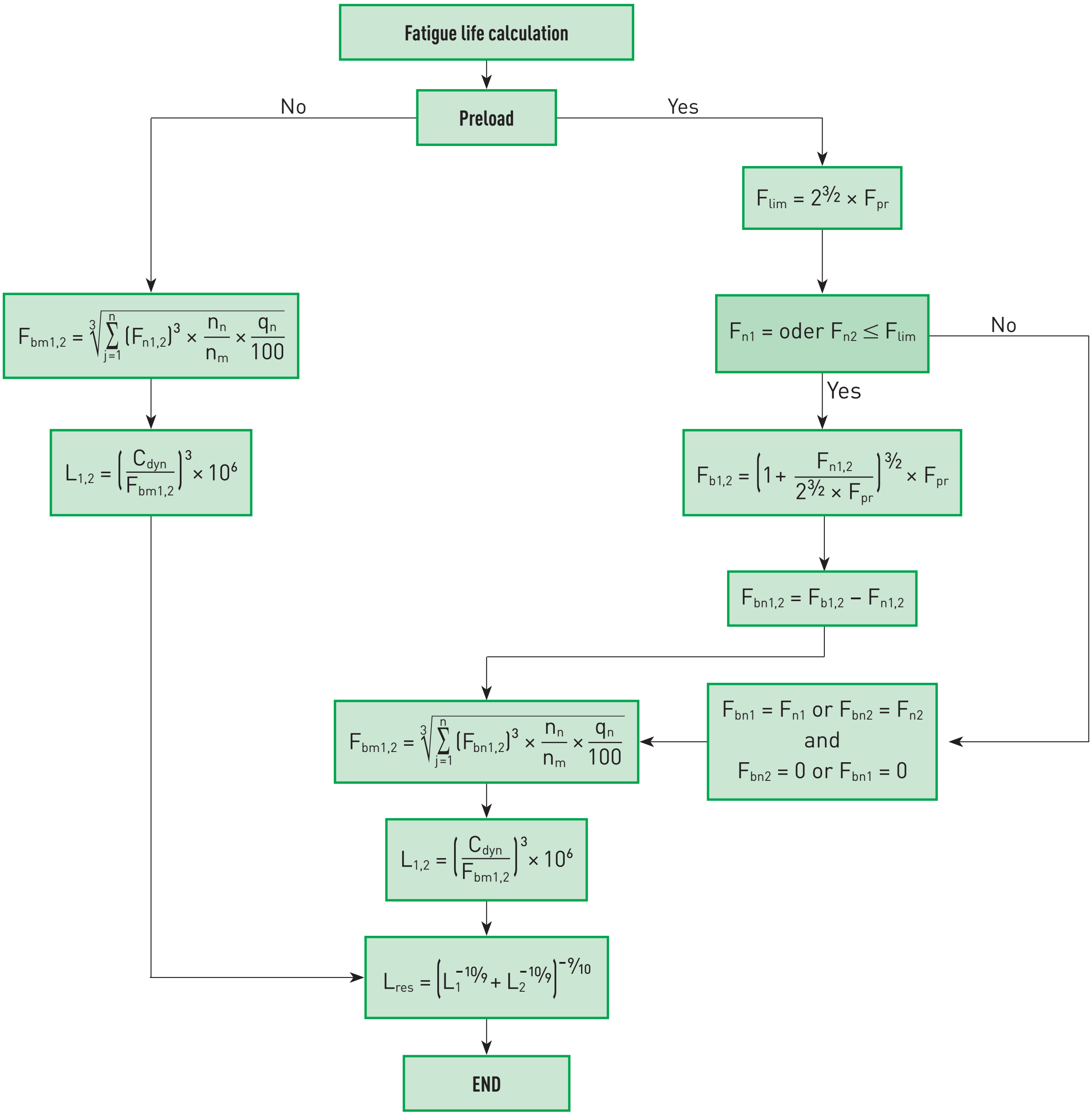
$$L_m = L \times f_r \qquad L_{hm} = L_h \times f_r$$

f_r Reliability factor (see Table 3.13)

Table 3.13 **Reliability factors for service life calculation**

Reliability %	Reliability Factor f_r
90	1.00
95	0.63
96	0.53
97	0.44
98	0.33
99	0.21

Flow chart for fatigue life calculation



3.7.3 Torque and power to the motor

Fig. 3.22 shows the relevant parameters of a ballscrew feed system.
Below is the formula for calculating the required motor torque

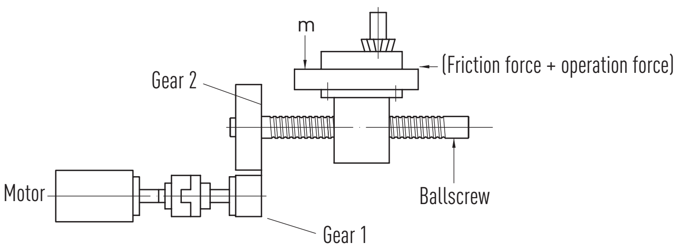


Fig. 3.22 **Simplified diagram of a ballscrew system**

- Direct drive system (conversion of rotary motion into linear motion)

F 3.15
$$T_a = \frac{F_w \times P}{2{,}000 \times \pi \times \eta_1}$$

T_a Motor torque for direct system [Nm]
T_c Motor torque for reverse system [Nm]
F_w Total axial force [N], friction force + work force
P Pitch [mm]
η_1 Direct mechanical efficiency (0.85–0.95)
η_2 Reverse mechanical efficiency (0.75–0.85)

- Reverse transmission system (conversion of linear motion into rotary motion)

F 3.16
$$T_c = \frac{F_w \times P \times \eta_2}{2{,}000 \times \pi}$$

- Total motor torque for uniform motion

F 3.17
$$T_M = (T_a + T_b + T_d)\,\frac{N_1}{N_2}$$

T_M Motor drive torque [Nm]
T_b Support bearing friction torque [Nm]
T_d Preload torque[Nm]
N_1 Number of teeth per gear 1 (Pinion)
N_2 Number of teeth per gear 2 (Crown)

In the case of accelerated motion:

F 3.18
$$T'_a = J \times \alpha$$

T'_a Torque due to acceleration [Nm]
J System inertia [Kg m²]
α Angular acceleration [rad/s²]
t_a Acceleration time [s]
n_1 Initial speed [1/min]
n_2 Final speed [1/min]

F 3.19
$$\alpha = \frac{2\pi \times \Delta n}{60 \times t_a}$$

F 3.20
$$\Delta n = n_2 - n_1$$

F 3.21
$$J = J_M + J_{G1} + J_{G2} \times \left(\frac{N_1}{N_2}\right)^2 + \frac{1}{2} m_r \times \left(\frac{d_n}{2000}\right)^2 \times \left(\frac{N_1}{N_2}\right)^2 + m_l \times \left(\frac{P}{2000\pi}\right)^2 \times \left(\frac{N_1}{N_2}\right)^2$$

= motor inertia + equivalent transmission inertia + ballscrew inertia (see Fig. 3.22)

m_r Mass of rotating parts [kg]
m_l Mass of components with linear motion [kg]
d_n Nominal ballscrew diameter [mm]
J_M Motor inertia [kgm²]
J_{G1} Pinion inertia [kgm²]
J_{G2} Crown inertia [kgm²]

- Total torque

F 3.22
$$T_{Ma} = T_M + T'_a$$

T_{Ma} Total torque [Nm]

- Motor power

F 3.23

$$P_A = \frac{T_{pmax} \times n_{max}}{9{,}550}$$

P_A Maximum power [kW]
T_{pmax} Maximum motor torque (safety factor × T_{max}) [Nm]
n_{max} Maximum speed [rpm]
t_a Acceleration time [s]
J Total moment of inertia [kgm²]
T_{M1} Total torque [Nm]
T_L Torque with uniform motion[Nm]
f Safety factor = 1.5

- Calculation of acceleration time

F 3.24

$$t_a = \frac{J}{T_{M1} - T_L} \times \frac{2\pi \times n_{max}}{60} \times f$$

3.7.4 Peak load

F 3.25

$$F_k = 4.072 \times 10^5 \left(\frac{f_k \times d_k^4}{l_s^2}\right)$$

F 3.28

$$F_{kmax} = 0.5 \times F_k$$

F_k Peak load [N]
F_{kmax} Maximum permissible load [N]
d_k Core diameter of the screw shaft [mm]
l_s Unsupported screw length[mm] (see Fig. 3.23)
f_k Specific factor for the type of support (peak load)

Fixed - Fixed	f_k = 1.0
Fixed – Supported	f_k = 0.5
Supported – Supported	f_k = 0.25
Fixed – Free	f_k = 0.0625

3.7.5 Critical shaft speed

F 3.26

$$n_k = 2.71 \times 10^8 \left(\frac{f_n \times d_k}{l_s^2}\right)$$

F 3.27

$$n_{kmax} = 0.8 \times n_k$$

n_k Critical shaft speed[rpm]
n_{kmax} Maximum permissible speed [rpm]
d_k Core diameter of the screw shaft [mm]
l_s Distance between supports [mm] (see Fig. 3.23)
f_n System type-specific factor (critical speed)

Fixed - Fixed	f_n = 1.0
Fixed – Supported	f_n = 0.692
Supported – Supported	f_n = 0.446
Fixed – Free	f_n = 0.147

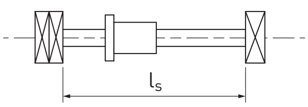


Fig. 3.23 **Distance between supports**

* For more details please refer to page 65 of the following catalogue

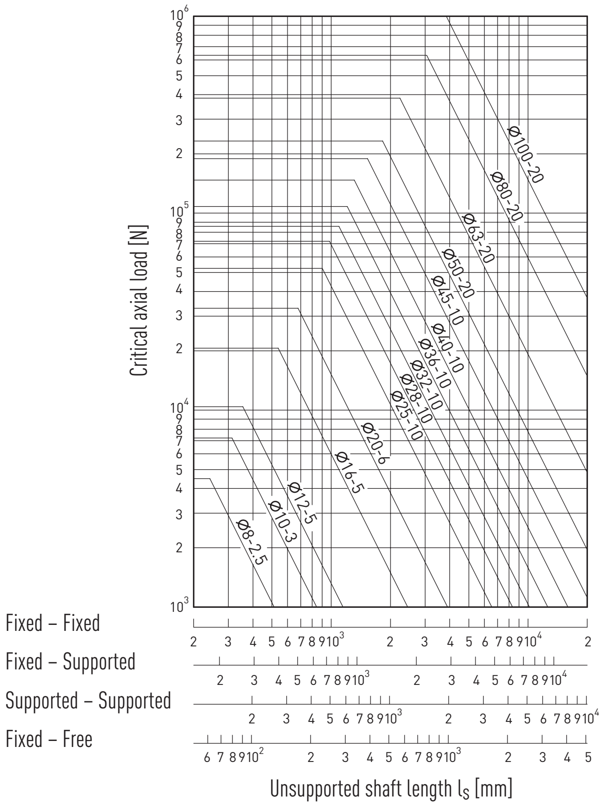


Fig. 3.24 **Peak load for shaft diameters and lengths**

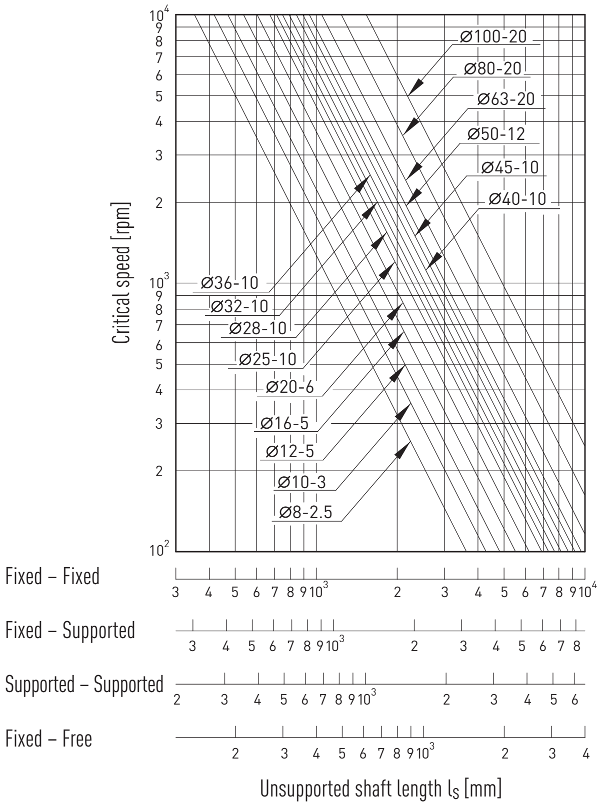


Fig. 3.25 **Critical speed for different shaft diameters and lengths**

3.7.7 Critical speed of the nut: Value D_N

The D_N value has a significant influence on the noise level generated by the ballscrew, the operating temperature and the service life of the recirculation system. It depends mainly on the type of recirculation adopted (see par.3.4), but also on the type of screw used, lubrication, etc.
The following values apply to HIWIN ballscrews

F 3.29 $$D_N = d_s \times n_{max}$$

d_s Shaft diameter [mm]
n_{max} Max. speed [rpm]

$_{DN} \leq$ 70,000 - 90,000 for rolled screws
$_{DN} \leq$ 90,000 - 120,000 for peeled and ground screws
$_{DN} \leq$ 180,000 for high speed ballscrews

3.7.6 Stiffness

Stiffness describes the failure of a machine component in the presence of a force. The overall stiffness of a ballscrew is given by the axial stiffness of the nut-shaft system, the contact stiffness of the raceway and the shaft stiffness. When selecting a ballscrew in a project, the stiffness of the support bearings and the mounting conditions of the nut on machine surfaces, etc. must also be taken into account.
The stiffness of the nut-shaft unit, the balls and the raceway can be combined to obtain the nut stiffness Rn. These values are listed in the dimensional tables for the various nut types.

- Stiffness of a ballscrew

F 3.30 $$\frac{1}{R_{bs}} = \frac{1}{R_s} + \frac{1}{R_n}$$

R_{bs} Overall stiffness of the ballscrew [N/μm]
R_s Threaded shaft stiffness [N/μm]
R_n Nut stiffness [N/μm]

- Threaded shaft stiffness

F 3.31

$$R_{s1} = \frac{\pi \times d_c^2 \times E}{4 \times l_1 \times 10^3}$$

Fixed - Radial/Free

F 3.32

$$R_{s2} = \frac{\pi \times d_c^2 \times E}{4 \times l_1 \times 10^3} \times \frac{l_2}{l_2 - l_1}$$

Fixed - Fixed

F 3.33

$$d_c = PCD - D_k \times \cos\alpha$$

R_s Shaft stiffness [N/μm]
d_c Diameter on which the force acts (mm)
E Elastic modulus [N/mm²]
α Contact angle between balls and track [°]
PCD Diameter of ball centres [mm]
D_k Nominal ball diameter [mm]
l_1 Distance between support and nut [mm]
l_2 Distance between support and support [mm]

- Nut stiffness

Nut stiffness is measured using an axial force equal to the maximum possible preload of 10% of the dynamic load (Cdyn) and this value is given in the dimensional tables for each type of nut. When the preload is less than this value, the nut stiffness is calculated using the following relationship

F 3.34

$$R_n = 0.8 \times R \times \left(\frac{F_{pr}}{0.1 \times C_{dyn}}\right)^{1/3}$$

R_n Nut stiffness[N/μm]
R Stiffness from dimensional table [N/μm]
F_{pr} Preload force [N]
C_{dyn} Dynamic load from dimensional table [N]
F_{bm} Average axial force acting on the nut

The stiffness of a single nut with play can be calculated as follows, with an external axial force equal to 0.28_{Cdyn}:

F 3.35

$$R_n = 0.8 \times K \times \left(\frac{F_{bm}}{0.28 \times C_{dyn}}\right)^{1/3}$$

The axial stiffness of the entire drive system also includes, as mentioned, the stiffness of the support bearings and that of the nut mounting surface. The total stiffness must be taken into account when designing a system.

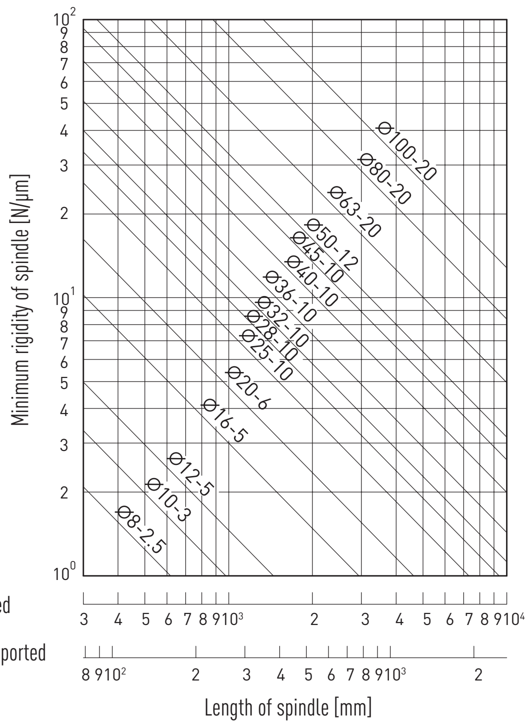
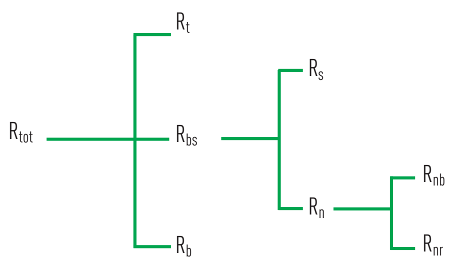


Fig. 3.26 **Shaft stiffness graph**



Rtot Total stiffness of the drive system
Rt Stiffness of the mounting surface
Rb Stiffness of support bearings
Rbs Ballscrew stiffness
Rs Stiffness of the threaded shaft
Rn Ballscrew nut stiffness
Rnb Ball and track stiffness
Rnr Stiffness of the nut-shaft unit

Fig. 3.27 **Stiffness distribution for ballscrew drive systems**

3.7.8 Thermal expansion

The increased temperature of the ballscrew shaft during operation affects the accuracy of the entire machine drive system, as thermal stress stretches the threaded shaft.
The following factors influence the temperature rise in ballscrews:
1) Preload
2) Lubrication
3) Shaft dilatation

As an example, Fig. 3.28 shows the relationship between working speed, preload and temperature rise, while Fig. 3.29 shows the temperature increase in the nut depending on the value of the resistant torque

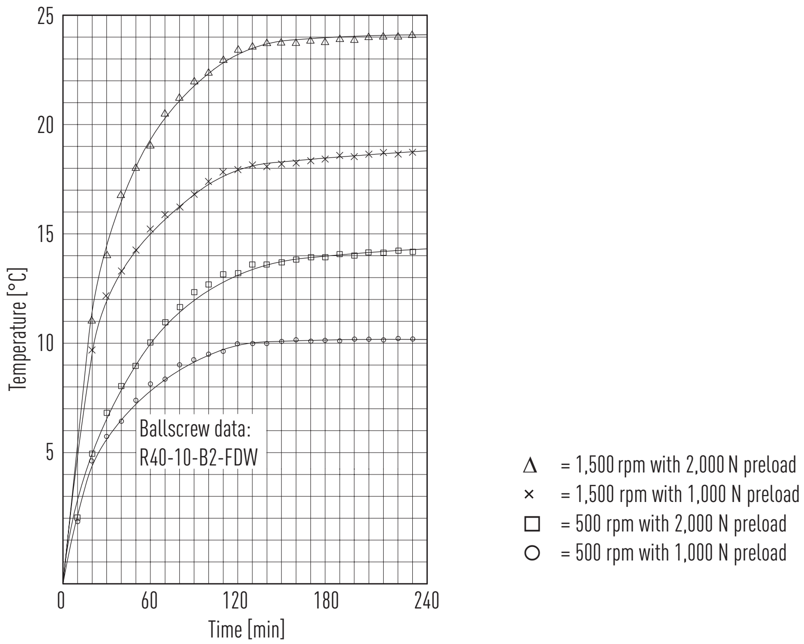


Fig. 3.28 **Relationship between working speed, preload and temperature rise**

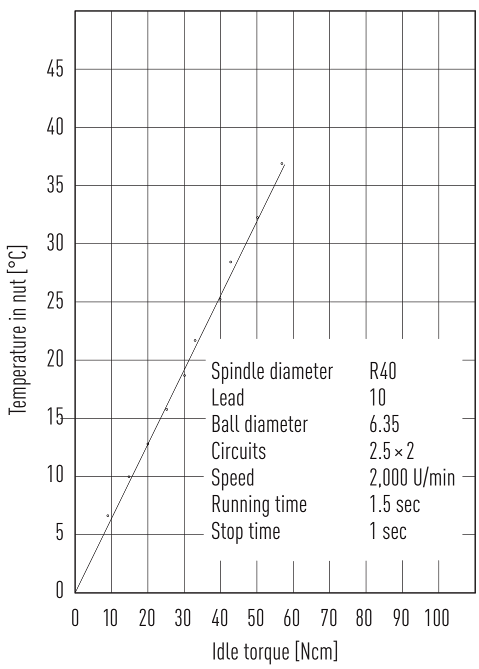


Fig. 3.29 **Relationship between the temperature rise in the ballscrew and the resistant torque**

The thermal expansion of the threaded shaft can be calculated using formula F 3.36
Expansion can be compensated for by prior tensioning of the shaft. For further information, please contact HIWIN.

F 3.36

$$\Delta L = 11.6 \times 10^{-6} \times \Delta T \times l_{s;total}$$

ΔL Thermal expansion of threaded shaft [mm]
ΔT Threaded shaft temperature rise [°C]
$L_{s;total}$ Shaft length + terminal (left/right) [mm]

3.8 Materials and heat treatment

3.8.1 Component materials
The materials used for the production of threaded shafts, nuts and balls are quenched and tempered, case-hardened and structural steels typical of bearings. Each HIWIN production plant worldwide uses material reference codes (ISO, DIN, JIS) depending on the place of origin, so please ask the HIWIN subsidiary in Italy for more details.

3.8.2 Heat treatment
Table 3.15 shows the hardness of the main components of HIWIN ballscrews. The surface hardness of the ballscrew affects both the dynamic load value and the static load value. The dynamic and static load values given in the dimensional table refer to a surface with HRC 60 hardness. If the surface hardness is lower than this value, the dynamic and static loads must be recalculated according to the following formula:

F 3.37

$$C_0' = C_0 \times f_{H0} \qquad f_{H0} = \left(\frac{\text{real hardness (HRC)}}{60} \right)^3 \leq 1$$

Hardness levels f_H and f_{H0}

C_0' Recalculated static load

C_0 Static load at 60 HRC

F 3.38

$$C' = C_{dyn} \times f_H \qquad f_H = \left(\frac{\text{real hardness (HRC)}}{60} \right)^2 \leq 1$$

C' Recalculated dynamic load

C_{dyn} Dynamic load at 60 HRC

Table 3.15 **Hardness of individual HIWIN ballscrew components**

Components	Treatment method	Hardness (HRC)
Shaft	Induction	58 – 62
Nut	Carburizing or induction hardening	58 – 62
Ball	Carbocementation	62 – 66

3.9 Lubrication
HIWIN ballscrews require appropriate lubrication by grease, semi-fluid grease or oil, depending on the application. They are supplied in standard packaging and must never be put into service without initial lubrication. For information on initial lubrication, the amount of lubricant to be used and the frequency of lubrication, please refer to the assembly instructions for "Ballscrews".

Table 3.16 **Lubricant Inspection and refuelling methods**

Lubrication method	Control instructions
Oil	Check the oil level in the ECU tank and the presence of contaminants once a week. In case of contamination, change the oil.
Grease	Check for contamination in the grease every 2-3 months. In the event of contamination, remove the grease and replace it with new grease. Change the grease every year.

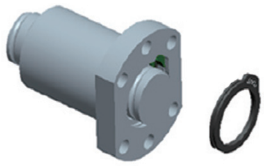
3.10 Seals

POM SEAL

The POM seal is the most traditional one, combining nut protection with maximum smoothness as it does not operate with sliding.

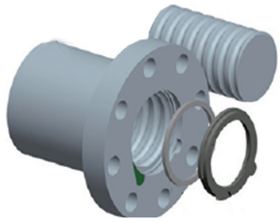
EW SEAL

The EW seal, made of TPU, is designed to protect the nut in the best possible way even in harsh environments such as woodworking machines, plastics, etc.



NW SEAL

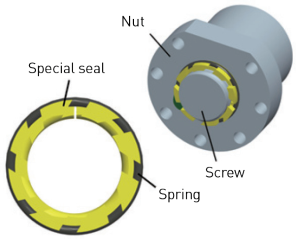
The NW seal, made of NBR, has always been suitable for protecting the nut in all industrial applications, from automation to all types of machineryi.



SPECIAL SEALS

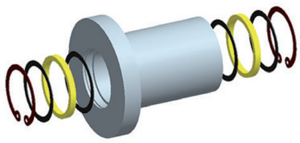
SS SEAL

The SS seal, consisting of a toothed NBR seal and a sealing spring, acts directly on the screw grooves and removes external agents, thus facilitating nut protection



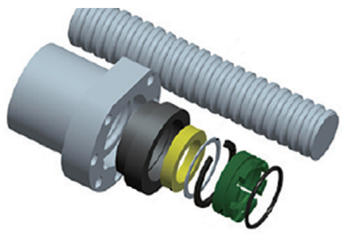
SP SEAL

The SP seal, with felt, replicates the profile of the screw groove and offers high protection and temperature resistance



SH SEAL

The SH seal, a combination of the SS and SP seals, offers the highest possible protection to the nut



Features and applications of screws for dusty environments

	Aluminium and iron shavings	Wood shavings	Aluminium and iron dust	Wood dust	Graphite or acrylic dust (talc-like)
	150-100 µm		50-30 µm		50-30 µm
SS	→				
NW	→	→			
EW			→	→	
SP				→	→
SH			→	→	→

4. Rolled Ballscrews

4.1 Properties

One of the advantages of rolled recirculating ballscrews is that the feed systems on which they are used have less friction, are quieter and perform better than those with sliding screws. HIWIN uses state-of-the-art technology for the rolling process and adopts strict control procedures for material selection, rolling itself, heat treatment, machining and assembly.

The flexibility of use of HIWIN rolled ballscrews allows them to be used in virtually all industrial sectors. Screws with shaft diameters from 8mm to 80mm are always kept in stock and are thus readily available with or without end machining. Standard complete bearings can be combined with standardised ends, allowing HIWIN to supply complete ballscrew systems.

4.2 Tolerance classes

Table 4.1 shows the tolerance classes for rolled ballscrews. Pitch accuracy is determined by the cumulative pitch error over any length of 300 mm.
The deviation along the entire length of the useful stroke is calculated using formula F 3.1 a on Page 13.

Table 4.1 **Tolerance classes for rolled ballscrews**

Stroke deviation over 300mm	Tolerance class	
	T5	**T7**
v_{300p}	0.023	0.052

Unit: mm

Table 4.2 **Range of rolled ballscrews available**

Nominal diameter	Pitch 1	1.25	2	2.5	3	4	5	5.08	6	8	10	12	16	20	25	30	32	36	40	50	63	64	80	100	* Maximum length
6	●	●	●																						800
8	●		●	■☆	●		●																		800
10			■☆	■	●	●	●		●		●			●											1500
12			●☆	■	●	■	☆	●	●	●	☆	☆													1500
14				■	●	●	■				●														3000
15							☆/■				☆		☆	●		●			●						3000
16	●		■	■		●	☆/■	●	●	●	☆/■	●	●				●								3000
18										●															3000
20				■		●	☆/■	■	●	●	☆			☆					●	●					3000
22																									3000
25				●		■	☆/■	■	●	●	☆/■			●	☆					●					4500
28							■		●		●														4500
32						■	☆/■	■	●	●	☆/■	●		☆	●		☆		●			●			4500
36							●		●	●	■	●		●				●							4500
38											☆/■		●	☆					☆						5600
40							☆/■		●	●	☆/■	●	●		●				●				●		5600
45											■	●		●											5600
48											☆			☆											5600
50							☆		●		☆/■	●	●	●		●			☆	☆				●	5600
55									●		●														5600
63											☆/■	●	●	☆/■					●		●				5600
80											☆	●	●	●☆		●									5600

*For longer lengths, please request information

■ :Left or right screw
● :Right screw only. Contact Hiwin for special requests.
☆ :Right screw in stock at Hiwin Italy.
☆/■ :Right screw in stock at Hiwin Italia, left screw available on request.

4.3 Ordering codes for rolled screws and ballscrews

To clearly identify the ballscrew, information on the ballscrew shaft and nut is required.

