KSK
PRECISE MOTION

MINIATURE BALL SCREWS

PRODUCT CATALOGUE

We have been manufacturing ball screws since 1967 and we deliver them almost all over the world. To provide our customers with the highest quality of the products and co-operation, we keep investing a lot of effort in continuous improvement. Thanks to this effort, every year we fight for the top positions in the leading innovative competitions. A certificate of quality in compliance with EN ISO 9001:2008 proves that our quality management system is at a high level. We also aim for maximum support of the industrial machinery development activities in our area, for which we participate in the following associations:

Association of Engineering Technology

CECIMO

Brno Regional Chamber of Commerce

OUR CUSTOMERS APPRECIATE ESPECIALLY THE FOLLOWING CHARACTERISTICS:

Quality

- We use new state-of-the-art technologies for manufacture and testing.
- Every ball screw undergoes substantial in-process and output inspection.
- We archive measured values for every product.

Development and courage

- We are not afraid of designing and implementing solutions for untypical applications.
- We take up full responsibility for our solutions.
- Thanks to our in-house development department we are very quick and flexible in this designing.

Customer orientation

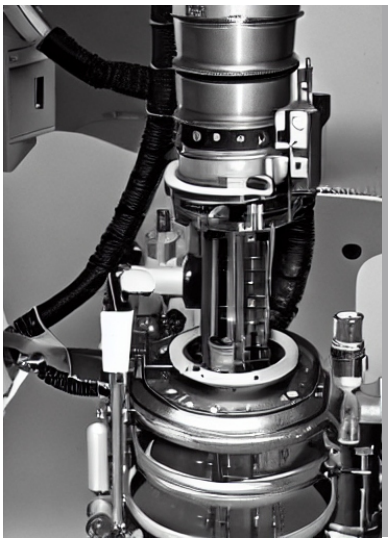
- We produce on the basis of client drawings.
- We are able to produce with smaller stop dimensions than required by ISO 3408.
- We like to actively engage in the proposed movement axes of our customers, helping them in correct dimensioning and cost-saving solutions.

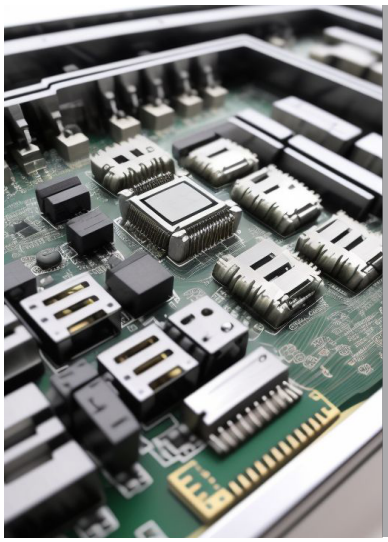
Miniature ball screws (from diameter 5 mm with pitch 0,5 mm) are structural elements, which transmit rotary movement to straight movement with high efficiency (approximately 94 - 97%). They feature high rigidity, accuracy, durability and especially high precision positioning in compact dimensions. Micro ball screws consist of ball shaft, ball nut both with ground thread, and its recirculation system as the standard ball screws.

Characteristics of the Micro Screws:

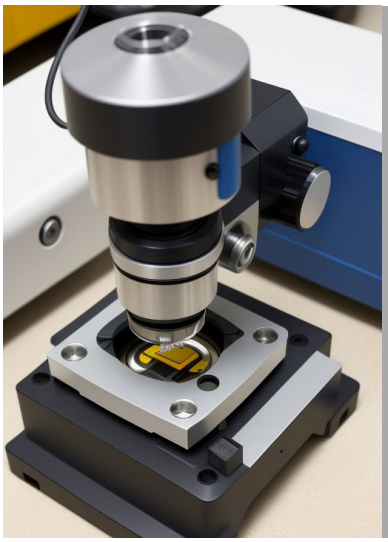
- **High precision positioning screws**
- **Very high running smoothness**
- **Delivered with required preloading**
- **Longest service life due to corresponding use of materials, custom engineering and the quality promise of a highly sophisticated production**

Miniature ball screws applications:


