



Roller screws

SR, BR, PR, ISR, SV, BV, PV, FLRBU

Technical Product Information

We pioneer motion

SCHAEFFLER

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1 Introduction

1.1 Schaeffler roller screws, high performance driving solutions

A wide assortment of industries rely on Schaeffler roller screws for their actuation requirements. Leading the trend to move from traditional forms of linear actuation, Schaeffler roller screws represent the state of the art driving force for powerful electro-mechanical actuation.

Schaeffler is a pioneer in the technology of roller screws and offers high quality, high performance and the widest assortment of roller screws available on the market.

The Schaeffler in-house highly integrated manufacturing process uses the latest machining technology including soft and hard machining, heat treatment (induction and through hardening), grinding and assembly operations.

Schaeffler manufacturing facilities also house laboratories dedicated to life tests, tribology, noise measurement and metallurgy. Beyond the standard assortment made from high grade bearing steel, Schaeffler offers special variants with stainless steel and high temperature steel combined with coatings, etc. to respond to the most demanding applications.

Schaeffler offers three main variants of planetary roller screws that do not require roller recirculation:

- The traditional SR assortment with threaded rollers synchronized to the nut, thanks to identical helix angle for the rollers and the nut
- The HR Ultra Power roller screws with increased capabilities compared to the SR assortment
- The ISR inverted roller screws with threaded rollers synchronized to the screw shaft, thanks to identical helix angle for the rollers and the shaft.

In addition, Schaeffler offers special variants of planetary roller screws:

- The SRR rotating nut roller screws
- Zero lead roller screws that can advantageously replace a traditional thrust bearing solution when extreme axial load carrying capacity, low weight and compactness are required.

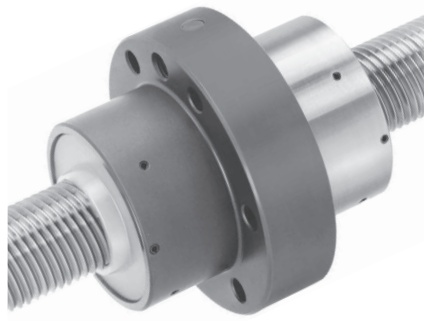
Schaeffler offers a wide assortment of recirculating roller screws. Since the rollers are circumferentially grooved, after each complete revolution around the nut, the grooved rollers must be recirculated back to their starting point on one side of the nut, with the help of cams and axial groove inside the nut.

Small leads are possible with a relatively larger thread pitch on the shaft and nut. This feature offers the ideal combination of small lead, high load carrying capacity, a high degree of stiffness and precision.

Nevertheless, the recirculating roller screws present lower speed and acceleration capabilities than planetary roller screws.

1.2 Product overview

1 Planetary roller screws SR



001BD29F

- Wide assortment of diameters and leads for numerous applications
- Reliable driving solution with high loads and speeds capabilities

2 Ultra Power planetary roller screws HR



001BD225

- Extreme load carrying capacity
- Robustness and long service life for highly demanding applications

3 Inverted planetary roller screws ISR



001BD227

- All the features and benefits of the planetary roller screw design
- Plus small leads, high load carrying capacity within a compact design

4 Rotating nut planetary roller screws SRR



001BD22B

- Operation similar to electro-mechanical cylinders
- Compact, integrated support bearing and roller screw nut functions

5 Zero lead roller screws



001BD22D

- Thrust bearing solution for special applications
- High thrust carrying capacity with compactness

6 Recirculating roller screws SV



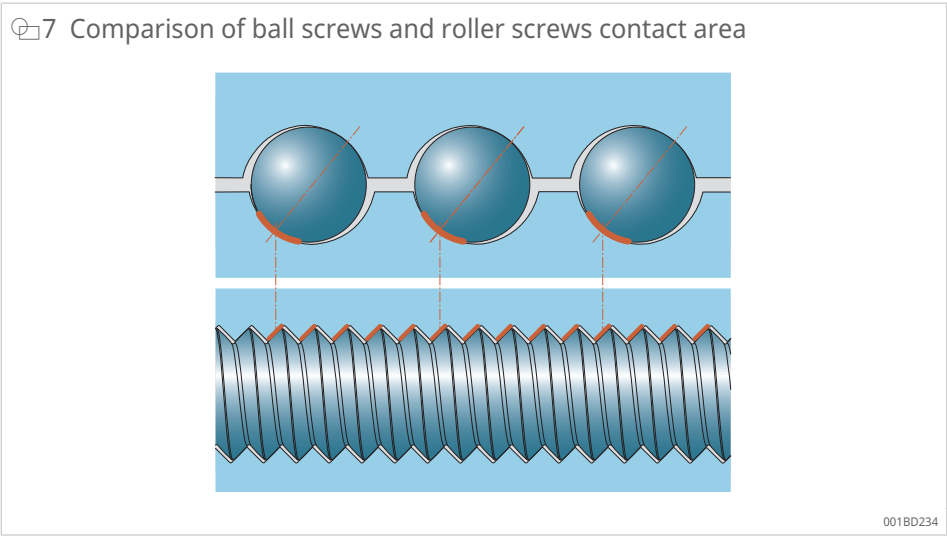
001BD2E4

- Small leads associated with high load carrying capacity
- Fine resolution and stiffness for ultra precision applications

1 Product overview

Expectations with electro-mechanical actuation	Schaeffler roller screw solutions
Increased productivity for industrial grade applications with operational duty cycle over 70 %	High load carrying capacity and cycling capability Accommodate high accelerations and high speeds
Up to 70 % energy savings compared to hydraulic and pneumatic actuation technologies	Mechanical efficiency usually greater than 80 %
Functionality, flexibility and controllability	Widest assortment of roller screws available on the market Accommodate heavy loads with transportation applications Provide accuracy for positioning applications Custom designs and flexible manufacturing equipment
Reliability	By design, the planetary roller screw offers greater reliability than other driving solutions
Higher repeatability and process stability	Limited wear, in particular for screws that have been run in at the factory
Easy integration into work cells and existing systems	High power density
Higher degree of precision	High degree of positioning accuracy further increased without backlash or with preload Recirculating roller screws with small leads are recommended for ultra-precision applications
Low noise levels	Very smooth and quiet operation with planetary roller screws
Cleanliness	Roller screws consume a very small amount of lubricants
Lower total cost of ownership (TCO) compared to traditional types of actuation	Long service life and reliability

With planetary roller screws, the application load is transmitted from the nut to the shaft through the barrel-shaped surfaces of the rollers. The number of contacts and the total surface area of the contacts between the shaft, the rollers and the nut are substantially increased compared to the ball screw design, resulting in larger dynamic and static load carrying capacities.



The absence of recirculating element embodies the fundamental conceptual advantage of the planetary roller screws. This feature eliminates the main failure mode of ball screws, that is linked to the recirculation of the balls. Indeed, recirculating heavily loaded balls induces alternate stresses on the balls and shock loads arising from the change of trajectory.

In addition, satellite rollers never come into contact with each other. This is a significant advantage of this product over most ball screw designs. Balls come into contact with each other in most ball screw designs, generating friction and adding a potential failure mode to the ball screw concept.

With recirculating roller screws, the application load transfers from the shaft to the nut through a set of grooved rollers. This design permits very small leads while offering high load carrying capacity and axial stiffness.

This mechanical advantage minimizes input torque and increases application resolution and performance. They can simplify a complete transmission and improve its rigidity. They are often used in applications involving advancing technology where reliable optimum performance is essential.

2 Advantages roller screw

Roller screw concept	Advantages over a ball screw	User benefits
Large number of contact points	High load carrying capacity and up to 10 times longer service life	Lower total cost of ownership (TCO)
Satellite rollers	Roller screw rotational speeds up to 50 % higher than a ball screw with similar carrying capacity Roller screw acceleration up to 3 times higher Absence of recirculation eliminating a significant failure mode	Increased speed of operations Higher productivity Higher degree of reliability
Planetary roller screws with small lead (down to 2 mm)	High load carrying capacity compared to ball screws with small lead which are designed with small diameter balls which have low load carrying capacity	High load carrying capacity combined with positioning accuracy and reduced torque requirements
Evenly spaced planetary or recirculating rollers	Good operation in applications with changes of direction, stable friction torque	Low noise High degree of reliability
Recirculating roller screws with small lead down to 1 mm	High load carrying capacity, high axial stiffness that cannot be obtained with a ball screw of similar lead and diameter Very small input torque	High resolution High stiffness Long service life Robustness

1.3 Selection guide

3 Planetary roller screws SR/BR, HR: Standard and maximum dynamic load carrying capacity C_a

1

P_h		2	4	5	6	8	9	10	12	15	18	20	24	25	30	35	36	40	42	50
d_0	Nut	C_a																		
mm		kN																		
8	SR/BR ¹⁾	8.61	8.93	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12	SR/BR	–	–	14.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12	SR/BR ¹⁾	13.2	–	15.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
15	SR/BR	–	–	26 ²⁾	–	27.4 ²⁾	–	–	–	–	–	–	–	–	–	–	–	–	–	–
15	SR/BR ¹⁾	23.9	–	29.7 ²⁾	–	29.4 ²⁾	–	–	–	–	–	–	–	–	–	–	–	–	–	–
18	SR/BR ¹⁾	30.4	–	37.7	–	38	–	–	–	–	–	–	–	–	–	–	–	–	–	–
21	SR/BR	–	–	50.6 ²⁾	52.8	57 ²⁾	–	59.2 ²⁾	–	–	–	–	–	–	–	–	–	–	–	–
21	SR/BR ¹⁾	47.4	–	57.8 ²⁾	60.3	65.2 ²⁾	–	63.6 ²⁾	–	–	–	–	–	–	–	–	–	–	–	–
24	SR/BR	–	–	–	42.3	–	–	–	47.7	–	–	–	–	–	–	–	–	–	–	–
24	SR/BR ¹⁾	–	–	–	47.3	–	–	–	53.3	–	–	–	–	–	–	–	–	–	–	–
25	SR/BR	–	–	68.4 ²⁾	–	76.1	–	78.6 ²⁾	–	85.6	–	–	–	–	–	–	–	–	–	–
25	SR/BR ¹⁾	–	–	78.2 ²⁾	–	87	–	89.8 ²⁾	–	91.9	–	–	–	–	–	–	–	–	–	–
30	SR/BR	–	–	92 ²⁾	95	103	–	106 ²⁾	–	119	–	123	–	–	–	–	–	–	–	–
30	SR/BR ¹⁾	–	–	105 ²⁾	109	117	–	122 ²⁾	–	127	–	132	–	–	–	–	–	–	–	–
36	SR/BR	–	–	–	90.5	–	97.5	–	107	–	114	–	–	–	–	–	–	–	–	–
36	SR/BR ¹⁾	–	–	–	106	–	115	–	125	–	128	–	138	–	–	–	–	–	–	–
39	SR/BR	–	–	129 ²⁾	–	–	–	153 ²⁾	–	168	–	173	–	175	–	–	–	–	–	–
39	SR/BR ¹⁾	–	–	148 ²⁾	–	–	–	174 ²⁾	–	192	–	198	–	188	–	–	–	–	–	–
44	SR/BR	–	–	–	–	130	–	–	144	–	158	–	168	–	166	–	–	–	–	–
44	SR/BR ¹⁾	–	–	–	–	153	–	–	169	–	185	–	188	–	185	–	–	–	–	–
48	SR/BR	–	–	198 ²⁾	–	218	–	232 ²⁾	–	258	–	266 ²⁾	–	286	276	–	–	–	–	–
48	SR/BR ¹⁾	–	–	240 ²⁾	–	250	–	265 ²⁾	–	295	–	304 ²⁾	–	327	316	–	–	–	–	–
56	SR/BR	–	–	–	–	–	–	–	212	–	–	–	242	–	–	–	258	–	–	–
56	SR/BR ¹⁾	–	–	–	–	–	–	–	249	–	–	–	284	–	–	–	289	–	–	–
60	SR/BR	–	–	–	–	–	–	339	–	373	–	395 ²⁾	–	–	–	–	–	–	–	–
60	SR/BR ¹⁾	–	–	–	–	–	–	387	–	426	–	452 ²⁾	–	–	–	–	–	–	–	–
60	HR	–	–	–	–	–	–	–	–	494	–	515	–	530	528	–	–	–	–	–
64	SR/BR	–	–	–	–	–	–	–	–	–	317	–	329	–	318	–	309	–	–	–
64	SR/BR ¹⁾	–	–	–	–	–	–	–	296	–	333	–	346	–	356	–	346	–	–	–
75	SR/BR ¹⁾	–	–	–	–	–	–	505	–	561	–	572	–	–	–	–	–	–	–	–
75	HR	–	–	–	–	–	–	–	–	836	–	845	–	855	852	–	–	–	–	–
80	SR/BR	–	–	–	–	–	–	365	–	–	420	–	452	–	–	–	–	–	398	–
80	SR ¹⁾	–	–	–	–	–	–	383	–	–	441	–	474	–	–	–	–	–	445	–
87	HR	–	–	–	–	–	–	–	–	1059	–	1061	–	1085	1085	–	–	–	–	–
99	SR ¹⁾	–	–	–	–	–	–	–	–	–	–	925	–	937	–	–	–	–	–	–
99	HR	–	–	–	–	–	–	–	–	1277	–	1311	–	1328	1330	1329	–	–	–	–
112.5	HR	–	–	–	–	–	–	–	–	1396	–	1421	–	1446	1455	1461	–	–	–	–
120	SR ¹⁾	–	–	–	–	–	–	–	–	–	–	1131	–	1127	–	–	–	–	–	–
120	HR	–	–	–	–	–	–	–	–	1547	–	1587	–	1585	1614	1640	–	1651	–	–
135	HR	–	–	–	–	–	–	–	–	1843	–	1858	–	1903	1904	1921	–	1909	–	1944
150	HR	–	–	–	–	–	–	–	–	2200	–	2240	–	2137	2167	2167	–	2176	–	2189
180	HR	–	–	–	–	–	–	–	–	3073	–	3123	–	3002	3009	3023	–	3075	–	3128
210	HR	–	–	–	–	–	–	–	–	–	–	3371	–	3435	3249	3265	–	3322	–	3381
240	HR	–	–	–	–	–	–	–	–	–	–	–	–	3919	3931	3994	–	3808	–	3860

¹⁾ Maximum number of rollers, on request

²⁾ Preferred range

4 Planetary roller screws PR, with internal preload: Standard and maximum dynamic load carrying capacity C_a

P_h		2	4	5	6	8	9	10	12	15	18	20	24	25	30	35	36
d_0	Nut type	C_a															
mm		kN															
8	PR ³⁾	4.74	4.92	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12	PR	–	–	7.76	–	–	–	–	–	–	–	–	–	–	–	–	–
12	PR ³⁾	7.25	–	8.32	–	–	–	–	–	–	–	–	–	–	–	–	–
15	PR	–	–	14.3	–	15.1	–	–	–	–	–	–	–	–	–	–	–
15	PR ³⁾	13.1	–	16.4	–	16.2	–	–	–	–	–	–	–	–	–	–	–
18	PR ³⁾	16.8	–	20.8	–	20.9	–	–	–	–	–	–	–	–	–	–	–
21	PR	–	–	27.9	29.1	31.4	–	32.6	–	–	–	–	–	–	–	–	–
21	PR ³⁾	26.1	–	31.8	33.2	35.9	–	35.0	–	–	–	–	–	–	–	–	–
24	PR	–	–	–	23.3	–	–	–	26.3	–	–	–	–	–	–	–	–
24	PR ³⁾	–	–	–	26.1	–	–	–	29.4	–	–	–	–	–	–	–	–
25	PR	–	–	37.7	–	41.9	–	43.3	–	47.2	–	–	–	–	–	–	–
25	PR ³⁾	–	–	43.1	–	47.9	–	49.5	–	50.6	–	–	–	–	–	–	–
30	PR	–	–	50.7	52.3	56.5	–	58.6	–	65.4	–	67.9	–	–	–	–	–
30	PR ³⁾	–	–	57.9	59.8	64.6	–	67.0	–	70.1	–	72.9	–	–	–	–	–
36	PR	–	–	–	49.8	–	53.7	–	58.7	–	62.9	–	68.1	–	–	–	–
36	PR ³⁾	–	–	–	58.5	–	63.1	–	69.0	–	70.3	–	76.1	–	–	–	–
39	PR	–	–	71.2	–	–	–	84.1	–	92.4	–	95.2	–	96.3	–	–	–
39	PR ³⁾	–	–	81.4	–	–	–	96.1	–	106	–	109	–	103	–	–	–
44	PR	–	–	–	–	71.9	–	–	79.2	–	86.9	–	92.5	–	91.4	–	–
44	PR ³⁾	–	–	–	–	84.4	–	–	93.0	–	102	–	103	–	102	–	–
48	PR	–	–	109	–	120	–	128	–	142	–	146	–	157	152	–	–
48	PR ³⁾	–	–	132	–	138	–	146	–	162	–	167	–	180	174	–	–
56	PR	–	–	–	–	–	–	–	117	–	–	–	133	–	–	–	142
56	PR ³⁾	–	–	–	–	–	–	–	137	–	–	–	157	–	–	–	159
60	PR	–	–	–	–	–	–	187	–	206	–	218	–	–	–	–	–
60	PR ³⁾	–	–	–	–	–	–	213	–	235	–	249	–	–	–	–	–
64	PR	–	–	–	–	–	–	–	–	–	177	–	184	–	178	–	173
64	PR ³⁾	–	–	–	–	–	–	–	166	–	186	–	193	–	199	–	193

³⁾ Maximum number of rollers, on request

5 Inverted roller screws ISR: Standard dynamic load carrying capacity C_a

P_h		2.4	3	4	5	6
d_0	Nut	C_a				
mm		kN				
18	ISR	35.6	37.8	36.6	37.8	40.4
21	ISR	55.5	59.6	63.3	61.5	64.2
24	ISR	63.7	67.2	72	75.3	74.5
30	ISR	93.2	99.2	105	111	117
39	ISR	135	143	153	161	169
48	ISR	209	221	234	247	259

C_a kN dynamic axial load rating
 d_0 mm nominal diameter of screw shaft
 d_1 mm Nominal diameter of the threaded shaft for recirculating roller screws
 P_h mm lead

6 Rotating nut roller screws SRR/BRR: Standard dynamic load carrying capacity C_a

P_h		5	10	15	20	25
d_0	Nut	C_a				
mm		kN				
25	SRR/BRR	68.4	78.5	85.6	–	–
30	SRR/BRR	91.9	106	119	123	–
39	SRR/BRR	129	153	168	173	175
48	SRR/BRR	198	232	258	266	286
60	SRR/BRR	–	339	373	395	–

7 Recirculating roller screws SV/BV: Standard dynamic load carrying capacity C_a

P_h		1	2	3	4	5
d_1	Nut type	C_a				
mm		kN				
8	SV/BV	8.5	–	–	–	–
10	SV/BV	8.95	8.95	–	–	–
12	SV/BV	10.3	10.3	–	–	–
16	SV/BV	11.5	11.5	–	–	–
20	SV/BV	18.5 ⁴⁾	18.5	–	–	–
25	SV/BV	32.9 ⁴⁾	32.9	–	–	–
32	SV/BV	64.3 ⁴⁾	64.3 ⁴⁾	–	–	–
40	SV/BV	79.1	49.9	–	–	–
50	SV/BV	190	98.1	153	98.1	–
63	SV/BV	–	186	–	186	–
80	SV/BV	–	–	–	325	–
100	SV/BV	–	–	–	–	469
125	SV/BV	–	–	–	–	756

⁴⁾ Preferred range

8 Recirculating roller screws PV, with internal preload: Standard dynamic load carrying capacity C_a

P_h		1	2	3	4	5
d_1	Nut	C_a				
mm		kN				
8	PV	4.88	–	–	–	–
10	PV	5.14	5.14	–	–	–
12	PV	5.96	5.96	–	–	–
16	PV	6.71	6.71	–	–	–
20	PV	10.6	10.6	–	–	–
25	PV	18.9	18.9	–	–	–
32	PV	36.9	36.9	–	–	–
40	PV	45.4	28.7	–	–	–
50	PV	109	56.6	88	56.6	–
63	PV	–	107	–	107	–
80	PV	–	–	–	187	–
100	PV	–	–	–	–	269
125	PV	–	–	–	–	434

C_a kN dynamic axial load rating
 d_0 mm nominal diameter of screw shaft
 d_1 mm Nominal diameter of the threaded shaft for recirculating roller screws
 P_h mm lead

2 Selection guide

2.1 Technical concepts

2.1.1 Introduction to Schaeffler roller screws

Roller screws convert rotary motion into linear motion and vice-versa. Loads are transferred from the screw shaft to the nut through a roller set, therefore, roller screws relate to general bearing technology. Various types of bearing steel are used to attain the hardness and material fatigue properties required for carrying heavy application loads over extended periods of service. Certain bearing concepts such as load ratings, load cycles, nominal calculated life and service life, stiffness, speed ratings, lubrication requirements, etc. are explained below to guide customers through the roller screw selection process.

The selection parameters are included in this chapter. To make the best selection of a roller screw, the designer should consider the following parameters such as the load cycle, the linear or rotational speed, the required life, the rates of acceleration and deceleration, the cycle rate, the environment, the lead accuracy, the stiffness, and any other special requirements.

For additional information about the roller screws selection process, please contact your local Schaeffler representative.

2.1.2 Basic dynamic load carrying capacity C_a

The dynamic load carrying capacity is used to compute the nominal fatigue life of roller screws. It corresponds to the axial load, constant in magnitude and direction, concentric with the roller screw axis, under which the calculated nominal fatigue life as defined by ISO 3408-5 reaches 10^6 revolutions.

2.1.3 Nominal fatigue life L_{10}

Nominal fatigue life L_{10} is, according to the ISO definition, the life attained or exceeded by 90 % of a sufficiently large group of identical roller screws, working under identical conditions (alignment, axially and centrally applied load, speed, acceleration, lubrication, temperature and cleanliness).

The nominal life of a roller screw is the statistical number of 10^6 revolutions which the roller screw is capable of reaching before the first signs of flaking signifying material fatigue occurs on one of the rolling surfaces.

When reliability greater than 90 % is required, the calculated nominal life must be corrected. See values for the correction factor in the table. For example, if a reliability of 98 % is required, $L_2 = 0.33 \cdot L_{10}$ where L_{10} is calculated using the formulae ►27|2.1.20.

9 Correction factor for reliability

Reliability	Correction factor	L_n
%	–	–
90	1.00	L_{10}
95	0.62	L_5
96	0.53	L_4
97	0.44	L_3
98	0.33	L_2
99	0.21	L_1

2.1.4 Service life

The actual life achieved by a specific roller screw is known as service life. In addition to material fatigue, service life can be reduced by inadequate lubrication, wear, corrosion, contamination and, more generally, loss of the functional characteristics required by the application.

Experience with similar applications will help in selecting the right screw to obtain the desired service life. Structural requirements such as the strength of screw ends and nut attachments should also be considered.

To attain L_{10} life performance, the maximum cycle operating load F_{max} should not exceed 80 % of C_a (for SR and SV product assortments) to limit the Hertzian pressure at the rollers/ raceways contact points. If F_{max} exceeds 50 % of the C_a value, please contact your Schaeffler representative for validation.

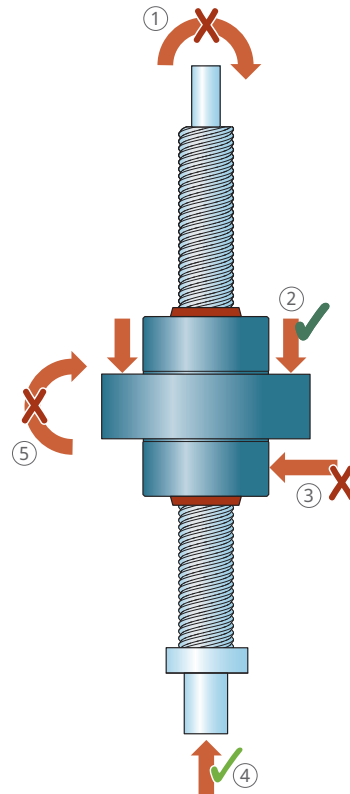
For small strokes (shorter than the nut length) or short oscillations, additional considerations such as the actual total number of loading cycles on any specific area of the shaft, and the false brinelling effect should be taken into account.

2.1.5 Equivalent dynamic load F_m

The loads acting on the screw can be calculated according to the laws of mechanics if the external forces are known or can be calculated. For product sizing and selection, it is necessary to calculate the equivalent dynamic load: this is the hypothetical load, constant in magnitude and direction, acting axially and centrally on the screw, which, if applied, would have the same influence on the screw life as the actual loading conditions which the screw will be subjected to.

Radial and moment loads must be accommodated by linear guides. It is extremely important to resolve these possible problems early in the design stage. Radial forces are detrimental to the life and expected performance of the screw.

8 Permissible and prohibited loading on roller screw



001DB9F0

1	Bending moment	2	Axial load
3	Radial load	4	Axial load
5	Tilting moment		

Please refer to the chapter entitled Recommendations for assembly ►147 | 5.

If misalignment, uneven loading, shock loads, etc. cannot be avoided, they must be taken into account during the sizing of the screw. Their influence on the screw's nominal life can generally be estimated.

2.1.6 Basic static load carrying capacity C_{0a}

Roller screws should be selected based on the basic static load carrying capacity C_{0a} , rather than the basic dynamic load carrying capacity, when they are subjected to continuous or intermittent shock loads while operating in stationary conditions for short periods of time.

The permissible load is determined by the permanent deformation caused by the load acting at the contact points. The static load carrying capacity is, according to ISO standards, the purely axially and centrally applied static load which creates, by calculation, a total (rolling element + threaded surface) permanent deformation equal to $1/10000$ of the curvature diameter of the rolling element.

In order to prevent surface damage, to keep smooth running and low noise level, Schaeffler recommends that the application loads do not exceed 80 % of the static load carrying capacity C_{0a} , which equals to a static safety factor s_0 of 1.25. Usually the C_{0a} value corresponds to a Hertzian contact pressure ranging between 4500 MPa and 4800 MPa.

The basic dynamic and static load carrying capacities are related to the material properties, and vary with the material hardness at the contact points. Please refer to the paragraph explaining “materials, heat treatment and coatings” ► 20 | 2.1.14.

The basic static load carrying capacity must be, at a minimum, equal to the product of the maximum applied axial static load and a static safety factor s_0 . Past experience with similar applications and requirements of maximum static load occurrence, running smoothness and noise level will guide the selection of s_0 .

For applications requiring high precision, roller screws should operate significantly below the static load carrying capacity, which means operation with a higher value for the static safety factor s_0 .

For heavily loaded applications where precision, noise level and running smoothness are not critical to the performance expectations, roller screws can operate at load levels close to the basic static load carrying capacity. With these conditions, special care must be paid to proper lubrication.

2.1.7 Critical rotating speed for screw shafts n_{cr}

A roller screw with the nut in a given position has a natural frequency of vibration in bending mode. When the screw shaft is rotating, it is important that the rotational speed not excite its natural frequency. If it does, it would result in elastic radial deflection of the shaft. In extreme conditions, without damping, the screw shaft could be bent. The natural frequency of the roller screw changes continuously as the nut moves along the shaft and in relation to the shaft supports. The positive effect of this axial nut displacement is that there is generally no time for the amplitude of the vibration at a given natural frequency to build up.

For calculation of the critical rotating speed, the shaft is the equivalent of a cylinder with an external diameter equal to the root diameter of the thread. The formula uses a parameter whose value is dictated by the mounting of the screw shaft ends, whether the screw shaft end is free, radially supported or fixed.

As a general rule, the nut is not considered to be a support for the screw shaft. Because of the potential inaccuracies in the mounting of the screw assembly, a safety factor of 0.8 is applied to the calculated critical speed.

Calculations where the nut is considered to be a support for the shaft or calculations which reduce the safety factor, require practical tests and possibly optimization of the design.

2.1.8 Permissible speed limit ($n \cdot d_0$) and acceleration

The permissible speed limit is the speed that a screw cannot reliably exceed at any time. It corresponds to the limiting speed of the rotation of rollers (SR and ISR types) or of the recirculation of the rollers (SV type) inside the nut. It is expressed as the product of maximum rotational speed n (min^{-1}) and the nominal diameter d_0 (mm) of the screw shaft. The speed limits quoted in this document are the maximum speeds that may be applied for short periods of time with optimized conditions of alignment, light external load or preload, and with appropriate lubrication.

Permissible speed limits for each technology:

- Planetary roller screw (SR) and inverted roller screw (ISR):
 $n \cdot d_0 \leq 160000$
- Recirculating roller screw (SV):
 $n \cdot d_1 \leq 30000$ for $d_1 \leq 25$ mm
 $n \cdot d_1 \leq 20000$ for $d_1 > 25$ mm

Running a screw continuously at the permissible speed limit may reduce the service life of the nut mechanism.

Important:

High speeds combined with high loads yield a relatively short nominal life.

In the case of high accelerations, decelerations or fast movement reversal, Schaeffler recommends either working under a nominal external load or applying a light preload to the nut to avoid roller sliding on the shaft.

The preload for screws subjected to high accelerations must be calculated to be sure that the rolling elements do not slide.

However, excessive preload will generate an unacceptable increase in frictional heat.

Roller screws preloaded for optimum rigidity (PR or PV prefix) should not be operated continuously at high speeds.

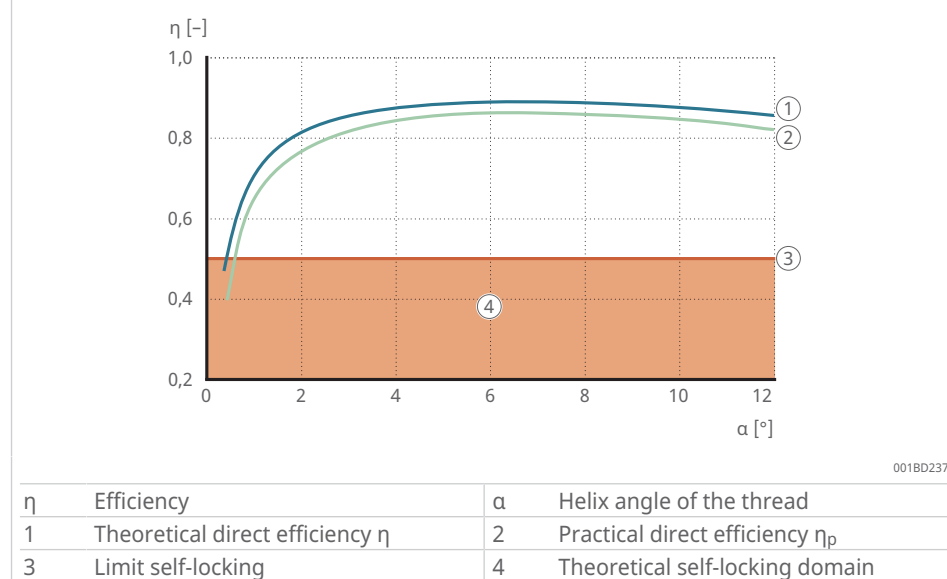
Recirculating roller screws should not be operated at permanent high linear speeds or at their maximum speed rating. High speeds will be detrimental to the recirculation cam's life. In addition, noise levels will increase.

2.1.9 Efficiency η

the contact surfaces, their finish and the helix angle of the thread. It also depends on the working conditions (load, speed, lubrication, preload, alignment, etc.).

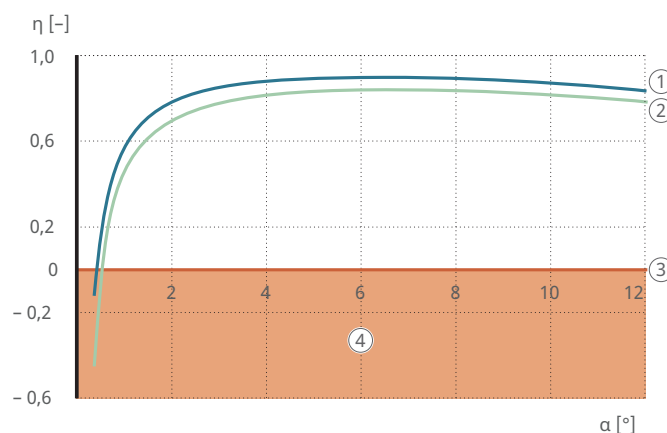
Direct efficiency η is used to define the input torque required to transform the rotation of one component into the translation of another.

9 Theoretical direct efficiency η and practical direct efficiency η_p



Conversely, indirect efficiency η' is used to define the axial load required to transform the translation of one component into the rotation of another one. It is also used to define the braking torque required to prevent that rotation.

10 Theoretical indirect efficiency η' and practical indirect efficiency η'_p



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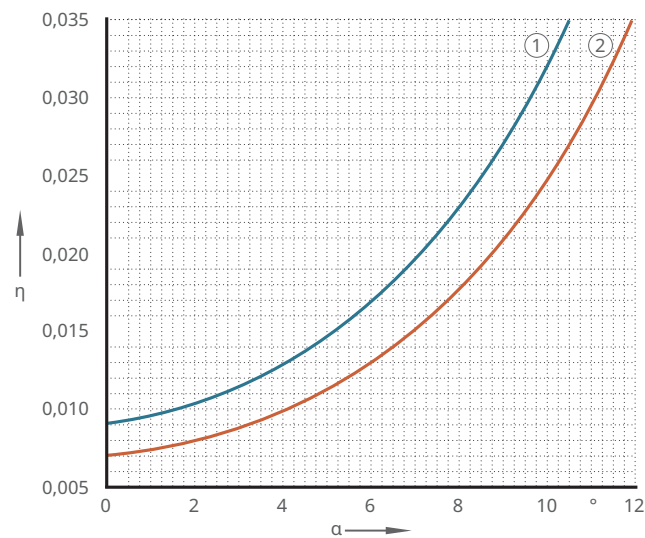
η	Efficiency	α	Helix angle of the thread
1	Theoretical indirect efficiency η'	2	Practical indirect efficiency η'_p
3	Limit self-locking	4	Theoretical self-locking domain

The reference coefficient of friction μ_{ref} would be achievable with perfect operating conditions of lubrication, alignment, etc. and it would result in generating a theoretical direct efficiency η , or a theoretical indirect efficiency η' . Because such laboratory conditions are not encountered with real applications, we define a practical coefficient of friction μ_{prac} used to estimate the practical efficiencies η_p and η'_p .

Practical efficiencies range between the starting efficiencies of a newly installed screw and that of a properly run-in screw. These practical values of efficiency are calculated with a practical value for the coefficient of friction μ_{prac} .

To account for real installation, running conditions and the experience of real life application, this practical coefficient of friction μ_{prac} corresponds to the reference coefficient of friction μ_{ref} increased by 30 %.

11 Reference coefficient of friction μ_{ref} and practical coefficient of friction μ_{prac}



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1	μ_{prac} practical coefficient of friction	2	μ_{ref} reference coefficient of friction
η	Efficiency	α	Helix angle of the thread

This calculation method reduces the practical efficiency of the screw versus its theoretical efficiency by about 5 %. Generally, the practical efficiency increases with speed, and over time with running in effect.

Note:

The helix angle alpha can be calculated using the relevant formula ►30 | 18.

2.1.10 Back-driving and braking torque T_b

Even though some roller screw dimensions should theoretically enable self-locking, screw mechanisms can always be back-driven with the right conditions of external forces and vibrations.

A braking mechanism (gear reducer, no-back or brake) must be part of the design if back-driving is to be avoided.

If back-driving is required, special care must be taken to align the whole system. Misalignment significantly increases the coefficient of friction by tilting and, consequently, increases the axial force required to back-drive the mechanism.



Vertical installations and applications presenting a risk of falling loads require special care by designers and users. It is the customer's responsibility to determine the need for back-up locking devices and safety systems

2.1.11 Break away torque T_x

This is the amount of torque required to overcome the following forces to start rotation:

- (a) The total inertia of all moving parts accelerated by the source of power (including rotational and linear movements).
- (b) The internal friction of the screw/nut assembly, bearings and associated guidance systems.

In general, the torque required to overcome inertia (a) is greater than the friction torque (b). The coefficient of friction μ_s for a high-efficiency screw, when it starts moving, is estimated to reach up to twice the amount of the practical dynamic coefficient of friction μ_{prac} , under normal operating conditions.

2.1.12 Driving torque T_t

This is the total torque required from the electric motor to overcome inertia, external forces, preload, friction, etc. Please, see calculation formulae ►27 | 2.1.20.

2.1.13 Static axial stiffness R_t

The static axial stiffness of a complete roller screw assembly is the ratio of the external axial load applied to the system and the axial displacement of the face of the nut in relation to the fixed (anchored) end of the screw shaft. The inverse of the system's overall stiffness is equal to the sum of all inverted values of stiffness for each component (screw shaft, roller nut, support bearings, etc.).

Therefore, the overall stiffness of the system is always lower than the lowest value for stiffness of any individual component.

Nut stiffness R_n

When a preload is applied to a nut, the internal play is eliminated. Additionally, the squeeze load responsible for generating the preload creates initial Hertzian elastic deformation at the contact points. This leads to an increase in stiffness proportionate to the preload value.

The theoretical elastic deformation at the contact points does not take into account machining inaccuracies, actual sharing of the load between the different contact surfaces, or elasticity of the nut and screw shaft.

For this reason, two stiffness values are given in the document:

- R_{ng} : This is the minimum nominal stiffness reached by any nut and roller assembly. This value, based on laboratory measurements, is a practical value and does not require any correction factor. It takes into account production tolerances, actual load sharing, preload torque tolerance, deflection of the nut body, etc. It can be used to calculate the total stiffness during the roller screw selection process.
- R_{nr} : This value corresponds to the reference nominal stiffness of a nut and roller assembly with all geometrical dimensions centered within the tolerances. It corresponds to the optimum stiffness level.

R_{nr} is always greater than R_{ng} . Both values are determined by applying an external axial load, centered on the screw shaft and equal to twice the preload force.

Shaft stiffness R_s

The elastic deformation of the screw shaft is proportional to its length and inversely proportional to the square of its root diameter.

According to the relatively low stiffness of the shaft, an increase of the nut preload (and its stiffness) will, in most cases, not increase significantly the overall stiffness of the system.

Consequently, the preload stated in the document for each screw dimension is the maximum and should not be exceeded.

2.1.14 Materials, heat treatment and coatings

Choice of steel material

Standard screw shafts are mainly manufactured from pretreated 50CrMo4 (otherwise 42CrMo4) which is surface hardened by induction. Through hardened 100Cr6 bearing steel is used for nuts and rollers.

100Cr6 can also be selected for the screw shaft for operation at higher temperature up to 180 °C, or if the application presents a concern for wear. Material properties are detailed in the following table.

10 Selection of standard steels

Component	Steel	Supplying state	Heat treatment	Maximum allowed operating temperature	Surface hardness at standard tempering temperature	Customer benefits
				°C	HRC	
Standard shaft	50CrMo4 or 42CrMo4	Pre-treated Tensile strength 880 MPa to 1030 MPa Yield strength > 650 MPa	Induction hardening	+110	58 ... 60	Good wear resistance Resilience
Standard shaft on request	50CrMo4	Pre-treated Tensile strength 880 MPa to 1030 MPa Yield strength > 650 MPa	Induction hardening Higher tempering temperature	+150	58 ... 60	Good wear resistance and medium temperature operation Resilience
Special shaft	100Cr6	Pre-treated Tensile strength 840 MPa to 970 MPa Yield strength > 500 MPa	Induction hardening	+180	59 ... 63	Higher wear resistance, adapted to higher operating temperature but more brittle
Nut and rollers	100Cr6	Annealed	Through hardening	+180	58 ... 62	Good wear resistance and high temperature operation

Stainless steel can be used for all types of roller screws. Properties offered by these special steel variants are summarized in the following table.

11 Selection of stainless steels

Steel	Description	Shaft hardness	Relative corrosion resistance
ISO standard		HRC	
X105CrMo17	Martensitic stainless steel	58 ... 60	++
X30Cr13	Martensitic stainless steel	50 ... 55	+++
X12CrNiMoV12-3	Carburizing stainless steel	58 ... 60	+++
X40CrMoVN16-2	Nitrogen stainless steel	58 ... 60	++++

Effect of surface hardness on roller screw basic load rating

According to the ISO reference calculations, the load ratings provided in the document are given for surface hardness above 654 HV (58 HRC). For materials or treatments resulting in a lower hardness, correction factors should be applied to the dynamic and static load carrying capacities:

f1 C_{ac}

$$C_{ac} = C_a \left(\frac{HV_a}{654} \right)^2$$

C_a	kN	dynamic axial load rating
C_{ac}	kN	Corrected dynamic axial load rating
HV_a	HV	Actual hardness

f2 C_{0ac}

$$C_{0ac} = C_{0a} \left(\frac{HV_a}{654} \right)^3$$

C_{0a}	kN	static axial load rating
C_{0ac}	kN	Corrected static axial load rating
HV_a	HV	Actual hardness

Note:

654 HV is equivalent to 58 HRC

Surface coatings

Schaeffler offers various types of surface coatings for improved roller screw performances:

- Manganese phosphate coating of carbon steels to improve corrosion resistance.
- Low friction coating is available on request.

2.1.15 Operating temperature

Operating at high temperatures will lower the steel hardness, alter the thread accuracy, may increase the oxidation of the materials and change the lubricant properties.

With operating temperature lower than $-20\text{ }^{\circ}\text{C}$, the core resilience of the material can become critical. The lower the temperature, the more brittle the material becomes, especially with a long or thin screw shaft. Bending stresses or shock loads increase the risk of fractures.

Applications with high cycling rates and high loads can generate excessive amounts of heat. To eliminate excess heat, Schaeffler can provide a nut mechanism, with cooling chambers. When connected to a customer supplied water circulation system, temperatures can be stabilized, enabling higher cycling rates and increased productivity.

2.1.16 Screw shaft buckling or column strength F_c

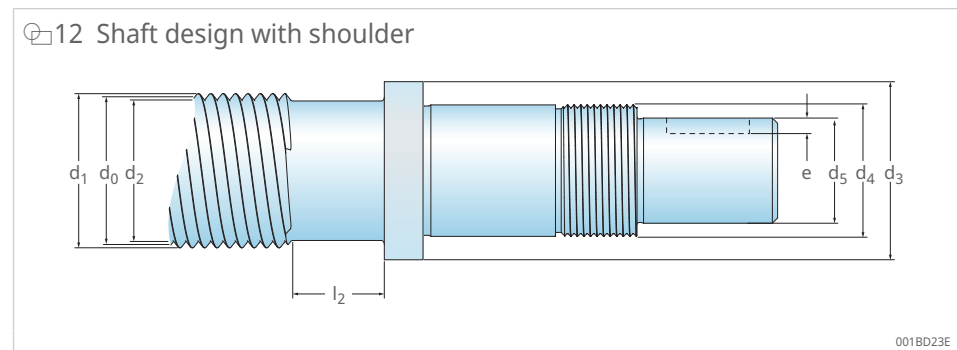
The column loading of a screw shaft must be checked when it is subjected to dynamic or static compression loading.

The maximum permissible compressive load is calculated using the Euler formulae, with a safety factor of 3 to 5, depending on the application. The type of shaft end mounting is critical for selecting the proper coefficient to be used in the Euler formulae.

When the screw shaft has a single diameter along its total length, the root diameter of the threaded shaft is used for the calculation. When the screw shaft comprises different sections with varying diameters, calculation becomes more complex.

2.1.17 Shaft design

It is possible to deliver screws with one end larger than the shaft outside diameter d_1 . This design feature is frequently used in conjunction with support bearings with large bore diameter. To grind the thread efficiently, an undercut with root diameter d_2 and length l_2 is needed.



d_0	mm	nominal diameter of screw shaft
d_1	mm	Outside diameter of threaded shaft
d_2	mm	Threaded shaft root diameter
d_3	mm	Outside diameter of shoulder
d_4	mm	Thread diameter a
d_5	mm	Diameter of shaft end
e	mm	Deep keyway at the machined shaft end
l_2	mm	Undercut length

12 Design conditions of the shaft ends

Type of roller screw	Design conditions	Value for l_2
SR, BR, PR, HR, SRR	$d_3 \leq 1.85 \cdot d_1$	$l_2 \geq 12 \text{ mm}$
	$P_h \leq 8 \text{ mm}$	
	$d_3 \leq 1.85 \cdot d_1$ $P_h > 8 \text{ mm}$	$l_2 \geq 1.4 \cdot P_h$
SV, BV, PV	$d_3 \leq 1.85 \cdot d_1$	$l_2 \geq 12 \text{ mm}$
	$P_h = 1 \text{ mm}$	
	$d_3 \leq 1.85 \cdot d_1$ Sizes $d_0 \cdot P_h = 40 \times 2 \text{ mm}$ oder $50 \times 2 \text{ mm}$ or $63 \times 2 \text{ mm}$	$l_2 \geq 12 \text{ mm}$
	$d_3 \leq 1.85 \cdot d_1$ All other types of recirculating roller screws	$l_2 \geq 14 \text{ mm}$
All types of roller screws	$d_3 > 1.85 \cdot d_1$	Please contact your local Schaeffler representative.

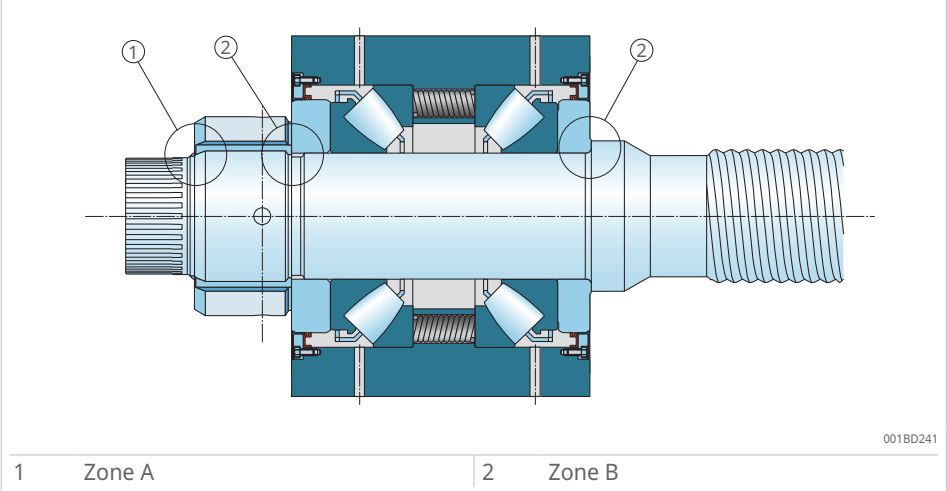
Designing the screw shaft ends

Customers designing their screw shaft ends are responsible for checking their strength against static and dynamic operating conditions.

The simple approach considers the shaft end diameters. Stress concentration factors must be used.

Zone A must be checked for strength against torsion and zone B must be checked for strength against torsion and tension.

13 Shaft end with support bearing



Important:

Application loads reaching the basic load rating C_a generate very high mechanical stresses on the shaft ends. Schaeffler strongly recommends that shaft ends be calculated with extreme care for such applications.

Zone A: Torsion only

The nominal shear stress τ caused by the input torque T is given by:

f3 Nominal shear stress τ

$$\tau = \frac{16000 \cdot T}{\pi \cdot d_5^3}$$

d_5	mm	Diameter of shaft end
T	Nm	input torque in a steady state
τ	N/mm ²	Nominal shear stress

This value is increased by a stress concentration factor f_4 to give the real shear stress τ_p :

f4 Real shear stress τ_p

$$\tau_p = f_4 \cdot \tau$$

f_4	–	Stress concentration factor, taken from established technical literature
τ	N/mm ²	Nominal shear stress
τ_p	N/mm ²	Effective shear stress

According to von Mises, the total stress σ_t :

f15 Equivalent stress under torsion

$$\sigma_t = 1.73 \cdot \tau_p$$

τ_p	N/mm ²	Effective shear stress
σ_t	N/mm ²	Equivalent stress under torsion

For safety, σ_t should be less than 67 % of the yield strength.

If the end diameter d_5 includes a keyway of depth e , calculate using $(d_5 - e)$ instead of d_5 .

The angle of twist of the screw shaft is given by:

f16 Screw shaft torsion angle θ

$$\theta = \frac{7.48 \cdot T \cdot l}{d_0^4}$$

d_0	mm	nominal diameter of screw shaft
l	mm	length between motor and nut
T	Nm	input torque in a steady state
θ	°	screw shaft torsion angle

The linear positioning error, δ , caused by this twist is:

f17 Positioning error δ

$$\delta = \frac{P_h \cdot \theta}{360}$$

P_h	mm	lead
δ	mm	Positioning error
θ	°	screw shaft torsion angle

Note:

Stress concentration factors f_4 and f_5 are available in all general mechanical literature.

Zone B: Axial + torsional stresses

The nominal axial stress caused by the axial load F is given by:

f18 Nominal axial stress σ

$$\sigma = \frac{4 \cdot F}{\pi \cdot d_4^2}$$

d_4	mm	Thread diameter a
F	N	Axial load
σ	N/mm ²	Nominal axial stress

This value is increased by a stress concentration factor f_5 to give the real principal stress σ_p :

f19 Real principle stress σ_p

$$\sigma_p = f_5 \cdot \sigma$$

σ_p	N/mm ²	Real axial stress
f_5	–	Stress concentration factor 5 taken from established technical literature
σ	N/mm ²	Nominal axial stress

As for zone A calculation:

f110 Real shear stress τ_p

$$\tau_p = f_4 \cdot \tau$$

f_4	–	Stress concentration factor, taken from established technical literature
τ	N/mm ²	Nominal shear stress
τ_p	N/mm ²	Effective shear stress

According to von Mises, the total stress σ_t :

f111 Equivalent stress under axial tensile, compressive, and torsional stress $\sigma(\tau)$

$$\sigma_\tau = \sqrt{\sigma_p^2 + 3 \cdot \tau_p^2}$$

σ_p	N/mm ²	Real axial stress
τ_p	N/mm ²	Effective shear stress
σ_τ	N/mm ²	Equivalent stress under axial tensile, compressive, and torsional stress

For safety, σ_τ should be less than 67 % of the yield strength.

2.1.18 Product inspection and certification

Standard or special inspection reports or certificates can be provided on request. The following reports can be supplied with roller screws:

1. Conformity with customer specifications (fl. DIN EN 10204)
2. Conformity with document specifications (fl. DIN EN 10204)
3. List of manufacturing and control operations
4. Preload torque curve or internal friction torque curve
5. Lead precision curve
6. Matching of travel deviation
7. Stiffness curve
8. Raw material chemical analysis
9. Magnetic particle inspection
10. Through hardening heat treatment
11. Induction hardening
12. Carburizing hardening
13. Surface treatment
14. Report for specific dimensions
15. FAIR (First Article Inspection Report) DIN EN 9102

2.1.19 Working environment

As a stand-alone component, the roller screws cannot be ATEX certified.

Use of roller screws for an application in a potentially explosive environment shall be related to a technical file deposit according to european directives relative to ATEX.

2.1.20 Calculation formulae

Basic life rating

f12 Basic life rating L_{10}

$$L_{10} = \left(\frac{C_a}{F_m} \right)^3$$

C_a	N	Basic dynamic load rating, axial
F_m	N	cubic mean load
L_{10}	10^6 revolutions	basic life rating

Required load rating

f13 Required load rating C_{req}

$$C_{req} = F_m \cdot (L_{10})^{1/3}$$

C_{req}	N	required dynamic load rating
F_m	N	cubic mean load
L_{10}	10^6 revolutions	basic life rating

Equivalent mean load

Duty cycle with step loading

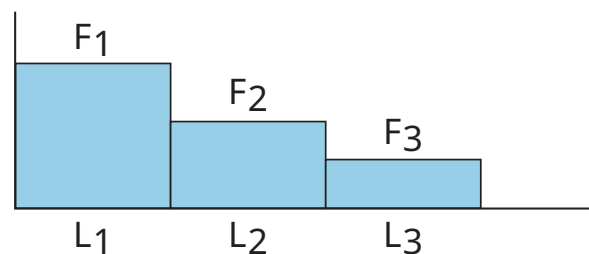
f14 Equivalent dynamic load F_m under constant load

$$F_m = \left(\frac{\sum F_i^3 \cdot l_i}{\sum l_i} \right)^{1/3}$$

F_i	N	load during stroke i
F_m	N	Equivalent dynamic load
l_i	mm	Travel distance under load F_i

F_i can be either a fixed value, or a calculation for continuous load varying cycles.

14 Equivalent mean load with step loading



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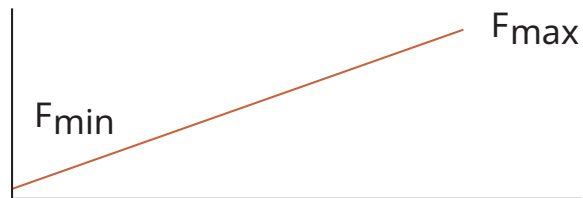
Duty cycle with continuous load variation

15 Duty cycle F_m with continuous load variation

$$F_m = \frac{F_{\min} + 2F_{\max}}{3}$$

F_m	N	cubic mean load
$F_{\max}$	N	maximum load
$F_{\min}$	N	minimum load

15 Equivalent mean load with continuous load variation



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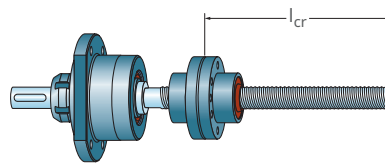
Critical speed of screw shaft (no safety factor)

16 Critical speed of screw shaft n_{cr} without safety factor

$$n_{cr} = 49 \cdot 10^6 \cdot \frac{f_1 \cdot d_2}{l^2}$$

n_{cr}	min^{-1}	critical speed
d_2	mm	root diameter
l	mm	free length
f_1	-	mounting correction factor 0.9 fixed, free 2.5 radial support, radial support 3.8 fixed, radial support 5.6 fixed, fixed

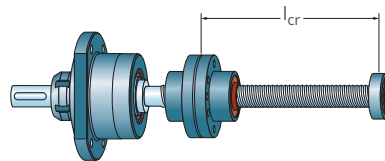
16 Critical speed, mounting factor $f_1 = 0.9$



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l_{cr} Distance between nut center and unsupported shaft end

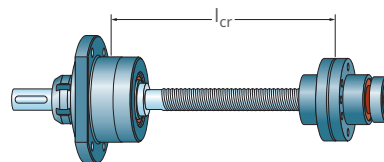
17 Critical speed, mounting factor $f_1 = 2.5$



001BD271

l_{cr} Center distance between nut and support bearings

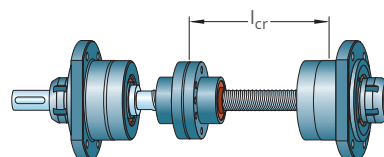
18 Critical speed, mounting factor $f_1 = 3.8$



001BD272

l_{cr} Center distance between nut and locating support bearing

19 Critical speed, mounting factor $f_1 = 5.6$



001BD275

l_{cr} Center distance between nut and locating support bearing (longest distance)

Notes:

- For each particular application, the most unfavorable conditions must be considered.
- It is generally recommended to apply a safety factor of 0.8 to the calculated value of the critical speed n_{cr} of the screw shaft.