[info required] [info from catalogue] [shaft info] [info optional]

RBS		R	40	10	T4		F	S	I	NW	800	1000	0.052	INFO

Type of shaft
RBS: Rolled
GBS: Ground
PBS: Peeled

Type of principles
(see descriptions on pages 5 and 6)
No number: one principle
2: two principles
4: four principles

Thread type
R: Right-hand screw
L: Left-hand screw

Nominal diameter

Pitch

Circuits per rpm

T3: 3x1	**K3:** 1x3
T4: 4x1	**K4:** 1x4
T5: 5x1	**K5:** 1x5
T6: 6x1	**K6:** 1x6

Type of nut principles
No code: the balls work on one screw principle
D: the balls work on two principles simultaneously

Nut shape
R: Round
F: With flange

Nut play
Nhe code: std play
Controlled play: ≤ 0,01mm
Backlash**0:** no backlash (ISO 5 only)
Light preload: 2-3% C (ISO 5 only)

Nut dimensions
No code: DIN std with flange
NTD_: nut body diameter
NTL_: nut length

For non-flanged nut
KEY: with key
THREAD: with thread

Precision
0.052: corresponding ISO 7
0.023: corresponding ISO 5

Total Length

Thread Length

Types of seals
EW: TPU seal
NW: NBR seal
SP: felt seal
No code: nylon seal

Recirculation types
I: Internal deflector
C: Super S series with connection cassette

Type of nut
S: Single nut
D: Double nut

Shaft-only coding *

RBS		R	40	10	800	1000	0.052

Nut-only coding

RBS		R	40	10	T4		F	S	I	NW

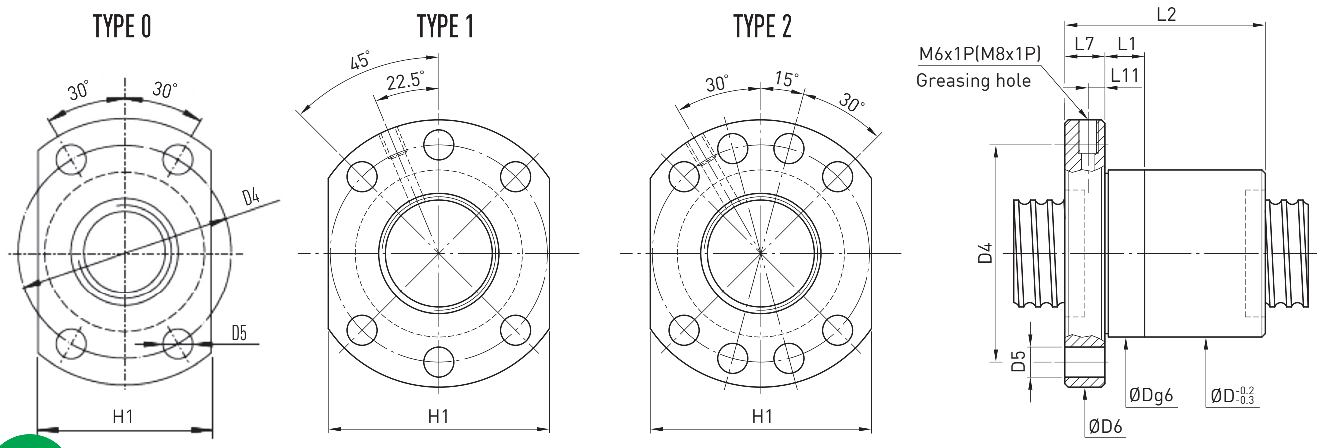
*It is possible to order the shaft only, but it is necessary to indicate the nut code

Table 4.3 **Overview of nut profiles**

Nut coding	Description
FSI	Single flange nut with single internal recirculation
FSC	Single flanged nut with cassette recirculation
CSR-RSC	Single cylindrical nut with key
CSR-RSB	Single cylindrical nut with thread
RSZ/FSZ	Z-series miniature nut

4.4 Nuts for rolled ballscrews

4.4.1 Single flange nuts FSC (DIN 69051 PART 5 FORM B)

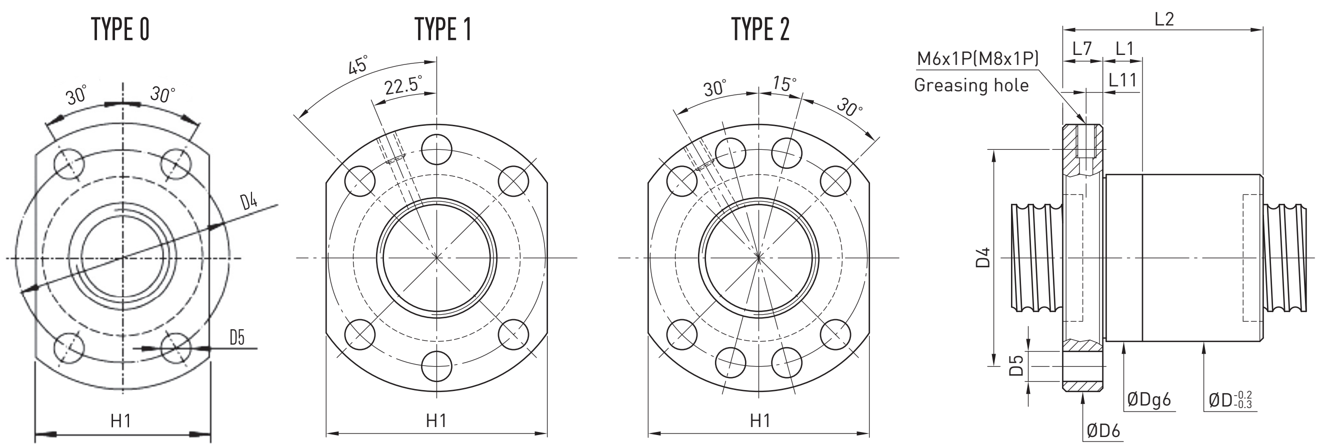


STOCK

Description	Measurements Ø Nominal	Measurements Pitch	Ball	Ball rpm	Dynamic load coeff. C(kfg)	Static load coeff. C0(kfg)	Nut D(g6)	Nut L1	Nut L2	Flange Type	Flange H1	Flange D6	Flange L7	Flange D4	Flange D5	Flange L11	Flange greasing hole
R12-5K4-FSCEW	12	5	2	4	560	1200	24	8	35	0	26	40	8	32	4.5	4	M3x0.5P
R12-10K3-FSCEW	12	10	2.381	3	520	1030	24	8	45		26	40	8	32	4.5	4	M3x0.5P
R15-5K4-FSCEW	15	5	3	4	1290	2140	28	10	38		40	48	10	38	5.5	5	M6x1P
2R15-10K3-FSCEW **	15	10	3	3	1010	1670	28	10	45		40	48	10	38	5.5	5	M6x1P
2R15-10K6-DFSCEW**	15	10	3	6	1470	3340	28	10	50		40	48	10	38	5.5	5	M6x1P
4R15-16K3-FSCEW **	15	16	3	3	1010	1730	28	10	61		40	48	10	38	5.5	5	M6x1P
4R15-16K4-DFSCEW **	15	16	3	4	1250	2220	28	10	45		40	48	12	38	5.5	6	M5x0.8P
R20-5K4-FSCEW	20	5	3	4	1500	2930	36	10	40		44	58	10	47	6.6	5	M6x1P
R20-10K3-FSCNW	20	10	3.175	3	990	2260	36	10	48		44	58	10	47	6.6	5	M6x1P
4R20-20K4-DFSC	20	20	3.175	4	1250	3110	36	25	57		44	58	12	47	6.6	6	M6x1P
4R20-20K4-DFSCEW*	20	20	3.175	4	1250	3110	36	10	57	1	44	58	10	47	6.6	4	M6x1P
R25-5K4-FSCEW	25	5	3	4	1670	3700	40	10	45		48	62	10	51	6.6	5	M6x1P
R25-10K4-FSCEW	25	10	3	4	1630	3520	40	10	64		48	62	10	51	6.6	5	M6x1P
4R25-25K4-DFSCEW	25	25	3.175	4	1720	3900	40	10	69		48	62	10	51	6.6	5	M6x1P
R32-5K4-FSCEW	32	5	3.175	4	2070	5360	50	10	48		62	80	12	65	9	6	M6x1P
R32-5K6-FSCEW	32	5	3.175	6	2980	8190	50	10	38		62	80	12	65	9	6	M6x1P
R32-10K5-FSCEW	32	10	3.969	5	3390	8160	50	10	77		62	80	12	65	9	6	M6x1P
2R32-20K3-FSCEW **	32	20	3.969	3	2130	4890	50	20	84		62	80	12	65	9	6	M6x1P
2R32-20K6-DFSCEW **	32	20	3.969	6	3870	9780	50	20	84		62	80	12	65	9	6	M6x1P
4R32-32K4-DFSCEW **	32	32	3.969	4	2100	6350	50	20	88		62	80	12	65	9	6	M6x1P
R38-10K5-FSCEW	38	10	6.35	5	5560	15680	63	16	80		70	93	14	78	9	7	M8x1P
R38-10K5-FSCNW	38	10	6.35	5	5560	15680	63	16	80		70	93	14	78	9	7	M8x1P
2R38-20K4-FSCEW	38	20	6.35	4	4490	12290	63	25	108		70	93	14	78	9	7	M8x1P
2R38-20K4-FSCNW	38	20	6.35	4	4490	12290	63	25	108		70	93	14	78	9	7	M8x1P
2R38-20K6-DFSCEW	38	20	6	6	6270	18120	63	25	88		70	93	14	78	9	7	M8x1P
4R38-40K4-DFSCEW	38	40	6.35	4	4230	11820	63	45	102		70	93	15	78	9	7	M8x1P
4R38-40K4-DFSCNW	38	40	6.35	4	4230	11820	63	45	102	2	70	93	15	78	9	7	M8x1P
R40-5K5-FSCNW	40	5	3.175	5	2200	8320	63	20	45		70	93	14	78	9	7	M8x1P
R40-5K6-FSCEW	40	5	3.175	6	2590	10060	63	10	50		70	93	14	78	9	7	M8x1P
2R40-20K4-FSC ***	40	20	6.35	4	4600	13010	65	25	108		70	93	14	78	9	7	M8x1P
R48-10K6-FSCNW	48	10	6.35	6	7330	24280	75	20	90		85	110	16	93	11	8	M8x1P
2R48-20K5-FSCNW	48	20	6.35	5	6180	19970	75	25	132		85	110	18	93	11	9	M8x1P
R50-5K6-FSCNW	50	5	3.175	6	2830	12720	75	10	50		85	110	16	93	11	8	M8x1P
4R50-40K6-DFSCEW	50	40	6.35	6	7170	24750	75	45	149	0	85	110	18	93	11	9	M8x1P
4R50-50K4-DFSC***	50	50	6.35	4	4800	15660	90	45	128		104	135	20	112	14	10	M8x1P
R63-10K6-FSC	63	10	6.35	6	8170	31750	90	25	94		95	125	18	108	11	9	M8x1P
4R63-40K6-DFSC	63	40	6.35	6	7910	31080	95	25	150	2	100	135	20	115	13.5	10	M8x1P
R80-10K6-FSC ***	80	10	6.35	6	9130	41300	105	16	90		110	145	20	125	13.5	8	M8x1P
R80-20K6-FSC	80	20	9.525	6	16030	61720	125	25	162		130	165	25	145	13.5	12.5	M8x1P

Notes: * Also available with NW seals ** Dimensions standardised to Ø 15 or Ø 32; DIN standards, only for pitches >5 and >10, respectively, indicate larger dimensions. HIWIN is also available to supply these versions
*** Non-DIN-compliant nut

4.4.2 Single flange nut FSI (DIN 69051 Part 5 Form B)

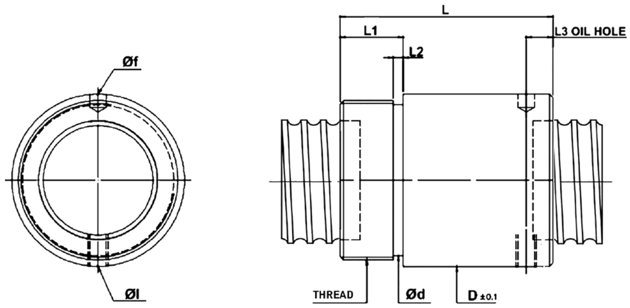


STOCK

Description	Measurements		Ball	Ball rpm	Dynamic load coeff. C(kfg)	Static load coeff. C0(kfg)	Nut			Flange							
	Ø Nominal	Pitch					D(g6)	L1	L2	Type	H1	D6	L7	D4	D5	L11	greasing hole
R8-2,5T3-FSI	8	2.5	1.5	3	147	222	16	22	28	0	19	28	6	22	3.4	3	M4x0.7P
R10-2T3-FSI ***	10	2	1.5	3	169	295	18	20	28	3	-	35	8	27	4.5	4	Ø4.5 PASS.
R12-2T3-FSI ***	12	2	1.5	3	197	386	20	23	28	0	24	37	5	29	4.5	4	Ø4.5 PASS
R16-5T3-FSI	16	5	3.175	3	664	1195	28	10	40	1	40	48	10	38	5.5	5	M6x1P
R16-10T3-FSI **	16	10	3.175	3	623	1102	28	10	60		40	48	10	38	5.5	5	M6x1P
R20-5T3-FSI	20	5	3.175	3	733	1495	36	10	44		44	58	10	47	6.6	5	M6x1P
R20-5T4-FSI	20	5	3.175	4	938	1993	36	10	52		44	58	10	47	6.6	5	M6x1P
R20-10T3-FSI	20	10	4.763	3	1149	2042	36	10	60		44	58	10	47	6.6	5	M6x1P
R25-5T3-FSI	25	5	3.175	3	879	2082	40	10	44		48	62	10	51	6.6	5	M6x1P
R25-5T4-FSI	25	5	3.175	4	1127	2776	40	12	52		48	62	10	51	6.6	5	M6x1P
R25-10T3-FSI	25	10	4.763	3	1430	2913	40	16	65		48	62	10	51	6.6	5	M6x1P
R32-10T4-FSI	32	10	6.35	4	2899	6404	50	16	85		62	80	12	65	9	6	M6x1P
R32-10T6-FSI	32	10	6.35	6	4109	9606	50	12	110		62	80	12	65	9	6	M6x1P
R32-5T6-FSINW	32	5	3.175	6	1829	5544	50	12	66		62	80	12	65	9	6	M6x1P
R40-10T4-FSI	40	10	6.35	4	3396	8488	63	16	87	2	70	93	14	78	9	7	M8x1P
R40-10T4-FSINW	40	10	6.35	4	3396	8488	63	16	87		70	93	14	78	9	7	M8x1P
R40-10T6-FSINW	40	10	6.35	6	4812	12732	63	16	108		70	93	14	78	9	7	M8x1P
R40-5T4-FSI	40	5	3.175	4	1414	4621	63	10	53		70	93	14	78	9	7	M8x1P
R40-5T6-FSI	40	5	3.175	6	2990	11650	63	10	66		70	93	14	78	9	7	M8x1P
R50-10T3-FSI	50	10	6.35	3	3045	8334	75	16	78		85	110	16	93	11	8	M8x1P
R50-10T4-FSI	50	10	6.35	4	3899	11112	75	16	89		85	110	16	93	11	8	M8x1P
R50-5T4-FSI	50	5	3.175	4	1562	5939	75	10	57		85	110	16	93	11	8	M8x1P
R50-5T6-FSI	50	5	3.175	6	2213	8909	75	10	70		85	110	16	90	11	8	M8x1P
R50-20T4-FSI	50	20	9.525	4	8306	21608	75	16	149		85	110	16	93	11	8	M8x1P
R63-16T5-FSI***	63	16	9.525	5	12056	37162	100	20	153	3	-	148	22	123	13	11	1/8PTx10DP
R63-20T5-FSI	63	20	9.525	5	11536	35194	95	25	175	2	100	135	20	115	13.5	10	M8x1P

Notes:
* Also available with NW seals
** Dimensions standardised to Ø 15 or Ø 32; DIN standards, only for pitches >5 and >10, respectively, indicate larger dimensions. HIWIN is also available to supply these versions
*** Non-DIN-compliant nut

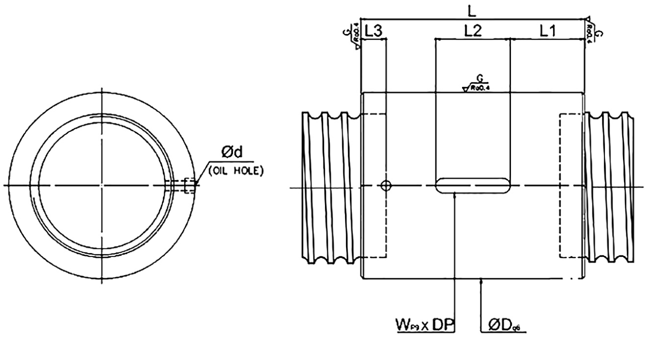
4.4.3 RSI/RSB threaded nuts



STOCK

Description	Measurements		Ball	Ball rpm	Dynamic load coeff. C(kfg)	Static load coeff. C0(kfg)	Nut								
	Ø Nominal	Pitch					D	L	Thread	L1	L2	Ød	Øf	L3	Øl
R10-2T3-RSI	10	2	1.5	3	169	295	19.5	28	M17x1P	7.5	2	15.5	-	-	2P
R10-3T2-RSI	10	3	2.381	2	197	283	21	29	M18x1P	9	3	16.5	3.2x2.5DP	2.5	-
R12-2T3-RSI	12	2	1.5	3	197	386	20	28	M18x1P	8	2	16.5	-	-	2P
R12-5T3-RSI	12	5	2	3	265	461	25.5	39	M20x1P	10	2	18	3x3DP	4	-
2R12-10T3-DRSI	12	10	2.381	3	247	387	22	45	M20x1P	10	2	18	2.5x2.5DP	7	-
R16-5T5-RSI	16	5	3.175	5	1030	1992	32.5	56	M26x1.5P	12	4	23.5	4x3DP	4	2.5P
R16-10T3-RSI	16	10	3.175	3	623	1102	32	64	M26x1.5P	12	2.5	23.5	4x3DP	7	2.5P
R20-5T5-RSI	20	5	3.175	5	1137	2941	38	58	M35x1.5P	12	3	32.5	4x3.5DP	8	M6x1P
R20-10T3-RSI	20	10	4.763	3	1149	2042	38	67	M35x1.5P	12	3	32.5	4x3.5DP	12	M6x1P
R25-5T6-RSI	25	5	3.175	6	1597	4164	43	67	M40x1.5P	19	4	37.5	5x4DP	8	M6x1P
R25-10T4-RSI	25	10	4.763	4	1832	3885	43	85	M40x1.5P	19	4	37.5	5x4DP	12	M6x1P
R32-5T5-RSI	32	5	3.175	5	1563	4620	52	64	M48x1.5P	19	3	45.5	5x4DP	8	M6x1P
R32-10T4-RSI	32	10	6.35	4	2899	6404	54	95	M48x1.5P	19	4	45.5	8x4DP	15	M6x1P
R40-10T5-FSI	40	10	6.35	5	6418	17755	65	110	M60x2P	24	3	57.6	8x4.5DP	15	-
R50-20T5-RSI	50	20	9.525	5	10063	27010	80	176	M72x1.5P	30	4	69.5	-	-	M8x1P

4.4.4 Nuts with RSI/RSC key

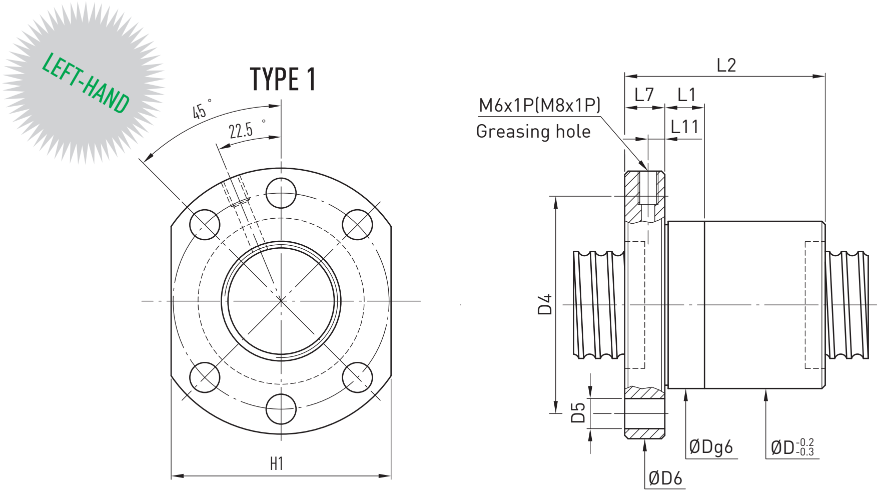


STOCK

Description	Measurements		Ball	Ball rpm	Dynamic load coeff. C(kfg)	Static load coeff. C0(kfg)	Nut				Key			
	Ø Nominal	Pitch					D (g6)	L	L3	Ød	W (p9)	DP	L2	L1
R8-2.5T3-RSI	8	2.5	1.5	3	147	222	16	16	3.5	2	3	1.8	6	5
R12-5K3-RSC	12	5	2	3	430	900	24	28	3.5	2	5	3	12	8
2R12-10K2-RSCNW	12	10	2.381	2	360	660	24	33	3.5	2	5	3	12	10.5
R15-5K4-RSCEW-E	15	5	3	4	1290	2140	28	35	7	4	5	3	12	14.5
2R15-10K3-RSC	15	10	3	3	810	1670	28	45	9.5	4	5	3	16	14.5
R16-5T4-RSI	16	5	3.175	4	851	1594	28	48	7	4	5	3	12	14.5
R16-10T3-RSI	16	10	3.175	3	623	1102	28	45	9.5	4	5	3	16	14.5
R20-5T4-RSI	20	5	3.175	4	938	1993	33	45	8	4	5	2	20	12.5
R20-10K4-RSC	20	10	3.175	4	1280	3070	36	60	12	4	4	3	20	20
R25-5K4-RSC	25	5	3	4	1340	3700	38	45	9.5	4	5	3	16	14.5
R25-10K4-RSC	25	10	3	4	1330	3680	38	64	9.5	4	5	3	20	22
R32-5K5-RSC	32	5	3.175	5	2030	6780	48	48	9.5	4	5	3	20	14
R32-10K5-RSC	32	10	3.969	5	3390	8160	48	73	9.5	4	5	3	20	28.5
R38-10K4-RSC	38	10	6.35	4	4550	12410	63	70	14	4	5	3	20	25
2R38-20K4-DRSC	38	20	6.35	4	4290	11640	63	70	7.5	4	6	3.5	30	20
R40-5K6-RSC	40	5	3.175	6	2590	10060	56	54	9.5	4	5	3	20	17
R48-10K6-RSC	48	10	6.35	6	7330	24280	75	90	10	4	6	3.5	30	30
2R48-20K4-RSC	48	20	6.35	4	5050	15810	75	112	12	4	6	3.5	40	36

HIWIN srl is available to evaluate the production of nuts with different geometries, loads or seals.

4.4.5 Single flange nuts FSC/FSI

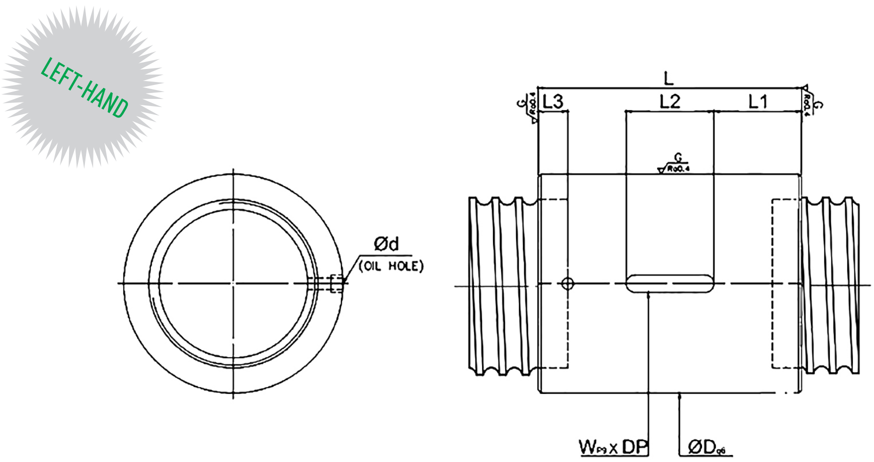


STOCK

Description	Measurements		Ball	Ball rpm	Dynamic load coeff. C(kfg)	Static load coeff. C0(kfg)	Nut			Flange							
	Ø Nominal	Pitch					D (g6)	L1	L2	Tipo	H1	D6	L7	D4	D5	L11	Greasing hole
L15-5K4-FSCEW	15	5	3	4	1290	2140	28	10	38	1	40	48	10	38	5,5	5	M6x1P
L20-5T4-FSI	20	5	3.175	4	938	1993	36	10	52	1	44	58	10	47	6,6	5	M6x1P
L25-5T4-FSI	25	5	3.175	4	1127	2776	40	12	52	1	48	62	10	51	6,6	5	M6x1P
L32-5K6-FSCEW* **	32	5	3.175	6	2980	8190	48	10	48	form A		73	13	60	6,6	6,5	M6x1P
L32-5K6-FSCEW	32	5	3.175	6	2980	8190	50	10	48	1	62	80	12	65	9	6	M6x1P
L32-10T4-FSI	32	10	6.35	4	2901	6403	50	16	85	1	62	80	12	65	9	6	M6x1P

***Non-DIN-compliant

4.4.6 Nuts with RSI/RSC key

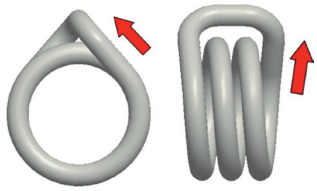


STOCK

Description	Measurements		Ball	Ball rpm	Dynamic load coeff. C(kfg)	Static load coeff. C0(kfg)	Nut				Key			
	Ø Nominal	Pitch					D (g6)	L	L3	Ø d	W (p9)	DP	L2	L1
L15-5K4-RSCEW	15	5	3	4	1290	2140	28	35	7	4	5	3	12	8.5
L25-5T4-RSI	25	5	3,175	4	1673	4480	38	45	9.5	4	5	3	16	14.5

HIWIN srl is available to evaluate the production of nuts with different geometries, loads or seals.

4.4.5 Z Series miniature screws



Features

Compact design: nut body also in reduced size according to request

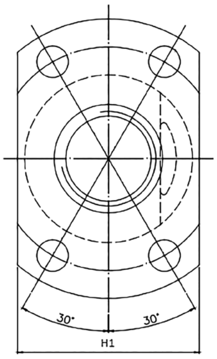
Smoothness: no-load torque up to 20-30% lower

Service life: 20-30% higher load coefficients
(compared to traditional nuts)

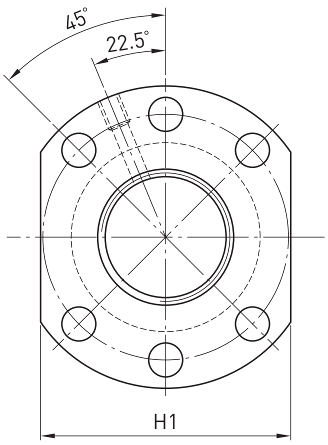
Very high dynamics: DN value of 160.000 and maximum acceleration even over 15 m/s^2.
Ask HIWIN for higher dynamics.

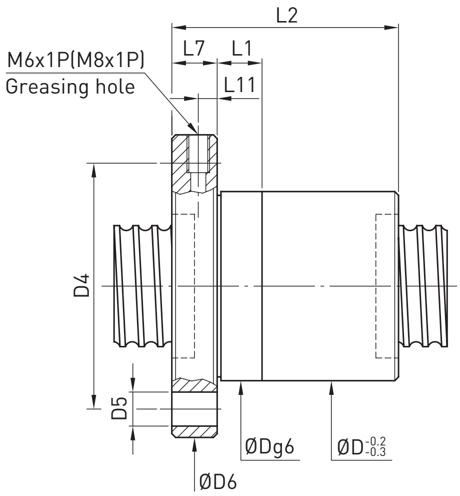
4.4.5.1 FSZ Series Flanged Miniature Screws

TYPE 0



TYPE 1

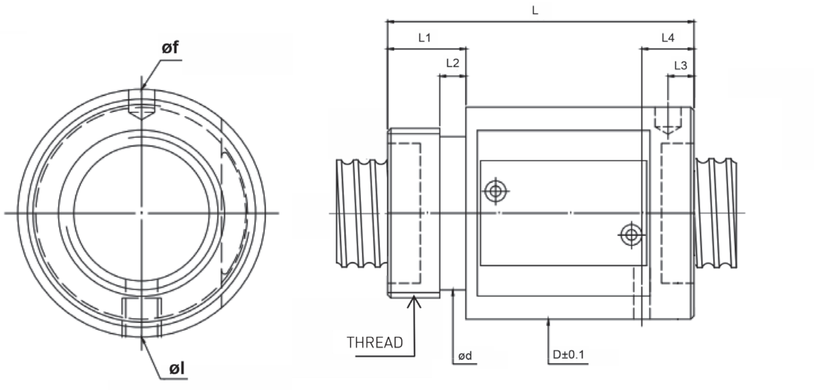




STOCK

Description	Measurements		Ball	Ball rpm	Dynamic load coeff. C(kfg)	Static load coeff. C0(kfg)	Nut			Flange							
	Ø Nominal	Pitch					D (g6)	L1	L2	Tipo	H1	D6	L7	D4	D5	L11	Greasing hole
R8-2,5B1-FSZ	8	2.5	1.5	2.6x1	220	390	16	10	23	0	19	28	6	22	3.4	-	
R10-2B1-FSZ	10	2	1.5	2.6x1	250	500	19	10	28	0	23	36	6	28	4.5	-	
R12-2C1-FSZ	12	2	1.5	3.6x1	370	870	24	10	30	0	26	40	8	32	4.5	-	
R16-5C1-FSZEW	16	5	3.175	3.6x1	1140	2430	28	10	45	1	40	48	10	38	5.5	5	M6x1P
R20-5C1-FSZEW	20	5	3.175	3.6x1	1280	3100	36	10	52	1	44	58	10	47	6.6	5	M6x1P

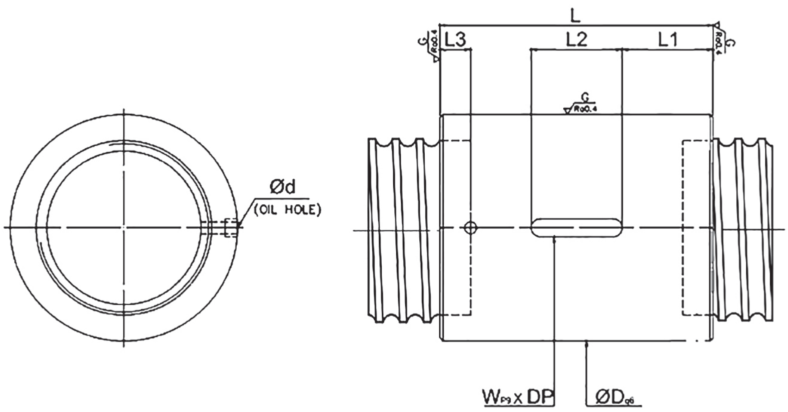
4.4.5.2 RSZ Series Miniature Cylindrical Threaded Screws



STOCK

Description	Measurements		Ball	Ball rpm	Dynamic load coeff. C(kfg)	Static load coeff. C0(kfg)	Nut									
	Ø Nominal	Pitch					D	L	Thread	L1	L2	Ød	Øf	L3	Øl	L4
R10-2B1-RSZ	10	2	1.5	2.6x1	250	500	19.5	26	M17x1P	7.5	2	15.5	-	-	2P	-
R12-2C1-RSZ	12	2	1.5	3.6x1	370	870	20	27	M18x1P	8	2	16.5	-	-	2P	-
R16-5C1-RSZ	16	5	3.175	2.6x1	950	1960	32.5	47	M26x1.5P	12	4	23.5	4x3DP	4	2.5P	8
R20-5C1-RSZ	20	5	3.175	2.6x1	970	2240	38	47	M35x1.5P	12	3	32.5	4x3.5 DP	8	M6x1P	8

4.4.5.3 Miniature Cylindrical Screws with RSZ Key



STOCK

Description	Measurements		Ball	Ball rpm	Dynamic load coeff. C(kfg)	Static load coeff. C0(kfg)	Nut				Key			
	Ø Nominal	Pitch					D (g6)	L	L3	Ød	W (P9)	DP	L2	L1
R8-2.5B1-RSZ	8	2.5	1.5	2.6x1	220	390	16	16	3.5	2	3	1.8	6	5
R16-5C1-RSZ	16	5	3.175	2.6x1	1140	2430	28	40	7	4	5	3	12	14.5
R20-5C1-RSZ	20	5	3.175	2.6x1	1280	3100	33	45	8	4	5	2	20	12.5

5. Peeled Ballscrews

5.1 Properties
In terms of quality, HIWIN peeled ballscrews belong to the group of so-called "High Precision" screws, together with ground screws. In fact, on request, we can provide a certificate of pitch measurement. In fact, peeled screws are also used for numerous conveying systems or positioning applications, especially due to the left-hand thread option that can be easily obtained on the shaft in addition to the right-hand thread. Peeled ballscrews can be supplied with both single and double nut geometries. We can supply complete, customised ballscrews at short notice. Complete combined bearing units with standardised ends simplify design requirements.

5.2 Tolerance classes
Table 5.1 shows the tolerance classes for peeled ballscrews. Pitch accuracy is determined by the cumulative pitch error over any length of 300 mm.

Table 5.1 **Tolerance classes for peeled ballscrews**

Stroke deviation over 300mm	Tolerance class	
	T5	T7
v300p	0.023	0.052

Unit: mm

Table 5.2 **Range of available peeled ballscrews**

Nominal diameter	Pitch			Max. shaft length [1]	Max. thread length
	5	10	20		
16	OX			6.000	4.700
20	OX			6.000	5.100
25	OX	OX		6.000	5.100
32	OX	OX	OX	6.000	5.100
40	OX	OX	OX	6.000	5.100
50	OX	OX	OX	6.000	5.100
63		OX	OX	6.000	5.100
80		OX	OX	6.000	5.100

Unit: mm
Greater lengths are available on request
O Right-hand and left-hand
X For fast delivery, right-hand is preferred

[1] Speed and peak load are factors to be taken into account in the case of long shafts.

5.3 HIWIN order code for peeled screws

Shaft and nut information is required to clearly identify the screw.

[info required]		[info from catalogue]						[shaft info]		[info optional]	
PBS	R	40	10	T4		DEB	N	800	1000	0.052	INFO

Type of shaft
PBS: Peeled
GBS: Ground
RBS: Rolled

Thread type
R: Right-hand screw
L: Left-hand screw
R/L: Right/left screw

Nominal diameter

Pitch

Circuits per rpm
K: Cassette recirculation
T: Internal recirculation with deflector

Nuts per shaft
no number: 1 nut
(for R/L: 2 - one per thread)

Type of nut
DEB: Single nut
DDB: Double nut
AME: Rotating nut

Nut play
Nhe code: std play
Controlled play: ≤ 0.01mm
Backlash**0:** no backlash (ISO 5 only)
Light preload: 2-3% C (ISO 5 only)

For non-flanged nut
KEY: with key
THREAD: with thread

Accuracy
0.052: corresponding ISO 7
0.023: corresponding ISO 5

Total Length

Thread Length
in case of R/L:
indicate the sum of the 2 threads

Seal
N: NBR seal (NW)
F: Felt seal (SP)
K: Toothed seal (SS)
V: Toothed seal + felt (SH)
B: Brushes
S: POM

NOTE: Order the shaft-mounting tube separately.