MICROSCOPES


SEMICONDUCTOR INDUSTRY


AERONAUTICS AND DEFENSE


INSPECTION EQUIPMENT


MEDICINE AND DIAGNOSTICS


LABORATORY EQUIPMENT

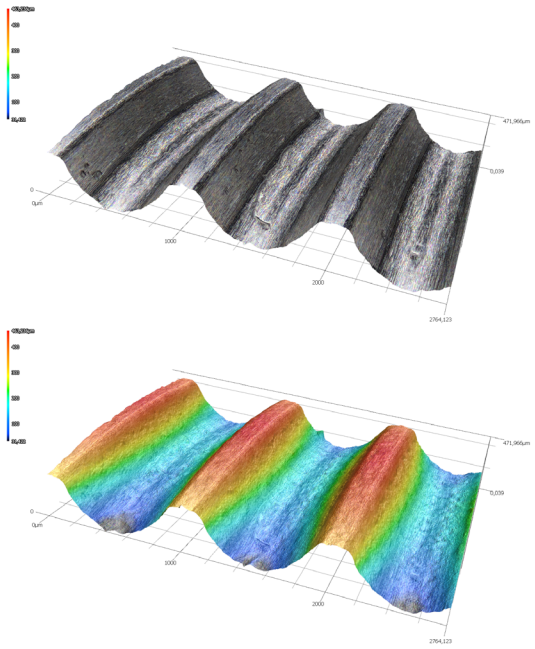
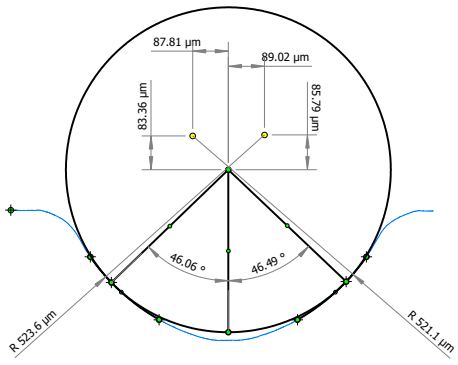
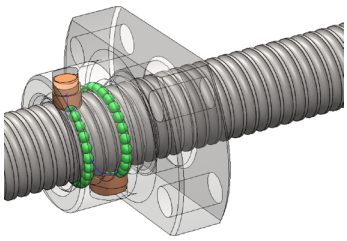
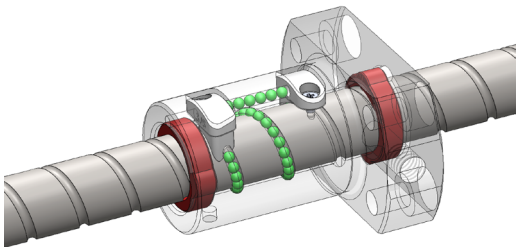
Please contact us with your applications to find all possibilities with our Miniature Ball Screws.

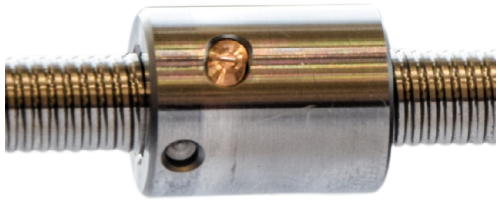
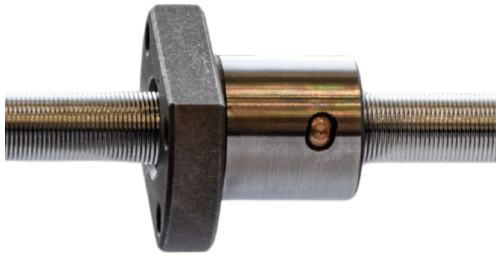
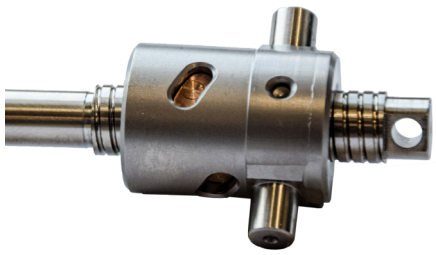
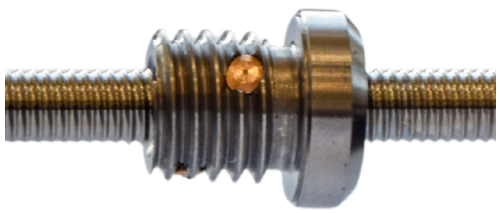
1. Application and use