Speed limit of the mechanism (maximal speed applied through very short periods)

$n_{d0} \leq 160000$ for all types of planetary roller screws

$n_{d1} \leq 30000$ for SV, BV, PV with $d_1 \leq 25$ mm

$n_{d1} \leq 20000$ for SV, BV, PV with $d_1 > 25$ mm

Maximum permissible acceleration: 12000 rad/s² for all types of planetary roller screws 4000 rad/s² for all types of recirculating roller screws

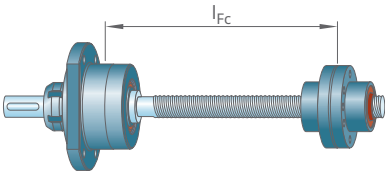
Buckling strength with safety factor 3

17 Threaded shaft buckling strength F_c

$$F_c = \frac{34 \cdot 10^3 \cdot f_3 \cdot d_2^4}{l_{Fc}^2}$$

d_2	mm	Threaded shaft root diameter
f_3	–	Coefficient for calculating the buckling strength of the threaded shaft 0.25 fixed bearing, free 2 fixed bearing and floating bearing, radial support 4 fixed bearing, fixed bearing
F_c	N	buckling strength
l_{Fc}	mm	Distance between the fixed bearing of the shaft and the outer position of the nut

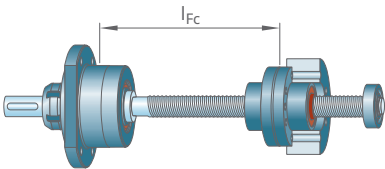
20 Buckling strength, mounting factor $f_3 = 0.25$



001BD279

l_{Fc} Distance between the fixed bearing of the shaft and the outer position of the nut

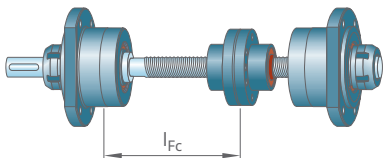
21 Buckling strength, mounting factor $f_3 = 2$



001BD27B

l_{Fc} Distance between the fixed bearing of the shaft and the outer position of the nut

22 Buckling strength, mounting factor $f_3 = 4$



001BD27C

l_{Fc} Distance between the fixed bearing of the shaft and the outer position of the nut

Helix angle

18 Helix angle α

$$\alpha = \arctan\left(\frac{P_h}{\pi \cdot d_0}\right)$$

d_0	mm	nominal diameter of screw shaft
P_h	mm	lead
α	°	Helix angle of the thread

Theoretical efficiencies

19 Direct theoretical efficiency η

$$\eta = \frac{1}{1 + \frac{\pi \cdot d_0}{P_h} \cdot \mu_{ref}}$$

d_0	mm	nominal diameter of screw shaft
P_h	mm	lead
μ_{ref}	–	reference friction coefficient
η	%	efficiency

μ_{ref} is extracted from the coefficient of friction diagram ►18 | 11.

Regarding value d:

- d_0 for SR planetary roller screws
- d_1 for SV recirculating roller screws
- D_0 for ISR inverted roller screws

f120 Indirect theoretical efficiency η'

$$\eta' = 2 - \frac{1}{\eta}$$

η	%	efficiency
η'	%	indirect efficiency

Practical efficiencies

f121 Practical direct efficiency η_p

$$\eta_p = \frac{1}{1 + \frac{\pi \cdot d_0}{P_h} \cdot \mu_{\text{prac}}}$$

d_0	mm	nominal diameter of screw shaft
P_h	mm	lead
μ_{prac}	–	practical coefficient of friction
η_p	%	practical efficiency

μ_{prac} is extracted from the coefficient of friction diagram.

Regarding value d:

- d_0 for SR planetary roller screws
- d_1 for SV recirculating roller screws
- D_0 for ISR inverted roller screws

f122 Indirect practical efficiency η'_p

$$\eta'_p = 2 - \frac{1}{\eta_p}$$

η_p	%	practical efficiency
η'_p	%	indirect practical efficiency

Input torque in a steady state

f123 Input torque in a steady state T

$$T = \frac{F \cdot P_h}{2000 \cdot \pi \cdot \eta_p}$$

F	N	maximum load of the cycle
P_h	mm	lead
T	Nm	Torque
η_p	%	practical efficiency

Power requirement in a steady state

fig 24 Power requirement P

$$P = \frac{F \cdot n \cdot P_h}{60000 \cdot \eta_p}$$

F	N	maximum load of the cycle
n	min ⁻¹	Revolutions per minute
P	W	Power consumption
P _h	mm	lead
η _p	%	practical efficiency

Preload torque

fig 25 Preload torque T_{pr}

$$T_{pr} = \frac{F_{pr} \cdot P_h}{1000 \cdot \pi} \cdot \left(\frac{1}{\eta_p} - 1 \right)$$

F _{pr}	N	preload force
P _h	mm	lead
T _{pr}	Nm	preload torque
η _p	%	practical efficiency

Braking torque (the restraining torque considered in a back-driving system)

fig 26 Braking torque T_b

$$T_b = \frac{F \cdot P_h \cdot \eta'}{2000 \cdot \pi}$$

F	N	Axial load
P _h	mm	lead
T _b	Nm	braking torque
η'	%	indirect efficiency

To consider the worst case conditions, we use the theoretical indirect efficiency.

Nominal motor torque during acceleration

For a horizontal screw:

f127 Nominal motor torque T_t during acceleration of horizontal roller screws

$$T_t = T_f + T_{pr} + \frac{P_h \cdot [F + m_L \cdot \mu_f \cdot g]}{2000 \cdot \pi \cdot \eta_p} + \dot{\omega} \cdot \Sigma I$$

For a vertical screw:

f128 Nominal motor torque T_t during acceleration of vertical roller screws

$$T_t = T_f + T_{pr} + \frac{P_h \cdot [F + m_L \cdot g]}{2000 \cdot \pi \cdot \eta_p} + \dot{\omega} \cdot \Sigma I$$

F	N	Axial load
g	m/s ²	acceleration of gravity $g = 9.81 \text{ m/s}^2$
m_L	kg	mass in movement
P_h	mm	lead
T_f	Nm	friction torque in support bearings, motor, seals, etc.
T_{pr}	Nm	preload torque
T_t	Nm	driving torque
ΣI	kg · m ²	$I_M + I_L + I_S \cdot l \cdot 10^{-9}$
I_M	kg · m ²	inertia of motor
I_S	kg · mm ² / m	inertia of screw shaft per meter
l	mm	length of screw shaft
μ_f	-	coefficient of friction of guide systems
η_p	%	practical efficiency
$\dot{\omega}$	rad/s ²	angular acceleration

f129 Equivalent inertia of the external load I_L

$$I_L = m_L \cdot \left(\frac{P_h}{2 \cdot \pi} \right)^2 \cdot 10^{-6}$$

I_L	kg · mm ²	inertia of load
m_L	kg	mass of the load
P_h	mm	lead

For a hollow shaft the actual inertia is calculated as follows:

f130 Actual inertia of the threaded shaft I_{Sa}

$$I_{Sa} = I_S \cdot l \cdot 10^{-9} \cdot \left(\frac{d_0^4 - d_b^4}{d_0^4} \right)$$

d_0	mm	nominal diameter of screw shaft
d_b	mm	bore diameter of the shaft
I_S	kg · mm ² /m	inertia of screw shaft per meter of shaft length
I_{Sa}	kg · mm ² /m	Actual inertia of the threaded shaft
l	mm	length of screw shaft

Nominal braking torque during deceleration

For a horizontal screw:

fig 31 Nominal braking torque T'_b during deceleration of horizontal roller screws

$$T'_b = \frac{P_h \cdot \eta' \cdot [F + m_L \cdot \mu_f \cdot g]}{2000 \cdot \pi} + \dot{\omega} \cdot \Sigma I - T_f - T_{pr}$$

For a vertical screw:

fig 32 Nominal braking torque T'_b during deceleration of vertical roller screws

$$T'_b = \frac{P_h \cdot \eta' \cdot [F + m_L \cdot g]}{2000 \cdot \pi} + \dot{\omega} \cdot \Sigma I - T_f - T_{pr}$$

F	N	Axial load
g	m/s ²	acceleration of gravity g = 9.81 m/s ²
m _L	kg	mass in movement
P _h	mm	lead
T _f	Nm	friction torque in support bearings, motor, seals, etc.
T _{pr}	Nm	preload torque
T' _b	Nm	braking torque during deceleration
ΣI	kg · m ²	I _M + I _L + I _S · l · 10 ⁻⁹
I _M	kg · m ²	inertia of motor
I _S	kg · mm ² / m	inertia of screw shaft per meter
l	mm	length of screw shaft
μ _f	-	coefficient of friction of guide systems
η'	%	indirect efficiency
ω̇	rad/s ²	angular acceleration

Static axial stiffness of a complete roller screw assembly

fig 33 Static axial stiffness of a complete roller screw assembly

$$\frac{1}{R_t} = \frac{1}{R_s} + \frac{1}{R_n} + \frac{1}{R_p}$$

R _t	N/μm	stiffness of a complete assembly
R _n	N/μm	nut stiffness
R _s	N/μm	shaft stiffness
R _p	N/μm	support bearing stiffness

Shaft stiffness

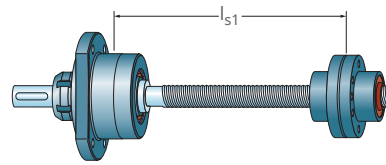
Fixed-free or fixed-radial support:

fig 34 Fixed bearing, floating bearing or fixed bearing, radial support R_s

$$R_s = 165 \cdot \frac{d_2^2}{l_{s1}}$$

d ₂	mm	Threaded shaft root diameter
l _{s1}	mm	distance between the centers of the fixed support bearing and nuts
R _s	N/μm	shaft stiffness

23 Configuration with fixed support and radial support for stiffness calculation



001BD27D

l_{s1} Distance between the centers of the fixed support bearing and nuts

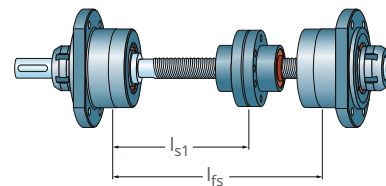
Fixed-fixed assembly:

f35 Fixed bearing, fixed bearing R_s

$$R_s = \frac{165 \cdot d_2^2 \cdot l_s}{l_{s1} \cdot (l_s - l_{s1})}$$

d_2	mm	Threaded shaft root diameter
l_s	mm	distance between centers of fixed support bearings
l_{s1}	mm	distance between the centers of the fixed support bearing and nuts
R_s	N/μm	shaft stiffness

24 Configuration with two fixed supports for stiffness calculation



001C5626

l_s Distance between the centers of the fixed support bearings l_{s1} Distance between the centers of the fixed support bearing and nuts

Note:

The lowest stiffness is reached when the nut is in central position.

f36 Distance between the center of the fixed support bearing and the center of the nut l_{s1}

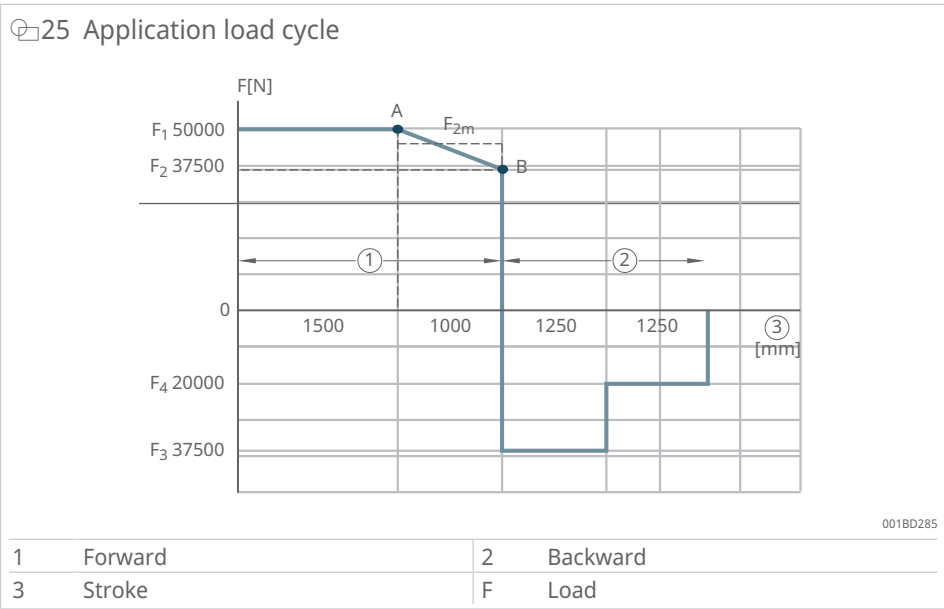
$$l_{s1} = \frac{l_s}{2} \rightarrow R_s = \frac{165 \cdot d_2^2}{l_s} \cdot 4$$

d_2	mm	Threaded shaft root diameter
l_s	mm	distance between centers of fixed support bearings
l_{s1}	mm	distance between the centers of the fixed support bearing and nuts
R_s	N/μm	shaft stiffness

For additional information, please contact your local Schaeffler representative.

2.1.21 Calculation example

- Customer wishes to select a planetary roller screw for his application
- To achieve the required linear speed of the application, customer has preselected a lead of 20 mm. Screw rotational speed is 600 min⁻¹ during the operation cycle
- Nut type should be flanged for assembly purposes
- Roller screw shaft is horizontally mounted, with one fixed end on the start position, and the other end on radial support



- Operation is
 - 1 cycle/min,
 - 7 h/day,
 - 260 days/year for 5 years minimum

Calculation of equivalent mean load F_m

$F_1 = 50000 \text{ N}$
on $L_1 = 1500 \text{ mm}$

f37 Equivalent dynamic load F_{2m} in phase 2

$$F_{2m} = \frac{2F_1 + F_2}{3} = 45833 \text{ N}$$

F_1	N	Load at the start of phase 2
F_2	N	Load at the end of phase 2
F_{2m}	N	Equivalent dynamic load in phase 2

on $L_2 = 1000 \text{ mm}$

$F_3 = 37500 \text{ N}$
on $L_3 = 1250 \text{ mm}$

$F_4 = 20500 \text{ N}$
on $L_3 = 1250 \text{ mm}$

f138 Equivalent dynamic load F_m

$$F_m = \sqrt[3]{\frac{50000^3 \cdot 1500 + 45833^3 \cdot 1000 + 37500^3 \cdot 1250 + 20000^3 \cdot 1250}{1500 + 1000 + 1250 + 1250}}$$

F_m	N	Equivalent dynamic load
-------	---	-------------------------

$$F_m = 41590 \text{ N}$$

Calculation of required dynamic carrying capacity $C_{a \text{ req}}$

With consideration to the operational cycle:

With the preselection of lead $P_h = 20 \text{ mm}$

Minimum $L_{10} = 60 \cdot 7 \cdot 260 \cdot 5 = 546000 \text{ cycles}$

f139 Rating life

$$L_{10} = 546000 \cdot \frac{1500 + 1000 + 1250 + 1250}{20}$$

L_{10}	10^6 revolutions	basic life rating
----------	--------------------	-------------------

$$L_{10} = 136.5 \cdot 10^6 \text{ revolutions}$$

$$C_{a \text{ req}} = F_m \cdot (L_{10})^{1/3} = 41590 \cdot (136.5)^{1/3} = 214141 \text{ N}$$

Looking at the product tables, we find that:

SRF 48×20R with $C_a = 265690 \text{ N}$ satisfies the requirement of minimum dynamic carrying capacity

Selection of support bearing

Our recommendation table indicates that support bearing size FLRBU7 is recommended for screw type SRF 48×20R ►142 | 4.6.4

In the following calculations, we will assume that the radial support at the other end of the screw shaft has a total width of 50 mm.

Efficiencies

Theoretical direct efficiency

f140 Helix angle

$$\alpha = \arctan\left(\frac{P_h}{\pi \cdot d_0}\right) = 7.55^\circ$$

d_0	mm	nominal diameter of screw shaft
P_h	mm	lead
α	°	Helix angle of the thread

Taken from the coefficient of friction reference diagram where ►16 | 9:

$$\mu_{\text{ref}} = 0.016$$

$$\mu_{\text{prac}} = 0.021$$

f41 Theoretical direct efficiency

$$\eta = \frac{1}{1 + \frac{\pi \cdot d_0}{P_h} \cdot \mu_{\text{ref}}} = 0.892$$

d_0	mm	nominal diameter of screw shaft
P_h	mm	lead
μ_{ref}	–	reference friction coefficient
η	%	efficiency

Theoretical indirect efficiency

f42 Theoretical indirect efficiency

$$\eta' = 2 - \frac{1}{\eta} = 0.879$$

η	%	efficiency
η'	%	indirect efficiency

Practical direct efficiency

We consider the practical coefficient of friction $\mu_{\text{prac}} = 0.021$

f43 Practical direct efficiency

$$\eta_p = \frac{1}{1 + \frac{\pi \cdot d_0}{P_h} \cdot \mu_{\text{prac}}} = 0.863$$

d_0	mm	nominal diameter of screw shaft
P_h	mm	lead
μ_{prac}	–	practical coefficient of friction
η_p	%	practical efficiency

Input torque in a steady state

Phase 1 has the highest application load $F_{\text{max}} = 50000 \text{ N}$

f44 Driving torque

$$T = \frac{F \cdot P_h}{2000 \cdot \pi \cdot \eta_p} = \frac{50000 \cdot 20}{2000 \cdot \pi \cdot 0.863} = 184.4 \text{ Nm}$$

F	N	Axial load
T	Nm	input torque in a steady state
P_h	mm	lead
η_p	%	practical efficiency

Power requirement in a steady state

Phase 1 has the highest application load $F_{\max} = 50000 \text{ N}$

Rotational speed is 600 min^{-1}

f45 Power consumption

$$P = \frac{50000 \cdot 600 \cdot 20}{60000 \cdot 0.862} = 11600 \text{ W}$$

P	W	required power
---	---	----------------

Braking torque

Phase 1 has the highest application load $F_{\max} = 50000 \text{ N}$

f46 Braking torque

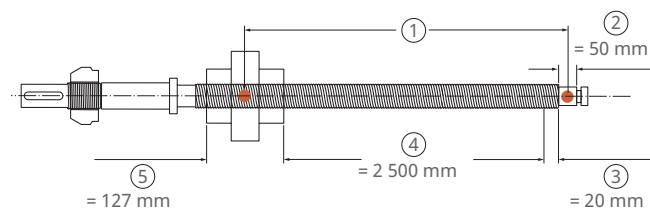
$$T_b = \frac{50000 \cdot 20 \cdot 0.879}{2000 \cdot \pi} = 139.9 \text{ N}$$

T_b	Nm	braking torque
-------	----	----------------

Critical speed of screw shaft

For the critical speed evaluation, we have to consider the most critical configurations for the screw, where we encounter the longest shaft free length. In the present case study, the two most critical configurations are:

26 Free length in case (A)



001BD289

1	Free length	2	Supported length
3	Stroke reserve	4	Stroke length
5	Nut length		

$$\text{Free length} = 127/2 + 2500 + 20 + 50/2 = 2608.50 \text{ mm}$$

A) Nut at start position (zero stroke) that gives a free length of 2608.5 mm between the center of the nut and the center of the radial support at the end of the shaft.

In this configuration, the mounting conditions are supported/supported with a corresponding factor $f_1 = 2.5$

The root diameter $d_2 = 45.5 \text{ mm}$, the calculated critical speed is:

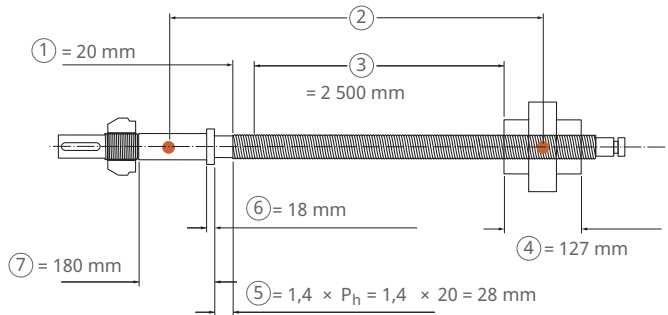
f147 Critical speed of the shaft

$$n_{cr} = 49 \cdot 10^6 \cdot \frac{2.5 \cdot 45.5}{2608.5^2} = 819 \text{ min}^{-1}$$

n_{cr}	min^{-1}	critical speed
----------	-------------------	----------------

By applying a safety factor of 0.8:
 $n_{cr} \cdot 0.8 = 819 \cdot 0.8 = 655 \text{ min}^{-1} > 600 \text{ min}^{-1}$
OK.

27 Free length in case (B)



001BD28A

1	Stroke reserve	2	Free length
3	Stroke length	4	Nut length
5	Free stroke	6	Shoulder
7	Supported length		

$$\text{Free length} = \frac{127}{2} + 2500 + 20 + 28 + 18 + \frac{180}{2} = 2719.50 \text{ mm}$$

B) Nut at full stroke of 2500 mm that gives a free length of 2719.5 mm between the center of the nut and the center of the fixed support bearing.

In this configuration, the mounting conditions are fixed/supported with corresponding factor $f_1 = 3.8$.

The calculation is:

f148 Critical speed of the shaft

$$n_{cr} = 49 \cdot 10^6 \cdot \frac{3.8 \cdot 45.5}{2719.5^2} = 1146 \text{ min}^{-1}$$

n_{cr}	min^{-1}	critical speed
----------	-------------------	----------------

$n_{cr} \cdot 0.8 = 1146 \cdot 0.8 = 917 \text{ min}^{-1} > 600 \text{ min}^{-1}$
OK

Speed limit

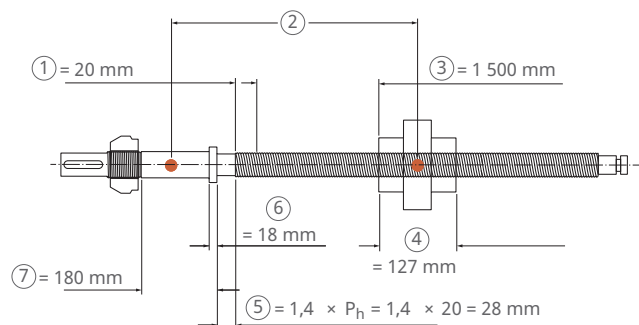
$$n \cdot d_0 = 600 \cdot 48 = 28000 < 160000$$

OK

Buckling strength with safety factor = 3

We must consider two critical situations for calculating the buckling strength.

28 Buckling length in case (A)



001BD28C

1	Stroke reserve	2	Buckling length
3	Stroke length	4	Nut length
5	Free stroke	6	Shoulder
7	Supported length		

$$\text{Buckling length} = \frac{127}{2} + 1500 + 20 + 28 + 18 + \frac{180}{2} = 1719.50$$

Point (A) with maximum application load at end of phase 1 (travel = 1500 mm).

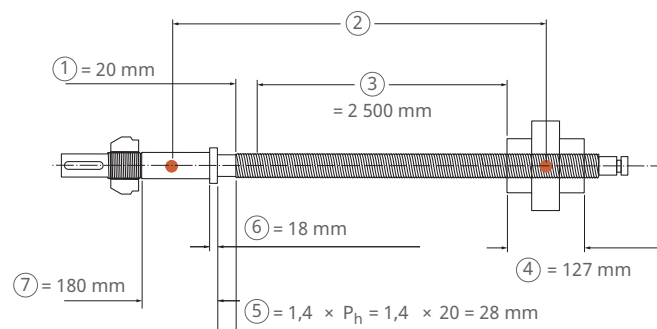
In this configuration, the mounting conditions are fixed/supported with corresponding factor $f_3 = 2$.

f49 Buckling strength with max. application load

$$F_{cr} = \frac{34 \cdot 10^3 \cdot 2 \cdot 45.5^4}{1719.5^2} = 98571 \text{ N} > F_1 = 50000 \text{ N}$$

F_1	N	Load at the start of phase 2
F_{cr}	N	Buckling strength

29 Buckling length in case (B)



001BD28E

1	Stroke reserve	2	Buckling length
3	Stroke length	4	Nut length
5	Free stroke	6	Shoulder
7	Supported length		

$$\text{Buckling length} = \frac{127}{2} + 2500 + 20 + 28 + 18 + \frac{180}{2} = 2719.50$$

Point (B) with lower application load and longer total travel of 2500 mm at end of phase 2.

§50 Buckling strength with lower application load and longer total travel

$$F_{cr} = \frac{34 \cdot 10^3 \cdot 2 \cdot 45.5^4}{2719.5^2} = 39407 \text{ N} > F_2 = 37500 \text{ N}$$

F_2	N	Load at the end of phase 2
F_{cr}	N	Buckling strength

Same case with customer selecting a preloaded roller screw

Should the customer prefer a preloaded roller screw for the application in order to have a stiffer assembly, then the initial selection would be:

PRK 60×20R with $C_a = 217610 \text{ N}$

Now check this screw against all dimensioning parameters.

Efficiencies

Theoretical direct efficiency

§51 Helix angle

$$\alpha = \arctan\left(\frac{P_h}{\pi \cdot d_0}\right) = 6.05^\circ$$

d_0	mm	nominal diameter of screw shaft
P_h	mm	lead
α	°	Helix angle of the thread

Taken from the coefficient of friction reference diagram where ►16 | 9:

$\mu_{ref} = 0.013$

$\mu_{prac} = 0.017$

§52 Theoretical direct efficiency

$$\eta = \frac{1}{1 + \frac{\pi \cdot d_0 \cdot \mu_{ref}}{P_h}} = 0.891$$

d_0	mm	nominal diameter of screw shaft
P_h	mm	lead
μ_{ref}	-	reference friction coefficient
η	%	efficiency

Theoretical indirect efficiency

§53 Theoretical indirect efficiency

$$\eta' = 2 - \frac{1}{\eta} = 0.877$$

η	%	efficiency
η'	%	indirect efficiency

Practical direct efficiency

We consider the practical coefficient of friction $\mu_{\text{prac}} = 0.017$

f154 Practical direct efficiency

$$\eta_p = \frac{1}{1 + \frac{\pi \cdot d_0 \cdot \mu_{\text{prac}}}{P_h}} = 0.862$$

d_0	mm	nominal diameter of screw shaft
P_h	mm	lead
μ_{prac}	–	practical coefficient of friction
η_p	%	practical efficiency

Input torque in a steady state

Phase 1 has the highest application load $F_{\text{max}} = 50000 \text{ N}$

f155 Driving torque

$$T = \frac{50000 \cdot 20}{2000 \cdot \pi \cdot 0.862} = 184.6 \text{ Nm}$$

T	Nm	input torque in a steady state
---	----	--------------------------------

Power requirement in a steady state

Phase 1 has the highest application load $F_{\text{max}} = 50000 \text{ N}$

Rotational speed is 600 min^{-1}

f156 Power consumption

$$P = \frac{50000 \cdot 600 \cdot 20}{60000 \cdot 0.863} = 11587 \text{ W}$$

P	W	required power
---	---	----------------

Braking torque

Phase 1 has the highest application load $F_{\text{max}} = 50000 \text{ N}$

f157 Braking torque

$$T_b = \frac{F \cdot P_h \cdot \eta'}{2000 \cdot \pi} = \frac{50000 \cdot 20 \cdot 0.877}{2000 \cdot \pi} = 139.6 \text{ Nm}$$

T_b	Nm	braking torque
F	N	Axial load
P_h	mm	lead
η'	%	indirect efficiency

Critical speed of screw shaft

Screw type PRK 60×20R has a larger nominal diameter and a larger root diameter than screw type SRF 48×20R that was already calculated. Therefore, the critical speed will not be a problem for screw size PRK 60×20R.

Axial stiffness

In the product table we find that nominal preload $F_{pr} = 2326 \text{ N}$

First, we confirm that the internal preload is appropriate for the application ►45 | 2.2.2:

- Minimum application load in phase 4: $F_4 = 20000 \text{ N}$
- F_4 is greater than $2.83 \cdot 2326 \text{ N} = 6583 \text{ N}$

This is to make sure that the nut half that does not carry the load is completely unloaded and does not face marginal loading with risk of sliding. Nominal preload $F_{pr} = 2326 \text{ N}$ is OK for the application.

Under this nominal preload conditions ($F_{pr} = 2326 \text{ N}$), the minimum nominal stiffness of the nut is $R_{ng} = 700 \text{ N}/\mu\text{m}$.

Total axial stiffness of the roller screw is:

§158 Total axial stiffness

$$\frac{1}{R_t} = \frac{1}{R_s} + \frac{1}{R_{ng}}$$

R_t	$\text{N}/\mu\text{m}$	stiffness of a complete assembly
R_{ng}	$\text{N}/\mu\text{m}$	min. nominal stiffness of the nut
R_s	$\text{N}/\mu\text{m}$	shaft stiffness

At point (B), full stroke:

With $d_2 = 57.5 \text{ mm}$ for roller screw size PRK 60×20R

§159 Shaft stiffness

$$R_s = 165 \cdot \frac{57.2^2}{2719.5} = 201 \text{ N}/\mu\text{m}$$

R_s	$\text{N}/\mu\text{m}$	shaft stiffness
-------	------------------------	-----------------

$1/R_t = 1/201 + 1/700$ $R_t = 156 \text{ N}/\mu\text{m}$ at full stroke

If we include the axial stiffness of the fixed support bearing FLRBU7, we calculate the total system stiffness:

$R_p = 1250 \text{ N}/\mu\text{m}$

§160 Axial stiffness of the entire system

$$\frac{1}{R_t} = \frac{1}{R_s} + \frac{1}{R_{ng}} + \frac{1}{R_p} = \frac{1}{201} + \frac{1}{700} + \frac{1}{1250}$$

d_0	mm	nominal diameter of screw shaft
R_{ng}	$\text{N}/\mu\text{m}$	min. nominal stiffness of the nut
R_p	$\text{N}/\mu\text{m}$	support bearing stiffness
R_t	$\text{N}/\mu\text{m}$	stiffness of a complete assembly

$R_t = 139 \text{ N}/\mu\text{m}$ at full stroke

2.2 Axial play and preload

2.2.1 Axial play and preload

Standard roller screws are manufactured with axial play which varies between 0.02 mm and a maximum of 0.1 mm, depending on product size.

Roller screws can be manufactured without backlash or with preload.

13 Prefix Internal nut design

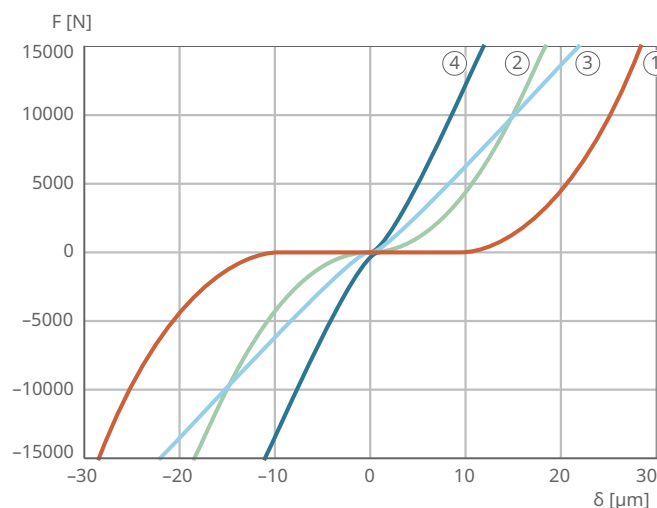
Nut type	
Prefix	Internal nut design
SR	Planetary roller screw with axial play
BR	Planetary roller screw without backlash
PR	Planetary roller screw with preloaded split nut
PRM	Planetary roller screw with preloaded double nut
SV	Recirculating roller screw with axial play
BV	Recirculating roller screw without backlash
PV	Recirculating roller screw with preloaded split nut
PVM	Recirculating roller screw with preloaded double nut

For optimum stiffness and positioning accuracy during reversal of loading direction, or during operation with low external load, internally preloaded nuts are recommended. Under these conditions, preloaded nuts exhibit a much lower axial deflection and much higher stiffness than non-preloaded nuts.

All preloaded roller screws (PR and PV types) are run in before delivery to the customer. This process stabilizes preload and stiffness and virtually eliminates backlash over the service life of the screw.

2.2.2 Preload and stiffness

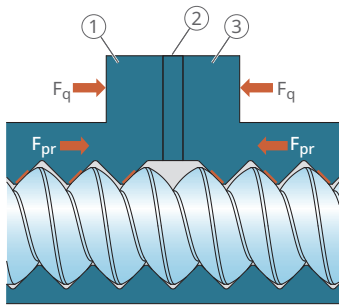
30 Load/deflection curve for different nut types



001BD243

F	Load	δ	Deflection
1	Single nut with axial play	2	Single nut without backlash
3	Preloaded split nut	4	Preloaded double nut

31 Preload in a split nut without external load

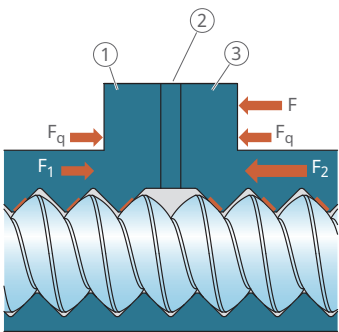


001BD246

1	Nut half 1	2	Calibrated spacer
3	Nut half 2	F_q	Squeeze load applied to two nut halves via housing or mounting screws
F_{pr}	Internal preload force generated by the squeeze load		

The effect of the internal preload in a split nut is shown in figure "Preload in a split nut without external load". A squeeze load F_q is applied to the two halves of a split nut. With a precisely ground and calibrated spacer, this squeeze load F_q generates the internal preload force F_{pr} .

32 Preloaded split nut with external force

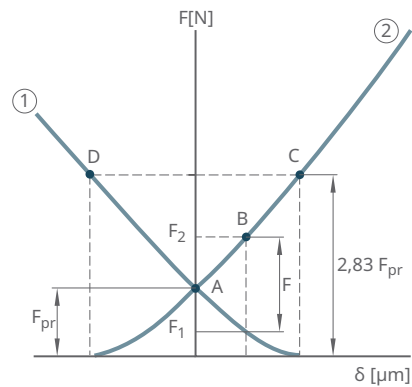


001BD248

1	Nut half 1	2	Calibrated spacer
3	Nut half 2	F_q	Squeeze load applied to two nut halves via housing or mounting screws
F	External load	F_1	Resulting preload force on nut half 1
F_2	Resulting preload force on nut half 2		

The application of an external load F on a preloaded split nut results in different F_1 and F_2 values.

33 Concept of preloaded nut



001BD249

F	Load	δ	Deflection
1	Nut half 1	2	Nut half 2
F_{pr}	Squeeze load between two nut halves per half, between nut half and shaft	F_1	Resulting preload force on nut half 1
F_2	Resulting preload force on nut half 2		

The relative load distribution on the two halves of the preloaded split nut can be described by the figure "Concept of preloaded nut":

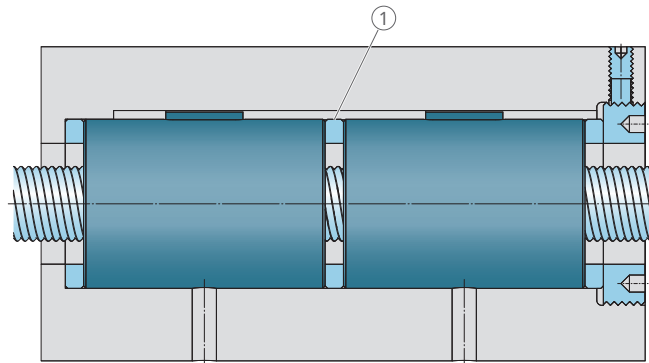
- At point A: without external load F , the two nut halves are in equilibrium under preload F_{pr}
- At point B: with external load F applied to nut half 2, the axial force taken by nut half #2 increases to value F_2 , and the preload of nut half 1 is reduced to value F_1 . For all situations where $F \leq 2.83 F_{pr}$, the load seen by nut half 2 is greater than the external load. Therefore, increasing the preload would reduce the life of the screw
- At point C, where external load $F = 2.83 F_{pr}$, the axial load taken by nut half 2 is equal to F . At this point, nut half 1 becomes unloaded
- At point D, with $F = 2.83 F_{pr}$ applied to nut half #1, nut half 2 becomes unloaded.

For a given system, the level of the preload force F_{pr} corresponds to a few percentage points of its dynamic load carrying capacity C_a .

With a preloaded split nut design, the external load is taken by one of the two nut halves for a given external load direction. Under high loads, the load carrying capacity and maximum stiffness level of a preloaded split nut are substantially lower than for a one-piece nut. Under low load conditions, a preloaded split nut eliminates backlash and increases the degree of stiffness.

Because of the very high load capacity and stiffness of roller screws, a split nut usually offers sufficient capacity for most applications and offers an extremely compact design.

34 Double nut with preload



001BD24C

1 Calibrated spacer

In exceptional cases where the load rating of a preloaded split nut is not sufficient, two single nuts may be preloaded together. Exact dimensions are available on request by contacting Schaeffler.

2.2.3 Preload torque T_{pr}

Preload torque T_{pr} is the friction torque resulting from the sole preload force F_{pr} , and is calculated considering the practical efficiency of the selected screw ➤ 27 | 2.1.20.

2.2.4 Preload torque tolerances

For preloaded roller screws, an optimum preload torque T_{pr} has been calculated and is provided in the product tables.

These values correspond to a compromise between the stiffness level and the preload force applied. A higher preload torque would penalize the driving torque, potentially decrease the product life and could generate additional heat, whereas a lower preload torque would decrease the level of stiffness. For specific cases where a different preload torque is required, please contact your local Schaeffler representative.

The variation tolerance of preload torque along a screw shaft depends on:

- The helix angle of the screw thread
- The slenderness of the screw shaft (i.e. the ratio l_1/d_0 of threaded length over nominal diameter)
- The lead precision
- The preload torque range

14 Tolerance of preload torque for screws with $\alpha < 11^\circ$

T _{pr}		G1	G3	G5	G1	G3	G5
over	incl.	l ₁ /d ₀ ≤ 40 and l ₁ ≤ 4000			40 < l ₁ /d ₀ ≤ 60 and l ₁ ≤ 4000		
Nm		± %					
0	0.2	35	40	50	40	50	60
0.2	0.6	25	30	35	30	35	40
0.6	1.0	20	25	30	25	30	35
1.0	2.5	15	20	25	20	25	30
2.5	6.3	10	15	20	15	20	25
6.3	10.0	10	10	15	15	15	20

d_0 mm nominal diameter of screw shaft

l_1 mm Threaded shaft thread length

T_{pr} Nm preload torque

15 Tolerance of preload torque for screws with $\alpha \geq 11^\circ$

T_{pr}		G3	G5	G3	G5
over	incl.	$l_1 \leq 2000$		$2000 < l_1 \leq 4000$	
Nm		$\pm \%$			
0	10.0	70	80	80	90

l_1 mm Threaded shaft thread length

T_{pr} Nm preload torque

Planetary roller screws preloaded for optimum stiffness with $\alpha \geq 11^\circ$ are not available with G1 lead precision

The tables give the tolerances for preload torque variation, with screw thread helix angle less than 11° , and greater than 11° respectively.

Preload torque is measured at 50 min^{-1} with ISO VG 68 oil grade for BR and PR screw types and with ISO VG 220 oil grade for BV and PV screw types.

Note:

The helix angle α can be calculated using formulae ►27 | 2.1.20.

Example:

Screw PRU 39×5R 433/780 G3 WPR has been selected.

According to the information in the product tables, the preload torque is $T_{pr} = 1.3 \text{ Nm}$. What is the tolerance of preload torque for G3 lead precision?

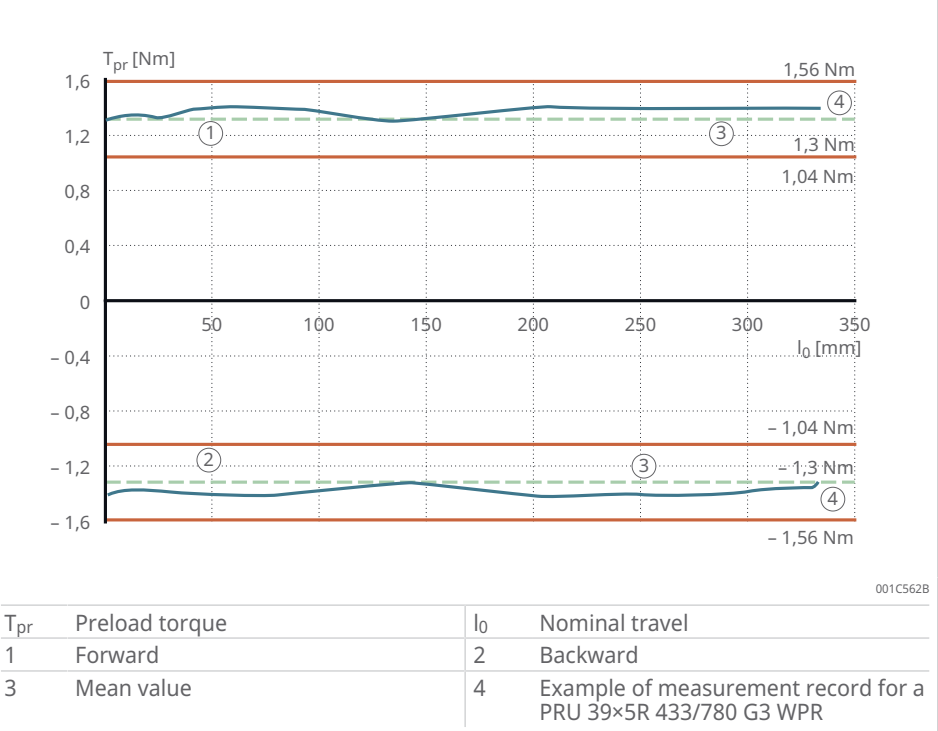
The helix angle is 2.34° and the threaded length is 433 mm ($l_1/d_0 = 11.1 < 40$).

A tolerance of $\pm 20 \%$ is given ►49 | 14.

All screws will exhibit a friction torque of $1.3 \text{ Nm} \pm 20 \%$ or 1.04 Nm to 1.56 Nm.

The corresponding minimum nominal nut stiffness is $R_{ng} = 750 \text{ N}/\mu\text{m}$, and the nominal reference nut stiffness is $R_{nr} = 980 \text{ N}/\mu\text{m}$.

35 Preload torque measurement diagram



The diagram presents the calculated ranges and a typical torque variation measurement. Preload torque or internal friction torque certificates can be supplied on request.

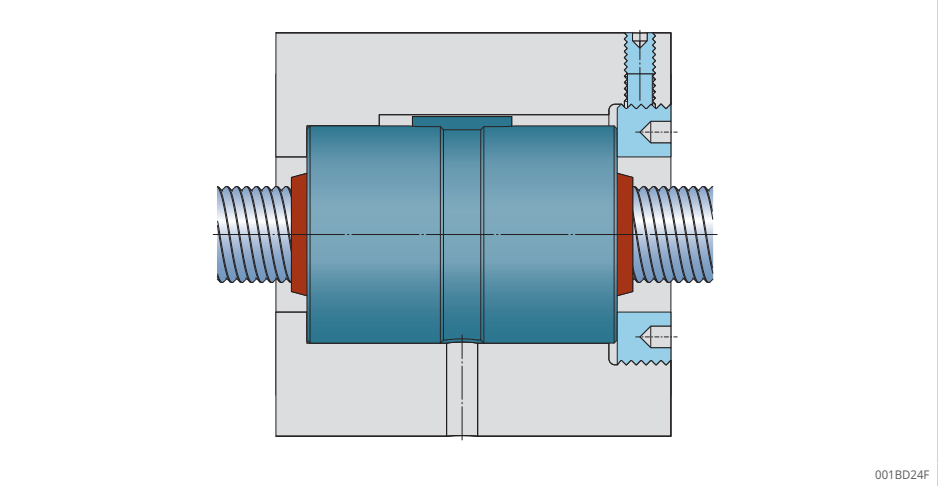
2.2.5 Preload adjustment

Cylindrical nuts

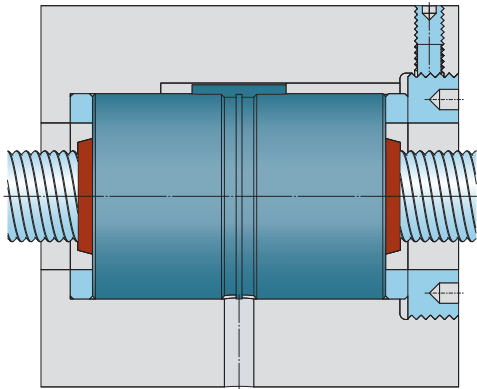
For cylindrical nuts with preload, the stoppers threaded into the housing must be tightened according to the torque values listed in table "SRC/BRC/PRU" for PRU planetary roller screws, and in table "SVC/BVC/PVU" for PVU recirculating roller screws.

Note that torque values in tables also apply to single piece nuts such as SRC/ BRC and SVC/BVC nut types respectively.

36 SRC/BRC



37 PRU

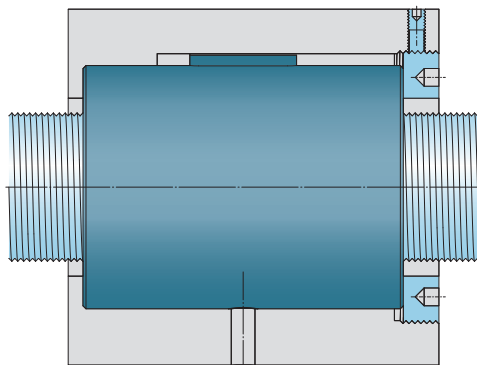


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16 SRC/BRC/PRU

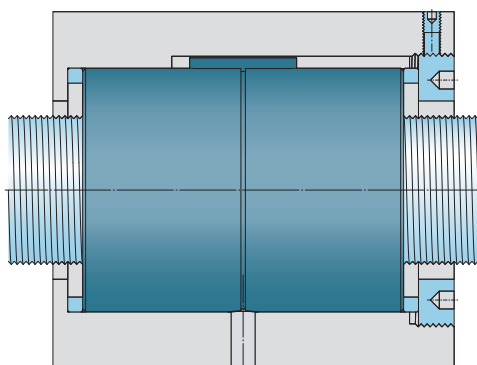
Nominal diameter	Housing stopper thread	Tightening torque	Squeeze load
d ₀		Nm	N
mm			
8	M30×1.0	20	2700
12	M35×1.0	35	4100
15	M40×1.0	45	4600
21	M50×1.0	65	5500
25	M60×1.0	80	5500
30	M70×1.5	100	5900
39	M90×1.5	140	6400
44	M88×1.5	160	7600
48	M110×1.5	180	6800
60	M130×2.0	230	7400
64	M125×2.0	250	8300
75	M158×2.0	310	8200
80	M148×2.0	340	9600
99	M215×2.5	440	8500
120	M230×2.5	550	9950
150	M340×2.5	730	8950

38 SVC/BVC



001BD252

39 PVU



001BD257

17 SVC/BVC/PVU

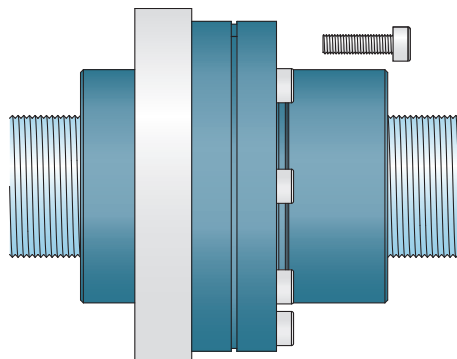
Nominal diameter d_1 mm	Housing stopper thread	Tightening torque Nm	Squeeze load N
8	M25×1.0	20	3250
10	M27×1.0	27	4000
12	M30×1.0	35	4800
16	M35×1.0	48	5600
20	M40×1.0	62	6400
25	M47×1.0	82	7200
32	M60×1.0	110	7600
40	M75×1.5	145	8000
50	M87×1.5	300	9000
63	M108×2.0	300	9600
80	M146×2.0	335	9500
100	M185×2.5	440	9900
125	M230×2.5	580	10000

Standard nuts are made of bearing steel hardened to 58 HRC to 62 HRC. Under certain load conditions, it is necessary to use hardened and ground spacers to avoid imbedding the nut side face into the housing shoulder and into the stopper clamping area. This precautionary measure will diminish the risk that preload and stiffness are reduced.

Flanged nuts

For flanged nuts with preload, the fixing bolts must be tightened according to the torque values listed in table "PRK/PVK" for PRK planetary roller screws and PVK recirculating roller screws.

40 PRK/PVK



001BD258

18 PRK/PVK

Nominal diameter	Number of screws	Screw size	Tightening torque
d_0			Nm
mm			
8	6	M4	3
10	6	M4	3
12	6	M4	3
15	6	M5	6
16	6	M4	3
20	6	M5	6
21	6	M5	6
25 (PRK)	6	M6	10
25 (PVK)	6	M5	6
30	6	M8	25
32	6	M6	10
36	6	M8	25
39	6	M10	50
40	6	M8	25
44	6	M10	50
48	6	M12	80
50	6	M10	50
56	6	M12	80
60	6	M16	200
63	6	M12	80
64	6	M16	200
80	8	M16	200
100	12	M16	200
125	12	M18	270

2.3 Lead precision and manufacturing tolerances

2.3.1 Lead precision

19 Maximum permitted travel variation over 300 mm

Lead precision grade	v_{300p} μm
G1	6
G3	12
G5	23

v_{300p} μm Permissible travel variation within 300 mm travel

20 Travel deviation and maximum permitted travel variation over the useful travel l_u

l_u over incl. mm		G1		G3		G5	
		e_p	v_{up}	e_p	v_{up}	e_p	v_{up}
		μm					
0	315	6	6	12	12	23	23
315	400	7	6	13	12	25	25
400	500	8	7	15	13	27	26
500	630	9	7	16	14	32	29
630	800	10	8	18	16	36	31
800	1000	11	9	21	17	40	34
1000	1250	13	10	24	19	47	39
1250	1600	15	11	29	22	55	44
1600	2000	18	13	35	25	65	51
2000	2500	22	15	41	29	78	59
2500	3150	26	17	50	34	96	69
3150	4000	21	21	62	41	115	82
4000	5000	–	–	76	49	140	99
5000	6300	–	–	–	–	170	119

e_p μm Tolerance on specified travel
 l_u mm Useful travel
 v_{up} μm Permissible travel variation within useful travel l_u

Generally speaking, the precision indicated defines the lead precision class that complies with ISO 3408-3, e. g. G1, G3 and G5.

Standard lead precision is G5. On request, Schaeffler can deliver roller screws with G3 or G1 lead precision.

A roller screw lead precision class is primarily defined by the maximum permitted travel variation v_{300p} over a threaded length of 300 mm ➤ 54 | 19.

21 Useful travel

Type of roller screw	Useful travel $l_u = \text{threaded length} - 2 \cdot l_e$
Planetary roller screw	$l_e = d_0$
Recirculating roller screw	$l_e = d_0$

l_e mm excess travel (no lead precision required)
 d_0 mm nominal diameter of screw shaft

For very short strokes or special travels, contact Schaeffler.

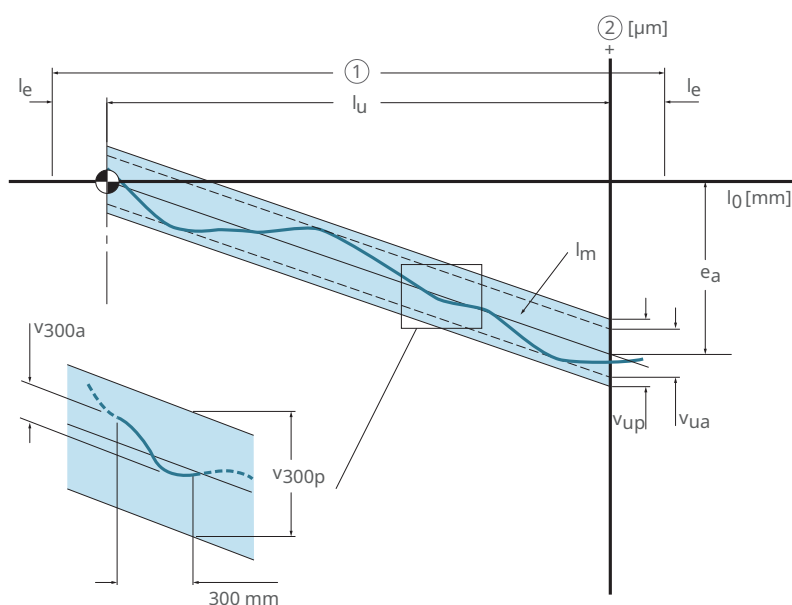
Lead precision characteristics are defined by the permitted lead error e_p , and the permitted travel variation v_{up} , measured at 20 °C over the useful stroke l_u .

Some customer applications require a travel compensation c to account for the effect of operating temperature on the lead precision: a temperature variation by 1 °C results in dimensional change of 11.5 $\mu\text{m}/\text{m}$ of screw shaft length. Consequently, if needed, a travel compensation c can be achieved.

- Standard case with $c = 0$, see "Definition of lead error measurement"
- Case with customer specific value of c , see "Case without travel compensation"

Lead precision graphs can be supplied on request.

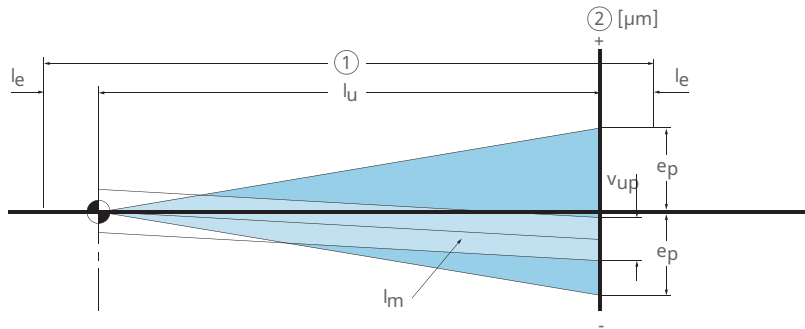
41 Definition of lead error measurement



001BD259

1	Threaded length	2	Lead error
l_e	Excess travel (no lead precision required)	l_u	Useful travel
v_{up}	Permissible travel variation within useful travel l_u	v_{ua}	Measured travel variation within useful travel l_u
e_a	Actual (measured) mean travel deviation over the specified travel	l_m	Actual mean travel (line which best fits the actual travel curve by method of least squares)
v_{300p}	Permissible travel variation within 300 mm travel	l_0	Nominal travel
v_{300a}	Measured travel variation over 300 mm		

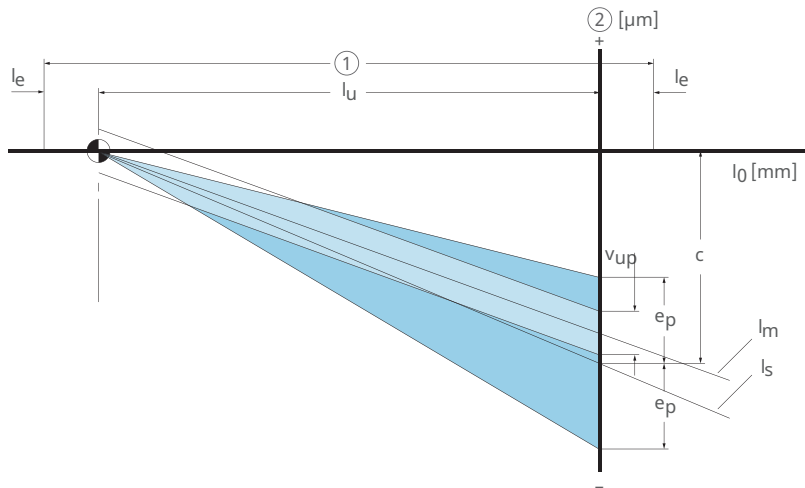
42 Case without travel compensation



001BD25D

1	Threaded length	2	Lead error
l_e	Excess travel (no lead precision required)	l_u	Useful travel
v_{up}	Maximum permitted travel variation over the useful travel l_u	l_m	Actual mean travel (line which best fits the actual travel curve by method of least squares)
e_p	Permitted mean travel deviation (lead error) over the specified travel		

43 Case with negative travel compensation



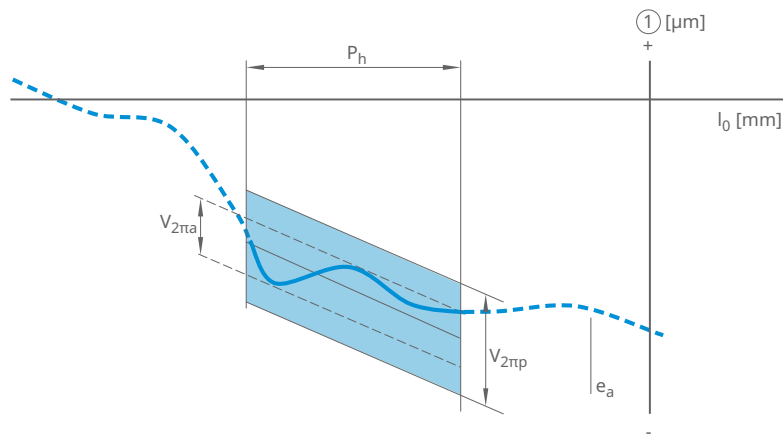
001BD260

1	Threaded length	2	Lead error
l_e	Excess travel (no lead precision required)	l_u	Useful travel
v_{up}	Maximum permitted travel variation over the useful travel l_u	c	Travel compensation (difference between l_s and l_0 to be defined by the customer)
e_p	Permitted mean travel deviation (lead error) over the specified travel	l_m	Actual mean travel (line which best fits the actual travel curve by method of least squares)
l_s	Specified travel	l_0	Nominal travel

Permissible travel variation $v_{2\pi p}$ within 2π rad (one revolution)

The maximum permissible travel variation $v_{2\pi p}$ over one revolution can be an important parameter for some very high precision applications.

