



Ball screws

Technical Product Information

We pioneer motion

SCHAEFFLER

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1 Introduction

1.1 Product description

This catalogue describes Schaeffler expertise, technology and solutions related to precision rolled ball screws. Thanks to our lengthy experience with manufacturing ball screws and continuous product and process development, Schaeffler provides customers with precision rolled ball screw solutions that fulfil their most demanding applications in terms of efficiency, precision, durability and value.

In many cases, these ball screws can replace ground ball screws, offering a similar level of performance and precision at a lower cost.

The high quality of Schaeffler rolled ball screws is achieved through our dedicated manufacturing processes, including precision rolling and specific heat-treatment.

☞1 Product description



1.2 Product overview

1 Product overview

Nut	Ball screw	Play	Type of recirculation	Features	d ₀	P _h	Details		
					mm	mm			
SD	Miniature	Axial clearance	Internal, by inserts	-	8 ... 16	2 ... 10	►30 3.1		
BD		No play			8 ... 16	2 ... 10	►30 3.1		
SH		Axial clearance	External, by integrated tube		6 ... 12.7	2 ... 12.7	►30 3.1		
SDS		Axial clearance	Internal, by inserts		Corrosion-resistant steel	8 ... 16	2 ... 5	►34 3.2	
BDS		No play				8 ... 16	2 ... 5	►34 3.2	
SHS		Axial clearance	External, by integrated tube			6	2	►34 3.2	
SP	High-performance miniature	Axial clearance	Internal, by inserts	-		8 ... 16	2.5 ... 5	►38 3.3	
BP		No play				8 ... 16	2.5 ... 5	►38 3.3	
SX	Universal screws	Axial clearance	Internal, by inserts			-	20 ... 63	5 ... 10	►42 3.4
BX		No play			20 ... 63		5 ... 10	►42 3.4	
SN	Precision screws	Axial clearance	Internal, by inserts		-		16 ... 63	5 ... 10	►58 3.8
BN		No play					16 ... 63	5 ... 10	►58 3.8
PN		Preloaded		16 ... 63			5 ... 10	►62 3.9	
SND		Axial clearance		DIN nut			16 ... 63	5 ... 10	►50 3.6
BND		No play				16 ... 63	5 ... 10	►50 3.6	
PND		Preloaded				16 ... 63	5 ... 10	►54 3.7	
SL	Long lead screws	Axial clearance	by faces		-	25 ... 50	20 ... 50	►66 3.10	
TL		No play		25 ... 50		20 ... 50	►66 3.10		
SLD		Axial clearance		DIN nut		32	32	►66 3.10	
TLD		No play				32	32	►66 3.10	
SLT	Rotating nut	Axial clearance	by faces	-		25 ... 50	20 ... 50	►70 3.11	
TLT		No play				25 ... 50	20 ... 50	►70 3.11	
FLBU	Thrust support bearing	-	flanged housing		-	16 ... 63	-	►82 3.14	
PLBU		-	fixed pillow block			16 ... 63	-	►86 3.15	
BUF	Support pillow block	-	fixed pillow block			16 ... 63	-	►90 3.16	

2 Selection guide

2.1 Technical concepts

2.1.1 Introduction to Schaeffler ball screws

Ball screws convert rotary motion into linear motion, and vice-versa, and loads are transferred from the screw shaft to the nut through a ball set: in this sense, ball 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. Some bearing concepts such as load ratings, load cycles, nominal and service life, stiffness, speed ratings, lubrication requirements, etc. are explained below to guide customers through the ball screw selection process.

Only basic selection parameters are included in this chapter. To make the very best selection of a ball screw, the designer should consider critical parameters such as the load cycle, the linear or rotational speed, the rates of acceleration and deceleration, the cycle rate, the environment, the required life, the lead accuracy, the stiffness, and any other special requirements. If in doubt, please consult the Schaeffler ball screw assembly specialists who will assist you in the selection process.

2.1.2 Basic dynamic load carrying capacity C_a

The dynamic load rating capacity is used to compute the nominal fatigue life of ball screws. It results from the axial load, constant in magnitude and direction, which acts along the central axis of the ball screw, resulting in the calculated nominal life as defined by ISO of one million revolutions.

With a given combination of nominal diameter and lead, a ball screw's dynamic and static load carrying capacities are determined by the number of ball turns supporting the load.

For each product family, the type and number of circuits generate a specific number of ball turns. For example, the SH type nut with external tube recirculation typically presents 2.5 turns of balls within a circuit. The standard SD type nut has 3 circuits covering 0.9 turns each.

2.1.3 Nominal fatigue life L_{10}

Nominal fatigue life is, according to the ISO definition, the life achieved or exceeded by 90 % of a large-enough group of apparently identical ball screws, working under identical conditions (alignment, axially and centrally applied load, speed, acceleration, lubrication, temperature and cleanliness).

The nominal life of a ball screw is the statistical number of revolutions which the ball screw is capable of reaching before the first signs of material fatigue by flaking occur on one of the rolling surfaces.

2.1.4 Service life

The actual life achieved by a specific ball screw before it fails is known as "service life." Failure is due not only to material fatigue by flaking, but also to inadequate lubrication, wear of the recirculation system, corrosion, contamination and, more generally, loss of the functional characteristics required by the application.

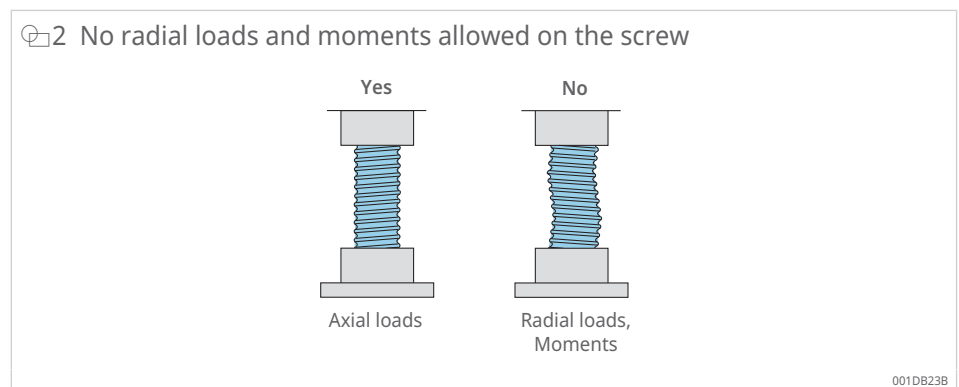
Experience acquired with similar applications will help in selecting the right screw to obtain the necessary service life. Structural requirements such as the strength of screw ends and nut attachments should be considered.

To attain L_{10} life performance, a mean working load of up to 60 % of C_a (to limit the Hertz pressure at the balls / raceways contacts) and a stroke higher than 4 leads (to avoid false-brinelling which could occur with very short strokes or oscillation movements) are required.

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 (e.g. power transmission, work, rotary and linear inertia forces) are known or can be calculated. It is necessary to calculate the equivalent dynamic load.

Radial and moment loads must be taken up by linear bearing systems. It is extremely important to resolve these problems at the earliest possible design stage. These forces are detrimental to the life and the expected performance of the screw.



When the load fluctuates during the working cycle, it is necessary to calculate the equivalent dynamic load: this load is defined as 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 loads which the screw is subjected to.

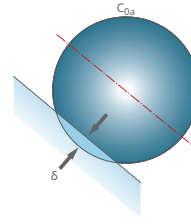
If misalignment, uneven loading, shocks, etc. cannot be avoided in the application, they must be taken in account during the sizing of the ball screw. Their influence on the screw's nominal life can generally be estimated.

2.1.6 Basic static load carrying capacity C_{0a}

Ball screws should be selected considering the basic static load capacity C_{0a} , rather than the basic dynamic load capacity, when they are subjected to continuous or intermittent shock loads while stationary or rotating at very low speed 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 0.0001 times the diameter of the rolling element.

3 Basic static load C_{0a}



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

2.1.7 Critical rotating speed for screw shafts n_{cr}

For this calculation, the shaft is equated to a cylinder, with an external diameter equal to the root diameter of the thread. The formulae use a parameter whose value is dictated by the mounting of the screw shaft, whether it is simply supported or fixed.

As a general rule, the nut is not considered to be a support of 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 which consider the nut to be a support for the shaft, or which reduce the safety factor, require practical tests and possibly optimization of the design.

2.1.8 Permissible speed limit n_p

The permissible speed limit is the speed which a screw cannot reliably exceed at any time. It is generally the limiting speed of the recirculation system in the nut. It is expressed as the product of maximum rotational speed (min^{-1}) and the nominal diameter of the screw shaft (mm). The speed limits quoted in this catalogue are the maximum speeds that may be applied for very short periods of time and with optimized running conditions of alignment, light external load and preload with monitored lubrication. Running a screw continuously at the permissible speed limit may lead to a reduction of the calculated life of the nut mechanism.

! High speed associated with high load requires a large input power and yields a relatively short nominal life. In the case of high acceleration and deceleration, we recommend either working under a nominal external load or applying a light preload to the nut to avoid internal sliding during reversal of movement. The preload for screws subjected to high velocity must be calculated to ensure that the rolling elements do not slide. Excessive preload will create an unacceptable increase in the internal temperature.

2.1.9 Screw shaft buckling

The column loading of the 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 to select the proper coefficients 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 comprises different sections with varying diameters, calculation becomes more complex.

2.1.10 Lubrication

Proper quantities and quality of lubrication must be selected if ball screws are to operate correctly and to maximize their service life.

Greater care is required for operation at high speed, as the lubricant spread on the surface of the screw shaft may be thrown off by centrifugal forces. It is important to monitor this phenomenon during the first run at high speed and, if necessary, to adapt the frequency of re-lubrication or the flow of lubricant, or to select a lubricant with a different viscosity.

Monitoring the steady temperature reached by the nut allows for the optimization of the frequency of re-lubrication or the oil flow rate.

2.1.11 Efficiency and backdriving η

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

“Direct efficiency” is used to define the input torque required to transform the rotation of one component into the translation of the other. Conversely, “indirect efficiency” is used to define the axial load required to transform the translation of one component into the rotation of the other one. It is also used to define the braking torque required to prevent that rotation.

It is safe to assume that ball screws are reversible or back-driveable under almost all circumstances. A braking mechanism (gear reducers or brake) must be part of the design, if back-driving is to be avoided.

Preload torque

Screws with internal preload exhibit a certain amount of friction torque. This torque still exists when ball screws are not externally loaded. Preload torque is measured with ISO grade 64 oil.

Starting torque

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

1. the total inertia of all moving parts accelerated by the source of power (including rotational and linear movements);
2. the internal friction of the screw / nut assembly, bearings and associated guiding devices.

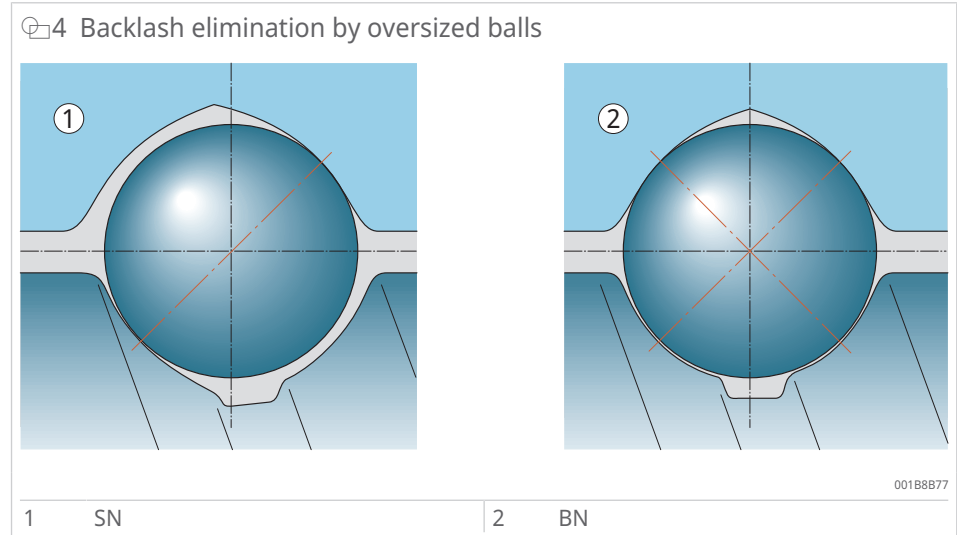
In general, the torque required to overcome the inertia (1) is greater than the friction torque (2). The friction coefficient of the high efficiency screw when starting moving (μ_s) is estimated to reach up to double the amount of the dynamic coefficient μ , under normal conditions of usage.

2.1.12 Axial play and preload

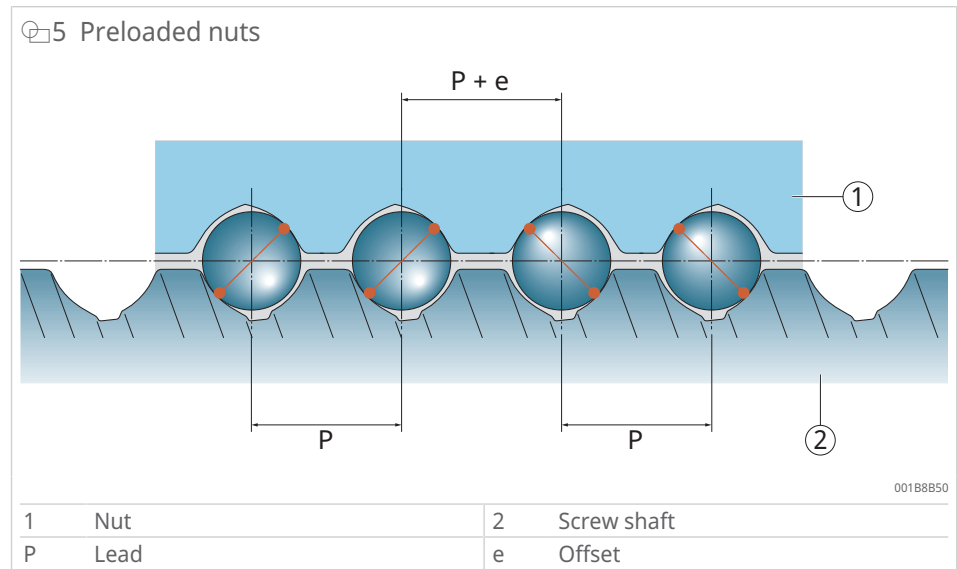
Schaeffler products are available with a range of versions of axial play.

Standard axial play is intended for transport screws, when the product is not subject to vibrations, high accelerations, and when positioning accuracy under load is not critical (e.g.: SN type).

Reduced play (e.g.: SN type with reduced play) and backlash elimination by oversized balls (e.g.: BN type) are recommended to increase assembly precision.



For optimum stiffness and positioning accuracy under load, internally preloaded nuts are recommended (e.g.: PN type).



When subjected to external loading, preloaded nuts exhibit a much lower elastic deformation than non preloaded nuts. Preload is the amount of force applied to a set of two halfnuts necessary to either press them together or to push them apart with the purpose of eliminating backlash or increasing the stiffness of the assembly. The preload is measured by the value of the preload torque (see explanations in the previous paragraph). For a given amount of preload (expressed in Newton), the friction torque varies with different types of nuts and with the preloading method. The friction torque due to preload is indicated in product tables.

2.1.13 Static axial stiffness R_t

The static axial stiffness of a complete ball 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. Please see calculation formulae ►13|2.1.20.