Table 5.3 **Overview of nut profiles**

NUT CODING	Description
DEB	Single flanged nut
DDB	Double flanged nut
AME	Rotating nut

5.4 Nuts for peeled ballscrews

5.4.1 Single flanged DEB-x

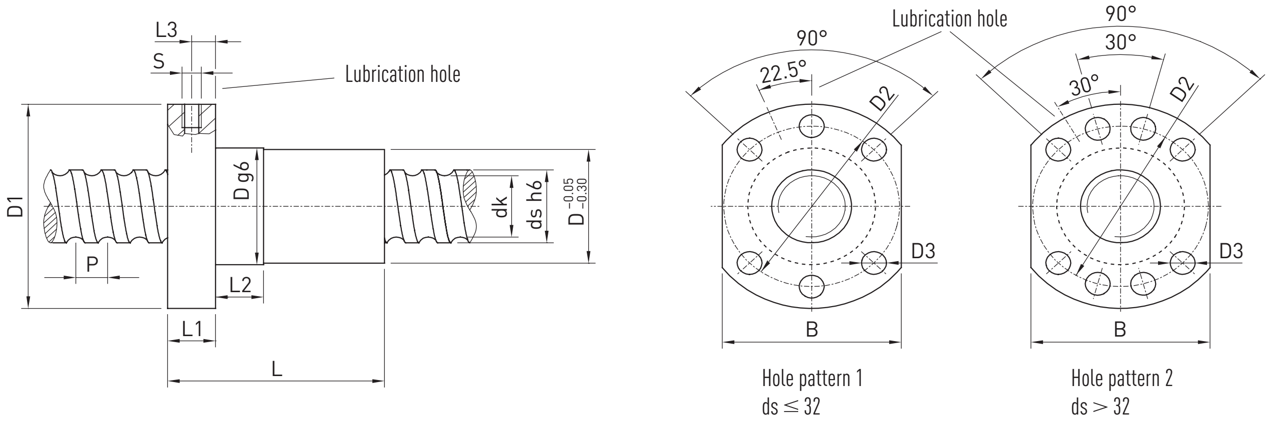


Fig. 5.1 **DEB single flanged nuts with NW and SP seals**

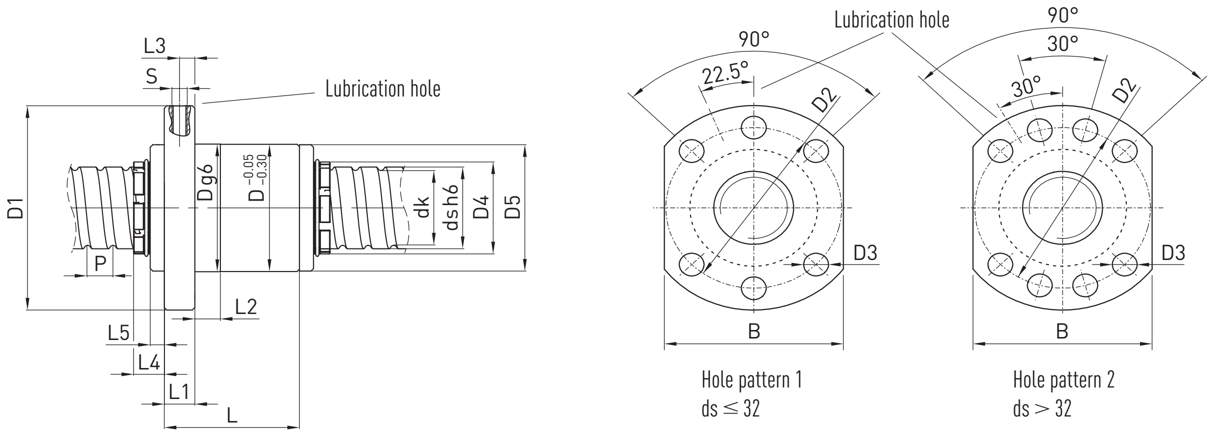


Fig. 5.2 **DEB single flanged nuts with SS and SH seals**

5.4.2 Single flanged nuts with NW and SP seals

STOCK

Table 5.4 **Nut dimensions**

Article Number	ds	P	D	D1	D2	D3	L	L1	L2	L3	L4 [1]	L5 [1]	S	B	dk	Dynamic load coefficient C_{dyn} [N]	Static load coefficient C_0 [N]	Max. axial play [mm]	Mass [kg/piece]	NW/ SS	SP/ SH
R16-05K4-DEB-x	15	5	28	48	38	5.5	47	10	10	5.0	14	8	M6	40	12.5	10,400	16,400	0.02	0.15	x	x
R16-10K3-DEB-x	15	10	28	48	38	5.5	53	10	10	5.0	14	8	M6	40	12.9	8,200	12,800	0.02	0.17	x	x
R16-16K2-DEB-x	15	16	28	48	38	5.5	55	10	10	5.0	14	8	M6	40	12.9	5,600	8,300	0.02	0.18	x	
R20-05K4-DEB-x	20	5	36	58	47	6.6	48	10	10	5.0	10.5	5	M6	44	17.3	13,900	23,300	0.02	0.29	x	x
R20-10K3-DEB-x	20	10	36	58	47	6.6	55	10	10	5.0	10.5	5	M6	44	17.3	9,900	17,400	0.02	0.30	x	x
R20-20K2-DEB-x	20	20	36	58	47	6.6	65	10	10	5.0	12	6	M6	44	17.3	7,000	11,800	0.02	0.32	x	
R25-05K4-DEB-x	25	5	40	62	51	6.6	53	10	10	5.0	11.5	6	M6	48	22.3	15,600	29,800	0.02	0.32	x	x
R25-10K4-DEB-x	25	10	40	62	51	6.6	70	10	10	5.0	12	6	M6	48	22.3	14,300	29,700	0.02	0.38	x	x
R25-25K2-DEB-x	25	25	40	62	51	6.6	79	10	10	5.0	12	6	M6	48	22.3	7,700	14,900	0.02	0.41	x	
R32-05K5-DEB-x	32	5	50	80	65	9.0	53	12	10	6.0	12.5	6	M6	62	29.3	20,700	48,700	0.02	0.60	x	x
R32-10K5-DEB-x	32	10	50	80	65	9.0	83	14	20	7.0	11	6	M6	62	28.7	30,900	72,800	0.02	0.68	x	x
R32-10K5-DEBH-x	32	10	56	86	71	9.0	87	14	20	7.0	12	6	M6	65	26.9	55,500	108,800	0.02	0.75	x	x
R32-20K2-DEB-x	32	20	56	86	71	9.0	72	14	20	7.0	11	6	M6	65	26.9	24,800	43,000	0.02	0.75	x	
R40-05K5-DEB-x	40	5	63	93	78	9.0	56	14	10	7.0	11	5	M8 × 1	70	37.3	22,500	61,700	0.02	0.90	x	x
R40-10K4-DEB-x	38	10	63	93	78	9.0	81	14	20	7.0	11	5	M8 × 1	70	32.9	50,500	105,800	0.02	1.13	x	x
R40-20K2-DEB-x	38	20	63	93	78	9.0	79	14	20	7.0	12	5	M8 × 1	70	32.9	27,500	52,400	0.03	1.10	x	
R40-40K2-DEB-x	38	40	63	93	78	9.0	113	14	20	7.0	11	5	M8 × 1	70	32.9	27,200	53,300	0.04	1.60	x	
R50-05K5-DEB-x	50	5	75	110	93	11.0	58	16	10	8.0	12	6	M8 × 1	85	47.3	24,900	77,900	0.02	1.20	x	x
R50-10K5-DEB-x	50	10	75	110	93	11.0	93	16	20	8.0	12	6	M8 × 1	85	44.9	70,500	179,100	0.02	1.80	x	x
R50-20K3-DEB-x	50	20	75	110	93	11.0	101	16	20	8.0	12	6	M8 × 1	85	44.9	45,100	106,900	0.03	1.95	x	
R63-10K6-DEB-x	63	10	90	125	108	11.0	103	18	10	9.0	13	7	M8 × 1	95	57.9	90,800	271,500	0.04	2.90	x	x
R63-20T5-DEB-x	63	20	95	135	115	13.5	169	20	25	10.0	15	9	M8 × 1	100	55.5	129,000	315,400	0.04	4.10	x	
R63-20K6-DEBH-x	63	20	125	165	145	13.5	185	25	25	12.5	18	10	M8 × 1	130	53.2	295,900	723,500	0.04	9.50	x	x
R80-10K6-DEB-x	80	10	105	145	125	13.5	105	20	12	10.0	14	6	M8 × 1	110	74.9	101,800	355,800	0.04	3.00	x	x
R80-20K5-DEB-x	80	20	125	165	145	13.5	157	25	25	12.5	17	9	M8 × 1	130	72.5	151,700	437,400	0.05	7.80	x	
R80-20K6-DEBH-x	78	20	135	175	155	13.5	175	25	25	12.5	19	11	M8 × 1	140	68.2	336,500	931,200	0.05	13.50	x	
R80-20K7-DEBH-x	78	20	135	175	155	13.5	195	25	25	12.5	19	11	M8 × 1	140	68.2	384,100	1,086,400	0.05	15.00	x	

[1] Only for SS and SH seals

Dimensions without unit indication are in mm

- Reduced axial play on request
- Nuts with oil scraper
- Left-hand nuts on request
- For a detailed overview of types of seals refer to page 33 of this catalogue
- Cylindrical nuts available in keyed or threaded versions

Example of order:

R	63	10	T6	DEB	3850	3972	0.052

Peeled Screws

5.4.2 DDB-x double flanged nuts

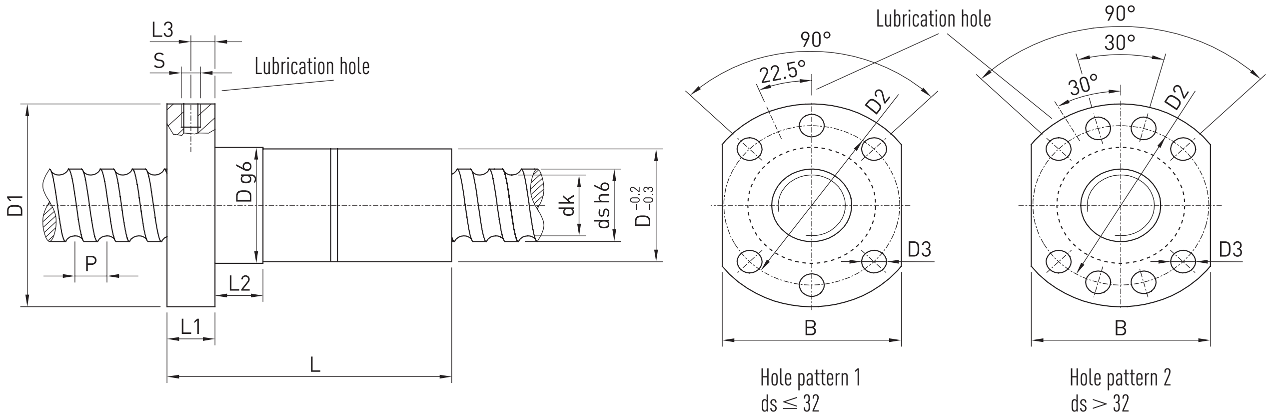


Fig. 5.3 **DDB double flanged nuts with NW and SP seals**

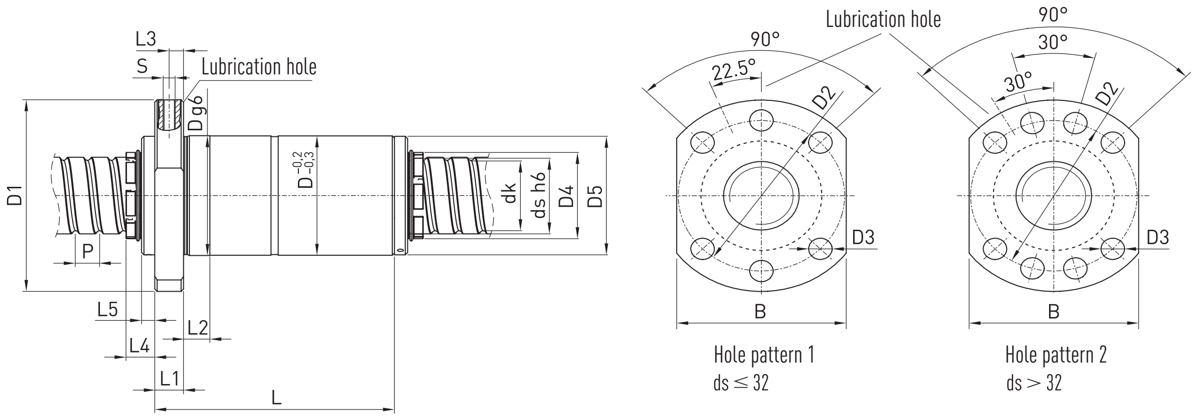


Fig. 5.4 **DDB double flanged nuts with SS and SH seals**

5.4.3 DDB flanged double nuts (DIN 69051 Part 5 Form B)

STOCK

Table 5.5 **Nut dimensions**

Article Number	ds	P	D	D1	D2	D3	L	L1	L2	L3	L4[1]	L5[1]	S	B	dk	Dynamic load coefficient C_{dyn} [N]	Static load coefficient C_0 [N]	Max. axial play	NW/ SS	SP/ SH
R16-05K4-DDB-x	15	5	28	48	38	5.5	75	10	10	5	14	8	M6	40	12,5	10,400	16,400	0.3	x	x
R20-05K4-DDB-x	20	5	36	58	47	6.6	87	10	10	5	10.5	5	M6	44	17,3	13,900	23,300	0.5	x	x
R25-05K4-DDB-x	25	5	40	62	51	6.6	96	10	10	5	11.5	6	M6	48	22,3	15,600	29,800	0.68	x	x
R25-10K4-DDB-x	25	10	40	62	51	6.6	130	10	10	5	12	6	M6	48	22,3	14,300	29,700	0.7	x	x
R32-05K5-DDB-x	32	5	50	80	65	9.0	96	12	10	6	12.5	6	M6	62	29,3	20,700	48,700	1.2	x	x
R32-10K5-DDB-x	32	10	50	80	65	9.0	156	14	20	7	11	6	M6	62	28,7	30,900	72,800	1.3	x	x
R32-10K4-DDBH-x	32	10	56	86	71	9.0	144	14	20	7	12	6	M6	62	26,9	45,800	87,000	1.4	x	x
R32-20K2-DDB-x	32	20	56	86	71	9.0	134	14	20	7	11	6	M6	65	26,9	24,800	43,000	1.4	x	
R40-05K5-DDB-x	40	5	63	93	78	9.0	101	14	10	7	11	5	M8 x 1	70	37,3	22,500	61,700	1.7	x	x
R40-10K4-DDB-x	38	10	63	93	78	9.0	150	14	20	7	11	5	M8 x 1	70	32,9	50,500	105,800	1.9	x	x
R40-20K2-DDB-x	38	20	63	93	78	9.0	146	14	20	7	12	5	M8 x 1	70	32,9	27,500	52,400	2.0	x	
R50-05K5-DDB-x	50	5	75	110	93	11.0	103	16	10	8	12	6	M8 x 1	85	47,3	24,900	77,900	2.1	x	x
R50-10K4-DDB-x	50	10	75	110	93	11.0	153	16	20	8	12	6	M8 x 1	85	44,9	58,200	143,300	3.2	x	x
R50-20K3-DDB-x	50	20	75	110	93	11.0	189	16	20	8	12	6	M8 x 1	85	44,9	45,100	106,900	4.8	x	
R63-10K6-DDB-x	63	10	90	125	108	11.0	193	18	16	9	13	7	M8 x 1	95	57.9	90,800	271,500	6.8	x	x
R63-20T4-DDB-x	63	20	95	135	115	13.5	289	20	25	10	15	9	M8 x 1	100	55.5	105,000	250,000	8.0	x	
R80-10K6-DDB-x	80	10	105	145	125	13.5	195	20	25	10	14	6	M8 x 1	110	74.9	101,800	355,800	6.0	x	x
R80-20K4-DDB-x	80	20	125	165	145	13.5	259	25	25	12.5	17	9	M8 x 1	130	72.5	135,000	349,900	14.0	x	

[1] Only for SS and SH seals

Dimensions without unit indication are in mm

- Preload
- Nuts with oil scraper
- Left-hand nuts on request
- Double cylindrical nuts available in keyed version

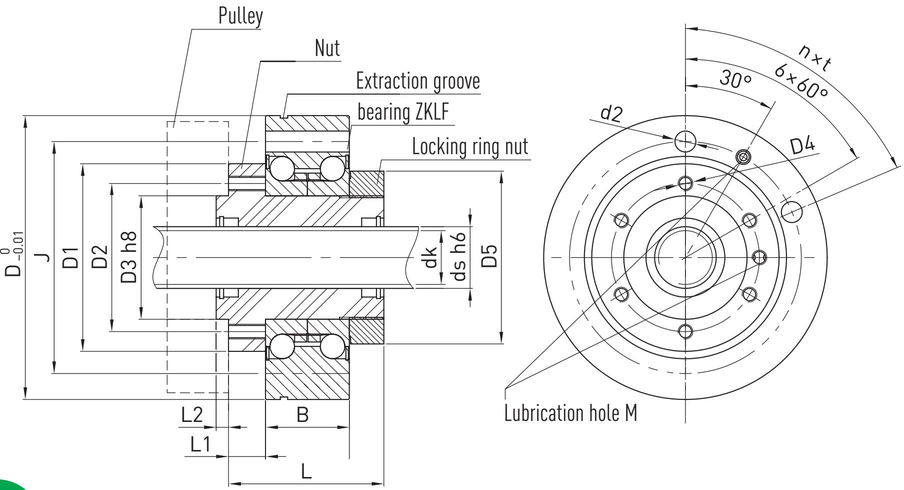
Example of order:

R	63	10	T6	DDB	3850	3972	0.052

Peeled Screws

5.4.5 Rotating nuts AME

- The nuts are fitted with axial angular contact ball bearings type ZKLF...ZF (PE version)
- The bearing is locked by a HIR series ring nut



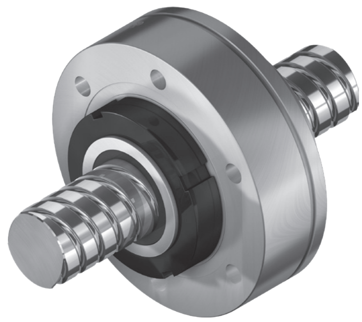


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Table 5.8 **Nut dimensions**

Article number	Shaft dimensions			Nut dimensions									Bearing dimensions					Dynamic load coefficient C_{dyn} [N]	Static load coefficient C_0 [N]	max no. [rpm]
	ds	P	dk	D1	D2	D3	D4	D5	L	L1	L2	M	D	J	n × t	d2	B			
R16-05T3-AME	16	5	13.5	50	40	30	M6	47	50	10	3	M6	80	63	6 × (60°)	6.5	28	9,600	12,700	4,000
R20-05T4-AME	20	5	17.5	63	52	40	M6	60	60	12	5	M6	100	80	4 × (90°)	8.5	34	13,900	21,800	3,300
R25-05T4-AME	25	5	22.5	76	60	50	M6	72	63	15	5	M6	115	94	6 × (60°)	8.5	34	15,600	27,900	3,000
R25-10T3-AME	25	10	21.0	76	60	50	M6	72	74	15	5	M6	115	94	6 × (60°)	8.5	34	24,100	36,200	3,000
R32-05T5-AME	32	5	29.5	76	62	50	M8	72	70	15	5	M6	115	94	6 × (60°)	8.5	34	20,700	43,900	3,000
R32-10T4-AME	32	10	27.8	76	62	50	M8	72	105	15	5	M6	115	94	6 × (60°)	8.5	34	40,900	63,200	3.000
R32-20T2-AME	32	20	27.8	76	62	50	M8	72	100	15	5	M6	115	94	6 × (60°)	8.5	34	20,300	26,800	3.000
R40-05T5-AME	40	5	37.5	90	70	60	M8	82	76	15	5	M6	145	120	8 × (45°)	8.5	45	22,500	54,600	2.400
R40-10T3-AME	40	10	35.8	90	70	60	M8	82	85	15	5	M6	145	120	8 × (45°)	8.5	45	37,100	61,900	2.400
R40-20T2-AME	40	20	35.8	90	70	60	M8	82	105	15	5	M6	145	120	8 × (45°)	8.5	45	23,800	36,400	2.400
R50-05T5-AME	50	5	47.5	100	84	70	M10	94	78	15	5	M6	155	130	8 × (45°)	8.5	45	24,900	69,800	2.200
R50-10T4-AME	50	10	45.8	100	84	70	M10	94	95	15	5	M6	155	130	8 × (45°)	8.5	45	52,800	106,800	2.200
R50-20T3-AME	50	20	45.8	100	84	70	M10	94	120	15	5	M6	155	130	8 × (45°)	8.5	45	40,000	76,200	2.200
R63-10T6-AME	63	10	58.8	130	110	90	M10	122	120	20	7	M8	190	165	8 × (45°)	10.5	55	84,700	210,800	1.800

Dimensions without unit indication are in mm

Order example

R	40	20	T2	AME	3800	3900	0.052

6. Ground Ballscrews

6.1 Properties

Ground ballscrews offer the best precision compared to other screw types. Ground screws with a pitch precision of up to 3.5μm/300 mm thread length can be produced by grinding the product after hardening. These ballscrews are mainly used in machine tools, grinding the product after hardening. Ground ballscrews are always produced to order to meet customer requirements in terms of nut shape, calculation coefficients, preloading method, seal type and end machining. Please contact us for further details.

The following pages highlight the most commonly used flanged nuts, single or double, with deflector (FSI, FDI or OFSI) or cassette (FSC or FDC). This is only part of our product range. We can supply nuts and diameter/pitch combinations in different sizes. The precision classes of screws and the maximum shaft lengths in relation to nominal diameters are highlighted below.

6.2 Precision classes

Table 6.1 **Precision classes for ground ballscrews**

Permitted deviation	Tolerance class					
	T0	**T1**	**T2**	**T3**	**T4**	**T5**
V_{2p}	3.0	4	6	8	8	8
V_{300}	3.5	6	8	12	18	23

Unit: μm

Table 6.2 **Maximum grindable diameter/length combinations**

Diameter	6	8	10	12	16	20	25	32	40	50	63	80	100
Accuracy	**Maximum shaft lengths of ballscrews**												
T0	110	170	300	400	600	700	1.000	1.200	1.500	1,800*	2,000*	2,000*	2,000*
T1 ISO1	110	170	400	500	720	950	1,300	1,800	2,300	3,100*	4,000*	4,000*	4,000*
T2	140	200	500	630	900	1,300	1,700	2,200	2,900	4,000*	5,200*	6,300*	6,300*
T3 ISO3	170	250	500	630	1,000	1,400	1,800	2,500	3,500	4,500*	6,000*	10,000*	10,000*
T4	170	250	500	630	1,000	1,400	1,800	2,500	3,500	4,500	6,000*	10,000*	10,000*
T5 ISO5	170	250	500	630	1,410	1,700	2,400	3,000	3,800	5,000	6,900	10,000	10,000

Units: mm

* Please contact HIWIN

Table 6.3 **Nuts available with ground shafts**

Nut coding	Description
FSC	Single flanged nut with cassette recirculation
FDC	Double flanged coil with cassette recirculation
FSI	Single flanged volute with deflector recirculation
FDI	Double flanged volute with deflector recirculation
OFSI	Single flanged pitch offset nut with deflector recirculation
FSC	Stock series
FSI	Stock series

STOCK

HIWIN is able to produce any type of nut according to design. The flexibility of HIWIN's ground screw production allows the design of flanged, cylindrical or special nuts with different dimensions through the use of different ways to close the recirculation. On the following pages, the **FSC** and **FSI** series are presented, also with different ball diameters, and above all the corresponding **FDC** and **FDI** double nuts, the ideal solution where high preload combined with precision must be favoured. Finally, there is the **OFSI** series, the single nut that combines compactness and the need for high preload values. The dimensions listed all refer to the DIN69051 standard; further combinations of diameter, pitch or nut size are available, please ask HIWIN directly.

The stock ground screw series with single nut is characterised by having nuts and shafts manufactured to particularly tight tolerances, making them interchangeable with each other. This feature allows HIWIN Italia to keep shafts and nuts in stock and thus offer ground screws with customised shanks, with much tighter lead times. In order to guarantee the required precision and/or preload, these screws will in any case only be supplied with shaft-mounted nuts.

6.3 HIWIN order code for ground screws

In order to clearly identify the screw, information on the shaft and nut is required.

GBS	2	R	40	10	T	4		FSI	800	1000	0.023	INFO

Type of shaft
GBS: Ground
RBS: Rolled
PBS: Peeled

Number of principles on the shaft:
1: One principle
2: Two principles
3: Three principles
4: Four principles

Thread direction:
R: Right-hand thread
L: Left-hand thread

Nominal diameter

Pitch

Recirculation type:
K: Cassette recirculation
T: Internal Recirculation
B: External Recirculation

Nut play
Nhe code: std play
Controlled play: ≤ 0.01mm
Backlash**0:** no backlash (ISO 5 only)
Light preload: 2-3% C (ISO 5 only)

Nut dimensions
Nhe code: DIN std with flange
NTD_: nut body diameter
NTL_: nut length

For non-flanged nut
KEY: with key
THREAD: with thread

Precision thread
0.023: corresponding ISO5
0,012: corresponding ISO3
0.06: corresponding ISO1

Total length

Thread length

Nut Shape / Type
(see Tab 6.3)

None: One single principle
D: 2-principle nut
T: 3-principle nut
Q: 4-principle nut
O: Preload with pitch offset in the nut (OFFSET)

Number of circuits

Note:
even if conditioned separately, ground nuts and shafts from the stock series cannot be sold separately.

6.4 Single nuts for ground ballscrews

6.4.1 Single nuts DIN type FSI/FSC (DIN 69051 part 5 form B) HIWIN Italy stock

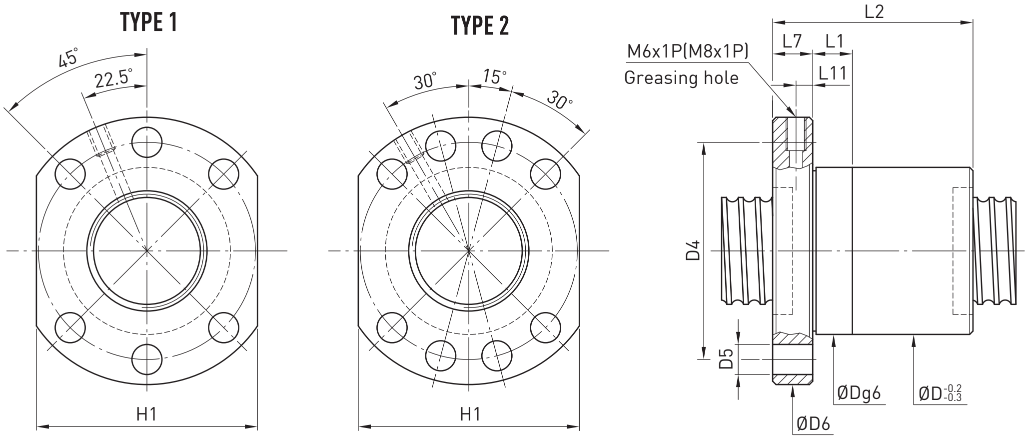


Table 6.7 **Nut dimensions**

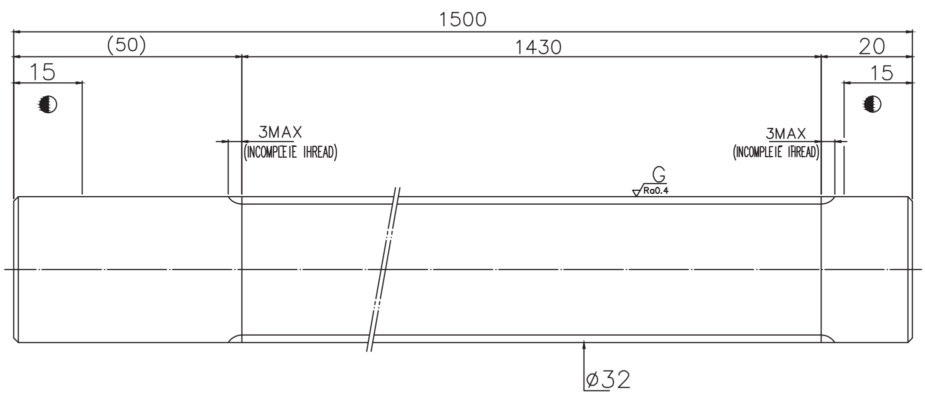
STOCK

Description	Measurements		Ball	Ball rpm	Dynamic load coeff. C(kfg)	Static load coeff. C0(kfg)	Nut			Flange								Max. shaft length	Max. thread length
	∅ nominal	Pitch					D (g6)	L1	L2	Tipo	H1	D6	L7	D4	D5	L11	Greasing hole		
R16-5T3-FSI	16	5	3.175	3	731	1331	28	10	40	1	40	48	10	38	5.5	5	M6x1P	1080	1040
R20-5K4-FSC	20	5	3.175	4	1490	3640	36	10	40	1	44	58	10	47	6.6	5	M6x1P	1200	1160
R20-10K3-FSC	20	10	3	3	1130	2660	36	10	48	1	44	58	10	47	6.6	5	M6x1P	1200	1160
R25-5K4-FSC	25	5	3.175	4	1650	4610	40	10	43	1	48	62	10	51	6.6	5	M6x1P	1200	1160
R25-10K4-FSC	25	10	3.175	4	1640	4580	40	10	60	1	48	62	10	51	6.6	6	M6x1P	1000	960
R32-5K5-FSC	32	5	3.175	5	2250	7530	50	10	43	1	62	80	12	65	9	6	M6x1P	1500	1430
R32-10K4-FSC	32	10	3.969	4	2520	7480	50	10	63	1	62	80	12	65	9	6	M6x1P	1500	1430
R32-10T5-FSI	32	10	6.35	5	5860	14490	50	10	103	1	62	80	12	65	9	6	M6x1P	1500	1730
R38-10K5-FSC	38	10	6.35	5	6180	17420	63	16	80	2	70	93	14	78	9	7	M8x1P	2000	1930
R38-20K4-FSC	38	20	6.35	4	4990	13660	63	25	108	2	70	93	14	78	9	7	M8x1P	2500	2400
R40-5K5-FSC	40	5	3.175	5	2470	9490	63	20	45	2	70	93	14	78	9	7	M8x1P	1500	1430
R50-5K6-FSC	50	5	3.175	6	3180	14420	75	20	50	2	85	110	16	93	11	8	M8x1P	2500	2375
R50-10K6-FSC	50	10	6.35	6	8290	28160	75	10	90	2	85	110	16	93	11	8	M8x1P	3000	2875

- Nut dimensions outside DIN 69051 on request
- Different diameters and pitches on request

Code example:

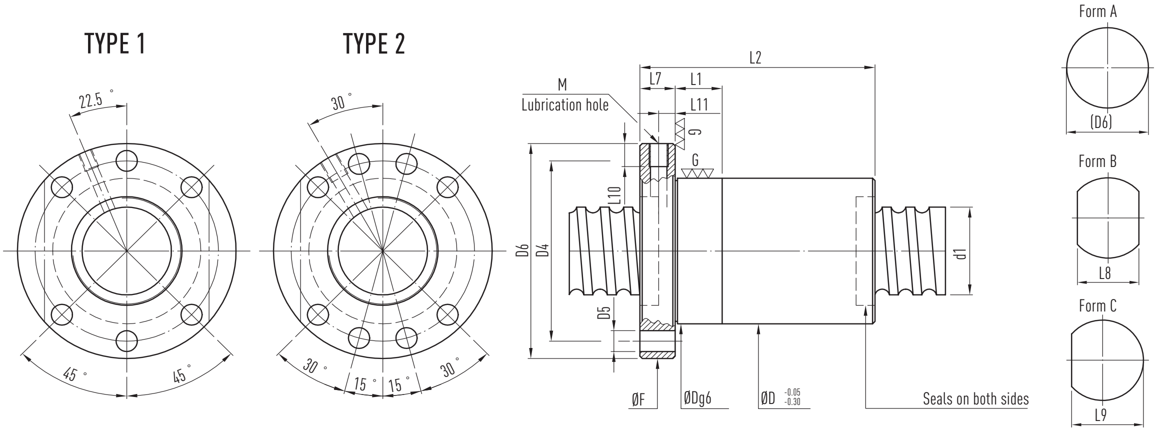
GBS	R25	5K4	FSC	1160	1200	0.023



Example of stock shaft R32-10-1430-1500-0.018

Ground Screws

6.4.2 Single FSC flanged nuts with cassette recirculation



Type	Measurements Ø Nominal	Measurements Pitch	PCD	Ø primitive	ball	Ball rpm	Stiffness K (kgf/μm)	Dynamic Load C(kgf)	Static Load Co(kgf)	Nut D	Nut L1	Nut L2	Flange Type	Flange Form A (D6)	Flange Form B (L8)	Flange Form C (L9)	Flange L7	Flange D4	Flange D5	Lubr. hole M	Lubr. hole L10	Lubr. hole L11	Double principle	Incomplete thread
R14-10K3	14	10	14.6	10.724	3.175	3	24	920	1790		10	46												
R15-10K3		10	16	12.869	3	3	26	930	1970	28	10	45		48	40	44		38						
R15-16K2		16				2	16	610	1230		10	45												
R15-10K3	15	10	15.6	12.324		3	25	960	1930		10	44							5.5	M5 × 0.8P	6			
R15-20K2		20			3.175	2	15	630	1256	34	10	50		57	43	50		45						
R16-16K2	16	16	16.4	13.124		2	17	680	1385		10	47												•
R20-10K4		10	21	17.868	3	4	43	1390	3560		10	55												
R20-5K4		5				4	42	1490	3640		10	40												
R20-10K3	20	10	20.6	17.324	3.175	3	32	1130	2660	36	10	47		58	44	51		47						
R20-20K2		20				2	21	760	1730		10	57											•	
R20-6K5		6	20.8	16.744	3.969	5	58	2420	5660	42	10	49		64	50	57		53						•
R20-8K5		8	21	16.132	4.763	5	58	2960	6505	45	10	64		65	51	58		54				5		•
R25-5K4		5				4	49	1650	4612		10	43												
R25-10K3		10				3	38	1260	3370		10	50												
R25-15K5		15	25.6	22.324	3.175	5	63	1980	5730	40	10	90		62	48	55		51						
R25-20K3		20				3	39	1260	3436		10	80											•	
R25-25K2		25				2	25	840	2170		10	69											•	
R25-6K5	25	6				5	68	2720	7192	45	10	50		65	51	58		54						
R25-8K5		8				5	70	2710	7170	48	10	62		68	54	61		57						
R25-10K4		10	25.8	21.744	3.969	4	56	2210	5660		10	60							6.6					
R25-12K4		12				4	56	2200	5640	45	10	67		65	51	58		54						•
R25-16K3		16				3	42	1670	4127		10	71												•
R25-20K3		20				3	43	1710	4290		10	80												
R25-8K5		8	26	21.132	4.763	5	72	3480	8683	50	10	64		70	56	64		60						•
R28-6K5		6	28.8	24.744	3.969	5	74	2840	7966	50	10	49	1											•
R28-8K5		8				5	79	3690	9780		10	62												•
R28-10K5	28	10	29	24.132	4.763	5	80	3680	9760	52	10	72		80	62	71		65						•
R28-16K4		16				4	64	2970	7661	50	10	92								M6 × 1P	8		•	•
R32-5K4		5	32.6	29.324	3.175	4	57	1840	5960	48	10	38		70	54	62		59						•
R32-5.08K4		5.08				4	57	1840	5940		10	39												•
R32-6K5		6				5	83	3090	9480	56	10	48		86	65	75.5	12	71				6		•
R32-8K5		8				5	85	3080	9430	53	10	59		83	62	72.5		68						
R32-8K5		8				5	84	3080	9460		10	59												
R32-10K5		10	32.8	28.744	3.969	5	85	3080	9450		10	73			62			65						
R32-15K4		15				4	69	2500	7440		10	90											•	
R32-20K3		20				3	52	1900	5430	50	20	87		80		71								
R32-32K2		32				2	34	1280	3530		20	87			62			65					•	
R32-40K2		40				2	32	1240	3440		20	94											•	
R32-8K5	32	8				5	84	3860	10914	55	10	64												•
R32-10K5		10				5	86	3850	10890	56	10	79												
R32-12K5		12				5	87	3840	10870		20	88												
R32-20K4		20	33	28.132	4.763	4	72	3190	8914		20	106		86	65	75.5		71					•	•
R32-25K3		25				3	53	2420	6500	54	20	97											•	•
R32-32K2		32				2	34	1620	4100		20	88											•	•
R32-10K5		10				5	90	5640	14480		10	77												•
R32-12K5		12	33.4	26.91	6.35	5	90	5620	14450	62	20	87		92	74	83		77						•
R32-16K4		16				4	73	4570	11390		20	92							9					•
R32-20K4		20				4	70	4240	10854	57	20	107		87	66	78		72						
R36-6K5		6	36.8	32.744	3.969	5	88	3240	10632	56	10	51		86	65	77		71						•
R36-10K5		10				5	98	6010	16440		20	80												•
R36-12K5		12				5	99	5990	16420	66	20	87		96	73	84.5	14	81				7		
R36-16K5	36	16	37.4	30.91	6.35	5	100	5960	16350		20	109												•
R36-20K4		20				4	80	4840	12880	65	20	108		95	72	83.5		80					•	•
R36-20K4		20				4	79	4840	12880	61	20	108		91	68	79.5		76						
R36-36K2		36				2	39	2540	6240		20	95	2										•	
R38-8K5		8	39	34.132	4.763	5	96	4190	13110	61	20	64		91	68	79.5		76		M8 × 1P	10			•
R38-10K4		10				4	81	5050	13790		20	70												
R38-15K4		15				4	83	5020	13740		20	88												
R38-16K5	38	16				5	104	6140	17340		20	108												
R38-20K4		20	39.4	32.91	6.35	4	83	4990	13660	63	25	108		93	70	81.5		78					•	
R38-25K4		25				4	83	4940	13560		25	127											•	•
R38-40K2		40				2	40	2590	6560		25	103											•	

Note: 1. Stiffness without preload. The axial load is calculated at 30% of the dynamic load.
2. Lower or higher circuits than those indicated are however available.