44 Travel deviation within 2π rad



001BD263

1	Lead error	l_0	Nominal travel
$v_{2\pi a}$	Actual travel deviation within 2π rad	$v_{2\pi p}$	Max. permissible travel variation within 2π rad
e_a	Actual (measured) mean travel deviation over the specified travel	P_h	Lead

22 Maximum permitted travel variation within 2π rad

Lead precision grade	$v_{2\pi p}$ μm
G1	4
G3	6
G5	8

This lead precision parameter $v_{2\pi p}$ is explained in figure "Travel deviation within 2π rad". Values in accordance with ISO 3408-3 are provided in table "Maximum permitted travel variation within 2π rad".

On request, Schaeffler can measure and provide the actual travel variation $v_{2\pi a}$ over one revolution, for nominal screw diameters up to 40 mm and screw lengths up to 1000 mm.

Matching of travel deviation for screws working in parallel

When 2 or more screws are used together in parallel on one piece of equipment, it's often important to match their lead deviations.

23 Maximum mean travel deviation

Numbers of screws in a set	M μm
2	v_{up}
> 2	$1.5 \cdot v_{up}$

v_{up} μm Permissible travel variation within useful travel l_u

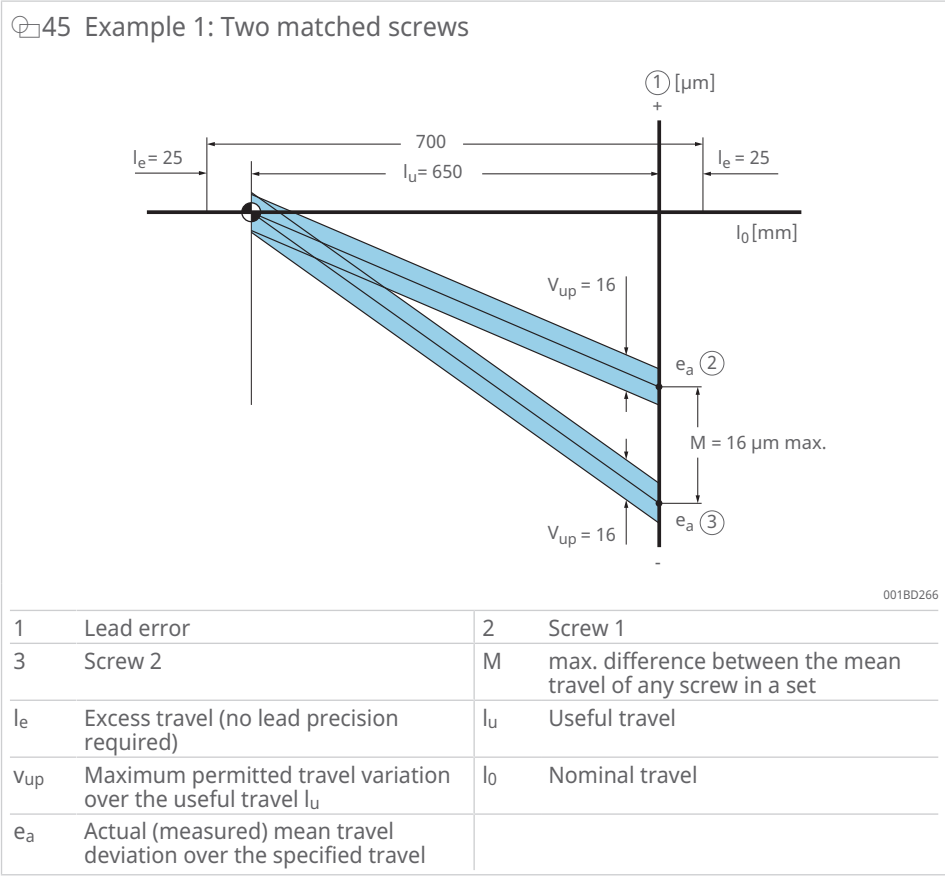
A value M is defined as the maximum difference between the mean travel of any screw in a set. In cases where three or more screws are installed, M represents the maximum difference between the two most extreme mean travels of the set of screws.

Following figures represent 3 typical application examples.

Example 1

Two planetary roller screws of type SRC 25×5R 700/900 G3 Z WPR with lead precision G3 are working in parallel.

e_p 18 μm
 v_{up} 16 μm
 $M = v_{up}$ 16 μm

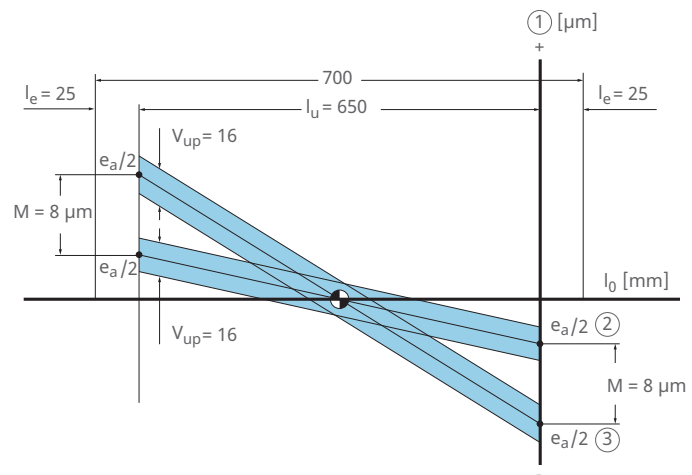


Example 2

Two planetary roller screws of type SRC 25×5R 700/900 G3 Z WPR with lead precision G3 are working in parallel. The zero position is regulated at the middle position of the travel of the nut.

$$\begin{aligned} e_p &= 18 \mu\text{m} \\ V_{up} &= 16 \mu\text{m} \\ M = V_{up} \div 2 &= 8 \mu\text{m} \end{aligned}$$

46 Example 2: Two matched screws with centered zero position



001BD267

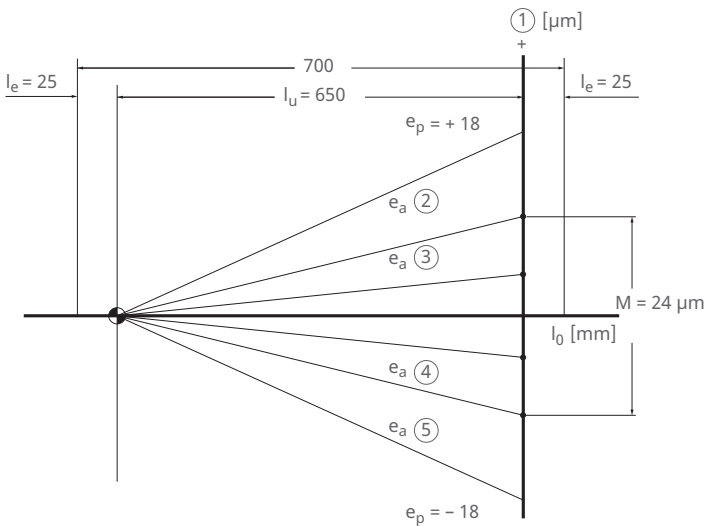
1	Lead error	2	Screw 1
3	Screw 2	M	max. difference between the mean travel of any screw in a set
l_e	Excess travel (no lead precision required)	l_u	Useful travel
V_{up}	Maximum permitted travel variation over the useful travel l_u	l_0	Nominal travel
e_a	Actual (measured) mean travel deviation over the specified travel		

Example 3

Four planetary roller screws of type SRC 25×5R 700/900 G3 Z WPR with lead precision G3 are working in parallel.

e_p 18 μm
 V_{up} 16 μm
 $M = 1,5 \cdot V_{up}$ 24 μm

47 Example 3: Four matched screws



001BD26A

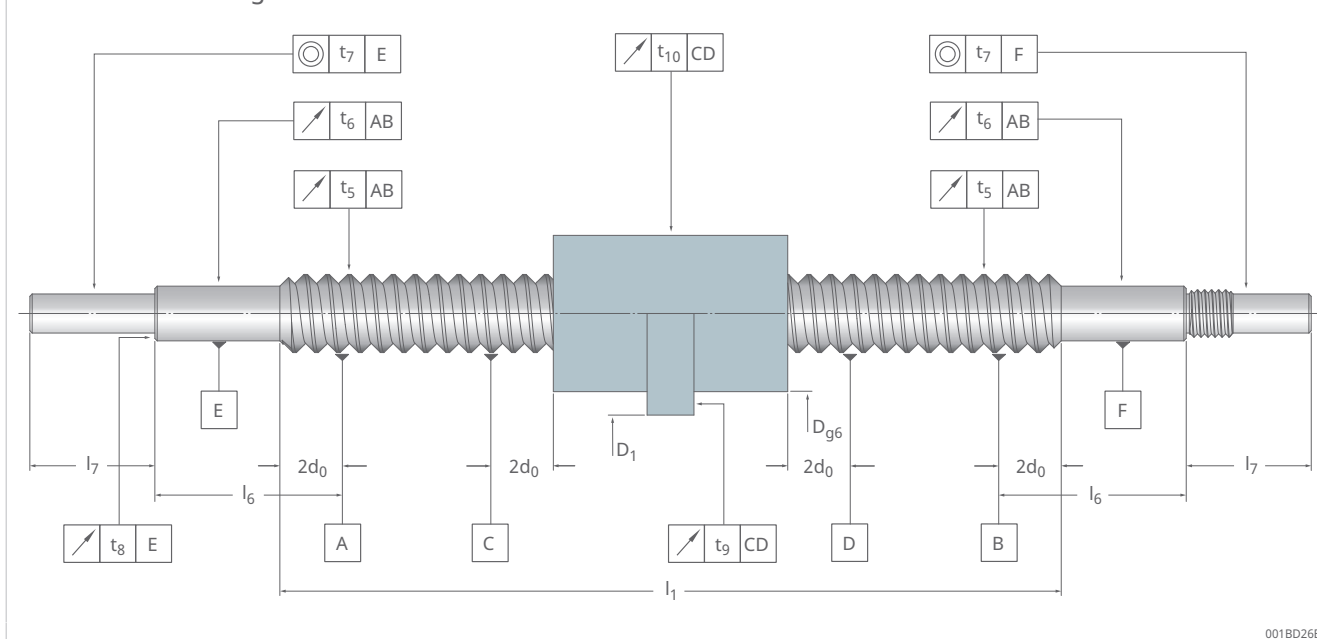
1	Lead error	2	Screw 1
3	Screw 2	4	Screw 3
5	Screw 4	M	max. difference between the mean travel of any screw in a set
l_e	Excess travel (no lead precision required)	l_u	Useful travel
e_p	Permitted mean travel deviation (lead error) over the specified travel	l_0	Nominal travel
e_a	Actual (measured) mean travel deviation over the specified travel		

2.3.2 Manufacturing tolerances

Parameters other than lead precision correspond in standard to class 5 of ISO 3408-3. If the application requires special tolerances, ISO class 3 or ISO class 1, please specify these requirements in the inquiry.

2

48 Manufacturing tolerances



Shaft

- t₅ straightness
- t₆ radial run-out of journal diameter
- t₇ concentricity of ends/journal diameter
- t₈ axial run-out of bearing support face

Nut

- t₉ axial run-out of the nut flange face
- t₁₀ radial run-out of the nut diameter/screw

Manufacturing tolerances class 5

24 Manufacturing tolerances class 5, Straightness t₅

Nominal diameter		Threaded length l ₁	Tolerance
d ₀		l _{1 ref}	if l ₁ ≤ l _{1 ref}
over	incl.		t ₅
mm	mm	mm	μm
6	12	320	32
12	25	640	32
25	50	1260	32
50	100	2520	32
100	200	5000	32
200	–	1)	1)

1) For additional information about tolerances, please contact your local Schaeffler representative.

25 Manufacturing tolerances class 5, Ratio l_1/d , straightness t_5

Ratio if $l_1 > l_{1 \text{ ref}}$	Tolerance
l_1/d_0 ratio	t_5
–	μm
≤ 40	64
≤ 60	96
≤ 80	160
≤ 100	256

26 Manufacturing tolerances class 5, Concentricity deviation t_6 concentricity of the ends/pin diameter t_7 , axial run-out deviation of the contact surface t_8

Nominal diameter		Tolerance				
d_0		t_6	$t_6 \text{ min}$	t_7	$t_7 \text{ min}$	t_8
over	incl.					
mm	mm	μm	μm	μm	μm	μm
6	20	$0.25 \cdot l_6$	20	$0.10 \cdot l_7$	8	5
20	50	$0.20 \cdot l_6$	25	$0.08 \cdot l_7$	10	5
50	63	$0.16 \cdot l_6$	32	$0.06 \cdot l_7$	12	5
63	125	$0.16 \cdot l_6$	32	$0.06 \cdot l_7$	12	6
125	200	$0.13 \cdot l_6$	40	$0.05 \cdot l_7$	16	8
200	–	²⁾	²⁾	²⁾	²⁾	²⁾

²⁾ For additional information about tolerances, please contact your local Schaeffler representative.

27 Manufacturing tolerances class 5, Axial run-out deviation of the nut flange face t_9

Nut flange outer diameter		Tolerance
D_1		t_9
over	incl.	
mm	mm	μm
16	32	16
32	63	20
63	125	25
125	250	32
250	500	40

Measured by rotating the shaft and nut together.

28 Manufacturing tolerances class 5, Concentricity deviation of the nut diameter to the outer diameter of the screw thread t_{10}

Nut body outer diameter		Tolerance
D		t_{10}
over	incl.	
mm	mm	μm
16	32	16
32	63	20
63	125	25
125	250	32
250	500	40

Measured by rotating the nut around the fixed shaft.

Manufacturing tolerances class 3

29 Manufacturing tolerances class 3, Straightness t_5

Nominal diameter		Threaded length l_1	Tolerance
d_0		$l_{1 \text{ ref}}$	if $l_1 \leq l_{1 \text{ ref}}$
over	incl.		t_5
mm	mm	mm	μm
6	12	320	25
12	25	640	25
25	50	1260	25
50	100	2520	25
100	200	5000	25
200	–	³⁾	³⁾

³⁾ For additional information about tolerances, please contact your local Schaeffler representative.

30 Manufacturing tolerances class 3, Ratio l_1/d , straightness t_5

Ratio	Tolerance
if $l_1 > l_{1 \text{ ref}}$	
l_1/d_0 ratio	t_5
–	μm
≤ 40	50
≤ 60	75
≤ 80	125
≤ 100	> 200

31 Manufacturing tolerances class 3, Concentricity deviation t_6 and concentricity of the ends/pin diameter t_7 , axial run-out deviation of the contact surface t_8

Nominal diameter		Tolerance				
d_0		t_6	$t_{6 \text{ min}}$	t_7	$t_{7 \text{ min}}$	t_8
over	incl.					
mm	mm	μm	μm	μm	μm	μm
6	20	$0.15 \cdot l_6$	12	$0.08 \cdot l_7$	6	4
20	50	$0.13 \cdot l_6$	16	$0.06 \cdot l_7$	8	4
50	63	$0.10 \cdot l_6$	20	$0.05 \cdot l_7$	10	4
63	125	$0.10 \cdot l_6$	20	$0.05 \cdot l_7$	10	5
125	200	$0.08 \cdot l_6$	25	$0.04 \cdot l_7$	12	6
200	–	⁴⁾	⁴⁾	⁴⁾	⁴⁾	⁴⁾

⁴⁾ For additional information about tolerances, please contact your local Schaeffler representative.

32 Manufacturing tolerances class 3, Axial run-out deviation of the nut flange face t_9

Nut flange outer diameter		Tolerance
D_1		t_9
over	incl.	
mm	mm	μm
16	32	12
32	63	16
63	125	20
125	250	25
250	500	32

Measured by rotating the shaft and nut together.

33 Manufacturing tolerances class 3, Concentricity deviation of the nut diameter to the outer diameter of the screw thread t_{10}

Nut body outer diameter		Tolerance
D		t_{10}
over	incl.	
mm	mm	μm
16	32	12
32	63	16
63	125	20
125	250	25
250	500	32

Measured by rotating the nut around the fixed shaft.

Manufacturing tolerances class 1

34 Manufacturing tolerances class 1, Straightness t_5

Nominal diameter		Threaded length l_1	Tolerance
d_0		$l_{1 \text{ ref}}$	if $l_1 \leq l_{1 \text{ ref}}$
over	incl.		t_5
mm	mm	mm	μm
6	12	320	20
12	25	640	20
25	50	1260	20
50	100	2520	20
100	200	5000	20
200	–	5)	5)

5) For additional information about tolerances, please contact your local Schaeffler representative.

35 Manufacturing tolerances class 1, Ratio l_1/d , straightness t_5

Ratio	Tolerance
if $l_1 > l_{1 \text{ ref}}$	
l_1/d_0 ratio	t_5
–	μm
≤ 40	40
≤ 60	65
≤ 80	100
≤ 100	160

36 Manufacturing tolerances class 1, Concentricity deviation t_6 and concentricity of the ends/pin diameter t_7 , axial run-out deviation of the contact surface t_8

Nominal diameter		Tolerance				
d_0		t_6	$t_6 \text{ min}$	t_7	$t_7 \text{ min}$	t_8
over	incl.					
mm	mm	μm	μm	μm	μm	μm
6	20	$0.12 \cdot l_6$	10	$0.06 \cdot l_7$	5	3
20	50	$0.10 \cdot l_6$	12	$0.05 \cdot l_7$	6	3
50	63	$0.08 \cdot l_6$	16	$0.04 \cdot l_7$	8	3
63	125	$0.08 \cdot l_6$	16	$0.04 \cdot l_7$	8	4
125	200	6)	6)	6)	6)	6)
200	240	6)	6)	6)	6)	6)

6) For additional information about tolerances, please contact your local Schaeffler representative.

37 Manufacturing tolerances class 1, Axial run-out deviation of the nut flange face t_9

Nut flange outer diameter		Tolerance
D_1		t_9
over	incl.	
mm	mm	μm
16	32	10
32	63	12
63	125	16
125	250	20
250	500	7)

7) For additional information about tolerances, please contact your local Schaeffler representative.

Measured by rotating the shaft and nut together.

38 Manufacturing tolerances class 1, Concentricity deviation of the nut diameter to the outer diameter of the screw thread t_{10}

Nut body outer diameter		Tolerance
D		t_{10}
over	incl.	
mm	mm	μm
16	32	10
32	63	12
63	125	16
125	250	20
250	500	8)

8) For additional information about tolerances, please contact your local Schaeffler representative.

Measured by rotating the nut around the fixed shaft.

3 Preferred range

The Schaeffler preferred range encompasses the most frequently used sizes of planetary roller screws and recirculating roller screws. Within that assortment, standard size nuts are stocked at Schaeffler factories in Europe and North America for improved availability, greater value, and shorter delivery times. Shafts are manufactured according to customer requirements.

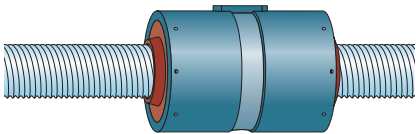
 39 Customer requirements

Design and manufacturing operations	• Standard roller screws with standard and maximum load ratings are available with axial play (SR or SV prefix), or without backlash (BR or BV prefix) • Nut dimensions are detailed hereafter • Standard shaft end machining can include turning, milling and grinding operations • End machining is available for Schaeffler support bearings
Materials	• For the preferred range, shafts and nuts are manufactured with standard high quality roller screw steel, detailed in the present Schaeffler document Roller screws • Stainless steel and special treatments are not available with the preferred range
Capabilities	• Machining operations such as splines, hollow shaft, etc. are possible, but might require more time to complete • Unless specified, manufacturing tolerances will be according to ISO 3408-3 class 5 • Lead precision is G5 according to ISO standards. G3 and G1 also possible on request • Screw assemblies are shipped with a protective rust inhibitor coating • Special documents can be supplied on request: Certificate of conformity to customer drawings # 1969981, lead precision curve • Matching FLRBU support bearings size 2 to 6 can be delivered with the screws
Export note	• Product for nuclear, aerospace or military applications may be subject to export restrictions and/or licensing requirements. In such cases, delivery time shall be dependent upon securing approvals from the appropriate governmental authority

3.1 Planetary roller screws with standard nuts in stock

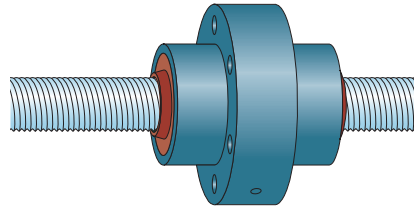
- SRC: cylindrical nut with axial play
- BRC: cylindrical nut without backlash
- SRF: flanged nut with axial play
- BRF: flanged nut without backlash
- SRC/BRC/BRF nuts with wiper recesses as standard
- Standard wipers supplied on request
- Right handed thread only
- Standard or maximum number of rollers available

 49 SRC/BRC: cylindrical nut with wipers



001BD231

50 SRF/BRF: flanged nut with wipers



001BD22E

40 Planetary roller screws with standard nuts in stock

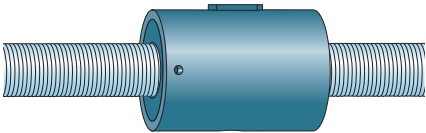
d ₀	P _h	C _a	C _{0a}	C _a max.	C _{0a} max.	available nut types	L _{tp} max.
mm	mm	kN	kN	kN	kN		mm
15	5	26	43.6	29.7	53.3	SRC/BRC	975
15	8	27.4	40.8	29.4	45.3	SRC/BRC/SRF/BRF	975
21	5	50.6	82	57.8	100	SRC/BRC/SRF/BRF	1400
21	8	57	84.1	65.2	103	SRC/BRC	1400
21	10	59.2	83	63.6	92.2	SRC/BRC/SRF/BRF	1400
25	5	68.4	122	72.2	149	SRC/BRC	1650
25	10	78.6	118	89.9	145	SRC/BRC	1650
30	5	92	178	105	218	SRC/BRC/SRF/BRF	2000
30	10	106	174	122	213	SRC/BRC/SRF/BRF	2000
39	5	129	269	148	329	SRC/BRC/SRF/BRF	2650
39	10	153	271	174	331	SRC/BRC/SRF/BRF	2650
48	5	198	482	240	642	SRC/BRC/SRF/BRF	3300
48	10	232	475	265	581	SRC/BRC/SRF/BRF	3300
48	20	266	462	304	565	SRC/BRC/SRF/BRF	3300
60	20	395	787	452	960	SRC/BRC/SRF/BRF	4250

C _{0a}	kN	static axial load rating
C _a	kN	dynamic axial load rating
d ₀	mm	nominal diameter of screw shaft
L _{tp}	mm	max. threaded shaft length
P _h	mm	lead

3.2 Recirculating roller screws with standard nuts in stock

- SVC cylindrical nut with axial play
- BVC cylindrical nut without backlash
- SVC/BVC nuts without wiper recess
- No wiper availability

51 SVC/BVC: cylindrical nut



001BD233

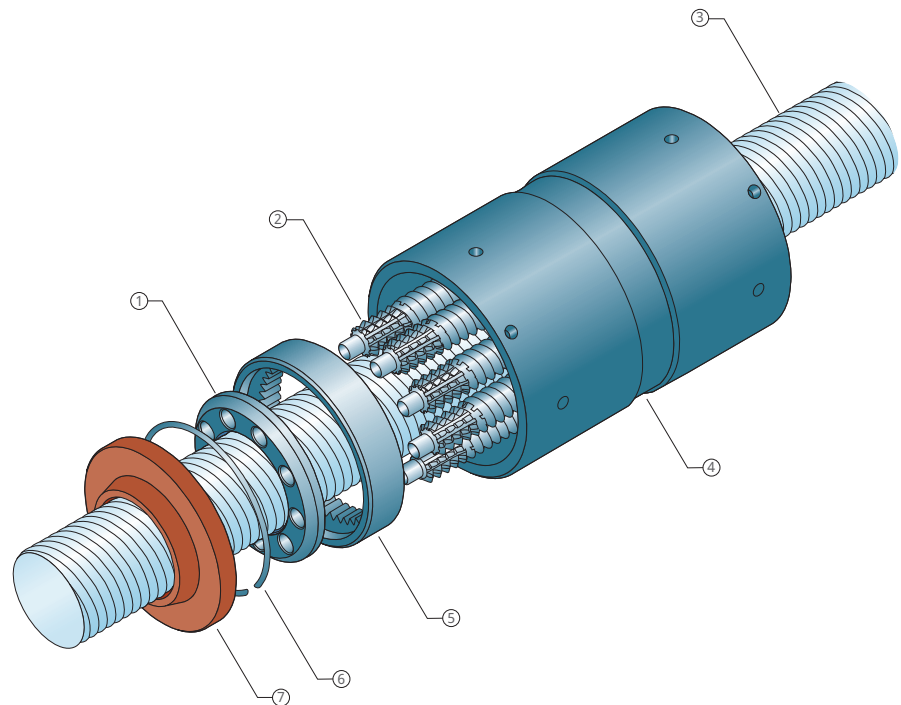
41 SVC/BVC recirculating roller screws with standard nuts in stock

d ₀	P _h	C _a	C _{0a}	L _{tp} max.
mm	mm	kN	kN	mm
20	1	18.5	36.6	1300
25	1	32.9	68.4	1650
32	1	64.3	159	2150
32	2	64.3	159	2159
C _{0a}	kN	static axial load rating		
C _a	kN	dynamic axial load rating		
d ₀	mm	nominal diameter of screw shaft		
L _{tp}	mm	max. threaded shaft length		
P _h	mm	lead		

4 Product range

4.1 Planetary roller screws SR

52 Planetary roller screws SR



001BD290

1	Guide ring	2	Satellite rollers
3	Shaft	4	Nut
5	Internal-toothed ring	6	Snap ring
7	Wipers on request		

Concept

Planetary roller screws operating without recirculation provide the high level of robustness, load carrying capacity, speed and acceleration, service life and reliability for ultimate driving performance.

Application examples

- Presses for plastic injection moulding and blow moulding
- Electro-mechanical presses
- Broaching machines
- Large machine tools
- Car assembly lines (spot welding, gluing, riveting, etc.)
- Factory automation
- Off-highway vehicles
- Oil & gas
- Aerospace
- Steel industry
- Test benches

Design features	User benefits
Satellite rollers without recirculation	Maximum reliability, high speed capability, low noise
Evenly spaced, guided and synchronized rollers	Robustness, resistance to shocks Very well adapted for operation with frequent changes of direction without friction torque singularities Operation within contaminated environments Smooth running
Absence of miniature parts	Very robust and durable
Nominal diameters from 8 mm to 120 mm	Wide standard assortment to fit most customer applications
Long leads up to 42 mm	High linear speeds up to 1.8 m/s for size 44×30
Small leads down to 2 mm	Ideal combination of precise positioning accuracy, increased load carrying capacity, axial stiffness, high speed and low torque requirements
Shaft length up to 8000 mm	For additional information about longer shaft lengths, please contact your local Schaeffler representative
Maximum $n \cdot d_0 = 160000$ Acceleration up to 12000 rad/s^2 for standard SR screws, and can be higher for special variants	High speed rating of rolling screw, improving customer productivity
High dynamic load carrying capacity up to 1131 kN for SR assortment	Long service life
High static load carrying capacity up to 4038 kN for SR assortment	Ability to accommodate heavy shock loads without raceway damage
High axial stiffness, further increased with a preloaded version	High positioning accuracy
Roller retention for nut and shaft disassembly	Easy roller screw assembly into customer machinery, no need of sleeve like for ball screws
Optional support bearings	Complete support bearings ready to use, simplified application design and assembly, easy ordering process
Three standard versions are available: - SR with axial play - BR without backlash (for $d_0 \leq 64 \text{ mm}$) - PR with preloaded split nut (for $d_0 \leq 64 \text{ mm}$)	Equipment stiffness and accuracy further increased with the preloaded version
On request, the SR assortment can be delivered with maximized load rating (maximum number of rollers) for sizes $d_0 \leq 80 \text{ mm}$.	Increased load rating within the same roller nut design
Flexible design and manufacturing equipment	Custom designs to fit customer applications, e. g. left hand threads

General symbols

C_{0a}	kN	static axial load rating
C_a	kN	dynamic axial load rating
d_0	mm	nominal diameter of screw shaft
I_s	$\text{kg} \cdot \text{mm}^2/\text{m}$	inertia of screw shaft per meter of shaft length
P_h	mm	lead
Z_n	cm^3	initial grease volume for the nut
Z_s	cm^3	initial grease volume for the screw shaft
η	%	efficiency
η'	%	indirect efficiency

53 Product overview SR planetary roller screws

SR planetary roller screws



Threaded rollers



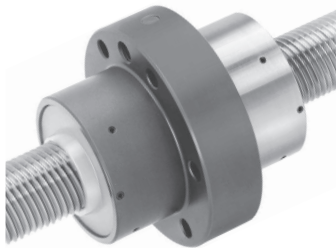
Components assembly

SRC/BRC planetary roller screws with cylindrical nut

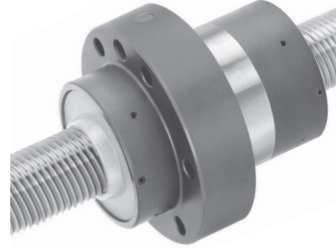


Standard SRC

SRF/BRF/SRP/BRP planetary roller screws with flanged nut



Standard SRF



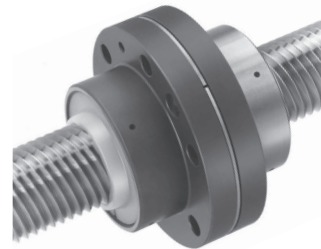
Standard SRP

PRU preloaded planetary roller screws with cylindrical nut



Standard PRU

PRK preloaded planetary roller screws with flanged nut

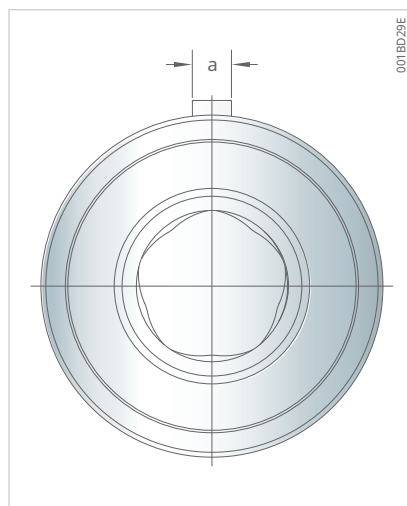


Standard PRK

001DF37E

4.1.1 SRC, BRC

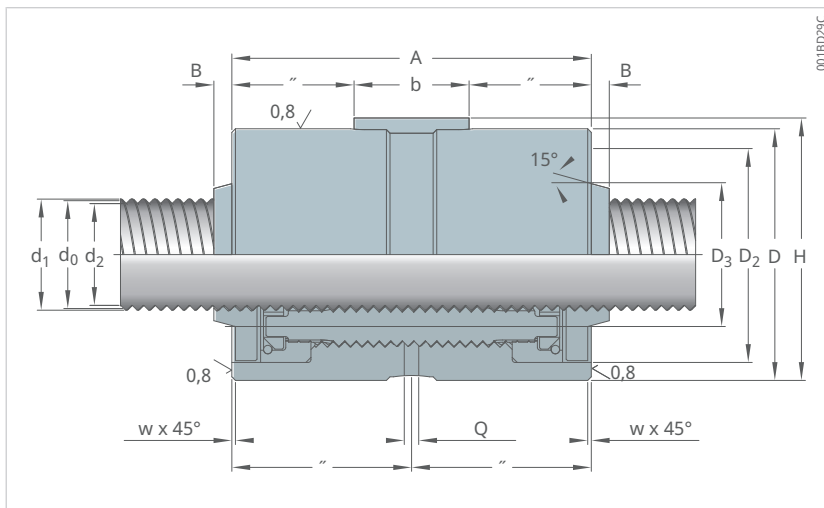
planetary roller screws
cylindrical nut



SRC, BRC

Designation		d ₀	P _h	L _{tp} ¹⁾	C _a ²⁾	C _{0a} ²⁾	C _a ³⁾	C _{0a} ³⁾	η	η'	S _{ap}	T _{be}	m _n	m _s	I _s
							max	max							
–		mm	mm	mm	kN	kN	kN	kN	–	–	mm	Nm	kg	kg/m	kg · mm²/m
SRC/BRC 8×2	–	8	2	500	–	–	8.61	16	0.88	0.87	0.02	0.1	0.1	0.4	3.2
SRC/BRC 8×4	–	8	4	500	–	–	8.93	13.4	0.88	0.87	0.02	0.1	0.1	0.4	3.2
SRC/BRC 12×2	–	12	2	750	–	–	13.2	22.5	0.86	0.83	0.02	0.1	0.1	0.9	16
SRC/BRC 12×5	–	12	5	750	14.1	18.3	15.1	20.4	0.89	0.88	0.02	0.1	0.2	0.9	16
SRC/BRC 15×2	–	15	2	975	–	–	23.9	52.7	0.84	0.8	0.02	0.2	0.2	1.4	39
SRC/BRC 15×5	✓	15	5	975	26	43.6	29.7	53.3	0.89	0.88	0.02	0.2	0.2	1.4	39
SRC/BRC 15×8	✓	15	8	975	27.4	40.8	29.4	45.3	0.88	0.86	0.02	0.2	0.2	1.4	39
SRC/BRC 18×2	–	18	2	1200	–	–	30.4	71	0.82	0.77	0.02	0.3	0.35	2	81
SRC/BRC 18×5	–	18	5	1200	–	–	37.7	70.9	0.89	0.87	0.02	0.3	0.35	2	81
SRC/BRC 18×8	–	18	8	1200	–	–	38	61.5	0.89	0.87	0.02	0.3	0.35	2	81
SRC/BRC 21×2	–	21	2	1400	–	–	47.4	103	0.8	0.74	0.02	0.3	0.4	2.7	150
SRC/BRC 21×5	✓	21	5	1400	50.6	82	57.8	100	0.88	0.86	0.02	0.3	0.4	2.7	150
SRC/BRC 21×6	–	21	6	1400	52.8	82.2	60.3	100	0.89	0.87	0.02	0.3	0.4	2.7	150
SRC/BRC 21×8	✓	21	8	1400	57	84.1	65.2	103	0.89	0.88	0.02	0.3	0.4	2.7	150
SRC/BRC 21×10	✓	21	10	1400	59.2	83	63.6	92.2	0.89	0.87	0.04	0.3	0.4	2.7	150
SRC/BRC 24×6	–	24	6	1600	42.3	65.2	47.3	77	0.88	0.87	0.02	0.4	0.5	3.6	256
SRC/BRC 24×12	–	24	12	1600	47.7	62.3	53.3	73.7	0.88	0.87	0.04	0.4	0.5	3.6	256
SRC/BRC 25×5	✓	25	5	1650	68.4	122	78.2	149	0.87	0.85	0.02	0.4	0.7	3.9	301
SRC/BRC 25×8	–	25	8	1650	76.1	122	87	149	0.89	0.88	0.02	0.4	0.7	3.9	301
SRC/BRC 25×10	✓	25	10	1650	78.6	118	89.8	145	0.89	0.88	0.04	0.4	0.7	3.9	301
SRC/BRC 25×15	–	25	15	1650	85.6	120	91.9	133	0.87	0.85	0.07	0.4	0.7	3.9	301

✓	-	preferred range
I _{nn}	kg · mm ²	inertia of a rotating nut
I _{ns}	kg · mm ²	inertia of rollers with rotating shaft
L _{tp}	mm	max. threaded shaft length
m _n	kg	mass of nut
m _s	kg	mass of threaded shaft
S _{ap}	mm	max. axial play
T _{be}	Nm	preload torque for zero-backlash nut
Z _n	cm ³	initial grease volume for the nut
Z _s	cm ³	initial grease volume for the screw shaft



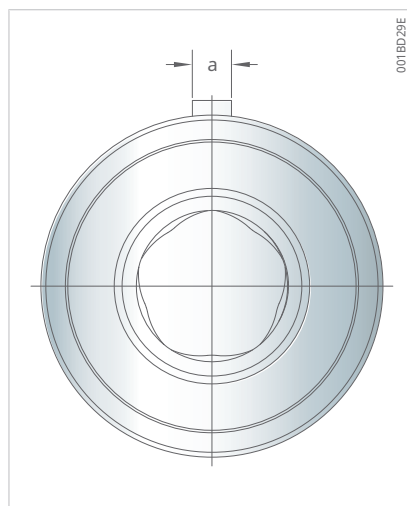
SRC, BRC

I _{nn}	I _{ns}	Z _n	Z _s	d ₁	d ₂	D	A	w	a	b	H	Q	B	D ₂	D ₃
kg · mm ²	kg · mm ²	cm ³	cm ³ /m	mm	mm	g6/H7	h12	mm	h9	mm	mm	mm	mm	mm	mm
11.4	0.2	0.8	4	8.2	7.6	25	44	0.5	4	12	26.5	5	3	21	13
11.4	0.2	0.9	4	8.4	7.3	25	44	0.5	4	12	26.5	5	3	21	13
22.9	0.3	1.1	6	12.2	11.6	30	44	0.5	4	12	31.5	5	3	25	17
22.9	0.4	1.4	6	12.4	11.3	30	44	0.5	4	12	31.5	5	3	25	17
45.2	1.5	1.9	7	15.2	14.6	35	50	0.5	4	16	36.5	5	3	30	20
45.2	1.2	2.3	7	15.4	14.3	35	50	0.5	4	16	36.5	5	3	30	20
45.2	1.2	2.3	7	15.6	14	35	50	0.5	4	16	36.5	5	3	30	20
81	3	4	8	18.2	17.6	40	58	0.5	5	18	42	5	3	35	23
81	3	4	8	18.4	17.3	40	58	0.5	5	18	42	5	3	35	23
81	3	4	8	18.6	17	40	58	0.5	5	18	42	5	3	35	23
141	6.5	5	10	21.2	20.6	45	64	0.5	5	20	47	5	4	40.5	26
141	6.5	5	10	21.4	20.3	45	64	0.5	5	20	47	5	4	40.5	26
141	6.5	5	10	21.5	20.2	45	64	0.5	5	20	47	5	4	40.5	26
141	6.5	5	10	21.6	20	45	64	0.5	5	20	47	5	4	40.5	26
141	6.5	5	10	21.8	19.8	45	64	0.5	5	20	47	5	4	40.5	26
173	6.3	4	11	24.4	23.3	48	58	0.5	5	20	50	5	6	42	31
173	6.3	4	11	24.8	22.8	48	58	0.5	5	20	50	5	6	42	31
322	14.3	10	11	25.4	24.3	53	78	0.5	6	25	55.5	5	6	47	32
322	14.3	10	11	25.6	24	53	78	0.5	6	25	55.5	5	6	47	32
322	14.3	10	11	25.8	23.8	53	78	0.5	6	25	55.5	5	6	47	32
322	14.3	10	11	26.2	23.2	53	78	0.5	6	25	55.5	5	6	47	32

- 1) For BRC (backlash eliminated), maximum length can be shorter
- 2) Standard number of rollers. Configuration not available for certain sizes
- 3) Maximum number of rollers on request, or standard for certain sizes

4.1.2 SRC, BRC

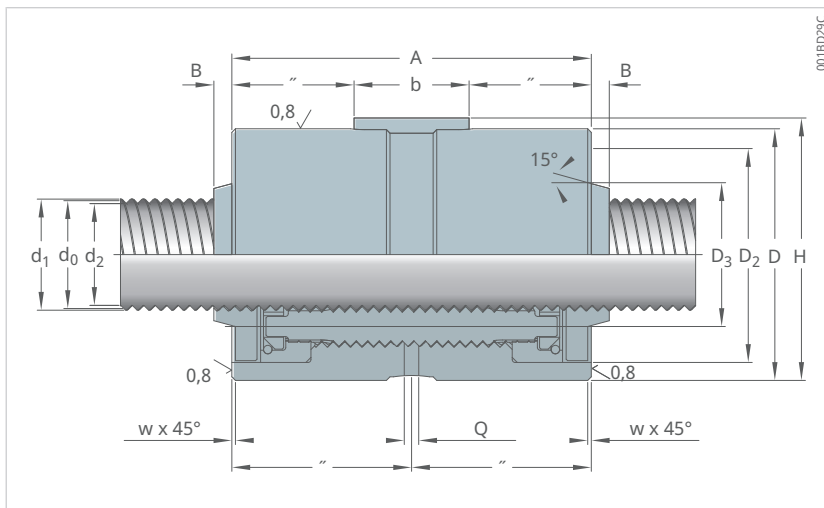
planetary roller screws
cylindrical nut



SRC, BRC

Designation		d ₀	P _h	L _{tp} ¹⁾	C _a ²⁾	C _{0a} ²⁾	C _a ³⁾	C _{0a} ³⁾	η	η'	S _{ap}	T _{be}	m _n	m _s	I _s
							max	max							
-		mm	mm	mm	kN	kN	kN	kN	-	-	mm	Nm	kg	kg/m	kg · mm²/m
SRC/BRC 30×5	✓	30	5	2000	92	178	105	218	0.86	0.83	0.02	0.6	1.2	5.6	624
SRC/BRC 30×6	-	30	6	2000	95	175	109	214	0.87	0.85	0.02	0.6	1.2	5.6	624
SRC/BRC 30×8	-	30	8	2000	103	178	117	218	0.88	0.87	0.02	0.6	1.2	5.6	624
SRC/BRC 30×10	✓	30	10	2000	106	174	122	213	0.89	0.88	0.04	0.6	1.2	5.6	624
SRC/BRC 30×15	-	30	15	2000	119	182	127	201	0.88	0.87	0.07	0.6	1.2	5.6	624
SRC/BRC 30×20	-	30	20	2000	123	177	132	197	0.86	0.83	0.07	0.8	1.2	5.6	624
SRC/BRC 36×6	-	36	6	2400	90.5	179	106	228	0.86	0.83	0.02	0.8	1.2	8	1290
SRC/BRC 36×9	-	36	9	2400	97.5	174	115	222	0.88	0.87	0.02	0.8	1.2	8	1290
SRC/BRC 36×12	-	36	12	2400	107	181	125	230	0.89	0.88	0.04	0.8	1.2	8	1290
SRC/BRC 36×18	-	36	18	2400	114	177	128	209	0.88	0.87	0.07	0.8	1.2	8	1290
SRC/BRC 36×24	-	36	24	2400	124	184	138	218	0.86	0.83	0.07	0.8	1.2	8	1290
SRC/BRC 39×5	✓	39	5	2650	129	269	148	329	0.83	0.8	0.02	0.9	2.1	9.4	1780
SRC/BRC 39×10	✓	39	10	2650	153	271	174	331	0.88	0.87	0.04	0.9	2.1	9.4	1780
SRC/BRC 39×15	-	39	15	2650	168	273	192	334	0.89	0.88	0.07	0.9	2.1	9.4	1780
SRC/BRC 39×20	-	39	20	2650	173	261	198	319	0.88	0.87	0.07	0.9	2.1	9.4	1780
SRC/BRC 39×25	-	39	25	2650	175	249	188	277	0.86	0.84	0.07	0.9	2.1	9.4	1780
SRC/BRC 44×8	-	44	8	3000	130	261	153	333	0.86	0.84	0.02	1.1	1.7	11.9	2890
SRC/BRC 44×12	-	44	12	3000	144	263	169	335	0.89	0.87	0.04	1.1	1.7	11.9	2890
SRC/BRC 44×18	-	44	18	3000	158	265	185	337	0.89	0.88	0.07	1.1	1.7	11.9	2890
SRC/BRC 44×24	-	44	24	3000	168	267	188	315	0.88	0.86	0.07	1.1	1.7	11.9	2890
SRC/BRC 44×30	-	44	30	3000	166	246	185	291	0.85	0.83	0.07	1.1	1.7	11.9	2890

✓	-	preferred range
I _{nn}	kg · mm ²	inertia of a rotating nut
I _{ns}	kg · mm ²	inertia of rollers with rotating shaft
L _{tp}	mm	max. threaded shaft length
m _n	kg	mass of nut
m _s	kg	mass of threaded shaft
S _{ap}	mm	max. axial play
T _{be}	Nm	preload torque for zero-backlash nut
Z _n	cm ³	initial grease volume for the nut
Z _s	cm ³	initial grease volume for the screw shaft



SRC, BRC

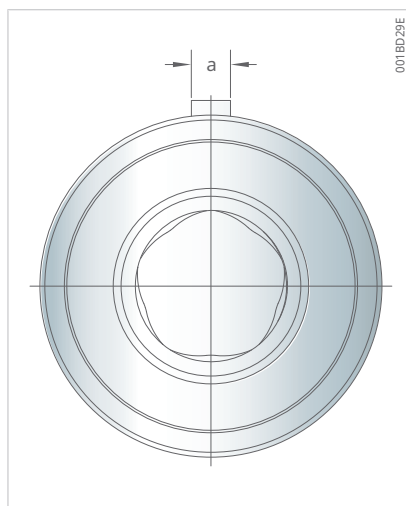
I _{nn}	I _{ns}	Z _n	Z _s	d ₁	d ₂	D	A	w	a	b	H	Q	B	D ₂	D ₃
kg · mm ²	kg · mm ²	cm ³	cm ³ /m	mm	mm	g6/H7	h12	mm	h9	mm	mm	mm	mm	mm	mm
762	36.2	14	14	30.4	29.4	64	85	0.5	6	32	66.5	5	7	58	38
762	36.2	14	14	30.5	29.3	64	85	0.5	6	32	66.5	5	7	58	38
762	36.2	14	14	30.6	29	64	85	0.5	6	32	66.5	5	7	58	38
762	36.2	14	14	30.8	28.8	64	85	0.5	6	32	66.5	5	7	58	38
762	36.2	14	14	31.2	28.3	64	85	0.5	6	32	66.5	5	7	58	38
762	35.9	14	14	31.5	27.6	64	85	0.5	6	32	66.5	5	7	58	38
923	46	13	16	36.4	35.4	68	80	0.5	5	25	70	5	8	62	45
923	46	13	16	36.6	35.1	68	80	0.5	5	25	70	5	8	62	45
873	46	13	16	36.8	34.8	68	80	0.5	5	25	70	5	8	62	45
873	46	13	16	37.2	34.2	68	80	0.5	5	25	70	5	8	62	45
873	46	13	16	37.5	33.6	68	80	0.5	5	25	70	5	8	62	45
2030	124	28	18	39.4	38.4	80	100	1	8	40	83	7	8	73	50
2030	124	28	18	39.8	37.9	80	100	1	8	40	83	7	8	73	50
2030	124	28	18	40.2	37.3	80	100	1	8	40	83	7	8	73	50
2030	124	28	18	40.5	36.7	80	100	1	8	40	83	7	8	73	50
2030	124	28	18	40.9	36.1	80	100	1	8	40	83	7	8	73	50
1730	119	23	20	44.5	43.2	80	90	0.5	6	32	82.5	7	8	74	56
1730	119	23	20	44.8	42.8	80	90	0.5	6	32	82.5	7	8	74	56
1730	118	23	20	45.2	42.3	80	90	0.5	6	32	82.5	7	8	74	56
1730	118	23	20	45.5	41.7	80	90	0.5	6	32	82.5	7	8	74	56
1730	118	23	20	45.9	41.1	80	90	0.5	6	32	82.5	7	8	74	56

- 1) For BRC (backlash eliminated), maximum length can be shorter
- 2) Standard number of rollers. Configuration not available for certain sizes
- 3) Maximum number of rollers on request, or standard for certain sizes

4.1.3 SRC, BRC

planetary roller screws

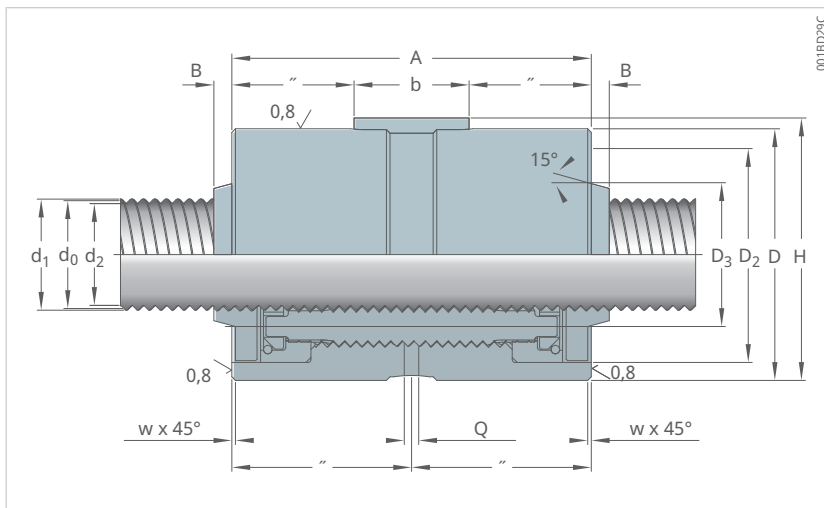
cylindrical nut



SRC, BRC

Designation		d ₀	P _h	L _{tp} ¹⁾	C _a ²⁾	C _{0a} ²⁾	C _a ³⁾	C _{0a} ³⁾	η	η'	S _{ap}	T _{be}	m _n	m _s	I _s
		mm	mm	mm	kN	kN	max	max			mm	Nm	kg	kg/m	kg · mm ² /m
-	✓	48	5	3300	198	482	240	642	0.81	0.76	0.02	1.3	4.2	14.2	4090
SRC/BRC 48×5	-	48	8	3300	218	471	250	575	0.86	0.83	0.02	1.3	4.2	14.2	4090
SRC/BRC 48×8	-	48	10	3300	232	475	265	581	0.87	0.85	0.04	1.3	4.2	14.2	4090
SRC/BRC 48×10	-	48	15	3300	258	486	295	594	0.89	0.88	0.07	1.3	4.2	14.2	4090
SRC/BRC 48×15	✓	48	20	3300	266	462	304	565	0.89	0.88	0.07	1.3	4.2	14.2	4090
SRC/BRC 48×20	-	48	25	3300	286	491	327	600	0.88	0.87	0.07	1.3	4.2	14.2	4090
SRC/BRC 48×25	-	48	30	3300	276	467	316	571	0.87	0.85	0.07	1.3	4.2	14.2	4090
SRC/BRC 48×30	-	56	12	4000	212	433	249	551	0.87	0.86	0.04	1.7	3.2	19.3	7580
SRC/BRC 56×12	-	56	24	4000	242	419	284	533	0.89	0.88	0.07	1.7	3.2	19.3	7580
SRC/BRC 56×24	-	56	36	4000	258	424	289	501	0.86	0.84	0.07	1.7	3.2	19.3	7580
SRC/BRC 56×36	-	60	10	4250	339	780	387	953	0.86	0.83	0.04	1.9	7.3	22.2	9990
SRC/BRC 60×10	-	60	15	4250	373	783	426	957	0.88	0.87	0.07	1.9	7.3	22.2	9990
SRC/BRC 60×15	✓	60	20	4250	395	786	452	960	0.89	0.88	0.07	1.9	7.3	22.2	9990
SRC/BRC 60×20	-	64	12	4600	-	-	296	763	0.87	0.84	0.04	2.1	5.4	25.3	12900
SRC/BRC 64×12	-	64	18	4600	317	726	333	781	0.89	0.87	0.07	2.1	5.2	25.3	12900
SRC/BRC 64×18	-	64	24	4600	329	690	346	743	0.89	0.88	0.07	2.1	5.2	25.3	12900
SRC/BRC 64×24	-	64	30	4600	318	620	356	733	0.89	0.87	0.07	2.1	4.9	25.3	12900
SRC/BRC 64×30	-	64	36	4600	309	589	346	697	0.88	0.86	0.07	2.1	4.9	25.3	12900
SRC/BRC 64×36															

✓	-	preferred range
I _{nn}	kg · mm ²	inertia of a rotating nut
I _{ns}	kg · mm ²	inertia of rollers with rotating shaft
L _{tp}	mm	max. threaded shaft length
m _n	kg	mass of nut
m _s	kg	mass of threaded shaft
S _{ap}	mm	max. axial play
T _{be}	Nm	preload torque for zero-backlash nut
Z _n	cm ³	initial grease volume for the nut
Z _s	cm ³	initial grease volume for the screw shaft



SRC, BRC

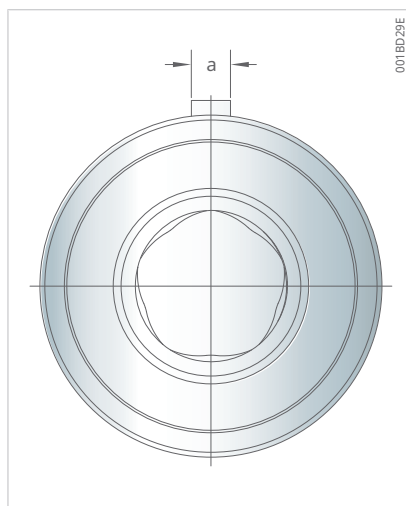
I _{nn}	I _{ns}	Z _n	Z _s	d ₁	d ₂	D	A	w	a	b	H	Q	B	D ₂	D ₃
						g6/H7	h12		h9						
kg · mm ²	kg · mm ²	cm ³	cm ³ /m	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
6520	371	54	22	48.4	47.4	100	127	1	8	45	103	7	9	90	60
6520	371	54	22	48.6	47.1	100	127	1	8	45	103	7	9	90	60
6520	371	54	22	48.8	46.9	100	127	1	8	45	103	7	9	90	60
6520	371	54	22	49.2	46.3	100	127	1	8	45	103	7	9	90	60
6520	371	54	22	49.5	45.8	100	127	1	8	45	103	7	9	90	60
6520	370	54	22	49.9	45.2	100	127	1	8	45	103	7	9	90	60
6520	370	54	22	50.3	44.6	100	127	1	8	45	103	7	9	90	60
5000	385	46	25	56.8	54.9	100	112	1	8	40	103	7	9	93	66
5000	383	46	25	57.5	53.8	100	112	1	8	40	103	7	9	93	66
5000	383	46	25	58.3	52.5	100	112	1	8	40	103	7	9	93	66
16500	1100	100	27	60.8	58.9	122	152	1	10	45	125	10.5	9	110	71
16500	1100	100	27	61.2	58.4	122	152	1	10	45	125	10.5	9	110	71
16400	1100	100	27	61.5	57.8	122	152	1	10	45	125	10.5	9	110	71
10600	984	46	29	64.8	62.9	115	129	1	8	45	118	7	11	106	75
10500	914	54	29	65.2	62.3	115	129	1	8	45	118	7	11	106	75
10500	911	54	29	65.5	61.8	115	129	1	8	45	118	7	11	106	75
10300	771	69	29	65.9	61.2	115	129	1	8	45	118	7	11	106	75
10300	771	69	29	66.3	60.6	115	129	1	8	45	118	7	11	106	75