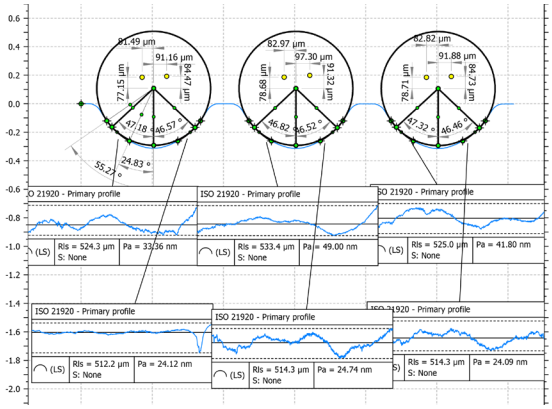
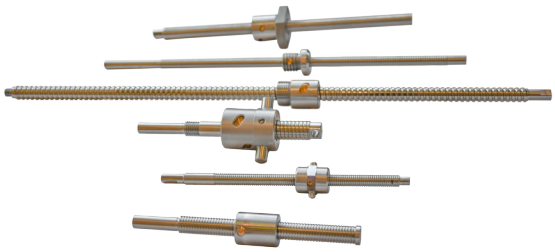
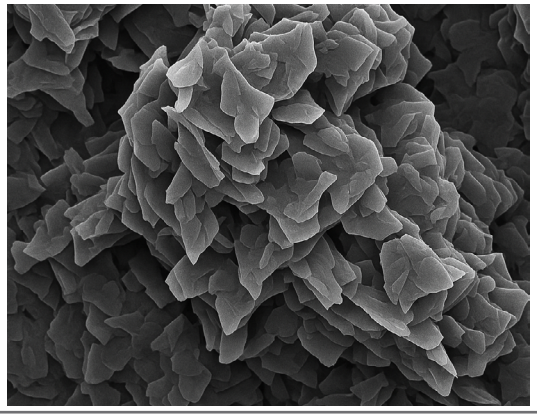
Ground miniature ball screws are used where high accuracy and precision are required, e.g. in robotic surgery, medical devices and the aerospace industry – see table of Application and use below:

APPLICATION INDUSTRY	APPLICATION EXAMPLE	PRECISION GRADE		
		P0	P1	P3
MICROSCOPES	Positioning tables	●	●	
	Measuring stages	●		
	Microscope stages		●	●
	Automated Sample Handling	●	●	
SEMICONDUCTOR INDUSTRY	Wafer systems and drives	●		
	Production of printed circuit board (PCB)	●		
	Production of integrated circuits (IC)		●	
	PCB milling machines			●
	Tabletop units for panel production			●
	Device for transporting the glass substrate		●	●
AERONAUTICS AND DEFENSE	Aircraft flap actuators		●	●
	Brake system actuators		●	●
	Motion sensors	●	●	
	Spacecraft control systems	●	●	
	Missile and Rocket Systems		●	●
	Radar and Antenna Positioning		●	●
	Turrets and Weapon Systems	●	●	
	Unmanned Aerial Vehicles (UAVs)		●	●
	Satellite Mechanisms	●	●	
	Armored Vehicle Suspensions		●	●
	Simulation and Training Equipment	●	●	
INSPECTION EQUIPMENT	Motorized Focus Drives		●	
	Operating Devices		●	●
	Automated Sample Handling			●
MEDICINE AND DIAGNOSTICS	Computed tomography (CT) scanners	●	●	
	Magnetic resonance imaging (MRI)			●
	X-RAY equipment		●	●
	Ultrasound devices		●	●
	Surgical robots	●	●	
LABORATORY EQUIPMENT	Desktop blood analyzers			●
	Automatic analyzers of laboratory samples		●	●
MICROMANIPULATIONS	Miniature robotics		●	●
	Compact actuators	●	●	
	3D printers		●	●
OPTICS	Optics devices		●	●
	Precision Electro-Optical Systems	●	●	
	Laser surface scanning	●	●	