6.4.2 Single FSC flanged nut with cassette recirculation (continued)

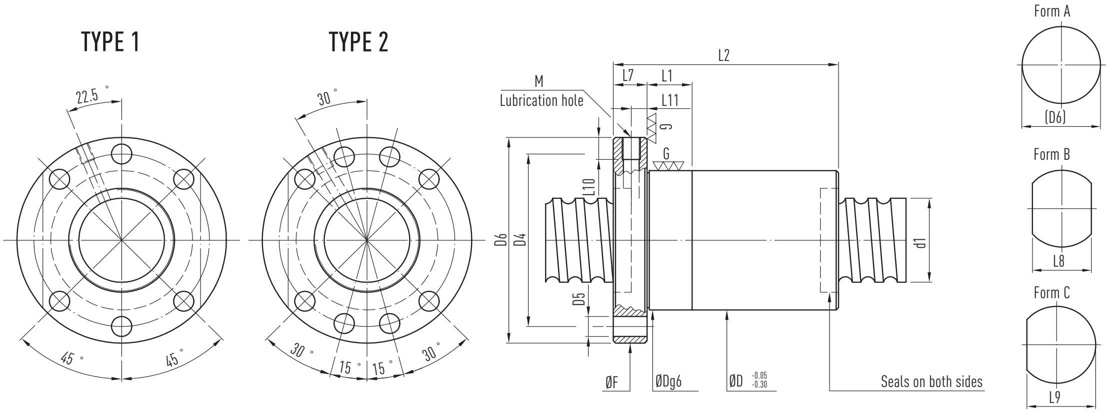


Table 6.5 **Nut dimensions (continued)**

Type	Measurements		PCD	Ø primitive	ball	Ball rpm	Stiffness K (kgf/μm)	Dynamic Load C(kgf)	Static Load Co(kgf)	Nut			Flange							Lubr. hole			Double principle	Incomplete thread
	Ø Nominal	Pitch								D	L1	L2	Type	Form A (D6)	Form B (L8)	Form C (L9)	L7	D4	D5	M	L10	L11		
R40-5K5		5	40.6	37.324	3.175	5	85	2470	9490		20	45												
R40-6K5		6	40.8	36.744	3.969	5	95	3370	11780	63	20	52		93	70	81.5		78						
R40-8K5		8				5	101	4360	14200		20	64												•
R40-10K5		10	41	36.132	4.763	5	102	4350	14180	61	20	80		91	68	79.5		76						
R40-20K4		20				4	84	3520	11130		20	110												
R40-16K5		16	41.2	35.522	5.556	5	107	5170	15510	68	20	108		98	75	86.5		83						
R40-10K5		10				5	106	6340	18400		20	83												•
R40-12K5	40	12				5	108	6330	18380		20	86					14		9			7		•
R40-16K5		16				5	109	6300	18320	70	20	108		100	75	87.5		85						•
R40-20K4		20	41.4	34.91	6.35	4	87	5130	14440		20	110											•	
R40-30K3		30				3	67	4000	11010		20	117											•	•
R40-25K4		25				4	86	5080	14350	65	25	127		95	72	83.5		80					•	•
R40-40K2		40				2	42	2660	6940		25	101											•	
R40-12K5		12	41.6	34.299	7.144	5	110	7430	20790	75	20	90		110	85	97.5		93						•
R40-16K5		16				5	112	7400	20720		20	109												•
R45-8K5		8	46	41.132	4.763	5	109	4550	15860	70	20	66		105	80	92.5		90						•
R45-10K5		10				5	118	6810	21320		20	78												•
R45-12K5		12				5	119	6800	21290		20	89												•
R45-16K5		16	46.4	39.91	6.35	5	121	6780	21240	75	20	108		110	85	97.5		93						
R45-20K4		20				4	98	5520	16760		25	108											•	
R45-25K4	45	25				4	98	5480	16670		25	129											•	
R45-40K3		40				3	71	4100	12020		25	145											•	
R45-12K5		12				5	119	7830	23290		20	88												•
R45-16K5		16	46.6	39.299	7.144	5	120	7810	23230	80	20	119		117	92	104.5		100						
R45-20K4		20				4	97	6360	18330		25	113												
R50-5K5		5	50.6	47.324	3.175	5	95	2700	11940	70	20	45		100	75	87.5		85						
R50-8K5		8	51	46.132	4.763	5	116	4730	17530	75	20	74		110	85	97.5		93						•
R50-10K5		10				5	125	7050	23300		25	80												
R50-12K5		12				5	127	7040	23280		25	90					16		11			8		•
R50-15K5		15				5	129	7030	23250	82	25	104	2	118	92	105		100		M8 × 1P	10			
R50-16K5		16				5	129	7020	23230		25	109												•
R50-20K4		20	51.4	44.91	6.35	4	104	5720	18340		25	106											•	
R50-25K4		25				4	104	5690	18260		25	129											•	
R50-30K4	50	30				4	104	5650	18170	75	25	147		110	85	97.5		93					•	
R50-35K3		35				3	80	4430	13840		25	133											•	
R50-40K3		40				3	79	4390	13750		25	145											•	
R50-30K2		30	51.6	44.299	7.144	2	53	3560	9960	82	25	92		118	92	105		100					•	•
R50-12K5		12				5	130	9480	28776		25	97												•
R50-16K5		16	51.8	43.688	7.938	5	132	9450	28710	85	25	112												•
R50-20K5		20				5	134	9420	28630		25	138		121	95	108		103						•
R50-50K2		50				2	52	3980	10860		25	124												•
R50-20K4		20	52.2	42.466	9.525	4	113	9870	27420	86	25	120												
R55-16K5	55	16	56.4	49.91	6.35	5	139	7420	26157	82	25	104		118	92	105		100						•
R63-10K5		10				5	144	7720	29190		25	84												•
R63-12K5		12	64.4	57.91	6.35	5	147	7720	29180	95	25	94		135	100	117.5		115						•
R63-20K5		20				5	157	7850	30020		25	132												•
R63-40K2	63	40				2	62	3310	11100		25	110					20					10	•	
R63-12K5		12	64.8	56.688	7.938	5	152	10520	36440	98	25	94		138	103	120.5		118						•
R63-16K4		16				4	132	11010	34520	107	25	100		147	112	129.5		127						
R63-20K5		20	65.2	55.466	9.525	5	168	13430	43530		25	140												
R63-25K5		25				5	166	13390	43420	110	25	165		150	115	132.5		130	13.5				•	•
R70-16K4	70	16	72.2	62.466	9.525	4	141	11470	38040	115	25	105		155	120	137.5		135						
R70-20K4		20				4	143	11450	37990		25	122												
R80-10K5		10	81.4	74.91	6.35	5	166	8620	37980	110	25	80		150	115	132.5		130						
R80-12K5		12	81.8	73.688	7.938	5	177	11740	47130	115	25	102		155	120	137.5	25	135				12.5		
R80-16K4	80	16				4	155	12410	44960	125	25	105		170	135	152.5		150						•
R80-20K4		20	82.2	72.466	9.525	4	160	12400	44910	120	25	122												
R80-25K4		25				4	159	12370	44840	120	25	145		165	130	147.5		145						•
R80-30K4		30				4	161	12340	44750	120	25	165												•

Note: 1. Stiffness without preload. The axial load is calculated at 30% of the dynamic load.
2. Lower or higher circuits than those indicated are however available.

Ground Screws

6.4.3 Single FSI flanged nuts with deflector

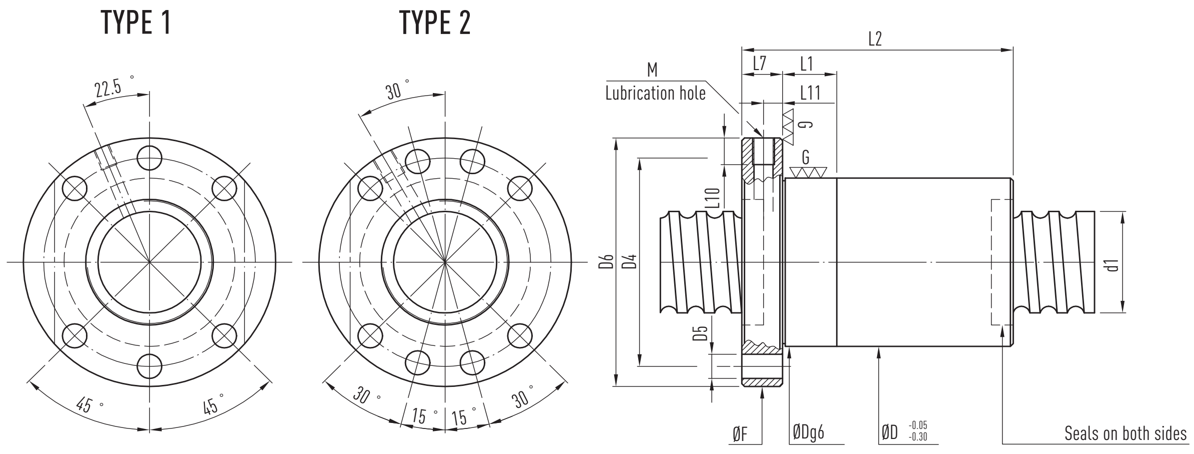


Table 6.6 **Nut dimensions**

Nut type	ds	P	ball	D min.	F	D4	D5	L2	L7	L1	L11	M	dk	Stiffness [N/µm]	Dynamic Load Coefficient Cdyn [N]	Static Load Coefficient C0[N]	Mass [kg]
R8-2.5T3-FSI	8	2.5	1.500	18	35	27	4.5	28	5	—	—	—	6.65	80	1,700	2,670	0.04
R16-2T3-FSI	16	2.0	1.500	27	44	34	4.5	36	10	—	5.0	M6	14.65	140	2,520	5,930	0.17
R16-5T3-FSI	16	5.0	3.175	30	54	41	5.5	46	12	12	6.0	M6	13.32	110	7,310	13,310	0.32
R16-5T4-FSI	16	5.0	3.175	30	54	41	5.5	52	12	12	6.0	M6	13.32	120	9,360	17,750	0.34
R20-2T4-FSI	20	2.0	1.500	32	52	40	5.5	40	10	12	5.0	M6	18.65	360	3,990	11,120	0.25
R20-2T6-FSI	20	2.0	1.500	32	52	40	5.5	52	10	12	5.0	M6	18.65	320	5,180	15,510	0.29
R20-5T3-FSI	20	5.0	3.175	34	57	45	5.5	46	12	12	6.0	M6	17.32	200	8,520	17,670	0.35
R20-5T4-FSI	20	5.0	3.175	34	57	45	5.5	53	12	12	6.0	M6	17.32	270	10,910	23,560	0.38
R25-2T3-FSI	25	2.0	1.500	36	58	46	5.5	35	10	12	5.0	M6	23.65	200	3,090	9,800	0.24
R25-2T4-FSI	25	2.0	1.500	36	58	46	5.5	40	10	12	5.0	M6	23.65	270	3,950	13,070	0.26
R25-2T6-FSI	25	2.0	1.500	36	58	46	5.5	50	10	12	5.0	M6	23.65	390	5,600	19,600	0.30
R25-5T3-FSI	25	5.0	3.175	40	64	51	5.5	46	11	10	5.5	M6	22.32	280	9,770	23,140	0.42
R25-5T4-FSI	25	5.0	3.175	40	64	51	5.5	51	11	10	5.5	M6	22.32	370	12,520	30,850	0.44
R25-5T5-FSI	25	5.0	3.175	40	63	51	5.5	56	11	10	5.5	M6	22.32	400	15,160	38,560	0.47
R25-5T6-FSI	25	5.0	3.175	40	63	51	5.5	65	11	10	5.5	M6	22.32	480	17,730	46,270	0.52
R25-10T3-FSI	25	10.0	4.763	45	69	55	6.6	65	15	12	7.5	M6	21.13	250	15,910	32,360	0.80
R25-10T4-FSI	25	10.0	4.763	45	69	55	6.6	80	15	12	7.5	M6	21.13	330	20,380	43,150	0.90
R32-5T3-FSI	32	5.0	3.175	44	74	60	6.6	46	12	12	6.0	M6	29.32	330	11,170	30,810	0.49
R32-5T4-FSI	32	5.0	3.175	44	74	60	6.6	53	12	12	6.0	M6	29.32	420	14,310	41,080	0.53
R32-5T6-FSI	32	5.0	3.175	44	74	60	6.6	66	12	12	6.0	M6	29.32	630	20,270	61,620	0.59
R32-10T3-FSI	32	10.0	6.350	51	82	68	6.6	72	16	12	8.0	M6	26.91	350	25,390	53,270	1.02
R32-10T4-FSI	32	10.0	6.350	51	82	68	6.6	83	16	12	8.0	M6	26.91	480	32,520	71,020	1.11
R40-5T4-FSI	40	5.0	3.175	51	80	66	6.6	53	16	12	8.0	M8 × 1	37.32	500	15,990	52,800	0.66
R40-5T6-FSI	40	5.0	3.175	51	80	66	6.6	66	16	12	8.0	M8 × 1	37.32	740	22,650	79,190	0.73
R40-10T3-FSI	40	10.0	6.350	60	96	80	9.0	76	16	15	8.0	M8 × 1	34.91	400	29,590	70,690	1.37
R40-10T4-FSI	40	10.0	6.350	60	96	80	9.0	87	16	15	8.0	M8 × 1	34.91	510	37,890	94,260	1.49
R50-5T4-FSI	50	5.0	3.175	62	96	80	9.0	57	16	15	8.0	M8 × 1	47.32	620	17,570	67,450	0.95
R50-5T6-FSI	50	5.0	3.175	62	96	80	9.0	70	16	15	8.0	M8 × 1	47.32	910	24,900	10,117	1.04
R50-10T3-FSI	50	10.0	6.350	69	114	92	11.0	78	18	20	9.0	M8 × 1	44.91	500	33,970	92,560	1.85
R50-10T4-FSI	50	10.0	6.350	69	114	92	11.0	89	18	20	9.0	M8 × 1	44.91	630	43,500	123,410	1.98
R50-10T6-FSI	50	10.0	6.350	69	114	92	11.0	112	18	20	9.0	M8 × 1	44.91	940	61,650	185,110	2.26
R50-20T4-FSI	50	20.0	9.525	75	129	105	14.0	186	28	30	14.0	M8 × 1	42.47	800	93,270	239,550	5.30
R63-10T4-FSI	63	10	6.350	82	134	110	14.0	91	20	20	10.0	M8 × 1	57.91	790	48,600	158,580	2.54

Table 6.6 **Nut dimensions (cont'd)**

Nut type	ds	P	ball	D min.	F	D4	D5	L2	L7	L1	L11	M	dk	Stiffness [N/μm]	Dynamic Load Coefficient Cdyn [N]	Static Load Coefficient C0[N]	Mass [kg]
R63-10T6-FSI	63	10	6350	82	134	110	14.0	114	20	20	10.0	M8 × 1	57.91	1,150	68,870	237,860	2.88
R80-10T4-FSI	80	10	6350	99	152	127	14.0	91	20	20	10.0	M8 × 1	74.91	960	55,590	21,118	3.00
R80-10T6-FSI	80	10	6350	99	152	127	14.0	114	20	20	10.0	M8 × 1	74.91	1,400	78,790	316,770	3.42
R80-20T3-FSI	80	20	9525	108	174	143	18.0	138	24	25	12.0	M8 × 1	72.47	950	96,630	316,220	6.30
R80-20T4-FSI	80	20	9525	108	174	143	18.0	161	24	25	12.0	M8 × 1	72.47	1,250	123,750	421,620	6.96
R100-20T4-FSI	100	20	9525	135	194	163	18.0	161	24	30	12.0	M8 × 1	92.47	1,550	135,690	531,610	8.60

Dimensions without unit indication are in mm

- The stiffness values indicated were calculated without preload for loads equal to 30% of the dynamic load
- Non-standard nut dimensions on request
- Different diameters and pitches on request

Code example:

R	50	10	T4	FSI	2250	2325	0.023

Ground Screws

6.4.4 OFSI single flanged nuts with deflector (DIN 69051 PART 5 FORM B)

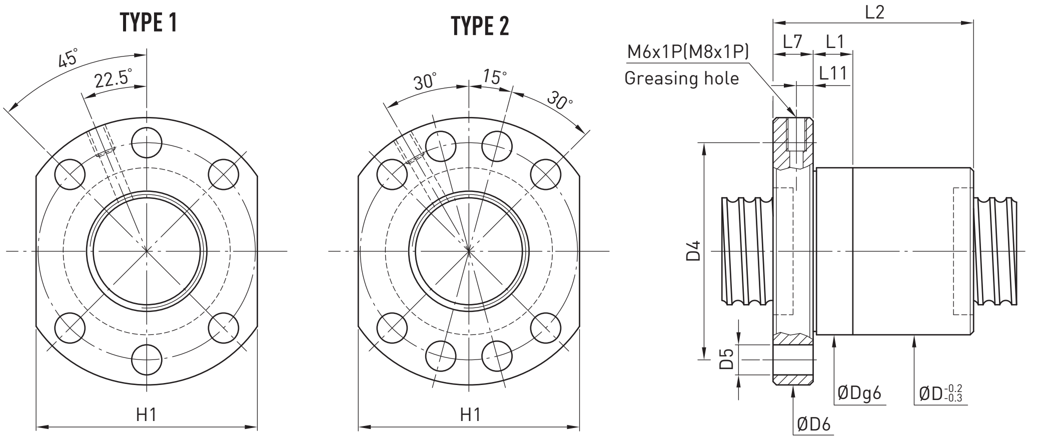


Table 6.7 **Nut dimensions**

Description	Measurements		Ball	Ball rpm	C dynamic (kgf)	C static C0 (kgf)	Nut			Flange							
	Ø nominal	Pitch					D (g6)	L1	L2	Type	H1	D6	L7	D4	D5	L11	Greasing hole
R16-5T3-OFSI	16	5	3.175	3	940	1830	28	10	60		40	48	10	38	5.5	5	M6x1P
R20-5T3-OFSI	20	5	3.175	3	1090	2440	36	10	62		44	58	10	47	6.6	5	M6x1P
R20-10T2-OFSI	20	10	4.763	2	1240	2280	36	10	71		44	58	10	47	6.6	5	M6x1P
R25-5T3-OFSI	25	5	3.175	3	1240	3200	40	10	68	1	48	62	10	51	6.6	5	M6x1P
R25-10T3-OFSI	25	10	4.763	3	2030	4450	40	16	128		48	62	10	51	6.6	5	M6x1P
R32-10T3-OFSI	32	10	6.35	3	3270	7350	50	10	117		62	80	12	65	9	6	M6x1P
R32-5T4-OFSI	32	5	3.175	4	1800	5690	50	10	79		62	80	12	65	9	6	M6x1P
R40-10T4-OFSI	40	10	6.35	4	4860	13030	63	16	137		70	93	14	78	9	7	M8x1P
R40-5T4-OFSI	40	5	3.175	4	2010	7310	63	10	81	2	70	93	14	78	9	7	M8x1P
R50-10T4-OFSI	50	10	6.35	4	4350	12340	75	10	143		85	110	16	93	11	8	M8x1P

- Nutshell dimensions outside DIN 69051 on request
- Different diameters and pitches on request

Code example:

GBS	R25	5T3	OFSI	2250	2325	0.023

6.4.5 FDI double flanged nuts with deflector

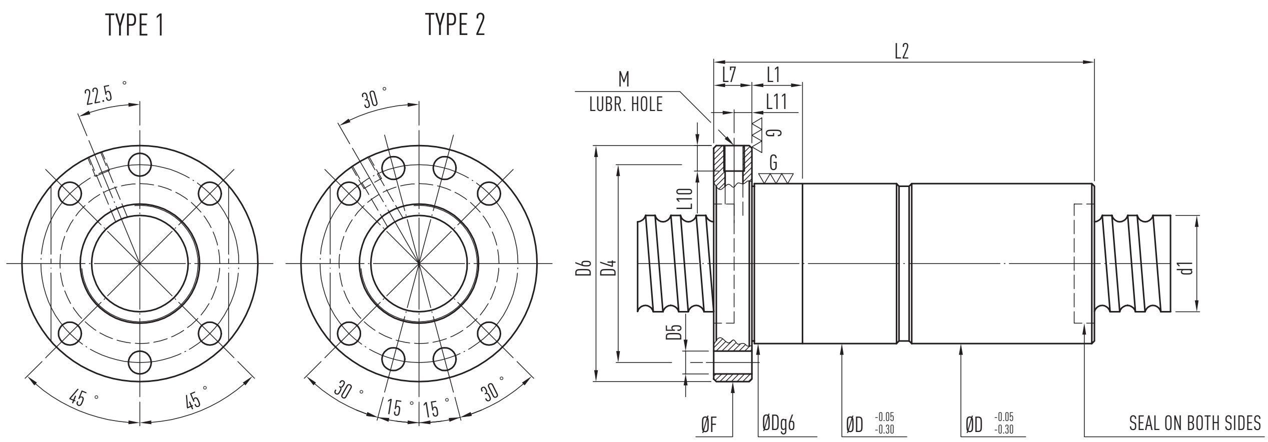


Table 6.8 **Nut dimensions**

Nut type	ds	P	ball	D min.	F	D4	D5	L2	L7	L1	L11	M	dk	Stiffness [N/µm]	Dynamic Load Coefficient Cdyn [N]	Static Load Coefficient C0[N]	Mass [kg]
R16-5T3-FDI	16	5	3.175	30	54	41	5.5	78	12	24	6.0	M6	13.32	200	7,310	13,310	0.43
R16-5T4-FDI	16	5	3.175	30	54	41	5.5	90	12	24	6.0	M6	13.32	230	9,360	17,750	0.48
R20-5T3-FDI	20	5	3.175	34	57	45	5.5	78	12	24	6.0	M6	17.32	390	8,520	17,670	0.49
R20-5T4-FDI	20	5	3.175	34	57	45	5.5	92	12	24	6.0	M6	17.32	540	10,910	23,560	0.55
R25-5T3-FDI	25	5	3.175	40	64	52	5.5	78	12	24	5.5	M6	22.32	550	9,770	23,140	0.59
R25-5T4-FDI	25	5	3.175	40	64	52	5.5	96	12	24	5.5	M6	22.32	730	12,520	30,850	0.69
R25-10T3-FDI	25	10	4.763	51	74	60	6.6	140	15	24	7.5	M6	21.13	490	16,430	32,650	1.38
R32-5T3-FDI	32	5	3.175	44	74	60	6.6	78	12	24	6.0	M6	29.32	640	11,170	30,810	0.65
R32-5T4-FDI	32	5	3.175	44	74	60	6.6	96	12	24	6.0	M6	29.32	820	14,310	41,080	0.74
R32-5T6-FDI	32	5	3.175	44	74	60	6.6	118	12	24	6.0	M6	29.32	1,210	20,270	61,620	0.85
R32-10T3-FDI	32	10	6.350	51	82	68	6.6	129	16	24	8.0	M6	26.91	680	25,390	53,270	1.50
R32-10T4-FDI	32	10	6.350	51	82	68	6.6	155	16	24	8.0	M6	26.91	820	32,520	71,020	1.72
R40-5T4-FDI	40	5	3.175	51	80	66	6.6	96	16	24	8.0	M8 × 1	37.32	990	15,990	52,800	0.89
R40-5T6-FDI	40	5	3.175	51	80	66	6.6	122	16	24	8.0	M8 × 1	37.32	1,460	22,650	79,190	1.03
R40-10T3-FDI	40	10	6.350	60	96	80	9.0	133	16	30	8.0	M8 × 1	34.91	760	29,590	70,690	1.99
R40-10T4-FDI	40	10	6.350	60	96	80	9.0	155	16	30	8.0	M8 × 1	34.91	1,010	37,890	94,260	2.22
R50-5T4-FDI	50	5	3.175	62	96	80	9.0	96	16	30	8.0	M8 × 1	47.32	1,210	17,570	67,450	1.23
R50-5T6-FDI	50	5	3.175	62	96	80	9.0	122	16	30	8.0	M8 × 1	47.32	1,770	24,900	101,170	1.42
R50-10T3-FDI	50	10	6.350	69	114	92	11.0	135	18	40	9.0	M8 × 1	44.91	950	33,970	92,560	2.53
R50-10T4-FDI	50	10	6.350	69	114	92	11.0	157	18	40	9.0	M8 × 1	44.91	1,240	43,500	123,410	2.80
R50-10T6-FDI	50	10	6.350	69	114	92	11.0	203	18	40	9.0	M8 × 1	44.91	1,840	61,650	185,110	3.35
R63-10T4-FDI	63	10	6.350	82	134	110	14.0	159	20	40	10.0	M8 × 1	57.91	1,580	48,600	158,580	3.53
R63-10T6-FDI	63	10	6.350	82	134	110	14.0	205	20	40	10.0	M8 × 1	57.91	2,280	68,870	237,860	4.20
R80-10T4-FDI	80	10	6.350	99	152	127	14.0	172	20	40	10.0	M8 × 1	74.91	1,900	55,590	211,180	4.45
R80-10T6-FDI	80	10	6.350	99	152	127	14.0	214	20	40	10.0	M8 × 1	74.91	2,770	78,790	316,770	5.20
R80-20T3-FDI	80	20	9.525	108	174	143	18.0	250	24	50	12.0	M8 × 1	72.47	1,890	96,630	316,220	9.54
R80-20T4-FDI	80	20	9.525	108	174	143	18.0	296	24	50	12.0	M8 × 1	72.47	2,480	123,750	421,620	10.87
R100-20T4-FDI	100	20	9.525	135	194	163	18.0	296	24	60	12.0	M8 × 1	92.47	3,000	135,690	531,610	12.69

Dimensions without unit indication are in mm

- The indicated stiffness values are calculated for a preload of 10% of the dynamic load
- Non-standard nut dimensions on request
- Different diameters and pitches on request

Code example:

R	50	10	T4	FDI	2250	2325	0.023

6.4.6 FDC double flanged nuts with cassette recirculation

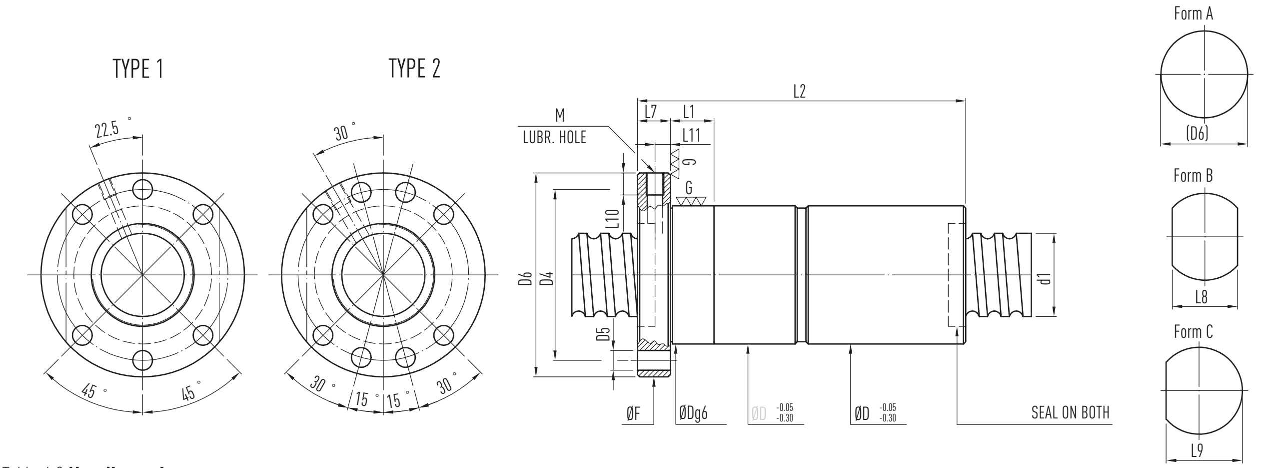


Table 6.9 **Nut dimensions**

Type	Measurements Ø Nominal	Measurements Pitch	PCD	Ø primitive	ball	Ball rpm	Stiffness K (kgf/μm)	Dynamic Load C(kgf)	Static Load Co(kgf)	Nut D	Nut L1	Nut L2	Flange Type	Flange Form A (D6)	Flange Form B (L8)	Flange Form C (L9)	Flange L7	Flange D4	Flange D5	Lubr. hole M	Lubr. hole L10	L11	Double principle	Incomplete thread
R14-10K3	14	10	14.6	10.724	3.175	3	31	920	1790	28	10	96	1	48	40	44	10	38	5.5	M5 × 0.8P	6	5		
R15-10K3	15	10	16	12.869	3	3	34	930	1970		10	94												
R15-16K2		16				2	21	610	1230		10	94												
R15-10K3		10	15.6	12.324	3.175	3	33	960	1930	34	10	92		57	43	50		45						
R15-20K2		20				2	20	630	1256		10	104												
R16-16K2	16	16	16.4	13.124	3.175	2	23	680	1385		10	98												•
R20-10K4	20	10	21	17.868	3	4	57	1390	3560		10	114												
R20-5K4		5	20.6	17.324	3.175	4	55	1490	3640	36	10	84		58	44	51		47	6.6	M6 × 1P	8			
R20-10K3		10				3	42	1130	2660		10	98												
R20-20K2		20				2	27	760	1730		10	118											•	
R20-6K5		6	20.8	16.744	3.969	5	77	2420	5660	42	10	102		64	50	57		53						•
R20-8K5		8	21	16.132	4.763	5	77	2960	6505	45	10	132		65	51	58		54						•
R25-5K4	25	5	25.6	22.324	3.175	4	65	1650	4612	40	10	90		62	48	55		51						
R25-10K3		10				3	50	1260	3370		10	104												
R25-15K5		15				5	83	1980	5730		10	184												
R25-20K3		20				3	51	1260	3436		10	164											•	
R25-25K2		25				2	32	840	2170		10	142											•	
R25-6K5		6	25.8	21.744	3.969	5	91	2720	7192	45	10	104		65	51	58		54						
R25-8K5		8				5	92	2710	7170	48	10	128		68	54	61		57						
R25-10K4		10				4	74	2210	5660	45	10	124		65	51	58		54						
R25-12K4		12				4	74	2200	5640		10	138												•
R25-16K3		16				3	55	1670	4127		10	146												•
R25-20K3		20				3	55	1710	4290		10	164												
R25-8K5		8	26	21.132	4.763	5	96	3480	8683	50	10	132		70	56	64		60						•
R28-6K5	28	6	28.8	24.744	3.969	5	93	2840	7966	50	10	102		80	62	71	12	65				6		•
R28-8K5		8	29	24.132	4.763	5	104	3690	9780		10	128												•
R28-10K5		10				5	105	3680	9760		10	148												•
R28-16K4		16				4	84	2970	7661		10	188											•	•
R32-5K4	32	5	32.6	29.324	3.175	4	77	1840	5960	48	10	80		70	54	62		59						•
R32-5.08K4		5.08				4	77	1840	5940		10	82												•
R32-6K5		6	32.8	28.744	3.969	5	111	3090	9480	56	10	100		86	65	75.5		71						•
R32-8K5		8				5	112	3080	9430	53	10	122		83	62	72.5		68						
R32-8K5		8				5	112	3080	9460	50	10	122		80	62	71		65	9					
R32-10K5		10				5	113	3080	9450		10	150												
R32-15K4		15				4	91	2500	7440		10	184											•	
R32-20K3		20				3	68	1900	5430		20	178												
R32-32K2		32				2	44	1280	3530		20	178											•	
R32-40K2		40				2	42	1240	3440		20	192											•	
R32-8K5		8	33	28.132	4.763	5	112	3860	10914	55	10	132		86	65	75.5	14	71				7		•
R32-10K5		10				5	113	3850	10890	56	10	162												
R32-12K5		12				5	114	3840	10870		20	180												
R32-20K4		20				4	94	3190	8914	54	20	216											•	•
R32-25K3		25				3	70	2420	6500		20	198											•	•
R32-32K2		32				2	44	1620	4100		20	180											•	•
R32-10K5		10	33.4	26.91	6.35	5	119	5640	14480	62	10	158		92	74	83		77						•
R32-12K5		12				5	119	5620	14450		20	178												•
R32-16K4		16				4	96	4570	11390		20	188												•
R32-20K4		20				4	71	4240	10854	57	20	218		87	66	78		72						
R36-6K5	36	6	36.8	32.744	3.969	5	118	3240	10632	56	10	106	2	86	65	77		71						•
R36-10K5		10	37.4	30.91	6.35	5	130	6010	16440	66	20	164		96	73	84.5		81		M8 × 1P	10			•
R36-12K5		12				5	131	5990	16420		20	178												
R36-16K5		16				5	132	5960	16350		20	222												•
R36-20K4		20				4	105	4840	12880	65	20	220		95	72	83.5		80					•	•
R36-20K4		20				4	105	4840	12880	61	20	220		91	68	79.5		76						
R36-36K2		36				2	51	2540	6240		20	194											•	
R38-8K5	38	8	39	34.132	4.763	5	127	4190	13110	61	20	132		91	68	79.5		76						•
R38-10K4		10	39.4	32.91	6.35	4	107	5050	13790	63	20	144		93	70	81.5		78						
R38-15K4		15				4	109	5020	13740		20	180												
R38-16K5		16				5	137	6140	17340		20	220												
R38-20K4		20				4	110	4990	13660		25	220											•	
R38-25K4		25				4	109	4940	13560		25	258											•	•
R38-40K2		40				2	53	2590	6560		25	210											•	

Note: 1. Stiffness without preload. The axial load is calculated at 10% of the dynamic load.
2. Lower or higher circuits than those indicated are however available.