Nut stiffness: R_n

When a preload is applied to a split nut, the internal play is eliminated. Additionally, the Hertzian elastic deformation increases with increased preload and increased stiffness.

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 of the screw shaft. For this reason, the practical stiffness values given in the catalogue are lower than the theoretical values. They are determined by Schaeffler assuming a preload of 8.5 % C_a for screws with diameter up to 40 mm, and a preload of 7 % C_a for screws with diameter greater than 40 mm, when applying an external axial load centred on the screw shaft and equal to twice the amount of preload.

Shaft stiffness: R_s

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

According to the relative importance of the screw deformation, an excessive increase of nut preload and of the supporting bearings yields a limited increase of stiffness and noticeably increases the preload torque and therefore the running temperature.

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

Please see calculation formulae ►13|2.1.20.

2.1.14 Materials, heat treatment and coatings

Standard screw shafts are manufactured from carbon steel which is surface hardened by induction. For standard screws, rolling surface hardness is 56 HRC to 60 HRC, depending on diameter (for very small diameter screws, the temperature during the hardening process is slightly lowered to avoid the through-hardening of the screw shaft, therefore resulting in lower surface hardness). Standard nuts are machined from steel which is through-hardened (100 Cr6 or equivalent for diameters ≥ 20 mm, and carbon steel for diameters < 20 mm). Most stainless steel screws have a surface hardness ranging from 50 HRC to 58 HRC, depending on the type of stainless steel being used and the screw diameter (note the effect of reduced hardening temperature on small diameter screws, as previously mentioned). The load ratings provided in the catalogue are given for standard screws only.

Schaeffler offers various types of surface coating for improved ball screw performance:

- Manganese phosphate coating is standard for the SX/BX universal nuts. This coating can also be applied to most ranges of precision rolled ball screws to improve the resistance to corrosion
- Low friction coating or chrome coating are available on request. Please contact Schaeffler.

2.1.15 Operating temperature

Screws made from standard steel and screws operating under normal loads can operate from -20 °C to $+110\text{ °C}$.

Between $+110\text{ °C}$ and $+130\text{ °C}$, Schaeffler must be notified for adaptation of the annealing procedure and for review of the application with hardness below the standard minimum value.

Above $+130\text{ °C}$, steel adapted to the temperature of the application should be selected (100Cr6, special steel, etc.). Please consult Schaeffler for advice.

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

2.1.16 Ball screw support bearings

To assist the customer design and machinery assembly process, Schaeffler has developed a range of support bearings specifically designed for ball screws with nominal diameter starting from 16 mm. These support bearings can easily be mounted on the screw shaft ends, following Schaeffler recommendations for ends machining ▶76 | 3.13. Three types of support bearings available for fixed axial mounting (FLBU type ▶82 | 3.14), for fixed radial mounting (PLBU type ▶86 | 3.15) and for pure radial support (BUF type ▶90 | 3.16), all fitted with premium bearings, greased and sealed for life. Schaeffler stocks these support bearings for quick delivery.

2.1.17 Designing the screw shaft ends

Generally speaking, when the ends of the screw shaft are specified by the customer's engineering staff, it is their responsibility to check the strength of these ends. However, we offer and recommend a choice of standard machined ends ▶76 | 3.13.

Please bear in mind that no dimension on the shaft ends can exceed d_2 . Otherwise, traces of the root of the thread will appear. If the application requires a shaft end with a smooth surface of diameter greater than d_2 , it is advisable to add an additional part attached to the machined shaft end. A minimum shoulder should be sufficient to maintain the bearing inner ring. Please follow bearing mounting recommendations ▶98 | 4.

2.1.18 Critical applications

The standard products have been fitted with composite ball recirculation inserts. If the ball screws are used in severe applications, or if the inserts are used to prevent system collapse (especially in the case of vertical applications), optional steel inserts are available.

For critical applications, Schaeffler also offers optional safety rings for miniature ball screws, and safety nuts for larger ball screws. In such cases, the customer should consult Schaeffler to define the optimum solution.

2.1.19 Working environment

Our products have not been developed for use in an explosive environment. Consequently, Schaeffler cannot take any responsibility for the use of ball screws in such applications.

2.1.20 Calculation formulae

Basic life rating

f1 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

2

Required load rating

f2 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

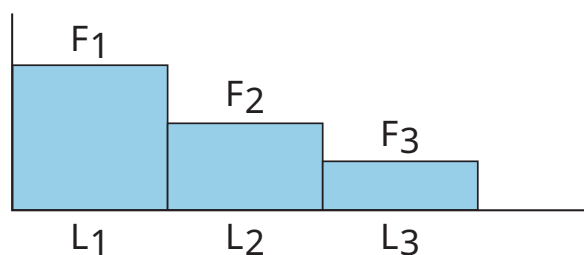
Duty cycle with step loading

f3 Equivalent mean load F_m

$$F_m = \frac{(F_1^3 \cdot L_1 + F_2^3 \cdot L_2 + F_3^3 \cdot L_3 + \dots)^{1/3}}{(L_1 + L_2 + L_3 + \dots)^{1/3}}$$

F_m	N	cubic mean load
L_n	mm	load period n
F_n	N	load during period n

6 Equivalent mean load with step loading



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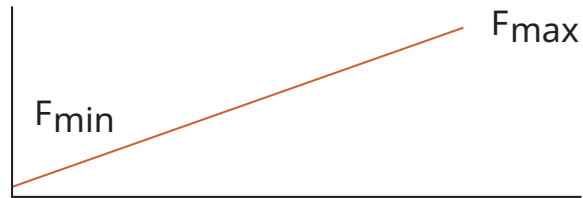
Duty cycle with continuous load variation

f14 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

f17 Equivalent mean load with continuous load variation



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Critical speed of screw shaft (no safety factor)

f15 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 3.8 fixed, radial support 5.6 fixed, fixed

! 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)

With recirculation by inserts / tubes (SD/BD/SH, SDS/BDS/SHS, SHS/BX, SND/BND/PND, SN/BN/PN)

$$n \cdot d_0 < 50000$$

With recirculation through flange (SL/TL, SLD/SLD)

$$n \cdot d_0 < 90000$$

If $n \cdot d_0 > 50000$ oder 90000, respectively, please consult Schaeffler.

With high-speed insertrecirculation (SP/SP)

n	min ⁻¹	Revolutions per minute
d_0	mm	nominal diameter of screw

Maximum admissible acceleration is 4000 rad/s².

Buckling strength, with safety factor 3

f16 Buckling strength F_c with safety factor 3

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

d_2	mm	root diameter
f_3	-	mounting correction factor: 0.25 fixed, free 2 fixed, radial support 4 fixed, fixed
F_c	N	buckling strength
l	mm	free length

Theoretical efficiencies

f17 Direct theoretical efficiency η

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

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

SH/SHS: $\mu_{\text{ref}} = 0.0065$ SD/BD, SDS/BDS, SX/BX, SND/BND/PND, SN/BN/PN, SLT/TLT: $\mu_{\text{ref}} = 0.006$ f18 Indirect theoretical efficiency η'

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

η	%	efficiency
η'	%	indirect efficiency

Practical efficiency

f19 Practical efficiency

$$\eta_p = 0.9 \cdot \eta$$

η_p	%	practical efficiency
η	%	efficiency

The value 0.9 is an average value between the practical efficiency of a new screw and that of a properly run-in screw. It should be used for industrial applications in all normal working conditions. For extreme cases, please contact Schaeffler.

Preloaded efficiency

η_{pr} is calculated using $\mu_{ref} = 0.01$ for preloaded systems.

§10 Preloaded efficiency η_{pr}

$$\eta_{pr} = \frac{1}{1 + \frac{\pi \cdot d}{P_h} \cdot 0.01}$$

d	mm	nominal diameter of screw shaft
P_h	mm	lead
η_{pr}	%	Preloaded efficiency

Input torque in a steady state

§11 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

§12 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

§13 Preload torque T_{pr}

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

F_{pr}	N	preload
P_h	mm	lead
T_{pr}	Nm	Preload torque
η_{pr}	%	Preloaded efficiency

Restraining torque (considering a back-driving system)

f14 Restraining torque T_B

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

F	N	maximum load of the cycle
P_h	mm	lead
T_B	Nm	Restraining torque
η'	%	indirect efficiency

For safety reasons, we use the theoretical indirect efficiency.

Nominal motor torque during acceleration

f15 Nominal motor torque during acceleration T_t (horizontal screw)

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

f16 Nominal motor torque during acceleration T_t (vertical screw)

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

g	m/s ²	acceleration of gravity g = 9.81 m/s ²
F	N	maximum load of the cycle
m_L	kg	mass of the load
P_h	mm	lead
T_f	Nm	torque from friction in support bearings, motors, seals, etc.
T_{pr}	Nm	Preload torque
T_t	Nm	nominal motor 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	-	friction coefficient of the external load on its guiding
η_p	%	practical efficiency
$\dot{\omega}$	rad/s ²	angular acceleration

Nominal braking torque during deceleration

§17 Nominal braking torque during deceleration T'_t (horizontal screw)

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

§18 Nominal braking torque during deceleration T'_t (vertical screw)

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

F	N	maximum load of the cycle
g	m/s ²	acceleration of gravity $g = 9.81 \text{ m/s}^2$
m_L	kg	mass of the load
P_h	mm	lead
T_f	Nm	torque from friction in support bearings, motors, seals, etc.
T_{pr}	Nm	Preload torque
T'_t	Nm	nominal braking 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	-	friction coefficient of the external load on its guiding
η'	%	indirect efficiency
$\dot{\omega}$	rad/s ²	angular acceleration

§19 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

Static axial stiffness of a complete ball screw assembly

§20 Static axial stiffness R_t

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

R_n	N/μm	Stiffness of nut
R_p	N/μm	Stiffness of support bearings
R_s	N/μm	Stiffness of shaft
R_t	N/μm	Stiffness of a complete assembly

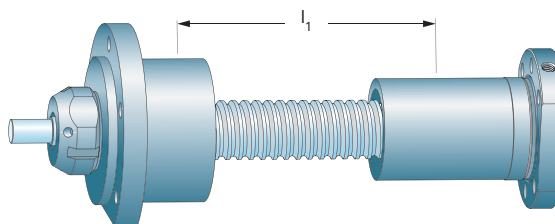
Shaft stiffness

f121 Shaft stiffness fixed-free or fixed-radial support R_s

$$R_s = 165 \cdot \frac{d_2^2}{l_1}$$

d_2	mm	root diameter
l_1	mm	distance center of fixed support bearing to center of nut
R_s	N/ μ m	Stiffness of shaft

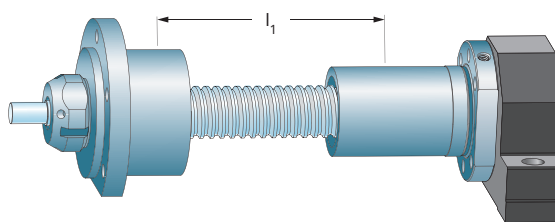
8 Fixed/free guided shaft



00188BF8

l_1 Distance between the center of the fixed support bearing and the center of the nut

9 Fixed/radially guided shaft



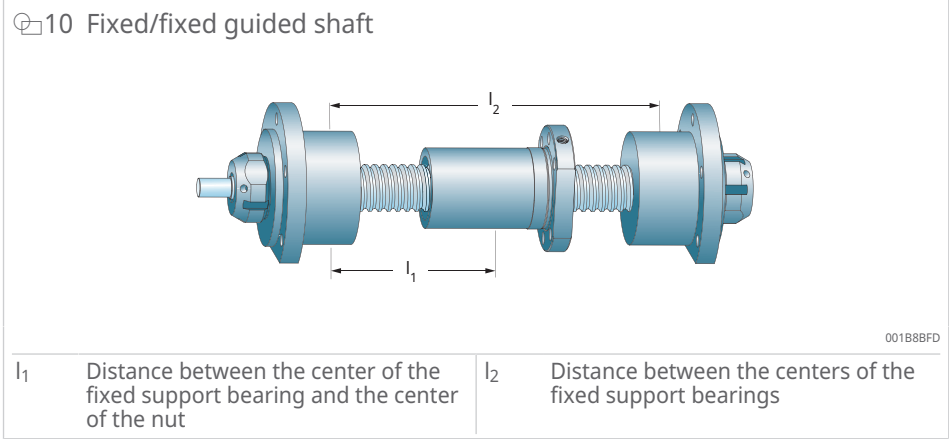
00188BFC

l_1 Distance between the center of the fixed support bearing and the center of the nut

f122 Shaft stiffness fixed-fixed assembly R_s

$$R_s = \frac{165 \cdot d_2^2 \cdot l_2}{l_1 \cdot (l_2 - l_1)}$$

d_2	mm	root diameter
l_1	mm	distance center of fixed support bearing to center of nut
l_2	mm	distance between centers of fixed support bearings
R_s	N/ μ m	Stiffness of shaft

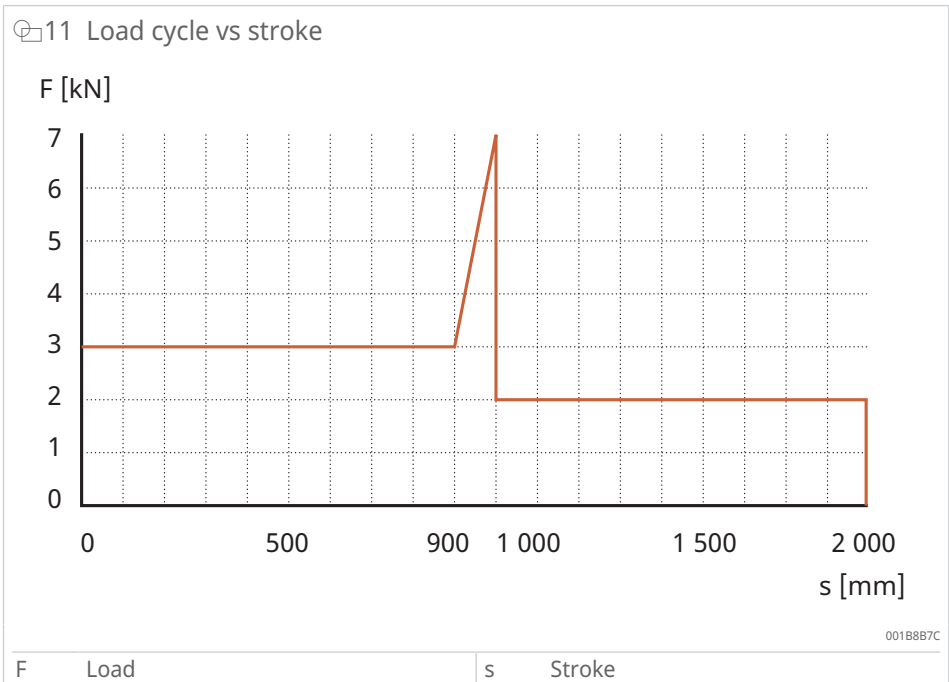


! For additional information, please contact Schaeffler

2.1.21 Calculation example for a ball screw

Description of customer application:

- Ball screw type PND 25 × 5. Ball screw is described ▶54|3.7:
Nut with internal preload, 2 · 3 circuits, dynamic carrying capacity $C_a = 12.7$ kN, and static carrying capacity $C_{0a} = 22.7$ kN
- Screw shaft is horizontally mounted and supported by two support bearings of types PLBU25 and BUF25
- Load cycle as follows:
 - **Phase 1:** Steady axial load of 3 kN, on travel of 900 mm, with linear speed 100 mm/s, or phase duration of 9 s
 - **Phase 2:** Regular load increase from 3 kN to 7kN, on travel of 100 mm, with linear speed 10 mm/s, or phase duration of 10 s
 - **Phase 3:** Nut return to initial position, with steady load of 2 kN, on travel of 1000 mm, with linear speed 100 mm/s or phase duration of 10 s
 - Then period of 31 s with zero load, no displacement
 - Operation during 7 hours per day, 5 days per week, 50 weeks per year.