- 1) For BRC (backlash eliminated), maximum length can be shorter
- 2) Standard number of rollers. Configuration not available for certain sizes
- 3) Maximum number of rollers on request, or standard for certain sizes

4.1.4 SRC, BRC

planetary roller screws

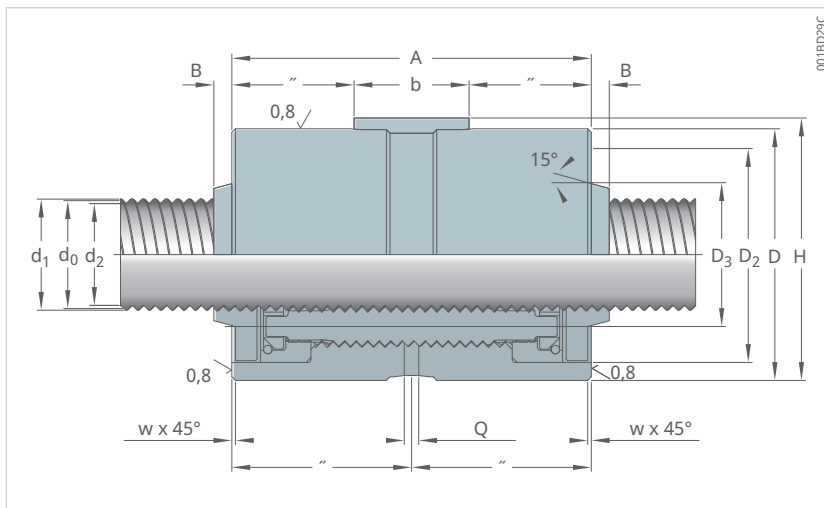
cylindrical nut



SRC, BRC

Designation		d ₀	P _h	L _{tp} ¹⁾	C _a ²⁾	C _{0a} ²⁾	C _a ³⁾	C _{0a} ³⁾	η	η'	S _{ap}	T _{be}	m _n	m _s	I _s
							max	max							
-		mm	mm	mm	kN	kN	kN	kN	-	-	mm	Nm	kg	kg/m	kg · mm ² /m
SRC 75×10	-	75	10	5500	-	-	505	1486	0.84	0.8	0.04	-	14.6	34.7	24400
SRC 75×15	-	75	15	5500	-	-	561	1491	0.87	0.85	0.07	-	14.6	34.7	24400
SRC 75×20	-	75	20	5500	-	-	572	1496	0.88	0.87	0.07	-	14.6	34.7	24400
SRC 80×10	-	80	10	6000	365	1040	383	1115	0.83	0.79	0.02	-	8.9	39.5	31600
SRC 80×18	-	80	18	6000	420	1020	441	1098	0.88	0.86	0.07	-	8.9	39.5	31600
SRC 80×24	-	80	24	6000	452	1040	474	1120	0.89	0.87	0.07	-	8.9	39.5	31600
SRC 80×42	-	80	42	6000	398	837	445	989	0.88	0.87	0.07	-	8.9	39.5	31600
SRC 99×20	-	99	20	7500	-	-	925	3090	0.87	0.85	0.07	-	36.2	60.4	74000
SRC 99×25	-	99	25	7500	-	-	937	3096	0.89	0.88	0.07	-	36.2	60.4	74000
SRC 120×20	-	120	20	8000	-	-	1131	4141	0.84	0.81	0.07	-	55.5	88.8	160000
SRC 120×25	-	120	25	8000	-	-	1127	4038	0.87	0.85	0.07	-	55.5	88.8	160000

✓	-	preferred range
I _{nn}	kg · mm ²	inertia of a rotating nut
I _{ns}	kg · mm ²	inertia of rollers with rotating shaft
L _{tp}	mm	max. threaded shaft length
m _n	kg	mass of nut
m _s	kg	mass of threaded shaft
S _{ap}	mm	max. axial play
T _{be}	Nm	preload torque for zero-backlash nut
Z _n	cm ³	initial grease volume for the nut
Z _s	cm ³	initial grease volume for the screw shaft



SRC, BRC

I _{nn}	I _{ns}	Z _n	Z _s	d ₁	d ₂	D	A	w	a	b	H	Q	B	D ₂	D ₃
kg · mm ²	kg · mm ²	cm ³	cm ³ /m	mm	mm	g6/H7	h12	mm	h9	mm	mm	mm	mm	mm	mm
46900	4150	140	33	75.8	73.9	150	191	1	10	63	153	10.5	10	136	87
46900	4150	140	33	76.2	73.4	150	191	1	10	63	153	10.5	10	136	87
46900	4150	140	33	76.5	72.9	150	191	1	10	63	153	10.5	10	136	87
26000	2720	100	36	80.7	79	140	156	1	10	63	143	10.5	12	132	92
26000	2720	100	36	81.2	78.4	140	156	1	10	63	143	10.5	12	132	92
26000	2710	100	36	81.5	77.8	140	156	1	10	63	143	10.5	12	132	92
25200	2290	130	36	82.7	76.1	140	156	1	10	63	143	10.5	12	132	92
207000	17500	340	44	100.5	96.9	200	260	1.5	16	100	204	15	12	180	112
207000	17500	340	44	100.9	96.3	200	260	1.5	16	100	204	15	12	180	112
453000	40900	540	53	121.5	118	240	280	1.5	16	100	244	15	12	220	180
453000	40900	540	53	121.9	117.4	240	280	1.5	16	100	244	15	12	220	180

- 1) For BRC (backlash eliminated), maximum length can be shorter
 2) Standard number of rollers. Configuration not available for certain sizes
 3) Maximum number of rollers on request, or standard for certain sizes

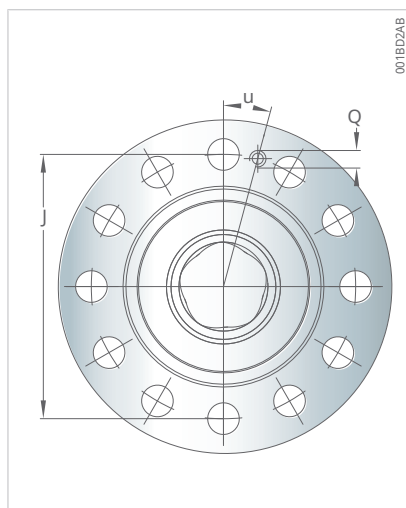
4.1.5 SRF, BRF, SRP, BRP

planetary roller screws

flanged nut

SRF/BRF: flange centered

SRP/BRP: flange off-centered



SRF, BRF, SRP, BRP

Designation		d ₀	P _h	L _{tp} ¹⁾	C _a ²⁾	C _{0a} ²⁾	C _a ³⁾	C _{0a} ³⁾	η	η'	S _{ap}	T _{be}	m _n	m _s	I _s
							max	max							
-		mm	mm	mm	kN	kN	kN	kN	-	-	mm	Nm	kg	kg/m	kg · mm²/m
SRF/BRF 8×4	-	8	4	500	-	-	8.93	13.4	0.88	0.87	0.02	0.1	0.3	0.4	3.2
SRF/BRF 12×5	-	12	5	750	14.1	18.3	15.1	20.4	0.89	0.88	0.02	0.1	0.3	0.9	16
SRF/BRF 15×5	-	15	5	975	26	43.6	30	53	0.89	0.88	0.02	0.2	0.5	1.4	39
SRF/BRF 15×8	-	15	8	975	27.4	40.8	30	45	0.88	0.86	0.02	0.2	0.5	1.4	39
SRF/BRF 18×5	-	18	5	1200	-	-	38	71	0.89	0.87	0.02	0.3	0.6	2	81
SRF/BRF 18×8	-	18	8	1200	-	-	38	62	0.89	0.87	0.02	0.3	0.6	2	81
SRF/BRF/SRP/BRP 21×5	✓	21	5	1400	50.6	82	58	101	0.88	0.86	0.02	0.3	0.7	2.7	150
SRF/BRF/SRP/BRP 21×6	-	21	6	1400	52.8	82.2	60	101	0.89	0.87	0.02	0.3	0.7	2.7	150
SRF/BRF/SRP/BRP 21×8	-	21	8	1400	57	84.1	65	103	0.89	0.88	0.02	0.3	0.7	2.7	150
SRF/BRF/SRP/BRP 21×10	✓	21	10	1400	59.2	83	64	92	0.89	0.87	0.04	0.3	0.7	2.7	150
SRF/BRF/SRP/BRP 24×6	-	24	6	1600	42.3	65.2	47	77	0.88	0.87	0.02	0.4	0.8	3.6	256
SRF/BRF/SRP/BRP 24×12	-	24	12	1600	47.7	62.3	53	74	0.88	0.87	0.04	0.4	0.8	3.6	256
SRF/BRF/SRP/BRP 25×5	-	25	5	1650	68.4	122	78	149	0.87	0.85	0.02	0.4	1.4	3.9	301
SRF/BRF/SRP/BRP 25×8	-	25	8	1650	76.1	122	87	149	0.89	0.88	0.02	0.4	1.4	3.9	301
SRF/BRF/SRP/BRP 25×10	-	25	10	1650	78.6	118	90	145	0.89	0.88	0.04	0.4	1.4	3.9	301
SRF/BRF/SRP/BRP 25×15	-	25	15	1650	85.6	120	92	133	0.87	0.85	0.07	0.4	1.4	3.9	301
SRF/BRF/SRP/BRP 30×5	✓	30	5	2000	92	178	106	218	0.86	0.83	0.02	0.6	2.1	5.6	625
SRF/BRF/SRP/BRP 30×6	-	30	6	2000	95	175	109	215	0.87	0.85	0.02	0.6	2.1	5.6	625
SRF/BRF/SRP/BRP 30×8	-	30	8	2000	103	178	118	218	0.88	0.87	0.02	0.6	2.1	5.6	625
SRF/BRF/SRP/BRP 30×10	✓	30	10	2000	106	174	122	214	0.89	0.88	0.04	0.6	2.1	5.6	625
SRF/BRF/SRP/BRP 30×15	-	30	15	2000	119	182	127	201	0.88	0.87	0.07	0.6	2.1	5.6	625
SRF/BRF/SRP/BRP 30×20	-	30	20	2000	123	177	133	197	0.86	0.83	0.07	0.8	2.1	5.6	625

✓

I_{nn} kg · mm²I_{ns} kg · mm²L_{tp} mmm_n kgm_s kgS_{ap} mmT_{be} NmZ_n cm³Z_s cm³

preferred range

inertia of a rotating nut

inertia of rollers with rotating shaft

max. threaded shaft length

mass of nut

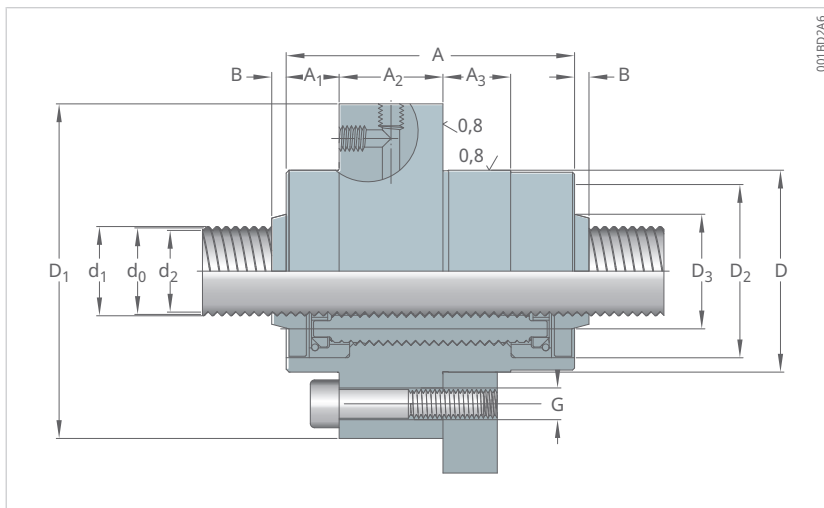
mass of threaded shaft

max. axial play

preload torque for zero-backlash nut

initial grease volume for the nut

initial grease volume for the screw shaft



SRF, BRF, SRP, BRP

I _{nn}	I _{ns}	Z _n	Z _s	d ₁	d ₂	D ⁴⁾	A	A ₁ ⁵⁾		A ₃	A ₂	D ₁	J	G	Q	B	D ₂	D ₃	u
								g6	h12	..F	..P								
kg · mm ²		cm ³	cm ³ /m	mm	mm	mm	mm					mm	mm	–	–	mm			°
66.4	0.2	0.9	4	8.4	7.3	25	44	14	–	14	16	46	36	M4×6	M6	3	21	13	30
106	0.4	1.4	6	12.4	11.3	30	44	14	–	14	16	51	41	M4×6	M6	3	25	17	30
202	1.2	2.3	7	15.4	14.3	35	50	16	–	16	18	58	46	M5×6	M6	3	30	20	30
202	1.2	2.3	7	15.6	14	35	50	16	–	16	18	58	46	M5×6	M6	3	30	20	30
244	3	4	8	18.4	17.3	40	58	20	–	20	18	63	51	M5×6	M6	3	35	23	30
244	3	4	8	18.6	17	40	58	20	–	20	18	63	51	M5×6	M6	3	35	23	30
437	6.5	5	10	21.4	20.3	45	64	23	10	10	18	68	56	M5×6	M6	4	40.5	26	30
437	6.5	5	10	21.5	20.2	45	64	23	10	10	18	68	56	M5×6	M6	4	40.5	26	30
437	6.5	5	10	21.6	20	45	64	23	10	10	18	68	56	M5×6	M6	4	40.5	26	30
437	6.5	5	10	21.8	19.8	45	64	23	10	10	18	68	56	M5×6	M6	4	40.5	26	30
525	6.3	4	11	24.4	23.3	48	58	20	10	10	18	71	59	M5×6	M6	6	42	31	30
525	6.3	4	11	24.8	22.8	48	58	20	10	10	18	71	59	M5×6	M6	6	42	31	30
1200	14	10	11	25.4	24.3	56	78	29	10	10	20	84	70	M6×6	M6	6	47	32	30
1200	14	10	11	25.6	24	56	78	29	10	10	20	84	70	M6×6	M6	6	47	32	30
1200	14	10	11	25.8	23.8	56	78	29	10	10	20	84	70	M6×6	M6	6	47	32	30
1200	14	10	11	26.2	23.2	56	78	29	10	10	20	84	70	M6×6	M6	6	47	32	30
2680	36	14	14	30.4	29.4	64	85	29	12	15	27	97	81	M8×6	M6	7	58	38	30
2680	36	14	14	30.5	29.3	64	85	29	12	15	27	97	81	M8×6	M6	7	58	38	30
2680	36	14	14	30.6	29	64	85	29	12	15	27	97	81	M8×6	M6	7	58	38	30
2680	36	14	14	30.8	28.8	64	85	29	12	15	27	97	81	M8×6	M6	7	58	38	30
2680	36	14	14	31.2	28.3	64	85	29	12	15	27	97	81	M8×6	M6	7	58	38	30
2680	36	14	14	31.5	27.6	64	85	29	12	15	27	97	81	M8×6	M6	7	58	38	30

1) For BRC (backlash eliminated), maximum length can be shorter

2) Standard number of rollers. Configuration not available for certain sizes

3) Maximum number of rollers on request, or standard for certain sizes

4) g6 fit only applies to the finished surface, on side opposite to the lubrication port, marked with a 0.8√. Fit on the lubrication port side +0.5/0 mm.

5) SRP/BRP configuration is not available for screws with nominal diameter d₀ from 8 to 18 mm.

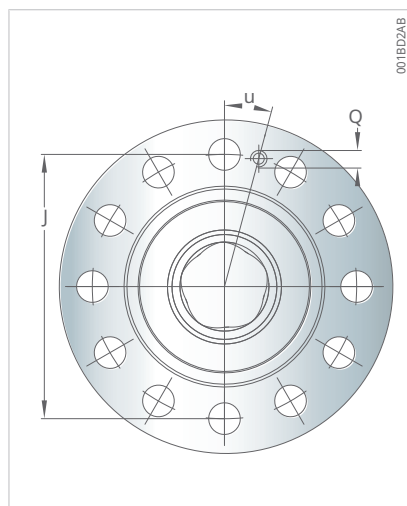
4.1.6 SRF, BRF, SRP, BRP

planetary roller screws

flanged nut

SRF/BRF: flange centered

SRP/BRP: flange off-centered



SRF, BRF, SRP, BRP

Designation		d ₀	P _h	L _{tp} ¹⁾	C _a ²⁾	C _{0a} ²⁾	C _a ³⁾	C _{0a} ³⁾	η	η'	S _{ap}	T _{be}	m _n	m _s	I _s
							max	max							
–		mm	mm	mm	kN	kN	kN	kN	–	–	mm	Nm	kg	kg/m	kg · mm²/m
SRF/BRF/SRP/BRP 36×6	–	36	6	2400	90.5	179	107	229	0.86	0.83	0.02	0.8	2.2	8	1290
SRF/BRF/SRP/BRP 36×9	–	36	9	2400	97.5	174	115	222	0.88	0.87	0.02	0.8	2.2	8	1290
SRF/BRF/SRP/BRP 36×12	–	36	12	2400	107	181	126	231	0.89	0.88	0.04	0.8	2.1	8	1290
SRF/BRF/SRP/BRP 36×18	–	36	18	2400	114	177	128	209	0.88	0.87	0.07	0.8	2.1	8	1290
SRF/BRF/SRP/BRP 36×24	–	36	24	2400	124	184	139	218	0.86	0.83	0.07	0.8	2.1	8	1290
SRF/BRF/SRP/BRP 39×5	✓	39	5	2650	129	269	148	329	0.83	0.8	0.02	0.9	4	9.4	1780
SRF/BRF/SRP/BRP 39×10	✓	39	10	2650	153	271	175	332	0.88	0.87	0.04	0.9	4	9.4	1780
SRF/BRF/SRP/BRP 39×15	–	39	15	2650	168	273	192	334	0.89	0.88	0.07	0.9	4	9.4	1780
SRF/BRF/SRP/BRP 39×20	–	39	20	2650	173	261	198	319	0.88	0.87	0.07	0.9	4	9.4	1780
SRF/BRF/SRP/BRP 39×25	–	39	25	2650	175	249	188	277	0.86	0.84	0.07	0.9	4	9.4	1780
SRF/BRF/SRP/BRP 44×8	–	44	8	3000	130	261	154	333	0.86	0.84	0.02	1.1	3.6	11.9	2890
SRF/BRF/SRP/BRP 44×12	–	44	12	3000	144	263	169	335	0.89	0.87	0.04	1.1	3.6	11.9	2890
SRF/BRF/SRP/BRP 44×18	–	44	18	3000	158	265	186	338	0.89	0.88	0.07	1.1	3.6	11.9	2890
SRF/BRF/SRP/BRP 44×24	–	44	24	3000	168	267	188	316	0.88	0.86	0.07	1.1	3.6	11.9	2890
SRF/BRF/SRP/BRP 44×30	–	44	30	3000	166	246	186	292	0.85	0.83	0.07	1.1	3.6	11.9	2890
SRF/BRF/SRP/BRP 48×5	✓	48	5	3300	198	482	240	643	0.81	0.76	0.02	1.3	7.8	14.2	4090
SRF/BRF/SRP/BRP 48×8	–	48	8	3300	218	471	250	576	0.86	0.83	0.02	1.3	7.8	14.2	4090
SRF/BRF/SRP/BRP 48×10	✓	48	10	3300	232	475	265	581	0.87	0.85	0.04	1.3	7.8	14.2	4090
SRF/BRF/SRP/BRP 48×15	–	48	15	3300	258	486	295	595	0.89	0.88	0.07	1.3	7.8	14.2	4090
SRF/BRF/SRP/BRP 48×20	✓	48	20	3300	266	462	304	565	0.89	0.88	0.07	1.3	7.8	14.2	4090
SRF/BRF/SRP/BRP 48×25	–	48	25	3300	286	491	327	601	0.88	0.87	0.07	1.3	7.8	14.2	4090
SRF/BRF/SRP/BRP 48×30	–	48	30	3300	276	467	316	571	0.87	0.85	0.07	1.3	7.8	14.2	4090

✓

 I_{nn} I_{ns} L_{tp} m_n m_s S_{ap} T_{be} Z_n Z_s

-

kg · mm²kg · mm²

mm

kg

kg

mm

Nm

cm³cm³

preferred range

inertia of a rotating nut

inertia of rollers with rotating shaft

max. threaded shaft length

mass of nut

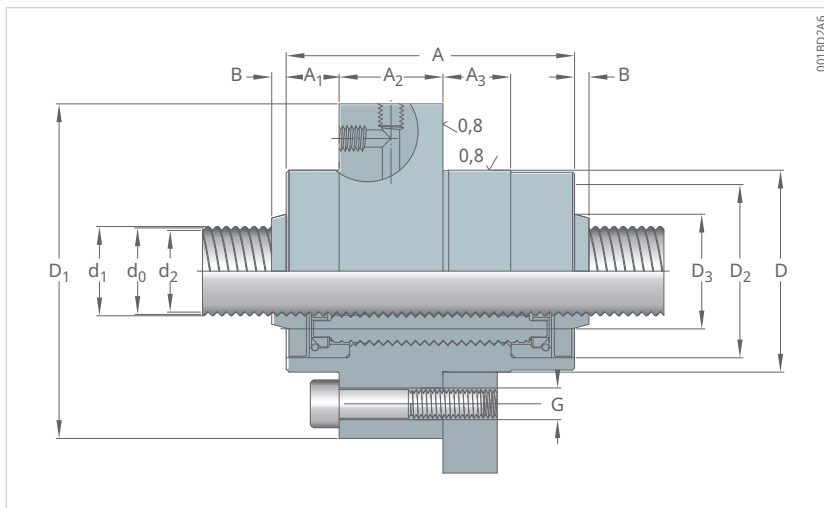
mass of threaded shaft

max. axial play

preload torque for zero-backlash nut

initial grease volume for the nut

initial grease volume for the screw shaft



SRF, BRP, SRP, BRP

I _{nn}	I _{ns}	Z _n	Z _s	d ₁	d ₂	D ⁴⁾	A	A ₁ ⁵⁾		A ₃	A ₂	D ₁	J	G	Q	B	D ₂	D ₃	u
						g6	h12	..F	..P										
kg · mm ²		cm ³	cm ³ /m	mm	mm	mm	mm					mm	mm	–	–	mm			°
3170	46	13	16	36.4	35.4	68	80	26.5	12	15	27	102	85	M8×6	M6	8	62	45	30
3170	46	13	16	36.6	35.1	68	80	26.5	12	15	27	102	85	M8×6	M6	8	62	45	30
3120	46	13	16	36.8	34.8	68	80	26.5	12	15	27	102	85	M8×6	M6	8	62	45	30
3120	46	13	16	37.2	34.2	68	80	26.5	12	15	27	102	85	M8×6	M6	8	62	45	30
3120	46	13	16	37.5	33.6	68	80	26.5	12	15	27	102	85	M8×6	M6	8	62	45	30
8360	124	28	18	39.4	38.4	82	100	33.5	13	18	33	124	102	M10×6	M6	8	73	50	30
8360	124	28	18	39.8	37.9	82	100	33.5	13	18	33	124	102	M10×6	M6	8	73	50	30
8360	124	28	18	40.2	37.3	82	100	33.5	13	18	33	124	102	M10×6	M6	8	73	50	30
8360	124	28	18	40.5	36.7	82	100	33.5	13	18	33	124	102	M10×6	M6	8	73	50	30
8360	124	28	18	40.9	36.1	82	100	33.5	13	18	33	124	102	M10×6	M6	8	73	50	30
8030	119	23	20	44.5	43.2	82	90	28.5	12	18	33	124	102	M10×6	M6	8	74	56	30
8030	119	23	20	44.8	42.8	82	90	28.5	12	18	33	124	102	M10×6	M6	8	74	56	30
8030	118	23	20	45.2	42.3	82	90	28.5	12	18	33	124	102	M10×6	M6	8	74	56	30
8030	118	23	20	45.5	41.7	82	90	28.5	12	18	33	124	102	M10×6	M6	8	74	56	30
8030	118	23	20	45.9	41.1	82	90	28.5	12	18	33	124	102	M10×6	M6	8	74	56	30
18500	371	54	22	48.4	47.4	105	127	45	15	20	37	150	127	M12×6	M8×1	9	90	60	30
18500	371	54	22	48.6	47.1	105	127	45	15	20	37	150	127	M12×6	M8×1	9	90	60	30
18500	371	54	22	48.8	46.9	105	127	45	15	20	37	150	127	M12×6	M8×1	9	90	60	30
18500	371	54	22	49.2	46.3	105	127	45	15	20	37	150	127	M12×6	M8×1	9	90	60	30
18500	371	54	22	49.5	45.8	105	127	45	15	20	37	150	127	M12×6	M8×1	9	90	60	30
18500	370	54	22	49.9	45.2	105	127	45	15	20	37	150	127	M12×6	M8×1	9	90	60	30
18500	370	54	22	50.3	44.6	105	127	45	15	20	37	150	127	M12×6	M8×1	9	90	60	30

1) For BRC (backlash eliminated), maximum length can be shorter

2) Standard number of rollers. Configuration not available for certain sizes

3) Maximum number of rollers on request, or standard for certain sizes

4) g6 fit only applies to the finished surface, on side opposite to the lubrication port, marked with a 0.8√. Fit on the lubrication port side +0.5/0 mm.

5) SRP/BRP configuration is not available for screws with nominal diameter d₀ from 8 to 18 mm.

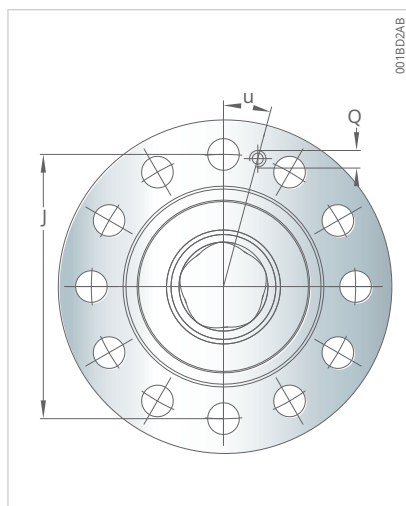
4.1.7 SRF, BRF, SRP, BRP

planetary roller screws

flanged nut

SRF/BRF: flange centered

SRP/BRP: flange off-centered



SRF, BRF, SRP, BRP

Designation		d ₀	P _h	L _{tp} ¹⁾	C _a ²⁾	C _{0a} ²⁾	C _a ³⁾	C _{0a} ³⁾	η	η'	S _{ap}	T _{be}	m _n	m _s	I _s
							max	max							
–		mm	mm	mm	kN	kN	kN	kN	–	–	mm	Nm	kg	kg/m	kg · mm²/m
SRF/BRF/SRP/BRP 56×12	–	56	12	4000	212	433	250	552	0.87	0.86	0.04	1.7	6.5	19.3	7580
SRF/BRF/SRP/BRP 56×24	–	56	24	4000	242	419	285	534	0.89	0.88	0.07	1.7	6.5	19.3	7580
SRF/BRF/SRP/BRP 56×36	–	56	36	4000	258	424	289	502	0.86	0.84	0.07	1.7	6.5	19.3	7580
SRF/BRF/SRP/BRP 60×10	–	60	10	4250	339	780	388	953	0.86	0.83	0.04	1.9	12.1	22.2	9990
SRF/BRF/SRP/BRP 60×15	–	60	15	4250	373	783	427	957	0.88	0.87	0.07	1.9	12.1	22.2	9990
SRF/BRF/SRP/BRP 60×20	✓	60	20	4250	395	786	452	961	0.89	0.88	0.07	1.9	12.1	22.2	9990
SRF/BRF/SRP/BRP 64×12	–	64	12	4600	–	–	297	764	0.87	0.84	0.04	2.1	11.3	25.3	12900
SRF/BRF/SRP/BRP 64×18	–	64	18	4600	317	726	333	782	0.89	0.87	0.07	2.1	11.2	25.3	12900
SRF/BRF/SRP/BRP 64×24	–	64	24	4600	329	690	346	743	0.89	0.88	0.07	2.1	11.2	25.3	12900
SRF/BRF/SRP/BRP 64×30	–	64	30	4600	318	620	356	733	0.89	0.87	0.07	2.1	10.9	25.3	12900
SRF/BRF/SRP/BRP 64×36	–	64	36	4600	309	589	346	697	0.88	0.86	0.07	2.1	10.9	25.3	12900
SRF/SRP 75×10	–	75	10	5500	–	–	505	1486	0.84	0.8	0.04	–	20.6	34.7	24400
SRF/SRP 75×15	–	75	15	5500	–	–	561	1491	0.87	0.85	0.07	–	20.6	34.7	24400
SRF/SRP 75×20	–	75	20	5500	–	–	572	1496	0.88	0.87	0.07	–	20.6	34.7	24400
SRF/SRP 80×10	–	80	10	6000	365	1040	384	1115	0.83	0.79	0.02	–	17.7	39.5	31600
SRF/SRP 80×18	–	80	18	6000	420	1020	442	1099	0.88	0.86	0.07	–	17.7	39.5	31600
SRF/SRP 80×24	–	80	24	6000	452	1040	475	1121	0.89	0.87	0.07	–	17.7	39.5	31600
SRF/SRP 80×42	–	80	42	6000	398	837	445	989	0.88	0.87	0.07	–	17.7	39.5	31600
SRF/SRP 99×20	–	99	20	7500	–	–	925	3091	0.87	0.85	0.07	–	48.3	60.4	74000
SRF/SRP 99×25	–	99	25	7500	–	–	937	3096	0.89	0.88	0.07	–	48.3	60.4	74000
SRF/SRP 120×20	–	120	20	8000	–	–	1131	4041	0.84	0.81	0.07	–	89	88.8	160000
SRF/SRP 120×25	–	120	25	8000	–	–	1127	4038	0.87	0.85	0.07	–	89	88.8	160000

✓

 I_{nn}

-

kg · mm² I_{ns} kg · mm² L_{tp}

mm

 m_n

kg

 m_s

kg

 S_{ap}

mm

 T_{be}

Nm

 Z_n cm³ Z_s cm³

preferred range

inertia of a rotating nut

inertia of rollers with rotating shaft

max. threaded shaft length

mass of nut

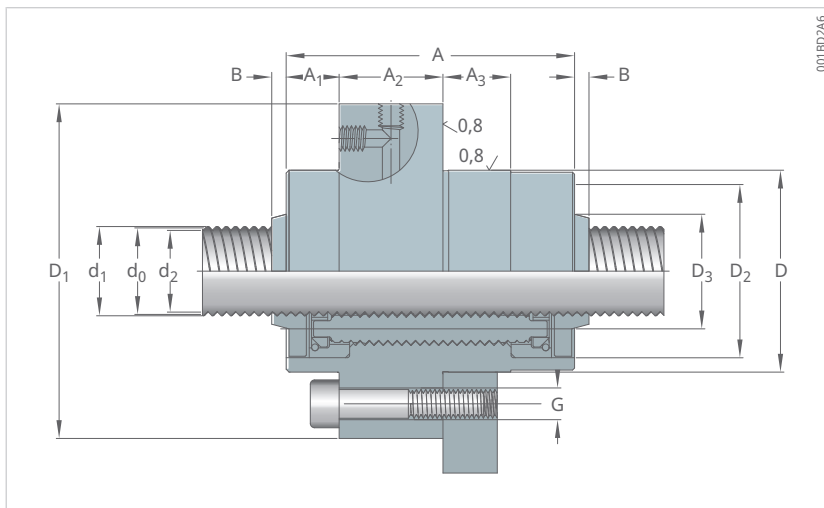
mass of threaded shaft

max. axial play

preload torque for zero-backlash nut

initial grease volume for the nut

initial grease volume for the screw shaft



SRF, BRF, SRP, BRP

I _{nn}	I _{ns}	Z _n	Z _s	d ₁	d ₂	D ⁴⁾	A	A ₁ ⁵⁾		A ₃	A ₂	D ₁	J	G	Q	B	D ₂	D ₃	u
								g6	h12	..F	..P								
kg · mm ²		cm ³	cm ³ /m	mm	mm	mm	mm					mm	mm	–	–	mm			°
21300	385	46	25	56.8	54.9	105	112	37.5	15	20	37	150	127	M12×6	M8×1	9	93	66	30
21300	383	46	25	57.5	53.8	105	112	37.5	15	20	37	150	127	M12×6	M8×1	9	93	66	30
21300	383	46	25	58.3	52.5	105	112	37.5	15	20	37	150	127	M12×6	M8×1	9	93	66	30
52800	1100	100	27	60.8	58.9	122	152	53.5	17	25	45	180	150	M16×6	M8×1	9	110	71	30
52800	1100	100	27	61.2	58.4	122	152	53.5	17	25	45	180	150	M16×6	M8×1	9	110	71	30
52800	1100	100	27	61.5	57.8	122	152	53.5	17	25	45	180	150	M16×6	M8×1	9	110	71	30
50200	984	46	29	64.8	62.9	120	129	42	17	25	45	180	150	M16×6	M8×1	11	106	75	30
50100	914	54	29	65.2	62.3	120	129	42	17	25	45	180	150	M16×6	M8×1	11	106	75	30
50100	911	54	29	65.5	61.8	120	129	42	17	25	45	180	150	M16×6	M8×1	11	106	75	30
49900	771	69	29	65.9	61.2	120	129	42	17	25	45	180	150	M16×6	M8×1	11	106	75	30
49900	771	69	29	66.3	60.6	120	129	42	17	25	45	180	150	M16×6	M8×1	11	106	75	30
114000	4150	140	33	75.8	73.9	150	191	73	21	35	45	210	180	M16×8	M8×1	10	136	87	22.5
114000	4150	140	33	76.2	73.4	150	191	73	21	35	45	210	180	M16×8	M8×1	10	136	87	22.5
114000	4150	140	33	76.5	72.9	150	191	73	21	35	45	210	180	M16×8	M8×1	10	136	87	22.5
108000	2720	100	36	80.7	79	150	156	55.5	19	35	45	210	180	M16×8	M8×1	12	132	92	22.5
108000	2720	100	36	81.2	78.4	150	156	55.5	19	35	45	210	180	M16×8	M8×1	12	132	92	22.5
108000	2710	100	36	81.5	77.8	150	156	55.5	19	35	45	210	180	M16×8	M8×1	12	132	92	22.5
108000	2290	130	36	82.7	76.1	150	156	55.5	19	35	45	210	180	M16×8	M8×1	12	132	92	22.5
449000	17500	340	44	100.5	96.9	200	260	102.5	26	40	55	275	245	M16×12	M8×1	12	180	112	15
449000	17500	340	44	100.9	96.3	200	260	102.5	26	40	55	275	245	M16×12	M8×1	12	180	112	15
1290000	40900	540	53	121.5	118	260	280	112.5	27	60	55	340	305	M16×12	M12×1.75	12	220	180	15
1290000	40900	540	53	121.9	117.4	260	280	112.5	27	60	55	340	305	M16×12	M12×1.75	12	220	180	15

1) For BRC (backlash eliminated), maximum length can be shorter

2) Standard number of rollers. Configuration not available for certain sizes

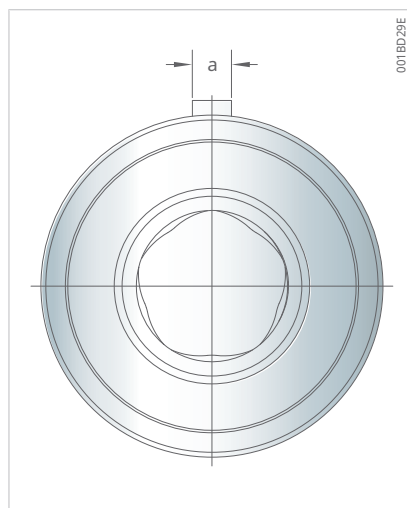
3) Maximum number of rollers on request, or standard for certain sizes

4) g6 fit only applies to the finished surface, on side opposite to the lubrication port, marked with a 0.8√. Fit on the lubrication port side +0.5/0 mm.

5) SRP/BRP configuration is not available for screws with nominal diameter d₀ from 8 to 18 mm.

4.1.8 PRU

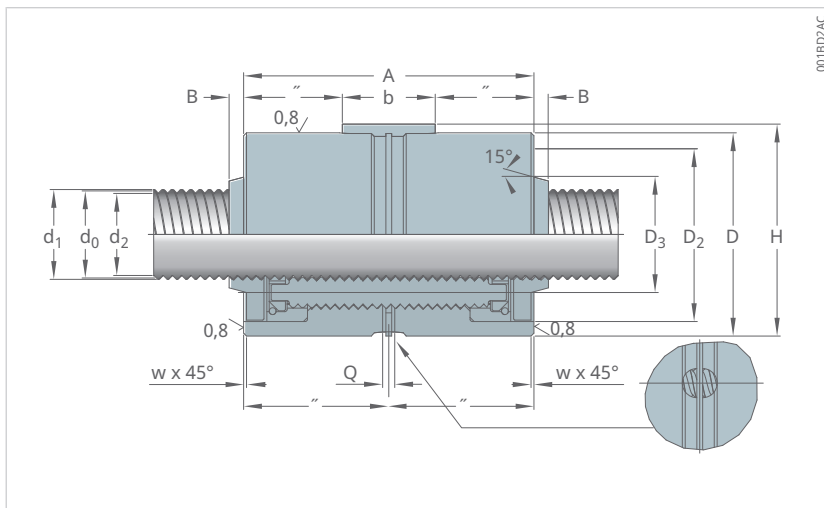
preloaded
planetary roller screws
cylindrical nut



PRU

Designation	d ₀	P _h	L _{tp}	C _a ¹⁾	C _{0a} ¹⁾	C _a ²⁾	C _{0a} ²⁾	η	η'	R _{ng}	R _{nr}	T _{pr}	F _{pr}	m _n	m _s	I _s
						max	max									
-	mm	mm	mm	kN	kN	kN	kN	-	-	N/μm	N/μm	Nm	N	kg	kg/m	kg · mm ² /m
PRU 8×2	8	2	400	-	-	4.74	7.98	0.88	0.87	173	193	0.1	602	0.1	0.4	3.2
PRU 8×4	8	4	400	-	-	4.92	6.72	0.88	0.87	110	150	0.1	236	0.1	0.4	3.2
PRU 12×2	12	2	600	-	-	7.25	11.2	0.86	0.83	249	298	0.2	1007	0.2	0.9	16
PRU 12×5	12	5	600	7.76	9.17	8.32	10.2	0.89	0.88	180	240	0.2	570	0.2	0.9	16
PRU 15×2	15	2	750	-	-	13.1	26.4	0.84	0.8	498	565	0.3	1211	0.2	1.4	39
PRU 15×5	15	5	750	14.3	21.8	16.4	26.6	0.89	0.88	290	380	0.3	932	0.2	1.4	39
PRU 15×8	15	8	750	15.1	20.4	16.2	22.7	0.88	0.86	242	315	0.3	954	0.2	1.4	39
PRU 18×2	18	2	900	-	-	16.8	35.5	0.82	0.77	529	644	0.4	1500	0.36	2	81
PRU 18×5	18	5	900	-	-	20.8	35.5	0.89	0.87	348	385	0.4	1078	0.35	2	81
PRU 18×8	18	8	900	-	-	20.9	30.8	0.89	0.87	202	224	0.4	630	0.35	2	81
PRU 21×2	21	2	1100	-	-	26.1	51.6	0.8	0.74	675	762	0.5	1740	0.4	2.7	150
PRU 21×5	21	5	1100	27.9	41	31.8	50.1	0.88	0.86	400	520	0.5	1341	0.4	2.7	150
PRU 21×6	21	6	1100	29.1	41.1	33.2	50.2	0.89	0.87	359	467	0.5	1394	0.4	2.7	150
PRU 21×8	21	8	1100	31.4	42.1	35.9	51.4	0.89	0.88	311	404	0.5	1354	0.4	2.7	150
PRU 21×10	21	10	1100	32.6	41.5	35	46.1	0.89	0.87	200	260	0.5	557	0.4	2.7	150
PRU 24×6	24	6	1250	23.3	32.6	26.1	38.5	0.88	0.87	370	490	0.6	1597	0.5	3.6	256
PRU 24×12	24	12	1250	26.3	31.2	29.4	36.8	0.88	0.87	150	200	0.6	541	0.5	3.6	256
PRU 25×5	25	5	1300	37.7	60.9	43.1	74.4	0.87	0.85	460	600	0.6	1577	0.7	3.9	301
PRU 25×8	25	8	1300	41.9	60.8	47.9	74.3	0.89	0.88	347	385	0.6	1335	0.7	3.9	301
PRU 25×10	25	10	1300	43.3	59.2	49.5	72.4	0.89	0.88	290	380	0.6	1008	0.7	3.9	301
PRU 25×15	25	15	1300	47.2	59.8	50.6	66.5	0.87	0.85	180	230	0.6	426	0.7	3.9	301

F _{pr}	N	preload force
I _{nn}	kg · mm ²	inertia of a rotating nut
I _{ns}	kg · mm ²	inertia of rollers with rotating shaft
L _{tp}	mm	max. threaded shaft length
m _n	kg	mass of nut
m _s	kg	mass of threaded shaft
R _{ng}	N/μm	min. nominal stiffness of the nut
R _{nr}	N/μm	reference nominal stiffness of the nut
S _{ap}	mm	max. axial play
T _{pr}	Nm	preload torque
Z _n	cm ³	initial grease volume for the nut
Z _s	cm ³	initial grease volume for the screw shaft



PRU

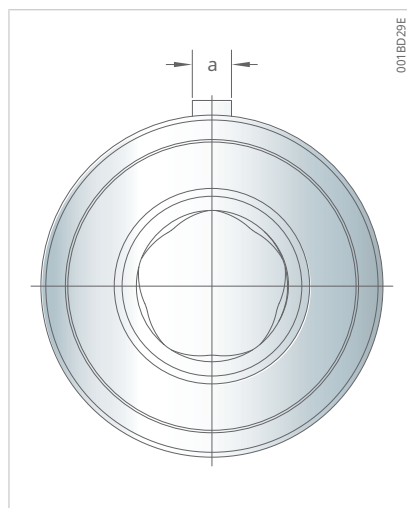
I _{nn}	I _{ns}	Z _n	Z _s	d ₁	d ₂	D	A	w	a	b	H	Q	B	D ₂	D ₃
kg · mm ²	kg · mm ²	cm ³	cm ³ /m	mm	mm	g6/H7	h12	mm	mm	mm	mm	mm	mm	mm	mm
11.4	0.1	0.8	4	8.2	7.6	25	44	0.5	4	12	26.5	5	3	21	13
11.4	0.1	0.9	4	8.4	7.3	25	44	0.5	4	12	26.5	5	3	21	13
22.9	0.4	1.1	6	12.2	11.6	30	44	0.5	4	12	31.5	5	3	25	17
22.9	0.4	1.4	6	12.4	11.3	30	44	0.5	4	12	31.5	5	3	25	17
45.2	1.2	1.9	7	15.2	14.6	35	50	0.5	4	16	36.5	5	3	30	20
45.2	1.2	2.3	7	15.4	14.3	35	50	0.5	4	16	36.5	5	3	30	20
45.2	1.2	2.3	7	15.6	14	35	50	0.5	4	16	36.5	5	3	30	20
81	3	4	8	18.2	17.6	40	58	0.5	5	18	42	5	3	35	23
81	3	4	8	18.4	17.3	40	58	0.5	5	18	42	5	3	35	23
81	3	4	8	18.6	17	40	58	0.5	5	18	42	5	3	35	23
141	6.5	5	10	21.2	20.6	45	64	0.5	5	20	47	5	4	40.5	26
141	6.5	5	10	21.4	20.3	45	64	0.5	5	20	47	5	4	40.5	26
141	6.5	5	10	21.5	20.2	45	64	0.5	5	20	47	5	4	40.5	26
141	6.5	5	10	21.6	20	45	64	0.5	5	20	47	5	4	40.5	26
141	6.5	5	10	21.8	19.8	45	64	0.5	5	20	47	5	4	40.5	26
173	6.3	4	11	24.4	23.3	48	58	0.5	5	20	50	5	6	42	31
173	6.3	4	11	24.8	22.8	48	58	0.5	5	20	50	5	6	42	31
322	14.3	10	11	25.4	24.3	53	78	0.5	6	25	55.5	5	6	47	32
322	14.3	10	11	25.6	24	53	78	0.5	6	25	55.5	5	6	47	32
322	14.3	10	11	25.8	23.8	53	78	0.5	6	25	55.5	5	6	47	32
322	14.3	10	11	26.2	23.2	53	78	0.5	6	25	55.5	5	6	47	32

1) Standard number of rollers. Configuration not available for certain sizes

2) Maximum number of rollers on request, or standard for certain sizes

4.1.9 PRU

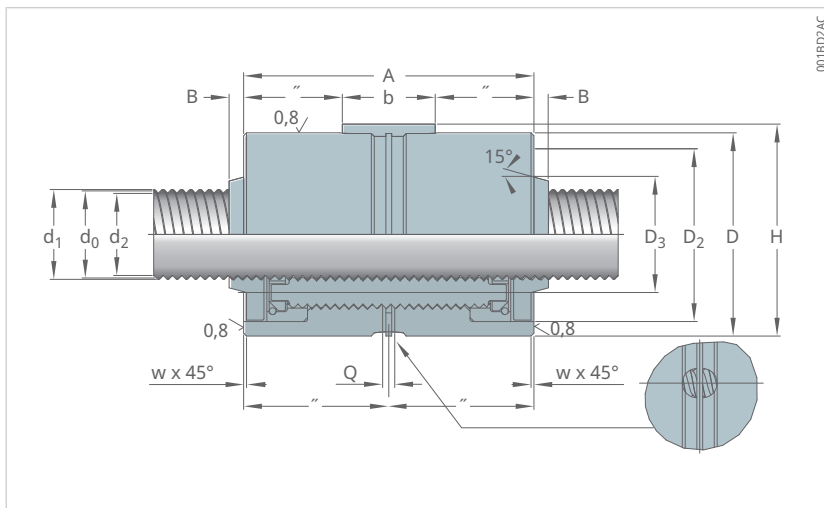
preloaded
planetary roller screws
cylindrical nut



PRU

Designation	d ₀	P _h	L _{tp}	C _a ¹⁾	C _{0a} ¹⁾	C _a ²⁾	C _{0a} ²⁾	η	η'	R _{ng}	R _{nr}	T _{pr}	F _{pr}	m _n	m _s	I _s
						max	max									
-	mm	mm	mm	kN	kN	kN	kN	-	-	N/μm	N/μm	Nm	N	kg	kg/m	kg · mm ² /m
PRU 30×5	30	5	1600	50.7	89.2	57.9	109	0.86	0.83	620	810	0.9	1844	1.2	5.6	624
PRU 30×6	30	6	1600	52.3	87.7	59.8	107	0.87	0.85	561	729	0.9	1780	1.2	5.6	624
PRU 30×8	30	8	1600	56.5	89.1	64.6	109	0.88	0.87	489	544	0.9	1629	1.2	5.6	624
PRU 30×10	30	10	1600	58.6	87.2	67	107	0.89	0.88	420	550	0.9	1472	1.2	5.6	624
PRU 30×15	30	15	1600	65.4	90.7	70.1	101	0.88	0.87	280	311	0.9	601	1.2	5.6	624
PRU 30×20	30	20	1600	67.9	88.6	72.9	98.5	0.86	0.83	190	260	1.1	555	1.2	5.6	624
PRU 36×6	36	6	1900	49.8	89.7	58.5	114	0.86	0.83	770	1000	1.2	2334	1.2	8	1290
PRU 36×9	36	9	1900	53.7	87	63.1	111	0.88	0.87	530	689	1.2	1960	1.2	8	1290
PRU 36×12	36	12	1900	58.7	90.6	69	115	0.89	0.88	510	660	1.2	1820	1.2	8	1290
PRU 36×18	36	18	1900	62.9	88.3	70.3	104	0.88	0.87	260	330	1.2	707	1.2	8	1290
PRU 36×24	36	24	1900	68.1	92.2	76.1	109	0.86	0.83	240	310	1.5	649	1.2	8	1290
PRU 39×5	39	5	2100	71.2	134	81.4	164	0.83	0.8	750	980	1.3	2288	2.1	9.4	1780
PRU 39×10	39	10	2100	84.1	135	96.1	166	0.88	0.87	500	650	1.3	1965	2.1	9.4	1780
PRU 39×15	39	15	2100	92.4	136	106	167	0.89	0.88	390	510	1.3	1465	2.1	9.4	1780
PRU 39×20	39	20	2100	95.2	130	109	159	0.88	0.87	220	290	1.3	694	2.1	9.4	1780
PRU 39×25	39	25	2100	96.3	125	103	138	0.86	0.84	210	280	1.8	697	2.1	9.4	1780
PRU 44×8	44	8	2400	71.9	131	84.4	166	0.86	0.84	688	895	1.6	2432	1.7	11.9	2890
PRU 44×12	44	12	2400	79.2	131	93	167	0.89	0.87	610	800	1.6	2297	1.7	11.9	2890
PRU 44×18	44	18	2400	86.9	132	102	169	0.89	0.88	430	550	1.6	1497	1.7	11.9	2890
PRU 44×24	44	24	2400	92.5	133	103	158	0.88	0.86	290	380	1.6	725	1.7	11.9	2890
PRU 44×30	44	30	2400	91.4	123	102	146	0.85	0.83	190	250	2.1	727	1.7	11.9	2890

F _{pr}	N	preload force
I _{nn}	kg · mm ²	inertia of a rotating nut
I _{ns}	kg · mm ²	inertia of rollers with rotating shaft
L _{tp}	mm	max. threaded shaft length
m _n	kg	mass of nut
m _s	kg	mass of threaded shaft
R _{ng}	N/μm	min. nominal stiffness of the nut
R _{nr}	N/μm	reference nominal stiffness of the nut
S _{ap}	mm	max. axial play
T _{pr}	Nm	preload torque
Z _n	cm ³	initial grease volume for the nut
Z _s	cm ³	initial grease volume for the screw shaft



PRU

I _{nn}	I _{ns}	Z _n	Z _s	d ₁	d ₂	D	A	w	a	b	H	Q	B	D ₂	D ₃
kg · mm ²	kg · mm ²	cm ³	cm ³ /m	mm	mm	g6/H7	h12	mm	mm	mm	mm	mm	mm	mm	mm
762	36.2	14	14	30.4	29.4	64	85	0.5	6	32	66.5	5	7	58	38
762	36.2	14	14	30.5	29.3	64	85	0.5	6	32	66.5	5	7	58	38
762	36.2	14	14	30.6	29	64	85	0.5	6	32	66.5	5	7	58	38
762	36.2	14	14	30.8	28.8	64	85	0.5	6	32	66.5	5	7	58	38
762	35.9	14	14	31.2	28.3	64	85	0.5	6	32	66.5	5	7	58	38
762	35.9	14	14	31.5	27.6	64	85	0.5	6	32	66.5	5	7	58	38
823	45.7	13	16	36.4	35.4	68	80	0.5	5	25	70	5	8	62	45
823	45.7	13	16	36.6	35.1	68	80	0.5	5	25	70	5	8	62	45
823	45.7	13	16	36.8	34.8	68	80	0.5	5	25	70	5	8	62	45
823	45.7	13	16	37.2	34.2	68	80	0.5	5	25	70	5	8	62	45
823	45.7	13	16	37.5	33.6	68	80	0.5	5	25	70	5	8	62	45
2030	124	28	18	39.4	38.4	80	100	1	8	40	83	7	8	73	50
2030	124	28	18	39.8	37.9	80	100	1	8	40	83	7	8	73	50
2030	124	28	18	40.2	37.3	80	100	1	8	40	83	7	8	73	50
2030	124	28	18	40.5	36.7	80	100	1	8	40	83	7	8	73	50
2030	124	28	18	40.9	36.1	80	100	1	8	40	83	7	8	73	50
1730	119	23	20	44.5	43.2	80	90	0.5	6	32	82.5	7	8	74	56
1730	119	23	20	44.8	42.8	80	90	0.5	6	32	82.5	7	8	74	56
1730	118	23	20	45.2	42.3	80	90	0.5	6	32	82.5	7	8	74	56
1730	118	23	20	45.5	41.7	80	90	0.5	6	32	82.5	7	8	74	56
1730	118	23	20	45.9	41.1	80	90	0.5	6	32	82.5	7	8	74	56

1) Standard number of rollers. Configuration not available for certain sizes

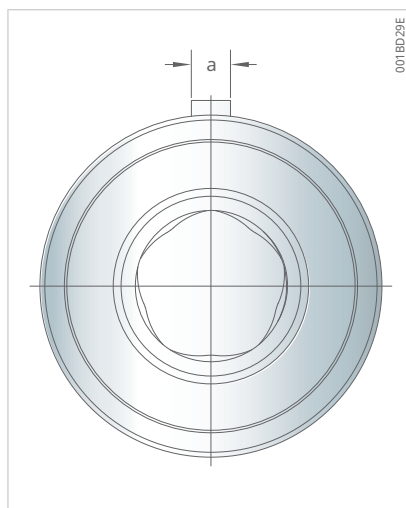
2) Maximum number of rollers on request, or standard for certain sizes