2. Technical data

CHARACTERISTICS	PICTURE	DESCTIPTION	
GROUND BALL SCREW THREAD		Accuracy and quality of the miniature ball screws are largely dependent on the manufacturing technology. Miniature ball screws are produced by grinding technology only.	
BALL SCREW PROFILE		To achieve the maximum transmission efficiency, it is necessary to make an ideal profile of the ball screw thread. The profile is not made of one radius but two radii with offset (so called gothic arch, see picture on the left). This profile shape offers an ideal efficiency to load capacity (ratings) ratio of the ball screw.	
BALL SCREW RECIRCULATION SYSTEM		Internal ball recirculation with beds	Version marking: **IN** Maximum speed coefficient: $n_{max} = \frac{50\,000}{d_0}$
		External ball recirculation radially inserted	Version marking: **EX** Maximum speed coefficient: $n_{max} = \frac{70\,000}{d_0}$

CHARACTERISTICS	PICTURE	DESCTIPTION
BALL NUT UNIT TYPE		**A** PRELOADED NUT WITHOUT FLANGE
		**AP** PRELOADED NUT WITH FLANGE
		**C** PRELOADED NUT WITH METRIC THREAD
		**SPECIAL** PRELOADED NUT WITH PINS
		**SPECIAL** PRELOADED NUT WITH FLANGE AND METRIC THREAD

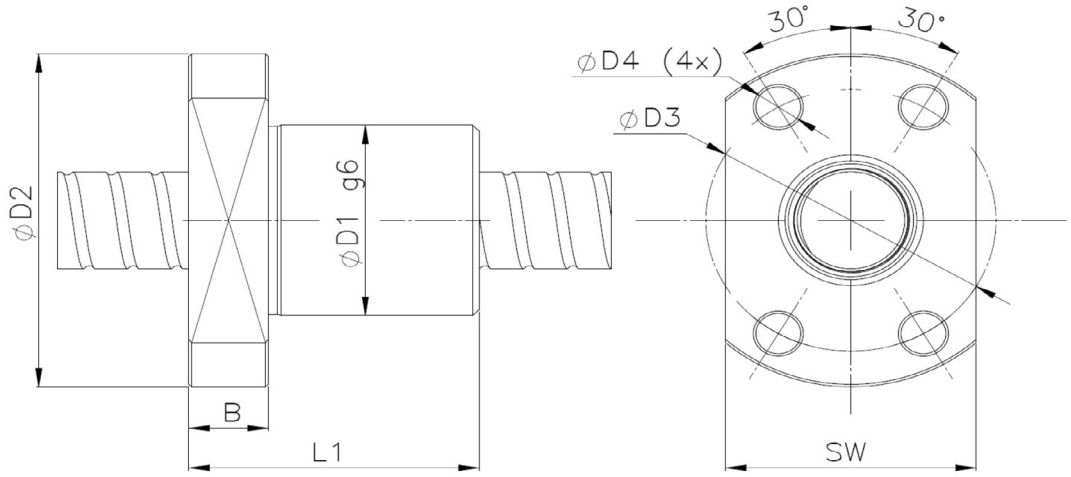
CHARACTERISTICS	PICTURE	DESCTIPTION	
GRADE OF RAW MATERIALS	Stainless steel: **1.4112** Steel: **Cf53**	Nuts and the shaft are hardened to 50-60 HRC. Minimum shaft strength Rm = 800 MPa. The final quality is tested by long term durability tests follwed by the analysis of the functional parts of the transmission assembly when the specified wear limits are achieved.	
THREAD PITCH ACCURACY CLASS SPECIFICATION	**P0** **P1** **P3**	**3,5** **6** **12**	Pitch tolerance on the thread length of 300 mm v_{300p} [µm]
SURFACE TREATMENT - ELECTROPOLISHING		Superior surface finishing of ball screws improving mechanical properties, lifespan and corrosion resistance. A smooth finish cuts down on friction loss, improving the bearing ratio, optimizing wear and tear and minimizing energy consumption and noise. Remove burrs from sharp or fragile parts that are not suitable for traditional finishing techniques without rounding edges or damaging the part.	
PASSIVATION - STAINLESS STEEL		Corrosion resistance - removes free iron particles from the surface. Long-term surface stability - forms a protective layer of chromium oxide -> protects in aggressive environments (moisture, chemicals). Reduced risk of microcracks - a cleaner, dirt-free surface minimizes the formation of cracks that could lead to material fatigue.	
COATING - TUNGHSTEN DISULFIDE		Tungsten disfluide (WS2) solid lubricat coating. Extremly thin (max. 0,5 µm) film coating provides friction and sliding wear reduction that improves performance. **Properties** • To recude energy lost To friction • To minimize excessive heat from friction • As lubrication for tight tolerances • Wear reduction • Thermal stability	