Calculation of equivalent mean load

First, we check that the maximum load from the duty cycle does not create an excessive loading condition that would be detrimental to service life. Please refer to explanation in paragraph "Service life" ►6|2.1.4.

Maximum application load = 7 kN, while 60 % of $C_a = 60 \% \cdot 12.7 = 7.6 \text{ kN} \rightarrow \text{OK}$

$$F_1 = 3000 \text{ N}$$

F_{2m} is calculated over the mean load of the continuous load variation.

f123 Calculation load F_{2m}

$$F_{2m} = \frac{F_{2 \min} + 2 \cdot F_{\max}}{3} = \frac{3000 + 2 \cdot 7000}{3} = 5667 \text{ N}$$

$$F_{2m} = 5667 \text{ N}$$

- on $L_1 = 900 \text{ mm}$
- on $L_2 = 100 \text{ mm}$
- on $L_3 = 1000 \text{ mm}$

$$F_3 = 2000 \text{ N}$$

f124 Calculation of equivalent mean load F_m

$$F_m = \sqrt[3]{\frac{F_1^3 \cdot L_1 + F_{2m}^3 \cdot L_2 + F_3^3 \cdot L_3}{L_1 + L_2 + L_3}} = \sqrt[3]{\frac{3000^3 \cdot 900 + 5667^3 \cdot 100 + 2000^3 \cdot 1000}{900 + 100 + 1000}} = 2934 \text{ N}$$

Calculation of basic life rating L_{10}

f125 Calculation of nominal fatigue life L_{10}

$$L_{10} = \left(\frac{C_a}{F_m} \right)^3 = \left(\frac{12700}{2934} \right)^3 = 81.1$$

Number of nut revolutions per one complete cycle =

$$(2 \cdot 1000) \div 5 = 400 \text{ revolutions}$$

$$\text{Or } (81.1 \cdot 10^6) \div 400 = 202750 \text{ complete cycles}$$

$$\text{One complete cycle lasts } (9 + 10 + 10 + 31) = 60 \text{ s}$$

$$\text{Or life rating of } (202750 \cdot 60) \div (3600 \cdot 7 \cdot 5 \cdot 50) = 1.9 \text{ years with } 90 \% \text{ reliability}$$

Critical speed of screw shaft

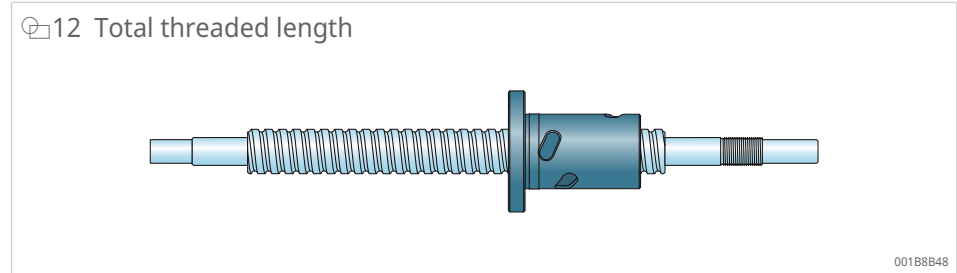
The critical speed must be checked, especially when the nut travel is long compared to the shaft diameter.

Maximum speed during the duty cycle:

f126 Max. rotating speed of screw shaft v_{\max}

$$v_{\max} = \frac{s}{P_h} \cdot 60 = \frac{100}{5} \cdot 60 = 1200 \text{ min}^{-1}$$

The shaft threaded length is calculated with considering the total nut travel (1000 mm), plus the nut length (62 mm) plus extra free length at each shaft end equal to two leads ($2 \cdot 2 \cdot 5 = 20$ mm).

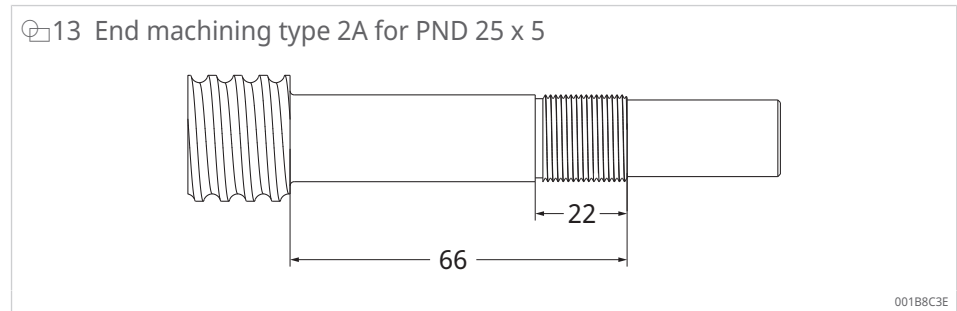


So total threaded length $l_{tot} = 1082$ mm. Screw assembly is horizontally mounted.

End machining is 2A for support bearing PLBU25 and end machining is type 4A for support bearing BUF25. The combination of 2A + 4A ends machining is called "HA" when ordering the screw ▶74 | 3.12.

For end type 2A, with screw nominal diameter $d_0 = 25$ mm, the central axial position of the bearings is calculated ▶76 | 3.13:

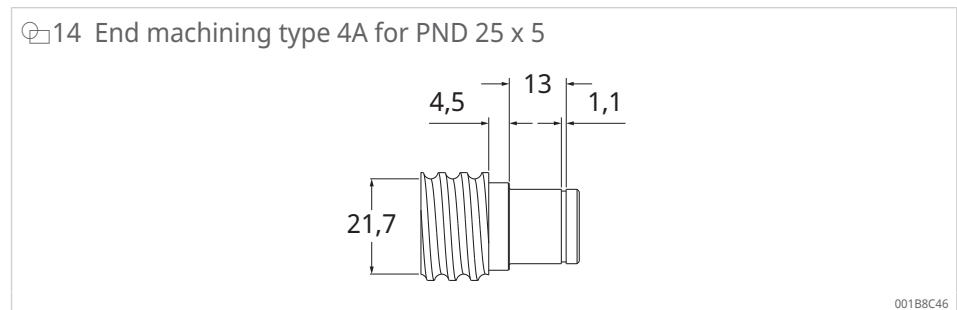
- $B_1 = 66$ mm
- $G_1 = 22$ mm



$(B_1 - G_1) \div 2 = (66 - 22) \div 2 = 22$ mm from the end of the threaded shaft.

For end type 4A, with screw nominal diameter $d_0 = 25$ mm, the central axial position of the bearings is calculated ▶76 | 3.13:

- $B_7 = 4.5$ mm
- $B_5 = 13$ mm
- $m = 1.1$ mm



$B_7 + ((B_5 - m) \div 2) = 4.5 + ((13 - 1.1) \div 2) = 11$ mm from the end of the threaded shaft.

The free length between the two support bearings

f127 Calculation of the free length between the support bearings

$$l = l_{\text{tot}} + \frac{B_1 - G_1}{2} + B_7 + \frac{B_5 - m}{2} = 1082 + \frac{66 - 22}{2} + 4.5 + \frac{13 - 1.1}{2} = 1115 \text{ mm}$$

The root diameter of the threaded shaft is:

$$d_2 = 21.7 \text{ mm}$$

Calculation of critical speed n_{cr}

f128 Calculation of the critical speed n_{cr}

$$n_{\text{cr}} = 49 \cdot 10^6 \cdot \frac{f_1 \cdot d_2}{l^2} = 49 \cdot 10^6 \cdot \frac{3.8 \cdot 21.7}{1115^2} = 3250 \text{ min}^{-1} > v_{\text{max}} = 1200 \text{ min}^{-1}$$

The critical speed is above the maximum rotating speed of screw shaft and is therefore rated as OK.

Speed limit

f129 Calculation of the system speed $n \cdot d_0$

$$n \cdot d_0 = 1200 \cdot 25 = 30000 < 50000$$

Buckling strength

f130 Calculation of the buckling strength F_c

$$F_c = \frac{34 \cdot 10^3 \cdot f_3 \cdot d_2^4}{l^2} = \frac{34 \cdot 10^3 \cdot 2 \cdot 21.7^4}{1115^2} = 12.5 \text{ kN} > F_{\text{max}} = 7 \text{ kN}$$

Theoretical direct efficiency

f131 Calculation of the direct theoretical efficiency η

$$\eta = \frac{1}{1 + \frac{\pi \cdot d_0}{P_h} \cdot \mu_{\text{ref}}} = \frac{1}{1 + \frac{\pi \cdot 25}{5} \cdot 0.006} = 0.914$$

Theoretical indirect efficiency

f132 Calculation of the indirect theoretical efficiency η'

$$\eta' = 2 - \frac{1}{\eta} = 2 - \frac{1}{0.914} = 0.906$$

Practical efficiency

f133 Calculation of the practical efficiency η_p

$$\eta_p = 0.9 \cdot \eta = 0.9 \cdot 0.914 = 0.823$$

Input torque in a steady state

f134 Calculation of the starting torque T

$$T = \frac{F \cdot P_h}{2000 \cdot \pi \cdot \eta_p} = \frac{7000 \cdot 5}{2000 \cdot \pi \cdot 0.823} = 6.8 \text{ Nm}$$

Power requirement in a steady state

Phase 1:

f135 Calculation of the power requirement in a steady state P Phase 1

$$P_1 = \frac{F_1 \cdot n \cdot P_h}{60000 \cdot \eta_p} = \frac{3000 \cdot 1200 \cdot 5}{60000 \cdot 0.823} = 365 \text{ W}$$

Phase 2:

f136 Calculation of the power requirement in a steady state P Phase 2

$$P_2 = \frac{F_{2 \text{ max}} \cdot n \cdot P_h}{60000 \cdot \eta_p} = \frac{7000 \cdot 120 \cdot 5}{60000 \cdot 0.823} = 85 \text{ W}$$

Phase 3:

f137 Calculation of the power requirement in a steady state P Phase 3

$$P_3 = \frac{F_3 \cdot n \cdot P_h}{60000 \cdot \eta_p} = \frac{2000 \cdot 1200 \cdot 5}{60000 \cdot 0.823} = 243 \text{ W}$$

2.2 Lead precision and manufacturing tolerances

2.2.1 Manufacturing precision

Generally speaking, the precision indicated defines the lead precision that complies with ISO standards, e.g. G5, G7, etc.

Parameters other than lead precision correspond to Schaeffler internal standards, generally based on ISO class 7. If the application requires special tolerances, for example class 5, please specify these requirements in the inquiry.

☒ Lead precision P_g according to ISO

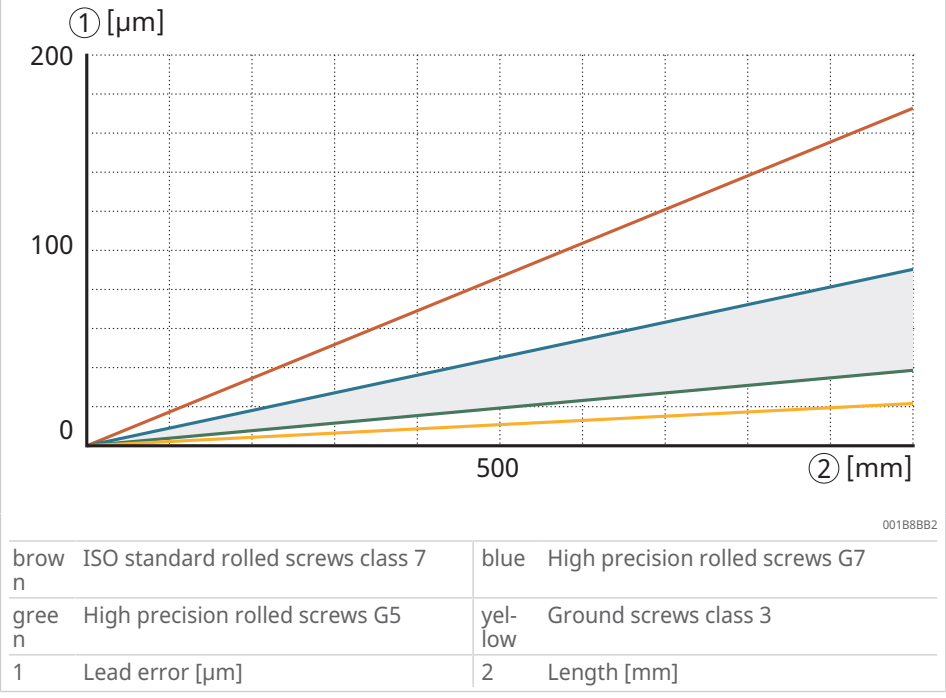
P_g		G5		G7		G9	
V_{300p}		23		35		87	
l_u		e_p	v_{up}	e_p	v_{up}	e_p	v_{up}
mm	mm	μm	μm	μm	μm	μm	μm
0	315	23	23	52	35	130	87
315	400	25	25	57	40	140	100
400	500	27	26	63	46	155	115
500	630	32	29	70	52	175	130
630	800	36	31	80	57	200	140
800	1000	40	34	60	63	230	155
1000	1250	47	39	105	70	260	175
1250	1600	55	44	125	80	310	200
1600	2000	65	51	150	90	370	230
2000	2500	78	59	175	105	440	260
2500	3150	96	69	210	125	530	310
3150	4000	115	82	260	150	640	370
4000	5000	140	99	320	175	790	440
5000	6000	170	119	390	210	960	530

e_p	μm	Tolerance on specified travel
l_u	mm	Useful travel
P_g	-	Lead precision
V_{300p}	μm	Permissible travel variation within 300 mm travel
v_{up}	μm	Permissible travel variation within useful travel l_u

2.2.2 High precision rolled ball screws from Schaeffler

High technology machinery associated with precise control of the cold forming and metallurgical processes results in screw production that virtually offers the same accuracy and performance level of ground ball screws, but at a lower cost. Standard lead precision is G9, which complies with ISO 286-2:1988. Production meets G7 lead precision for screw shaft diameters starting from $d_0 = 20$ mm. On request, Schaeffler can deliver ball screws with G5 lead precision which are in accordance with ISO 3408-3:2006, defined for positioning screws and matching the lead precision of G5 ground ball screws.