4.1.10 PRU

preloaded

planetary roller screws

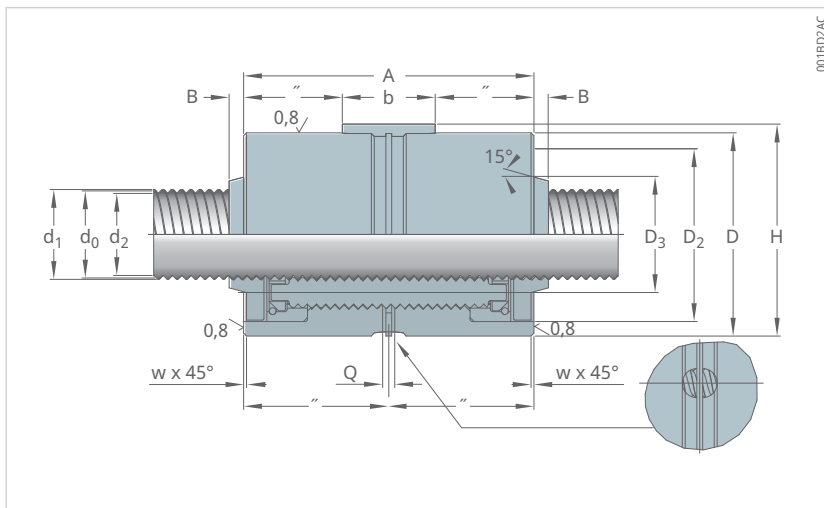
cylindrical nut



PRU

Designation	d ₀	P _h	L _{tp}	C _a ¹⁾	C _{0a} ¹⁾	C _a ²⁾		η	η'	R _{ng}	R _{nr}	T _{pr}	F _{pr}	m _n	m _s	I _s
						max	max									
-	mm	mm	mm	kN	kN	kN	kN	-	-	N/μm	N/μm	Nm	N	kg	kg/m	kg · mm ² /m
PRU 48×5	48	5	2600	109	241	132	321	0.81	0.76	1080	1410	1.9	2698	4.2	14.2	4090
PRU 48×8	48	8	2600	120	235	138	288	0.86	0.83	889	1156	1.9	2583	4.2	14.2	4090
PRU 48×10	48	10	2600	128	238	146	290	0.87	0.85	760	980	1.9	2405	4.2	14.2	4090
PRU 48×15	48	15	2600	142	243	162	297	0.89	0.88	600	780	1.9	2072	4.2	14.2	4090
PRU 48×20	48	20	2600	146	231	167	283	0.89	0.88	460	600	1.9	1423	4.2	14.2	4090
PRU 48×25	48	25	2600	157	246	180	300	0.88	0.87	320	480	1.9	782	4.2	14.2	4090
PRU 48×30	48	30	2600	152	233	174	285	0.87	0.85	344	384	2.5	1260	4.2	14.2	4090
PRU 56×12	56	12	3100	117	217	137	276	0.87	0.86	810	1060	2.4	2952	3.2	19.3	7580
PRU 56×24	56	24	3100	133	210	157	267	0.89	0.88	410	530	2.4	1579	3.2	19.3	7580
PRU 56×36	56	36	3100	142	212	159	251	0.86	0.84	290	370	3.2	910	3.2	19.3	7580
PRU 60×10	60	10	3400	187	390	213	476	0.86	0.83	1030	1340	2.7	2913	7.3	22.2	9990
PRU 60×15	60	15	3400	206	391	235	478	0.88	0.87	830	1080	2.7	2635	7.3	22.2	9990
PRU 60×20	60	20	3400	218	393	249	480	0.89	0.88	700	910	2.7	2326	7.3	22.2	9990
PRU 64×12	64	12	3650	-	-	166	382	0.87	0.84	930	1200	3	3328	5.4	25.3	12900
PRU 64×18	64	18	3650	177	363	186	391	0.89	0.87	790	1030	3	2900	5.2	25.3	12900
PRU 64×24	64	24	3650	184	345	193	371	0.89	0.88	640	840	3	2318	5.2	25.3	12900
PRU 64×30	64	30	3650	178	310	199	366	0.89	0.87	440	570	3	1292	4.9	25.3	12900
PRU 64×36	64	36	3650	173	295	193	348	0.88	0.86	350	450	3	892	4.9	25.3	12900

F _{pr}	N	preload force
I _{nn}	kg · mm ²	inertia of a rotating nut
I _{ns}	kg · mm ²	inertia of rollers with rotating shaft
L _{tp}	mm	max. threaded shaft length
m _n	kg	mass of nut
m _s	kg	mass of threaded shaft
R _{ng}	N/μm	min. nominal stiffness of the nut
R _{nr}	N/μm	reference nominal stiffness of the nut
S _{ap}	mm	max. axial play
T _{pr}	Nm	preload torque
Z _n	cm ³	initial grease volume for the nut
Z _s	cm ³	initial grease volume for the screw shaft



PRU

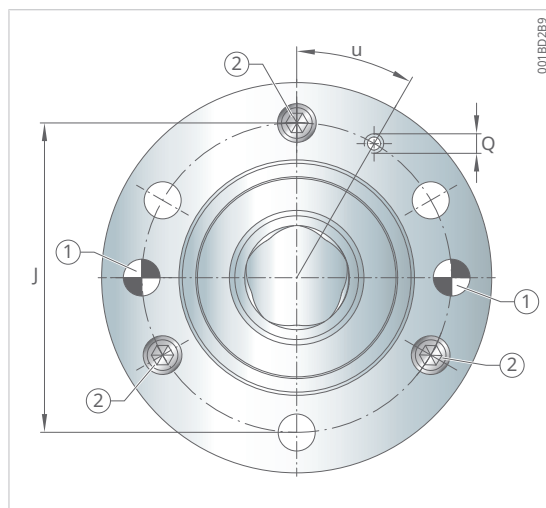
I _{nn}	I _{ns}	Z _n	Z _s	d ₁	d ₂	D	A	w	a	b	H	Q	B	D ₂	D ₃
kg · mm ²	kg · mm ²	cm ³	cm ³ /m	mm	mm	g6/H7	h12	mm	h9	mm	mm	mm	mm	mm	mm
6520	371	54	22	48.4	47.4	100	127	1	8	45	103	7	9	90	60
6520	371	54	22	48.6	47.1	100	127	1	8	45	103	7	9	90	60
6520	371	54	22	48.8	46.9	100	127	1	8	45	103	7	9	90	60
6520	371	54	22	49.2	46.3	100	127	1	8	45	103	7	9	90	60
6520	371	54	22	49.5	45.8	100	127	1	8	45	103	7	9	90	60
6520	370	54	22	49.9	45.2	100	127	1	8	45	103	7	9	90	60
6520	370	54	22	50.3	44.6	100	127	1	8	45	103	7	9	90	60
5000	385	46	25	56.8	54.9	100	112	1	8	40	103	7	9	93	66
5000	383	46	25	57.5	53.8	100	112	1	8	40	103	7	9	93	66
5000	383	46	25	58.3	52.5	100	112	1	8	40	103	7	9	93	66
16500	1100	100	27	60.8	58.9	122	152	1	10	45	125	10.5	9	110	71
16500	1100	100	27	61.2	58.4	122	152	1	10	45	125	10.5	9	110	71
16400	1100	100	27	61.5	57.8	122	152	1	10	45	125	10.5	9	110	71
10600	984	46	29	64.8	62.9	115	129	1	8	45	118	7	11	106	75
10500	914	54	29	65.2	62.3	115	129	1	8	45	118	7	11	106	75
10500	911	54	29	65.5	61.8	115	129	1	8	45	118	7	11	106	75
10300	771	69	29	65.9	61.2	115	129	1	8	45	118	7	11	106	75
10300	771	69	29	66.3	60.6	115	129	1	8	45	118	7	11	106	75

1) Standard number of rollers. Configuration not available for certain sizes

2) Maximum number of rollers on request, or standard for certain sizes

4.1.11 PRK

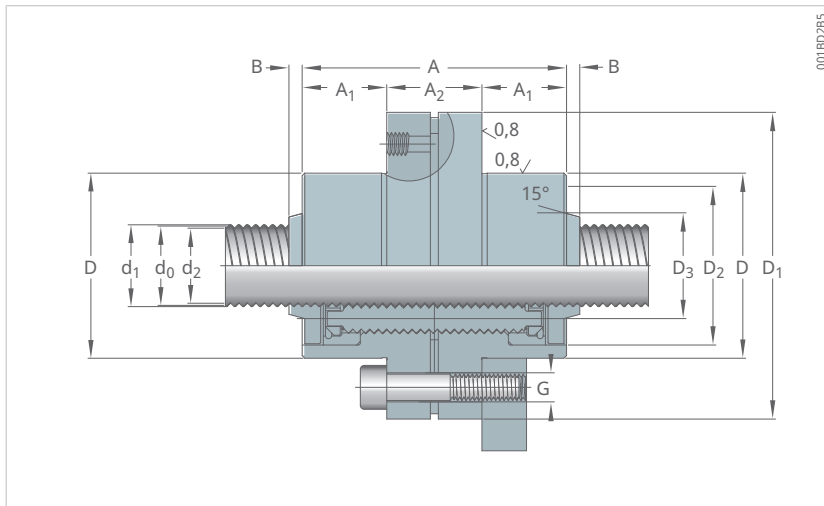
preloaded
planetary roller screws
flanged nut



PRK

Designation	d ₀	P _h	L _{tp}	C _a ¹⁾	C _{0a} ¹⁾	C _a ²⁾		η	η'	R _{ng}	R _{nr}	T _{pr}	F _{pr}	m _n	m _s	I _s	I _{nn}
						max	max			min							
–	mm	mm	mm	kN	kN	kN	kN	–	–	N/μm	N/μm	Nm	N	kg	kg/m	kg · mm ² /m	kg · mm ²
PRK 8×4	8	4	400	–	–	4.92	6.72	0.88	0.87	110	150	0.1	236	0.3	0.4	3.2	66.4
PRK 12×5	12	5	600	7.76	9.17	8.32	10.2	0.89	0.88	180	240	0.2	570	0.3	0.9	16	106
PRK 15×5	15	5	750	14.3	21.8	16.4	26.6	0.89	0.88	290	380	0.3	932	0.5	1.4	39	202
PRK 15×8	15	8	750	15.1	20.4	16.2	22.7	0.88	0.86	242	315	0.3	954	0.5	1.4	39	202
PRK 18×5	18	5	900	–	–	20.8	35.5	0.89	0.87	348	385	0.4	1078	0.6	2	81	244
PRK 18×8	18	8	900	–	–	20.9	30.8	0.89	0.87	202	224	0.4	630	0.6	2	81	244
PRK 21×5	21	5	1100	27.9	41	31.8	50.1	0.88	0.86	400	520	0.5	1341	0.7	2.7	150	437
PRK 21×6	21	6	1100	29.1	41.1	33.2	50.2	0.89	0.87	359	467	0.5	1394	0.7	2.7	150	437
PRK 21×8	21	8	1100	31.4	42.1	35.9	51.4	0.89	0.88	311	404	0.5	1354	0.7	2.7	150	437
PRK 21×10	21	10	1100	32.6	41.5	35	46.1	0.89	0.87	200	260	0.5	557	0.7	2.7	150	437
PRK 24×6	24	6	1250	23.3	32.6	26.1	38.5	0.88	0.87	370	490	0.6	1597	0.8	3.6	256	524
PRK 24×12	24	12	1250	26.3	31.2	29.4	36.8	0.88	0.87	150	200	0.6	541	0.8	3.6	256	524
PRK 25×5	25	5	1300	37.7	60.9	43.1	74.4	0.87	0.85	460	600	0.6	1577	1.4	3.9	301	1200
PRK 25×8	25	8	1300	41.9	60.8	47.9	74.3	0.89	0.88	347	385	0.6	1335	1.4	3.9	301	1200
PRK 25×10	25	10	1300	43.3	59.2	49.5	72.4	0.89	0.88	290	380	0.6	1008	1.4	3.9	301	1200
PRK 25×15	25	15	1300	47.2	59.8	50.6	66.5	0.87	0.85	180	230	0.6	426	1.4	3.9	301	1200
PRK 30×5	30	5	1600	50.7	89.2	57.9	109	0.86	0.83	620	810	0.9	1844	2.1	5.6	624	2680
PRK 30×6	30	6	1600	52.3	87.7	59.8	107	0.87	0.85	561	729	0.9	1780	2.1	5.6	624	2680
PRK 30×8	30	8	1600	56.5	89.1	64.6	109	0.88	0.87	489	544	0.9	1629	2.1	5.6	624	2680
PRK 30×10	30	10	1600	58.6	87.2	67	107	0.89	0.88	420	550	0.9	1472	2.1	5.6	624	2680
PRK 30×15	30	15	1600	65.4	90.7	70.1	101	0.88	0.87	280	311	0.9	601	2.1	5.6	624	2680
PRK 30×20	30	20	1600	67.9	88.6	72.9	98.5	0.86	0.83	190	260	1.1	555	2.1	5.6	624	2680

F _{pr}	N	preload force
I _{nn}	kg · mm ²	inertia of a rotating nut
I _{ns}	kg · mm ²	inertia of rollers with rotating shaft
L _{tp}	mm	max. threaded shaft length
m _n	kg	mass of nut
m _s	kg	mass of threaded shaft
R _{ng}	N/μm	min. nominal stiffness of the nut
R _{nr}	N/μm	reference nominal stiffness of the nut
S _{ap}	mm	max. axial play
T _{pr}	Nm	preload torque
Z _n	cm ³	initial grease volume for the nut
Z _s	cm ³	initial grease volume for the screw shaft



PRK

I _{ns}	Z _n	Z _s	d ₁	d ₂	D ³⁾	A	A ₁	A ₂	D ₁	J	G	Q	B	D ₂	D ₃	u
					g6/H7	h12				js12						
kg · mm ²	cm ³	cm ³ /m	mm	mm	mm	mm	mm	mm	mm	mm	–	–	mm	mm	mm	°
0.1	0.9	4	8.4	7.3	25	44	14	16	46	36	M4×6	M6	3	21	13	30
0.4	1.4	6	12.4	11.3	30	44	14	16	51	41	M4×6	M6	3	25	17	30
1.2	2.3	7	15.4	14.3	35	50	16	18	58	46	M5×6	M6	3	30	20	30
1.2	2.3	7	15.6	14	35	50	16	18	58	46	M5×6	M6	3	30	20	30
5.7	4	8	18.4	17.3	40	58	20	18	63	51	M5×6	M6	3	35	23	30
5.7	4	8	18.6	17	40	58	20	18	63	51	M5×6	M6	3	35	23	30
6.5	5	10	21.4	20.3	45	64	23	18	68	56	M5×6	M6	4	40.5	26	30
6.5	5	10	21.5	20.2	45	64	23	18	68	56	M5×6	M6	4	40.5	26	30
6.5	5	10	21.6	20	45	64	23	18	68	56	M5×6	M6	4	40.5	26	30
6.5	5	10	21.8	19.8	45	64	23	18	68	56	M5×6	M6	4	40.5	26	30
6.3	4	11	24.4	23.3	48	58	20	18	71	59	M5×6	M6	6	42	31	30
6.3	4	11	24.8	22.8	48	58	20	18	71	59	M5×6	M6	6	42	31	30
14.3	10	11	25.4	24.3	56	78	29	20	84	70	M6×6	M6	6	47	32	30
14.3	10	11	25.6	24	56	78	29	20	84	70	M6×6	M6	6	47	32	30
14.3	10	11	25.8	23.8	56	78	29	20	84	70	M6×6	M6	6	47	32	30
14.3	10	11	26.2	23.2	56	78	29	20	84	70	M6×6	M6	6	47	32	30
36.2	14	14	30.4	29.4	64	85	29	27	98	81	M8×6	M6	7	58	38	30
36.2	14	14	30.5	29.3	64	85	29	27	98	81	M8×6	M6	7	58	38	30
36.2	14	14	30.6	29	64	85	29	27	98	81	M8×6	M8	7	58	38	30
36.2	14	14	30.8	28.8	64	85	29	27	98	81	M8×6	M8	7	58	38	30
36.2	14	14	31.2	28.3	64	85	29	27	98	81	M8×6	M8	7	58	38	30
35.9	14	14	31.5	27.6	64	85	29	27	98	81	M8×6	M8	7	58	38	30

1) Standard number of rollers. Configuration not available for certain sizes

2) Maximum number of rollers on request, or standard for certain sizes

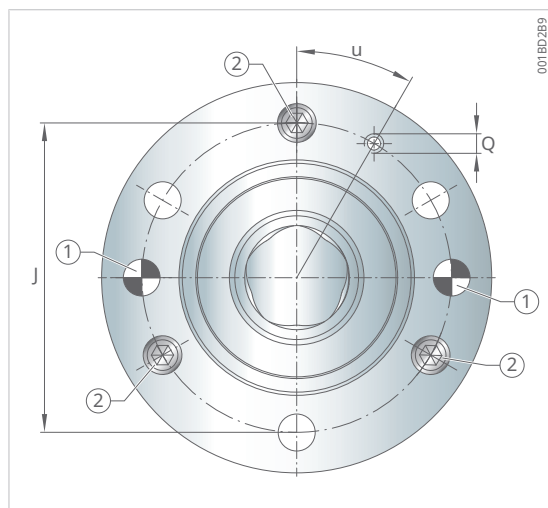
3) g6 fit only applies to the finished surface, on side opposite to the lubrication port, marked with a 0.8/. Fit on the lubrication port side +0.5/0 mm.

(1) 2 dowel pins to hold preload

(2) 3 bolts for transport

4.1.12 PRK

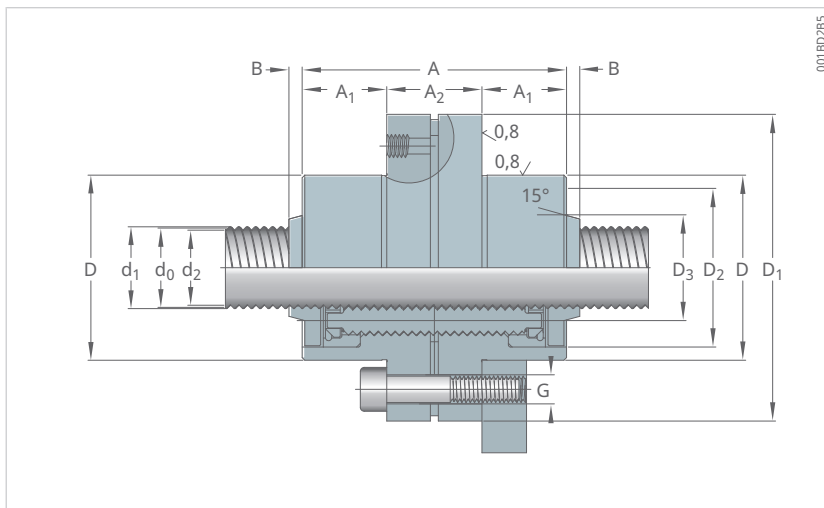
preloaded
planetary roller screws
flanged nut



PRK

Designation	d ₀	P _h	L _{tp}	C _a ¹⁾	C _{0a} ¹⁾	C _a ²⁾		η	η'	R _{ng}	R _{nr}	T _{pr}	F _{pr}	m _n	m _s	I _s	I _{nn}
						max	max			min							
–	mm	mm	mm	kN	kN	kN	kN	–	–	N/μm	N/μm	Nm	N	kg	kg/m	kg · mm ² /m	kg · mm ²
PRK 36×6	36	6	1900	49.8	89.7	58.5	114	0.86	0.83	770	1000	1.2	2334	2.1	8	1290	3170
PRK 36×9	36	9	1900	53.7	87	63.1	111	0.88	0.87	530	689	1.2	1960	2.1	8	1290	3170
PRK 36×12	36	12	1900	58.7	90.6	69	115	0.89	0.88	510	660	1.2	1820	2.1	8	1290	3120
PRK 36×18	36	18	1900	62.9	88.3	70.3	104	0.88	0.87	260	330	1.2	707	2.1	8	1290	3120
PRK 36×24	36	24	1900	68.1	92.2	76.1	109	0.86	0.83	240	310	1.5	649	2.1	8	1290	3120
PRK 39×5	39	5	2100	71.2	134	81.4	164	0.83	0.8	750	980	1.3	2288	4	9.4	1780	8360
PRK 39×10	39	10	2100	84.1	135	96.1	166	0.88	0.87	500	650	1.3	1965	4	9.4	1780	8360
PRK 39×15	39	15	2100	92.4	136	106	167	0.89	0.88	390	510	1.3	1465	4	9.4	1780	8360
PRK 39×20	39	20	2100	95.2	130	109	159	0.88	0.87	220	290	1.3	694	4	9.4	1780	8360
PRK 39×25	39	25	2100	96.3	125	103	138	0.86	0.84	210	280	1.8	697	4	9.4	1780	8360
PRK 44×8	44	8	2400	71.9	131	84.4	166	0.86	0.84	761	989	1.6	3445	3.6	11.9	2890	8020
PRK 44×12	44	12	2400	79.2	131	93	167	0.89	0.87	610	800	1.6	2297	3.6	11.9	2890	8020
PRK 44×18	44	18	2400	86.9	132	102	169	0.89	0.88	430	550	1.6	1497	3.6	11.9	2890	8020
PRK 44×24	44	24	2400	92.5	133	103	158	0.88	0.86	290	380	1.6	725	3.6	11.9	2890	8020
PRK 44×30	44	30	2400	91.4	123	102	146	0.85	0.83	190	250	2.1	724	3.6	11.9	2890	8020
PRK 48×5	48	5	2600	109	241	132	321	0.81	0.76	1080	1410	1.9	2698	7.7	14.2	4090	23000
PRK 48×8	48	8	2600	120	235	138	288	0.86	0.83	889	1156	1.9	2583	7.7	14.2	4090	23000
PRK 48×10	48	10	2600	128	238	146	291	0.87	0.85	760	980	1.9	2405	7.7	14.2	4090	23000
PRK 48×15	48	15	2600	142	243	162	297	0.89	0.88	600	780	1.9	2072	7.7	14.2	4090	23000
PRK 48×20	48	20	2600	146	231	167	283	0.89	0.88	460	600	1.9	1423	7.7	14.2	4090	23000
PRK 48×25	48	25	2600	157	246	180	300	0.88	0.87	320	420	1.9	782	7.7	14.2	4090	23000
PRK 48×30	48	30	2600	152	233	174	285	0.87	0.85	344	384	2.5	1260	7.7	14.2	4090	23000

F _{pr}	N	preload force
I _{nn}	kg · mm ²	inertia of a rotating nut
I _{ns}	kg · mm ²	inertia of rollers with rotating shaft
L _{tp}	mm	max. threaded shaft length
m _n	kg	mass of nut
m _s	kg	mass of threaded shaft
R _{ng}	N/μm	min. nominal stiffness of the nut
R _{nr}	N/μm	reference nominal stiffness of the nut
S _{ap}	mm	max. axial play
T _{pr}	Nm	preload torque
Z _n	cm ³	initial grease volume for the nut
Z _s	cm ³	initial grease volume for the screw shaft



PRK

Ins	Z _n	Z _s	d ₁	d ₂	D ³⁾	A	A ₁	A ₂	D ₁	J	G	Q	B	D ₂	D ₃	u
					g6/H7	h12				js12						
kg · mm ²	cm ³	cm ³ /m	mm	mm	mm	mm	mm	mm	mm	mm	–	–	mm	mm	mm	°
45.7	13	16	36.4	35.4	68	80	26.5	27	102	85	M8×6	M6	8	62	45	30
45.7	13	16	36.6	35.1	68	80	26.5	27	102	85	M8×6	M6	8	62	45	30
45.7	13	16	36.8	34.8	68	80	26.5	27	102	85	M8×6	M6	8	62	45	30
45.7	13	16	37.2	34.2	68	80	26.5	27	102	85	M8×6	M6	8	62	45	30
45.7	13	16	37.5	33.6	68	80	26.5	27	102	85	M8×6	M6	8	62	45	30
124	28	18	39.4	38.4	82	100	33.5	33	124	102	M10×6	M6	8	73	50	30
124	28	18	39.8	37.9	82	100	33.5	33	124	102	M10×6	M6	8	73	50	30
124	28	18	40.2	37.3	82	100	33.5	33	124	102	M10×6	M6	8	73	50	30
124	28	18	40.5	36.7	82	100	33.5	33	124	102	M10×6	M6	8	73	50	30
124	28	18	40.9	36.1	82	100	33.5	33	124	102	M10×6	M6	8	73	50	30
119	23	20	44.5	43.2	82	90	28.5	33	124	102	M10×6	M6	8	74	56	30
119	23	20	44.8	42.8	82	90	28.5	33	124	102	M10×6	M6	8	74	56	30
118	23	20	45.2	42.3	82	90	28.5	33	124	102	M10×6	M6	8	74	56	30
118	23	20	45.5	41.7	82	90	28.5	33	124	102	M10×6	M6	8	74	56	30
118	23	20	45.9	41.1	82	90	28.5	33	124	102	M10×6	M6	8	74	56	30
371	54	22	48.4	47.4	105	127	45	37	150	127	M12×6	M8×1	9	90	60	30
371	54	22	48.6	47.1	105	127	45	37	150	127	M12×6	M8×1	9	90	60	30
371	54	22	48.8	46.9	105	127	45	37	150	127	M12×6	M8×1	9	90	60	30
371	54	22	49.2	46.3	105	127	45	37	150	127	M12×6	M8×1	9	90	60	30
371	54	22	49.5	45.8	105	127	45	37	150	127	M12×6	M8×1	9	90	60	30
370	54	22	49.9	45.2	105	127	45	37	150	127	M12×6	M8×1	9	90	60	30
370	54	22	50.3	44.6	105	127	45	37	150	127	M12×6	M8×1	9	90	60	30

¹⁾ Standard number of rollers. Configuration not available for certain sizes

²⁾ Maximum number of rollers on request, or standard for certain sizes

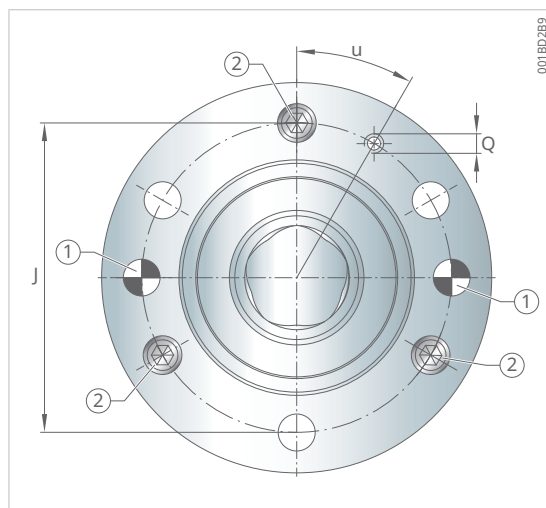
³⁾ g6 fit only applies to the finished surface, on side opposite to the lubrication port, marked with a 0.8/. Fit on the lubrication port side +0.5/0 mm.

(1) 2 dowel pins to hold preload

(2) 3 bolts for transport

4.1.13 PRK

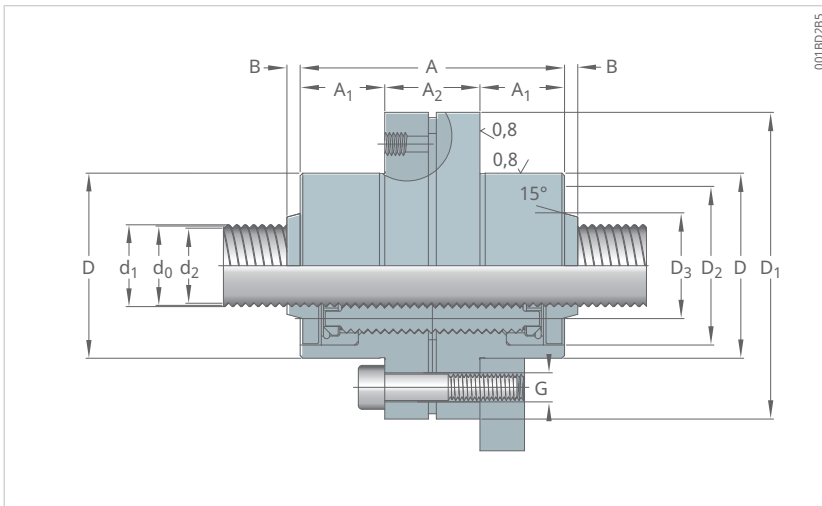
preloaded
planetary roller screws
flanged nut



PRK

Designation	d ₀	P _h	L _{tp}	C _a ¹⁾	C _{0a} ¹⁾	C _a ²⁾	C _{0a} ²⁾	η	η'	R _{ng}	R _{nr}	T _{pr}	F _{pr}	m _n	m _s	I _s	I _{nn}
						max	max			min							
-	mm	mm	mm	kN	kN	kN	kN	-	-	N/μm	N/μm	Nm	N	kg	kg/m	kg · mm ² /m	kg · mm ²
PRK 56×12	56	12	3100	117	217	137	276	0.87	0.86	810	1060	2.4	2952	6.5	19.3	7580	21300
PRK 56×24	56	24	3100	133	210	157	267	0.89	0.88	410	530	2.4	1579	6.5	19.3	7580	21300
PRK 56×36	56	36	3100	142	212	159	251	0.86	0.84	290	370	3.2	910	6.5	19.3	7580	21300
PRK 60×10	60	10	3400	187	390	213	477	0.86	0.83	1030	1340	2.7	2913	12.1	22.2	9990	52800
PRK 60×15	60	15	3400	206	391	235	478	0.88	0.87	830	1080	2.7	2635	12.1	22.2	9990	52800
PRK 60×20	60	20	3400	218	393	249	480	0.89	0.88	700	910	2.7	2326	12.1	22.2	9990	52800
PRK 64×12	64	12	3650	-	-	166	382	0.87	0.84	930	1200	3	3328	11.3	25.3	12900	50200
PRK 64×18	64	18	3650	177	363	186	391	0.89	0.87	790	1030	3	2900	11.3	25.3	12900	50200
PRK 64×24	64	24	3650	184	345	193	371	0.89	0.88	640	840	3	2318	11.3	25.3	12900	50200
PRK 64×30	64	30	3650	178	310	199	366	0.89	0.87	440	570	3	1292	11.3	25.3	12900	50200
PRK 64×36	64	36	3650	173	295	193	348	0.88	0.86	350	450	3	892	11.3	25.3	12900	50200

F _{pr}	N	preload force
I _{nn}	kg · mm ²	inertia of a rotating nut
I _{ns}	kg · mm ²	inertia of rollers with rotating shaft
L _{tp}	mm	max. threaded shaft length
m _n	kg	mass of nut
m _s	kg	mass of threaded shaft
R _{ng}	N/μm	min. nominal stiffness of the nut
R _{nr}	N/μm	reference nominal stiffness of the nut
S _{ap}	mm	max. axial play
T _{pr}	Nm	preload torque
Z _n	cm ³	initial grease volume for the nut
Z _s	cm ³	initial grease volume for the screw shaft



PRK

I _{ns}	Z _n	Z _s	d ₁	d ₂	D ³⁾	A	A ₁	A ₂	D ₁	J	G	Q	B	D ₂	D ₃	u
kg · mm ²	cm ³	cm ³ /m	mm	mm	g6/H7	h12				js12						
385	46	25	56.8	54.9	105	112	37.5	37	150	127	M12×6	M8×1	9	93	66	30
383	46	25	57.5	53.8	105	112	37.5	37	150	127	M12×6	M8×1	9	93	66	30
383	46	25	58.3	52.5	105	112	37.5	37	150	127	M12×6	M8×1	9	93	66	30
1100	100	27	60.8	58.9	122	152	53.5	45	180	150	M16×6	M8×1	9	110	71	30
1100	100	27	61.2	58.4	122	152	53.5	45	180	150	M16×6	M8×1	9	110	71	30
1100	100	27	61.5	57.8	122	152	53.5	45	180	150	M16×6	M8×1	9	110	71	30
984	46	29	64.8	62.9	120	129	42	45	180	150	M16×6	M8×1	11	106	75	30
914	54	29	65.2	62.3	120	129	42	45	180	150	M16×6	M8×1	11	106	75	30
911	54	29	65.5	61.8	120	129	42	45	180	150	M16×6	M8×1	11	106	75	30
771	69	29	65.9	61.2	120	129	42	45	180	150	M16×6	M8×1	11	106	75	30
771	69	29	66.3	60.6	120	129	42	45	180	150	M16×6	M8×1	11	106	75	30

1) Standard number of rollers. Configuration not available for certain sizes

2) Maximum number of rollers on request, or standard for certain sizes

3) g6 fit only applies to the finished surface, on side opposite to the lubrication port, marked with a 0.8√. Fit on the lubrication port side +0.5/0 mm.

(1) 2 dowel pins to hold preload

(2) 3 bolts for transport

4.2 Ultra Power roller screws HR

Concept

The Ultra Power roller screws represent the strongest variant of the Schaeffler planetary roller screw product line. They are designed for heavy loads and long service life.

The Ultra Power assortment of planetary roller screws is optimized to provide a load carrying capacity increase up to 60 % over the standard SR planetary roller screw with the same combination of diameter and lead, and, in addition, to reach the maximum possible service life within a compact space.

In order to operate within the principles of rolling fatigue and attain the L_{10} life performance, the maximum cycle operating load should not exceed 80 % of the C_a value.

The maximum load should be applied on the nut flange, not on the mounting bolts.

Roller screws without backlash or with preloaded split nut are not available in this assortment.

Application examples

The Ultra Power roller screws offer the power of hydraulic actuators combined with the precision and flexibility of electric control:

- Injection moulding machines for plastic and rubber
- Electro-mechanical presses
- Broaching machines
- Large machine tools
- Off-highway vehicles
- Oil & gas equipment
- Steel industry including casting and rolling
- Friction welding
- Hydro-electric power plants
- Powerful electro-mechanical cylinders
- Heavy lifting equipment

Design features	User benefits
Planetary roller screw concept with maximized load rating	Highest possible load carrying capacity of any type of rolling screw Reliability, resistance to shock loads, robustness in harsh environments
Nominal diameters from 60 mm to 240 mm	Wide standard assortment to fit most heavy duty applications
Long leads up to 50 mm	High linear speed capability with long lead (1 m/s for size 135×50)
Shaft lengths up to 8000 mm for diameters 120 mm and 135 mm	For additional information about longer shaft lengths, please contact your local Schaeffler representative
Maximum $n \cdot d_0 = 160000$	High speed for increased productivity
High dynamic load carrying capacity up to 3994 kN for HR assortment	Long service life
High static load carrying capacity up to 23350 kN for HR assortment	Ability to accommodate heavy shock loads without raceway damage
Ultra Power roller screws is available with axial play lower than 0.07 mm (0.1 mm for screws with lead ≥ 40 mm)	Unique combination of extreme load carrying capacity and driving accuracy
Standard versions include wipers (WPR in the designation). Screws can be delivered without wipers on request (designation with NOWPR suffix)	Solution contributes to long service life
Standard lead precision is G5, lead precision G3 or G1 on request	Precise driving accuracy
Optional support bearings	Wide variety of spherical roller thrust bearing combinations
Three standard versions are available: • HRC: cylindrical nut • HRF: nut with centered flange • HRP: nut with off-centered flange	Increased design flexibility
Adaptable tooling for non-standard, left hand threads or special designs	Custom solutions on request. Please contact your Schaeffler sales office for specific requirements and their feasibility

General symbols

C_{0a}	kN	static axial load rating
C_a	kN	dynamic axial load rating
d_0	mm	nominal diameter of screw shaft
I_s	$\text{kg} \cdot \text{mm}^2/\text{m}$	inertia of screw shaft per meter of shaft length
P_h	mm	lead
Z_n	cm^3	initial grease volume for the nut
Z_s	cm^3	initial grease volume for the screw shaft
η	%	efficiency
η'	%	indirect efficiency

54 Product overview HR Ultra Power roller screws

HR Ultra Power roller screws



Threaded rollers



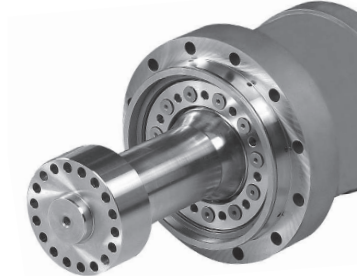
Components assembly

HRC Ultra Power planetary roller screws with cylindrical nut



Standard HRC

HRF/HRP Ultra Power planetary roller screws with flanged nut



HRP

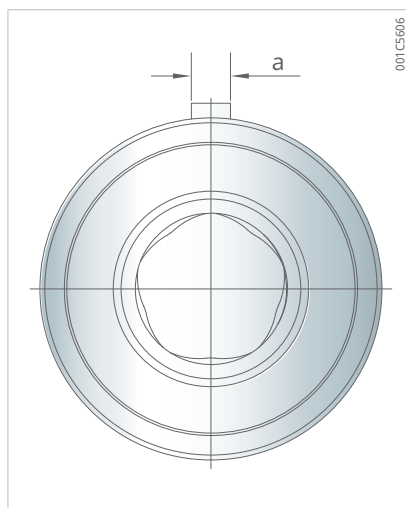
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4.2.1 HRC

ultra power planetary roller screw

cylindrical nut

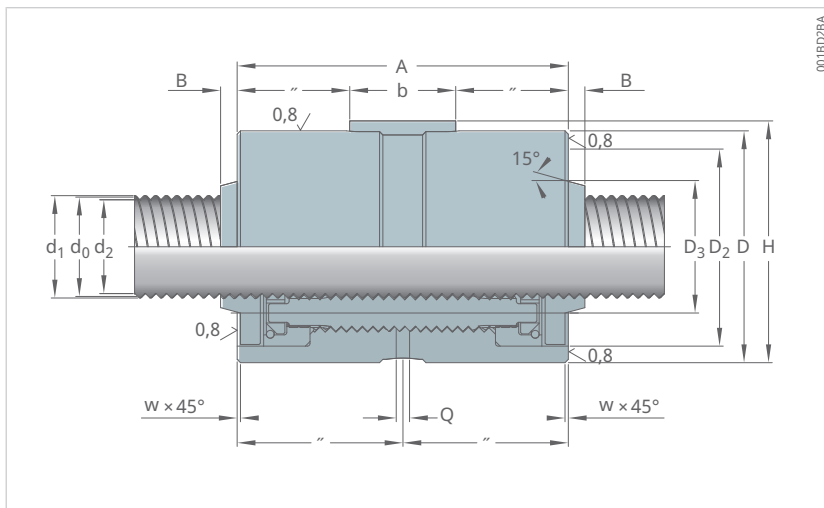
standard wiper



HRC

Designation	d_0	P_h	L_{tp}	C_a	C_{0a}	η	η'	S_{ap}	m_n	m_s	I_s
-	mm	mm	mm	kN	kN	-	-	mm	kg	kg/m	kg · mm ² /m
HRC 60×15	60	15	4250	494	1206	0.88	0.87	0.07	9	22.2	9990
HRC 60×20	60	20	4250	515	1181	0.89	0.88	0.07	9	22.2	9990
HRC 60×25	60	25	4250	530	1227	0.89	0.88	0.07	9	22.2	9990
HRC 60×30	60	30	4250	528	1216	0.88	0.87	0.07	9	22.2	9990
HRC 75×15	75	15	5500	836	2473	0.87	0.85	0.07	16	34.7	24400
HRC 75×20	75	20	5500	845	2455	0.88	0.87	0.07	16	34.7	24400
HRC 75×25	75	25	5500	855	2461	0.89	0.88	0.07	16	34.7	24400
HRC 75×30	75	30	5500	852	2420	0.89	0.88	0.07	16	34.7	24400
HRC 87×15	87	15	6000	1059	3527	0.86	0.84	0.07	26	45.8	42800
HRC 87×20	87	20	6000	1061	3452	0.88	0.86	0.07	26	45.8	42800
HRC 87×25	87	25	6000	1085	3513	0.89	0.87	0.07	26	45.8	42800
HRC 87×30	87	30	6000	1085	3465	0.89	0.88	0.07	26	45.8	42800
HRC 99×15	99	15	7500	1277	4671	0.85	0.82	0.07	40	60.4	74000
HRC 99×20	99	20	7500	1311	4741	0.87	0.85	0.07	40	60.4	74000
HRC 99×25	99	25	7500	1328	4749	0.88	0.87	0.07	40	60.4	74000
HRC 99×30	99	30	7500	1330	4694	0.89	0.87	0.07	40	60.4	74000
HRC 99×35	99	35	7500	1329	4639	0.89	0.88	0.07	40	60.4	74000
HRC 112.5×15	112.5	15	7500	1396	5288	0.84	0.8	0.07	58	76.8	120000
HRC 112.5×20	112.5	20	7500	1421	5297	0.86	0.84	0.07	58	76.8	120000
HRC 112.5×25	112.5	25	7500	1446	5341	0.88	0.86	0.07	58	76.8	120000
HRC 112.5×30	112.5	30	7500	1455	5315	0.88	0.87	0.07	58	76.8	120000
HRC 112.5×35	112.5	35	7500	1461	5289	0.89	0.88	0.07	58	76.8	120000

I_{nn}	kg · mm ²	inertia of a rotating nut
I_{ns}	kg · mm ²	inertia of rollers with rotating shaft
L_{tp}	mm	max. threaded shaft length
m_n	kg	mass of nut
m_s	kg	mass of threaded shaft
P_h	mm	lead
S_{ap}	mm	max. axial play
Z_n	cm ³	initial grease volume for the nut
Z_s	cm ³	initial grease volume for the screw shaft



HRC

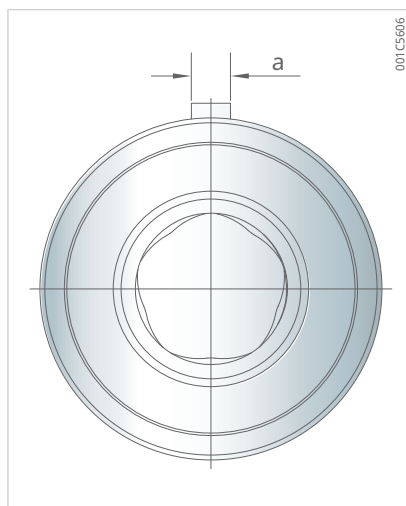
I _{nn}	I _{ns}	Z _n	Z _s	d ₁	d ₂	D	A	w	a	b	H	Q	B	D ₂	D ₃
kg · mm ²	kg · mm ²	cm ³	cm ³ /m	mm	mm	g6/H7	mm	mm	h9	mm	mm	mm	mm	mm	mm
18700	1680	90	27	61.1	58.5	122	171	1	10	56	125	11	9	110	71
18700	1680	90	27	61.5	58	122	171	1	10	56	125	11	9	110	71
18700	1680	90	27	61.9	57.5	122	171	1	10	56	125	11	9	110	71
18700	1680	90	27	62.3	57	122	171	1	10	56	125	11	9	110	71
51700	5130	170	33	76.1	73.5	150	213	1	10	63	153	11	10	136	87
51700	5130	170	33	76.5	73	150	213	1	10	63	153	11	10	136	87
51700	5130	170	33	76.9	72.5	150	213	1	10	63	153	11	10	136	87
51700	5130	170	33	77.3	72	150	213	1	10	63	153	11	10	136	87
111000	10600	270	38	88.1	85.5	175	245	1.5	12	100	178	12	12	158	103
111000	10600	270	38	88.5	85	175	245	1.5	12	100	178	12	12	158	103
111000	10600	270	38	88.9	84.5	175	245	1.5	12	100	178	12	12	158	103
111000	10600	270	38	89.3	84	175	245	1.5	12	100	178	12	12	158	103
220000	20400	400	44	100.1	97.5	200	280	1.5	16	100	204	15	12	180	112
220000	20400	400	44	100.5	97	200	280	1.5	16	100	204	15	12	180	112
220000	20400	400	44	100.9	96.5	200	280	1.5	16	100	204	15	12	180	112
220000	20400	400	44	101.3	96	200	280	1.5	16	100	204	15	12	180	112
220000	20400	400	44	101.6	95.5	200	280	1.5	16	100	204	15	12	180	112
423000	37100	550	50	113.6	111	230	300	1.5	16	100	234	15	12	210	140
423000	37100	550	50	114	110.5	230	300	1.5	16	100	234	15	12	210	140
423000	37100	550	50	114.4	110	230	300	1.5	16	100	234	15	12	210	140
423000	37100	550	50	114.8	109.5	230	300	1.5	16	100	234	15	12	210	140
423000	37100	550	50	115.1	109	230	300	1.5	16	100	234	15	12	210	140

4.2.2 HRC

ultra power planetary roller screw

cylindrical nut

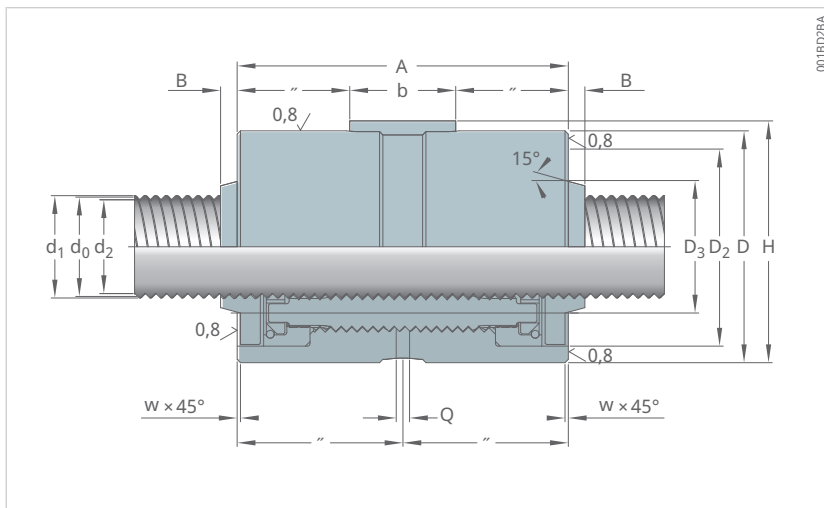
standard wiper



HRC

Designation	d_0	P_h	L_{tp}	C_a	C_{0a}	η	η'	S_{ap}	m_n	m_s	I_s
-	mm	mm	mm	kN	kN	-	-	mm	kg	kg/m	kg · mm ² /m
HRC 120×15	120	15	8000	1547	6179	0.83	0.79	0.07	64	88.8	160000
HRC 120×20	120	20	8000	1587	6263	0.86	0.83	0.07	64	88.8	160000
HRC 120×25	120	25	8000	1585	6123	0.87	0.85	0.07	64	88.8	160000
HRC 120×30	120	30	8000	1614	6207	0.88	0.87	0.07	64	88.8	160000
HRC 120×35	120	35	8000	1640	6291	0.89	0.87	0.07	64	88.8	160000
HRC 120×40	120	40	8000	1651	6301	0.89	0.88	0.1	64	88.8	160000
HRC 135×15	135	15	8000	1843	8037	0.82	0.77	0.07	108	113	261000
HRC 135×20	135	20	8000	1858	7922	0.85	0.82	0.07	108	113	261000
HRC 135×25	135	25	8000	1903	8059	0.86	0.84	0.07	108	113	261000
HRC 135×30	135	30	8000	1904	7943	0.88	0.86	0.07	108	113	261000
HRC 135×35	135	35	8000	1921	7953	0.88	0.87	0.07	108	113	261000
HRC 135×40	135	40	8000	1909	7796	0.89	0.87	0.1	108	113	261000
HRC 135×50	135	50	8000	1944	7901	0.89	0.88	0.1	108	113	261000
HRC 150×15	150	15	7200	2200	10446	0.8	0.75	0.07	163	139	390000
HRC 150×20	150	20	7200	2240	10459	0.84	0.8	0.07	163	139	390000
HRC 150×25	150	25	7200	2137	9553	0.86	0.83	0.07	163	139	390000
HRC 150×30	150	30	7200	2167	9611	0.87	0.85	0.07	163	139	390000
HRC 150×35	150	35	7200	2167	9483	0.88	0.86	0.07	163	139	390000
HRC 150×40	150	40	7200	2176	9449	0.88	0.87	0.1	163	139	390000
HRC 150×50	150	50	7200	2189	9379	0.89	0.88	0.1	163	139	390000

I_{nn}	kg · mm ²	inertia of a rotating nut
I_{ns}	kg · mm ²	inertia of rollers with rotating shaft
L_{tp}	mm	max. threaded shaft length
m_n	kg	mass of nut
m_s	kg	mass of threaded shaft
P_h	mm	lead
S_{ap}	mm	max. axial play
Z_n	cm ³	initial grease volume for the nut
Z_s	cm ³	initial grease volume for the screw shaft



HRC

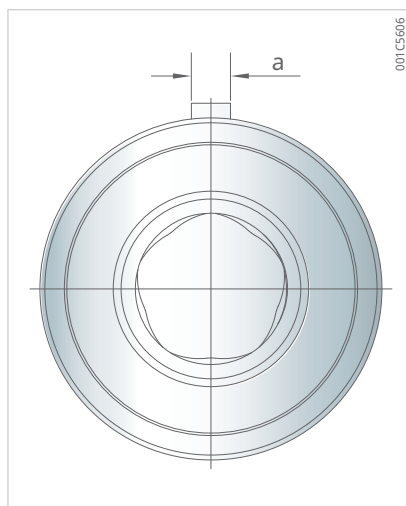
I _{nn}	I _{ns}	Z _n	Z _s	d ₁	d ₂	D	A	w	a	b	H	Q	B	D ₂	D ₃
kg · mm ²	kg · mm ²	cm ³	cm ³ /m	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
516000	47200	700	53	121.1	118.5	240	330	1.5	16	100	244	15	12	220	180
516000	47200	700	53	121.5	118	240	330	1.5	16	100	244	15	12	220	180
516000	47200	700	53	121.9	117.5	240	330	1.5	16	100	244	15	12	220	180
516000	47200	700	53	122.3	117	240	330	1.5	16	100	244	15	12	220	180
516000	47200	700	53	122.6	116.5	240	330	1.5	16	100	244	15	12	220	180
516000	47200	700	53	123	116	240	330	1.5	16	100	244	15	12	220	180
1180000	94200	980	60	136.1	133.5	280	370	2	28	120	286	15	11.5	250	180
1180000	94200	980	60	136.5	133	280	370	2	28	120	286	15	11.5	250	180
1180000	94200	980	60	136.9	132.5	280	370	2	28	120	286	15	11.5	250	180
1180000	94200	980	60	137.3	132	280	370	2	28	120	286	15	11.5	250	180
1180000	94200	980	60	137.6	131.5	280	370	2	28	120	286	15	11.5	250	180
1180000	94200	980	60	138	131	280	370	2	28	120	286	15	11.5	250	180
1180000	94200	980	60	138.8	130	280	370	2	28	120	286	15	11.5	250	180
2350000	160000	1350	66	151.1	148.5	320	412	3	32	160	327	15	12.5	280	230
2350000	160000	1350	66	151.5	148	320	412	3	32	160	327	15	12.5	280	230
2350000	160000	1350	66	151.9	147.5	320	412	3	32	160	327	15	12.5	280	230
2350000	160000	1350	66	152.3	147	320	412	3	32	160	327	15	12.5	280	230
2350000	160000	1350	66	152.6	146.5	320	412	3	32	160	327	15	12.5	280	230
2350000	160000	1350	66	153	146	320	412	3	32	160	327	15	12.5	280	230
2350000	160000	1350	66	153.8	145	320	412	3	32	160	327	15	12.5	280	230

4.2.3 HRC

ultra power planetary roller screw

cylindrical nut

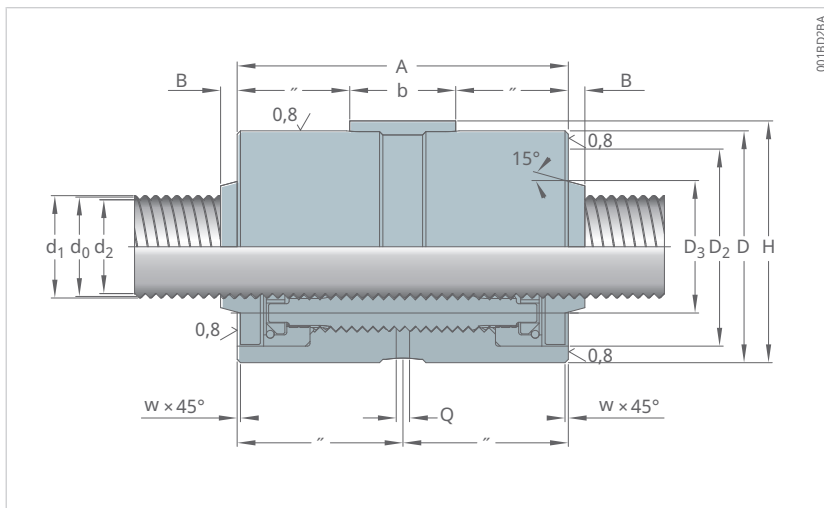
standard wiper



HRC

Designation	d_0	P_h	L_{tp}	C_a	C_{0a}	η	η'	S_{ap}	m_n	m_s	I_s
-	mm	mm	mm	kN	kN	-	-	mm	kg	kg/m	kg · mm ² /m
HRC 180×15	180	15	4300	3073	17366	0.78	0.71	0.07	310	200	809000
HRC 180×20	180	20	4300	3123	17319	0.82	0.77	0.07	310	200	809000
HRC 180×25	180	25	4300	3002	16004	0.84	0.81	0.07	310	200	809000
HRC 180×30	180	30	4300	3009	15790	0.86	0.83	0.07	310	200	809000
HRC 180×35	180	35	4300	3023	15690	0.87	0.85	0.07	310	200	809000
HRC 180×40	180	40	4300	3075	15931	0.88	0.86	0.1	310	200	809000
HRC 180×50	180	50	4300	3128	16073	0.89	0.87	0.1	310	200	809000
HRC 210×20	210	20	2300	3371	19164	0.8	0.74	0.07	416	270	1490000
HRC 210×25	210	25	2300	3435	19324	0.82	0.79	0.07	416	270	1490000
HRC 210×30	210	30	2300	3249	17472	0.84	0.81	0.07	416	270	1490000
HRC 210×35	210	35	2300	3265	17359	0.86	0.83	0.07	416	270	1490000
HRC 210×40	210	40	2300	3322	17635	0.87	0.85	0.1	416	270	1490000
HRC 210×50	210	50	2300	3381	17798	0.88	0.86	0.1	416	270	1490000
HRC 240×25	240	25	1300	3919	23387	0.81	0.76	0.07	533	353	2540000
HRC 240×30	240	30	1300	3931	23089	0.83	0.79	0.07	533	353	2540000
HRC 240×35	240	35	1300	3994	23350	0.84	0.82	0.07	533	353	2540000
HRC 240×40	240	40	1300	3808	21497	0.86	0.83	0.1	533	353	2540000
HRC 240×50	240	50	1300	3860	21536	0.87	0.85	0.1	533	353	2540000

I_{nn}	kg · mm ²	inertia of a rotating nut
I_{ns}	kg · mm ²	inertia of rollers with rotating shaft
L_{tp}	mm	max. threaded shaft length
m_n	kg	mass of nut
m_s	kg	mass of threaded shaft
P_h	mm	lead
S_{ap}	mm	max. axial play
Z_n	cm ³	initial grease volume for the nut
Z_s	cm ³	initial grease volume for the screw shaft



HRC

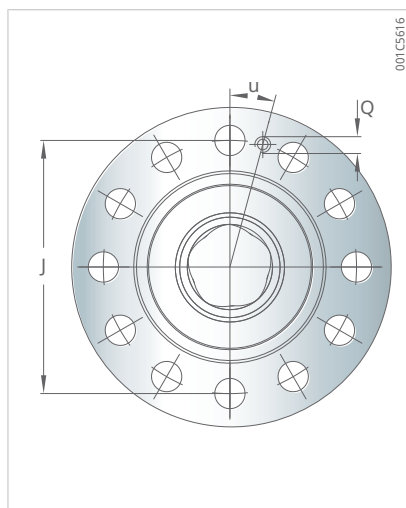
I _{nn}	I _{ns}	Z _n	Z _s	d ₁	d ₂	D	A	w	a	b	H	Q	B	D ₂	D ₃
kg · mm ²	kg · mm ²	cm ³	cm ³ /m	mm	mm	g6/H7	mm	mm	mm	mm	mm	mm	mm	mm	mm
6540000	437000	2500	79	181.1	178.5	390	528	3	32	160	397	20	15	340	250
6540000	437000	2500	79	181.5	178	390	528	3	32	160	397	20	15	340	250
6540000	437000	2500	79	181.9	177.5	390	528	3	32	160	397	20	15	340	250
6540000	437000	2500	79	182.3	177	390	528	3	32	160	397	20	15	340	250
6540000	437000	2500	79	182.6	176.5	390	528	3	32	160	397	20	15	340	250
6540000	437000	2500	79	183	176	390	528	3	32	160	397	20	15	340	250
6540000	437000	2500	79	183.8	175	390	528	3	32	160	397	20	15	340	250
11200000	854000	3150	92	211.5	208	440	570	3	40	200	450	20	15	398	250
11200000	854000	3150	92	211.9	207.5	440	570	3	40	200	450	20	15	398	250
11200000	854000	3150	92	212.3	207	440	570	3	40	200	450	20	15	398	250
11200000	854000	3150	92	212.6	206.5	440	570	3	40	200	450	20	15	398	250
11200000	854000	3150	92	213	206	440	570	3	40	200	450	20	15	398	250
11200000	854000	3150	92	213.8	205	440	570	3	40	200	450	20	15	398	250
17000000	1190000	5000	106	241.9	237.5	490	600	3	50	200	501	20	15	448	290
17000000	1190000	5000	106	242.3	237	490	600	3	50	200	501	20	15	448	290
17000000	1190000	5000	106	242.6	236.5	490	600	3	50	200	501	20	15	448	290
17000000	1190000	5000	106	243	236	490	600	3	50	200	501	20	15	448	290
17000000	1190000	5000	106	243.8	235	490	600	3	50	200	501	20	15	448	290