6.4.6 FDC double flanged nuts with cassette recirculation (cont'd)

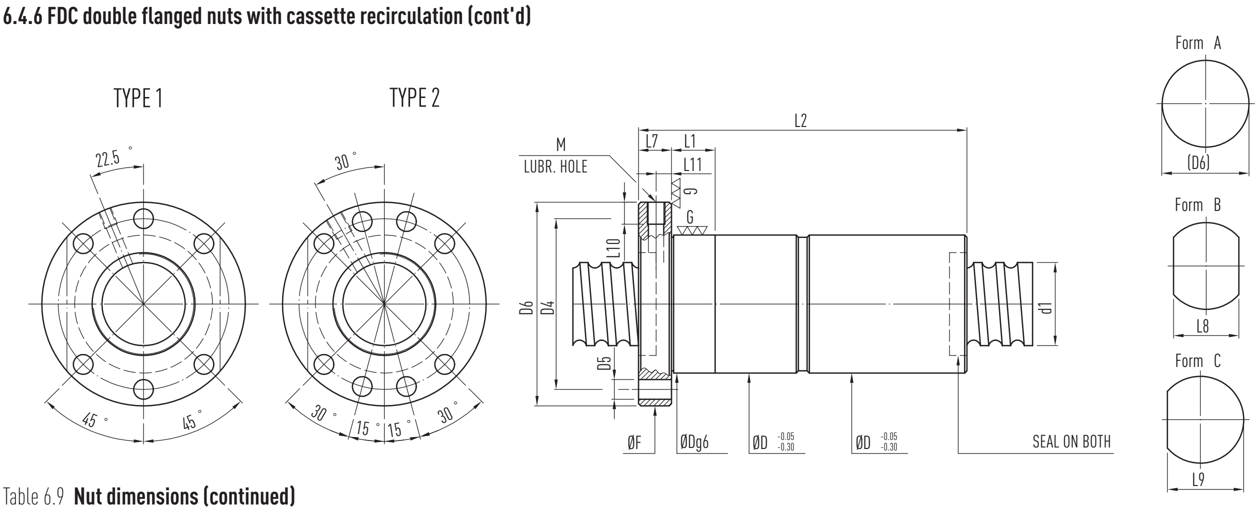


Table 6.9 **Nut dimensions (continued)**

Type	Measurements		PCD	Ø primitive	ball	Ball rpm	Stiffness K (kgf/μm)	Dynamic Load C(kgf)	Static Load Co(kgf)	Nut			Flange							Lubr. hole			Double principle	Incomplete thread
	Ø Nominal	Pitch								D	L1	L2	Type	Form A (D6)	Form B (L8)	Form C (L9)	L7	D4	D5	M	L10	L11		
R40-5K5	40	5	40.6	37.324	3.175	5	114	2470	9490	63	20	95	2	93	70	81.5	14	78	9	M8 × 1P	10	7		
R40-6K5		6	40.8	36.744	3.969	5	127	3370	11780		20	109												
R40-8K5		8	41	36.132	4.763	5	135	4360	14200		20	140												•
R40-10K5		10				5	136	4350	14180	61	20	164		91	68	79.5		76						
R40-20K4		20				4	111	3520	11130		20	226												
R40-16K5		16	41.2	35.522	5.556	5	141	5170	15510	68	20	220		98	75	86.5		83						
R40-10K5		10	41.4	34.91	6.35	5	141	6340	18400	70	20	170		100	75	87.5		85						•
R40-12K5		12				5	142	6330	18380		20	178												•
R40-16K5		16				5	143	6300	18320		20	221												•
R40-20K4		20				4	115	5130	14440		20	225											•	
R40-30K3		30				3	88	4000	11010		20	239											•	•
R40-25K4		25				4	114	5080	14350	65	25	259		95	72	83.5		80					•	•
R40-40K2		40				2	56	2660	6940		25	207											•	
R40-12K5		12	41.6	34.299	7.144	5	146	7430	20790	75	20	185		110	85	97.5		93						•
R40-16K5		16				5	147	7400	20720		20	223												•
R45-8K5	45	8	46	41.132	4.763	5	145	4550	15860	70	20	137		105	80	92.5	16	90	11			8		•
R45-10K5		10	46.4	39.91	6.35	5	156	6810	21320	75	20	161		110	85	97.5		93						•
R45-12K5		12				5	158	6800	21290		20	183												•
R45-16K5		16				5	160	6780	21240		20	221												
R45-20K4		20				4	129	5520	16760		25	221											•	
R45-25K4		25				4	129	5480	16670		25	263											•	
R45-40K3		40				3	93	4100	12020		25	295											•	
R45-12K5		12	46.6	39.299	7.144	5	157	7830	23290		20	181												•
R45-16K5		16				5	159	7810	23230		20	243												
R45-20K4		20				4	128	6360	18330	80	25	230		117	92	104.5		100						
R50-5K5	50	5	50.6	47.324	3.175	5	129	2700	11940	70	20	95		100	75	87.5		85						
R50-8K5		8	51	46.132	4.763	5	154	4730	17530	75	20	153		110	85	97.5		93						•
R50-10K5		10	51.4	44.91	6.35	5	166	7050	23300	82	25	166		118	92	105		100						
R50-12K5		12				5	169	7040	23280		25	186												•
R50-15K5		15				5	171	7030	23250		25	214												
R50-16K5		16				5	171	7020	23230		25	224												•
R50-20K4		20				4	138	5720	18340		25	218											•	
R50-25K4		25				4	134	5690	18260	75	25	263		110	85	97.5		93					•	
R50-30K4		30				4	136	5650	18170		25	299											•	
R50-35K3		35				3	105	4430	13840		25	271											•	
R50-40K3		40				3	104	4390	13750		25	295											•	
R50-30K2		30	51.6	44.299	7.144	2	70	3560	9960	82	25	190		118	92	105		100					•	•
R50-12K5		12	51.8	43.688	7.938	5	173	9480	28776	85	25	200		121	95	108		103						•
R50-16K5		16				5	175	9450	28710		25	229												•
R50-20K5		20				5	176	9420	28630		25	281												•
R50-50K2		50				2	69	3980	10860		25	253												•
R50-20K4		20	52.2	42.466	9.525	4	149	9870	27420	86	25	245												
R55-16K5	55	16	56.4	49.91	6.35	5	185	7420	26157	82	25	213		118	92	105	20	100	13.5			10		•
R63-10K5	63	10	64.4	57.91	6.35	5	192	7720	29190	95	25	173		135	100	117.5		115						•
R63-12K5		12				5	196	7720	29180		25	194												•
R63-20K5		20				5	208	7850	30020		25	270												•
R63-40K2		40				2	82	3310	11100		25	226											•	
R63-12K5		12	64.8	56.688	7.938	5	202	10520	36440	98	25	194		138	103	120.5		118						•
R63-16K4		16	65.2	55.466	9.525	4	175	11010	34520	107	25	206		147	112	129.5		127						
R63-20K5		20				5	222	13430	43530		25	286												
R63-25K5		25				5	218	13390	43420	110	25	336		150	115	132.5		130					•	•
R70-16K4	70	16	72.2	62.466	9.525	4	187	11470	38040	115	25	216		155	120	137.5	25	135				12.5		
R70-20K4		20				4	190	11450	37990		25	250												
R80-10K5	80	10	81.4	74.91	6.35	5	223	8620	37980	110	25	170		150	115	132.5		130						
R80-12K5		12	81.8	73.688	7.938	5	238	11740	47130	115	25	210		155	120	137.5		135						
R80-16K4		16	82.2	72.466	9.525	4	206	12410	44960	125	25	216		170	135	152.5		150						•
R80-20K4		20				4	212	12400	44910	120	25	250		165	130	147.5		145						
R80-25K4		25				4	211	12370	44840		25	296												•
R80-30K4		30				4	212	12340	44750		25	336												•

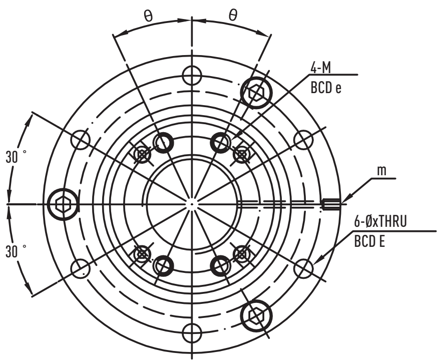
Note: 1. Stiffness without preload. The axial load is calculated at 10% of the dynamic load.
2. Lower or higher circuits than those indicated are however available.

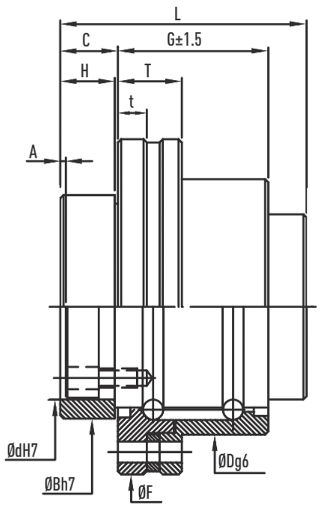
7 Ballscrews for special applications

7.1 Integrated rotating nuts

7.**1.1 Applications**:
- Semi-conductor industries
- Robots
- Woodworking machines
- Laser cutting machines

7.**1.2 Features**:
- Compact and high positioning
  A compact design using the nut and a support bearing as integrated units.
  The screw has two possible uses: with fixed shaft and sliding nut or with fixed nut and sliding shaft.
- Easy installation
  Installed by simply fixing the nut directly into the housing with screws.
- High Dynamics
  When used with a fixed shaft, this will not produce any inertia effect. A lower power motor can thusbe selected to meet the required dynamic requirements.
- Stiffness
  It has greater reliability and stiffness because the integrated unit has a very compact construction. No kickback during rolling.
- Quietness
  The special design allows the steel balls to circulate within the nut. The noise generated by high speed operation is lower than with a normal ballscrew.





- Nuts with integrated bearings
- Nut dimensions outside DIN 69051 on request
- **Different diameters and pitches on request**

Code example:

RBS	4R20	20K4	DFSCR2EW	1000	1000	0.052

Table 7.1 **Nut dimensions**

STOCK

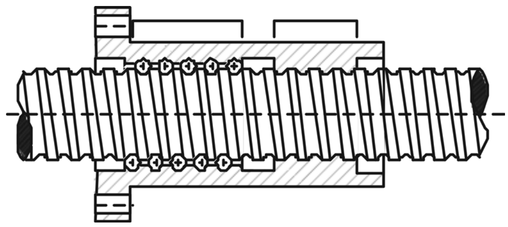
Description	Measurements		Ball	Ball rpm	Nut						Flange		Pulley				Bearing			
	∅ nominal	Pitch			D (g6)	G	L	C	C (kgf)	C0 (kgf)	∅F	T	BCD-E	BCD-e	α	M	∅B	∅d	C (kgf)	C0 (kgf)
4R20-20K4-DFSCR2EW	20	20	3.175	4	62	34	54	11	1250	3110	78	6	70	31	20°	M5x0.8P	50	39	1187	2326
4R25-25K4-DFSCR2EW	25	25	3.175	4	72	43	65	12.5	1380	3900	92	8	81	38	20°	M6X1P	58	47	1243	2567
4R32-32K4-DFSCR2EW	32	32	3.969	4	80	55	80	14	2100	6350	105	9	91	48	20°	M6X1P	66	58	2050	4277
4R38-40K4-DFSCR1	38	40	6.35	4	110	68	103	16.5	4230	11820	140	11	123	61	25°	M8X1.25P	90	73	3127	6906

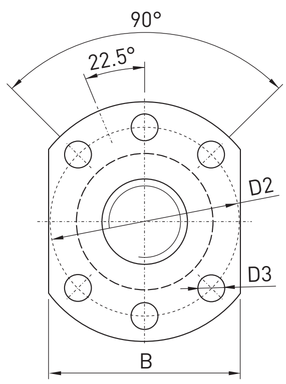
7.2 Safety nuts size DIN 69051 Doors 5

The safety nut comprises a threaded shaft unit and a safety unit The safety nut basically functions in the same way as a standard ballscrew nut. If the axial play increases due to wear, ball breakage or loss of balls, the thread of the safety unit comes into contact with the thread of the ballscrew. The nut cannot therefore break out. The normal function of the unit is guaranteed up to an axial backlash of 0.4 mm.

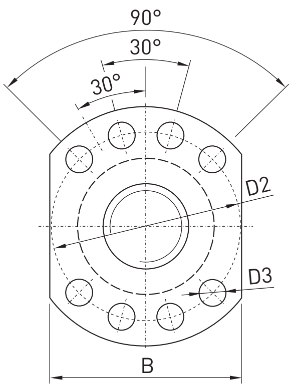
Scope of application:

- Lifting equipment
- Fastening devices
- Lifting platforms
- Elevators

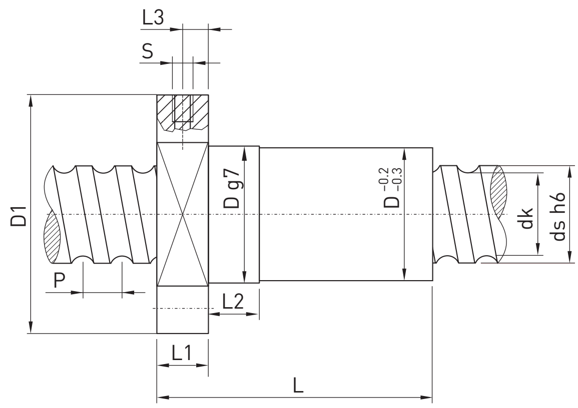




Hole pattern 1
ds ≤ 32



Hole pattern 2
ds > 32



Code example:

RBS	R32	10T4	FSI	1000	1000	0.052	Safety nut

Nut Type	ds	P	D	D1	D2	D3	Hole pattern	L	L1	L2	L3	S	B	Dk	Dynamic Load Coefficient Cdyn [N]	Static Load Coefficient C0[N]
R32-10T4FSI	32	10	56	86	70	9	1	130	15	16	7.5	M6	66	27,8	28990	64040
R40-10T4FSI	40	10	63	93	78	9	2	130	15	16	7.5	M8x1	70	35,8	33960	84880
R50-10T5FSI	50	10	75	110	93	11	2	132	16	16	8	M8x1	85	45,8	55260	166680
R63-20T5FSI	63	20	95	135	115	13.5	2	230	20	25	10	M8x1	100	55,4	115360	351940
R80-20T6FSI	80	20	125	165	145	13.5	2	230	25	25	12.5	M8x1	130	72,4	157300	569300

NOTE 1 The use of a safety nut alone does not offer sufficient protection against unintentional lowering of a load. The safety guidelines valid for the application must be observed. The safety nut is not a safety component within the meaning of the Machinery Directive.

NOTE2 The data refer to nuts for rolled shafts. For safety nuts on high precision shafts please contact HIWIN Italy

NOTE3 **Different diameters and pitches on request**

7.3 High load capacity screws

7.3.1 Scope of application

Heavy load ballscrews are screws with ball tracks designed to accommodate large-diameter balls. For this reason they are able to withstand very high loads.
They are used in plastic injection moulding machines, die casting machines, general electromechanical presses, high-capacity actuators and robots.

7.3.2 Functional characteristics

Can withstand high loads

- Load capacity 2-3 times that of the generic standard series
- High acceleration load
- Special lubrication system for short strokes

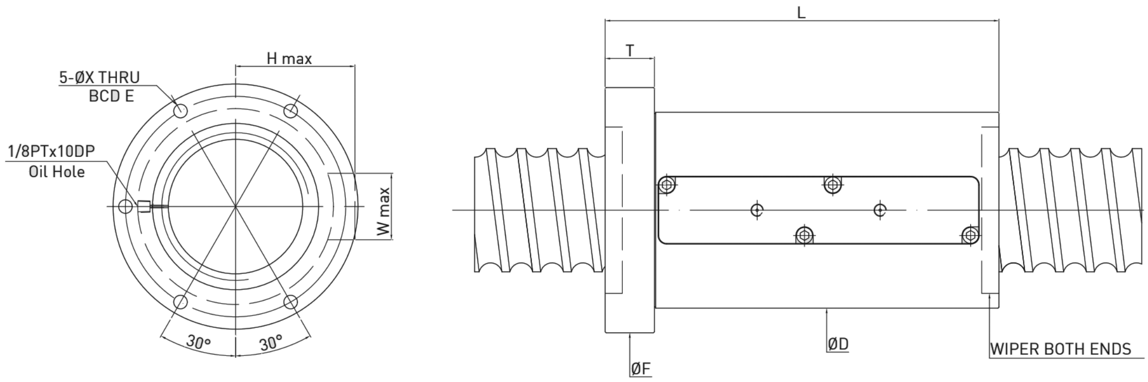
Precision

- Screws are ground and have ISO 5 and ISO 7 precisions

High speed and long life

- The reinforced recirculation system allows even very high speeds to be supported and ensures a long service life.

Maximum shaft length: 2m



For approximate pre-dimensioning, one can calculate the maximum axial force which the nut can offer simply by using this formula:

$$P_{max} \approx \frac{C_0}{10}$$

This obviously does not take into account any compression instability of the shaft, which can be calculated using formulas F3.25 and F3.26 on page 28 of this catalogue.

High load capacity screws are often involved in applications with short strokes, especially in relation to their pitch (necessary to accommodate generously sized balls). Therefore, there is the possibility of inserting spacers between the balls.
This option, called "**spacer Q1**", reduces the effect of short, repetitive stroke on ball wear.

N.B. = Number and size of holes are indicative: they can therefore be made to drawing.
HIWIN is willing to evaluate, together with the designer, the size and number of connection screws, depending on the conditions of the application.

Table 7.2 **Nut dimensions**

Article No.	Diameter	Pitch	Balls	Circuits	Dynamic C		Static C		D	L	F	T	E	X	H	W
					kgf	KN	kgf	KN								
R36-10Z1	36	10	7.144	4.8×1	9070	88.9	25160	246.6	62	96	96	18	79	9	42	26
R36-12X2	36	12	7.144	2.8×2	10330	101.2	29310	287.2	66	129	100	18	80	9	45	27
R40-10Y2	40	10	7.144	3.8×2	14310	140.2	45130	442.3	66	135	100	18	82	9	45	27
R40-10Z1	40	10	7.144	4.8×1	9640	94.5	28500	279.3	66	95	100	18	82	9	45	27
R50-10X1	50	10	7.144	2.8×1	6630	65.0	20560	201.5	75	76	109	18	92	9	49	26
R50-12Z2	50	12	7.938	4.8×2	22170	217.3	78700	771.3	77	185	111	22	94	9	49.5	27
R50-14Y2	50	14	9.525	3.8×2	23360	228.9	75440	739.3	80	189	114	28	97	9	54	32
R50-16X3	50	16	12.7	2.8×3	37130	363.9	111030	1088.1	95	243	129	28	112	9	59.5	36
R50-16Y2	50	16	12.7	3.8×2	34060	333.8	100460	984.5	95	209	129	28	112	9	61	36
R50-16Y3	50	16	12.7	3.8×3	48280	473.1	150690	1476.8	95	291	129	28	112	9	61	36
R50-16Z1	50	16	12.7	4.8×1	22940	224.8	63450	621.8	95	145	129	28	112	9	61	33
R63-10Y2	63	10	7.144	3.8×2	17420	170.7	71750	703.2	90	139	125	18	109	9	55	27
R63-14Z2	63	14	9.525	4.8×2	31490	308.6	119310	1169.2	94	217	128	28	111	9	60.5	32
R63-16X2	63	16	12.7	2.8×2	29250	286.7	92760	909.0	105	179	139	28	122	9	67	37
R63-16Y2	63	16	12.7	3.8×2	38040	372.8	125880	1233.6	105	209	139	28	122	9	65.5	37
R63-16Y3	63	16	12.7	3.8×3	53910	528.3	188830	1850.5	105	289	139	28	122	9	65.5	37
R63-16Z2	63	16	12.7	4.8×2	46500	455.7	159010	1558.3	105	243	139	28	122	9	67	36
R63-16Z3	63	16	12.7	4.8×3	65910	645.9	238520	2337.5	105	339	139	28	122	9	67	36
R63-20X2	63	20	15.875	2.8×2	39120	383.4	115750	1134.4	117	217	157	32	137	11	72.5	41
R63-20Y2	63	20	15.875	3.8×2	50870	498.5	157090	1539.5	117	257	157	32	137	11	72.5	41
R63-20Y3	63	20	15.875	3.8×3	72090	706.5	235640	2309.3	117	359	157	32	137	11	75.5	42
R63-20Z2	63	20	15.875	4.8×2	62180	609.4	198430	1944.6	117	299	157	32	137	11	75.5	42
R80-16Y1	80	16	12.7	3.8×1	23300	228.3	79810	782.1	120	135	154	32	137	9	73	39
R80-16Z2	80	16	12.7	4.8×2	51710	506.8	201630	1976.0	120	247	154	32	137	9	74	39
R80-16Z3	80	16	12.7	4.8×3	73290	718.2	302450	2964.0	120	343	154	32	137	9	74	39
R80-20Y2	80	20	15.875	3.8×2	56700	555.7	196910	1929.7	130	259	170	32	150	11	80	45
R80-20Y3	80	20	15.875	3.8×3	80360	787.5	295370	2894.6	130	359	170	32	150	11	80	45
R80-20Z2	80	20	15.875	4.8×2	69320	679.3	248730	2437.6	130	299	170	32	150	11	80	45
R80-25Y2	80	25	19.05	3.8×2	73750	722.8	244710	2398.2	145	320	185	40	165	11	90	53
R80-25Y3	80	25	19.05	3.8×3	104520	1024.3	367070	3597.3	145	445	185	40	165	11	90	53
R80-25Z2	80	25	19.05	4.8×2	90160	883.6	309110	3029.3	145	372	185	40	165	11	90	53
R100-20Y2	100	20	15.875	3.8×2	63210	619.5	249430	2444.4	145	255	185	32	165	11	90	49
R100-20Y3	100	20	15.875	3.8×3	89580	877.9	374140	3666.6	145	355	185	32	165	11	90	49
R100-20Z1	100	20	15.875	4.8×1	42570	417.2	157530	1543.8	145	175	185	32	165	11	90	49
R100-20Z2	100	20	15.875	4.8×2	77270	757.2	315070	3087.7	145	295	185	32	165	11	90	49
R100-20Z3	100	20	15.875	4.8×3	109510	1073.2	472600	4631.5	145	415	185	32	165	11	90	49
R100-25X2	100	25	19.05	2.8×2	62600	613.5	222540	2180.9	159	266	199	40	179	11	100	55
R100-25Y2	100	25	19.05	3.8×2	81410	797.8	302030	2959.9	159	320	199	40	179	11	100	59
R100-25Y3	100	25	19.05	3.8×3	115370	1130.6	453040	4439.8	159	445	199	40	179	11	100	59
R100-25Z2	100	25	19.05	4.8×2	99520	975.3	381510	3738.8	159	366	199	40	179	11	98	58
R120-25Y2	120	25	19.05	3.8×2	87740	859.9	359120	3519.4	173	316	213	40	193	11	109	56
R120-25Y3	120	25	19.05	3.8×3	124340	1218.5	538690	5279.2	173	441	213	40	193	11	109	59
R125-25Y2	125	25	19.05	3.8×2	89890	880.9	377880	3703.2	180	320	220	40	200	11	114	56
R125-25Z2	125	25	19.05	4.8×2	109890	1076.9	477320	4677.7	180	370	220	40	200	11	114	56

Code example

GBS	R50	16Y2	FSP	Q1	1000	1000	0.052	-L

8 Supports and accessories

8.1 General shank configuration of a ballscrew

Mounting types

The choice of support and mounting type for the screw is very important because it influences stiffness, speed and peak load. The table illustrating 4 of the most common mounting systems can help you make the right choice.

Shank design

Almost all ballscrew applications use angular and radial bearings with diameters that can be obtained by machining shafts, without any special precautions other than, sometimes, a ring that allows the angular bearing to be fully seated once the mounting ring is tightened. The table on this page and the relevant assembly diagrams help the designer to identify the dimensions of the most common bearing shanks. The values include for the fixed bearings (III, IV and V) the adoption of a pair of angular contact ball bearings with a pressure angle of 40° with main dimensions according to DIN 628-1 (series 7200), while for the radial bearings (I and II) the ball bearing follows the main dimensions according to DIN 625-1. Equally good, if not better performing alternatives such as 60° pressure angle bearings or more compact double-row bearings with pressure angles from 25° to 60° are often used for the fixed bearing. In these cases, the dimensions referring to the axial dimensions must be modified accordingly.

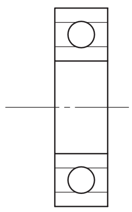
In particular, for all indications concerning the 60° precision angle angled bearing type BSB see page 75

HIWIN reserves the right to modify and improve the values in the table without prior notice.

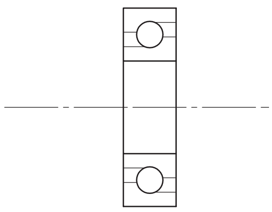
∅ Screw	D5 h5	D6 Seeger seat	D7 thread	D8 h8	E* ring	L3	Thickness B radial bearing L4	L5	L6	D7 Seeger seat	L8	L9	L10	L11	Ring nut thickness L12	L13 Key length	Key seat bxt1	I and II with radial bearing	III, IV and V with angular bearing
8	6	5.7	M6x0.5	4	6	15	6	26	24	0.8	38	44	50	18	8	12	2x1.2	606	726 C
10 and 12	8	7.6	M8x0.75	6	6	16	7	29	29	0.9	42	48	56	18	8	12	3x1.8	608	728 C
14 and 15	10	9.6	M10x0.75	8	8	20	9	39	36	1.15	46	54	64	20	8	14	3x1.8	6200	7200 B
16	12	11.5	M12x1.0	10	8	21	10	43	40	1.15	48	56	68	20	8	16	4x2.5	6201	7201 B
20	15	14.3	M15x1.0	12	10	24	11	47	44	1.15	55	65	77	25	8	16	5x3.0	6202	7202 B
20 and 25	17	16.2	M17x1.0	15	13	28	12	51	48	1.15	59	72	83	25	10	16	5x3.0	6203	7203 B
28 and 32	20	19	M20x1.0	16	17	34	14	60	56	1.35	66	83	94	28	10	18	6x3.5	6204	7204 B
32 and 36	25	23.9	M25x1.5	20	22	40	15	64	60	1.35	78	100	108	36	12	26	7x4.0	6205	7205 B
38 and 40	30	28.6	M30x1.5	25	20	39	16	68	64	1.65	86	106	118	42	12	32	8x4.0	6206	7206 B
45	35	33.3	M35x1.5	30	25	45	17	72	68	1.65	96	121	130	50	12	40	10x5.0	6207	7207 B
48 and 50	40	38	M40x1.5	35	20	47	18	77	72	1.95	110	130	146	60	14	50	12x5.0	6208	7208 B
55	45	42.5	M45x1.5	40	25.5	55	19	81	76	1.95	122	147.5	160	70	14	50	14x5.5	6209	7209 B
63	50	47	M50x1.5	45	10	32	20	85	80	2.2	134	144	174	80	14	60	14x5.5	6210	7210 B
70	55	52	M55x2.0	50	25	58	21	131	126	2.2	148	173	190	90	16	70	16x6.0	6211	7211 B
80	65	62	M65x2.0	60	10	49	22	138	132	2.7	162	172	206	100	16	80	18x7.0	6213	7213 B
100	75	72	M75x2.0	70	10	41	23	144	138	2.7	188	198	234	120	18	90	20x7,5	6215	7215 B

* Values refer to hot-moulded stop rings available from stock (except d5= 50, 65 and 75)

NOTE: for radial bearings the shrink disk solution is only necessary in special cases. In general, for radial supports E=0, consequently L3 must be subtracted.