15 Lead error as a function of length

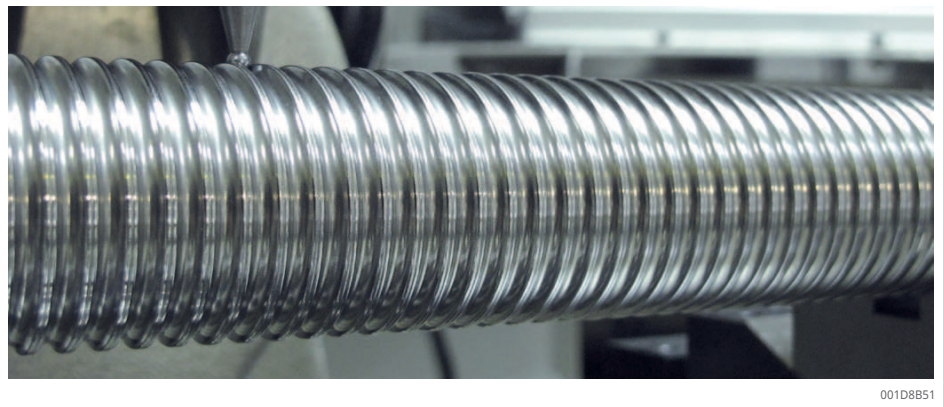


2.2.3 Lead precision

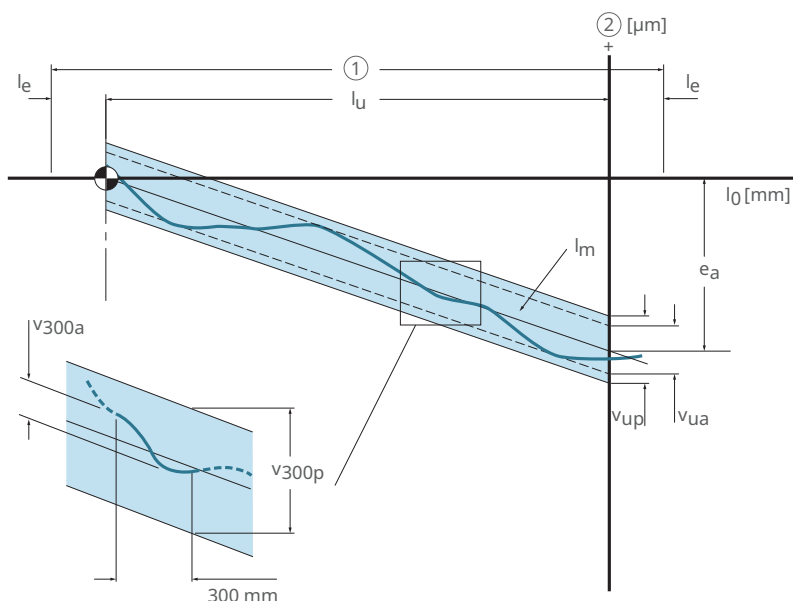
Lead precision is measured at 20 °C on the useful stroke l_u . At Schaeffler l_u is the threaded length of the shaft minus twice the length l_e equal to the screw nominal diameter. Some customer applications require a travel compensation c to account for the effect of operating temperature on the lead precision:

- Standard case with $c = 0$
- Case with specific value of c

16 Lead precision measurement



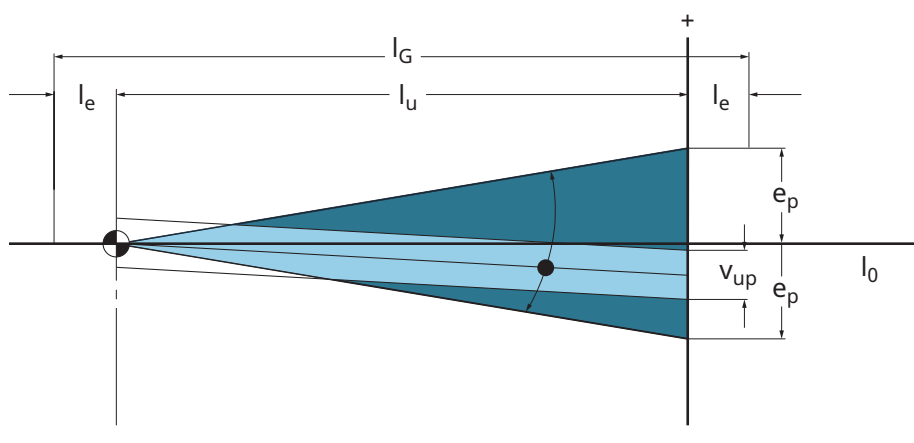
17 Definition of lead error measurement



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		

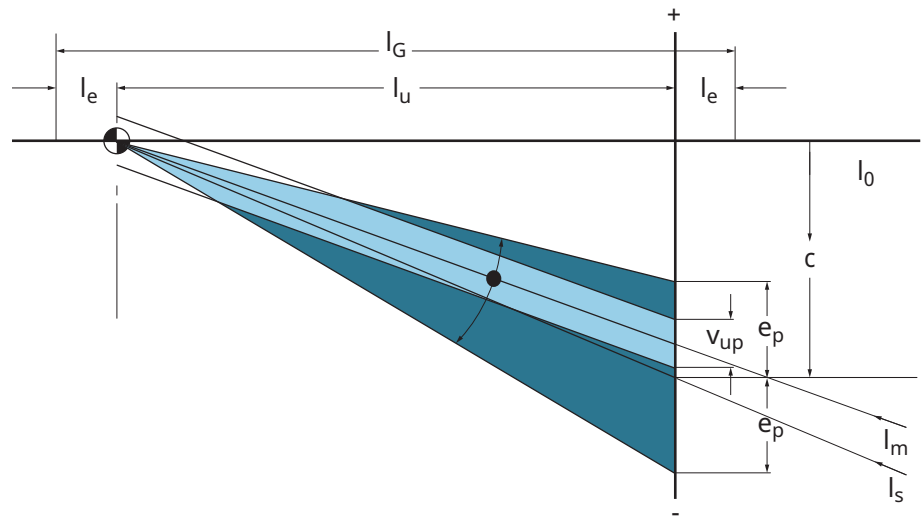
18 Standard case with $c = 0$



001B88BC

e_p	Tolerance over the specified travel	l_G	Threaded length
l_0	Nominal travel	l_u	Useful travel
l_e	Excess travel (no lead precision required)	v_{up}	Maximum permitted travel variation over the useful travel l_u

19 Case with specific value of c

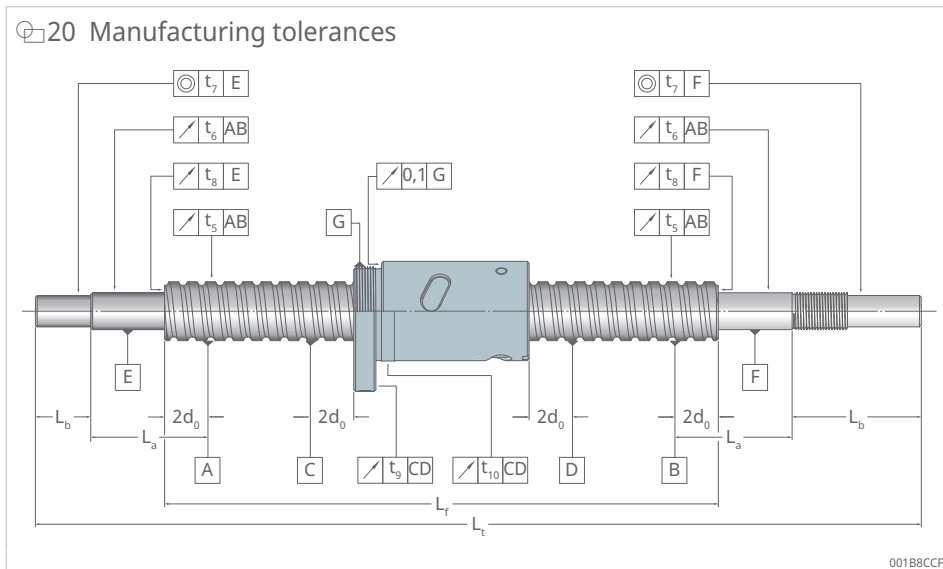


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c	Travel compensation (difference between l_s and l_0 to be defined by the customer)	l_m	Mean travel (by least squares method)
e_p	Tolerance over the specified travel	l_s	Specified travel
l_G	Threaded length	l_U	Useful travel
l_0	Nominal travel	v_{up}	Maximum permitted travel variation over the useful travel l_U
l_e	Excess travel (no lead precision required)		

2.2.4 Manufacturing tolerances

Standard manufacturing tolerances of Schaeffler ball screws are listed hereafter. For different requirement, contact Schaeffler.



3 Reference lengths and Tolerances

Nominal diameter		Reference lengths			Tolerances					
d_0		$L_{f,ref}$	$L_{a,ref}$	$L_{b,ref}$	t_{5p}	t_{6p}	t_{7p}	t_8	t_9	t_{10}
>	\leq				μm	μm	μm	μm	μm	μm
mm	mm	mm	mm	mm	μm	μm	μm	μm	μm	μm
6	12	80	80	80	40	40	-	6	-	-
12	16	160	80	80	40	40	-	6	20	20
16	20	160	80	80	40	40	16	6	20	25
20	25	160	125	125	40	50	16	6	20	25
25	40	315	125	125	40	50	16	6	25	25
40	50	315	125	125	40	50	16	6	25	32
50	63	630	200	200	40	63	20	6	25	32

4 Tolerances t_5 depending on ratio L_f / d_0

ratio		Tolerances
L_f / d_0		t_5
>	\leq	
mm	mm	μm
-	40	80
40	60	120
60	80	200
80	10	320

5 Determination of tolerances

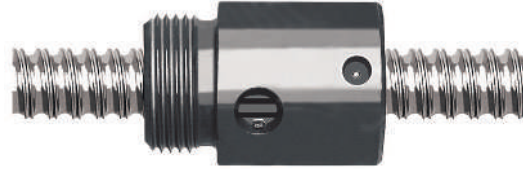
Tolerances	Requirement	Determined tolerance
t_5	$L_f \leq L_{f,ref}$	$t_5 = t_{5p}$
	$L_f > L_{f,ref}$	$t_5 = t_5$
t_6	$L_a \leq L_{a,ref}$	$t_6 = t_{6p}$
	$L_a > L_{a,ref}$	$t_6 = (L_a / L_{a,ref}) \times t_{6p}$
t_7	$L_b \leq L_{b,ref}$	$t_7 = t_{7p}$
	$L_b > L_{b,ref}$	$t_7 = (L_b / L_{b,ref}) \times t_{7p}$

3 Product range

3.1 Miniature screws SD/BD/SH

Rolled thread miniature ball screw, nut with threaded nose

☞21 Standard SD, BD



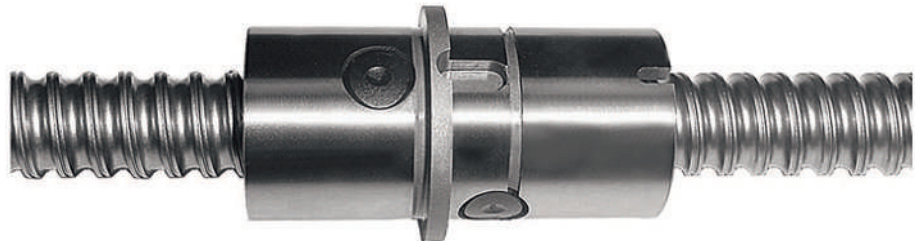
001B8C09

☞22 Standard SH



001B8C24

☞23 Customized SD, rotating nut with flange and bearing journals



001B8C16

Features

- Nominal diameter from 6 mm to 16 mm
- Lead from 2 mm to 12.7 mm
- Recirculation with inserts (SD/BD) or with tube (SH)
- Optional surface coating on shaft and nut
- Optional safety ring ¹⁾
- Optional wipers except 6×2 R – 10×3 R ²⁾

¹⁾ Available for 12×4 R – 12,7×12,7 R – 14×4 R – 16×5 R – 16×10 R

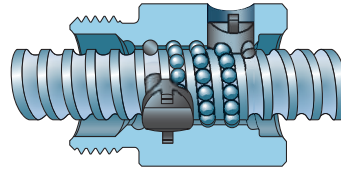
²⁾ It is not possible to supply safety ring and wipers in the same nut

Benefits

- Excellent repeatability with high positioning accuracy
- Smooth running
- Extremely compact nut design with threaded nose for easy assembly
- On request: Backlash elimination by oversized balls (BD Typ) over maximum length of 1000 mm.

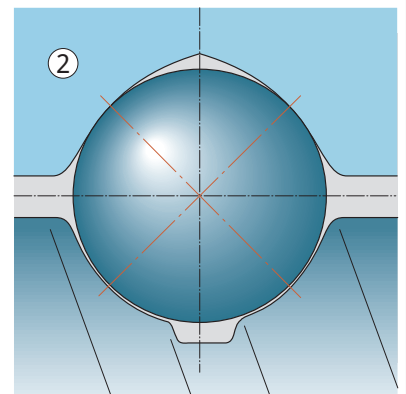
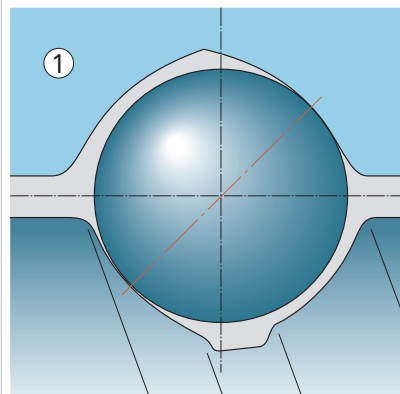
3

24 Recirculation SD, BD



001B8C07

25 SD, BD



001B8B77

1 SD

2 BD

3.1.1 Technical data

SD, BD, SH

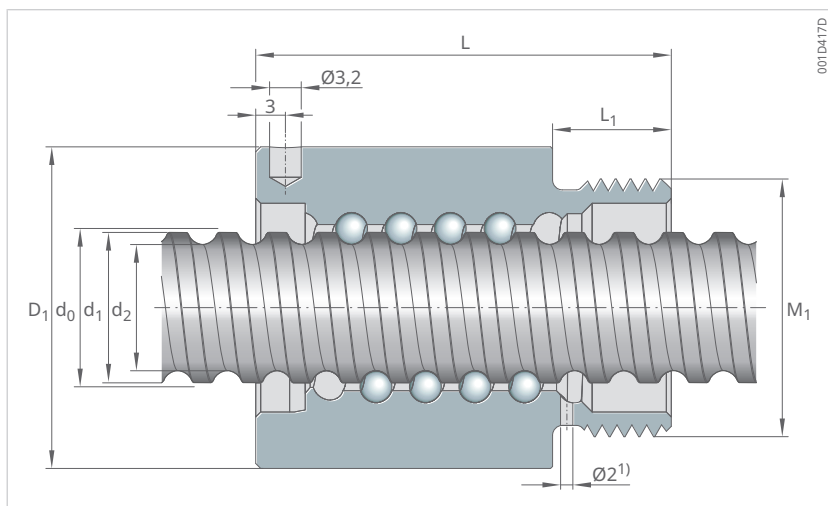
Rolled screw shaft

Nut with threaded nose

3

Designation	d ₀	P _h	C _a	C _{0a}	i	T	T _{red}	J _N	V _{gN}	m _N	m _s	J _s
-	mm	mm	kN	kN	-	mm	mm	kg · mm ²	cm ³	kg	kg/m	kg · mm ² /m
SH 6×2 R	6	2	1.9	2.2	1×2.5	0.05	0.02	7.7	0.1	0.025	0.18	0.7
SD/BD 8×2.5 R	8	2.5	2.2	2.7	3	0.07	0.03	1.12	0.1	0.025	0.32	2.1
SD/BD 10×2 R	10	2	2.5	3.6	3	0.07	0.03	1.7	0.1	0.03	0.51	5.2
SH 10×3 R	10	3	2.6	3.3	1×2.5	0.07	0.03	2.9	0.3	0.05	0.5	5.1
SD/BD 10×4 R	10	4	4.5	5.5	3	0.07	0.03	2.7	0.3	0.04	0.43	3.8
SD/BD 12×2 R	12	2	2.9	4.7	3	0.07	0.03	1.5	0.1	0.023	0.67	10
SD/BD 12×4 R	12	4	4.9	6.6	3	0.07	0.03	7	0.4	0.066	0.71	10.8
SD/BD 12×5 R	12	5	5.3	7.3	3	0.07	0.03	5	0.6	0.058	0.71	10.1
SH 12,7×12,7 R	12.7	12.7	6.6	8.9	2×1.5	0.07	0.03	20	1.1	0.15	0.71	16.2
SD/BD 14×4 R	14	4	6	9.1	3	0.07	0.03	8	0.6	0.083	1.05	22
SD/BD 16×2 R	16	2	3.3	6.2	3	0.07	0.03	9.2	0.6	0.1	1.4	39.7
SD/BD 16×5 R	16	5	7.6	10.7	3	0.07	0.03	22.7	0.9	0.135	1.3	33.9
SD/BD 16×10 R	16	10	10.7	17.2	2×1.8	0.07	0.03	24.4	1	0.16	1.21	30.7

d ₀	mm	nominal diameter of screw
C _{0a}	kN	basic load rating static of nut
C _a	kN	basic load rating dynamic of nut
m _N	kg	mass of nut
m _s	kg/m	mass of screw
V _{gN}	cm ³	grease volume for initial lubrication of the nut
V _{gS}	cm ³ /m	grease volume for initial lubrication of the screw
P _h	mm	lead
T	mm	standard play (max. value)
T _{red}	mm	reduced play (on request)
i	-	number of loaded turns
L _s	mm	length of screw
J _s	kg · mm ² /m	inertia of screw
J _N	kg · mm ²	inertia of nut