4.2.4 HRF, HRP

ultra power planetary roller screw

flanged nut

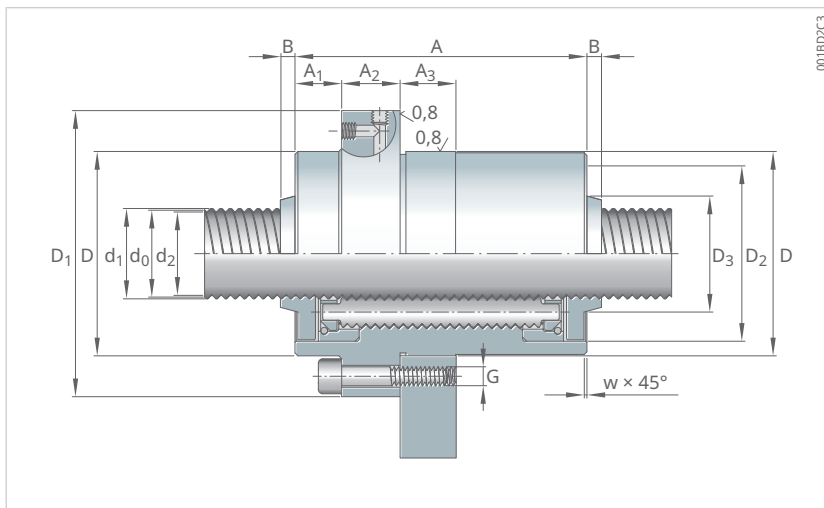
standard wiper



HRF, HRP

Designation	d_0	P_h	L_{tp}	C_a	C_{0a}	η	η'	S_{ap}	m_n	m_s	I_s	I_{nn}	I_{ns}
-	mm	mm	mm	kN	kN	-	-	mm	kg	kg/m	kg · mm ² /m	kg · mm ²	kg · mm ²
HRF/HRP 60×15	60	15	4250	495	1206	0.88	0.87	0.07	13	22.2	9990	29700	1680
HRF/HRP 60×20	60	20	4250	515	1181	0.89	0.88	0.07	13	22.2	9990	29700	1680
HRF/HRP 60×25	60	25	4250	530	1227	0.89	0.88	0.07	13	22.2	9990	29700	1680
HRF/HRP 60×30	60	30	4250	528	1216	0.88	0.87	0.07	13	22.2	9990	29700	1680
HRF/HRP 75×15	75	15	5500	836	2473	0.87	0.85	0.07	20	34.7	24400	73400	5130
HRF/HRP 75×20	75	20	5500	845	2455	0.88	0.87	0.07	20	34.7	24400	73400	5130
HRF/HRP 75×25	75	25	5500	855	2461	0.89	0.88	0.07	20	34.7	24400	73400	5130
HRF/HRP 75×30	75	30	5500	852	2420	0.89	0.88	0.07	20	34.7	24400	73400	5130
HRF/HRP 87×15	87	15	6000	1059	3527	0.86	0.84	0.07	31	45.8	42800	149000	10600
HRF/HRP 87×20	87	20	6000	1061	3452	0.88	0.86	0.07	31	45.8	42800	149000	10600
HRF/HRP 87×25	87	25	6000	1085	3513	0.89	0.87	0.07	31	45.8	42800	149000	10600
HRF/HRP 87×30	87	30	6000	1085	3465	0.89	0.88	0.07	31	45.8	42800	149000	10600
HRF/HRP 99×15	99	15	7500	1277	4671	0.85	0.82	0.07	46	60.4	74000	288000	20400
HRF/HRP 99×20	99	20	7500	1311	4741	0.87	0.85	0.07	46	60.4	74000	288000	20400
HRF/HRP 99×25	99	25	7500	1328	4749	0.88	0.87	0.07	46	60.4	74000	288000	20400
HRF/HRP 99×30	99	30	7500	1330	4694	0.89	0.87	0.07	46	60.4	74000	288000	20400
HRF/HRP 99×35	99	35	7500	1329	4639	0.89	0.88	0.07	46	60.4	74000	288000	20400
HRF/HRP 112,5×15	112.5	15	7500	1396	5288	0.84	0.8	0.07	66	76.8	120000	552000	37100
HRF/HRP 112,5×20	112.5	20	7500	1421	5297	0.86	0.84	0.07	66	76.8	120000	552000	37100
HRF/HRP 112,5×25	112.5	25	7500	1446	5341	0.88	0.86	0.07	66	76.8	120000	552000	37100
HRF/HRP 112,5×30	112.5	30	7500	1455	5315	0.88	0.87	0.07	66	76.8	120000	552000	37100
HRF/HRP 112,5×35	112.5	35	7500	1461	5289	0.89	0.88	0.07	66	76.8	120000	552000	37100

I_{nn}	kg · mm ²	inertia of a rotating nut
I_{ns}	kg · mm ²	inertia of rollers with rotating shaft
L_{tp}	mm	max. threaded shaft length
m_n	kg	mass of nut
m_s	kg	mass of threaded shaft
P_h	mm	lead
S_{ap}	mm	max. axial play
Z_n	cm ³	initial grease volume for the nut
Z_s	cm ³	initial grease volume for the screw shaft



HRF, HRP

Z _n	Z _s	d ₁	d ₂	D ¹⁾	A	A ₁	A ₁	A ₃	A ₂	D ₁	J	G	W	Q	B	D ₂	D ₃	u
				g6	h12	HRF	HRP				js12							
cm ³	cm ³ /m	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	-	mm	-	mm	mm	mm	°
90	27	61.1	58.5	122	171	70.5	25	40	30	166	146	M12×8	1	M8×1	9	110	71	22.5
90	27	61.5	58	122	171	70.5	25	40	30	166	146	M12×8	1	M8×1	9	110	71	22.5
90	27	61.9	57.5	122	171	70.5	25	40	30	166	146	M12×8	1	M8×1	9	110	71	22.5
90	27	62.3	57	122	171	70.5	25	40	30	166	146	M12×8	1	M8×1	9	110	71	22.5
170	33	76.1	73.5	150	213	89	30	40	35	195	174	M12×12	1	M8×1	10	136	87	15
170	33	76.5	73	150	213	89	30	40	35	195	174	M12×12	1	M8×1	10	136	87	15
170	33	76.9	72.5	150	213	89	30	40	35	195	174	M12×12	1	M8×1	10	136	87	15
170	33	77.3	72	150	213	89	30	40	35	195	174	M12×12	1	M8×1	10	136	87	15
270	38	88.1	85.5	175	245	102.5	35	40	40	220	200	M12×12	1.5	M8×1	12	158	103	15
270	38	88.5	85	175	245	102.5	35	40	40	220	200	M12×12	1.5	M8×1	12	158	103	15
270	38	88.9	84.5	175	245	102.5	35	40	40	220	200	M12×12	1.5	M8×1	12	158	103	15
270	38	89.3	84	175	245	102.5	35	40	40	220	200	M12×12	1.5	M8×1	12	158	103	15
400	44	100.1	97.5	200	280	115	40	40	50	245	224	M12×12	1.5	M8×1	12	180	112	15
400	44	100.5	97	200	280	115	40	40	50	245	224	M12×12	1.5	M8×1	12	180	112	15
400	44	100.9	96.5	200	280	115	40	40	50	245	224	M12×12	1.5	M8×1	12	180	112	15
400	44	101.3	96	200	280	115	40	40	50	245	224	M12×12	1.5	M8×1	12	180	112	15
400	44	101.6	95.5	200	280	115	40	40	50	245	224	M12×12	1.5	M8×1	12	180	112	15
550	50	113.6	111	230	300	125	50	40	50	286	260	M16×12	1.5	M12×1.75	12	210	140	15
550	50	114	110.5	230	300	125	50	40	50	286	260	M16×12	1.5	M12×1.75	12	210	140	15
550	50	114.4	110	230	300	125	50	40	50	286	260	M16×12	1.5	M12×1.75	12	210	140	15
550	50	114.8	109.5	230	300	125	50	40	50	286	260	M16×12	1.5	M12×1.75	12	210	140	15
550	50	115.1	109	230	300	125	50	40	50	286	260	M16×12	1.5	M12×1.75	12	210	140	15

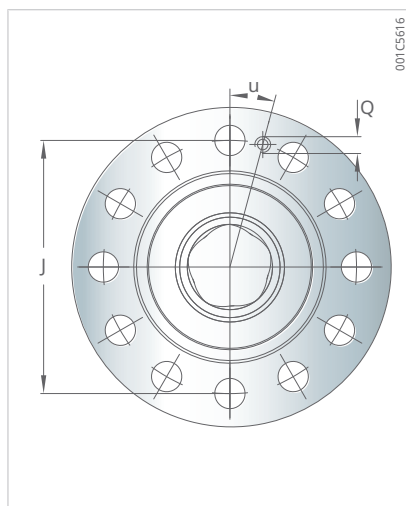
¹⁾ g6 fit only applies to the finished surface, on side opposite to the lubrication port, marked with a 0.8√. Fit on the lubrication port side +0.5/0 mm.

4.2.5 HRF, HRP

ultra power planetary roller screw

flanged nut

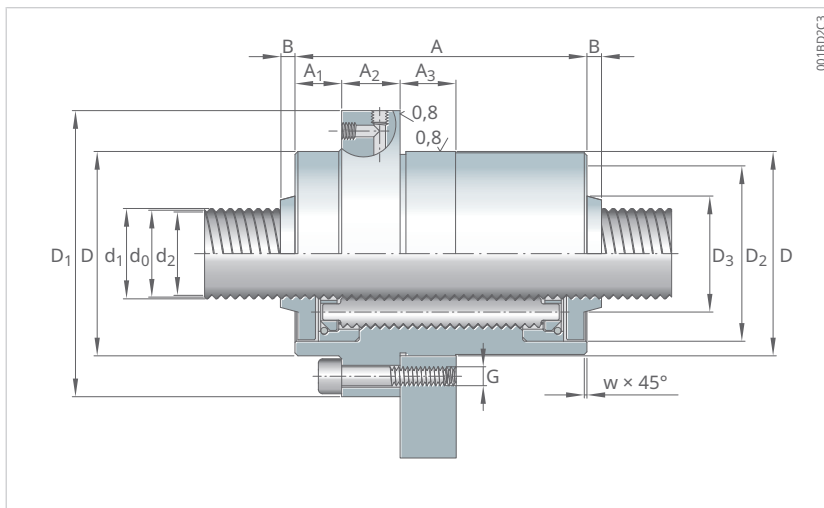
standard wiper



HRF, HRP

Designation	d_0	P_h	L_{tp}	C_a	C_{0a}	η	η'	S_{ap}	m_n	m_s	I_s	I_{nn}	I_{ns}
-	mm	mm	mm	kN	kN	-	-	mm	kg	kg/m	$\text{kg} \cdot \text{mm}^2/\text{m}$	$\text{kg} \cdot \text{mm}^2$	$\text{kg} \cdot \text{mm}^2$
HRF/HRP 120×15	120	15	8000	1547	6179	0.83	0.79	0.07	73	88.8	160000	676000	47200
HRF/HRP 120×20	120	20	8000	1587	6263	0.86	0.83	0.07	73	88.8	160000	676000	47200
HRF/HRP 120×25	120	25	8000	1585	6123	0.87	0.85	0.07	73	88.8	160000	676000	47200
HRF/HRP 120×30	120	30	8000	1614	6207	0.88	0.87	0.07	73	88.8	160000	676000	47200
HRF/HRP 120×35	120	35	8000	1640	6291	0.89	0.87	0.07	73	88.8	160000	676000	47200
HRF/HRP 120×40	120	40	8000	1651	6301	0.89	0.88	0.1	73	88.8	160000	676000	47200
HRF/HRP 135×15	135	15	8000	1843	8037	0.82	0.77	0.07	122	113	261000	1500000	94200
HRF/HRP 135×20	135	20	8000	1858	7922	0.85	0.82	0.07	122	113	261000	1500000	94200
HRF/HRP 135×25	135	25	8000	1903	8059	0.86	0.84	0.07	122	113	261000	1500000	94200
HRF/HRP 135×30	135	30	8000	1904	7943	0.88	0.86	0.07	122	113	261000	1500000	94200
HRF/HRP 135×35	135	35	8000	1921	7953	0.88	0.87	0.07	122	113	261000	1500000	94200
HRF/HRP 135×40	135	40	8000	1909	7796	0.89	0.87	0.1	122	113	261000	1500000	94200
HRF/HRP 135×50	135	50	8000	1944	7901	0.89	0.88	0.1	122	113	261000	1500000	94200
HRF/HRP 150×15	150	15	7200	2200	10446	0.8	0.75	0.07	180	139	390000	2900000	160000
HRF/HRP 150×20	150	20	7200	2240	10459	0.84	0.8	0.07	180	139	390000	2900000	160000
HRF/HRP 150×25	150	25	7200	2137	9553	0.86	0.83	0.07	180	139	390000	2900000	160000
HRF/HRP 150×30	150	30	7200	2167	9611	0.87	0.85	0.07	180	139	390000	2900000	160000
HRF/HRP 150×35	150	35	7200	2167	9483	0.88	0.86	0.07	180	139	390000	2900000	160000
HRF/HRP 150×40	150	40	7200	2176	9449	0.88	0.87	0.1	180	139	390000	2900000	160000
HRF/HRP 150×50	150	50	7200	2189	9379	0.89	0.88	0.1	180	139	390000	2900000	160000

I_{nn}	$\text{kg} \cdot \text{mm}^2$	inertia of a rotating nut
I_{ns}	$\text{kg} \cdot \text{mm}^2$	inertia of rollers with rotating shaft
L_{tp}	mm	max. threaded shaft length
m_n	kg	mass of nut
m_s	kg	mass of threaded shaft
P_h	mm	lead
S_{ap}	mm	max. axial play
Z_n	cm^3	initial grease volume for the nut
Z_s	cm^3	initial grease volume for the screw shaft



HRF, HRP

Z _n	Z _s	d ₁	d ₂	D ¹⁾	A	A ₁	A ₁	A ₃	A ₂	D ₁	J	G	W	Q	B	D ₂	D ₃	u
				g6	h12	HRF	HRP				js12							
cm ³	cm ³ /m	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	-	mm	-	mm	mm	mm	°
700	53	121.1	118.5	240	330	137.5	50	60	55	296	270	M16×12	1.5	M12×1.75	12	220	180	15
700	53	121.5	118	240	330	137.5	50	60	55	296	270	M16×12	1.5	M12×1.75	12	220	180	15
700	53	121.9	117.5	240	330	137.5	50	60	55	296	270	M16×12	1.5	M12×1.75	12	220	180	15
700	53	122.3	117	240	330	137.5	50	60	55	296	270	M16×12	1.5	M12×1.75	12	220	180	15
700	53	122.6	116.5	240	330	137.5	50	60	55	296	270	M16×12	1.5	M12×1.75	12	220	180	15
700	53	123	116	240	330	137.5	50	60	55	296	270	M16×12	1.5	M12×1.75	12	220	180	15
980	60	136.1	133.5	280	370	155	60	80	60	345	315	M18×12	2	M12×1.75	11.5	250	180	15
980	60	136.5	133	280	370	155	60	80	60	345	315	M18×12	2	M12×1.75	11.5	250	180	15
980	60	136.9	132.5	280	370	155	60	80	60	345	315	M18×12	2	M12×1.75	11.5	250	180	15
980	60	137.3	132	280	370	155	60	80	60	345	315	M18×12	2	M12×1.75	11.5	250	180	15
980	60	137.6	131.5	280	370	155	60	80	60	345	315	M18×12	2	M12×1.75	11.5	250	180	15
980	60	138	131	280	370	155	60	80	60	345	315	M18×12	2	M12×1.75	11.5	250	180	15
980	60	138.8	130	280	370	155	60	80	60	345	315	M18×12	2	M12×1.75	11.5	250	180	15
1350	66	151.1	148.5	320	412	171	65	80	70	385	355	M18×12	3	M12×1.75	12.5	280	230	15
1350	66	151.5	148	320	412	171	65	80	70	385	355	M18×12	3	M12×1.75	12.5	280	230	15
1350	66	151.9	147.5	320	412	171	65	80	70	385	355	M18×12	3	M12×1.75	12.5	280	230	15
1350	66	152.3	147	320	412	171	65	80	70	385	355	M18×12	3	M12×1.75	12.5	280	230	15
1350	66	152.6	146.5	320	412	171	65	80	70	385	355	M18×12	3	M12×1.75	12.5	280	230	15
1350	66	153	146	320	412	171	65	80	70	385	355	M18×12	3	M12×1.75	12.5	280	230	15
1350	66	153.8	145	320	412	171	65	80	70	385	355	M18×12	3	M12×1.75	12.5	280	230	15

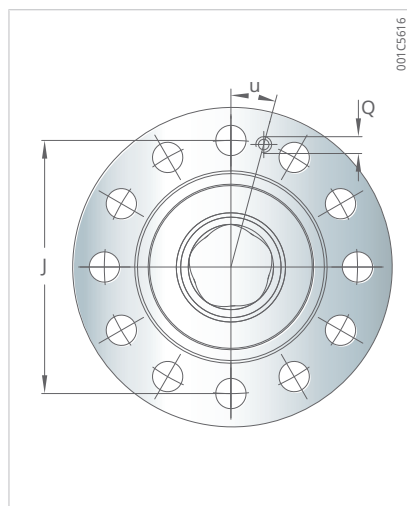
¹⁾ g6 fit only applies to the finished surface, on side opposite to the lubrication port, marked with a 0.8/. Fit on the lubrication port side +0.5/0 mm.

4.2.6 HRF, HRP

ultra power planetary roller screw

flanged nut

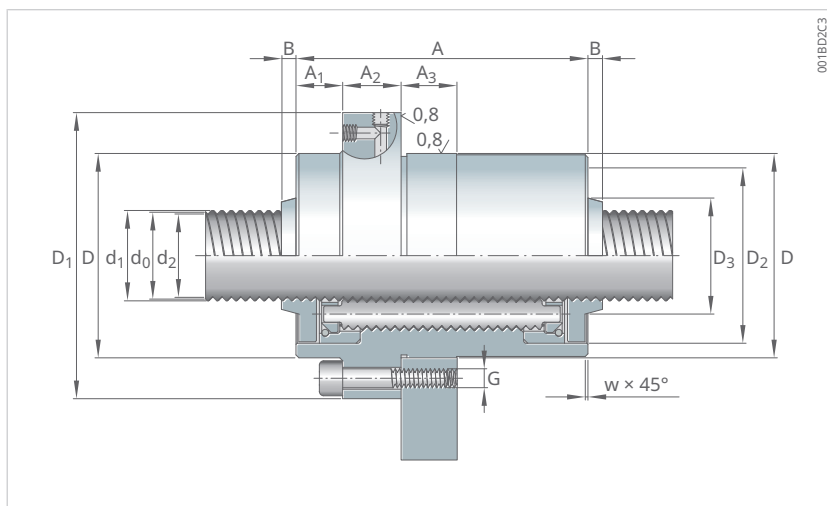
standard wiper



HRF, HRP

Designation	d_0	P_h	L_{tp}	C_a	C_{0a}	η	η'	S_{ap}	m_n	m_s	I_s	I_{nn}	I_{ns}
-	mm	mm	mm	kN	kN	-	-	mm	kg	kg/m	$\text{kg} \cdot \text{mm}^2/\text{m}$	$\text{kg} \cdot \text{mm}^2$	$\text{kg} \cdot \text{mm}^2$
HRF/HRP 180×15	180	15	4300	3073	17366	0.78	0.71	0.07	344	200	809000	8200000	437000
HRF/HRP 180×20	180	20	4300	3123	17319	0.82	0.77	0.07	344	200	809000	8200000	437000
HRF/HRP 180×25	180	25	4300	3002	16004	0.84	0.81	0.07	344	200	809000	8200000	437000
HRF/HRP 180×30	180	30	4300	3009	15790	0.86	0.83	0.07	344	200	809000	8200000	437000
HRF/HRP 180×35	180	35	4300	3023	15690	0.87	0.85	0.07	344	200	809000	8200000	437000
HRF/HRP 180×40	180	40	4300	3075	15931	0.88	0.86	0.1	344	200	809000	8200000	437000
HRF/HRP 180×50	180	50	4300	3128	16073	0.89	0.87	0.1	344	200	809000	8200000	437000
HRF/HRP 210×20	210	20	2300	3371	19164	0.8	0.74	0.07	465	270	1490000	14100000	854000
HRF/HRP 210×25	210	25	2300	3435	19324	0.82	0.79	0.07	465	270	1490000	14100000	854000
HRF/HRP 210×30	210	30	2300	3249	17472	0.84	0.81	0.07	465	270	1490000	14100000	854000
HRF/HRP 210×35	210	35	2300	3265	17359	0.86	0.83	0.07	465	270	1490000	14100000	854000
HRF/HRP 210×40	210	40	2300	3322	17635	0.87	0.85	0.1	465	270	1490000	14100000	854000
HRF/HRP 210×50	210	50	2300	3381	17798	0.88	0.86	0.1	465	270	1490000	14100000	854000
HRF/HRP 240×25	240	25	1300	3919	23387	0.81	0.76	0.07	594	353	2540000	21400000	1190000
HRF/HRP 240×30	240	30	1300	3931	23089	0.83	0.79	0.07	594	353	2540000	21400000	1190000
HRF/HRP 240×35	240	35	1300	3994	23350	0.84	0.82	0.07	594	353	2540000	21400000	1190000
HRF/HRP 240×40	240	40	1300	3808	21497	0.86	0.83	0.1	594	353	2540000	21400000	1190000
HRF/HRP 240×50	240	50	1300	3860	21536	0.87	0.85	0.1	594	353	2540000	21400000	1190000

I_{nn}	$\text{kg} \cdot \text{mm}^2$	inertia of a rotating nut
I_{ns}	$\text{kg} \cdot \text{mm}^2$	inertia of rollers with rotating shaft
L_{tp}	mm	max. threaded shaft length
m_n	kg	mass of nut
m_s	kg	mass of threaded shaft
P_h	mm	lead
S_{ap}	mm	max. axial play
Z_n	cm^3	initial grease volume for the nut
Z_s	cm^3	initial grease volume for the screw shaft



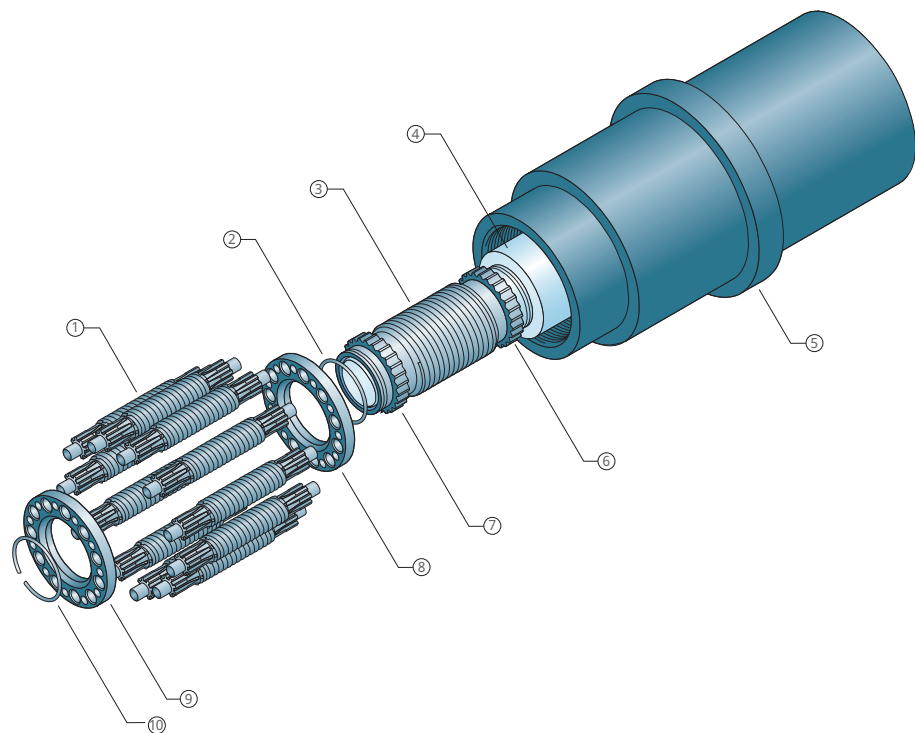
HRF, HRP

Z _n	Z _s	d ₁	d ₂	D ¹⁾	A	A ₁	A ₁	A ₃	A ₂	D ₁	J	G	W	Q	B	D ₂	D ₃	u
				g6	h12	HRF	HRP				js12							
cm ³	cm ³ /m	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	-	mm	-	mm	mm	mm	°
2500	79	181.1	178.5	390	528	219	96	100	90	470	433	M22×12	3	M12×1.75	15	340	250	15
2500	79	181.5	178	390	528	219	96	100	90	470	433	M22×12	3	M12×1.75	15	340	250	15
2500	79	181.9	177.5	390	528	219	96	100	90	470	433	M22×12	3	M12×1.75	15	340	250	15
2500	79	182.3	177	390	528	219	96	100	90	470	433	M22×12	3	M12×1.75	15	340	250	15
2500	79	182.6	176.5	390	528	219	96	100	90	470	433	M22×12	3	M12×1.75	15	340	250	15
2500	79	183	176	390	528	219	96	100	90	470	433	M22×12	3	M12×1.75	15	340	250	15
2500	79	183.8	175	390	528	219	96	100	90	470	433	M22×12	3	M12×1.75	15	340	250	15
3150	92	211.5	208	440	570	235	100	100	100	530	490	M24×12	3	M12×1.75	15	398	250	15
3150	92	211.9	207.5	440	570	235	100	100	100	530	490	M24×12	3	M12×1.75	15	398	250	15
3150	92	212.3	207	440	570	235	100	100	100	530	490	M24×12	3	M12×1.75	15	398	250	15
3150	92	212.6	206.5	440	570	235	100	100	100	530	490	M24×12	3	M12×1.75	15	398	250	15
3150	92	213	206	440	570	235	100	100	100	530	490	M24×12	3	M12×1.75	15	398	250	15
3150	92	213.8	205	440	570	235	100	100	100	530	490	M24×12	3	M12×1.75	15	398	250	15
5000	106	241.9	237.5	490	600	250	100	100	100	580	540	M24×16	3	M12×1.75	15	448	290	11.25
5000	106	242.3	237	490	600	250	100	100	100	580	540	M24×16	3	M12×1.75	15	448	290	11.25
5000	106	242.6	236.5	490	600	250	100	100	100	580	540	M24×16	3	M12×1.75	15	448	290	11.25
5000	106	243	236	490	600	250	100	100	100	580	540	M24×16	3	M12×1.75	15	448	290	11.25
5000	106	243.8	235	490	600	250	100	100	100	580	540	M24×16	3	M12×1.75	15	448	290	11.25

¹⁾ g6 fit only applies to the finished surface, on side opposite to the lubrication port, marked with a 0.8√. Fit on the lubrication port side +0.5/0 mm.

4.3 Inverted roller screws ISR

55 ISR inverted roller screws



001BD2C7

1	Satellite rollers	2	Snap ring
3	Threaded shaft	4	Push tube
5	Nut	6	External-toothed ring
7	External-toothed ring	8	Guide ring
9	Guide ring	10	Snap ring

Concept

The inverted planetary roller screw provides powerful electro-mechanical actuation when compactness, low torque and high load capabilities are prerequisites.

The rollers, synchronized with the threaded shaft through toothed rings, translate along the nut. The application loads acting on the translating push tube transit through the planetary rollers to the rotating shaft or nut.

Toothed rings and guides provide the rolling motion and the even circumferential position of the rollers, for near-perfect load distribution. The rings and guides also avoid any parasitic friction between the rollers.

Application examples

The compact inverted roller screw, incorporated within an electro-mechanical actuator, can replace hydraulic or pneumatic actuation systems typically found in the following applications:

- Factory automation (for example, automotive assembly lines)
- Welding guns
- Portable high power tools
- Oil and gas subsea equipment
- Aerospace actuators

56 Inverted roller screw ISR



001DB9C0

Design features	User benefits
Planetary roller screw concept without recirculation	Long service life and increased reliability improve productivity
Leads as small as 2.4 mm, combined with the benefits of the robust planetary roller screw design	Small leads achieved with robust threads, while providing high load carrying capacity and high axial stiffness Reduced requirements for electric motor torque to reach high load actuation
Either nut or shaft can be driven, the non-rotating and translating component acting directly as the push tube	Design flexibility Anti-rotation function can be easily integrated into the component acting as the push tube
Custom screw-to-motor attachments for easy integration	Compact, light weight solution with fewer parts for easy installation
Standard delivery without wipers	Guiding and sealing functions easily integrated on nut or shaft, resulting in high performance sealing
High speed and acceleration capability, similar to planetary roller screws	Preferred solutions for applications with high duty cycle and high cycle rates
Flexible production equipment	Custom designs to fit customer applications. Multiple dimensions can be created, starting from the standard assortment of planetary roller screws
Small lead associated to a relatively large nominal nut diameter	Low backdriving ability and even self locking solutions are possible

General symbols

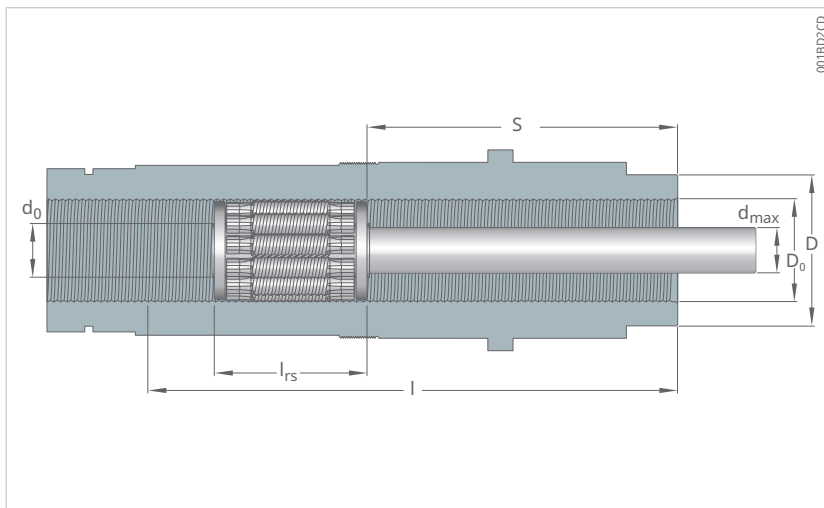
C_{0a}	kN	static axial load rating
C_a	kN	dynamic axial load rating
d_0	mm	nominal diameter of screw shaft
P_h	mm	lead
S_{ap}	mm	max. axial play
η	%	efficiency
η'	%	indirect efficiency

4.3.1 ISR

inverted

roller screw

Designation	d ₀	D ₀	P _h	C _a	C _{0a}
–	mm	mm	mm	kN	kN
ISR 18×2,4R3	18	30	2.4	35.6	69.9
ISR 18×3R3	18	30	3	37.8	70.9
ISR 18×4R3	18	30	4	36.6	61.2
ISR 18×5R3	18	30	5	37.8	59.2
ISR 18×6R3	18	30	6	40.4	61.9
ISR 21×2,4R3	21	35	2.4	55.5	102
ISR 21×3R3	21	35	3	59.6	105
ISR 21×4R3	21	35	4	63.3	104
ISR 21×5R3	21	35	5	61.5	91.8
ISR 21×6R3	21	35	6	64.2	92.2
ISR 24×2,4R3	24	40	2.4	63.7	118
ISR 24×3R3	24	40	3	67.2	119
ISR 24×4R3	24	40	4	72	119
ISR 24×5R3	24	40	5	75.3	118
ISR 24×6R3	24	40	6	74.5	109
ISR 30×2,4R3	30	50	2.4	93.2	195
ISR 30×3R3	30	50	3	99.2	198
ISR 30×4R3	30	50	4	105	194
ISR 30×5R3	30	50	5	111	197
ISR 30×6R3	30	50	6	117	200
ISR 39×2,4R3	39	65	2.4	135	311
ISR 39×3R3	39	65	3	143	311
ISR 39×4R3	39	65	4	153	312
ISR 39×5R3	39	65	5	161	310
ISR 39×6R3	39	65	6	169	314
ISR 48×2,4R3	48	80	2.4	209	564
ISR 48×3R3	48	80	3	221	567
ISR 48×4R3	48	80	4	234	557
ISR 48×5R3	48	80	5	247	554
ISR 48×6R3	48	80	6	259	559



ISR

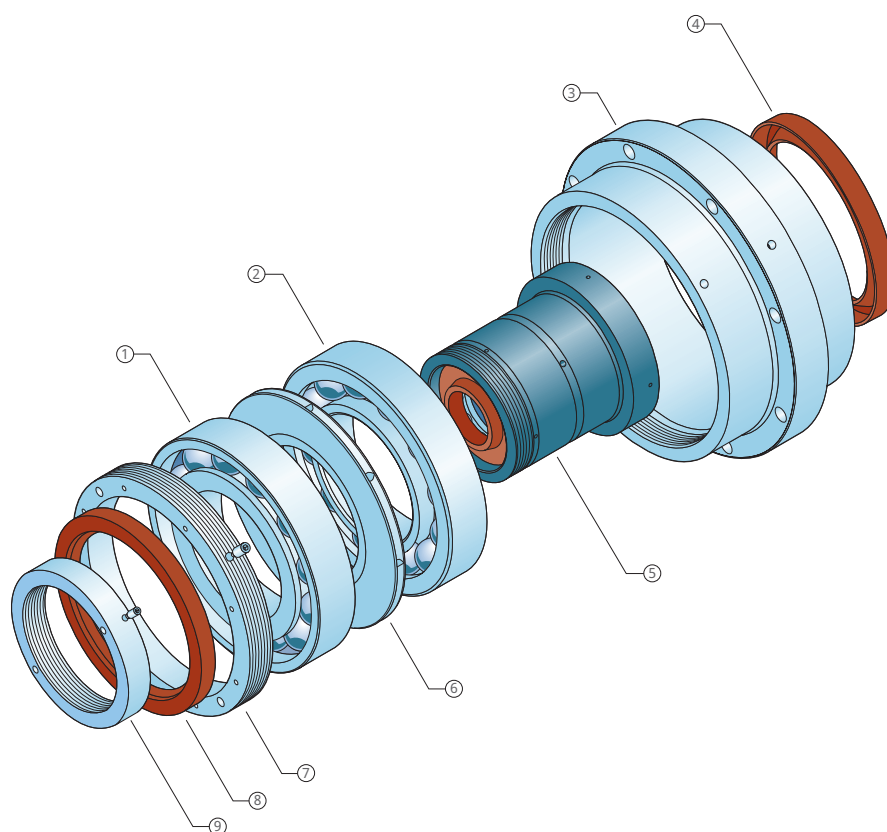
η_p	η'_p	S_{ap}	D	$d_{max}^{1)}$	$S^{2)}$	l_{rs}
–	–	mm	mm	mm	mm	mm
0.69	0.55	0.02	38	16	65	50
0.73	0.63	0.02	38	16	60	50
0.77	0.7	0.02	38	16	55	50
0.8	0.75	0.04	38	16	50	50
0.82	0.78	0.04	38	16	45	50
0.66	0.48	0.02	45	18	84	56
0.7	0.57	0.02	45	18	79	56
0.75	0.67	0.02	45	18	74	56
0.78	0.72	0.04	45	18	69	56
0.8	0.75	0.04	45	18	64	56
0.63	0.41	0.02	50	21	210	65
0.68	0.53	0.02	50	21	170	65
0.73	0.63	0.02	50	21	110	65
0.76	0.68	0.04	50	21	80	65
0.79	0.73	0.04	50	21	75	65
0.58	0.28	0.02	60	27	210	75
0.63	0.41	0.02	60	27	210	75
0.69	0.55	0.02	60	27	210	75
0.73	0.63	0.04	60	27	200	75
0.76	0.68	0.04	60	27	200	75
0.52	0.08	0.02	75	36	195	90
0.57	0.25	0.02	75	36	195	90
0.64	0.44	0.02	75	36	195	90
0.68	0.53	0.04	75	36	195	90
0.72	0.61	0.04	75	36	195	90
0.47	0	0.02	90	44	171	114
0.52	0.08	0.02	90	44	171	114
0.59	0.31	0.02	90	44	171	114
0.64	0.44	0.04	90	44	171	114
0.68	0.53	0.04	90	44	171	114

¹⁾ Recommended maximum push tube diameter for standard inverted roller screws. For additional information about large push tube diameters, please contact your local representative.

²⁾ For additional information about longer strokes, please contact your local representative.

4.4 Rotating nut with planetary roller screws SRR

57 SRR planetary roller screws with rotating nuts



001BD2CF

1	Bearing	2	Bearing
3	Bearing housing	4	Seal
5	Roller screw nut	6	Spacer ring
7	Housing nut	8	Seal
9	Preload nut for bearing		

Concept

A rotating nut planetary roller screw assembly is designed to function like an electro-mechanical cylinder, and is recommended for applications where space is limited.

The basic assembly consists of a housing, two angular contact ball bearings and a roller screw nut. In the case of direct drive, a customer supplied hollow motor drives the screw nut.

In the case of indirect drive, a customer supplied pulley or gear, attached to the back of the roller screw assembly is needed to drive the nut. The rotation of the nut translates the screw shaft which operates as a push tube of an electro-mechanical cylinder. The screw shaft must be fitted with an anti-rotation device and must be precisely guided.

Important:

Schaeffler recommends that the roller screw nut be relubricated by regular injection of lubricant through an axial hole and a radial hole drilled in the roller screw shaft ¹⁾.

Customers are responsible for sourcing and assembling the motor and/or drive train and frame holding the bearings housing.

- 1) For technical assistance regarding the roller screw nut relubrication, please contact your local Schaeffler representative

Application examples

- Production processes in automotive industry (servopresses, tube bending, forming, locking devices, etc.)
- Process in the injection moulding industry (part ejection)
- Short stroke and oscillating applications

4

Design features	User benefits
Planetary roller screws with a nut already fitted into a bearing housing	Convenience of a roller screw and integrated support function for easy design and assembly
Maximum $n_{d0} = 160000$ and acceleration up to 12000 rad/s^2	Ideal combination of high load carrying capacity, speed and acceleration for heavy duty applications and intensive cycling
72 series angular contact ball bearings mounted in the housing are fitted with the nut and then adjusted for preload	Length saving solution ready to incorporate into application. Simplified engineering for machine builders
Bearings in back-to-back preloaded arrangement	Robust and stiff bearing arrangement to accommodate moment loads from the power transmission
2 garter seals (2 shields for size $d_0 = 60 \text{ mm}$) protect the bearings against contaminants, making these assemblies relubrication-free under normal operating conditions	Durable assembly for operation in difficult environments
Wiper seals at each end of the nut of a standard assembly help to protect the nut from contaminants	
A grease fitting for the bearings is located on the outside surface of the housing. Standard grease is LGEP2. Specific grease is on request	Easy maintenance
Roller screw nut relubricated through conduits drilled in the screw shaft	Independent relubrication for the bearings and for the roller screw
Two versions are available: • SRR with axial play • BRR without backlash	Stiffness and running accuracy are further improved when a roller screw without backlash is selected

58 Product overview SRR/BRR Rotating nut with planetary roller screws

SRR/BRR planetary roller screws with rotating nut



Standard SRR



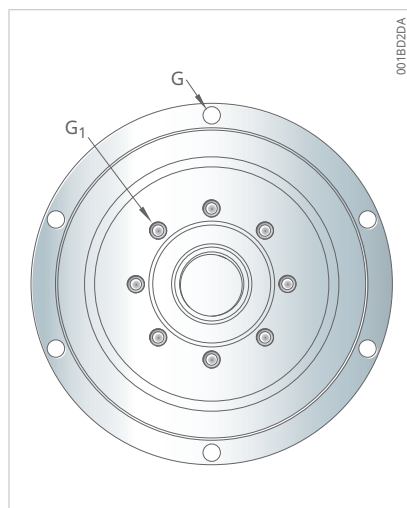
Components assembly

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4.4.1 SRR, BRR

planetary roller screws

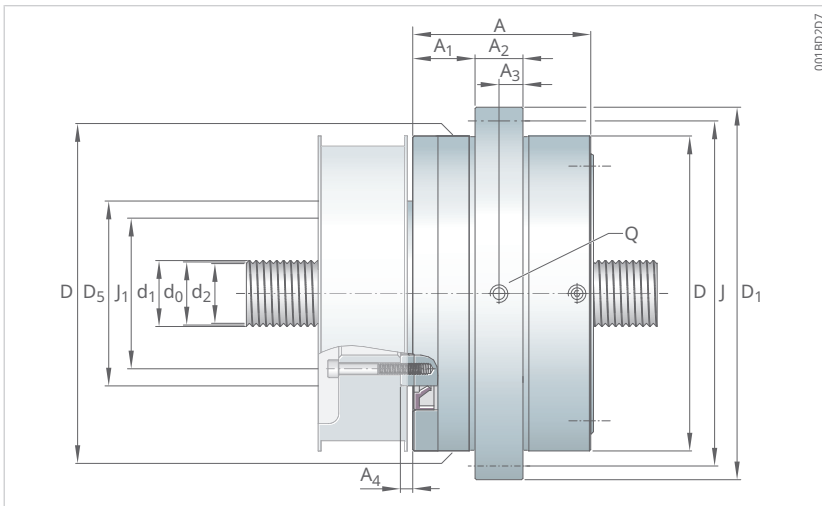
rotating nut



SRR, BRR

Designation	d ₀	P _h	L _{tp}	C _a	C _{0a}	η	η'	S _{ap}	m _n	m _s	I _{nn}	Z _n
-	mm	mm	mm	kN	kN	-	-	mm	kg	kg/m	kg · mm ²	cm ³
SRR/BRR 25×5	25	5	1650	68.4	122	0.87	0.85	0.02	7	3.9	1100	10.2
SRR/BRR 25×10	25	10	1650	78.5	118	0.89	0.88	0.04	7	3.9	1100	10.2
SRR/BRR 25×15	25	15	1650	85.6	120	0.87	0.85	0.07	7	3.9	1100	10.2
SRR/BRR 30×5	30	5	2000	91.9	178	0.86	0.83	0.02	12	5.6	2900	13.7
SRR/BRR 30×10	30	10	2000	106	174	0.89	0.88	0.04	12	5.6	2900	13.7
SRR/BRR 30×15	30	15	2000	119	181	0.88	0.87	0.07	12	5.6	2900	13.7
SRR/BRR 30×20	30	20	2000	123	177	0.86	0.83	0.07	12	5.6	2900	13.7
SRR/BRR 39×5	39	5	2650	129	269	0.83	0.8	0.02	20	9.4	10500	27.9
SRR/BRR 39×10	39	10	2650	153	270	0.88	0.87	0.04	20	9.4	10500	27.9
SRR/BRR 39×15	39	15	2650	168	273	0.89	0.88	0.07	20	9.4	10500	27.9
SRR/BRR 39×20	39	20	2650	173	261	0.88	0.87	0.07	20	9.4	10500	27.9
SRR/BRR 39×25	39	25	2650	175	249	0.86	0.84	0.07	20	9.4	10500	27.9
SRR/BRR 48×5	48	5	3300	198	482	0.81	0.76	0.02	37	14.2	28000	54
SRR/BRR 48×10	48	10	3300	232	475	0.87	0.85	0.04	37	14.2	28000	54
SRR/BRR 48×15	48	15	3300	258	486	0.89	0.88	0.07	37	14.2	28000	54
SRR/BRR 48×20	48	20	3300	266	462	0.89	0.88	0.07	37	14.2	28000	54
SRR/BRR 48×25	48	25	3300	286	491	0.88	0.87	0.07	37	14.2	28000	54
SRR/BRR 60×10	60	10	4250	339	780	0.86	0.83	0.04	100	22.2	85000	103
SRR/BRR 60×15	60	15	4250	373	783	0.88	0.87	0.07	100	22.2	85000	103
SRR/BRR 60×20	60	20	4250	395	786	0.89	0.88	0.07	100	22.2	85000	103

C _{0a}	kN	static axial load rating
C _a	kN	dynamic axial load rating
d ₀	mm	nominal diameter of screw shaft
I _{nn}	kg · mm ²	inertia of a rotating nut
L _{tp}	mm	max. threaded shaft length
m _n	kg	mass of nut
m _s	kg	mass of threaded shaft
P _h	mm	lead
S _{ap}	mm	max. axial play
Z _n	cm ³	initial grease volume for the nut
Z _s	cm ³	initial grease volume for the screw shaft
η	%	efficiency
η'	%	indirect efficiency



SRR, BRR (Pulley not part of the scope of delivery)

Z _s	d ₁	d ₂	D	A	A ₁	A ₂	A ₃	A ₄ ¹⁾	D ₁	J	D ₅	J ₁	G ²⁾	G ³⁾	G ₁	Q
			g6/H7	h12							g7					
cm ³ /m	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	-	-	-
11	25.4	24.3	120	81.5	28	25	12.5	6.5	153	137	70	58	9	6	M6×8	M6
11	25.8	23.8	120	81.5	28	25	12.5	6.5	153	137	70	58	9	6	M6×8	M6
11	26.2	23.2	120	81.5	28	25	12.5	6.5	153	137	70	58	9	6	M6×8	M6
13.2	30.4	29.4	150	91.5	30	25	12.5	7.5	190	170	85	70	11	6	M6×8	M8×1
13.2	30.8	28.8	150	91.5	30	25	12.5	7.5	190	170	85	70	11	6	M6×8	M8×1
13.2	31.2	28.3	150	91.5	30	25	12.5	7.5	190	170	85	70	11	6	M6×8	M8×1
13.2	31.5	27.6	150	91.5	30	25	12.5	7.5	190	170	85	70	11	6	M6×8	M8×1
17.1	39.4	38.4	180	109.5	34	35	17.5	12.5	222	202	110	90	13	6	M8×8	M8×1
17.1	39.8	37.9	180	109.5	34	35	17.5	12.5	222	202	110	90	13	6	M8×8	M8×1
17.1	40.2	37.3	180	109.5	34	35	17.5	12.5	222	202	110	90	13	6	M8×8	M8×1
17.1	40.5	36.7	180	109.5	34	35	17.5	12.5	222	202	110	90	13	6	M8×8	M8×1
17.1	40.9	36.1	180	109.5	34	35	17.5	12.5	222	202	110	90	13	6	M8×8	M8×1
21.1	48.4	47.4	230	130	45.5	35	17.5	9	272	252	135	110	13	8	M8×8	M8×1
21.1	48.8	46.9	230	130	45.5	35	17.5	9	272	252	135	110	13	8	M8×8	M8×1
21.1	49.2	46.3	230	130	45.5	35	17.5	9	272	252	135	110	13	8	M8×8	M8×1
21.1	49.5	45.8	230	130	45.5	35	17.5	9	272	252	135	110	13	8	M8×8	M8×1
21.1	49.9	45.2	230	130	45.5	35	17.5	9	272	252	135	110	13	8	M8×8	M8×1
26.4	60.8	58.9	320	189	70.5	45	22.5	10	380	350	160	135	17.5	8	M8×8	M8×1
26.4	61.2	58.4	320	189	70.5	45	22.5	10	380	350	160	135	17.5	8	M8×8	M8×1
26.4	61.5	57.8	320	189	70.5	45	22.5	10	380	350	160	135	17.5	8	M8×8	M8×1

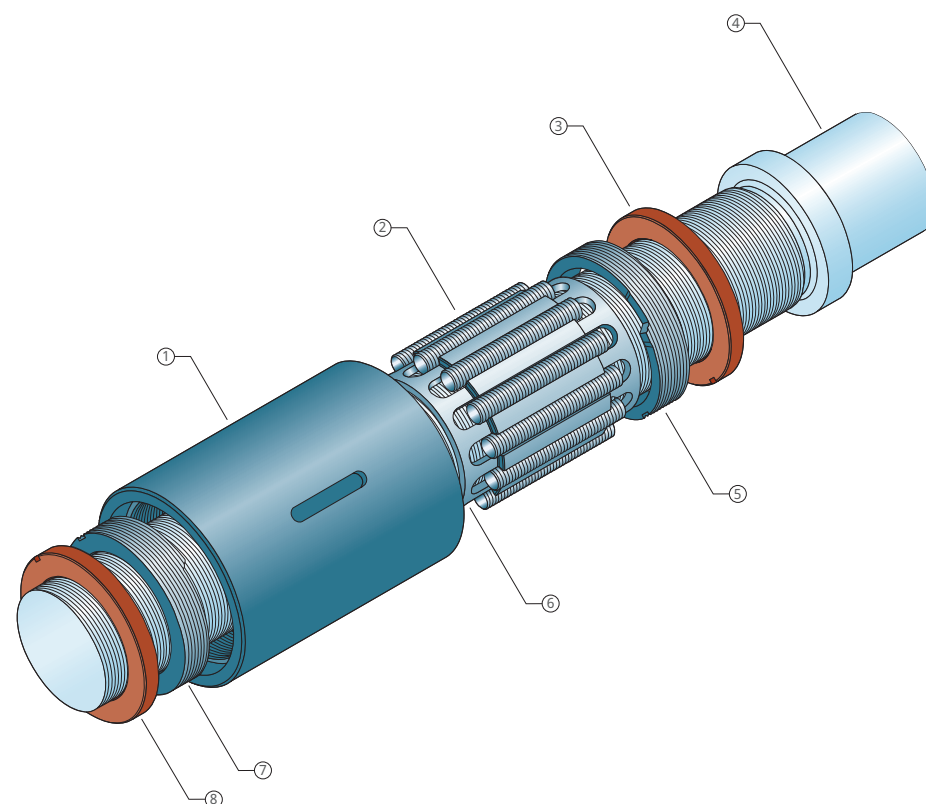
¹⁾ Axial offset between the faces of the rotating nut and the fixed bearing housing

²⁾ diameter

³⁾ number of holes in flange

4.5 Recirculating roller screws SV

59 Recirculating roller screws SV



001BD2DB

1	Nut	2	Roller
3	Wiper	4	Shaft
5	Cam ring	6	Cage
7	Cam ring	8	Wiper

Concept

Recirculating roller screws provide the ideal combination of load carrying capacity, fine resolution, positioning accuracy and axial stiffness for ultra precision driving solutions.

The small leads and small helix angle can provide a low back-driving capability, or even self-locking ability for certain sizes of recirculating roller screws, in combination with low rolling friction.