DIN 625

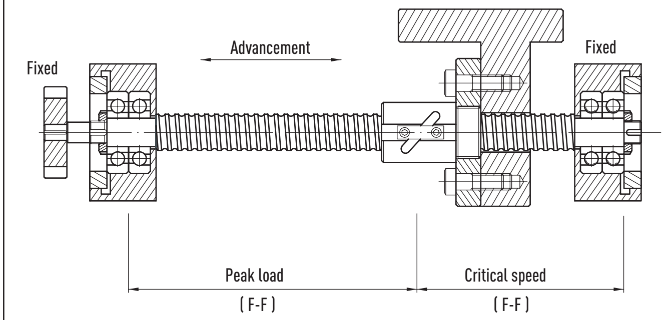


DIN 628

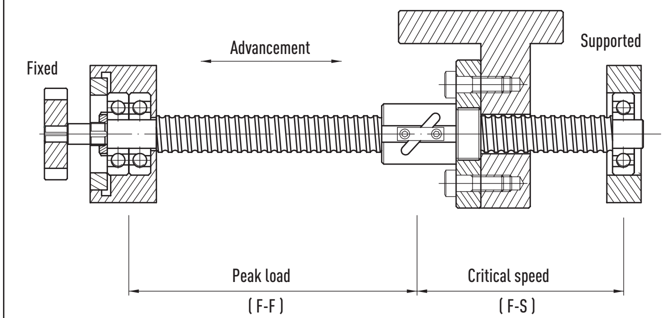
Advice for the designer

The diameter of the D5 shanks was chosen so as not to have thread marking and to ensure an optimal bearing stop.

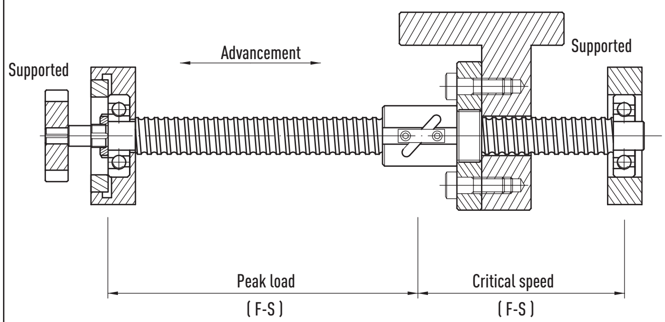
A. Fixed-fixed



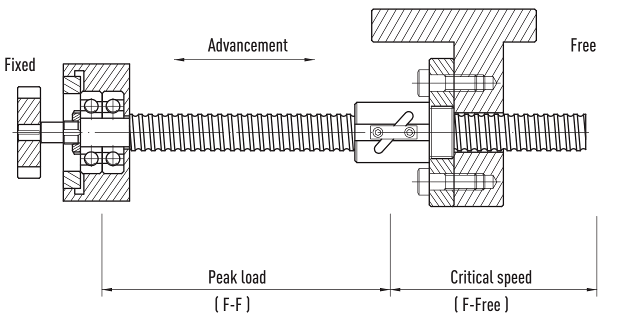
B. Fixed-supported



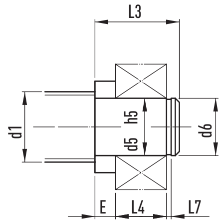
C. Supported-supported



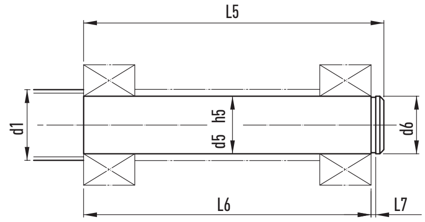
D. Fixed-free



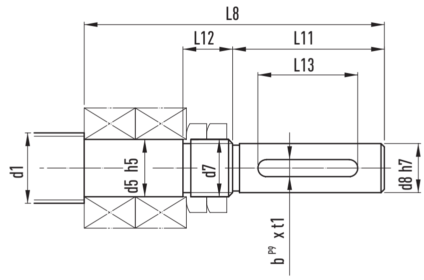
(I)



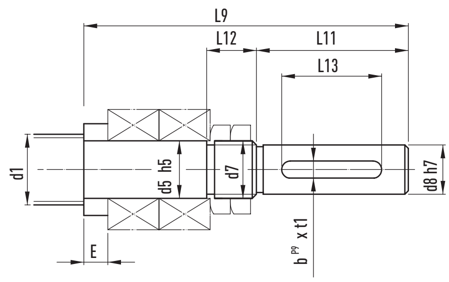
(II)



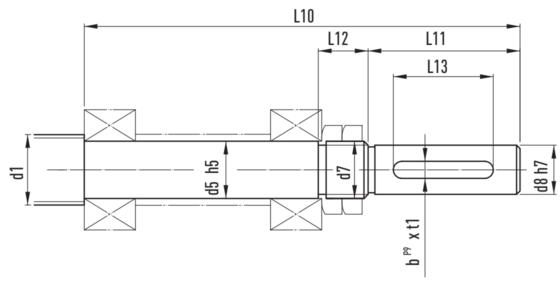
(III)



(IV)



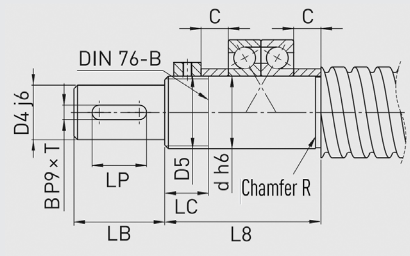
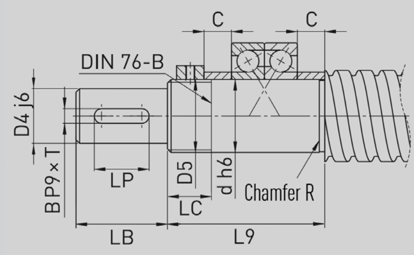
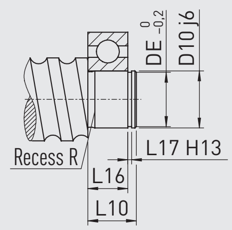
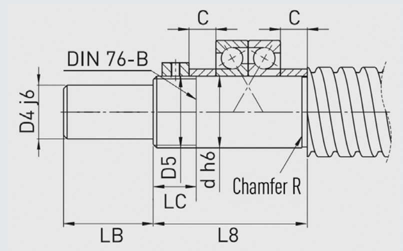
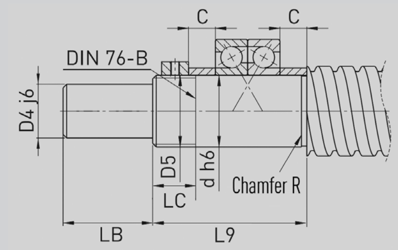
(V)



8.2 Supports and terminal configuration

HIWIN is at the disposal of designers by providing a range of supports and suggesting the relevant shank machining. In particular, the following types are recommended: "B", "E" and "F" for all standard handling applications with low or medium axial forces; the WBK series is recommended for applications with medium or high forces and high stiffness requirements, and finally the BSB bearing, contained in WBK, which allows maximum design flexibility to be combined with the performance of a 60° radial-axial that can be combined in all possible configurations.

Table 8.1 **Overview of standard shaft ends for EK, BK, FK, EF, BF, FF series bearings**

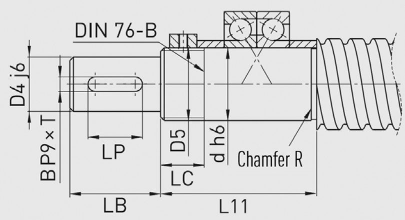
		
E8 type terminal Bearing: 70.. For complete FK, EK bearing unit	**E9 type terminal** Bearing: 72.. For complete BK bearing unit	**E10 type terminal** Bearing: deep groove ball bearing 60.. or 62.. For complete EF, BF, FF bearing units
		
E81 type terminal Bearing: 70.. For complete FK, EK bearing unit	**E91 type terminal** Bearing: 72.. For complete BK bearing unit	

Example: Shaft end coding, type E8, with mounting diameter d = 10 E8-10

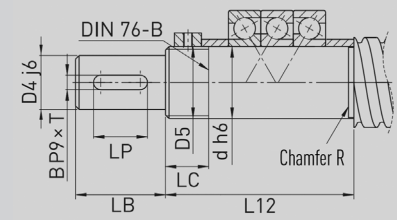
Table 8.2 **Standard bearing end dimensions for EK, BK, FK, EF, BF, FF series bearings**

Type of terminal	Nominal ballscrew Ø	d	D4	D5	D10	L8	L9	L10	L16	L17	DE	LC	LB	LP	B × T	C	Chamfer R
E_-08	12	8	6	M8 × 1	6	32	—	9	6	0.80	5.8	10	9	—	—	5.5	—
E_-10	15, 16	10	8	M10 × 1	8	36	36	10	7	0.90	7.7	11	20	14	2 × 1.2	5.5	—
E10-12	16[1)]	12	10	M12 × 1	10	36	36	11	8	1.15	9.6	11	23	16	3 × 1.8	5.5	E0.4X0.2
E8-12	16[1)]	12	10	M12 × 1	10	36	36	11	8	1.15	9.6	11	23	16	3 × 1.8	5.5	E0.4X0.2
E81-12	16[1)]	12	10	M12 × 1	10	36	36	11	8	1.15	9.6	11	23	16	3 × 1.8	5.5	E0.4X0.2
E_-15	20	15	12	M15 × 1	15	47	40	13	9	1.15	14.3	13	23	16	4 × 2.5	10	E0.4X0.2
E_-17	25	17	15	M17 × 1	15	59	53	16	12	1.15	16.2	17	23	16	4 × 2.5	9	E0.4X0.2
E_-20	25	20	17	M20 × 1	20	62	53	19	14	1.35	19.0	17	30	20	5 × 3.0	11	E0.6X0.2
E_-25	32	25	20	M25 × 1.5	25	76	65	20	15	1.35	23.9	20	50	36	6 × 3.5	15 (9)[3)]	E0.6X0.2
E_-30	40	30	25	M30 × 1.5	30	72	72	21	16	1.75	28.6	25	60	45	8 × 4.0	9	E0.6X0.2
E_-40	50	40	35[2)]	M40 × 1.5	40	—	93	23	18	1.95	38.0	35	80	56	10 × 5	15	E0.6X0.2

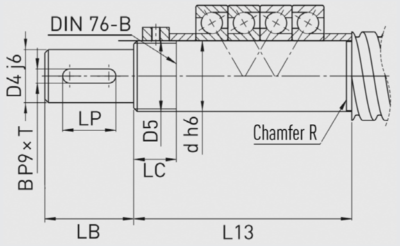
Table 8.3 **Overview of WBK series standard bearing terminals**



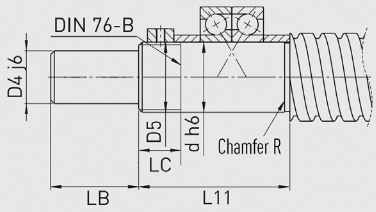
W1 type terminal
Bearing: BSB..
For complete WBK_DF bearing unit



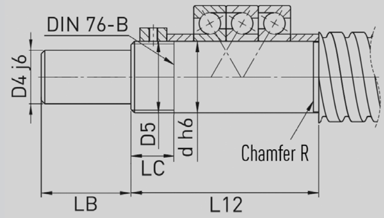
W2 type terminal
Bearing: BSB..
For complete WBK_DFD bearing unit



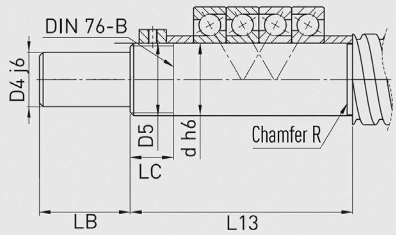
W3 type terminal
Bearing: BSB..
For complete WBK_DFF bearing unit



W11 type terminal
Bearing: BSB..
For complete WBK_DF bearing unit



W21 type terminal
Bearing: BSB..
For complete WBK_DFD bearing unit



W31 type terminal
Bearing: BSB..
For complete WBK_DFF bearing unit

Example: Shaft end coding, type W2, with mounting diameter d = 20: W2-20

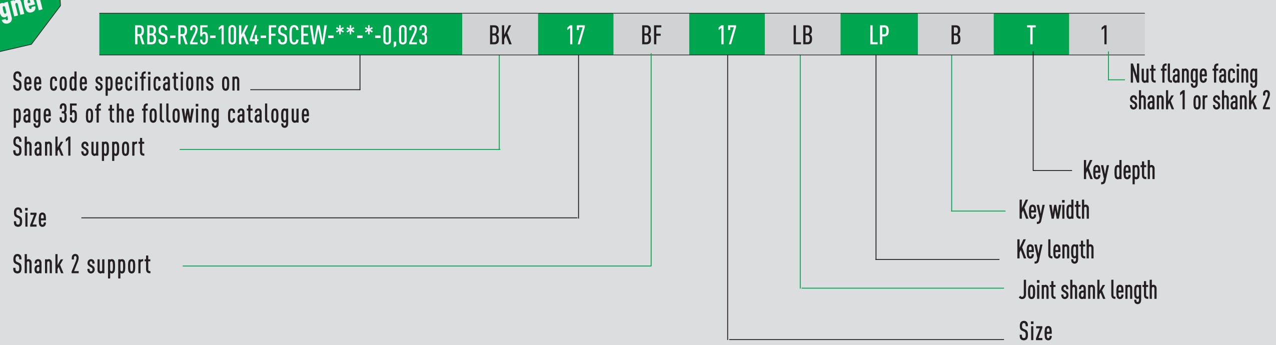
Table 8.4 **Dimensions of standard WBK series bearing terminals**

Type of terminal	Nominal ballscrew Ø	d	D4	D5	L11	L12	L13	LC	LB	LP	B × T
									suggested keys		
W_-15	20	15	12	M15 × 1	81	–	–	23	23	16	4 × 2.5
W_-17	25	17	14	M17 × 1	81	–	–	23	30	20	5 × 3.0
W_-20	25	20	17	M20 × 1	81	–	–	23	30	20	5 × 3.0
W_-25	32	25	20	M25 × 1.5	89	104	119	26	50	36	6 × 3.5
W_-30	40	30	25	M30 × 1.5	89	104	119	26	60	45	8 × 4.0
W_-35	45	35	30	M35 × 1.5	92	107	122	30	60	45	8 × 4.0
W_-40	50	40	35[1]	M40 × 1.5	92	107	122	30	80	56	10 × 5.0

Unit: mm
[1] Tolerance k6
Needless to say, we machine the shaft ends to your specifications and special requirements.
Note: the LB (and where present LP) dimension is only indicative because, not bound to the medium, it can be indicated as desired

Advice for the designer

For convenience, a screw can be coded at once with the machining of the ends, suitable for HIWIN supports, chosen from those in the catalogue.

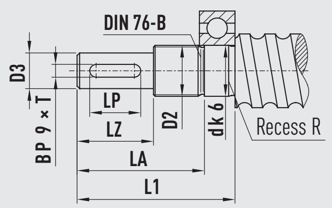


This code indicates a screw with a thread length of ** mm. The following formula is used to obtain the total length of the screw *mm:

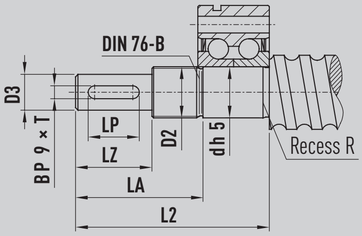
***mm = **mm + L8 or L9 + L10 + LB**

Supports and Accessories

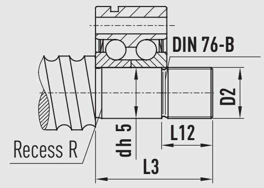
Table 8.5 **Overview of standard double-row angular contact ball bearings**



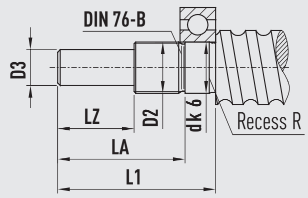
Supported terminal, type S1
Deep groove ball bearing 60 or 62



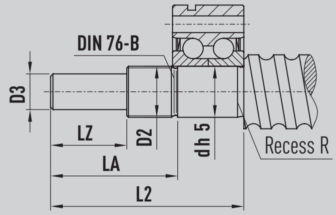
Fixed terminal, type S2
Double-row angular contact ball bearing



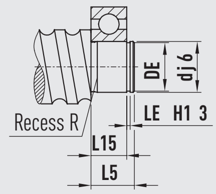
Fixed terminal, type S3
Double-row angular contact ball bearing



Supported terminal type S11
Deep groove ball bearing 60 or 62



Fixed terminal, type S21
Double-row angular contact ball bearing



Supported terminal type S5
Ball groove ball bearing 62

Table 8.6 **Dimensions of standard end pieces for double-row angular contact ball bearings**

Type of terminal	Nominal ballscrew Ø	d	D2	D3	L1	L2	L3	L5	L12	L15	DE	LE	LA	LP	LZ	B × T	Chamfer R
S_-06	12	6	M6 × 0.5	5 j6	31	37	—	8	—	6	5.7 h10	0.80	26	—	16	—	—
S_-10	15, 16	10	M10 × 0.75	8 j6	39	50	30	12	12	9	9.6 h10	1.10	32	14	20	2 × 1.2	—
S_-12	20	12	M12 × 1	10 j6	43	58	35	13	12	10	11.5 h11	1.10	35	16	23	3 × 1.8	E0.4 × 0.2
S_-17	25	17	M17 × 1	14 j6	60	73	43	15	20	12	16.2 h11	1.10	50	20	30	5 × 3	E0.4 × 0.2
S_-20	32	20	M20 × 1	14 j6	62	76	46	17	20	14	19 h12	1.30	50	20	30	5 × 3	E0.6 × 0.2
S_-25	40	25	M25 × 1.5	20 j6	83	96	46	19	20	15	23.9 h12	1.30	71	36	50	6 × 3.5	E0.6 × 0.2
S_-30	40	30	M30 × 1.5	25 j6	95	108	48	20	22	16	28.6 h12	1.60	82	45	60	8 × 4	E0.6 × 0.2
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	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	E0.6 × 0.3
S_-60	80	60	M60 × 2	50 k6	155	177	67	28	25	22	57 h12	2.15	135	70	110	14 × 5.5	E0.6 × 0.3

Unit: mm

Table 8.7 **Overview of shank machining (according to drawing or international standards) for EK, BK, FK fixed bearings**

Nominal ballscrew Ø	Support	Processing	Support	Processing	Support	Processing
12	EK08	E08-08/E81/08	–	–	FK08	E8-08/E81-08
15, 16	EK10	E8-10 / E81-10	BK10	E9-10/E91-10	FK10	E8-10/E81-10
16 1)	EK12	E8-12 / E81-12	BK12	E9-12/E91-12	FK12	E8-12/E81-12
20	EK15	E8-15 / E81-15	BK15	E9-15 / E91-15	FK15	E8-15/E81-15
25	EK20	E8-20 / E81-20	BK17	E9-17 / E91-17	FK17-FK20	E8-20/E81-20
32			BK25	E9-25 / E91-25	FK25	E8-25/E81-25
40			BK30	E9-30 / E91-30	FK30	E8-30/E81-30
50			BK40	E9-40 / E91-40	–	–

Note: When ordering a machined screw, we **always** recommend attaching a dimensioned technical drawing.

Table 8.8 **Overview of shank machining (according to drawing or international standards) for WBK fixed bearings**

Nominal ballscrew Ø	Flanged support	Shank machining
	WBK15DF	W1-15 / W11-15
25	WBK17DF	W1-17 / W11-17
25	WBK20DF	W1-20 / W11-20
32	WBK25DF	W1-25 / W11-25
32	WBK25DFD	W2-25 / W21-25
40	WBK30DF	W1-30 / W11-30
40	WBK30DFD	W2-30 / W21-30
45	WBK35DF	W1-35 / W11-35
45	WBK35DFD	W2-35 / W21-35
45	WBK35DFF	W3-35 / W31-35
50	WBK40DF	W1-40 / W11-40
50	WBK40DFD	W2-40 / W21-40
50	WBK40DFF	W3-40 / W31-40

Table 8.9 **Overview of shank machining (according to drawing or international standards) for EF, BF, FF radial bearings**

Nominal ballscrew Ø	Support	Processing	Support	Processing	Support	Processing
12	EF08	E10-08	–	–	FF08	E10-08
15, 16	EF10	E10-10	BF10	E10-10	FF10	E10-10
16 1)	EF12	E10-12	BF12	E10-12	FF12	E10-12
20	EF15	E10-15	BF15	E10-15	FF15	E10-15
25	EF20	E10-20	BF17	E10-17	FF17-FF20	E10-20
32			BF25	E10-25	FF25	E10-25
40			BF30	E10-30	FF30	E10-30
50			BF40	E10-40	–	–

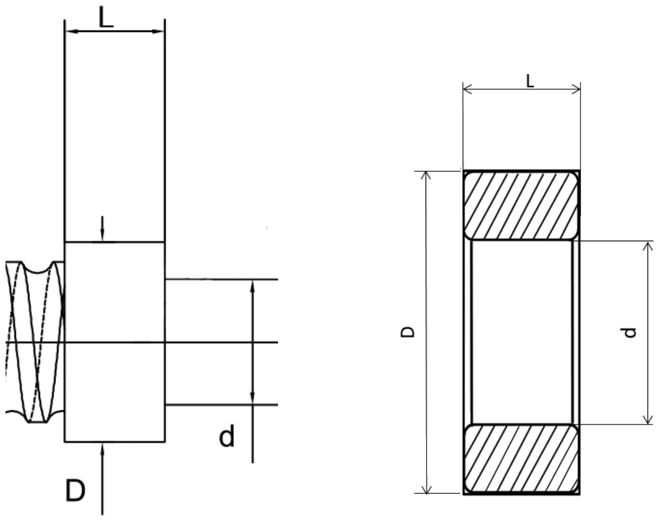
1) According to the effective outside diameter of the shaft dsmin = 15.5

Note: When ordering a machined screw, we **always** recommend attaching a dimensioned technical drawing.

8.2.1 Hot-galvanised ring options

For applications where greater safety is required that the angular contact bearings rest on the end-stop over the entire surface, it is possible to request the hot fitting of a ring, which will then be included in the final grinding process, effectively making it a single body with the shaft.
In order to guarantee optimum processing times for shanks, we invite designers to use ring dimensions as shown in the table. Rings with different dimensions will be considered with procurement times to be defined with HIWIN Italy.

Code example: ITAN D x d x L



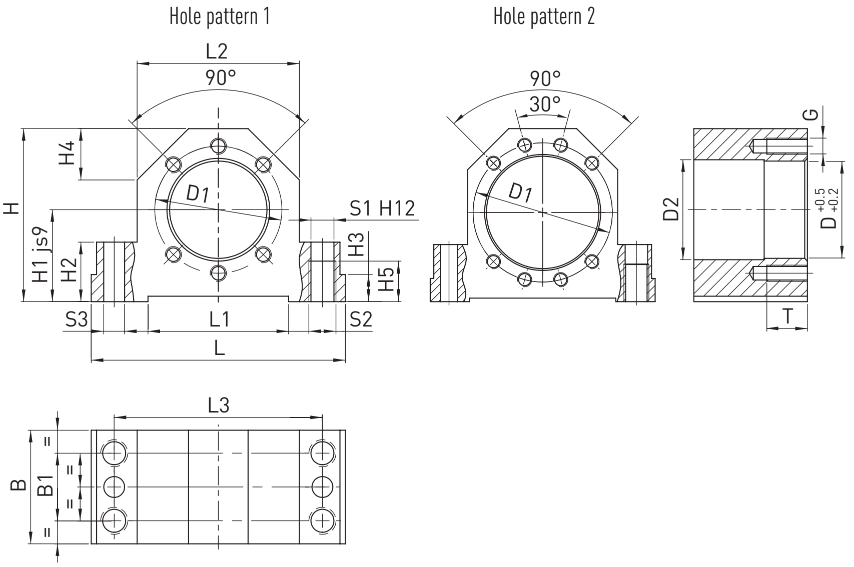
Ring keyed on shaft

Ring section

ITAN D x d x L	
ITAN8x6x6	ITAN26x16x8
ITAN12x6x6	ITAN70x42x18
ITAN14x10x12	ITAN32x25x22
ITAN16x10x8	ITAN35x26x15
ITAN16x10x7	ITAN36x12x8
ITAN16x12x12	ITAN38x30x20
ITAN16x12x7	ITAN40x20x10
ITAN16x12x8	ITAN40x25x20
ITAN16x12x20	ITAN40x32x20
ITAN17x14x17	ITAN40x25x27.6
ITAN20x12x10	ITAN47x30x10
ITAN20x15x13	ITAN48x30x20
ITAN22x12x8	ITAN48x35x20
ITAN22x15x10	ITAN63x55x25
ITAN22x17x13	ITAN50x45x25.5
ITAN24.5x12x12.5	ITAN60x40x15
ITAN24x15x5.5	ITAN60x40x21
ITAN25x20x17	ITAN70x42x18
ITAN25x20x20.5	

8.3 Connection flange for flanged nut DIN 69051 Part 5

The GFD connecting flange fits all nuts that follow the dimensions according to DIN 69051 part 5. The flange can be mounted from above (S1) and from below (S2) The housing can be fixed with two conical or cylindrical pins. For fastening, class 8.8 screws are recommended.



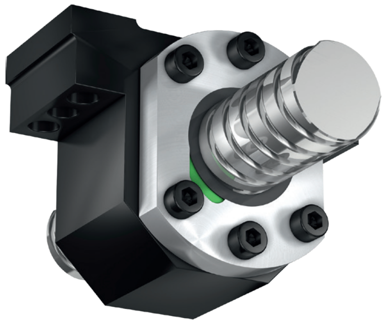


Table 8.10 **Connection flange dimensions**

Flange Type	Nominal Ø	L	L1	L2	L3	H	H1	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
GFD25	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

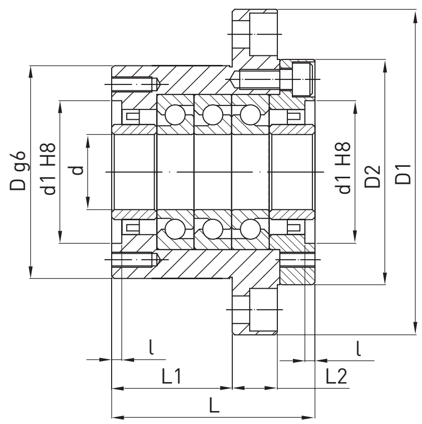
Table 8.11 **Connection flange dimensions**

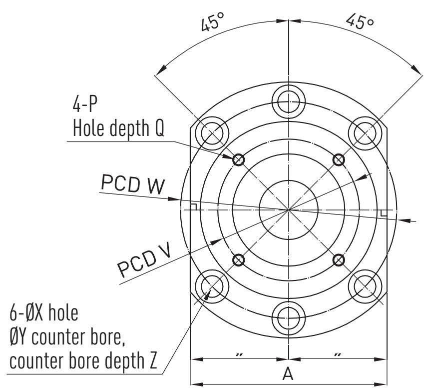
Flange Type	Nominal Ø	D	D1	D2	B	B1	S1	S2	S3	Hole pattern	G	T
GFD16	16	28	38	29	37	23	8.4	M10	7.7	1	M5	12
GFD20	20	36	47	37	42	25	8.4	M10	7.7	1	M6	15
GFD25	25	40	51	41	46	29	10.5	M12	9.7	1	M6	15
GFD32	32	50	65	51	49	29	10.5	M12	9.7	1	M8	20
GFD40	40	63	78	64	53	32	12.6	M14	9.7	2	M8	20
GFD50	50	75	93	76	59	34	12.6	M14	9.7	2	M10	25

Unit: mm

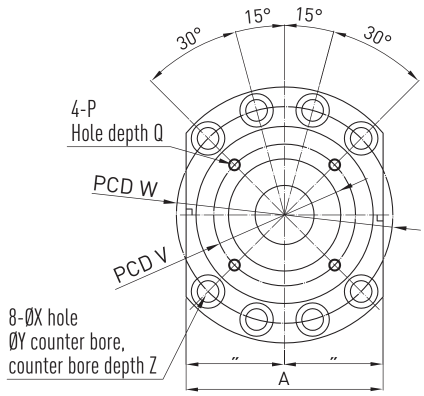
8.4 WBK series supports

The bearings in this series are particularly suitable for heavy-duty ballscrews. Depending on the axial load present, WBK systems are supplied with DF, DFD and DFF bearing arrangements, i.e. in pairs or with triads or quaternions.
The terminal machining procedures suitable for the WBK fixed bearing are W1, W2 and W3 (Chapter 8.1).





Hole pattern 1
ds ≤ 30



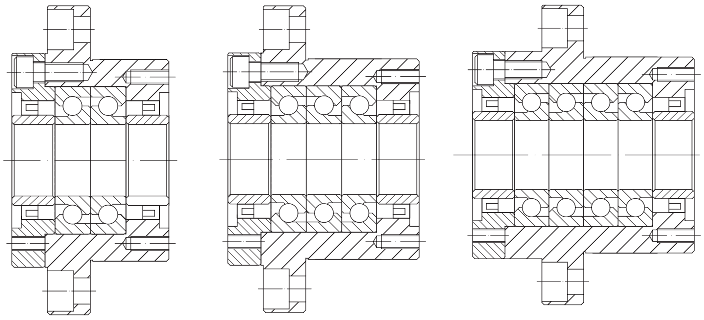
Hole pattern 2
ds > 30

Table 8.12 **WBK support dimensions**

Support	Nominal Ø	d	D	D1	D2	L	L1	L2	A	W	X	Y	Z	d1	l	V	P	Q
WBK15DF	20	15	70	106	72	60	32	15	80	88	9	14.0	8.5	45	3	58	M5	10
WBK17DF	25	17	70	106	72	60	32	15	80	88	9	14.0	8.5	45	3	58	M5	10
WBK20DF	25	20	70	106	72	60	32	15	80	88	9	14.0	8.5	45	3	58	M5	10
WBK25DF	32	25	85	130	90	66	33	18	100	110	11	17.5	11.0	57	4	70	M6	12
WBK25DFD	32	25	85	130	90	81	48	18	100	110	11	17.5	11.0	57	4	70	M6	12
WBK25DFF	32	25	85	130	90	96	48	18	100	110	11	17,5	11.0	57	4	70	M6	12
WBK30DF	40	30	85	130	90	66	33	18	100	110	11	17.5	11.0	57	4	70	M6	12
WBK30DFD	40	30	85	130	90	81	48	18	100	110	11	17.5	11.0	57	4	70	M6	12
WBK30DFF	40	30	85	130	90	96	48	18	100	110	11	17,5	11.0	57	4	70	M6	12
WBK35DF	45	35	95	142	102	66	33	18	106	121	11	17.5	11.0	69	4	80	M6	12
WBK35DFD	45	35	95	142	102	81	48	18	106	121	11	17.5	11.0	69	4	80	M6	12
WBK35DFF	45	35	95	142	102	96	48	18	106	121	11	17.5	11.0	69	4	80	M6	12
WBK40DF	50	40	95	142	102	66	33	18	106	121	11	17.5	11.0	69	4	80	M6	12
WBK40DFD	50	40	95	142	102	81	48	18	106	121	11	17.5	11.0	69	4	80	M6	12
WBK40DFF	50	40	95	142	102	96	48	18	106	121	11	17.5	11.0	69	4	80	M6	12

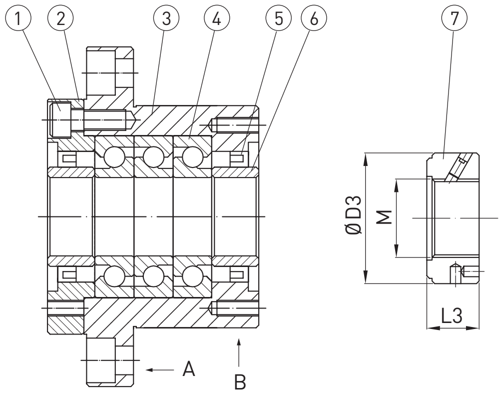
Unit: mm

Bearing arrangements in supports



DF Type DFD Type DFF Type

Support structure



(1) Locking screw, (2) Protective cover, (3) Bearing housing, (4) Bearings, (5) Seal, (6) Ring, (7) Ring nut

Note:
1. Use reference planes A and B for alignment during assembly.
2. For maximum precision, parts 1-6 must not be removed.