SD, BD, SH

Vgs	D1	M1	L		L1	Tightening spanner	Ls	d2	d1	Recommended support bearings	
			Without wipers ± 0.3	With wipers ¹⁾ ± 0.3		FACOM				max.	Thrust support bearing
cm ³ /m	mm	-	mm	mm	mm	-	mm	mm	mm	-	-
0.7	16.5	M14×1	20	-	7.5	126-A35	1000	4.7	6	-	-
1.1	17.5	M15×1	23.5	23.5	7.5	126-A35	1000	6.3	7.6	-	-
1.4	19.5	M17×1	22	22	7.5	126-A35	1000	8.3	9.5	-	-
1.3	21	M18×1	29	-	9	126-A35	1000	7.9	9.9	-	-
1.3	21	M18×1	28	31	8	126-A35	1000	7.4	8.9	-	-
1.7	20	M18×1	20	23.5	8	126-A35	2000	9.9	11.2	-	-
1.6	25.5	M20×1	34	34	10	126-A35	2000	9.4	11.3	-	-
1.4	23	M20×1	36	40	10	126-A35	2000	9.3	11.8	-	-
1.6	29.5	M25×1.5	50	50	12	126-A35	2000	10.2	13	-	-
1.7	27	M22×1.5	30	34	8	126-A35	2000	11.9	13.7	-	-
1.7	29.5	M25×1.5	27	27	12	126-A35	2000	14.3	15.5	FLBU 16/PLBU 16	BUF 16
2.1	32.5	M26×1.5	42	42	12	126-A35	2000	12.7	15.2	FLBU 16/PLBU 16	BUF 16
1.9	32	M26×1.5	46	46	12	126-A35	2000	12.6	15.2	FLBU 16/PLBU 16	BUF 16

¹⁾ Lubrication hole only present on variants with wipers.

3.2 Miniature screws SDS/BDS/SHS in stainless steel

Rolled thread miniature ball screw, nut with threaded nose

☐26 Standard SDS/BDS



001B8C1B

☐27 Standard SHS



001B8C49

☐28 Customized SDS nut with integrated trunnions



001B8C21

Features

- Nominal diameter from 6 mm to 16 mm
- Lead from 2 mm to 5 mm
- Standard lead precision G7 and G9
- Material for shaft and nut is X30Cr13 (similar to AISI 420)
- Balls are made of stainless steel type X105CrMo17 (similar to AISI 440C) ¹⁾
- Optional safety ring ²⁾
- Optional wipers ³⁾, except for SHS 6×2 R.

¹⁾ Except for size SDS/BDS 16×5 R using steel type 100Cr6 (similar to AISI 52100)

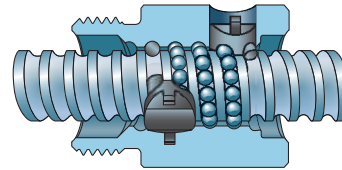
²⁾ Available for 12×4 R – 14×4 R – 16×5 R

³⁾ It is not possible to supply safety ring and wipers in the same nut

Benefits

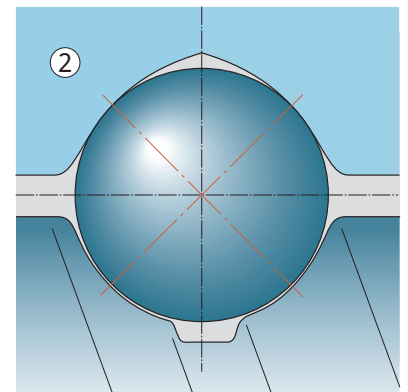
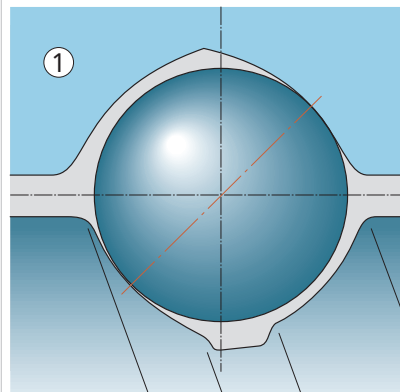
- Excellent repeatability with high positioning accuracy
- Smooth running
- Extremely compact nut design with threaded nose for easy assembly
- Backlash elimination by oversized balls on request (BDS designation), over maximum length of 1000 mm
- Suitable for long storage periods before customer usage, or for applications with extremely long service life
- Adapted for operation in clean environment

29 Recirculation SD, BD



001B8C07

30 SD, BD



001B8B77

1 SD

2 BD

3.2.1 Technical data

SDS, BDS, SHS

Rolled screw shaft

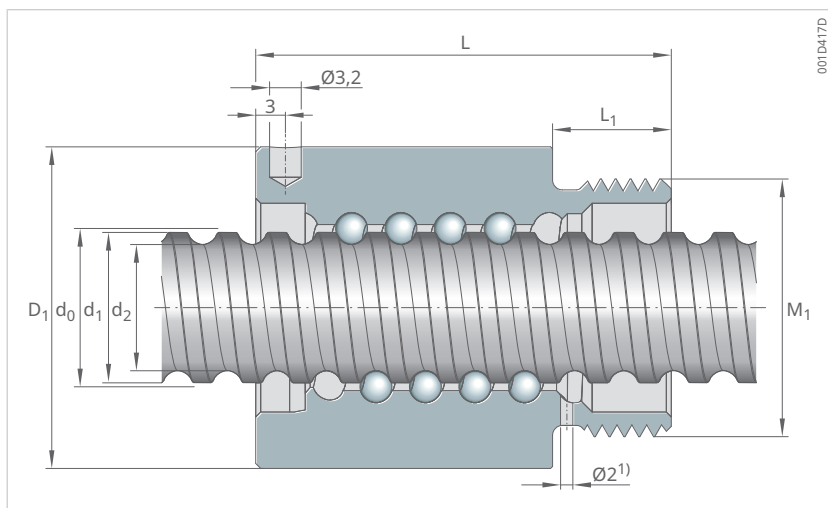
Nut with threaded nose

Corrosion-resistant steel

3

Designation	d ₀	P _h	C _a	C _{0a}	i	T	T _{red}	J _N	V _{gN}	m _N	m _s	J _s
-	mm	mm	kN	kN	-	mm	mm	kg · mm ²	cm ³	kg	kg/m	kg · mm ² /m
SHS 6×2 R	6	2	1.2	1.1	1×2.5	0.05	0.02	7.7	0.1	0.025	0.18	0.7
SDS/BDS 8×2,5 R	8	2.5	1.4	1.3	3	0.07	0.03	1.12	0.1	0.025	0.32	2.1
SDS/BDS 10×2 R	10	2	1.6	1.8	3	0.07	0.03	1.7	0.1	0.03	0.51	5.2
SDS/BDS 12×2 R	12	2	1.9	2.3	3	0.07	0.03	1.5	0.1	0.023	0.67	10
SDS/BDS 12×4 R	12	4	3.1	3.3	3	0.07	0.03	7	0.4	0.066	0.71	10.8
SDS/BDS 12×5 R	12	5	3.3	3.6	3	0.07	0.03	5	0.6	0.058	0.71	10.1
SDS/BDS 14×4 R	14	4	3.8	4.6	3	0.07	0.03	8	0.6	0.083	1.05	22
SDS/BDS 16×2 R	16	2	2.1	3.1	3	0.07	0.03	9.2	0.6	0.1	1.4	39.7
SDS/BDS 16×5 R	16	5	4.8	5.4	3	0.07	0.03	22.7	0.9	0.135	1.3	33.9

d ₀	mm	nominal diameter of screw
C _{0a}	kN	basic load rating static of nut
C _a	kN	basic load rating dynamic of nut
m _N	kg	mass of nut
m _s	kg/m	mass of screw
V _{gN}	cm ³	grease volume for initial lubrication of the nut
V _{gS}	cm ³ /m	grease volume for initial lubrication of the screw
P _h	mm	lead
T	mm	standard play (max. value)
T _{red}	mm	reduced play (on request)
i	-	number of loaded turns
L _s	mm	length of screw
J _s	kg · mm ² /m	inertia of screw
J _N	kg · mm ²	inertia of nut



SDS, BDS, SHS

Vgs	D1	M1	L		L1	Tightening spanner	Ls	d2	d1	Recommended support bearings	
			Without wipers ± 0.3	With wipers ¹⁾ ± 0.3		FACOM				max.	Thrust support bearing
cm ³ /m	mm	-	mm	mm	mm	-	mm	mm	mm	-	-
0.7	16.5	M14×1	20	-	7.5	126-A35	1000	4.7	6	-	-
1.1	17.5	M15×1	23.5	23.5	7.5	126-A35	1000	6.3	7.6	-	-
1.4	19.5	M17×1	22	22	7.5	126-A35	1000	8.3	9.5	-	-
1.7	20	M18×1	23.5	23.5	8	126-A35	2000	9.9	11.2	-	-
1.6	25.5	M20×1	34	34	10	126-A35	2000	9.4	11.3	-	-
1.4	23	M20×1	40	40	10	126-A35	2000	9.3	11.8	-	-
1.7	27	M22×1.5	34	34	8	126-A35	2000	11.9	13.7	-	-
1.7	29.5	M25×1.5	27	27	12	126-A35	2000	14.3	15.5	FLBU 16/PLBU 16	BUF 16
2.1	32.5	M26×1.5	42	42	12	126-A35	2000	12.7	15.2	FLBU 16/PLBU 16	BUF 16

¹⁾ Lubrication hole only present on variants with wipers.

3.3 High-performance miniature screws SP/BP

Rolled thread miniature ball screw, nut with threaded nose

31 SP/BP



001B8BC3

Features

- Nominal diameter from 6 mm to 16 mm
- Lead from 2 mm to 5 mm
- Standard lead precision G7 and G9
- Reduces tangential efforts on the recirculating balls
- Enables up to 2.4 times higher speed limits ($n \cdot d_0 < 120000$)
- Reduces noise levels
- Enables smoother running
- Provides much longer service life
- Interchangeable with most existing standard solutions
- Lubrication hole and wiper housings are standard
- Customized axial play and backlash elimination available
- Same attachment as existing series SD

Benefits

- Smooth running
- Low noise levels
- High speed capability
- Provides longer service
- Easy nut assembly
- Excellent repeatability
- High positioning accuracy
- Backlash-free version available

32 Recirculation SP/BP



001B8BCB

3.3.1 Technical data

SP, BP

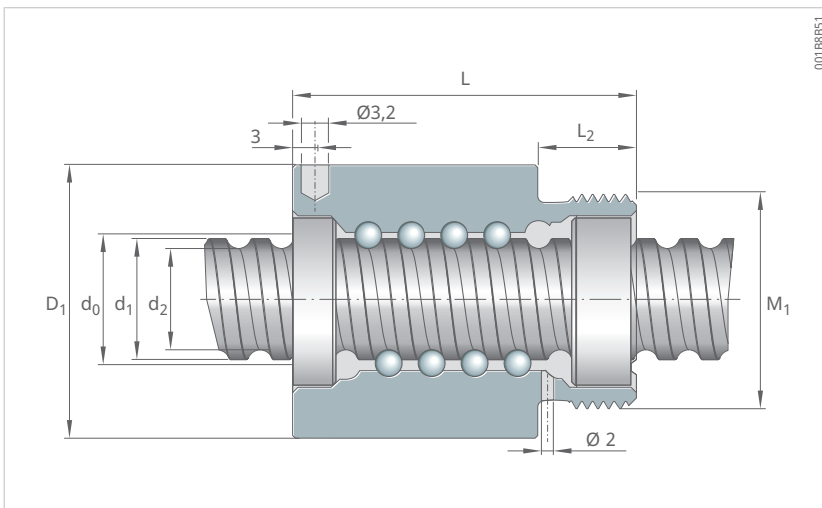
Rolled screw shaft

Nut with threaded nose

3

Designation	d ₀	Ph	C _a	C _{0a}	i	T	T _{red}	J _N	V _{gN}	m _N	m _s	J _s
-	mm	mm	kN	kN	-	mm	mm	kg · mm ²	cm ³	kg	kg/m	kg · mm ² /m
SP/BP 8×2,5 R	8	2.5	2.2	2.7	1×2.7	0.07	0.03	1.14	0.1	0.024	0.32	2.1
SP/BP 10×4 R	10	4	4.5	5.5	1×2.7	0.07	0.03	4.53	0.3	0.056	0.43	3.8
SP/BP 10×5 R	10	5	4.6	5.9	1×2.7	0.07	0.03	5.9	0.5	0.07	0.43	4
SP/BP 12×2 R	12	2	2.9	4.7	1×2.7	0.07	0.03	2.25	0.1	0.031	0.67	10
SP/BP 12×4 R	12	4	4.9	6.6	1×2.7	0.07	0.03	7.13	0.4	0.07	0.71	10.8
SP/BP 12×5 R	12	5	5.3	7.3	1×2.7	0.07	0.03	8.02	0.6	0.078	0.71	10.1
SP/BP 16×5 R	16	5	7.6	10.7	1×2.7	0.07	0.03	24.02	0.9	0.14	1.3	33.9

d ₀	mm	nominal diameter of screw
C _{0a}	kN	basic load rating static of nut
C _a	kN	basic load rating dynamic of nut
m _N	kg	mass of nut
m _s	kg/m	mass of screw
V _{gN}	cm ³	grease volume for initial lubrication of the nut
V _{gs}	cm ³ /m	grease volume for initial lubrication of the screw
Ph	mm	lead
T	mm	standard play (max. value)
T _{red}	mm	reduced play (on request)
i	-	number of loaded turns
L _s	mm	length of screw
J _s	kg · mm ² /m	inertia of screw
J _N	kg · mm ²	inertia of nut