Application examples

- Medical
- Laboratory equipment
- Semi-conductor industry
- Telescopes
- Satellites
- Precision grinders

Design features	User benefits
Absence of small parts compared to small lead ball screw	Highly robust and durable
Nominal diameters from 8 mm to 125 mm	Wide standard assortment to fit most applications
Standard leads from 1 mm to 5 mm	Ideal combination of precise positioning accuracy, high load carrying capacity, maximum axial stiffness, and low torque requirements Precise resolution of movement Good repeatability with small displacements
Shaft lengths up to 8000 mm	Longer shaft lengths available on request
Maximum $n_{d1} = 30000$ for nominal diameters $d_1 \leq 25$ mm Maximum $n_{d1} = 20000$ for nominal diameters $d_1 > 25$ mm Accelerations up to 4000 rad/s^2	
High dynamic load carrying capacity up to 756 kN	Long service life
High static load carrying capacity up to 2770 kN	Ability to accommodate heavy shock loads without raceway damage
Roller retention for nut and shaft disassembly (except for diameters $d_1 < 16$ mm)	Easy roller screw assembly
Optional support bearings	Support bearings simplify design, assembly, and ordering process
Three standard versions are available: - SV with axial play - BV without backlash - PV with preloaded split nut	Running accuracy and stiffness further improved without backlash or with preload
Flexible equipment	Custom designs, e. g. left hand threads available on request

General symbols

C_{0a}	kN	static axial load rating
C_a	kN	dynamic axial load rating
d_0	mm	nominal diameter of screw shaft
I_s	$\text{kg} \cdot \text{mm}^2/\text{m}$	inertia of screw shaft per meter of shaft length
P_h	mm	lead
Z_n	cm^3	initial grease volume for the nut
Z_s	cm^3	initial grease volume for the screw shaft
η	%	efficiency
η'	%	indirect efficiency

60 Product overview SV Recirculating roller screws

SV recirculating roller screws



Threaded rollers



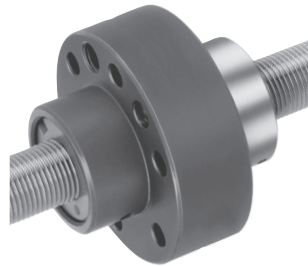
Components assembly

SVC/BVC recirculating roller screws with cylindrical nut



Standard SVC

SVF/BVF recirculating roller screws with flanged nut



Standard SVF

PVU preloaded recirculating roller screws with cylindrical nut



Standard PVU

PVK preloaded recirculating roller screws with flanged nut

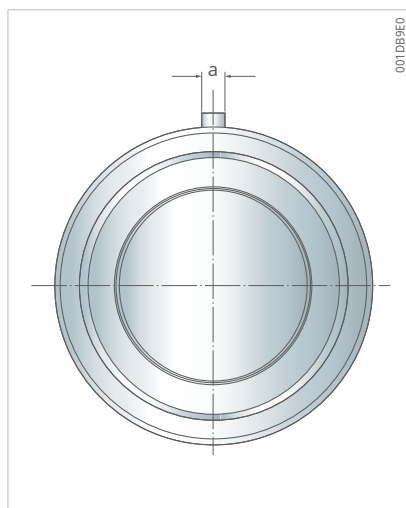


Standard PVK

001DF3BE

4.5.1 SVC, BVC

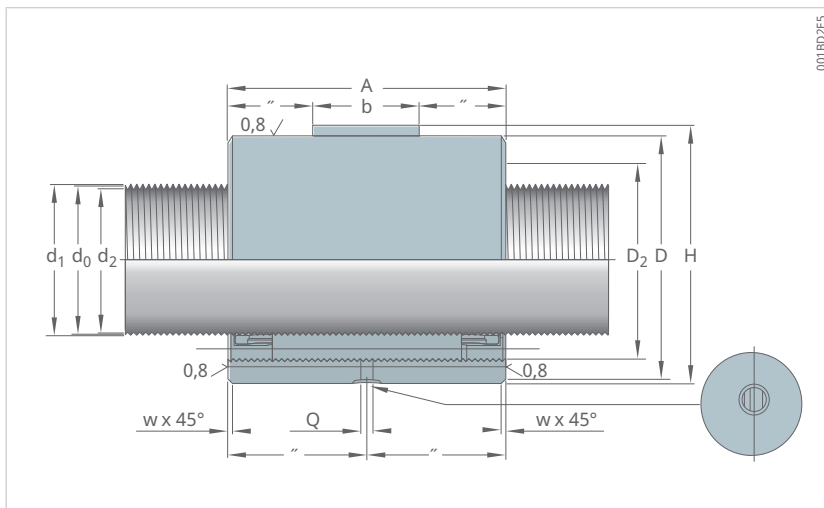
roller screw
recirculating
cylindrical nut



SVC, BVC

Designation		d ₁	P _h	L _{tp} ¹⁾	C _a	C _{0a}	η	η'	S _{ap}	T _{be}	m _n	m _s	I _s
-		mm	mm	mm	kN	kN	-	-	mm	Nm	kg	kg/m	kg · mm ² /m
SVC/BVC 8×1	-	8	1	500	8.5	11	0.83	0.79	0.02	0.1	0.1	0.36	2.6
SVC/BVC 10×1	-	10	1	650	8.95	11.4	0.8	0.75	0.02	0.1	0.1	0.57	6.7
SVC/BVC 10×2	-	10	2	650	8.95	11.4	0.87	0.85	0.02	0.1	0.1	0.57	6.7
SVC/BVC 12×1	-	12	1	750	10.3	14	0.78	0.71	0.02	0.1	0.1	0.84	14.2
SVC/BVC 12×2	-	12	2	750	10.3	14	0.86	0.83	0.02	0.1	0.1	0.84	14.2
SVC/BVC 16×1	-	16	1	1050	11.5	16.8	0.73	0.63	0.02	0.1	0.1	1.51	46.2
SVC/BVC 16×2	-	16	2	1050	11.5	16.8	0.83	0.79	0.02	0.1	0.1	1.51	46.2
SVC/BVC 20×1	✓	20	1	1300	18.5	36.6	0.69	0.54	0.02	0.18	0.2	2.38	115
SVC/BVC 20×2	-	20	2	1300	18.5	36.6	0.8	0.75	0.02	0.2	0.2	2.38	115
SVC/BVC 25×1	✓	25	1	1650	32.9	68.4	0.64	0.43	0.02	0.35	0.3	3.75	285
SVC/BVC 25×2	-	25	2	1650	32.9	68.4	0.77	0.7	0.02	0.4	0.3	3.75	285
SVC/BVC 32×1	✓	32	1	2150	64.3	159	0.58	0.28	0.02	0.5	0.6	6.18	773
SVC/BVC 32×2	✓	32	2	2150	64.3	159	0.73	0.63	0.02	0.5	0.6	6.18	773
SVC/BVC 40×1	-	40	1	2700	79.1	232	0.53	0.11	0.02	0.7	1.2	9.69	1900
SVC/BVC 40×2	-	40	2	2700	49.9	117	0.69	0.54	0.04	0.7	1.2	9.52	1840
SVC/BVC 50×1	-	50	1	3500	190	544	0.47	0	0.02	1.2	2	15	4550
SVC/BVC 50×2	-	50	2	3500	98.1	249	0.64	0.43	0.04	1.2	2	15	4550
SVC 50×3	-	50	3	3500	153	443	0.72	0.61	0.04	1.2	2	15	4550
SVC 50×4	-	50	4	3500	98.1	249	0.77	0.7	0.04	1.2	2	15	4550
SVC 63×2	-	63	2	4500	186	534	0.59	0.29	0.04	1.8	3.8	23.9	11600
SVC 63×4	-	63	4	4500	186	534	0.73	0.63	0.04	2	3.8	23.9	11600
SVC 80×4	-	80	4	6000	325	888	0.69	0.54	0.07	3	12.5	38.1	29400
SVC 100×5	-	100	5	8000	469	1376	0.69	0.54	0.07	4.5	22.8	59.51	71800
SVC 125×5	-	125	5	8000	756	2770	0.64	0.43	0.07	7	46.1	93.66	178000

✓	-	preferred range
I _{nn}	kg · mm ²	inertia of a rotating nut
I _{ns}	kg · mm ²	inertia of rollers with rotating shaft
L _{tp}	mm	max. threaded shaft length
m _n	kg	mass of nut
m _s	kg	mass of threaded shaft
S _{ap}	mm	max. axial play
T _{be}	Nm	preload torque for zero-backlash nut



SVC, BVC

I _{nn}	I _{ns}	Z _n	Z _s	d ₀	d ₂	D	A ²⁾	A ³⁾	w	a	b	H	Q	D ₂
							g6/H7	h12		h9				
kg · mm ²	kg · mm ²	cm ³	cm ³ /m	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
3.6	0.1	0.72	4	7.7	7.1	20	40	31	0.2	2	12	20.8	5	16.5
5	0.1	0.95	5	9.7	9.1	22	40	31	0.2	2	12	22.8	5	18.5
5	0.1	0.95	5	9.7	9.1	22	40	31	0.2	2	12	22.8	5	18.5
6.7	0.1	1.08	6	11.7	11.1	24	40	31	0.2	2	12	24.8	5	20.5
6.7	0.1	1.08	6	11.7	11.1	24	40	31	0.2	2	12	24.8	5	20.5
14	0.3	1.43	8	15.7	15.1	29	40	31	0.5	3	12	30.2	5	25
14	0.3	1.43	8	15.7	15.1	29	40	31	0.5	3	12	30.2	5	25
29.8	0.8	1.9	9	19.7	19.1	34	–	37	0.5	3	16	35.2	5	28.5
29.8	0.8	1.9	9	19.7	19.1	34	45	37	0.5	3	16	35.2	5	28.5
79.3	2.5	3.57	11	24.7	24.1	42	–	44	0.5	4	20	43.5	5	36
79.3	2.5	3.57	11	24.7	24.1	42	54	44	0.5	4	20	43.5	5	36
280	9.1	6.92	15	31.7	31.1	54	–	57	1	4	25	55.5	5	45
280	9.1	6.92	15	31.7	31.1	54	–	57	1	4	25	55.5	5	45
879	18.8	9.57	18	39.7	39.1	68	75	63	1	5	32	70	5	55
951	20	13.6	18	39.3	38.2	68	84	72	1	5	32	70	5	57
2190	76	24.9	22	49.7	49.1	82	101	85	1	6	32	84.5	8	70
2190	68.6	24.4	22	49.3	48.7	82	101	85	1	6	32	84.5	8	70
2190	88.1	24	22	49.5	48.6	82	108	92	1.5	6	35	84.5	8	70
2190	68.6	24.4	22	49.3	48.2	82	101	85	1	6	32	84.5	8	70
6460	230	44.3	28	62.3	61.2	103	120	104	1	6	40	105.5	8	94
6460	230	44.3	28	62.3	61.2	103	120	104	1	6	40	105.5	8	94
38900	1290	166	36	78.6	76.4	141	197	175	1.5	8	63	144	10	120
108000	4000	308	44	98.3	95.5	175	237	205	2	10	80	178	10	150
342000	11800	520	55	123.3	120.5	220	282	250	3	12	100	223	12	185

1) For BV (backlash elimination), maximal length can be shorter.

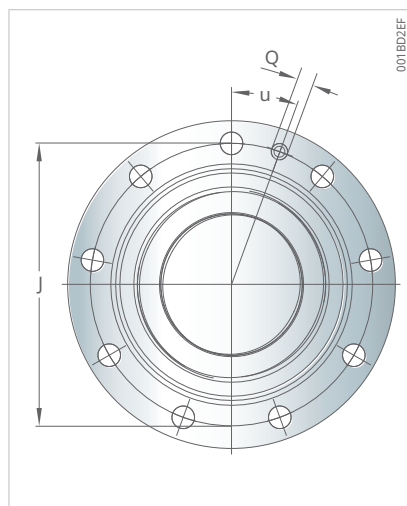
2) with wiper recesses

3) without wiper recesses

4) For this shorter version, please use the NORCS option ►146 | 4.7.

4.5.2 SVF, BVF

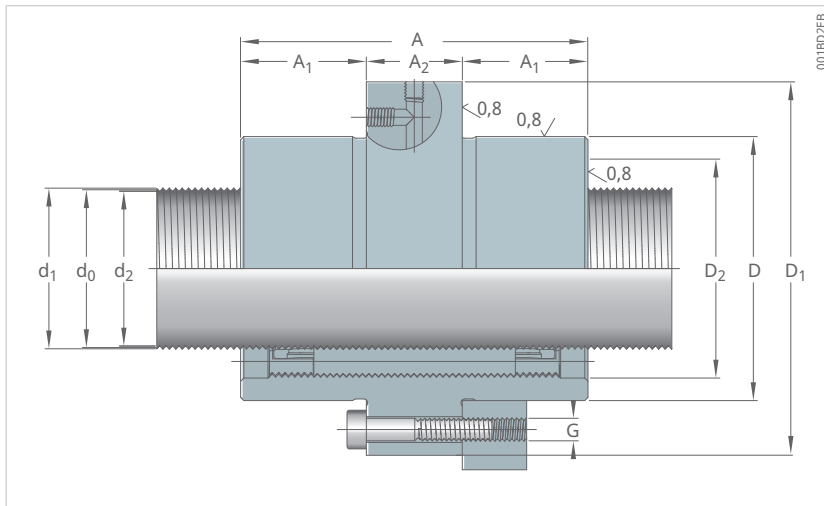
roller screw
recirculating
flanged nut



SVF, BVF

Designation	d ₁	P _h	L _{tp} ¹⁾	C _a	C _{0a}	η	η'	S _{ap}	T _{be}	m _n	m _s	I _s	I _{nn}
-	mm	mm	mm	kN	kN	-	-	mm	Nm	kg	kg/m	kg · mm ² /m	kg · mm ²
SVF/BVF 8×1	8	1	500	8.5	11	0.83	0.79	0.02	0.02	0.2	0.36	2.6	47.9
SVF/BVF 10×1	10	1	650	8.95	11.4	0.8	0.75	0.02	0.03	0.2	0.57	6.7	47
SVF/BVF 10×2	10	2	650	8.95	11.4	0.87	0.85	0.02	0.03	0.2	0.57	6.7	47
SVF/BVF 12×1	12	1	750	10.3	14	0.78	0.71	0.02	0.05	0.2	0.84	14.2	63.5
SVF/BVF 12×2	12	2	750	10.3	14	0.86	0.83	0.02	0.05	0.2	0.84	14.2	63.5
SVF/BVF 16×1	16	1	1050	11.5	16.8	0.73	0.63	0.02	0.1	0.3	1.51	46.2	100
SVF/BVF 16×2	16	2	1050	11.5	16.8	0.83	0.79	0.02	0.1	0.3	1.51	46.2	100
SVF/BVF 20×1	20	1	1300	18.5	36.6	0.69	0.54	0.02	0.18	0.4	2.38	115	192
SVF/BVF 20×2	20	2	1300	18.5	36.6	0.8	0.75	0.02	0.2	0.4	2.38	115	192
SVF/BVF 25×1	25	1	1650	32.9	68.4	0.64	0.43	0.02	0.35	0.6	3.75	285	416
SVF/BVF 25×2	25	2	1650	32.9	68.4	0.77	0.7	0.02	0.4	0.6	3.75	285	416
SVF/BVF 32×1	32	1	2150	64.3	159	0.58	0.28	0.02	0.5	1.2	6.18	773	1110
SVF/BVF 32×2	32	2	2150	64.3	159	0.73	0.63	0.02	0.5	1.2	6.18	773	1110
SVF/BVF 40×1	40	1	2700	79.1	232	0.53	0.11	0.02	0.7	2.1	9.69	1900	3120
SVF/BVF 40×2	40	2	2700	49.9	117	0.69	0.54	0.04	0.7	2.2	9.52	1840	3200
SVF/BVF 50×1	50	1	3500	190	544	0.47	0	0.02	1.2	3.7	15	4550	8190
SVF/BVF 50×2	50	2	3500	98.1	249	0.64	0.43	0.04	1.2	3.7	15	4550	8190
SVF 50×3	50	3	3500	153	443	0.72	0.61	0.04	1.2	3.7	15	4550	8050
SVF 50×4	50	4	3500	98.1	249	0.77	0.7	0.04	1.2	3.7	15	4550	8190
SVF 63×2	63	2	4500	186	534	0.59	0.29	0.04	1.8	6.4	23.9	11600	20100
SVF 63×4	63	4	4500	186	534	0.73	0.63	0.04	2	6.4	23.9	11600	20100
SVF 80×4	80	4	6000	325	888	0.69	0.54	0.07	3	17.8	38.1	29400	92600
SVF 100×5	100	5	8000	469	1376	0.69	0.54	0.07	4.5	33.1	59.5	71800	256000
SVF 125×5	125	5	8000	756	2770	0.64	0.43	0.07	7	62.3	93.7	178000	733000

I _{nn}	kg · mm ²	inertia of a rotating nut
I _{ns}	kg · mm ²	inertia of rollers with rotating shaft
L _{tp}	mm	max. threaded shaft length
m _n	kg	mass of nut
m _s	kg	mass of threaded shaft
S _{ap}	mm	max. axial play
T _{be}	Nm	preload torque for zero-backlash nut



SVF, BVF

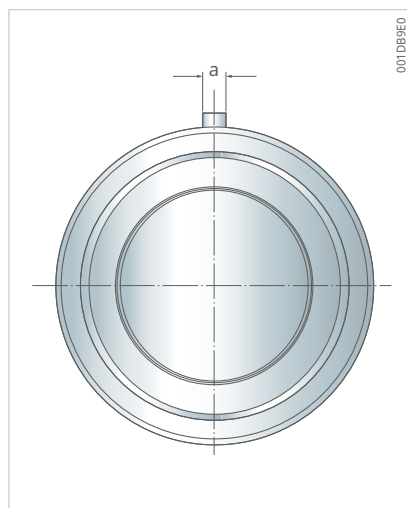
I _{ns}	Z _n	Z _s	d ₀	d ₂	D	A ²⁾	A ₁	A ₂	D ₁	J	G	Q	D ₂	u
					g6/H7	h12	h12		js12					
kg · mm ²	cm ³	cm ³ /m	mm	mm	mm	mm	mm	mm	mm	mm	-	-	mm	°
0.1	0.72	4	7.7	7.1	22	40	12	16	43	33	M4×6	M6	16.5	30
0.1	0.95	5	9.7	9.1	22	40	12	16	43	33	M4×6	M6	18.5	30
0.1	0.95	5	9.7	9.1	22	40	12	16	43	33	M4×6	M6	18.5	30
0.1	1.08	6	11.7	11.1	25	40	12	16	46	36	M4×6	M6	20.5	30
0.1	1.08	6	11.7	11.1	25	40	12	16	46	36	M4×6	M6	20.5	30
0.3	1.43	8	15.7	15.1	30	40	12	16	51	41	M4×6	M6	25	30
0.3	1.43	8	15.7	15.1	30	40	12	16	51	41	M4×6	M6	25	30
0.8	1.9	9	19.7	19.1	35	45	13.5	18	58	46	M5×6	M6	28.5	30
0.8	1.9	9	19.7	19.1	35	45	13.5	18	58	46	M5×6	M6	28.5	30
2.5	3.57	11	24.7	24.1	45	54	18	18	68	56	M5×6	M6	36	30
2.5	3.57	11	24.7	24.1	45	54	18	18	68	56	M5×6	M6	36	30
9.1	6.92	15	31.7	31.1	56	67	23.5	20	84	70	M6×6	M6	45	30
9.1	6.92	15	31.7	31.1	56	67	23.5	20	84	70	M6×6	M6	45	30
18.8	9.57	18	39.7	39.1	68	75	24	27	102	85	M8×6	M6	55	30
20	13.6	18	39.3	38.2	68	84	28.5	27	102	85	M8×6	M6	57	30
76	24.9	22	49.7	49.1	82	101	34	33	124	102	M10×6	M6	70	30
68.6	24.4	22	49.3	48.7	82	101	34	33	124	102	M10×6	M6	70	30
88.1	24	22	49.5	48.6	82	108	37.5	33	124	102	M10×6	M6	70	30
68.6	24.4	22	49.3	48.2	82	101	34	33	124	102	M10×6	M6	70	30
230	44.3	28	62.3	61.2	105	120	43.5	33	150	127	M12×6	M8×1	94	30
230	44.3	28	62.3	61.2	105	120	43.5	33	150	127	M12×6	M8×1	94	30
1290	166	36	78.6	76.4	140	197	76	45	200	170	M16×8	M8×1	120	22.5
4000	308	44	98.3	95.5	180	237	93.5	50	240	210	M16×12	M8×1	150	15
11800	520	55	123.3	120.5	220	282	113.5	55	310	270	M16×12	M8×1	185	15

1) For BV (backlash elimination), maximal length can be shorter.

2) with wiper recesses

4.5.3 PVU

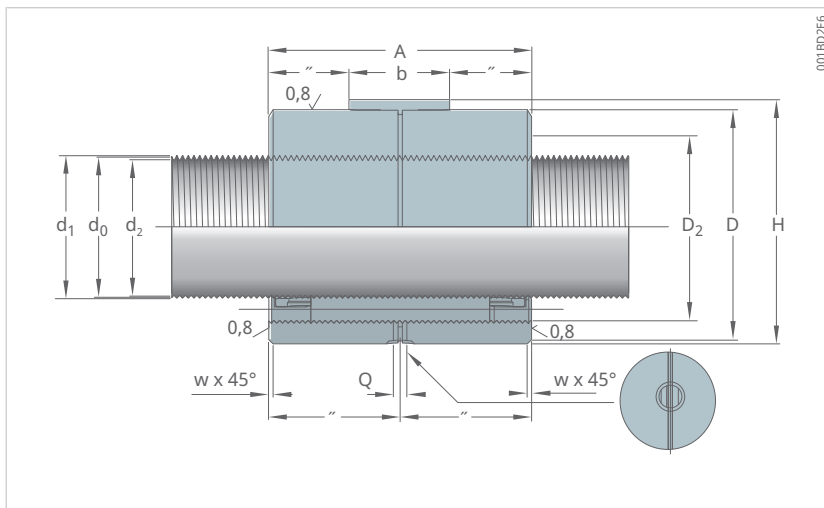
preloaded
roller screw
recirculating
cylindrical nut



PVU

Designation	d ₁	P _h	L _{tp}	C _a	C _{0a}	η	η'	R _{ng}	R _{nr}	T _{pr}	F _{pr}	m _n	m _s	I _s	I _{nn}
-	mm	mm	mm	kN	kN	-	-	N/μm	N/μm	Nm	N	kg	kg/m	kg · mm ² /m	kg · mm ²
PVU 8×1	8	1	400	4.88	5.51	0.83	0.79	140	190	0.05	770	0.1	0.36	2.6	3.6
PVU 10×1	10	1	500	5.14	5.7	0.8	0.75	138	185	0.07	820	0.1	0.57	6.7	5
PVU 10×2	10	2	500	5.14	5.7	0.87	0.85	138	185	0.07	820	0.1	0.57	6.7	5
PVU 12×1	12	1	600	5.96	7	0.78	0.71	159	215	0.1	940	0.1	0.84	14.2	6.7
PVU 12×2	12	2	600	5.96	7	0.86	0.83	159	215	0.1	940	0.1	0.84	14.2	6.7
PVU 16×1	16	1	825	6.71	8.42	0.73	0.63	182	245	0.15	1060	0.1	1.51	46.2	14
PVU 16×2	16	2	825	6.71	8.42	0.83	0.79	182	245	0.15	1060	0.1	1.51	46.2	14
PVU 20×1	20	1	1050	10.6	18.3	0.69	0.54	362	490	0.2	1430	0.2	2.38	115	29.8
PVU 20×2	20	2	1050	10.6	18.3	0.8	0.75	362	490	0.3	1430	0.2	2.38	115	29.8
PVU 25×1	25	1	1300	18.9	34.2	0.64	0.43	469	635	0.5	2270	0.3	3.75	285	79.3
PVU 25×2	25	2	1300	18.9	34.2	0.77	0.7	469	635	0.55	2270	0.3	3.75	285	79.3
PVU 32×1	32	1	1700	36.9	79.6	0.58	0.28	736	995	0.7	2510	0.6	6.18	773	280
PVU 32×2	32	2	1700	36.9	79.6	0.73	0.63	721	975	0.7	2320	0.6	6.18	773	280
PVU 40×1	40	1	2150	45.4	116	0.53	0.11	1034	1395	1	2840	1.2	9.69	1900	879
PVU 40×2	40	2	2150	28.7	58.6	0.69	0.54	618	835	1	2710	1.2	9.52	1840	951
PVU 50×1	50	1	2800	109	272	0.47	0	1100	1430	1.85	3900	2	15	4550	2190
PVU 50×2	50	2	2800	56.3	125	0.64	0.43	803	1045	1.85	3660	2	15	4550	2190
PVU 50×3	50	3	2800	88	222	0.72	0.61	1000	1300	1.85	3600	2	15	4550	2190
PVU 50×4	50	4	2800	56.3	125	0.77	0.7	803	1045	1.85	3660	2	15	4550	2190
PVU 63×2	63	2	3600	107	267	0.59	0.29	1177	1530	2.5	4540	3.8	23.9	11600	6460
PVU 63×4	63	4	3600	107	267	0.73	0.63	1177	1530	2.75	4540	3.8	23.9	11600	6460
PVU 80×4	80	4	4000	187	444	0.69	0.54	1280	1665	4	5410	12.5	38.1	29400	38900
PVU 100×5	100	5	4000	269	688	0.69	0.54	1323	1720	6	5920	22.8	59.5	71800	108000
PVU 125×5	125	5	4000	434	1385	0.64	0.43	2027	2635	8.5	6510	46.1	93.7	179000	342000

F _{pr}	N	preload force
I _{nn}	kg · mm ²	inertia of a rotating nut
I _{ns}	kg · mm ²	inertia of rollers with rotating shaft
L _{tp}	mm	max. threaded shaft length
m _n	kg	mass of nut
m _s	kg	mass of threaded shaft
R _{ng}	N/μm	min. nominal stiffness of the nut
R _{nr}	N/μm	reference nominal stiffness of the nut
S _{ap}	mm	max. axial play
T _{pr}	Nm	preload torque



PVU

I _{ns}	Z _n	Z _s	d ₀	d ₂	D	A ¹⁾	A ²⁾	w	a	b	H	Q	D ₂
					g6/H7	h12	h12 ³⁾		h9				
kg · mm ²	cm ³	cm ³ /m	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
0.1	0.72	4	7.7	7.1	20	40	31	0.2	2	12	20.8	5	16.5
0.1	0.95	5	9.7	9.1	22	40	31	0.2	2	12	22.8	5	18.5
0.1	0.95	5	9.7	9.1	22	40	31	0.2	2	12	22.8	5	18.5
0.1	1.08	6	11.7	11.1	24	40	31	0.2	2	12	24.8	5	20.5
0.1	1.08	6	11.7	11.1	24	40	31	0.2	2	12	24.8	5	20.5
0.3	1.43	8	15.7	15.1	29	40	31	0.5	3	12	30.2	5	25
0.3	1.43	8	15.7	15.1	29	40	31	0.5	3	12	30.2	5	25
0.8	1.9	9	19.7	19.1	34	45	37	0.5	3	16	35.2	5	28.5
0.8	1.9	9	19.7	19.1	34	45	37	0.5	3	16	35.2	5	28.5
2.5	3.57	11	24.7	24.1	42	54	44	0.5	4	20	43.5	5	36
2.5	3.57	11	24.7	24.1	42	54	44	0.5	4	20	43.5	5	36
9.1	6.92	15	31.7	31.1	54	67	57	1	4	25	55.5	5	45
9.1	6.92	15	31.7	31.1	54	67	57	1	4	25	55.5	5	45
18.8	9.57	18	39.7	39.1	68	75	63	1	5	32	70	5	55
20	13.6	18	39.3	38.2	68	84	72	1	5	32	70	5	57
76	24.4	22	49.7	49.1	82	101	85	1	6	32	84.5	8	70
68.6	24.4	22	49.3	48.7	82	101	85	1	6	32	84.5	8	70
81.1	24.4	22	49.5	48.6	82	108	92	1.5	6	35	84.5	8	70
68.6	24.4	22	49.3	48.2	82	101	85	1	6	32	84.5	8	70
230	44.3	28	62.3	61.2	103	120	104	1	6	40	105.5	8	94
230	44.3	28	62.3	61.2	103	120	104	1	6	40	105.5	8	94
1290	166	36	78.6	76.4	141	197	175	1.5	8	63	144	10	120
4000	308	44	98.3	95.5	175	237	205	2	10	80	178	10	150
11800	520	55	123.3	120.5	220	282	250	3	12	100	223	12	185

¹⁾ with wiper recesses

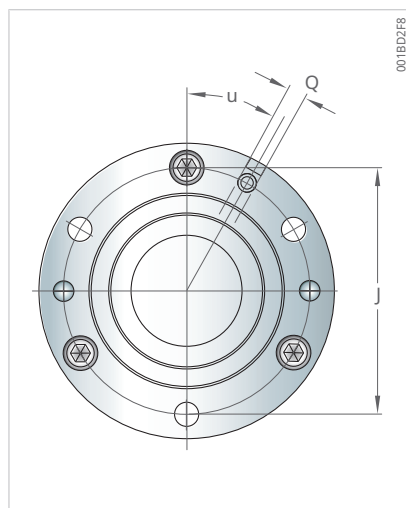
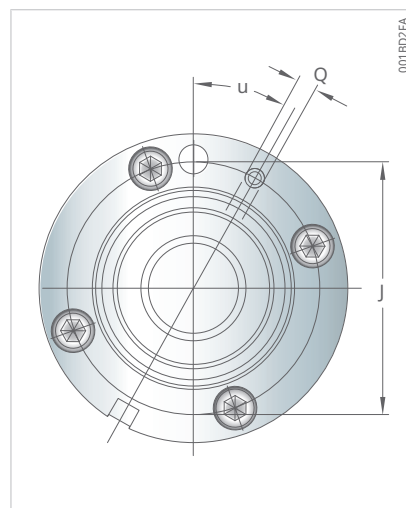
²⁾ without wiper recesses

³⁾ For this shorter version, please use the NORCS option ► 146 | 4.7.

4.5.4 PVK

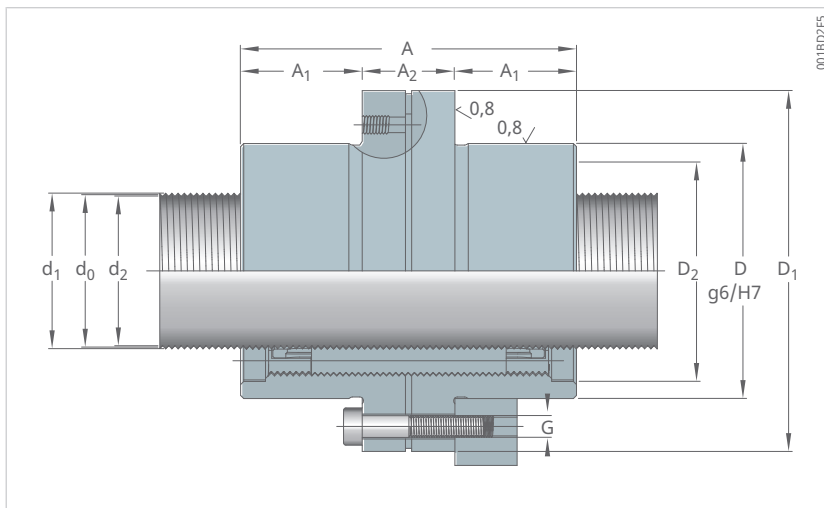
preloaded
roller screw
recirculating
flanged nut

4

d₁ 8 mm ... 63 mmd₁ 80 mm ... 125 mm

Designation ¹⁾	d ₁	P _h	L _{tp}	C _a	C _{0a}	η	η'	R _{ng}	R _{nr}	T _{pr}	F _{pr}	m _n	m _s	I _s	I _{nn}
-	mm	mm	mm	kN	kN	-	-	N/μm	N/μm	Nm	N	kg	kg/m	kg · mm ² /m	kg · mm ²
PVK 8×1	8	1	400	4.88	5.51	0.83	0.79	190	255	0.05	770	0.2	0.36	2.6	47.9
PVK 10×1	10	1	500	5.14	5.7	0.8	0.75	185	250	0.07	820	0.2	0.57	6.7	47
PVK 10×2	10	2	500	5.14	5.7	0.87	0.85	185	250	0.07	820	0.2	0.57	6.7	47
PVK 12×1	12	1	600	5.96	7	0.78	0.71	215	290	0.1	940	0.2	0.84	14.2	63.5
PVK 12×2	12	2	600	5.96	7	0.86	0.83	215	290	0.1	940	0.2	0.84	14.2	63.5
PVK 16×1	16	1	825	6.71	8.42	0.73	0.63	245	330	0.15	1060	0.3	1.51	46.2	100
PVK 16×2	16	2	825	6.71	8.42	0.83	0.79	245	330	0.15	1060	0.3	1.51	46.2	100
PVK 20×1	20	1	1050	10.6	18.3	0.69	0.54	490	660	0.2	1430	0.4	2.38	115	192
PVK 20×2	20	2	1050	10.6	18.3	0.8	0.75	490	660	0.3	1430	0.4	2.38	115	192
PVK 25×1	25	1	1300	18.9	34.2	0.64	0.43	635	855	0.5	2270	0.6	3.75	285	416
PVK 25×2	25	2	1300	18.9	34.2	0.77	0.7	635	855	0.55	2270	0.6	3.75	285	416
PVK 32×1	32	1	1700	36.9	79.6	0.58	0.28	995	1345	0.7	2510	1.2	6.18	773	1110
PVK 32×2	32	2	1700	36.9	79.6	0.73	0.63	975	1315	0.7	2320	1.2	6.18	773	1110
PVK 40×1	40	1	2150	45.4	116	0.53	0.11	1395	1885	1	2840	2.1	9.69	1900	3120
PVK 40×2	40	2	2150	28.7	58.6	0.69	0.54	835	1125	1	2710	2.2	9.52	1840	3200
PVK 50×1	50	1	2800	109	272	0.47	0	1430	1930	1.85	3900	3.7	15	4550	8190
PVK 50×2	50	2	2800	56.3	125	0.64	0.43	1045	1410	1.85	3660	3.7	15	4550	8190
PVK 50×3	50	3	2800	88	222	0.72	0.61	1300	1755	1.85	3600	3.7	15	4550	8050
PVK 50×4	50	4	2800	56.3	125	0.77	0.7	1045	1410	1.85	3660	3.7	15	4550	8190
PVK 63×2	63	2	3600	107	267	0.59	0.29	1530	2065	2.5	4540	6.4	23.9	11600	20100
PVK 63×4	63	4	3600	107	267	0.73	0.63	1530	2065	2.25	4540	6.4	23.9	11600	20100
PVK 80×4	80	4	4000	187	444	0.69	0.54	1665	2250	4	5410	17.8	38.1	29400	92600
PVK 100×5	100	5	4000	269	688	0.69	0.54	1720	2320	6	5920	33.1	59.5	71800	256000
PVK 125×5	125	5	4000	434	1385	0.64	0.43	2635	3555	8.5	6510	62.3	93.7	179000	733000

F _{pr}	N	preload force
I _{nn}	kg · mm ²	inertia of a rotating nut
I _{ns}	kg · mm ²	inertia of rollers with rotating shaft
L _{tp}	mm	max. threaded shaft length
m _n	kg	mass of nut
m _s	kg	mass of threaded shaft
R _{ng}	N/μm	min. nominal stiffness of the nut
R _{nr}	N/μm	reference nominal stiffness of the nut
S _{ap}	mm	max. axial play
T _{pr}	Nm	preload torque



PVK

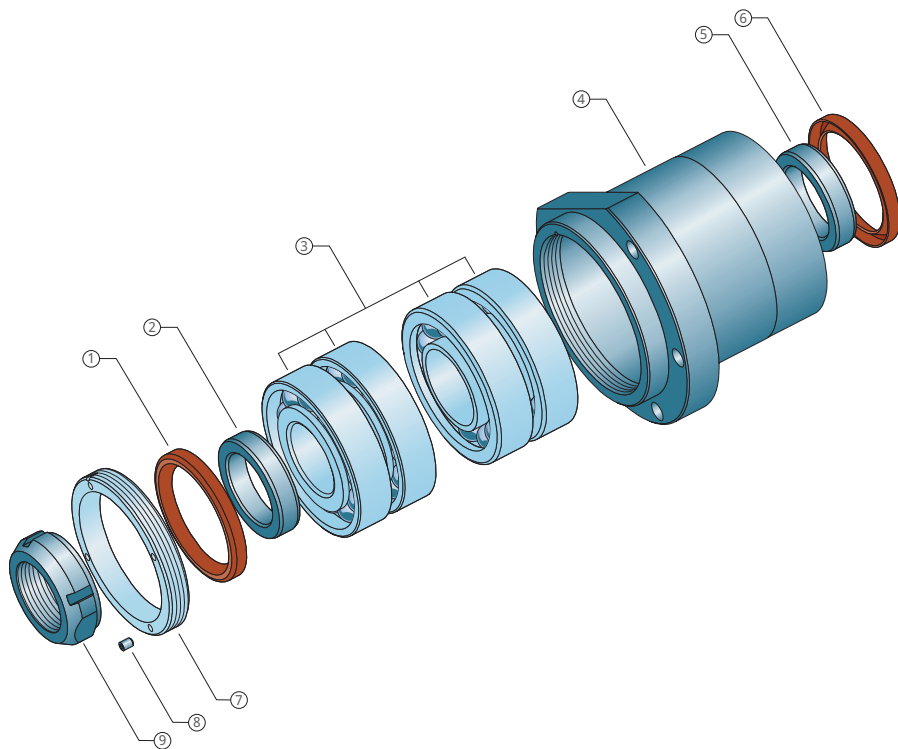
I _{ns}	Z _n	Z _s	d ₀	d ₂	D	A ²⁾		A ₂	D ₁	J	G	Q	D ₂	u
						g6/H7	h12							
kg · mm ²	cm ³	cm ³ /m	mm	mm	mm	mm	mm	mm	mm	mm	-	-	mm	°
0.1	0.72	4	7.7	7.1	22	40	12	16	43	33	M4×6	M6	16.5	30
0.1	0.95	5	9.7	9.1	22	40	12	16	43	33	M4×6	M6	18.5	30
0.1	0.95	5	9.7	9.1	22	40	12	16	43	33	M4×6	M6	18.5	30
0.1	1.08	6	11.7	11.1	25	40	12	16	46	36	M4×6	M6	20.5	30
0.1	1.08	6	11.7	11.1	25	40	12	16	46	36	M4×6	M6	20.5	30
0.3	1.43	8	15.7	15.1	30	40	12	16	51	41	M4×6	M6	25	30
0.3	1.43	8	15.7	15.1	30	40	12	16	51	41	M4×6	M6	25	30
0.8	1.9	9	19.7	19.1	35	45	13.5	18	58	46	M5×6	M6	28.5	30
0.8	1.9	9	19.7	19.1	35	45	13.5	18	58	46	M5×6	M6	28.5	30
2.5	3.57	11	24.7	24.1	45	54	18	18	68	56	M5×6	M6	36	30
2.5	3.57	11	24.7	24.1	45	54	18	18	68	56	M5×6	M6	36	30
9.1	6.92	15	31.7	31.1	56	67	23.5	20	84	70	M6×6	M6	45	30
9.1	6.92	15	31.7	31.1	56	67	23.5	20	84	70	M6×6	M6	45	30
18.8	9.57	18	39.7	39.1	68	75	24	27	102	85	M8×6	M6	55	30
20	13.6	18	39.3	38.2	68	84	28.5	27	102	85	M8×6	M6	57	30
76	24.4	22	49.7	49.1	82	101	34	33	124	102	M10×6	M6	70	30
68.6	24.4	22	49.3	48.7	82	101	34	33	124	102	M10×6	M6	70	30
81.1	24.4	22	49.5	48.6	82	108	37.5	33	124	102	M10×6	M6	70	30
68.6	24.4	22	49.3	48.2	82	101	34	33	124	102	M10×6	M6	70	30
230	44.3	28	62.3	61.2	105	120	43.5	33	150	127	M12×6	M8×1	94	30
230	44.3	28	62.3	61.2	105	120	43.5	33	150	127	M12×6	M8×1	94	30
1290	166	36	78.6	76.4	140	197	76	45	200	170	M16×8	M8×1	120	22.5
4000	308	44	98.3	95.5	180	237	93.5	50	240	210	M16×12	M8×1	150	15
11800	520	55	123.3	120.5	220	282	113.5	55	310	270	M16×12	M8×1	185	15

1) PVK d₁ 8 mm to 63 mm: dowel pins to hold preload, 3 bolts for transport
 PVK d₁ 80 mm to 125 mm: 4 bolts for transport, key to hold preload

2) with wiper recesses

4.6 Support bearings FLRBU

61 Support bearings FLRBU



001BD2FB

1	Seal	2	Spacer ring/seal rolling surface
3	Bearing	4	Bearing housing
5	Spacer ring/seal rolling surface	6	Seal
7	Housing nut	8	Clamping pin
9	Precision locknut		

Concept

To assist in the design and assembly process, Schaeffler has developed a standard assortment of support bearings which consists of a housing, a bearing arrangement and seals. The bearings are adjusted at the factory to improve stiffness and running accuracy. Supports bearings are filled with grease at the Schaeffler factory and are easy to install. Standard support bearings are specifically designed for roller screws with nominal diameters from to 8 mm to 80 mm (planetary roller screws) and from 8 mm to 125 mm (recirculating roller screws). These support bearings can easily be mounted on the screw shaft ends, following Schaeffler recommendations for standard machined ends.

For larger roller screws, a preselection of spherical roller thrust bearings is also available.

FLRBU sizes 1 to 9 with angular contact ball bearings

The standard assortment of support bearings consist of a steel housing and two to six angular contact ball bearings. Support bearing size FLRBU9 is available with a total of four or six bearings.

To attain the nominal life of the support bearings, the maximum static or dynamic operating load should not exceed 80 % of the C_a value of the support bearing. This recommendation considers the load carrying capacity of the bearings, the strength of the support bearing housing and the precision locknut.

Larger support bearing sizes with spherical roller thrust bearings

For extremely high load applications, Schaeffler has preselected sizes of spherical roller thrust bearings for assembly with back-to-back arrangement into larger support bearings. These support bearings are typically used in applications where there are extremely heavy axial loads in one direction and lighter loads in the other direction, e. g. presses. As a result, these assemblies typically have two different size bearings, supporting the application axial loads in each direction, and requiring the support bearing to be oriented correctly.

For additional information about optimizing the selection of each spherical roller thrust bearing, please contact your Schaeffler representative.

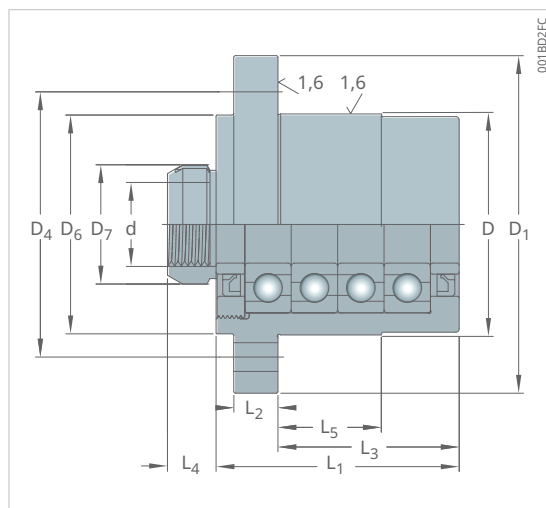
42 Support bearings description

Design features	User benefits
Precision machined steel housing	Complete support bearing solution ready to use, simplified application design, easy ordering process. Eliminates most technical risks associated with bearing and seal assemblies.
Preloaded angular contact ball bearings, 72 or 73 series, arranged back-to-back (1 + 1 for FLRBU1 and FLRBU2, 2 + 2 for FLRBU3 to FLRBU9 and 3 + 3 for FLRBU9)	Bearing solutions offering high speed capability and low friction torque. Bearings are arranged back-to-back and preloaded to increase stiffness and improve running accuracy.
Two garter seals	Greased for life
Precision locknut as standard	Precision locknuts are part of the standard Schaeffler product assortment, and can be ordered separately.
Standard screw shaft end machining defined for extremely heavy axial loads	Quick connection to shaft ends
Different bearing arrangements are available on request, should the applications present unique load conditions with the axial loads predominantly acting in one direction (1 + 3 and 3 + 1)	Bearing load carrying capacity matched to the roller screw load carrying capacity and application conditions. Support bearing dimensioning and load carrying capacity matched to the roller screw characteristics.

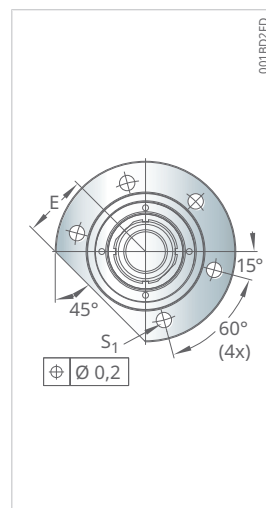
4.6.1 FLRBU, dimensions

support bearing

angular contact ball bearing



FLRBU



FLRBU

Designation	D ₁	D ₆	D	D ₄	D ₇	E	L ₁	L ₂	L ₃	L ₄	L ₅	n _{S1}	S ₁ ¹⁾
-			h7										H13
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	-	mm
FLRBU1	76	50	47	63	30	27	42	10	25	14	12	5	6.6
FLRBU2	90	62	60	76	37	32	46	10	32	18	18	5	6.6
FLRBU3	90	59	60	74	40	32	77	13	60	18	30	5	9
FLRBU4	120	80	80	100	44	44	89	16	68	20	36	5	11
FLRBU5	140	99	100	120	54	54	110	20	82	22	47	5	13
FLRBU6	171	130	130	152	75	67	140	25	98.5	25	58.5	5	13
FLRBU7	225	170	170	198	95	87	180	30	133.5	28	53.5	5	17.5
FLRBU8	285	219	220	252	125	115	235	35	179	32	99	5	22
FLRBU9 (2+2)	322	249	250	285	135	130	253	36	195	32	115	9	243
FLRBU9 (3+3)	322	249	250	285	135	130	347	36	289	32	115	9	243

BS

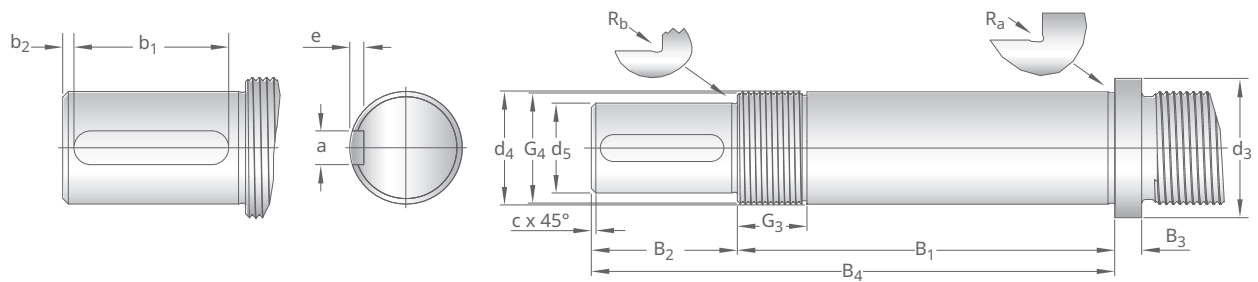
-

fixing screw

n_{S1}

-

number of fixture holes S₁



Standard machined ends

BS	d4 ²⁾	d5	d3	B1	B2	B3	B4	G4	G3	c	Ra	Rb	a	e	b1	b2
		h7		js12			js12	g6					N9	+0.1	+0.5	
-	mm	mm	mm	mm	mm	mm	mm	-	mm	mm	mm	mm	mm	mm	mm	mm
M6×25	12	10	17	58	20	5	78	M12×1	17	0.5	0.4	0.4	3	1.8	16	1.5
M6×25	17	15	23	66	30	5	96	M17×1	22	0.5	0.6	0.6	5	3	25	2
M8×25	20	17	27	97	40	7	137	M20×1	22	0.5	0.6	0.6	5	3	35	2
M10×30	25	20	34	112	45	7	157	M25×1,5	25	0.5	0.6	0.6	6	3.5	40	2.5
M12×40	35	30	45	134	55	10	189	M35×1,5	26	1	0.6	0.6	8	4	45	2.5
M12×40	50	40	62	168	65	12	233	M50×1,5	31	1	0.8	0.8	12	5	55	4
M16×55	65	60	78	210	100	18	310	M65×2	32	1	1.2	1	18	7	90	2.5
M20×65	90	85	108	270	120	25	390	M90×2	39	1	1.6	1.2	25	9	100	5
M22×70	100	95	120	288	140	25	428	M100×2	39	1	1.6	1.2	25	9	125	7
M22×70	100	95	120	382	140	25	522	M100×2	39	1	1.6	1.2	25	9	125	7

¹⁾ For the layout of FLRBU9 flange, contact Schaeffler.

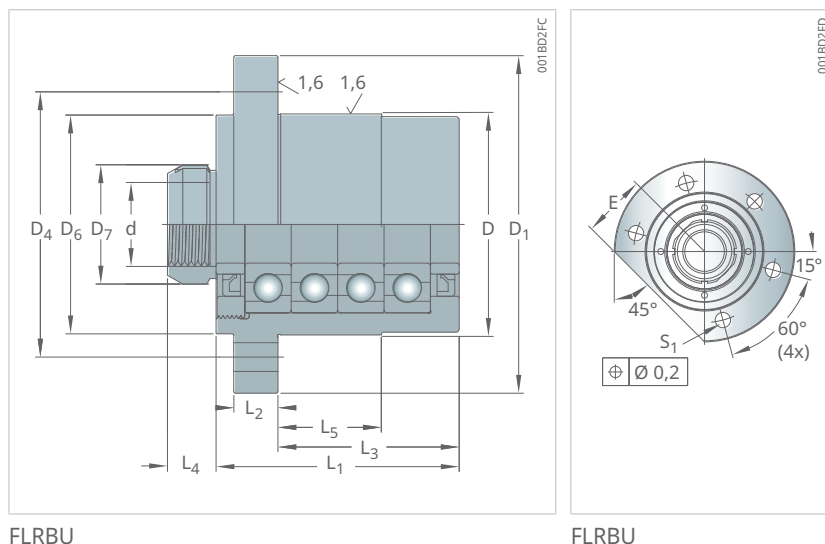
²⁾ standard tolerance for direct drive: h6
recommended tolerance for parallel drive: k6

4.6.2 FLRBU, performance data

support bearing

angular contact ball bearing

4



FLRBU

FLRBU

Designation		d	C _a	C _{0a}	S	sb	T _{pr}	R _a ¹⁾	m	KMT	HS	T _{KMT}	gs	T _{gs}
-		mm	kN	kN	-	-	Nm	N/μm	kg	-	-	Nm	-	Nm
FLRBU1	✓	12	13.8	13.6	1+1	7201	0.1	140	0.69	KMT 1	HN 3	15	M5	4.5
FLRBU2	✓	17	32.8	34.6	1+1	7303	0.25	215	1.93	KMT 3	HN 4	22	M6	8
FLRBU3	✓	20	42.4	60	2+2	7204	0.25	400	1.61	KMT 4	HN 5	27	M6	8
FLRBU4	✓	25	85.5	121.5	2+2	7305	1.1	540	3.3	KMT 5	HN 5	38	M6	8
FLRBU5	✓	35	129.7	211.5	2+2	7307	1.1	725	5.85	KMT 7	HN 7	65	M6	8
FLRBU6	✓	50	215.2	384.6	2+2	7310	1.5	900	11.1	KMT 10	HN 10	110	M8	18
FLRBU7	✓	65	305	630.8	2+2	7313	2	1100	25.1	KMT 13	HN 14	200	M8	18
FLRBU8	-	90	487.4	1107.7	2+2	7318	2.3	1570	53.1	KMT 18	HN 18	300	M10	35
FLRBU9 (2+2)	-	100	575.6	1515.4	2+2	7320	3	1640	73.1	KMT 20	HN 20	400	M10	35
FLRBU9 (3+3)	-	100	764.5	2273.1	3+3	7320	3.5	2300	96.1	KMT 20	HN 20	400	M10	35

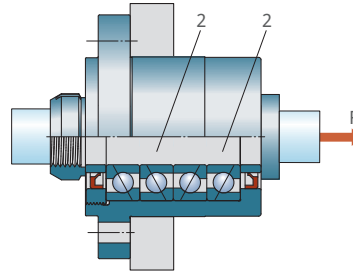
¹⁾ Axial stiffness of the housing and bearings assembly, Precision locknut and shaft stiffness not included

✓	-	preferred range
C _{0a}	kN	static axial load rating
C _a	kN	dynamic axial load rating
d	mm	bore diameter
gs	-	precision locknut: grub screw size
HS	-	precision locknut: hook wrench
KMT	-	precision locknut: designation
m	kg	mass of the support bearing
R _a	N/μm	stiffness of the bearing assembly
S	-	standard bearing arrangement
sb	-	bearing designation
T _{pr}	Nm	max. preload torque
T _{gs}	Nm	precision locknut: grub screw tightening torque
T _{KMT}	Nm	precision locknut: tightening torque

4.6.3 Recommendations for support bearings assembly and orientation

Standard support bearing orientation: Flange oriented towards machined end of shaft

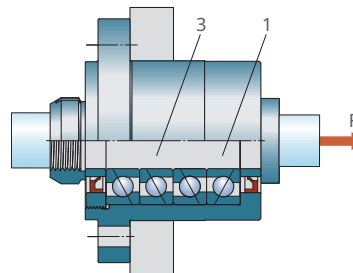
62 FLRBU (1+1) (2+2) (3+3)



001BD303

- Assembly recommended for similar tension and compression loads on roller screw
- Customer to check flange fixing bolts with compression loads

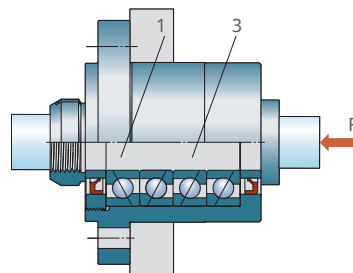
63 FLRBU (3+1)



001BD304

- Assembly recommended for predominantly tension loads on roller screw
- Customer to check flange fixing bolts with compression loads

64 FLRBU (1+3)

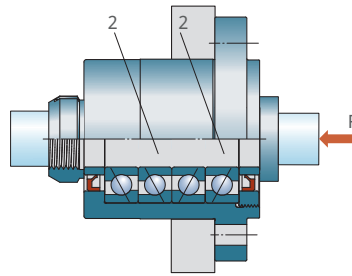


001BD305

- Not the ideal assembly in case of predominantly compression loads on roller screw
- Customer to check flange fixing bolts with tension loads

Non-standard support bearing orientation: Flange oriented towards thread of roller screw shaft

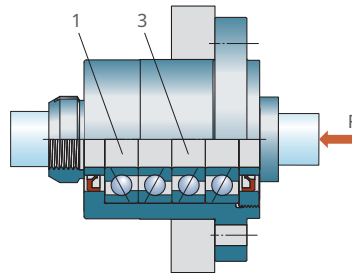
65 FLRBU (1+1) (2+2) (3+3)



001BD308

- Assembly recommended for similar tension and compression loads on roller screw
- Customer to check flange fixing bolts with compression loads

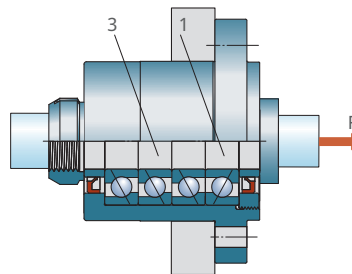
66 FLRBU (3+1)



001BD30A

- Assembly recommended for pre- dominantly compression loads on roller screw
- Customer to check flange fixing bolts with compression loads

67 FLRBU (1+3)



001BD30D

- Not the ideal assembly in case of predominantly tension loads on roller screw
- Customer to check flange fixing bolts with tension loads

Support bearing bore diameter	Load ratings for the 3 bearings carry- ing the main application loads		Load ratings for the opposite single bearing		Preferred	Designation
	Support bearing carrying capacity		Support bearing carrying capacity			
	dyn.	stat.	dyn.	stat.		
	C	C ₀	C	C ₀		
d						
mm	kN		kN			–
20	56.4	90	26.1	30	✓	FLRBU3
25	113.6	182.3	52.6	60.8	✓	FLRBU4
35	172.2	317.3	79.8	105.8	✓	FLRBU5
50	285.8	576.9	132.5	192.3	✓	FLRBU6
65	405.5	946.2	187.9	315.4	✓	FLRBU7
90	647.3	1661.5	300	553.9	–	FLRBU8
100	764.5	2273.1	354.3	757.7	–	FLRBU9 ¹⁾

¹⁾ Version with 4 bearings

4.6.4 Support bearings recommended for standard planetary roller screws

(standard number of rollers)

43 Planetary roller screws SR/BR, PR, HR: Recommended size of FLRBU support bearings ¹⁾

Ph		2	4	5	6	8	9	10	12	15	18	20	24	25	30	35	36	42
d ₀	Nut type	FLRBU size																
mm																		
8	SR/BR	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	PR	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	SR/BR	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	PR	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	SR/BR	2	-	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
15	PR	1	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
18	SR/BR	3	-	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
18	PR	2	-	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
21	SR/BR	4	-	4	4	4	-	4	-	-	-	-	-	-	-	-	-	-
21	PR	2	-	2	2	2	-	3	-	-	-	-	-	-	-	-	-	-
24	SR/BR	-	-	-	3	-	-	-	4	-	-	-	-	-	-	-	-	-
24	PR	-	-	-	2	-	-	-	2	-	-	-	-	-	-	-	-	-
25	SR/BR	-	-	4	-	4	-	4	-	4	-	-	-	-	-	-	-	-
25	PR	-	-	3	-	3	-	3	-	3	-	-	-	-	-	-	-	-
30	SR/BR	-	-	5	5	5	-	5	-	5	-	5	-	-	-	-	-	-
30	PR	-	-	4	4	4	-	4	-	4	-	4	-	-	-	-	-	-
36	SR/BR	-	-	-	5	-	5	-	5	-	5	-	5	-	-	-	-	-
36	PR	-	-	-	4	-	4	-	4	-	4	-	4	-	-	-	-	-
39	SR/BR	-	-	6	-	-	-	6	-	6	-	6	-	6	-	-	-	-
39	PR	-	-	5	-	-	-	5	-	5	-	5	-	5	-	-	-	-
44	SR/BR	-	-	-	-	6	-	-	6	-	6	-	6	-	6	-	-	-
44	PR	-	-	-	-	4	-	-	4	-	5	-	5	-	5	-	-	-
48	SR/BR	-	-	6	-	6	-	6	-	7	-	7	-	7	7	-	-	-
48	PR	-	-	5	-	5	-	6	-	6	-	6	-	6	6	-	-	-
56	SR/BR	-	-	-	-	-	-	-	6	-	-	-	7	-	-	-	7	-
56	PR	-	-	-	-	-	-	-	5	-	-	-	6	-	-	-	6	-
60	SR/BR	-	-	-	-	-	-	8	-	8	-	8	-	-	-	-	-	-
60	PR	-	-	-	-	-	-	6	-	6	-	6	-	-	-	-	-	-
60	HR	-	-	-	-	-	-	-	-	8	-	8	-	8	8	-	-	-
64	SR/BR	-	-	-	-	-	-	-	7	-	7	-	7	-	7	-	7	-
64	PR	-	-	-	-	-	-	-	6	-	6	-	6	-	6	-	6	-
75	SR/BR	-	-	-	-	-	-	9 (2+2)	-	9 (2+2)	-	9 (2+2)	-	-	-	-	-	-
75	PR	-	-	-	-	-	-	-	-	9 (3+3)	-	9 (3+3)	-	9 (3+3)	9 (3+3)	-	-	-
80	SR	-	-	-	-	-	-	8	-	-	8	-	8	-	-	-	-	8

¹⁾ Some SR/BR and PR planetary roller screw sizes (normal diameter × lead) are available with the maximum number of rollers only. In such case, the recommended FLRBU support bearing size is suitable for these configurations.

d₀ mm nominal diameter of screw shaft
P_h mm lead

4.6.5 Support bearings recommended for recirculating roller screws

44 Recirculating roller screws SV/BV, PV: Recommended size of FLRBU support bearings

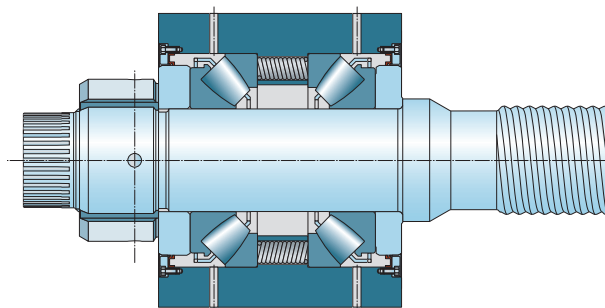
P _h		1	2	3	4	5
d ₁	Nut type	FLRBU size				
mm						
8	SV/BV	1	–	–	–	–
8	PV	1	–	–	–	–
10	SV/BV	1	1	–	–	–
10	PV	1	1	–	–	–
12	SV/BV	1	1	–	–	–
12	PV	1	1	–	–	–
16	SV/BV	1	1	–	–	–
16	PV	1	1	–	–	–
20	SV/BV	2	2	–	–	–
20	PV	1	1	–	–	–
25	SV/BV	3	3	–	–	–
25	PV	2	2	–	–	–
32	SV/BV	4	4	–	–	–
32	PV	3	3	–	–	–
40	SV/BV	5	4	–	–	–
40	PV	4	3	–	–	–
50	SV/BV	6	5	6	5	–
50	PV	5	4	5	4	–
63	SV/BV	–	6	–	6	–
63	PV	–	6	–	6	–
80	SV/BV	–	–	–	7	–
80	PV	–	–	–	6	–
100	SV/BV	–	–	–	–	8
100	PV	–	–	–	–	7
125	SV/BV	–	–	–	–	9 (3+3)
125	PV	–	–	–	–	8

d₁ mm Nominal diameter of the threaded shaft for recirculating roller screws

P_h mm lead

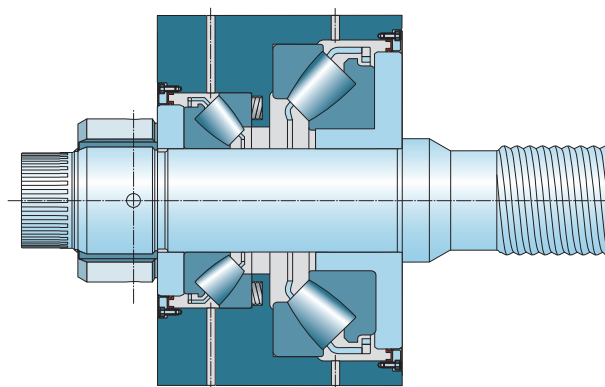
4.6.6 Preselection of spherical roller thrust bearings

68 Symmetrical bearing arrangement



001BD30F

69 Non-symmetrical bearing arrangement



001BD312

For applications where FLRBU9 support bearings cannot accommodate existing loads, Schaeffler can supply FLRBUs containing spherical roller thrust bearings. These larger support bearings complement the assortment of large roller screws and Ultra Power roller screws.