3. Main dimensions

Miniature ball screws are produced from diameter 5 mm, length 60 mm, pitch 0,5 mm up to diameter 16 mm, length 1000 mm and pitch 10 mm. All variants are listed in the table below:

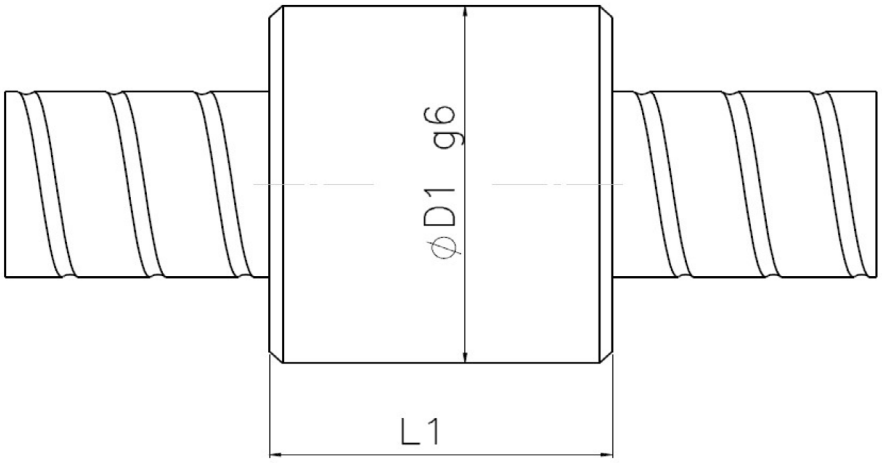
SHAFT DIAMETER [mm]	PITCH [mm]	BALL DIAMETER [mm]	SHAFT MAXIMUM LENGTH [mm]		
d_0	P_H	D_W	P0	P1	P3
5	0,5	0,6	120	160	170
	1	0,8			
	2	0,8			
	3	0,8			
	4	0,8			
6	0,5	0,6	180	240	250
	1	0,8			
	1,25	0,8			
	1,5	0,8			
	2	1,5875			
	2,5	1,5875			
	6	1,5875			
	8	1,5875			
8	0,5	0,6	250	330	350
	1	0,8			
	1,5	0,8			
	2	1,5875			
	2,5	1,5875			
	3	1,5875			
	4	1,5875			
	5	1,5875			
	8	1,5875			
10	0,5	0,8	260	320	420
	1	0,8			
	1,5	0,8			
	2	1,5875			
	2,5	2			
	3	2			
	4	2			
	5	2			
	6	2			
	10	2			
12	1	0,8	320	390	510
	2	1,5875			
	2,5	2			
	3	2			
	4	2			
	5	2			
	8	2			
	10	2			
14	1	0,8	380	460	600
	2	1,5875			
	2,5	1,5875			
	3	2			
	4	2			
	5	3,175			
	8	3,175			
16	2	1,5875	450	540	890
	2,5	1,5875			
	3	2			
	4	3,5			
	5	3,5			
	6	3,5			
	8	3,5			
	10	3,5			