SP, BP

Vgs	D ₁	M ₁	L		L ₂	Tightening Spanner	L _s	d ₂	d ₁	Recommended support bear- ings	
			Without wipers ± 0.3	With wipers		FACOM				max.	Thrust support bearing
cm ³ /m	mm	-	mm	mm	mm	-	mm	mm	mm	-	-
1.1	17.5	M15×1	23.5	23.5	7.5	126-A35	1000	6.3	7.6	-	-
1.3	23	M18×1	33	33	8	126-A35	1000	7.4	8.9	-	-
1.3	23	M18×1	39.5	-	10	126-A35	2000	7.4	8.9	-	-
1.7	21	M18×1	23.5	23.5	8	126-A35	2000	9.9	11.2	-	-
1.6	25.5	M20×1	34	34	10	126-A35	2000	9.4	11.3	-	-
1.4	25.5	M20×1	40	40	10	126-A35	2000	9.3	11.8	-	-
2.1	32.5	M26×1.5	42	42	12	126-A35	2000	12.7	15.2	FLBU 16/PLBU 16	BUF 16

3.4 Universal screws SX/BX

Rolled thread ball screw with recirculation through inserts, nut with threaded nose

3

④33 Standard SX/BX



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④34 Customised SX/BX



00188B96

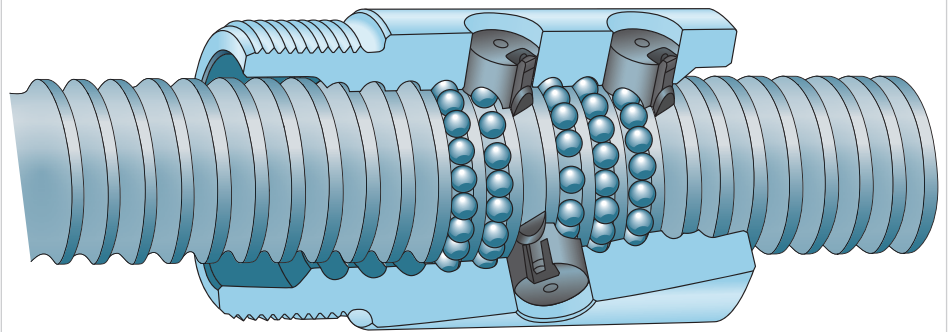
Features

- Nominal diameter from 20 mm to 63 mm
- Lead from 5 mm to 40 mm
- Standard composite recirculation inserts
- Optional steel recirculation inserts
- Lubrication hole for grease nipple or for automatic lubrication kit
- Phosphate coating on nut
- Optional shaft surface coating
- Optional nut flanges ▶46|3.5
- Optional safety nuts. Please contact Schaeffler for selection and usage of this option
- Optional wipers

Benefits

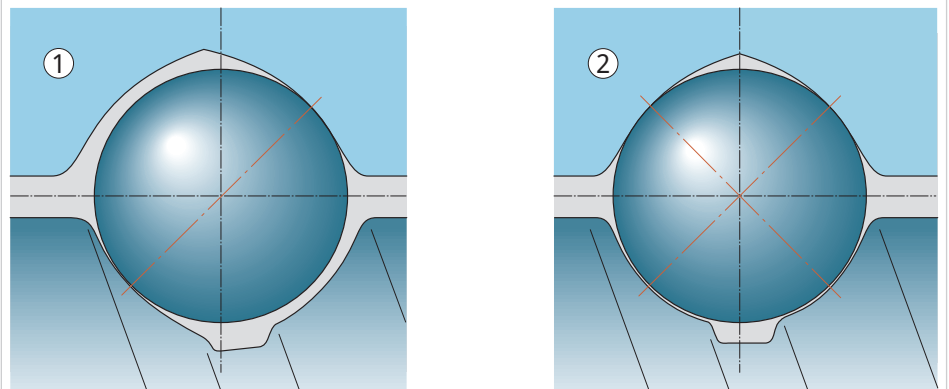
- Minimum nut outside diameter and threaded nose for easy assembly
- Nut design well suited and economical for transport screw applications
- Optional: steel recirculation inserts can act as a safety device for severe or vertical applications. Please contact Schaeffler for such applications.
- Backlash elimination by oversized balls on request (BX designation) for applications with vibrations / changes of direction, over maximum length of 1000 mm.

35 Recirculation SX, BX



001B8CB7

36 SX, BX



001B8B77

1 SX

2 BX

3.4.1 Technical data

SX, BX

Rolled screw shaft

Internal ball return

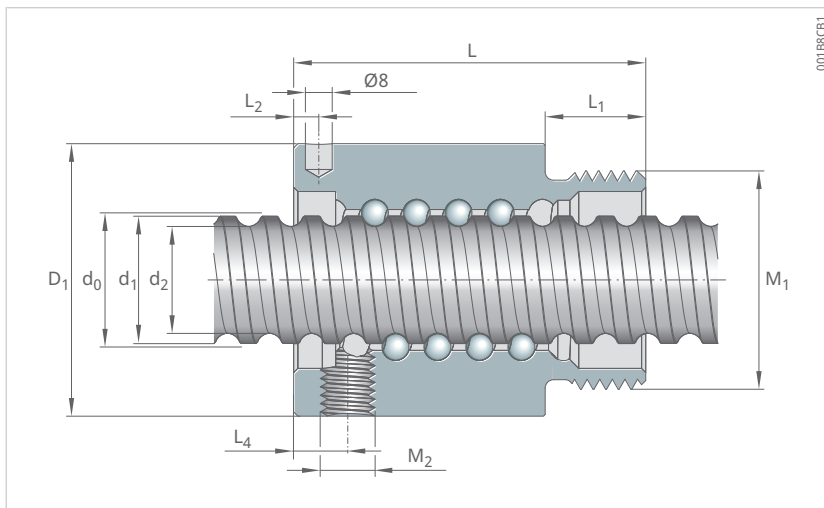
Nut with threaded nose

3

Designation	d ₀	P _h	C _a	C _{0a}	i	T	T _{red}	T _{pr}	J _N	V _{gN}	m _N	m _S	J _S
-	mm	mm	kN	kN	-	mm	mm	Nm	kg · mm ²	cm ³	kg	kg/m	kg · mm ² /m
SX/BX 20×5 R	20	5	14	23.8	4	0.1	0.05	0.1	60	1.3	0.24	2	85
SX/BX 25×5 R	25	5	19	37.8	5	0.1	0.05	0.17	125	2.5	0.39	3.3	224
SX/BX 25×10 R	25	10	23.5	39	4	0.12	0.08	0.23	135	4.6	0.4	3.2	255
SX/BX 32×5 R	32	5	22	51.6	5	0.1	0.05	0.25	230	2.6	0.48	5.6	641
SX/BX 32×10 R	32	10	27.1	52	4	0.12	0.08	0.32	400	5.9	0.77	5.6	639
SX/BX 40×5 R	40	5	24.3	65.6	5	0.1	0.05	0.34	390	3.3	0.58	9	1 639
SX/BX 40×10 R	40	10	61.5	124.1	5	0.12	0.08	0.64	840	12.4	1.25	8.4	1 437
SX/BX 50×10 R	50	10	80.4	188.8	6	0.12	0.08	1.02	2 400	19.9	2.4	13.6	3 736
SX/BX 63×10 R	63	10	91.2	248.3	6	0.12	0.08	1.44	4 620	25.4	3.1	22	9 913

1) For high load application, use FLRBU type. Refer to TPI 291 for end shaft and support bearings definitions.

d ₀	mm	nominal diameter of screw
C _{0a}	kN	basic load rating static of nut
C _a	kN	basic load rating dynamic of nut
m _N	kg	mass of nut
m _S	kg/m	mass of screw
V _{gN}	cm ³	grease volume for initial lubrication of the nut
V _{gS}	cm ³ /m	grease volume for initial lubrication of the screw
P _h	mm	lead
T	mm	standard play (max. value)
T _{red}	mm	reduced play (on request)
T _{pr}	Nm	Preload torque zero play for nut
i	-	number of loaded turns
L _S	mm	length of screw
J _S	kg · mm ² /m	inertia of screw
J _N	kg · mm ²	inertia of nut



SX, BX

Vgs	D1	M1	L	L1	L2	L4	M2	Tightening spanner	Ls	d2	d1	Recommended support bearings	
	js13	6g										max.	Thrust support bearing ¹⁾
cm ³ /m	mm	-	mm	mm	mm	mm	-	-	mm	mm	mm	-	-
2.7	38	M35×1.5	54	14	8	8	M6×1	HN5	3700	16.7	19.4	FLBU 20/PLBU 20	BUF 20
3.4	43	M40×1.5	69	19	8	8	M6×1	HN6	4700	21.7	24.6	FLBU 25/PLBU 25	BUF 25
3.2	43	M40×1.5	84	19	12	12	M6×1	HN6	4700	20.5	24.6	FLBU 25/PLBU 25	BUF 25
4.4	52	M48×1.5	64	19	8	8	M6×1	HN7	5700	28.7	31.6	FLBU 32/PLBU 32	BUF 32
3.7	54	M48×1.5	95	19	15	15	M6×1	HN7	5700	27.8	32	FLBU 32/PLBU 32/FLRBU 3	BUF 32
5.6	60	M56×1.5	65	19	8	8	M6×1	HN9	5700	36.7	39.6	FLBU 40/PLBU 40	BUF 40
5	65	M60×2	105	24	15	13	M8×1	HN9	5700	34	39.4	FLBU 40/PLBU 40/FLRBU 4	BUF 40
6.3	78	M72×2	135	29	15	15	M8×1	HN12	5700	44	49.7	FLBU 50/PLBU 50/FLRBU 5	BUF 50
8.1	93	M85×2	135	29	15	15	M8×1	HN14	5700	57	62.8	FLBU 63/PLBU 63	BUF 63

3.5 Dedicated flanges for SX/BX nuts

④37 FHRFound flange for SX nut



00188B84

④38 FHSF square flange for SX nut



00188B8E

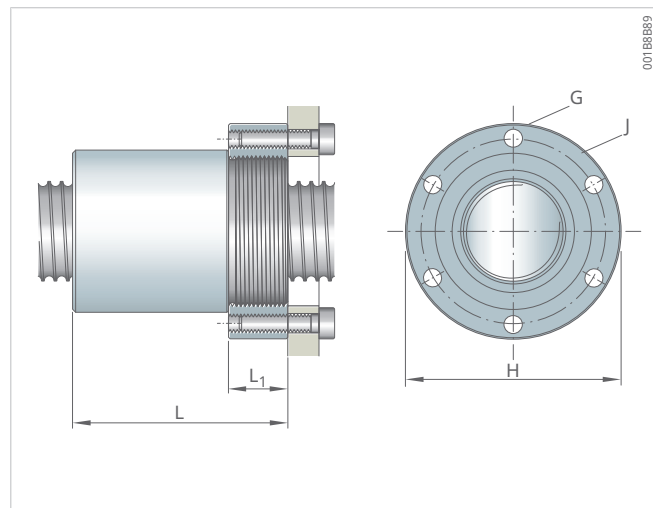
④39 FHTF trunnions flange for SX nut



00188B96

3.5.1 FHRF

round flange
for SX nut



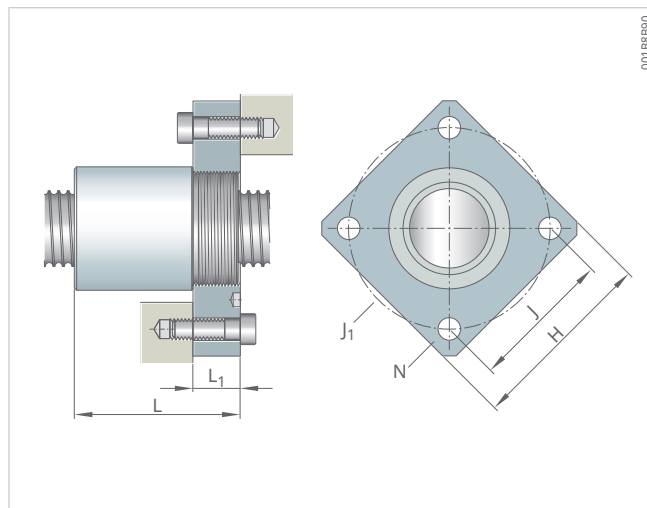
3

Designation	d_0	P_h	L	L_1	G	H	J
	mm	mm	mm	h14 mm	-	h12 mm	js12 mm
FHRF 20	20	5	55	15	M5	52	44
FHRF 25	25	5	70	20	M6	60	50
FHRF 25	25	10	85	20	M6	60	50
FHRF 32	32	5	65	20	M6	69	59
FHRF 32	32	10	96	20	M6	69	59
FHRF 40×5	40	5	66	20	M8	82	69
FHRF 40×10	40	10	106	25	M10	82	76
FHRF 50	50	10	136	30	M12	110	91
FHRF 63	63	10	136	30	M12	125	106

d_0 mm nominal diameter of screw
 P_h mm lead

3.5.2 FHSF
square flange
for SX nut

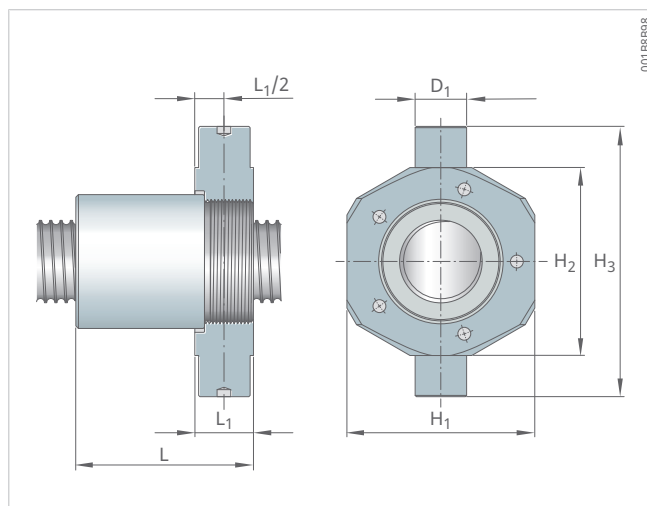
3



Designation	d ₀	P _h	L	L ₁	H	J	J ₁	N
	mm	mm	mm	mm	mm	mm	mm	mm
FHSF 20	20	5	55	15	60	45	63.6	6.6
FHSF 25	25	5	70	20	70	52	73.5	9
FHSF 25	25	10	85	20	70	52	73.5	9
FHSF 32	32	5	65	20	80	60	84.8	9
FHSF 32	32	10	96	20	80	60	84.8	9
FHSF 40×5	40	5	66	20	90	70	99	11
FHSF 40×10	40	10	106	25	100	78	110.3	13
FHSF 50	50	10	136	30	120	94	133	15
FHSF 63	63	10	136	30	130	104	147	15

d₀ mm nominal diameter of screw
P_h mm lead

3.5.3 FHTF trunnions flange for SX nut



3

Designation	d_0	P_h	L	L_1	H_1	H_2	H_3	D_1	Bushing designation ¹⁾
	mm	mm	mm	mm	js16 mm	h12 mm	h12 mm	h8 mm	
FHTF 20	20	5	57	17	55	56	80	15	151710A
FHTF 25	25	5	71	21	60	65	97	18	182015A
FHTF 25	25	10	86	21	60	65	97	18	182015A
FHTF 32	32	5	68	23	73	73	105	20	202315A
FHTF 32	32	10	99	23	73	73	105	30	202315A
FHTF 40×5	40	5	69	23	85	85	117	30	202315A
FHTF 40×10	40	10	108.5	27.5	98	98	140	25	252820A
FHTF 50	50	10	139	33	120	120	162	30	252820A
FHTF 63	63	10	139	33	135	135	177	30	252820A