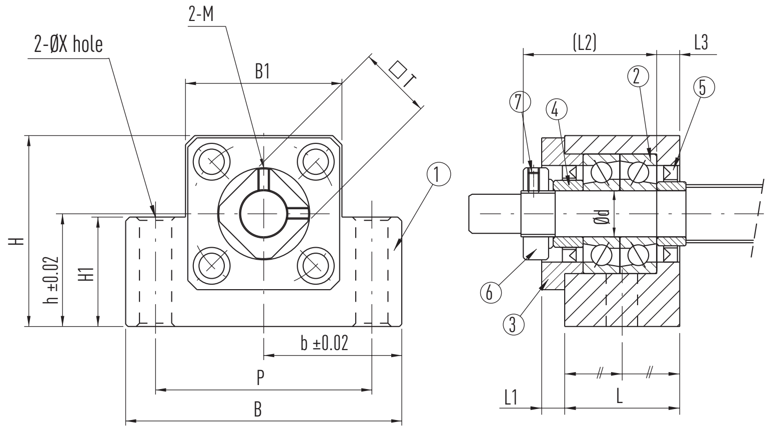
Table 8.13 **Bearing technical data**

Support	Dynamic load coefficient C_{dyn} [kN]	Permissible axial load [kN]	Preload [kN]	Axial stiffness [N/µm]	Starting torque [Nm]	Ring nut				Weight [kg]
						M	D3	L3	Ring nut tightening torque [Nm]	
WBK15DF	21.9	26.6	2.15	750	0.19	M15 × 1	30	14	8	1.9
WBK17DF	21.9	26.6	2.15	750	0.19	M17 × 1	32	16	9.5	1.9
WBK20DF	21.9	26.6	2.15	750	0.19	M20 × 1	38	16	17	1.9
WBK25DF	28.5	40.5	3.15	1,000	0.29	M25 × 1.5	38	18	21	3.1
WBK25DFD	46.5	81.5	4.30	1,470	0.39	M25 × 1.5	38	18	21	3.4
WBK25DFF	46.5	81.5	6.30	1,960	0.49	M25 × 1.5	38	18	21	3.8
WBK30DF	29.2	43.0	3.35	1,030	0.30	M30 × 1.5	45	18	32	3.0
WBK30DFD	47.5	86.0	4.50	1,520	0.40	M30 × 1.5	45	18	32	3.3
WBK30DFF	47.5	86.0	6.70	2,010	0.50	M30 × 1.5	45	18	32	3.8
WBK35DF	31.0	50.0	3.80	1,180	0.34	M35 × 1.5	52	18	48	3.4
WBK35DFD	50.5	100.0	5.20	1,710	0.45	M35 × 1.5	52	18	48	4.3
WBK35DFF	50.5	100.0	7.65	2,350	0.59	M35 × 1.5	52	18	48	5.0
WBK40DF	31.5	52.0	3.90	1,230	0.36	M40 × 1.5	58	20	72	3.6
WBK40DFD	51.5	104.0	5.30	1,810	0.47	M40 × 1.5	58	20	72	4.2

8.5 EK/EF series supports

8.5.1 EK fixed support

The axis height of the fixed support is adjusted to that of the EF radial support (Chapter 8.5.2). The terminal machining suitable for the EK fixed bearing is type E8-xx (Chapter 8.1).



(1) Housing, (2) Bearing, (3) Locking cover, (4) Support ring, (5) Seal, (6) Ring nut, (7) Locking Dowel

Table 8.14 **Support dimensions**

Type	Nominal Ø	d	L	L1	L2	L3	B	H	b	h	B1	H1	P	X	M	T
EK06	8	6	20	–	22	3,5	42	25	21	13	18	20	30	5,5	M3	12
EK08	12	8	23	6	26	4	52	32	26	17	25	26	38	6.6	M3	14
EK10	16	10	24	6	29.5	6	70	43	35.0	25	36	24	52	9	M3	16
EK12	16 1)	12	24	6	29.5	6	70	43	35.0	25	36	24	52	9	M4	19
EK15	20	15	25	6	36.0	5	80	49	40.0	30	41	25	60	11	M4	22
EK20	25	20	42	10	50.0	10	95	58	47.5	30	56	25	75	11	M4	30

Unit: mm

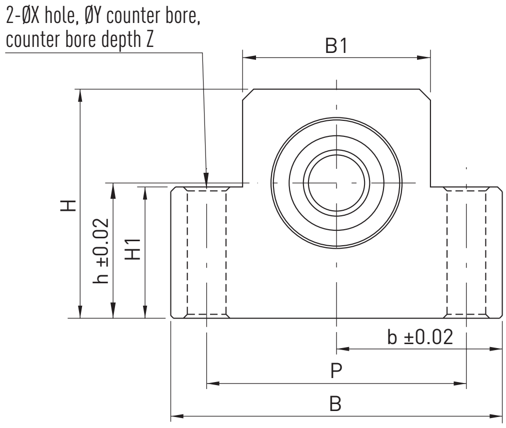
1) According to the effective outside diameter of the shaft dsmin = 15.5

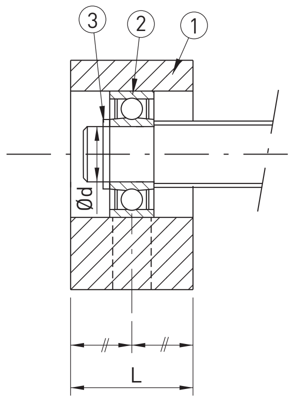
Table 8.15 **Bearing technical data**

Type	Bearing type	C_0 [N] static	C_r [N] dynamic	Maximum axial load [N]	Maximum speed [n/min]	Ring nut			
						Type	Ring nut tightening torque [Nm]	Thread	Ring nut tightening torque [Nm]
EK06	706A P0	2,900	1,530	0,730	52,800	RN6	2	M3	0.6
EK08	708	4,800	2,800	1,100	40,000	RN8	2.5	M3	0.6
EK10	7000A P0	8,800	5,200	2,000	24,000	RN10	2.9	M3	0.6
EK12	7001A P0	9,400	6,000	2,200	22,000	RN12	6.4	M4	1.5
EK15	7002A P0	10,000	6,900	2,400	19,000	RN15	7.9	M4	1.5
EK20	7204B P0	21,600	15,200	6,800	9,500	RN20	16.7	M4	1.5

8.5.2 EF radial support

The axis height of the radial support is adjusted to that of the EK fixed support (Chapter 8.5.1). The terminal machining suitable for the EF radial support is type E10-xx (Chapter 8.1).





(1) Housing, (2) Bearing, (3) Seeger

Table 8.16 **Support dimensions**

Type	Nominal Ø	d	L	B	H	b	h	B1	H1	P	X	Y	Z	Bearing	Seeger
EF06	8	6	12	42	25	21.0	13	18	20	30	5.5	9.5	11	606ZZ	S 06
EF08	12	6	14	52	32	26.0	17	25	26	38	6.6	11	12	606ZZ	S 06
EF10	16	8	20	70	43	35.0	25	36	24	52	9.0	–	–	608ZZ	S 08
EF12	16 1)	10	20	70	43	35.0	25	36	24	52	9.0	–	–	6000ZZ	S 10
EF15	20	15	20	80	49	40.0	30	41	25	60	9.0	–	–	6002ZZ	S 15
EF20	25	20	26	95	58	47.5	30	56	25	75	11.0	–	–	6204ZZ	S 20

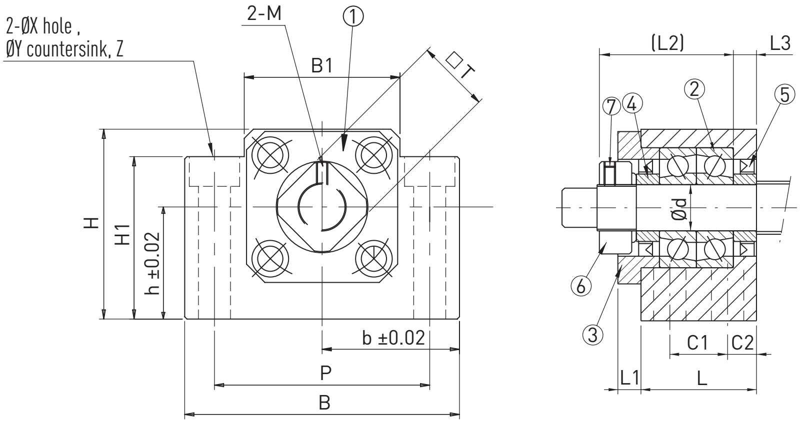
Unit: mm

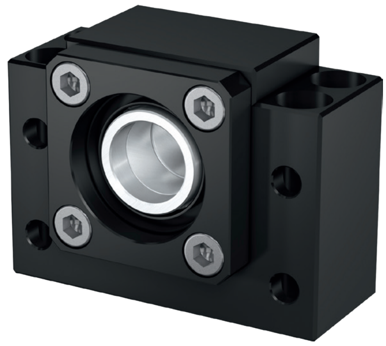
1) According to the effective outside diameter of the shaft dsmin = 15.5

8.6 BK/BF series supports

8.6.1 BK fixed support

The axis height of the fixed support is adjusted to that of the BF radial support (Chapter 8.6.2). The end machining suitable for the BK fixed bearing is type E9-xx (Chapter 8.1





(1) Housing
(2) Bearing
(3) Locking cover
(4) Support ring
(5) Seal
(6) Ring nut
(7) Locking Dowel

Table 8.17 **Support dimensions**

Type	Nominal Ø	d	L	L1	L2	L3	B	H	b	h
BK10	15.16	10	25	5	29.5	5	60	39	30	22
BK12	16	12	25	5	29.5	5	60	43	30	25
BK15	20	15	27	6	32	6	70	48	35	28
BK17	25	17	35	9	44	7	86	64	43	39
BK20	25	20	35	8	43	8	88	60	44	34
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 8.18 **Support dimensions (continued)**

Type	Nominal Ø	B1	H1	E	P	C1	C2	d2	X	Y	Z	M	T
BK10	15.16	34	32.5	15	46	13	6	5.5	6.6	10.8	5	M3	16
BK12	16	34	32.5	18	46	13	6	5.5	6.6	10.8	5	M4	19
BK15	20	40	38	18	54	15	6	6.6	6.6	11	1.5	M4	22
BK17	25	50	55	28	68	19	8	6.6	9	14	6.5	M4	24
BK20	25	52	50	22	70	19	8	9	9	14	8.5	M4	30
BK25	32	64	70	33	85	22	10	9	11	17	11.0	M6	35
BK30	40	76	78	33	102	23	11	11	14	20	13.0	M6	40
BK40	50	100	90	37	130	33	14	14	18	26	17.5	M6	50

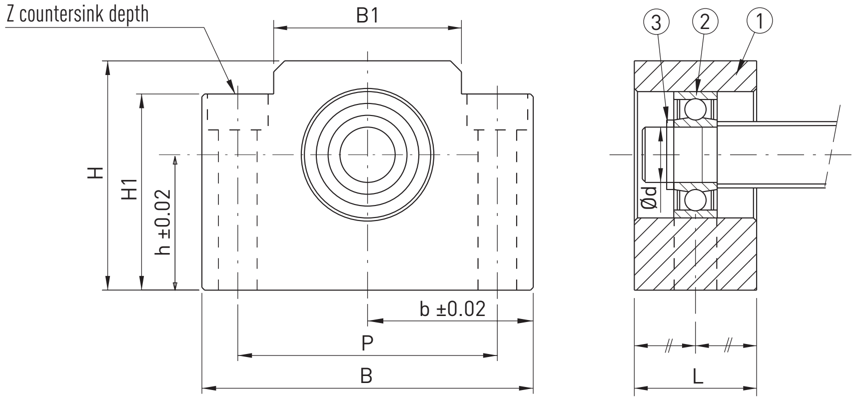
Unit: mm

Table 8.19 **Bearing technical data**

Type	Bearing type	C_{0r} [N] static	C_r [N] dynamic	Maximum axial load [N]	Maximum speed [n/min]	Ring nut			
						Type	Ring nut tightening torque [Nm]	Thread	Ring nut tightening torque [Nm]
BK10	7000A P0	8,800	5,200	1,900	24,000	RN10	2.9	M3	0.63
BK12	7001A P0	9,400	6,000	2,100	22,000	RN12	6.4	M4	1.50
BK15	7002A P0	10,000	6,900	2,400	19,000	RN15	7.9	M4	1.50
BK17	7003A P0	8,800	12,000	4,100	16,000	RN17	7.9	M4	1.50
BK20	7004A P0	8,800	13,200	4,200	15,000	RN20	16.7	M4	1.50
BK25	7205A P0	26,300	20,500	7,000	12,000	RN25	21.0	M6	5.00
BK30	7206B P0	33,500	27,000	10,600	7,100	RN30	31.0	M6	5.00
BK40	7208B P0	52,000	46,100	18,000	5,300	RN40	71.0	M6	5.00

8.6.2 BF radial support

The height of the radial support axis is adjusted to that of the BK fixed support (Chapter 8.6.1). The terminal machining suitable for the BF supported bearing is type E10-xx (Chapter 8.1).



(1) Housing, (2) Bearing, (3) Seeger

Table 8.20 **Support dimensions**

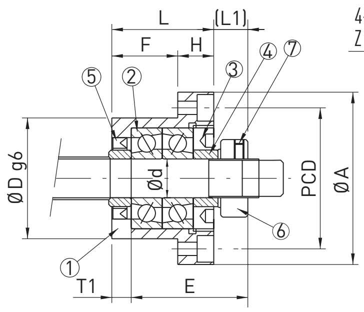
Type	Nominal Ø	d	L	B	H	b	h	B1	H1	P	X	Y	Z	Bearing	Seeger
BF10	16	8	20	60	39	30	22	34	32.5	46	6.6	10.8	5	608ZZ	S 08
BF12	16	10	20	60	43	30	25	34	32.5	46	6.6	10.8	1.5	6000ZZ	S 10
BF15	20	15	20	70	48	35	28	40	38	54	6.6	11	6.5	6002ZZ	S 15
BF17	25	17	23	86	64	43	39	50	55	68	9	14	8.5	6203ZZ	S 17
BF20	25	20	26	88	60	44	34	52	50	70	9	14	8.5	6004ZZ	S 20
BF25	32	25	30	106	80	53	48	64	70	85	11	17	11.0	6205ZZ	S 25
BF30	40	30	32	128	89	64	51	76	78	102	14	20	13.0	6206ZZ	S 30
BF40	50	40	37	160	110	80	60	100	90	130	18	26	17.5	6208ZZ	S 40

Unit: mm

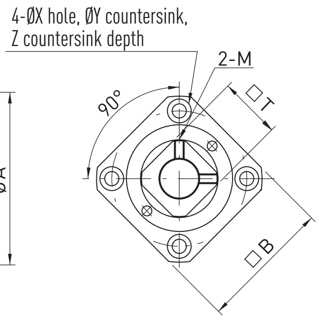
8.7 FK/FF Series Supports

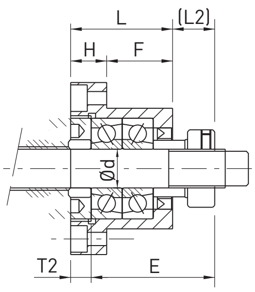
8.76.1 FK fixed support

The associated radial support is from the FF series (Chapter 8.7.2). The terminal machining suitable for the FK fixed bearing is type E8-xx (Chapter 8.1).



Variant A assembly





Variant B assembly

(1) Housing, (2) Bearing, (3) Locking cover, (4) Support ring, (5) Seal, (6) Ring nut, (7) Dowel

Table 8.21 **Support dimensions**

Article number	Nominal Ø	d	L	H	F	E	D	A	PCD	B	Variant A assembly		Variant B assembly		X	Y	Z	M	T
											L1	T1	L2	T2					
FK05	6	5	16.5	6	10.5	18.5	20	34	26	26	5.5	3.5	5	3	3.4	6.5	4	M3	11
FK06	8	6	20	7	13	22	22	36	28	28	5.5	3.5	6.5	4.5	3.4	6.5	4	M3	11
FK08	12	8	23	9	14	26	28	43	35	35	7	4	8	5	3.4	6.5	4	M3	14
FK10	16	10	27	10	17	29.5	34	52	42	42	7.5	5	8.5	6	4.5	8.0	5	M3	16
FK12	16[1]	12	27	10	17	29.5	36	54	44	44	7.5	5	8.5	6	4.5	8.0	5	M4	19
FK15	20	15	32	15	17	36.0	40	63	50	52	10.0	6	12.0	8	5.5	9.5	6	M4	22
FK17	25	17	45	22	23	47	50	77	62	61	11	9	14	12	6.6	11	10	M4	24
FK20	25	20	52	22	30	50.0	57	85	70	68	8.0	10	12.0	14	6.6	11.0	10	M4	30
FK25	32	25	57	27	30	60.0	63	98	80	79	13.0	10	20.0	17	9.0	15.0	13	M6	35
FK30	40	30	62	30	32	61.0	75	117	95	93	11.0	12	17.0	18	11.0	17.5	15	M6	40

Unit: mm

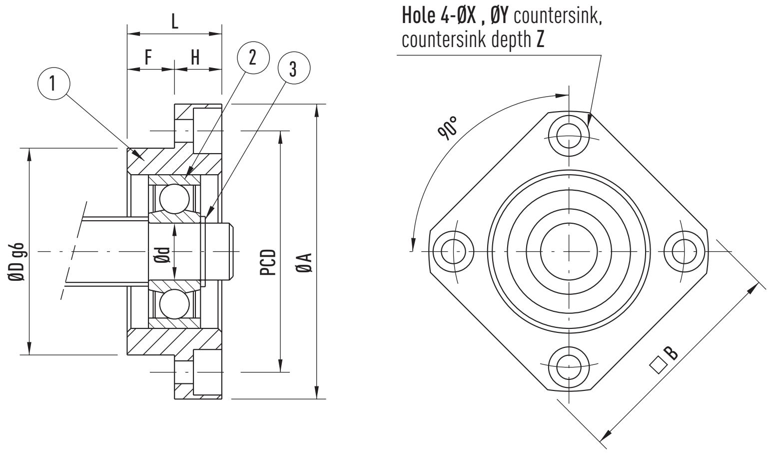
[1] According to the effective outside diameter of the shaft ds_{min} = 15.5

Table 8.22 **Bearing technical data**

Type	Bearing type	C_0 axial [N]	C_{dyn} axial [N]	Maximum permissible axial load [N]	Maximum speed [rpm]	Nut screw			
						Type	Ring nut tightening torque [Nm]	Thread	Ring nut tightening torque [Nm]
FK05	725A P0	2,300	1,190	660	57,600	RN5	1.7	M3	0.6
FK06	706A P0	2,900	1,530	730	52,800	RN6	2.0	M3	0.6
FK08	708	4,800	2,800	1,000	40,000	RN8	2.5	M3	0.6
FK10	7000A P0	8,800	5,200	1,900	24,000	RN10	2.9	M3	0.6
FK12	7001A P0	9,400	6,000	2,200	22,000	RN12	6.4	M4	1.5
FK15	7002A P0	10,000	6,900	2,400	19,000	RN15	7.9	M4	1.5
FK17	7203A P0	17,600	12,000	4,100	16,000	RN17	7.9	M4	1.5
FK20	7204B P0	21,600	15,300	6,800	9,500	RN20	16.7	M4	1.5
FK25	7205B P0	24,000	19,000	8,100	8,500	RN25	20.6	M6	4.9
FK30	7206B P0	33,500	27,000	10,600	7,100	RN30	31.4	M6	4.9

8.7.2 FF radial support

The associated fixed support is from the FK series (Chapter 8.7.1). The terminal machining suitable for the FF radial support is type E10-xx (Chapter 8.1).



(1) Housing, (2) Bearing, (3) Seeger

Table 8.23 **Support dimensions**

Type	Nominal Ø	d	L	H	F	D	A	PCD	B	X	Y	Z	Bearing	Seeger
FF6	8	6	10	6	4	22	36	28	28	3.4	6.5	4.0	606ZZ	S 06
FF10	16	8	12	7	5	28	43	35	35	3.4	6.5	4.0	608ZZ	S 08
FF12	16[1]	10	15	7	8	34	52	42	42	4.5	8.0	4.0	6000ZZ	S 10
FF15	20	15	17	9	8	40	63	50	52	5.5	9.5	5.5	6002ZZ	S 15
FF17	20	17	20	11	9	50	77	62	61	6.6	11	6.5	6203ZZ	S 17
FF20	25	20	20	11	9	57	85	70	68	6.6	11.0	6.5	6204ZZ	S 20
FF25	32	25	24	14	10	63	98	80	79	9.0	14.0	8.5	6205ZZ	S 25
FF30	40	30	27	18	9	75	117	95	93	11.0	17.0	11.0	6206ZZ	S 30

Unit: mm

[1] According to the effective outside diameter of the shaft ds_{min} = 15.5

Supports and Accessories

8.8 Rolling bearings

8.8.1 Introduction

HIWIN angular-contact rolling bearings with 60° pressure angle can be used in sets of two, three or four elements, or in various other combinations, to meet the required load requirements.
Rolling bearings can be mounted face-to-face or back-to-back. These types of bearings can withstand the load force in both axial and radial directions, and increasing the number of bearing sets increases the load capacity.

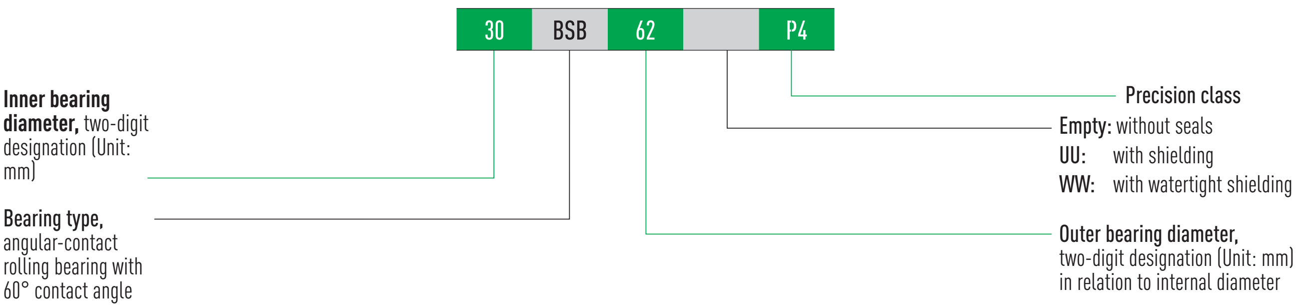
In a back-to-back configuration, the distance between the bearing load centres is large, which increases the tilting moment load capacity, so this particular configuration is even used on machining centre spindles. Although the tilting moment load capacity, for a face-to-face configuration, is lower, it offers the advantage of allowing a greater misalignment angle.

HIWIN rolling bearings have a pressure angle of 60°. This type of bearing can handle higher axial loads than the more traditional ones (see table page 61). It is in fact specifically designed for use in ballscrew assemblies, as the axial load capacity is high, which also leads to high axial stiffness. And it is precisely this aspect that ensures exceptional stability of the shaft when subjected to large axial loads. The purpose of rolling bearings is to enable the ballscrew to achieve the highest possible degree of accuracy.

8.8.2 Product Characteristics

- **Rotation accuracy** exceeding international standards.
- **Uniform rotation.**
- **Smaller dimensions** requiring less space.
- **Easy installation and adjustment.**
- Can be supplied together with HIWIN ballscrews, for a complete solution, see WBK supports

8.7.3 Product Specifications



8.7.4 Mounting Configuration

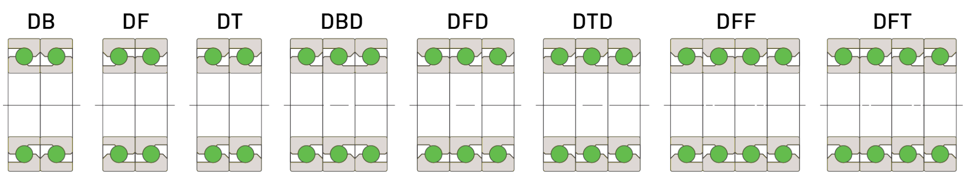


Table 8.24 **BSB standard dimensional tolerances**

Nominal bearing diameters [mm]		Inner diameter tolerances		Outer diameter tolerances		Width tolerances		Axial oscillation of rings
		P4		P4		P4		P4
OVER	INCLUDES	upper	lower	upper	lower	upper	lower	Max
10	18	0	-4	-	-	0	-80	2.5
18	30	0	-5	-	-	0	-120	2.5
30	50	0	-6	0	-6	0	-120	2.5
50	80	0	-7	0	-7	0	-150	2.5
50	120	0	-8	0	-8	0	-200	2.5

Unit µm
Note: Oscillation accuracy given in the table is based on ISO 492

Table 8.25 **Dimensional tolerances for shaft diameter and mounting hole**

Nominal diameters shaft/hole [mm]		Shaft tolerance		Hole tolerance	
		h5		H6	
OVER	INCLUDES	upper	lower	upper	lower
10	18	0	-8	-	-
18	30	0	-9	-	-
30	50	0	-11	+16	0
50	80	0	-13	+19	0
80	120	0	-15	+22	0

Unit µm

Table 8.26 **X and Y coefficients for determining the equivalent dynamic load**

Number of bearings		Pair		Terna			Quatern		
Mounting configuration		DB/DF	DT	DBD/DFD		DTD	DFT	DFF	DFT
Bearings opposite to axial load		1	2	1	2	3	1	2	3
Fa/Fr ≤ e	X	1.9	-	1.43	2.33	-	1.17	2.33	2.53
	Y	0.54	-	0.77	0.35	-	0.89	0.35	0.26
Fa/Fr > e	X	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
	Y	1	1	1	1	1	1	1	1

e = 2,17

The coefficients in Table 9.3 should be introduced in the relationship:

$$P_a = X \times F_r + Y \times F_a$$

P_a Dynamic load,equivalent (N)
F_r Radial force (N)
F_a Axial force (N)

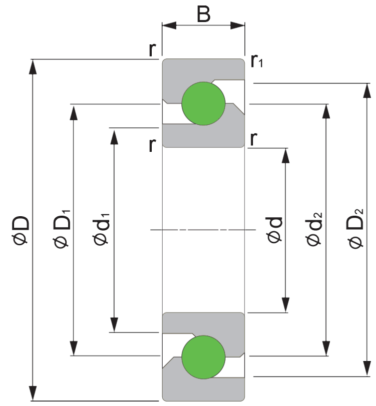


Table 8.27 **Bearing specifications**

Spec.	Main dimensions (mm)					Dimensions (mm)			
	d	D	B	r (min)	r_1 (min)	d_1	d_2	D_1	D_2
15 BSB 47	15	47	15	1	0.6	27.2	34	34	39.7
17 BSB 47	17	47	15	1	0.6	27.2	34	34	39.7
20 BSB 47	20	47	15	1	0.6	27.2	34	34	39.7
25 BSB 62	25	62	15	1	0.6	37	44.6	44.6	50.8
30 BSB 62	30	62	15	1	0.6	39.5	47.1	47.1	53.3
35 BSB 72	35	72	15	1	0.6	49.4	57	57	63.2
40 BSB 72	40	72	15	1	0.6	49.4	57	57	63.2

Table 8.28 **Bearing specifications**

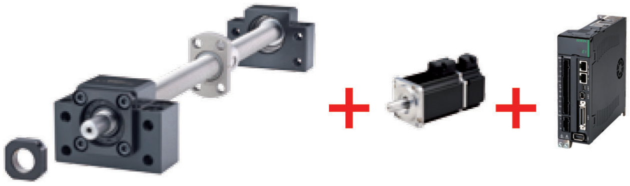
Spec.	Rpm permitted (rpm)	Basic dynamic load capacity (kN)			Max. axial load (kN)		
		1 row	2 rows	3 rows	1 row	2 rows	3 rows
15 BSB 47	6000	21.9	35.5	47.5	26.6	53	79.5
17 BSB 47	6000	21.9	35.5	47.5	26.6	53	79.5
20 BSB 47	6000	21.9	35.5	47.5	26.6	53	79.5
25 BSB 62	4500	28.5	46.5	61.5	40.5	81.5	122
30 BSB 62	4300	29.2	47.5	63	43	86	129
35 BSB 72	3600	31.5	51.5	68.5	52	104	157
40 BSB 72	3600	31.5	51.5	68.5	52	104	157

Table 8.29 **Bearing specifications**

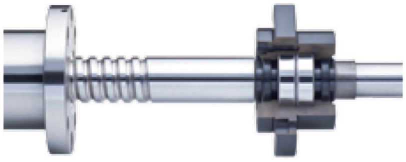
Spec.	Set of 2 (DF)			Set of 3 (DFD)			Set of 4 (DFF)		
	Preload (kN)	Stiffness (kN/µm)	Torque resistance (N-cm)	Preload (kN)	Stiffness (kN/µm)	Torque resistance (N-cm)	Preload (kN)	Stiffness (kN/µm)	Torque resistance (N-cm)
15 BSB 47	2.1	0.75	14	2.9	1.1	20	4.3	1.4	29
17 BSB 47	2.1	0.75	14	2.9	1.1	20	4.3	1.4	29
20 BSB 47	2.1	0.75	14	2.9	1.1	20	4.3	1.4	29
25 BSB 62	3.1	1.0	23	4.3	1.4	31	6.2	1.9	46
30 BSB 62	3.3	1.0	24	4.5	1.5	33	6.6	2.0	49
35 BSB 72	3.9	1.2	23	5.3	1.8	37	7.8	2.4	55
40 BSB 72	3.9	1.2	28	5.3	1.8	38	7.8	2.4	57

9 Total Solution with HIWIN Ballscrews

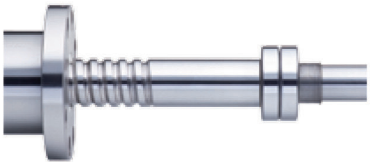
9.1 Ballscrew + Bearing/Mother Bearing+Motor+Drive

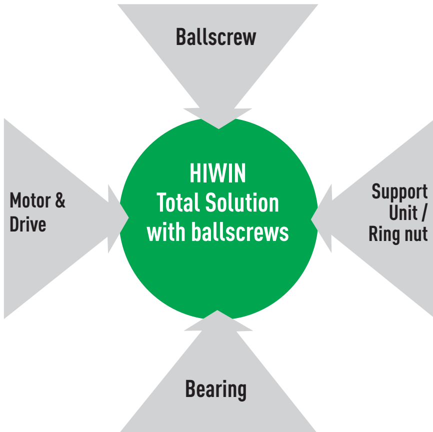


9.2 Ballscrew + Support Unit



9.3 Ballscrew + BSB bearing



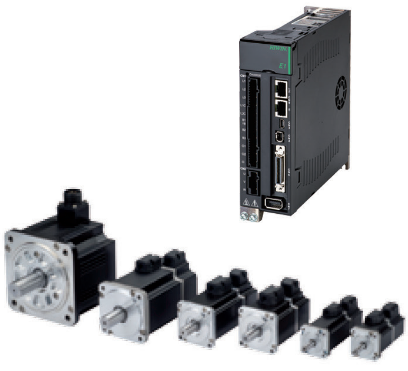


Bearing Specifications

Support units	Bearings
WBK	BSB
BK,BF	
FK,FF	
EK, EF	

Motor and Drive Specifications

Maximum voltage	230 VAC (mono- or three-phase)	230 VAC (three-phase only)	Encoder	Drive	Control interface:
230 VAC	50W 100W 200W 400W 750W 1kW	1.2kW 2kW	23 bit incremental 23 bits absolute	ED1	Standard (step/dir and voltage) Fieldbus (EtherCAT, mega-ulink, Mechatrolink III)



10. Ballscrew Assembly Instructions

10.1 Assembling and disassembling the nut from the shaft

CAUTION!

Risk of damage!
If the nut is removed from the shaft without using the appropriate mounting tube, there is a risk of causing damage due to loss of the balls.

- Always use the mounting tube to support the nut!

HIWIN ballscrews are generally supplied with the nut already mounted.
Should it be necessary to disassemble it, it is recommended to proceed as described below:

- Do not disassemble double nuts and preloaded single nuts.
- Never remove recirculation systems.
- Do not replace missing balls with new ones.
  All ballscrew balls must always be replaced at the same time.
- A mounting tube is required to support the nut. The outer diameter of the mounting tube is approx. 0.1- 0.2 mm smaller than the primitive thread diameter and is slightly longer than the nut.
- Place the mounting tube at the end of the thread and slide the nut in the direction of the tube, respecting the direction of the thread.
  The mounting tube prevents balls escaping from the nut. **The nut can then be removed from the shaft together with the mounting tube.**

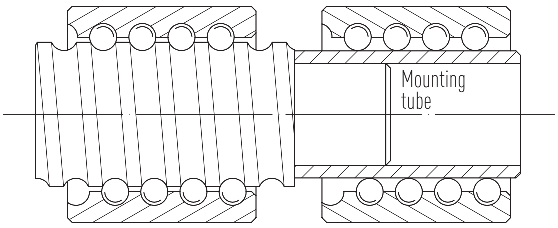


Fig. 10.1 **Removing the nut from the shaft using the mounting tube**

10.1.2 Nut assembly on the ballscrew shaft

To assemble the nut, follow the previous instructions in reverse order. Do not force the nut, otherwise it could become damaged. Before removing the mounting tube, ensure that the nut is fully inserted on the thread. Next, slide it on the shaft for a distance of at least three times its length.
Assemble the ballscrew nut using only the appropriate mounting tube. The use of unsuitable tools could damage the entire nut, even irreparably. The unassembled nuts are generally supplied already positioned on the mounting tube, which can then be used for correct assembly. If a special assembly tube is required, remember that the outer diameter of this tube must be approximately 0.1-0.2 mm smaller than the original diameter of the ballscrew and approximately 20 mm longer than the nut.

Nut assembly with nitrile rubber (NBR) or thermoplastic polyurethane (TPU)

Nuts fitted with NBR/TPU scrapers are equipped with a lip seal that acts as a sliding seal. As a result, the scraper is very effective in preventing foreign bodies from penetrating into the nut, thus extending its service life. In addition, the lip seal significantly reduces lubricant leakage along the thread groove.
To ensure the proper functioning of the lip seal, the nut must be assembled correctly. The following instructions must be observed to avoid impairing the function of the lip seal.
Incorrect assembly can lead to a reduction in the service life of the ballscrew.