Nut type AP



DIAMETER D_0	PITCH	BALL DIAMETER	NUMBER OF EFFECTIVE TURNS	WIPERS	NUT LENGTH	„FLANGE WIDTH"	„PITCH CIRCLE„	BALL NUT DIAMATER	FLANGE DIAMETER	HOLE DIAMETER	FLATTE-NING	STANDARD STEEL DYNAMIC LOAD	STANDARD STEEL STATIC LOAD	STAINLESS STEEL DYNAMIC LOAD	STAINLESS STEEL STATIC LOAD
	Ph	D_w	i	-	L1	B	D3	D1	D2	D4	SW	C_{am}	C_{om}	C_{am}	C_{om}
	[mm]	[mm]	-	-	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[N]	[N]	[N]	[N]
6	1	0,8	3	no	15	3,5	18	12	24	3,4	16	597	784	494	590
	2	0,8	2	no	18	4	18	12	24	3,4	16	392	471	325	355
8	1	0,8	3	no	16	4	21	14	27	3,4	18	695	1 096	575	825
	2	1,6	2	no	16	4	21	14	27	3,4	18	1 459	1 702	1 207	1 282
	2,5	1,6	3	yes	26	4	23	16	29	3,4	20	2 063	2 548	1 707	1 919
	3	1,6	3	yes	26	4	23	16	29	3,4	20	1 950	2 347	1 614	1 767
	4	1,6	3	yes	31	4	23	16	29	3,4	20	1 828	2 141	1 513	1 612
	5	1,6	3	yes	32	6	23	16	29	3,4	20	1 813	2 127	1 501	1 602
10	2	1,6	3	yes	28	5	27	18	35	4,5	22	2 396	3 392	1 983	2 554
	2,5	1,6	3	yes	28	5	27	18	35	4,5	22	2 393	3 388	1 981	2 551
	4	2	3	yes	36	6	29	22	37	4,5	24	4 052	5 477	3 354	4 124
12	1	0,8	3	yes	25	8	29	20	37	4,5	24	837	1 722	693	1 297
	2	1,6	3	yes	28	5	29	20	37	4,5	24	2 665	4 234	2 206	3 188
	2,5	1,6	3	yes	32	5	30	21	38	4,5	25	2 663	4 231	2 204	3 186
	3	1,6	3	yes	37	8	29	22	37	4,5	24	2 574	4 026	2 131	3 032
	4	2	3	yes	36	8	29	22	37	4,5	24	4 594	6 948	3 802	5 232

Nut type A



DIAMETER D_0	PITCH	BALL DIAMETER	NUMBER OF EFFECTIVE TURNS	WIPERS	BALL NUT LENGTH	BALL NUT DIAMATER	STANDARD STEEL DYNAMIC LOAD	STANDARD STEEL STATIC LOAD	STAINLESS STEEL DYNAMIC LOAD	STAINLESS STEEL STATIC LOAD
	Ph	D_w	-	-	L1	D1	C_{am}	C_{om}	C_{am}	C_{om}
	[mm]	[mm]	i	-	[mm]	[mm]	[N]	[N]	[N]	[N]
5	0,5	0,6	3	no	13	12	255	304	211	228
6	2	0,8	3	no	16	12	556	706	460	532
8	1	0,8	3	no	14	15	695	1 096	575	825
	2	1,6	3	no	18	14	2 067	2 552	1 711	1 922
	2,5	1,6	3	no	21	15	2 063	2 548	1 707	1 919
	3	1,6	3	no	21	15	1 950	2 347	1 614	1 767
	4	1,6	3	no	22	15	1 828	2 141	1 513	1 612
	5	1,6	3	no	22,5	15	1 813	2 127	1 501	1 602
10	2	1,6	3	yes	23	20	2 396	3 392	1 983	2 554
	2,5	1,6	3	yes	24	20	2 393	3 388	1 981	2 551
	4	2	3	yes	34	26	4 052	5 477	3 354	4 124
12	1	0,8	3	yes	17	20	837	1 722	693	1 297
	2	1,6	3	yes	23	22	2 665	4 234	2 206	3 188
	2,5	1,6	3	yes	28	22	2 663	4 231	2 204	3 186
	3	1,6	3	yes	23	22	2 574	4 026	2 131	3 032
	4	2	3	yes	30	22	4 594	6 948	3 802	5 232

4. Accuracy Class Specification

Miniature ball screws are produced according to the **ISO 3408 standard**. Below you can find basic permissible deviations and geometric tolerances in accordance with standard tolerance grade P0, P1 and P3.