¹⁾ Mounting of bushing on trunnions recommended

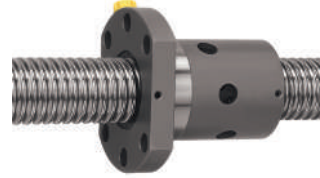
d_0 mm nominal diameter of screw
 P_h mm lead

3.6 Precision screws, SND/BND according to DIN 69051

Roller thread ball screw with recirculation through inserts, DIN nut

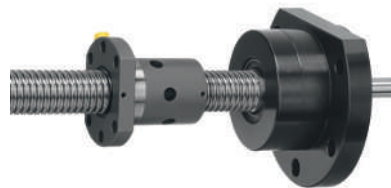
3

④40 Standard SND/BND



001B8C9C

④41 Assembly with flanged support bearing SND/BND



001B8C92

Features

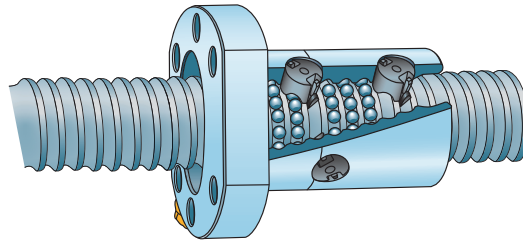
- Nominal diameter from 16 mm to 63 mm
- Lead from 5 mm to 10 mm
- Standard composite recirculation inserts
- Optional steel recirculation inserts
- Standard lead precision G5, G7 and G9
- Nut ground outside diameter / flange face
- Precision ground nut thread ¹⁾
- Lubrication hole for grease nipple or for automatic lubrication kit
- Optional surface coating on shaft and nut
- Optional safety nuts. Please contact Schaeffler for selection and usage of this option
- Optional wipers

¹⁾ Except 16×10 R: nut thread is not ground

Benefits

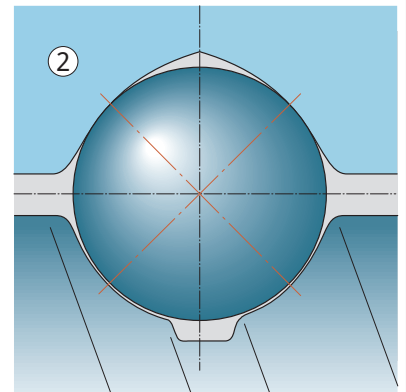
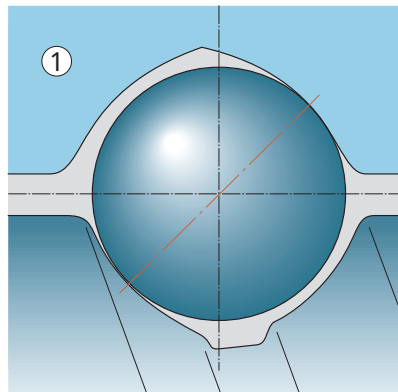
- Compact nut / integral flange for easy assembly
- Design well suited for positioning screws. G5 lead precision of ground ball screws
- Optional: steel recirculation inserts can act as a safety device for severe or vertical applications. Please contact Schaeffler for such applications.
- Optional: Backlash elimination by oversized balls on request (BND designation) over maximum length of 1000 mm.

42 Recirculation



001B8CA0

43 SND, BND



001B8B77

1 SND

2 BND

3.6.1 Technical data

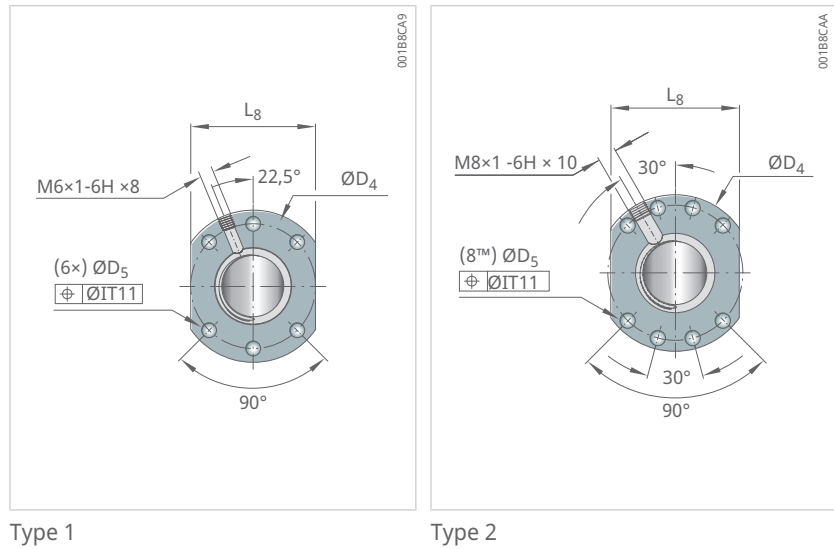
SND, BND

Rolled screw shaft

Internal ball return

DIN 69051

3



Designation	d ₀	P _h	C _a	C _{0a}	i	T	T _{red}	T _{pr}	J _N	Vg _N	m _N	m _s	J _s
-	mm	mm	kN	kN	-	mm	mm	Nm	kg · mm ²	cm ³	kg	kg/m	kg · mm ² /m
SND/BND 16×5 R	16	5	7.8	10.7	3	0.08	0.05	0.05	40	0.9	0.17	1.3	33
SND/BND 16×10 R	16	10	10.7	17.2	2×1.8	0.07	0.03	0.06	41	1.6	0.18	1.21	30.7
SND/BND 20×5 R	20	5	11.3	17.9	3	0.1	0.05	0.08	86	1.1	0.24	2	85
SND/BND 25×5 R	25	5	12.7	22.7	3	0.1	0.05	0.11	117	1.6	0.29	3.3	224
SND/BND 25×10 R	25	10	24.1	39	4	0.12	0.08	0.23	144	4.5	0.38	3.2	255
SND/BND 32×5 R	32	5	19	41.3	4	0.1	0.05	0.21	364	2.1	0.54	5.6	641
SND/BND 32×10 R	32	10	21.9	39	3	0.12	0.08	0.25	384	4.6	0.58	5.6	639
SND/BND 40×5 R	40	5	25.6	65.6	5	0.1	0.05	0.25	855	3.1	0.92	9	1639
SND/BND 40×10 R	40	10	63.3	124.1	5	0.12	0.08	0.64	1010	10.7	1.3	8.4	1437
SND/BND 50×10 R	50	10	71.3	157.3	5	0.12	0.08	0.88	2130	13.1	1.8	13.6	3736
SND/BND 63×10 R	63	10	81.5	206.9	5	0.12	0.08	1.23	4075	16.1	2.4	22	9913

1) For high load application, use FLRBU type. Refer to TPI 291 for end shaft and support bearings definitions.

d ₀	mm	nominal diameter of screw
C _{0a}	kN	basic load rating static of nut
C _a	kN	basic load rating dynamic of nut
m _N	kg	mass of nut
m _s	kg/m	mass of screw
Vg _N	cm ³	grease volume for initial lubrication of the nut
Vg _s	cm ³ /m	grease volume for initial lubrication of the screw
P _h	mm	lead
T	mm	standard play (max. value)
T _{red}	mm	reduced play (on request)
T _{pr}	Nm	Preload torque zero play for nut
i	-	number of loaded turns
L _s	mm	length of screw
J _s	kg · mm ² /m	inertia of screw
J _N	kg · mm ²	inertia of nut

3.7 Preloaded screws PND according to DIN 69051

Rolled thread ball screw with recirculation through inserts, DIN nut

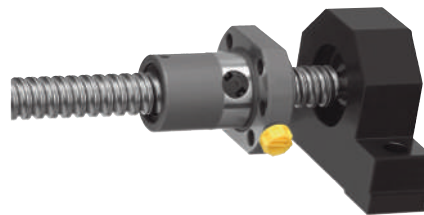
3

☐44 Standard PND



001B8BF6

☐45 Assembly with pillow block PND



001B8BE9

Features

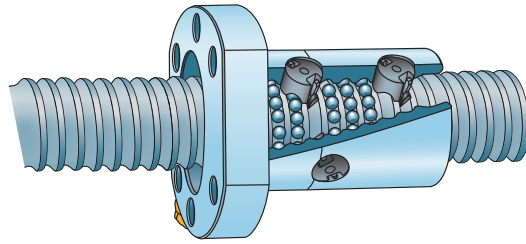
- Nominal diameter from 16 mm to 63 mm
- Lead from 5 mm to 10 mm
- Standard composite recirculation inserts
- Optional steel recirculation inserts
- Standard lead precision G5, G7 and G9
- Nut ground outside diameter / flange face
- Precision ground nut thread ¹⁾
- Standard preload 7 % to 8.5 % of ball screw C_a value, depending on ball screw size
- Lubrication hole for grease nipple or for automatic lubrication kit
- Optional surface coating on shaft and nut
- Optional safety nuts. Please contact Schaeffler for selection and usage of this option
- Optional wipers

Benefits

- Compact nut / integral flange for easy assembly
- One-piece nut ¹⁾ with internal preload for compactness and optimum rigidity
- Design well suited for positioning screws. G5 lead precision of ground ball screws
- Optional: steel recirculation inserts can act as a safety device for severe or vertical applications. Please contact Schaeffler for such applications.

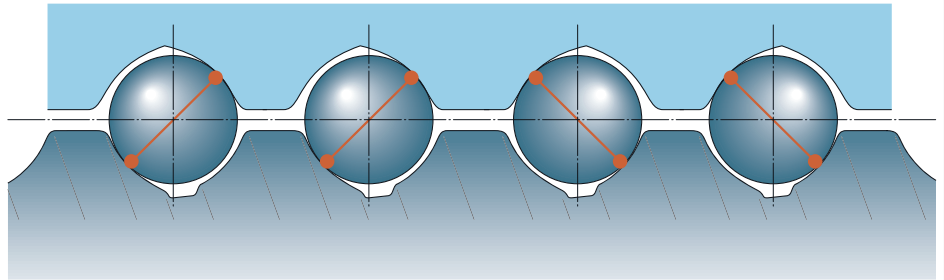
¹⁾ Except 16×10 R: nut thread is not ground, double nut design

46 Recirculation



001B8CA0

47 PND



001DB25B

3.7.1 Technical data

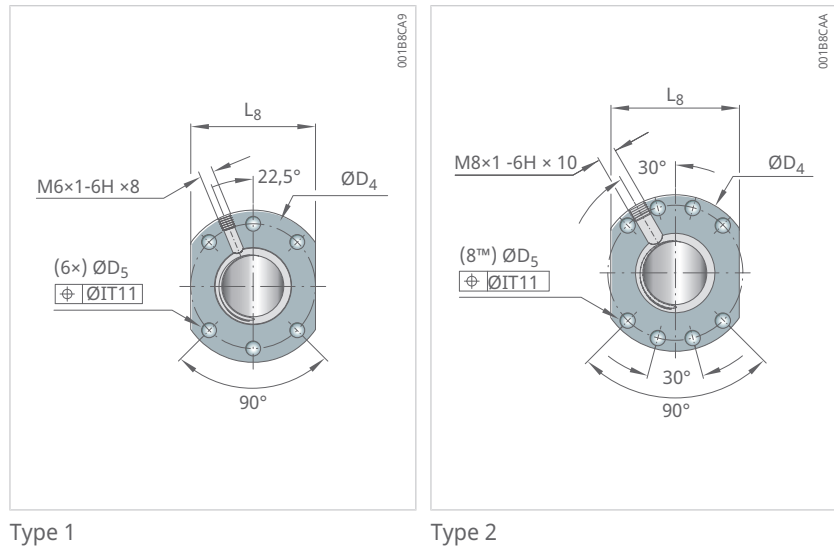
PND

Rolled screw shaft

Internal ball return

DIN 69051

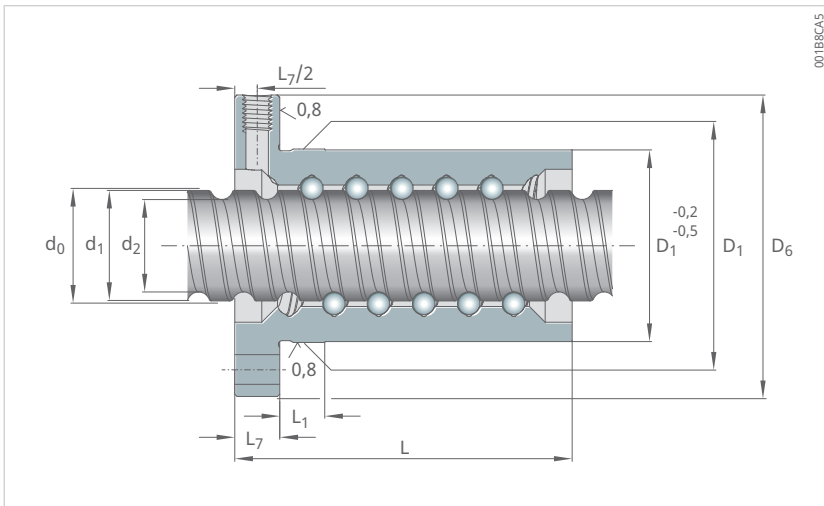
3



Designation	d ₀	P _h	C _a	C _{0a}	i	T _{pr}	R _n	J _N	V _{gN}	m _N	m _s	J _s
-	mm	mm	kN	kN	-	Nm	N/μm	kg · mm ²	cm ³	kg	kg/m	kg · mm ² /m
PND 16×5 R	16	5	5.5	7.1	2×2	0.08	147	46	1	0.19	1.3	33
PND 16×10 R	16	10	10.7	17.2	2×2×1.8	0.15	263	56	2.7	0.28	1.21	30.7
PND 20×5 R	20	5	8	11.9	2×2	0.14	248	91	1.3	0.26	2	85
PND 25×5 R	25	5	12.7	22.7	2×3	0.28	436	405	2	0.4	3.3	224
PND 25×10 R	25	10	13.3	19.5	2×2	0.3	264	245	4.5	0.53	3.2	255
PND 32×5 R	32	5	19	41.3	2×4	0.52	734	453	3.2	0.715	5.6	641
PND 32×10 R	32	10	21.9	39	2×3	0.61	490	490	7.6	0.81	5.6	639
PND 40×5 R	40	5	25.6	65.6	2×5	0.71	968	1110	4.8	1.3	9	1639
PND 40×10 R	40	10	52.2	99.3	2×4	1.47	793	1290	15.5	1.8	8.4	1437
PND 50×10 R	50	10	71.3	157.3	2×5	2.47	1 222	2940	27.5	2.6	13.6	3736
PND 63×10 R	63	10	81.5	206.9	2×5	3.46	1 448	5290	26.8	3.2	22	9913

1) For high load application, use FLRBU type. Refer to TPI 291 for end shaft and support bearings definitions.