Spherical roller thrust bearing arrangements can be either symmetrical or non-symmetrical. Non-symmetrical arrangements are typically used when loads are heavier on one direction than the other.

Because these support bearings are used on large machinery, Schaeffler designs the housing and bearing arrangement on a case by case basis.

For additional information about these support bearings, please contact your local Schaeffler representative.

45 Preselection of spherical roller thrust bearings

Ultra Power roller screws		Recommended size of spherical roller thrust bearings						
		Bore diameter	Outer diameter	Bearing mean diameter	Height	Basic load rating		Bearing designation
						Dynamic	Static	
d_0	P_h	d	D	d_m	H	C_a	C_{0a}	
mm	mm	mm	mm	mm	mm	kN		–
87	15 ... 30	110	230	170	73	1180	3000	29422 E
99	15 ... 35	130	270	200	85	1560	4050	29426 E
112.5	15 ... 35	140	280	210	85	1630	4300	29428 E
120	15 ... 40	150	300	225	90	1860	5100	29430 E
135	15 ... 50	160	320	240	95	2080	5600	29432 E
150	15 ... 50	170	340	255	103	2360	6550	29434 E
180	15 ... 50	200	400	300	122	3200	9000	29440 E
210	20 ... 50	240	440	360	122	3400	10200	29448 E
240	20 ... 50	260	480	370	132	4050	12900	29452 E

For selecting and dimensioning spherical roller thrust bearings, recommendations for the minimum load, calculating equivalent dynamic/static bearing load, lubrication, designing bearing arrangements, and mounting.

In particular, the following calculation assumptions must be used

The maximum axial load must not exceed a quarter of the static nominal load rating of the bearing.

- $s_0 = C_{0a}/F$
- $s_0 \geq 4$

C_{0a}	kN	Static load rating
F	Nm	Max. static or dynamic load rating of the thrust bearing
s_0	–	Static load safety factor

The permissible rotational speed of the bearing depends on the ratio of dynamic load rating to bearing equivalent mean load F_m .

When $C_a/F_m \leq 4$

→ max. $n \cdot d_L = 60000$

When $C_a/F_m = 8$

→ max. $n \cdot d_L = 120000$

When $C_a/F_m \geq 15$

→ max. $n \cdot d_L = 200000$

C_a	kN	Basic dynamic load rating
d_L	mm	Mean bearing diameter
F_m	N	Equivalent dynamic load
n	min^{-1}	Revolutions per minute

4.7 Ordering designation

70 Complete roller screw assembly

		SRF	30×5	R	425/590	G5	L	Z	WPR
Nut type									
SRC	Planetary roller screw, axial play, cylindrical nut								
BRC	Planetary roller screw, without backlash, cylindrical nut								
SRF	Planetary roller screw, axial play, centered flange								
BRF	Planetary roller screw, without backlash, centered flange								
SRP	Planetary roller screw, axial play, off-centered flange								
BRP	Planetary roller screw, without backlash, off-centered flange								
PRU	Planetary roller screw, preload with split nut, cylindrical nut								
PRK	Planetary roller screw, preload with split nut, centered flange								
HRC	Ultra Power planetary roller screw, cylindrical nut								
HRF	Ultra Power planetary roller screw, centered flange								
HRP	Ultra Power planetary roller screw, off-centered flange								
ISR	Inverted planetary roller screw, axial play								
SRR	Planetary roller screw, rotating nut, axial play								
BRR	Planetary roller screw, rotating nut, without backlash								
SVC	Recirculating roller screw, axial play, cylindrical nut								
BVC	Recirculating roller screw, without backlash, cylindrical nut								
SVF	Recirculating roller screw, axial play, centered flange								
BVF	Recirculating roller screw, without backlash, centered flange								
PVU	Recirculating roller screw, preload with split nut, cylindrical nut								
PVK	Recirculating roller screw, preload with split nut, centered flange								
Nominal diameter × lead [mm]									
Thread									
R	Right-hand thread								
L	Left-hand thread (on request)								
Threaded length/Total length [mm]									
Lead precision									
G5	Standard lead precision								
G3	Lead precision on request								
G1	Lead precision on request								
Montagerichtung der Flanschmutter									
S	Nut ground outer diameter D (g6) oriented towards shorter machined end of shaft								
L	Nut ground outer diameter D (g6) oriented towards longer machined end of shaft								
-	In case of identical machined ends, and for cylindrical nuts								
Shaft machined end									
Z	According to customer drawing								
wipers									
WPR	With wipers								
NOWPR	Without wipers								
NORCS	Shorter nut without wiper and without wiper recess (applicable to SVC and PVU ranges only)								

001DF3CE

5 Mounting instruction

5.1 Recommendations for assembly

5.1.1 Handling

Roller screw assemblies are precision components and should be handled with care to avoid damaging shocks, contamination or corrosion. After cleaning, avoid touching the screws with bare hands. Unprotected screws made of standard bearing steel are very sensitive to corrosion.

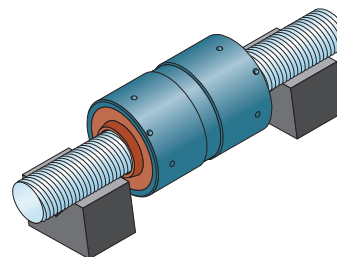
5.1.2 Storage

Roller screw assemblies should be stored so that they are not exposed to contaminants, vibrations, shocks, humidity or other detrimental conditions.

During shipping, roller screw assemblies are wrapped in heavy gauge plastic bags, which protect them from solid or liquid contaminants. They should remain in the shipping crate and wrapped until they are used.

If they are stored out of the shipping crate, roller screw assemblies must lie on wooden, plastic or aluminum V-shaped blocks and should not be subjected to vibrations. The V-shaped supports should be positioned on the threaded section of the screw shaft, or on the machined ends. The assembly must not be supported on the shelf by the nut body.

 71 Roller screw on V-shaped supports



001BD316

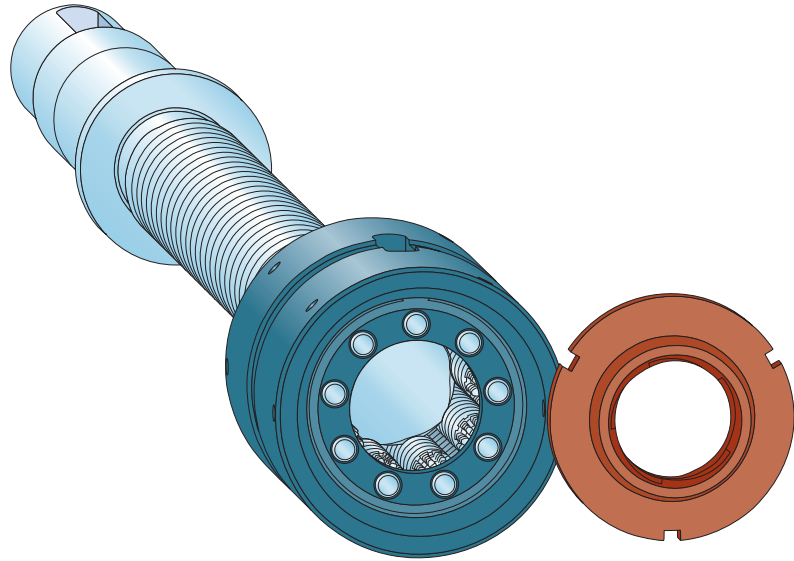
The standard rust inhibitor protects roller screws in their original sleeve for a period of 12 to 18 months. Storage temperature should range between -10°C and $+50^{\circ}\text{C}$. For longer storage periods, special packing such as VCI sleeve can be used. For additional information about roller screw storage, please contact your local Schaeffler representative.

5.1.3 Nut disassembly

If possible, do not remove the nut from the shaft, especially for preloaded assemblies. If the nut must be removed from the shaft, i.e. for shaft end machining, check the nut orientation before disassembly.

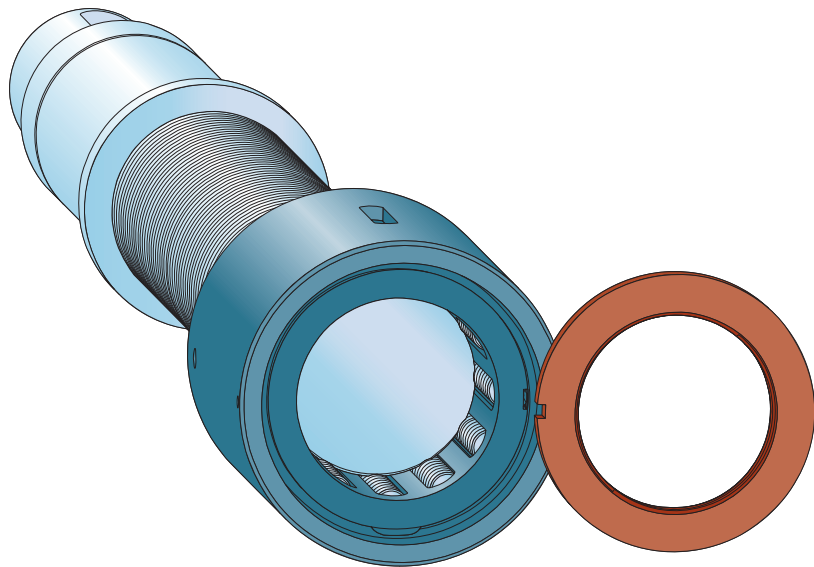
Identify the type of nut by removing one wiper.

72 Planetary roller screw



001BD31F

73 Recirculating roller screw

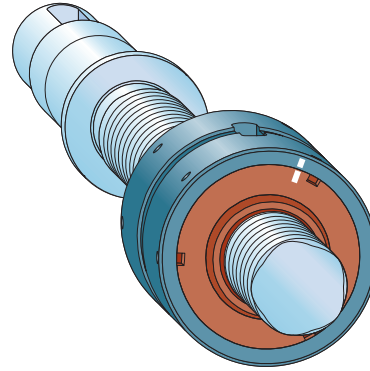


001BD322

For a recirculating roller screw with a nominal diameter < 16 mm, the nut should never be removed from the screw without using a sleeve (risk of losing the rollers).

For the other recirculating roller screws and for all planetary roller screws, the nut can be removed without any risk. But if the nut is fitted with wipers (components usually are black or white), Schaeffler recommends marking the wipers and their angular position in relation to the nut to facilitate the re-assembly process.

74 Marking of wiper angular position on the nut before disassembly



001BD31D

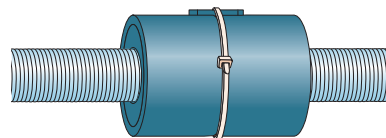
In order to achieve the proper axial play or preload required by the application, each nut is matched to its shaft. Therefore, special attention must be paid not to mix nuts and shafts during disassembly.

Just changing the orientation of a preloaded nut onto its matched screw shaft will affect the preload torque. Again, special care is required for proper disassembly and reassembly!

With preloaded assemblies (screws types with prefix PRU, PRK, PVU and PVK), do not remove the retaining device used for transportation inside the packaging. The retaining device can be:

- Transportation bolts (usually 3 screws) for the flanged types PRK and PVK
- Retaining strap for the cylindrical types PRU and PVU. When removing the retaining strap, there is a high risk of dropping the preloading spacers and the key. Therefore, this operation should be performed at the last minute when pressing the nut into its housing.

75 Retaining strap



001BD31A

5.1.4 Lubrication

The rust inhibitor is not a lubricant. For grease or oil lubrication, please refer to the lubrication chapter in this document.

5.1.5 Starting up the screw

After the assembly has been cleaned, fitted and lubricated, allow the nut to make several full strokes at low speed ($< 50 \text{ min}^{-1}$) and under light load (not to exceed 5 % of the roller screw dynamic load carrying capacity) in order to check the proper positioning of the limit switches or reversing mechanism. Then, normal load and speed can be applied.

5.1.6 Running in period

Non-preloaded roller screws will experience a running in process during the first hours of operation. Schaeffler recommends injecting half the volume of grease in the nut after running in, to renew the lubricant potentially contaminated by running in particles. For preloaded roller screws, a running in of 20000 revolutions is performed before delivery.

5.1.7 Monitoring screw life

At the end of the screw's service life, the following conditions become observable: Fatigue flaking, increase in axial play, deterioration of running behavior, increase in driving torque and increase in operating temperature. Also, lubricant becomes noticeably contaminated. These indicators are important methods of monitoring the condition of a roller screw. Immediate replacement is recommended at the end of the service life in order to avoid any damage to the installation.

Important

Poor quality or lack of lubricant, abnormal stresses, misalignment and tilting, and operation outside defined specifications will increase operating temperature of the roller screw. Monitoring the operating temperature will help detect any irregularities.

5.1.8 Traceability

Each roller screw shaft and nut are identified by engraving with unique manufacturing order and serial number. Each screw's individual dimensional data, lead precision, axial play, preload torque, etc. are recorded and archived by Schaeffler for a period of 10 years. This period can be enlarged for special applications.

5.1.9 Support bearings assembly

1. Check the direction of fitting (position of the flange) before fitting a FLRBU support bearing.
2. If necessary, heat the FLRBU up to 80 °C with a suitable heater.
3. Fit the FLRBU on the screw (check that it fits against the surface of the screw flange).
4. Prepare the precision locknut and loosen the grub screws one-quarter of a turn.
5. Fit the precision locknut
 - › Tighten to 1.5 times the tightening torque listed in the product table.
 - › Loosen the nut.
 - › Retighten the precision locknut to the torque values listed in the product table and tighten the locking screws.
6. Check the radial run-out of the machined end and mark the upper point.
7. If the run-out is out of tolerance, loosen and retighten the radial locking screw which is closest to the previously marked upper point.
8. Check the radial run-out again.
9. Check the operation of the support bearing.

5.1.10 Recommendations for bolts used with flanged nuts

Schaeffler recommends using bolts with steel quality that complies with ISO class 12.9.

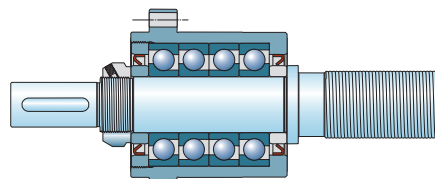
5.1.11 Alignment

Schaeffler linear guidance systems should be checked for proper alignment to avoid non-axial loading on the roller screw. If external linear guidance does not meet these requirements, we suggest mounting the roller screw nut on trunnions, or mounting the screw shaft on self-aligning bearings.

For assembly, Schaeffler recommends the following procedure which applies to an assembly with a rotating shaft screw and translating nut.

The linear guides must be correctly mounted according to recommendations for the selected guidance system.

76 Support bearing assembly

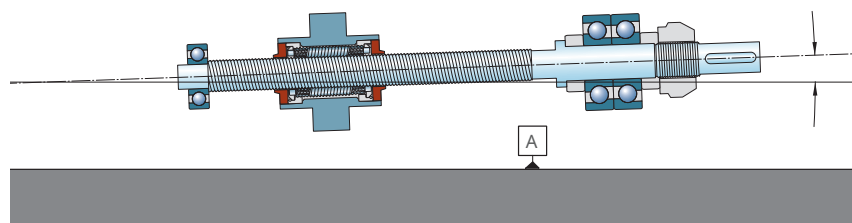


001BD323

1. Align the screw shaft with the linear guides.

Align the support bearing housings with the guides to obtain parallelism of the screw shaft with respect to the linear guides. The inclination of the support bearing axis versus the linear guide, in two perpendicular planes, must be less than $1/2000$ rad (0.03°); the ideal target being $1/5000$ rad (0.011°).

77 Align the screw shaft with the linear guides

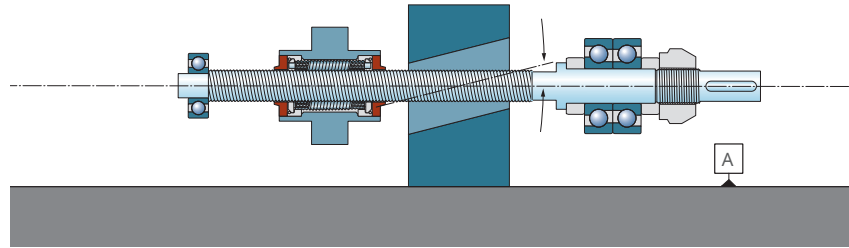


001BD324

2. Align the nut housing with the linear guides.

Align the roller screw nut housing with the axis of the linear guides to obtain parallelism of the nut axis with the linear guides. The inclination must be less than $1/2000$ rad (0.03°); the ideal target being $1/5000$ rad (0.011°). These tolerances must be maintained under load.

78 Align the nut housing with the linear guides

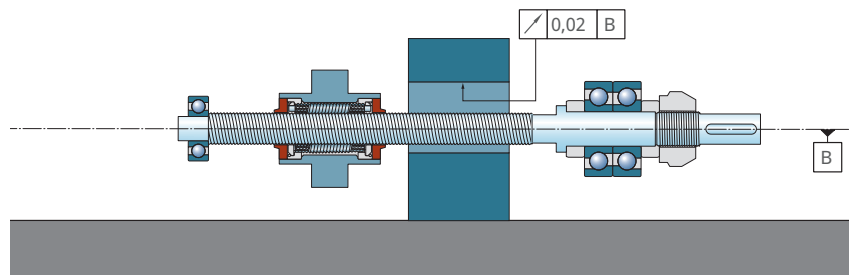


001BD327

3. Check the concentricity of the nut housing with the support bearings.

Schaeffler recommends checking that the nut housing is not off-centered versus the support bearings of the shaft. Otherwise, the excessive off-centered position of the nut housing would result in unacceptable radial loading on the roller screw. The radial eccentricity in two perpendicular planes must not exceed 0.02 mm between the nut housing bore diameter and the support bearings axis.

79 Check the concentricity of the nut housing with the support bearings



001BD328

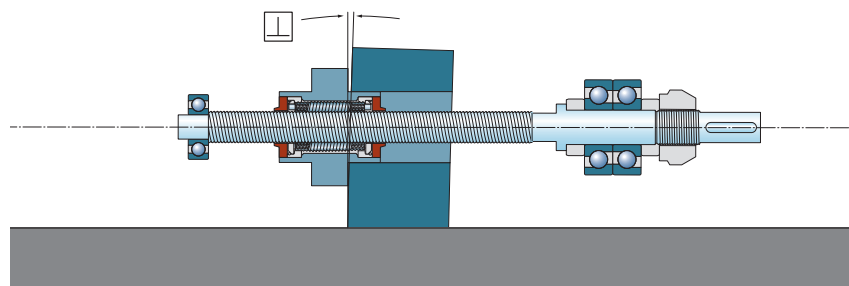
4. Check the axial run-out of the nut housing face versus the screw shaft axis (flanged nuts).

Schaeffler recommends checking that the nut housing presents the appropriate perpendicularity to the roller screw axis to avoid the tilting of the screw nut and to avoid uneven loading along the rollers.

The axial run-out of the housing face must be:

- Lower than 0.015 mm for screws with $d_0 \leq 15$ mm
- Lower than 0.02 mm for screws with $15 < d_0 \leq 39$ mm
- Lower than 0.04 mm for screws with $d_0 > 39$ mm

80 Check the axial run-out of the nut housing face versus the screw shaft axis



001BD32D

5.2 Lubrication

5.2.1 Lubrication for roller screws

The primary objectives of lubrication are:

- To prevent metal-to-metal contact between the rolling surfaces, and to minimize metal fatigue
- To protect against corrosion
- To minimize wear
- To maximize the roller screw service life
- To achieve performance requirements for given operational conditions (temperature, humidity, vacuum environment, corrosive environment, etc.)

In standard delivery conditions, roller screws are not lubricated. However, they can be lubricated on request. Please contact your local Schaeffler representative. For roller screws with standard delivery conditions, customers must provide proper lubrication prior to operation.

Important:

Before shipping, roller screws are coated with a rust inhibitor. The inhibitor is not a lubricant. Depending on the lubricant selected for the application, it may be necessary to remove the rust inhibitor before applying the lubricant in order to eliminate any risk of incompatibility. To remove the film, Schaeffler recommends the following procedure:

- Wash the roller screw assembly with a solvent.
- Allow the solvent to penetrate the nut assembly.
- Let the solvent drain completely from the roller screw assembly.

The rust inhibitor Schaeffler applies to its roller screws is not compatible with the following lubricants:

- Polyglycol base oil
- Ester base oil
- Silicone base oil
- Aluminum complex soap

If any of the above lubricants are used, please follow the procedure above to remove the rust inhibitor prior to lubrication.

There are three main types of lubricants, grease, oil and dry lubricant. In the majority of applications, grease or oil lubrication will be selected. Due to similar tribological conditions, most greases or oils recommended for gears and bearings are also suitable for roller screw lubrication.

46 Different lubricant pros and cons

Type of lubricant	User benefits	Constraints
Grease	Most practical and most usual lubrication solution for roller screws	Requires relubrication schedule
Oil	Higher lubrication performance for roller screws Circulating oil helps to clean the roller screw mechanism and stabilize the operating temperature	Requires more complex equipment installation Special care required for equipment cleanliness and tightness
Dry coating	Lubrication solution for specific applications or environments where liquid lubricants cannot be used	Requires advanced processing method Might require special steel variants for roller screws Higher cost Well defined operating conditions to achieve expected performance

5.2.2 Grease lubrication

Grease is the most common lubricant for screws. The grease type is primarily selected based on the requirements for operating temperature, load level, speed and environment.

Grease consists of base oil (average 80 % of total grease volume) which is the lubricating agent, contained in a thickener matrix or soap, plus additives which provide special properties.

Grease selection

Grease with a synthetic base oil is recommended over grease with a mineral base oil as it presents the advantages of greater stability over time and lower viscosity variation with changes of temperature.

The following synthetic oils provide good results for roller screw applications:

- Polyalphaolefins (PAO)
- Polyglycol (PAG)

Among many possible alternatives, the following thickeners achieve a good result with roller screw applications:

- Lithium or complex lithium
- Barium or complex barium

The dynamic viscosity characterizes the oil's ability to create a sufficiently thick hydrodynamic film between the contact surfaces of a screw. Lubricant data sheets usually provide the viscosity of the base oil at 40 °C and 100 °C.

In general, Schaeffler recommends lubricants with a viscosity around 100 cSt when the application has reached its normal operating temperature.

Normal operating temperature is determined by the heat generated by the roller screw, any externally applied heat and the amount of heat that can be transferred away from the screw.

Grease consistency or NLGI grade between 0 (semi-fluid) and 2 (soft) is suitable for most applications. For automatic lubrication systems, Schaeffler recommends checking the consistency required for the system to work properly.

For high speed applications and vertical applications which could cause the lubricant to fly off or pour down the shaft because of centrifugal forces, lubricants that will strongly adhere to the shaft are recommended. In this respect, barium soap and complex metallic soaps provide good adhesive properties. In these conditions, NLGI grade 2 is also recommended to provide good consistency.

However, when rotating speed is low (below 10 min^{-1}), high viscosity lubricants are recommended to enable the creation of a sufficiently thick hydrodynamic film between the rolling surfaces, and to limit friction under load. Schaeffler usually recommends a viscosity above 300 cSt at the operating temperature.

Shearing of the hydrodynamic lubricant film is proportional to the load level. In general, for external load levels greater than 25 % of the dynamic load carrying capacity of roller screws, Schaeffler recommends greases with extreme pressure (EP) additives.

Greases that pass the "four balls welding load test" under a weight of 250 kg, will perform well in heavily loaded applications.

The following working conditions require specific greases:

- Food industry
- Vacuum applications
- Presence of water
- Vibrations
- Small movements, oscillations

Lubrication systems can generally be adapted to our roller screws for automatic injection of grease.

Lubrication schedule and procedure

Schaeffler recommends the following lubrication schedule and procedure:

1. Commissioning and initial lubrication

New roller screws must be lubricated prior to use.

1.1. Lubrication procedure for the shaft:

On the threaded length of the shaft, spread a volume of grease with a brush. The product tables provide the quantity of grease Z_s to be applied per meter of threaded length for each screw size. This volume of grease is estimated using the following formula:

61 Volume of grease Z_s

$$Z_s = 4.4 \cdot 10^{-4} \cdot d_0 \cdot l_1$$

d_0	mm	nominal diameter of screw shaft
l_1	mm	Threaded length of the screw
Z_s	cm^3	initial grease volume for the screw shaft

1.2. Lubrication procedure for the nut:

Roller screws with a flanged nut have a threaded hole for a grease fitting. Roller screws with a cylindrical nut include a central groove and a lubrication hole that can be connected to a grease channel through the housing. During the initial lubrication Schaeffler recommends filling $\frac{1}{3}$ rd of the free space in the nut with grease. The volume of grease to be injected is listed in the product tables in column Z_n .

Inject the grease in several steps, rotate the nut on the shaft or the shaft in the nut (several revolutions) between two grease injections in order to spread the grease between the rollers and to spread it over the nut length.

2. First relubrication

For non-preloaded screws, Schaeffler recommends an additional injection volume of $Z_n/2$ after 100000 revolutions.

3. Lubrication maintenance schedule (after the first relubrication)

The following method describes the lubrication maintenance schedule and procedure for complete grease renewal, to be followed for the life of the roller screw, after the initial greasing operation and the first relubrication. This recommendation will optimize performance and extend the service life of the roller screw. This method is valid for screws working in an industrial environment, in a workshop, without external contaminants, and at ambient temperature not exceeding 40 °C.

A lubricant that does not completely meet the application requirements will require shorter relubrication intervals.

To avoid problems associated with grease compatibility (miscibility), always use the same type of grease. If, for whatever reason, it is necessary to switch to a different type of grease, check miscibility carefully. When in doubt, thoroughly clean the nut and screw shaft.

Note:

Grease applied to the length of the screw thread is usually not protected, which can accelerate aging and oxidation. The parameters determining the relubrication intervals are:

- Speed: maximum rotational speed of the application
- Load: mean axial load carried by the screw in the application. The mean load can be calculated using the formulae ➤27 | 2.1.20.
- Temperature: internal temperature of the nut mechanism, usually the temperature measured on the outside surface of the nut, plus 15 °C.

If idle time is very long compared to operational time, the natural ageing and oxidation of the grease tends to change the grease condition, and decrease relubrication intervals. This case is not in the scope of following method. The initial quantity of grease is the volume spread on the shaft plus the volume injected in the nut.

§62 Initial lubrication quantity Z_0		
$Z_0 = Z_s + Z_n$		
Z_0	cm ³	total grease quantity for the screw shaft and the nut
Z_n	cm ³	initial grease volume for the nut
Z_s	cm ³	initial grease volume for the screw shaft

The calculation of the lubrication intervals takes into account the actual operational time when the screw is in motion (idle time is not factored into that calculation).

The time before renewal of the initial quantity of grease is:

f63 Operational time before complete renewal of the initial quantity of grease t_g

$$t_g = t_s \cdot K_T \cdot K_F$$

K_F	-	Correction factor related to screw mean operating load
K_T	-	Correction factor related to roller screw maximum internal operating temperature
t_g	h	Operational time before complete renewal of the initial quantity of grease
t_s	h	Basic relubrication interval related to maximum speed

5



The renewal of grease should be done incrementally. Once the relubrication quantity and total interval are determined, they must be fractioned over time in practical volume and intervals. Schaeffler recommends applying small amounts of grease frequently rather than applying the full quantity in one operation.

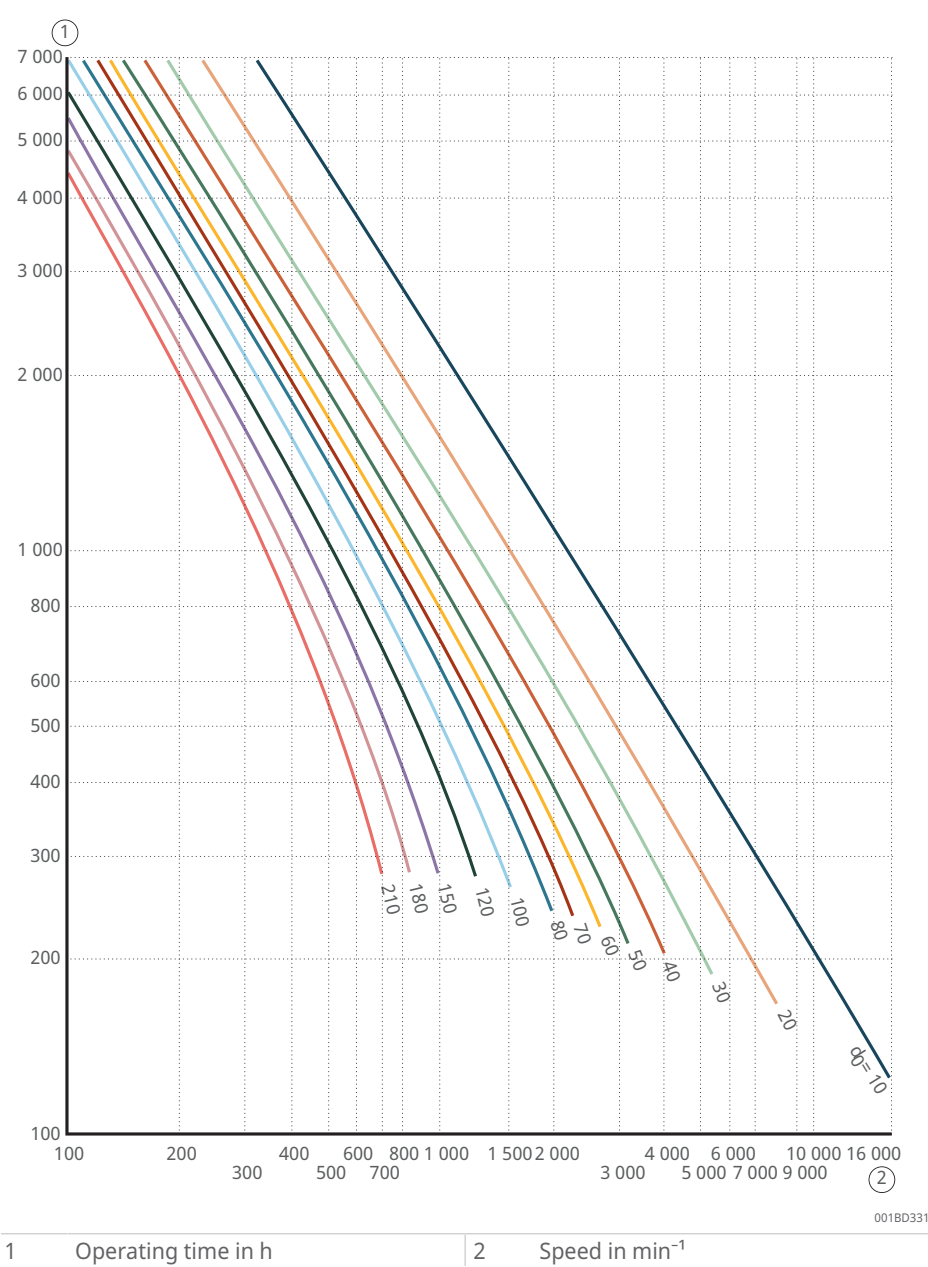
If all the grease is renewed at once (which is not recommended), operate the roller screw at low speed to spread the grease over the full length of the screw.

If the consistency or viscosity of the grease changes rapidly, or if the temperature does not stabilize to an acceptable level, either the relubrication intervals must be shortened, or the grease is not suitable for the application conditions and another type of grease must be used.

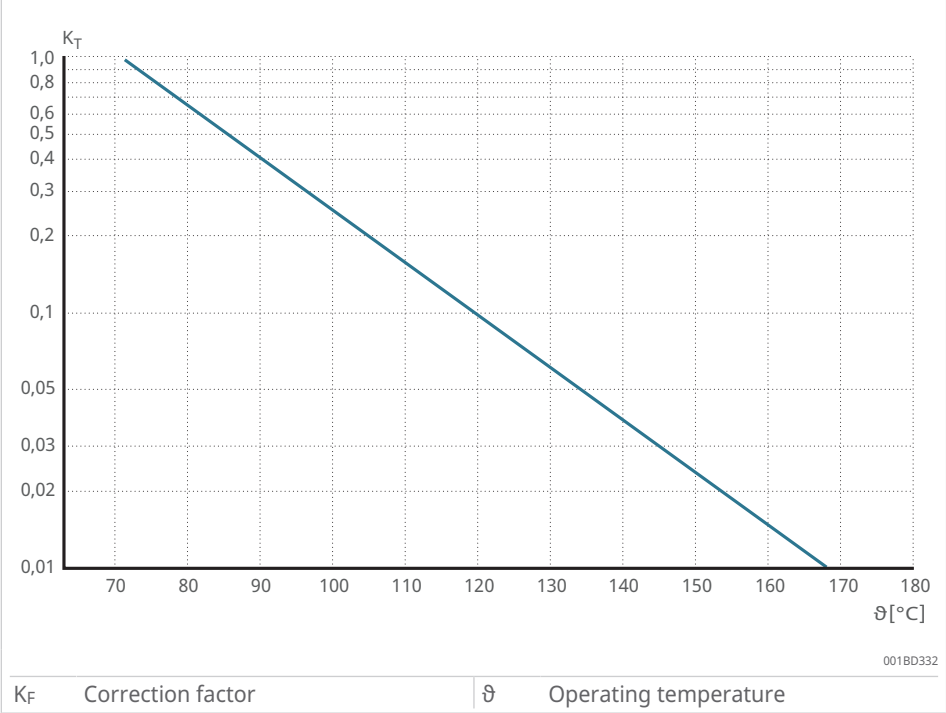
Always rotate the shaft during periodic lubrication to distribute the grease evenly in the nut and the shaft.

Rotating the shaft also prevents a roller from blocking the grease inlet hole.

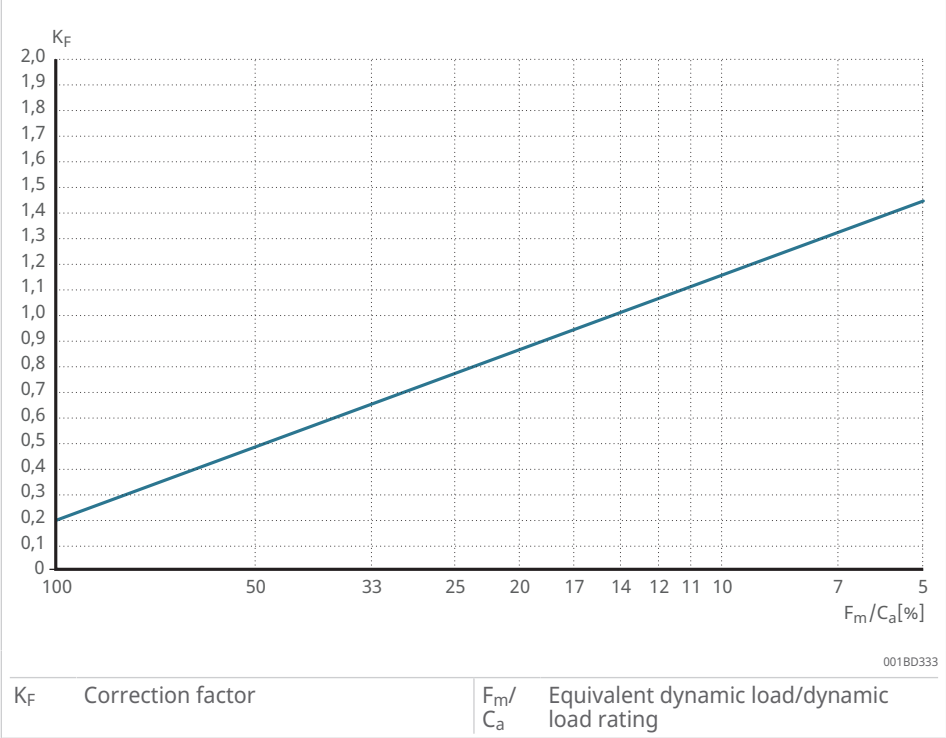
81 Diagram of the basic relubrication interval t_s .



82 Diagram of correction factor K_T for operating temperature



83 Diagram of correction factor K_F for mean operating load



Example:

Roller screw SRF 39 × 20R 760/1030 G5 Z WPR is used in a simulator, in the vertical position, and operates according to following conditions:

- Mean axial load over one working cycle = 17 kN
- Each working cycle accomplishes 32 back-and-forth strokes of 1000 mm (total travel of 32000 mm per working cycle), operation is 12 working cycles per h, 8 h/d.
- The screw is in motion during 70 % of the time of a working cycle, i. e. 5 h to 6 h/d of motion
- Maximum speed = 1500 min⁻¹

For such application data, a grease with metallic complex soap or barium is recommended because it will improve adhesion under high speed and vertical position. A viscosity of 100 cSt to 150 cSt at 40 °C is advised.

Initial quantity of grease when commissioning the screw

- Initial quantity of grease on the shaft Z_s
 $= 4.4 \cdot 10^{-4} \cdot d_0 \cdot l_1 = 4.4 \cdot 10^{-4} \cdot 39 \cdot 760 = 13 \text{ cm}^3$
- Initial quantity of grease in the nut Z_n
 $= 28 \text{ cm}^3$
- Total quantity of grease
 $= 13 \text{ cm}^3 + 28 \text{ cm}^3 = 41 \text{ cm}^3$ must be applied

Calculation of first relubrication

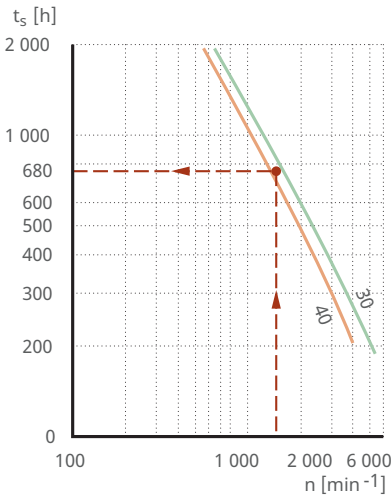
- With the given duty cycle, 100000 revolutions are reached within one day
- $(32000 \div 20) = 1600$ revolutions per working cycle
- 12 cycles/h
 $\rightarrow 19200$ revolutions/h
- 8 h/day per operation
 $\rightarrow 153600$ revolutions/day
- Approximately 1 day into operation, the first relubrication should be scheduled with 14 cm³ of new grease in the nut (half the initial volume of grease in the nut).

Calculation of lubrication maintenance schedule

- t_s :
 Maximum speed = 1500 min⁻¹ $d_0 = 39 \text{ mm}$:
 $\rightarrow$ From the diagram ►161 | 84: $t_s = 680 \text{ h}$
- K_T :
 The temperature measured on the nut external surface = 65 °C
 Internal screw nut temperature $\approx 80 \text{ °C}$
 $\rightarrow$ From the diagram ►161 | 85: $K_T = 0.65$
- K_F :
 Dynamic load carrying capacity C_a of SRF 39 x 20R = 172 kN
 $F_m \div C_a = 17 \div 172 \approx 10 \%$
 $\rightarrow$ From the diagram ►162 | 86: $K_F = 1.15$
- Therefore, the maintenance lubrication schedule t_g is:
 $= t_s \cdot K_T \cdot K_F = 680 \cdot 1.15 \cdot 0.65 = 508 \text{ h}$
 $= 90 \text{ days}$
 $(508 \div 5.6 \approx 90)$

Within a period of 90 days, 41 cm³ of new grease must be applied, to be divided in fractions applied on a regular basis.

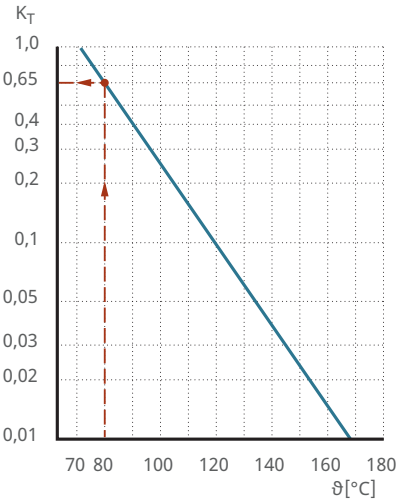
84 Example: Basic relubrication interval t_s based on the max. speed



001BD334

t_s	Relubrication interval	n	Rotational speed
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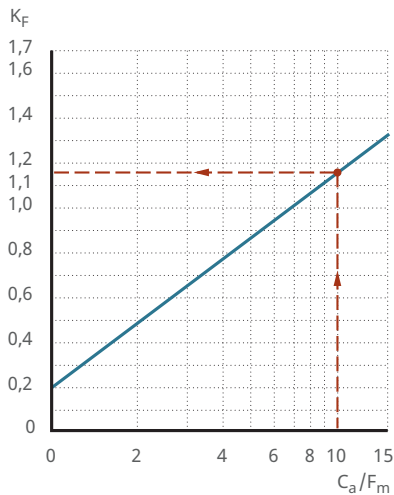
85 Example: Correction factor K_T for the max. internal temperature of the roller screw



001BD335

K_T	Correction factor	ϑ	Operating temperature
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86 Example: Correction factor K_F based on the mean operating load



001BD339

K_F	Correction factor	$\frac{C_a}{F_m}$	Equivalent dynamic load/dynamic load rating
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5.2.3 Oil lubrication

Oil lubrication provides the following advantages over grease lubrication. Oil dissipates heat more efficiently than grease, particularly when there are heavy duty cycles and/or high speeds.

It helps to remove contaminants, and helps to clean the roller screw nut.

Lubricating a roller screw with oil is normally accomplished using a centralized recirculating oil system. This type of system is ideal because it continuously replaces the oil in the nut with cooled filtered oil coming from the reservoir. This system is recommended to control the flow of lubricant, remove any contaminants and avoid overheating.

Oil selection

Oils used to lubricate other rotating parts such as bearings and especially gears can also be used to lubricate roller screws. Using hydraulic oils will jeopardize the product performance, condition and life.

The oil performance is affected by the rotational speed, the operating temperature and the load level.

The oil should have a viscosity of 100 cSt at the operating temperature. At low speed (below 10 min⁻¹), the viscosity should be = 300 cSt at the operating temperature.

EP additives are recommended to improve the oil film strength.

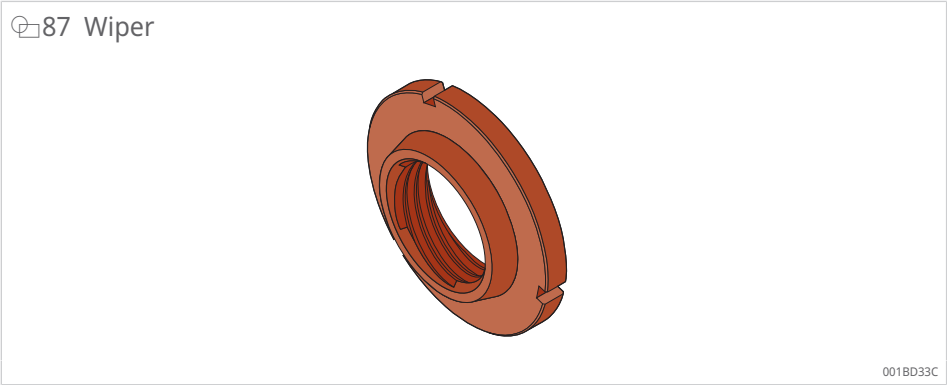
Corrosion resistant and stabilizing additives are also recommended. Synthetic oils (PAO, polyglycol or ester based) are recommended for long service life and stable operation at high temperatures.

Oil quantity

The quantity to be injected will depend on the size of the roller screw, the speed, the duty cycle and the sealing efficiency of the wipers. It can vary from 0.5 cm³/h to 100 cm³/h, with small injections of 0.1 cm³ to 1 cm³. It is best to adjust, by experience, the oil flow to obtain the correct stabilization temperature.

5.2.4 Wipers

Wipers are composite components fitted at the ends of the nut with the purpose of preventing contamination and keep ing the lubricant in place. Wipers are important components for roller screw performance and service life. It should be noted that standard wipers perform like labyrinth seals, not like garter seals. Depending on the product assortment, wipers are standard or optional.



Standard wipers are manufactured from acetyl resin with continuous operating temperature up to 110 °C and peak temperature up to 140 °C

47 Standard wipers

Roller screw types	Wipers in standard delivery (Acetyl resin material)
Planetary SR/BR/PR	To be specified in the designation
Planetary Ultra Power HR	Included
Planetary IR (inverted)	Not included and not an option (wipers cannot be fitted into this roller screw design, sealing can be integrated into the push tube)
Planetary SRR (rotating nut)	Included (wipers fitted in the roller screw nut, garter seals fitted in the bearings housing)
Recirculating SV/BV/PV	To be specified in the designation

48 Special wipers

Optional wiper design	Application
PTFE material	High operating temperatures: continuous temperature up to 200 °C, peak temperature up to 260 °C
Tighter wiper	Higher resistance to contaminants and better lubricant retention inside the nut
Split (two half moons)	Easier wiper disassembly on long, large diameter screws

Important

Normally, threaded wipers are not axially secured in the nut. If the maximum stroke position is not respected and the edge of wiper extends beyond the non-threaded portion of the screw, the wiper can disengage from the nut or potentially jam. For this reason, the user shall respect the maximum stroke position. On request, wipers can be axially secured to a nut to prevent disengagement of the wipers during operation.

5.2.5 Dry lubricants

When wet lubrication is not allowed or not effective (application examples: satellites, laboratories), dry lubricants present the following advantages:

- Low out-gassing (for example, satellite applications)
- Coefficient of friction independent of speed and temperature
- Positional stability
- Low rate of ageing (for example, during long storage periods)

Dry lubricants can be applied by projection, electrolytic deposit or physical vapour deposit.

Schaeffler recommends thin deposits that will support a low coefficient of friction: these dry lubricants are usually based on PTFE, MoS₂, WS₂, graphite. These coatings are not corrosion resistant, and special care must be taken when selecting raw materials.

Schaeffler also recommends thin deposits that enhance the resistance to wear. Such dry lubricants are typically based on tungsten carbide, Diamond like Carbon or chrome plating. They do not provide the low coefficient of friction of PTFE for example.

Dry lubricants (on a stand-alone basis) are not suitable for industrial grade or for heavy duty applications, and they cannot reach the rolling fatigue life achieved with grease or oil lubrication.

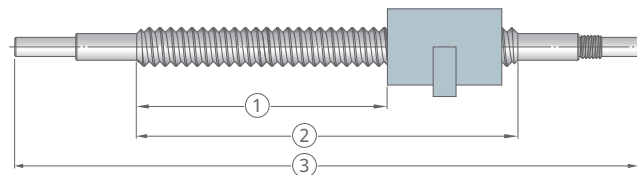
Note:

Lubrication that is performed at the customer facility after product delivery is outside the control of Schaeffler. However, Schaeffler provides the above guidelines to aid the customer in selecting a lubricant, and proper maintenance to provide maximum performance and product life. For additional information about lubricants and lubrication systems, please contact your local Schaeffler representative.

Customer and project information

Company name	
Address	
Contact name	
Email	
Phone number	
Website	
Project name	
Application type ¹⁾	
Customer is not a subsidiary or part of National Defense industry ¹⁾	☐ I agree
Application is not civil nuclear ¹⁾	☐ I agree
Application is civil ¹⁾	☐ I agree
Short description of application ¹⁾ (please attach a sketch if possible)	
Current technology used for similar application	
Annual roller screw requirements	
Prototype requirements	
Expected first delivery date	
Expected prototype delivery date	

Preselection design parameters



1	max. stroke	2	thread length
3	total length		

Maximum stroke	mm	
Threaded length	mm	
Total screw shaft length	mm	
Screw type (planetary, inverted, rotating nut, recirculating)	-	
Nut shape (cylindrical, centered flange, off-centered flange, split nut, double nut)	-	

Preselection of screw shaft nominal diameter

mm

Preselection of lead P_h

mm

Lead precision grade according to ISO 3408

–

Axial play (standard or specific), without backlash or with preload

–

Operating conditions

Environmental constraints

☐ Corrosive☐ Polluted☐ Vacuum☐ Other

Operating temperature

• Minimum

°C

• Average

°C

• Maximum

°C

• Ambient

°C

Lubrication

☐ Oil☐ Dry lubricant☐ Grease☐ Specific lubrication needed

If lubricant is already selected

• Brand name

• Type

• Viscosity at average operating temperature

cSt

Maximum loads, speed and acceleration

• Maximum dynamic tension load

N

• Maximum dynamic compression load

N

• Maximum static or shock tension load

N

• Maximum static or shock compression load

N

• Maximum linear speed

m/min

• Maximum acceleration

m/s²

Service life

• Stroke (1 cycle = 2 strokes)

mm

• Cycles/hour

• Hours/day

• Days/year

• Years

7 Symbols

Symbol	Unit	Description
α	°	Helix angle of the thread
η	–	Theoretical direct efficiency
η'	–	Theoretical indirect efficiency
η_p	–	Practical direct efficiency
η'_p	–	Practical indirect efficiency
μ_{prac}	–	Practical coefficient of friction
μ_{ref}	–	Reference coefficient of friction
μ_s	–	Coefficient of friction when starting
σ	MPa	Nominal axial stress
σ_p	MPa	Real axial stress
σ_t	MPa	Total stress
τ	MPa	Nominal shear stress
τ_p	MPa	Real shear stress
B	mm	Wiper overhang (protuding from nut length A)
C_{0a}	kN	Static load carrying capacity of a roller screw
C_a	kN	Dynamic load carrying capacity of a roller screw
C_{req}	kN	Required basic dynamic load carrying capacity
D_0	mm	Nominal nut diameter for an inverted roller screw
D_2	mm	Wiper outside diameter (= inner diameter of wiper recess)
D_3	mm	Wiper outside diameter in the plane of nut end face
d_0	mm	Nominal diameter of screw shaft
d_1	mm	Outside diameter of screw shaft
d_2	mm	Root diameter of screw shaft
d_b	mm	Bore diameter of a hollow screw shaft
e	mm	Depth of the keyway on shaft end machining
F	N	Axial load
F_c	N	Buckling strength
F_m	N	Equivalent constant cubic mean axial load
F_{pr}	N	Internal preload force between a nut half (or a nut) and the shaft
F_q	N	Squeeze load applied to two nut halves (or two nuts) by the housing or by fixing bolts
f_1	–	Mounting factor for calculation of critical speed of screw shaft
f_3	–	Mounting factor for calculation of buckling strength of screw shaft
f_4	–	Stress concentration factor for shaft end calculation for torsional stress
f_5	–	Stress concentration factor for shaft end calculation for axial stress
g	m/s ²	Acceleration of gravity = 9.8 m/s ²
HRC	HRC	Rockwell hardness
HV	HV	Vickers hardness
I	kg · m ²	Inertia
I_L	kg · m ²	Inertia of load
I_M	kg · m ²	Inertia of motor
I_{nn}	kg · mm ²	Inertia of a rotating nut
I_{ns}	kg · mm ²	Inertia of rollers with rotating shaft
I_s	kg · mm ² /m	Inertia of screw shaft per meter of shaft length
K_F	–	Correction factor for basic relubrication interval to account for operating load
K_s	h	Basic relubrication interval related to maximum speed
K_T	–	Correction factor for basic relubrication interval to account for operating temperature
L	mm	Length of stroke in a duty cycle
L_{10}	10 ⁶ revolutions	Basic life rating, revolutions
L_{10h}	h	Basic life rating, operating hours
L_n	10 ⁶ revolutions	Calculated life with reliability factor
L_{tp}	mm	Maximum total shaft length
l_0	mm	Nominal travel: Nominal lead multiplied by the number of revolutions
l_1	mm	Threaded length
l_{cr}	mm	Free length, or distance between the two supports for shaft critical speed calculation
l_{rs}	mm	Length of roller set in an inverted roller screw

Symbol	Unit	Description
m_L	kg	Mass of the load
m_n	kg	Mass of the nut with standard number of rollers
m_s	kg/m	Mass of the screw shaft per meter
n_{cr}	min^{-1}	Critical speed
P	W	Power
P_h	mm	Lead of a roller screw
Q	mm	Fixing hole for the grease fitting, or lubrication hole for cylindrical nuts
R_n	$\text{N}/\mu\text{m}$	Nut stiffness
R_{ng}	$\text{N}/\mu\text{m}$	Minimum nominal stiffness of a nut assembly
R_{nr}	$\text{N}/\mu\text{m}$	Reference nominal stiffness of a nut assembly
R_s	$\text{N}/\mu\text{m}$	Shaft stiffness
R_t	$\text{N}/\mu\text{m}$	Static axial stiffness of the roller screw assembly
S	mm	Maximum stroke for an inverted roller screw
S_{ap}	mm	Maximum axial play
T	Nm	Input torque in steady state
T_b	Nm	Back-driving and braking torque
T_{be}	Nm	Torque without backlash
T_f	Nm	Torque from friction in support bearings, motor, seals, etc.
T_{pr}	Nm	Preload torque
T_t	Nm	Total driving torque
u	°	Angular position of lubrication hole on flanged nut
Z_0	cm^3	Total grease volume for the screw shaft and the nut
Z_n	cm^3	Initial grease volume for the nut
Z_s	cm^3	Initial grease volume for the screw shaft

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