Table 1: Travel deviations per reference length

LENGTH [mm]		PERMISSIBLE TRAVEL VARIATION v_{pu} [µm]			TOLERANCE ON SPCIFIED TRAVEL e_p [µm]		
>	≤	P0	P1	P3	P0	P1	P3
0	315	3,5	6	12	4	6	12
315	400	3,5	6	12	5	7	13
400	500	4	7	13	6	8	15
500	630	4	7	14	6	9	16
630	800	5	8	16	7	10	18
800	1000	6	9	17	8	11	21

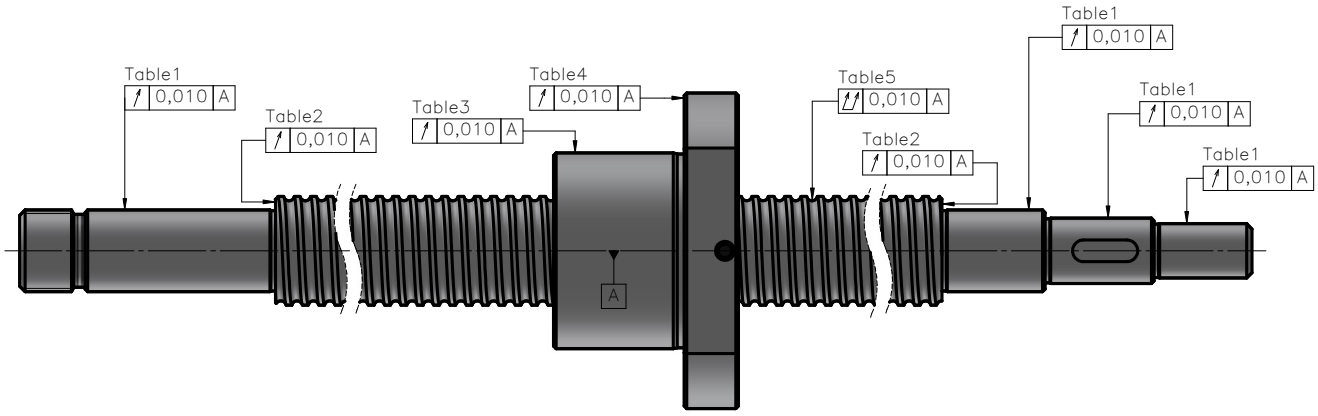


Table 2: Radial run-out bearing seat related to the centerline of screw groove and radial run-out of journal diameter related to the bearing seat.

SHAFT NOMINAL DIAMETER [mm]		PERMESSIBLE DEVIATION OF RADIAL RUN-OUT [µm]		
>	≤	P0	P1	P3
0	8	5	8	10
8	12	5	8	11
12	20	6	9	12

Table 3: Axial run-out of shaft (bearing) face related to the centerline of the bearing seat.

SHAFT NOMINAL DIAMETER [mm]		PERMESSIBLE DEVIATION OF RADIAL RUN-OUT [µm]		
>	≤	P0	P1	P3
0	8	5	8	10
8	12	5	8	11
12	20	6	9	12

Table 4: Axial run-out of ball nut location face related to the centerline of screw shaft.

NUT NOMINAL DIAMETER [mm]		PERMESSIBLE DEVIATION OF RADIAL RUN-OUT [µm]		
>	≤	P0	P1	P3
0	20	6	8	10
20	32	6	8	10
32	50	7	8	11

Table 5: Radial run-out of ball nut location diameter related to the centerline of screw shaft.

NUT NOMINAL DIAMETER [mm]		PERMESSIBLE DEVIATION OF RADIAL RUN-OUT [µm]		
>	≤	P0	P1	P3
0	20	6	9	12
20	32	7	10	12
32	50	8	12	15

KSK
PRECISE MOTION

KSK is a sought-after partner worldwide for the development and manufacture of precision ball screws. We owe this position to our reliability, excellent quality and smart product selection.

- The up-to-date catalogue version is always available on the company website in section Downloads.
- General terms and conditions as well as operating conditions can be found on the company website in section Downloads.
- Most of the used calculations are based on the ISO 3408 standard dealing with ball screws.
- Due to continuous technical development within our company, the technical parameters quoted in this catalogue are not binding on the KSK Precise Motion, a.s. company.
- The KSK Precise Motion, a.s. company hereby declares that it bears no liability for incorrect design proposals made by customers based on the data contained in this catalogue. If you need assistance, please contact our technical support.

KSK
PRECISE MOTION

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