- The thread of the ballscrew shaft must be chamfered, clean and free of burrs. The use of a small amount of grease at the end of the thread or on the scraper will facilitate assembly, protecting the seal and preventing damage.

Fig. 10.2 **Shaft end before NBR/TPU scraper assembly**

- Before assembly, check that the two scrapers have been properly seated inside the nut. The alignment of the scrapers is carried out by means of the appropriate featherkey. The scrapers must not protrude from the nut seat.

Fig. 10.3 **Before assembly, ensure that the scrapers have been correctly housed**

Assembly Instructions

- Place the mounting tube opposite the end of the ballscrew shaft to facilitate alignment between the nut and the shaft.
  During assembly, the nut should be aligned concentrically and be flush with the shaft.

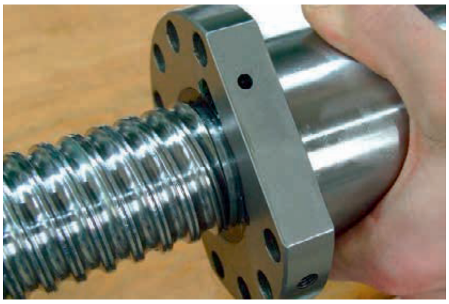


Fig. 10.4 **Nut-shaft alignment**

- Slide the nut towards the end of the thread and screw it onto the ballscrew shaft, exerting slight pressure as it rotates.
  The scraper will then be in the correct position on the thread groove. Screwing in the nut may require a slight effort. Screw the nut in completely.
  If the force required for the operation is excessive or the nut jams, unscrew it again and repeat the procedure.

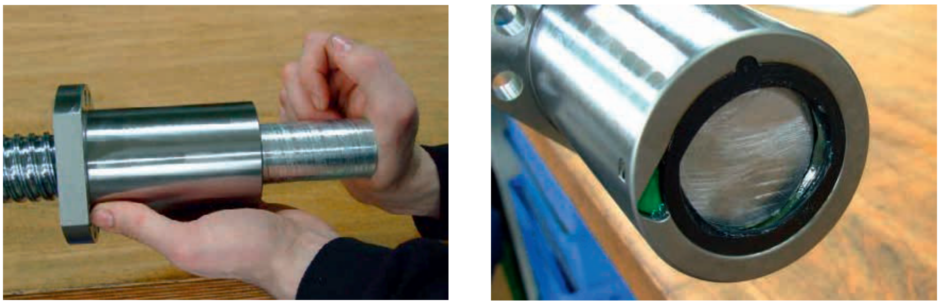


Fig. 10.5 **Nut assembly with NBR/TPU seal on the shaft**

- Continue screwing the nut slowly onto the shaft. Use your fingers or an unsharpened tool to secure the scraper close to the seal (e.g. a cylinder of suitable diameter), thus ensuring that the seal fits properly into the thread groove.

Do not use tools with sharp or pointed edges, otherwise you run the risk of damaging the seal.

Fig. 10.6 **Stop the NBR/TPU seal while slowly mounting the nut on the shaft**

- Screw the nut completely onto the shaft and slide it back and forth a distance of at least three times its length. The nut must turn easily on the shaft.
  Check that both scrapers are properly housed.
- Before commissioning, lubricate the ballscrew as indicated in the relevant instructions.

10.2 Bearing product assembly

10.2.1 Mounting surface requirements

- The surface must be suitably stable and rigid
- Planarity: ≤ 0.06mm
- Parallelism with respect to the guide system: ≤ 0.06mm
- The surface must be clean

10.2.2 Cleaning requirements

The presence of impurities could damage the rolling bearings. The residues of cleaning products themselves could contribute to the formation of impurities!

Measures for maintaining cleanliness:

- Ensure that the work area in which the assembly is carried out is clean.
- Clean the surface underneath.

Use only volatile solvents and lint-free cloths for cleaning!

Remove the support from the packaging only at the time of installation.
It is not necessary to remove the anti-corrosive product applied to these units.

10.2.3 Bearing unit assembly

The various bearing components have been correctly matched and cannot be removed, otherwise there is a risk of damaging the bearings.

When mounting the supports, ensure that the sharp edges do not damage the seals.

The bearing data sheets show the nominal tightening torques.

- Install the ballscrew nut in the housing by only partially tightening the fixing screws.
- Using the elastic ring, secure the supported bearing to the shaft (refer to Fig. 10.7).
- Using the precision ring nut, secure the fixed bearing on the relevant side of the shaft. Initially tighten the ring nut with twice the nominal torque. Then, after allowing 10 minutes to elapse, loosen the ring nut and then retighten it using the nominal tightening torque.

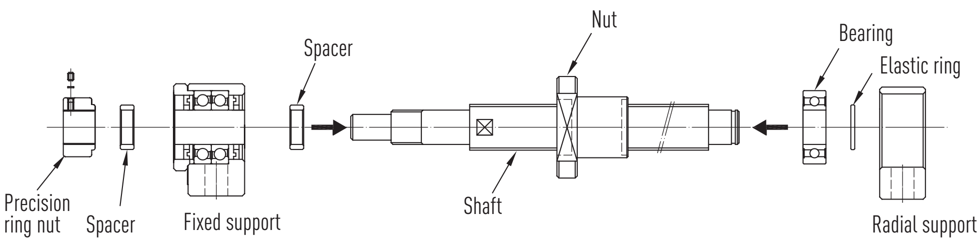


Fig. 10.7 Exploded view of ballscrew with bearing supports

Moving the table and thus the nut along the travel allowed by the linear guides will serve to align the supports correctly.

- Move the table with the nut as close as possible to the fixed bearing (refer to Fig. 10.8).

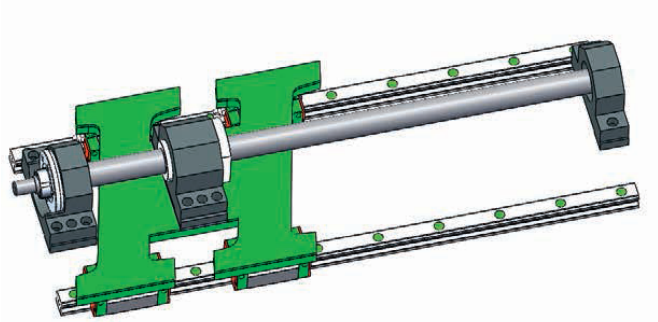


Fig. 10.8 **Ballscrew with nut near the left stop limit for fixed bearing alignment**

The fixed support aligns itself radially through the action of the binding forces exerted by the linear guides (refer to Fig. 10.9).

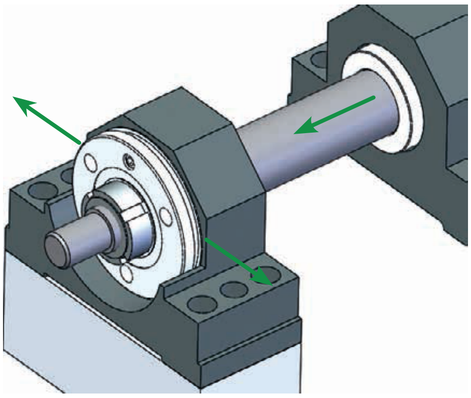


Fig. 10.9 **Binding forces applied to the fixed bearing**

- Tighten the support screws.
- Also tighten the screws of the nut.
- Move the nut as close as possible to the supported bearing.
- Also tighten the screws of the radial support.

It is advisable to tighten all screws.

The precision ring nut must be secured with a radial ring nut to prevent it from loosening.

The unit is now capable of constant force displacement throughout the entire stroke.

- **10.2.3.1 The assembly of the ballscrew and bearing supports can be considered completed.**

10.3 Separate bearing assembly

10.3.1 Mounting surface requirements

- The surface must be suitably stable and rigid
- Respect the specific circularity of the bearing seat (EN 5)
- The surface must not be treated
- The surface must be clean

10.3.2 Cleaning requirements

The presence of impurities could damage the rolling bearings. The residues of cleaning products themselves could contribute to the formation of impurities!

Measures for maintaining cleanliness:

- Ensure that the work area in which the assembly is carried out is clean.
- Clean the bearing seat.

Use only volatile solvents and lint-free cloths for cleaning!

Remove the bearing assembly from its packaging only at the time of installation.
It is not necessary to remove the anti-corrosive product applied to these units.

10.3.3 Bearing mounting

When assembling the bearings, bear in mind that the pressure force must only be applied to the ring to be inserted and that no other force or torque exerted during assembly must be discharged onto the balls.

In the case of installation with an uncertain fit, the bearing should preferably be warmed up to facilitate insertion.

The bearing data sheets show the nominal tightening torques.

- Using a precision ring nut, secure the flanged bearing to the fixed bearing side of the shaft. Initially tighten the ring nut a with twice the nominal torque. Then, after allowing 10 minutes to elapse, loosen the ring nut and then re-tighten it using the nominal torque.
- Push the fixed bearing into its seat. Screw the flange to the housing, only partially tightening the screws.
  Next, the radial position can be adjusted.
- When the shaft alignment is complete, tighten the screws in an alternating cross pattern.

- The installation of the bearing can be considered completed.

10.4 Lubrication

10.4.1 General information on lubrication

Adequate lubrication is necessary to ensure the function and service life of ballscrews.
The technical specifications and information below are intended to assist the user in selecting the appropriate lubricant, the quantities to be used, and to determine the frequency of lubrication.
These lubrication instructions do not exempt the user from checking and establishing the actual frequency of lubrication work required and, if necessary, changing it. At the end of each lubrication procedure, it must be checked that there is sufficient quantity of lubricant on each machine component (check the presence of the lubricating film).

Lubricants

- Reduce wear and tear
- Provide protection against dirt
- Prevent corrosion

When designing a machine, the lubricant must be taken into account. When selecting the lubricant, the operating temperature range as well as environmental and operating conditions must be considered.

10.4.2 Safety

CAUTION!

Warning! Danger to the environment and human health!
Contact with lubricants can cause irritation, poisoning, allergic reactions and damage to the environment.
- Use suitable, non-hazardous products. Please refer to the manufacturer's safety data sheets!
- Ensure proper disposal!

Intended use of lubricants

This chapter explains how to use lubricants safely. Improper handling of lubricants can harm people or even put their lives at risk.
It is essential to comply with the following indications.
Before handling lubricants, consult the respective safety data sheets.

- If possible, avoid recurrent skin contact for prolonged periods of time. Wash areas of the skin that have come into contact with lubricants with soap and water. During working hours, take protective measures for the skin. At the end of working hours, apply moisturising cream.
  If necessary, wear oil-resistant safety clothing (e.g. gloves, aprons). When washing hands soiled with petroleum, solvents or coolants, avoid contaminating water with these substances.
  Oil mists must be removed from the relevant supply point.
- Wear protective goggles to avoid contact with the eyes. Should lubricants come into contact with the eyes, rinse with-plenty of water.
  In case of prolonged eye irritation, consult an ophthalmologist.
- In case of accidental ingestion, do not induce vomiting and seek medical attention immediately.
- In principle, the relevant safety data sheet is available for each lubricant in accordance with 91/155/EEC.
  Safety data sheets contain detailed information for the protection of health and the environment as well as for accident prevention.
- Generally, lubricants pose a danger to waterways and therefore should not enter the soil in water and sewage systems.

10.4.3 Safety warnings for the storage of lubricants

Store lubricants in tightly closed containers and in a cool, dry place. Protect them from frost and direct sunlight.
Do not store lubricants near foodstuffs or oxidising agents.

10.5 Lubrication on delivery

HIWIN ballscrews are normally supplied protected by anti-corrosive substances. To protect the rolling bearings and preserve the integrity of the ballscrews, as well as to carry out some of the movements necessary for assembly, a mineral oil-based grease containing thickening agents is used, in accordance with DIN 51825 (K2K) (consistency class NLGI 2). Base oil viscosity: 60 mm^2 /s. Before using the unit for the first time, an initial lubrication should be carried out (refer to Chapter 10.10.1.1).

10.6 Lubricant selection

You can use oil, grease or semi-fluid grease.
For rolling bearings, you can use the lubricant of your choice. In principle, the choice of lubricant and type can be made in accordance with the lubrication used for other machine components, such as bearings and gears.

Do not use lubricants containing molybdenum disulphide MoS^2 or graphite.

10.7 Miscibility

Check the miscibility of different lubricants. Mineral oil-based lubricating oils with the same classification (e.g. CL) and similar viscosity (maximum one class difference) may be mixed.
The greases are miscible if the base oil and thickeners are the same. The viscosity of the base oil must be similar.
The NLGI class must not differ by more than one level.
If lubricants other than those indicated are used, lubrication intervals may be more frequent and the performance of the ballscrews may decrease. The possibility of potential chemical interactions between plastics, lubricants and protective substances must be taken into account.

Table 10.1 **HIWIN grease miscibility**

	G01	G02	G03	G04	G05
G01	●	●	●	○	○
G02	●	●	●	●	●
G03	●	●	●	●	●
G04	○	●	●	●	●
G05	○	●	●	●	●

Table 10.2 **Compatibility between protected components and HIWIN greases**

	G01	G02	G03	G04	G05
Standard ballscrews	○	●	●	●	●
Heavy-duty ballscrews	●	●	●	○	○

● Miscible/compatible
○ Partially miscible/compatible

Recommendation:
When using lubricants that are only partially miscible, it is advisable to wait until the previously used grease has been used up as much as possible before adding the new type. In addition, the quantity of the new lubricating grease must initially be increased.
If, on the other hand, non-miscible products are used, the old grease must be completely removed before the new one can be used.

10.8 Operating conditions

The choice of lubricant basically depends on operating temperatures and other factors, such as load level, oscillations, vibrations or short stroke applications. Any special requirements, such as use in harsh or aggressive environments, cleanrooms, vacuum or in the food industry, must also be considered.
A list of applications and their recommended lubricants can be found in Chapter 6.8. If in doubt, contact the lubricant manufacturer to ensure optimal lubrication.

10.9 Use of greases and oils in centralised lubrication systems

If a centralised lubrication system is used, it is advisable that initial lubrication be carried out separately (refer to Chapter 6.7.1.1) using a manual grease gun, before connection to the centralised system. In addition, it will be necessary to ensure that all pipes and system elements are filled with lubricant and that there are no air bubbles.
Avoid the use of particularly long or small-diameter pipes. Install piping on a slope. The number of pulses will depend on the partial quantities of lubricant and the size of the piston distributor.
In addition, always observe the instructions provided by the lubrication system manufacturer.

10.10 Ballscrew lubrication

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

Excessive pressure or too much lubricant can irreparably damage ballscrews.

In particular, ballscrew nuts with felt or lip seals must be lubricated carefully, otherwise the seals may become damaged.

10.10.1 General information on quantities of lubricant to be used

10.10.1.1 Initial lubrication before commissioning

HIWIN ballscrews are normally supplied protected by anti-corrosive substances. Initial lubrication takes place in three steps: add the appropriate amount of grease as indicated in the table; move the nut back and forth a distance of approximately three times its length; repeat the above steps twice more.

Initial lubrication for short stroke applications:

Stroke < 2 × nut length: add lubricant via the appropriate connections on both sides of the nut, if present, and lubricate.

Stroke < 0.5 × nut length: add lubricant via the appropriate connections on both sides of the nut, if present, and lubricate. During lubrication, move the ballscrew nut back and forth several times a distance of twice its length. If this is not possible, please contact HIWIN.

For short stroke applications, the lubricant quantities given in the corresponding tables must be doubled. If the nuts are not equipped with lubrication connections, lubricant can be applied through the shaft.

10.10.1.2 Subsequent lubrication

Lubrication frequency is strictly dependent on operating conditions (nominal size, pitch, speed, acceleration, loads, etc.) and environmental conditions (temperature, fluids, etc.). Environmental conditions such as heavy loads, vibrations, and the presence of dirt lead to an increase in the frequency of lubrication intervals. Conversely, under favourable conditions of cleanliness and non-heavy loads, the frequency of lubrication interventions can be decreased. If the ballscrews are mounted vertically, the quantities of lubricant used for subsequent lubrication should be increased by approximately 50%.
Under normal operating conditions, the indicated lubrication frequency applies.
For short stroke applications, the quantities of lubricant to be used for subsequent lubrication should be doubled.

10.11 Lubricant recommendations

The choice of lubricant basically depends on operating temperatures and other factors, such as load level, oscillations, vibrations or short stroke applications. Any special requirements, such as use in harsh or aggressive environments, cleanrooms, vacuum or in the food industry, must also be considered.
Below is a list of applications and their recommended lubricants. If in doubt, contact the lubricant manufacturer to ensure optimal lubrication.

10.11.1 Grease lubrication

For grease lubrication of rolling and plain bearings, we recommend a grease based on mineral oil containing thickening agents in accordance with DIN 51825 (K1K, K2K). For heavy-duty applications, EP additives (extreme pressure additives) must be used (KP1K, KP2K). NLGI consistency classes 1 or 2 or even other classes can be used after consulting the lubricant manufacturer.

Do not use greases containing solid lubricants such as molybdenum disulphide (MoS_2) or graphite.

Below are some examples of lubricants, purely as an indication and to facilitate the user's choice. Other types of lubricants may also be used, after consulting the respective supplier about the intended use (application).

10.11.1.1 Standard applications

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

Table 10.3 **Recommended greases for standard applications**

HIWIN	G05
Klüber	MICROLUBE GL-261
Mobil	Mobilux EP1
Fuchs Lubritech	Lagermeister BF2
Lubcon	TURMOGREASE CAK 2502
BECHEM	Ceritol CF 2

10.11.1.2 Heavy-duty applications

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

Table 10.4 **Recommended greases for heavy-duty applications**

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

10.11.1.3 Cleanroom applications

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

Table 10.5 **Recommended greases for cleanroom applications**

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

10.11.1.4 High-speed cleanroom applications

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

Table 10.6 **Recommended greases for high-speed applications for cleanrooms**

HIWIN	G03
Klüber	Isoflex Topas NCA52

10.11.1.5 High-speed applications

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

Table 10.7 **Recommended greases for high-speed applications**

HIWIN	G04
Klüber	Isoflex NCA15
Lubcon	TURMOGREASE Highspeed L252

10.11.1.6 Applications for the food industry, in accordance with USDA H1

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

Table 10.8 **Recommended greases for food industry applications, in accordance with USDA H1**

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

10.11.2 Lubrication with semi-fluid grease

Semi-fluid greases are often used in centralised lubrication systems, as their soft characteristics favour distribution.
Observe the manufacturer's instructions for lubrication systems.
Below are some examples of lubricants, purely as an indication and to facilitate the user's choice. Other types of lubricants may also be used, after consulting the respective supplier about the intended use (application and lubrication system).
In addition, always observe the instructions provided by the lubrication system manufacturer.

10.11.2.1 Standard applications

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

Table 10.9 **Recommended semi-fluid greases for standard applications**

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

10.11.2.2 Heavy-duty applications

For the use of semi-fluid greases in heavy-duty applications, it is advisable to consult the lubricant manufacturer.

10.11.2.3 Cleanroom/vacuum applications

For the use of semi-fluid greases in cleanroom/vacuum applications, it is advisable to consult the lubricant manufacturer.

10.11.2.4 High-speed applications

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

Table 10.10 **Recommended semi-fluid greases for high-speed applications**

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

10.11.2.5 Applications for the food industry, in accordance with USDA H1

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

Table 10.11 **Recommended semi-fluid greases for food industry applications, in accordance with USDA H1**

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

10.11.3 Oil lubrication

The advantages of oil lubrication are a more homogeneous distribution and better attainment of contact points. However, it should be borne in mind that lubricating oils that settle at the bottom of the unit, due to the force of gravity, cause dirt to accumulate more quickly. As a result, larger quantities of lubricant will have to be used than with grease. Oil lubrication is generally only suitable for centralised lubrication systems or for older lubrication unit equipment.
Observe the manufacturer's instructions for lubrication systems.
Below are some examples of lubricants, purely as an indication and to facilitate the user's choice. Other types of lubricants can also be used, after consulting the respective supplier about the intended use (application and central lubrication system).

10.11.3.1 Standard applications

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

Table 10.12 **Recommended oils for standard applications**

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

10.11.3.2 Heavy-duty applications

For the use of oils in heavy-duty applications, it is advisable to consult the lubricant manufacturer.

10.11.3.3 Cleanroom applications

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

Table 10.13 **Recommended oils for cleanroom applications**

Klüber	Tyreno Fluid E-95 V
Mobil	Mobilgear 626

10.11.3.4 High-speed applications

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

Table 10.14 **Recommended oils for high-speed applications**

Klüber	Klüberoil GEM 1-46 N

10.11.3.5 Applications for the food industry, in accordance with USDA H1

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

Table 10.15 **Recommended oils for food industry applications, in accordance with USDA H1**

Klüber	Klüberoil 4 UH1-68 N

10.11.4 HIWIN lubricants and accessories

10.11.4.1 HIWIN greases

Table 10.16 **General description of HIWIN greases**

Type of grease	Usage	Article code	
		70 g cartridge	400 g cartridge
			
G01	For heavy-duty applications	**GMBH** 20-000335 **TW** 7M00JA1	**GMBH** 20-000336 **TW** 7M007A1
G02	For cleanroom applications	**GMBH** 20-000338 **TW** 7M009A1	**GMBH** 20-000339 **TW** 7M00AA1
G03	For high-speed cleanroom applications	**GMBH** 20-000341 **TW** 7M00CA1	**GMBH** 20-00034 **TW** 7M00DA1
G04	High-speed applications	**GMBH** 20-000344 **TW** 7M00KA1	**GMBH** 20-000345 **TW** 7M00GA1
G05	Standard grease	**GMBH** 20-000347 **TW** 7M00LA1	**GMBH** 20-000348 **TW** 7M00MA1

10.11.4.2 Lubrication grease nipples and adapters

A1: Hydraulic adapter
Suitable for conical nipples (for grease), in accordance with DIN 71412, outer diameter 15 mm

Fig. 10.10 **A1**
*(Article number TW34900007)

A2: Cable adapter
Suitable for conical or spherical nipples (for grease), in accordance with DIN 71412/ DIN 3402, outer diameter 10 mm

Fig. 10.11 **A2**

A3: Hollow nozzle with adapter for lubrication
Suitable for spherical nipples (for grease), in accordance with DIN 3402, outer diameter 6 mm

Fig. 10.12 **A3**

A4: Spherical nozzle with adapter
Suitable for funnel-type nipples (for grease) according to DIN 3405, outer diameter 6 mm

Fig. 10.13 **A4**

A5: Pointed nozzle with adapter for lubrication

Fig. 10.14 **A5**

A6: Angle-type nozzle with adapter for lubrication

Fig. 10.15 **A6**

Set consisting of adapter and lubrication nozzles

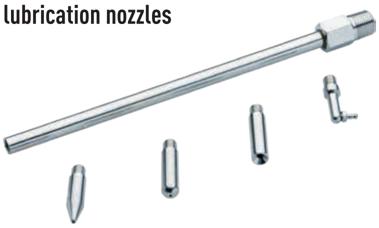


Fig. 10.16 **Adapter and nozzles for lubrication A3, A4, A5, A6**

GN-400C set: Manual grease nipple (large) and adapters A1, A2

Fig. 10.17 **GN-400C**
*Included in the set supplied by GMBH

GN-80M set: Manual grease nipple (small) and adapters A1, A2

Fig. 10.18 **GN-80M**

10.12 Lubricant quantity and frequency

CAUTION!

Risk of damage to ballscrews if lubrication is missing or incorrect!

If initial lubrication is omitted, excessive amounts of lubricant are used or excessive lubrication pressure is applied, the unit may become damaged, even irreparably.

- ▶ Never put the ballscrew into operation without initial lubrication!
- ▶ To avoid damaging the unit, always follow the specific procedure!

The lubricant quantities given below are to be considered as reference values, which may vary depending on environmental conditions.

10.12.1 Lubricant quantity and lubrication frequency for greases

Table 10.17 **Quantity of lubricants (grease lubrication) for DEB-N, DDB, ZE, ZD, SE, SEM, AME**

Nominal diameter × pitch	Single nut		Double nut		Frequency of subsequent lubrication
	Lubricant quantity for initial lubrication [g]	Lubricant quantity for subsequent lubrication [g]	Lubricant quantity for initial lubrication [g]	Lubricant quantity for subsequent lubrication [g]	Distance travelled [km]
R16-05_3	0.2 (3 ×)	0.3	0.3 (3 ×)	0.6	100
R16-05_4	0.2 (3 ×)	0.4	0.4 (3 ×)	0.8	100
R16-10_3	0.3 (3 ×)	0.6	–	–	200
R16-16_2	0.3 (3 ×)	0.7	–	–	320
R20-5_4	0.3 (3 ×)	0.6	0.6 (3 ×)	1.2	100
R20-10_3	0.5 (3 ×)	0.9	–	–	200
R20-20_2	0.6 (3 ×)	1.3	–	–	400
R25-5_4	0.4 (3 ×)	0.8	0.8 (3 ×)	1.5	100
R25-10_3	0.6 (3 ×)	1.1	1.2 (3 ×)	2.3	200
R25-10_4	0.8 (3 ×)	1.5	1.5 (3 ×)	3.1	200
R25-25_2	1.0 (3 ×)	2.0	–	–	500
R32-5_5	0.6 (3 ×)	1.2	1.2 (3 ×)	2.5	100
R32-10_3	0.9 (3 ×)	1.7	1.8 (3 ×)	3.5	200
R32-10_4	1.2 (3 ×)	2.3	2.3 (3 ×)	4.6	200
R32-10_5	1.5 (3 ×)	2.9	2.9 (3 ×)	5.8	200
R32-10_5-H	3.6 (3 ×)	7.2	5.7 (3 ×)	11.5	200
R32-20_2	2.9 (3 ×)	5.7	5.7 (3 ×)	11.5	400
R40-5_5	0.8 (3 ×)	1.6	1.5 (3 ×)	3.0	100
R40-10_3	2.3 (3 ×)	4.5	–	–	200
R40-10_4	3.0 (3 ×)	6.0	6.0 (3 ×)	11.9	200
R40-20_2	3.3 (3 ×)	6.6	6.6 (3 ×)	13.3	400
R40-40_2	6.0 (3 ×)	12.1	–	–	800
R50-5_5	1.0 (3 ×)	2.0	2.0 (3 ×)	3.9	100
R50-10_4	3.7 (3 ×)	7.4	5.9 (3 ×)	11.8	200
R50-10_5	4.6 (3 ×)	9.2	7.3 (3 ×)	14.7	200
R50-20_3	6.0 (3 ×)	11.9	11.9 (3 ×)	23.8	400
R63-10_6	5.7 (3 ×)	11.5	11.5 (3 ×)	22.9	200
R63-20_3	9.2 (3 ×)	18.4	–	–	400
R63-20_4	12.3 (3 ×)	24.5	24.5 (3 ×)	49.0	400
R63-20_5	15.3 (3 ×)	30.6	–	–	400
R63-20_6-H	22.9 (3 ×)	45.9	–	–	400
R80-10_6	7.5 (3 ×)	14.9	14.9 (3 ×)	29.8	200
R80-20_4	16.8 (3 ×)	33.5	26.9 (3 ×)	53.7	400
R80-20_5	21.0 (3 ×)	41.9	33.5 (3 ×)	67.1	400
R80-20_6-H	29.0 (3 ×)	58.1	–	–	400
R80-20_7-H	33.9 (3 ×)	67.8	–	–	400

Table 10.18 **Lubricant quantities (grease lubrication) for FSC, FSI, RSI, RSC**

Nominal diameter x pitch	Single nut		Frequency of subsequent lubrication
	Quantity of lubricant for initial lubrication [g]	Quantity of lubricant for subsequent lubrication [g]	Distance travelled [km]
R08-02.5_2	0.03 (3 ×)	0.05	50
R10-02.5_2	0.03 (3 ×)	0.06	50
R10-04_2	0.08 (3 ×)	0.16	80
R12-04_1	0.03 (3 ×)	0.05	80
R12-05_4	0.07 (3 ×)	0.14	100
R12-10_3	0.15 (3 ×)	0.30	200
R15-05_4	0.19 (3 ×)	0.38	100
R16-05_3	0.18 (3 ×)	0.36	100
R16-10_3	0.3 (3 ×)	0.6	200
R16-10_3-RSI	0.4 (3 ×)	0.7	200
R16-16_3	0.5 (3 ×)	1.0	320
R16-20_2	0.4 (3 ×)	0.9	400
R20-05_4	0.3 (3 ×)	0.6	100
R20-10_3	0.4 (3 ×)	0.9	200
R20-10_3-RSI	1.0 (3 ×)	1.9	200
R20-20_2	0.6 (3 ×)	1.3	400
R20-20_4	1.3 (3 ×)	2.5	400
R25-05_4	0.4 (3 ×)	0.8	100
R25-10_4	0.8 (3 ×)	1.5	200
R25-25_2	2.0 (3 ×)	4.0	500
R25-25_4	1.0 (3 ×)	2.0	500
R32-05_6	0.7 (3 ×)	1.5	100
R32-10_5	1.4 (3 ×)	2.8	200
R32-20_3	1.7 (3 ×)	3.5	400
R32-32_2	2.4 (3 ×)	4.9	640
R32-32_4	1.2 (3 ×)	2.4	640
R40-05_6	0.9 (3 ×)	1.8	100
R40-10_4	3.0 (3 ×)	6.0	200
R40-20_3	5.0 (3 ×)	10.0	400
R40-40_2	12.1 (3 ×)	24.2	800
R40-40_4	6.0 (3 ×)	12.1	800
R50-05_6	1.1 (3 ×)	2.3	100
R50-10_6	5.3 (3 ×)	10.5	200
R50-20_5	9.5 (3 ×)	19.0	400
R50-40_3	14.3 (3 ×)	28.7	800
R50-40_6	7.2 (3 ×)	14.3	800
R63-10_6	5.7 (3 ×)	11.5	200

Lubrication frequency after initial lubrication (grease lubrication)
Frequency of grease lubrication after initial lubrication and under standard conditions: approx. every 200/600 operating hours (or every 100 km) when operating in a clean working environment (reference values).

Standard conditions:
Load: max. 20 % of dynamic load
Temperature range: - 10 °C to + 80 °C
Specific speed value: < 120,000
Absence of shock or vibration
Different conditions or the presence of dirt result in an increase in lubrication frequency.

10.12.2 Lubricant quantity and lubrication frequency for semi-fluid greases

If a centralised lubrication system is used, it is recommended that initial lubrication be carried out separately, using a manual grease gun, before connection to the centralised system. In addition, it will be necessary to ensure that all pipes and system elements are filled with lubricant and that there are no air bubbles.
Avoid the use of particularly long or small-diameter pipes. Install piping on a slope. The number of pulses will depend on the partial quantities of lubricants and the size of the piston distributor.
In addition, always observe the instructions provided by the lubrication system manufacturer

Quantity of lubricant for lubrication with semi-fluid grease:
The quantities for lubrication with semi-fluid grease are the same as for lubrication with grease.

Lubrication frequency after initial lubrication:
After initial lubrication, the lubrication frequency for semi-fluid greases is 50% of that for greases.

Dimensions of piston distributor for lubrication with semi-fluid greases (single-line systems)
The interval between pulses for individual lubrications is calculated on the basis of the amount of lubricant used for lubrication (after initial lubrication), the frequency of lubrication after initial lubrication and the size of the piston distributor:

$$\text{Interval between lubrication pulses [km]} = \frac{\text{Piston distributor size [cm}^3\text{]}}{\text{Lubricant quantity [cm}^3\text{]}} \times \text{Lubrication interval [km]}$$

10.12.3 Lubricant quantity and lubrication frequency for oils

If a centralised lubrication system is used, it must be ensured that all pipes and system elements are filled with lubricant and that there are no air bubbles.
Avoid the use of particularly long or small-diameter pipes. Install piping on a slope. The number of pulses will depend on the partial quantities of lubricant and the size of the piston distributor.
In addition, always observe the instructions provided by the lubrication system manufacturer.

Table 10.19 **Lubricant quantities for oil lubrication**

Nominal Ø [mm]	Initial lubrication	Relubrication
	Partial quantity of oil [cm³]	Quantity of oil [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 oil bath lubrication is used, the shaft must be about 0.5 / 1 mm above the oil level.

Lubrication frequency after initial lubrication:
The frequency of lubrication after the initial lubrication should not exceed 8 hours.
The quantities of oil indicated in the table should be used.

Dimensions of piston distributor for semi-fluid oil supply units (single-line systems)
The interval between pulses for individual lubrications is calculated on the basis of the amount of lubricant used for lubrication (after initial lubrication), the frequency of lubrication after initial lubrication and the dimensions of the piston distributor:

$$\text{Lubrication pulse interval [km]} = \frac{\text{Size of piston distributor [cm}^3\text{]}}{\text{Quantity of lubricant [cm}^3\text{]}} \times \text{Lubrication interval [km]}$$

Notes

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Note:
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