d ₀	mm	nominal diameter of screw
C _{0a}	kN	basic load rating static of nut
C _a	kN	basic load rating dynamic of nut
m _N	kg	mass of nut
m _s	kg/m	mass of screw
V _{gN}	cm ³	grease volume for initial lubrication of the nut
V _{gS}	cm ³ /m	grease volume for initial lubrication of the screw
P _h	mm	lead
R _n	N/μm	Stiffness of nut
T	mm	standard play (max. value)
T _{red}	mm	reduced play (on request)
T _{pr}	Nm	Preload torque zero play for nut
i	-	number of loaded turns
L _s	mm	length of screw
J _s	kg · mm ² /m	inertia of screw
J _N	kg · mm ²	inertia of nut



PND

Vgs	D1	D4	Type	D5	D6	L	L1	L7	L8	Ls	d2	d1	Recommended support bearings	
	g6	js12		H13	h13								h13	max.
cm ³ /m	mm	mm	-	mm	mm	mm	mm	mm	mm	mm	mm	mm	-	-
2.1	28	38	1	5.5	48	48	10	10	40	2000	12.7	15.2	FLBU 16/PLBU 16	BUF 16
1.9	28	38	1	5.5	48	87	77	10	40	2000	12.6	15.2	FLBU 16/PLBU 16	BUF 16
2.7	36	47	1	6.6	58	50	10	10	44	3700	16.7	19.4	FLBU 20/PLBU 20	BUF 20
3.4	40	51	1	6.6	62	62	10	10	48	4700	21.7	24.6	FLBU 25/PLBU 25	BUF 25
3.2	40	51	1	6.6	62	75	10	10	48	4700	20.5	24.6	FLBU 25/PLBU 25	BUF 25
3.2	50	65	1	9	80	74	10	12	62	5700	28.7	31.6	FLBU 32/PLBU 32	BUF 32
4.1	50	65	1	9	80	100	10	12	62	5700	27.8	32	FLBU 32/PLBU 32	BUF 32
5.5	63	78	2	9	93	88	10	14	70	5700	36.7	39.6	FLBU 40/PLBU 40	BUF 40
4.9	63	78	2	9	93	130	20	14	70	5700	34	39.4	FLBU 40/PLBU 40/FLRBU 4	BUF 40
7.9	75	93	2	11	110	151	10	16	85	5700	44	49.7	FLBU 50/PLBU 50/FLRBU 5	BUF 50
7.9	90	108	2	11	125	153	10	18	95	5700	57	62.8	FLBU 63/PLBU 63	BUF 63

3.8 Precision screws SN/BN

Rolled thread ball screw with recirculation through inserts, cylindrical flange

3

④48 Standard SN/BN



001B8C77

④49 Customized SN, rotating nut with flange and bearing journals



001B8C8E

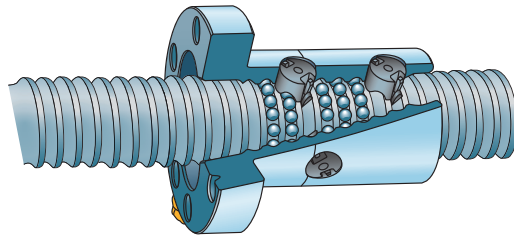
Features

- Nominal diameter from 16 mm to 63 mm
- Lead from 5 mm to 10 mm
- Standard composite recirculation inserts
- Optional steel recirculation inserts
- Standard lead precision G5, G7 and G9
- Nut ground outside diameter / flange face
- Precision ground nut thread
- Lubrication hole for grease nipple or for automatic lubrication kit
- Nut ground outside diameter / flange face
- Optional safety nuts. Please contact Schaeffler for selection and usage of this option
- Optional wipers

Benefits

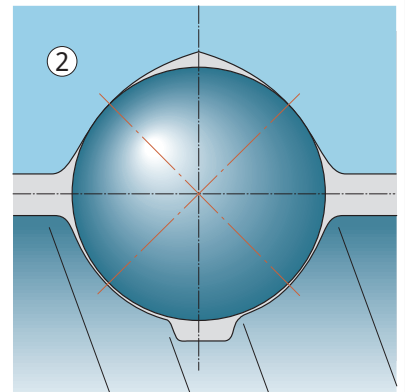
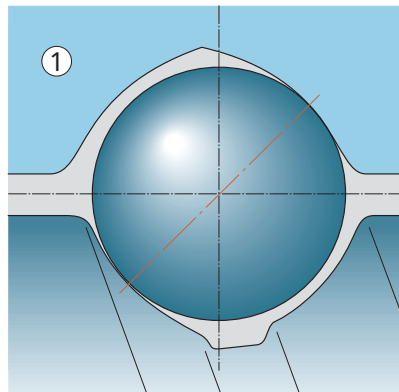
- Compact nut / integral flange for easy assembly
- Design well suited for positioning screws. G5 lead precision of ground ball screws
- Optional: steel recirculation inserts can act as a safety device for severe or vertical applications. Please contact Schaeffler for such applications.
- Optional: Backlash elimination by oversized balls on request (BN designation), over maximum length of 1000 mm.

☐ 50 Recirculation



001B8C88

☐ 51 SN, BN



001B8B77

1 SN

2 BN

3.8.1 Technical data

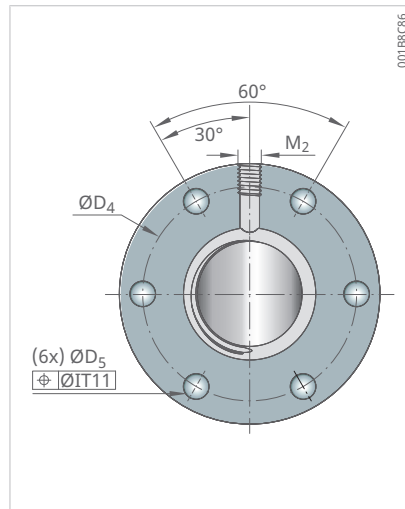
SN, BN

Rolled screw shaft

Internal ball return

Cylindrical flange

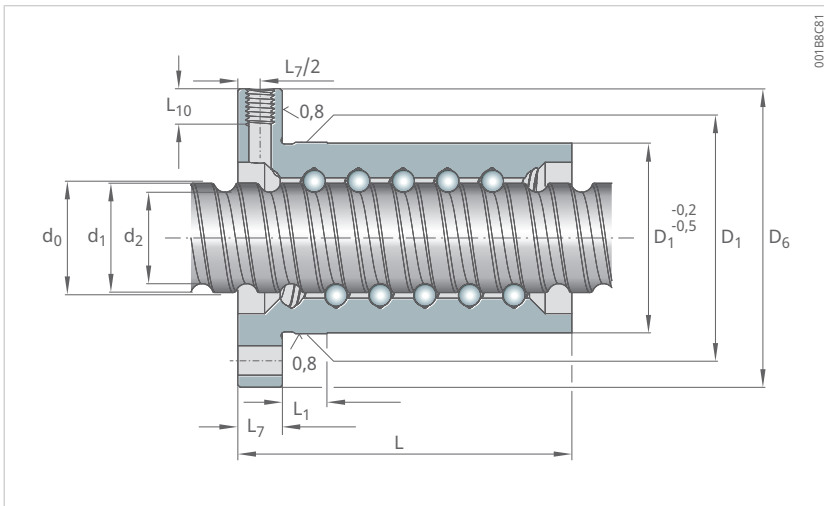
3



Designation	d ₀	P _h	C _a	C _{0a}	i	T	T _{red}	T _{pr}	J _N	V _{gN}	m _N	m _s	J _s
-	mm	mm	kN	kN	-	mm	mm	Nm	kg · mm ²	cm ³	kg	kg/m	kg · mm ² /m
SN/BN 16×5 R	16	5	7.8	10.7	3	0.08	0.05	0.05	45	0.9	0.18	1.3	33
SN/BN 20×5 R	20	5	11.3	17.9	3	0.1	0.05	0.08	88	1.2	0.24	2	85
SN/BN 25×5 R	25	5	12.7	22.7	3	0.1	0.05	0.11	127	1.6	0.28	3.3	224
SN/BN 25×10 R	25	10	24.1	39	4	0.12	0.08	0.23	244	4.5	0.53	3.2	255
SN/BN 32×5 R	32	5	19	41.3	4	0.1	0.05	0.21	250	2.1	0.4	5.6	641
SN/BN 32×10 R	32	10	21.9	39	3	0.12	0.08	0.25	673	4.6	0.83	5.6	639
SN/BN 40×5 R	40	5	25.6	65.6	5	0.1	0.05	0.25	495	3.1	0.58	9	1639
SN/BN 40×10 R	40	10	63.3	124.1	5	0.12	0.08	0.64	1285	10.7	1.4	8.4	1437
SN/BN 50×10 R	50	10	71.3	157.3	5	0.12	0.08	0.88	1305	13.1	1.8	13.6	3736
SN/BN 63×10 R	63	10	81.5	206.9	5	0.12	0.08	1.23	4180	16.1	2.25	22	9913

1) For high load application, use FLRBU type. Refer to TPI 291 for end shaft and support bearings definitions.

d ₀	mm	nominal diameter of screw
C _{0a}	kN	basic load rating static of nut
C _a	kN	basic load rating dynamic of nut
m _N	kg	mass of nut
m _s	kg/m	mass of screw
V _{gN}	cm ³	grease volume for initial lubrication of the nut
V _{gS}	cm ³ /m	grease volume for initial lubrication of the screw
P _h	mm	lead
T	mm	standard play (max. value)
T _{red}	mm	reduced play (on request)
T _{pr}	Nm	Preload torque zero play for nut
i	-	number of loaded turns
L _s	mm	length of screw
J _s	kg · mm ² /m	inertia of screw
J _N	kg · mm ²	inertia of nut



SN, BN

Vgs	D1	D4	D5	D6	L	L1	L7	L10	M2	L5	d2	d1	Recommended support bearings	
	g6		H13	h13	h13				6H	max.			Thrust support bearing ¹⁾	Support pillow block
cm ³ /m	mm	mm	mm	mm	mm	mm	mm	mm	-	mm	mm	mm	-	-
2.1	28	38	6×5.5	48	43.5	10	10	8	M6	2000	12.7	15.2	FLBU 16/PLBU 16	BUF 16
2.7	33	45	6×6.6	57	44.5	10	10	8	M6	3700	16.7	19.4	FLBU 20/PLBU 20	BUF 20
3.4	38	50	6×6.6	62	44.5	10	10	8	M6	4700	21.7	24.6	FLBU 25/PLBU 25	BUF 25
3.2	43	55	6×6.6	67	75	10	10	8	M6	4700	20.5	24.6	FLBU 25/PLBU 25	BUF 25
4.5	45	58	6×6.6	70	51.5	10	12	8	M6	5700	28.7	31.6	FLBU 32/PLBU 32	BUF 32
4.2	54	70	6×9	87	64	10	12	10	M8×1	5700	27.8	32	FLBU 32/PLBU 32	BUF 32
5.6	53	68	6×6.6	80	58.5	10	14	8	M6	5700	36.7	39.6	FLBU 40/PLBU 40	BUF 40
5.1	63	78	6×9	95	91	20	14	10	M8×1	5700	34	39.4	FLBU 40/PLBU 40/FLRBU 4	BUF 40
6.5	72	90	6×11	110	93	10	16	10	M8×1	5700	44	49.7	FLBU 50/PLBU 50/FLRBU 5	BUF 50
8.4	85	105	6×11	125	95	10	18	10	M8×1	5700	57	62.8	FLBU 63/PLBU 63	BUF 63

3.9 Preloaded screws PN

Rolled thread ball screw with recirculation through inserts, cylindrical flange

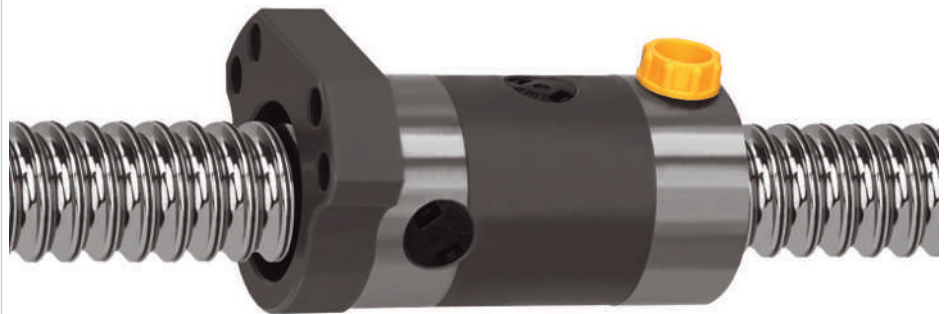
3

④52 Standard PN



00188BE1

④53 PN nut with customized compact flange



00188BE4

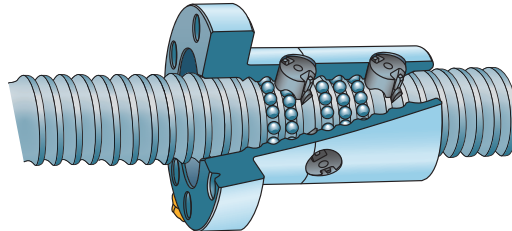
Features

- Nominal diameter from 16 mm to 63 mm
- Lead from 5 mm to 10 mm
- Standard composite recirculation inserts
- Optional steel recirculation inserts
- Standard lead precision G5, G7 and G9
- Nut ground outside diameter / flange face
- Rolled thread ball screw with recirculation through inserts, cylindrical flange
- Standard preload 7 % to 8.5 % of ball screw C_a value, depending on ball screw size
- Lubrication hole for grease nipple or for automatic lubrication kit
- Optional surface coating on shaft and nut
- Optional safety nuts. Please contact Schaeffler for selection and usage of this option
- Optional wipers

Benefits

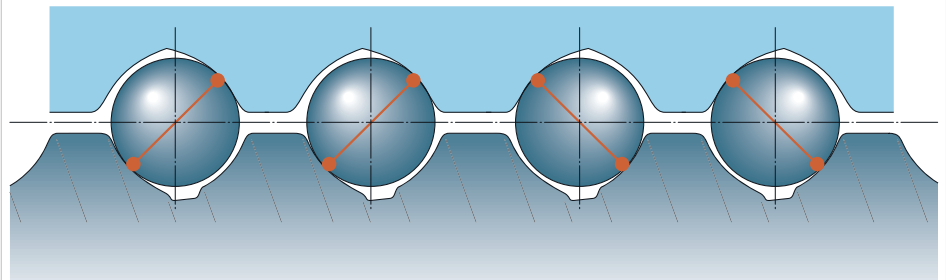
- Compact nut / integral flange for easy assembly
- One-piece nut with internal preload for compactness and optimum rigidity
- Design well suited for positioning screws. G5 lead precision of ground ball screws
- Optional: steel recirculation inserts can act as a safety device for severe or vertical applications. Please contact Schaeffler for such applications.

54 Recirculation



001B8C8B

55 PN

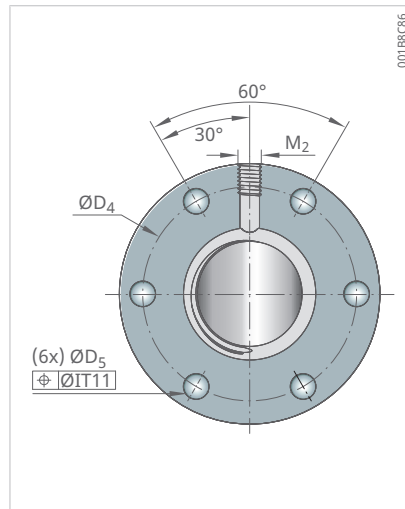


001DB25B

3.9.1 Technical data

PN
 Rolled screw shaft
 Internal ball return
 Cylindrical flange

3

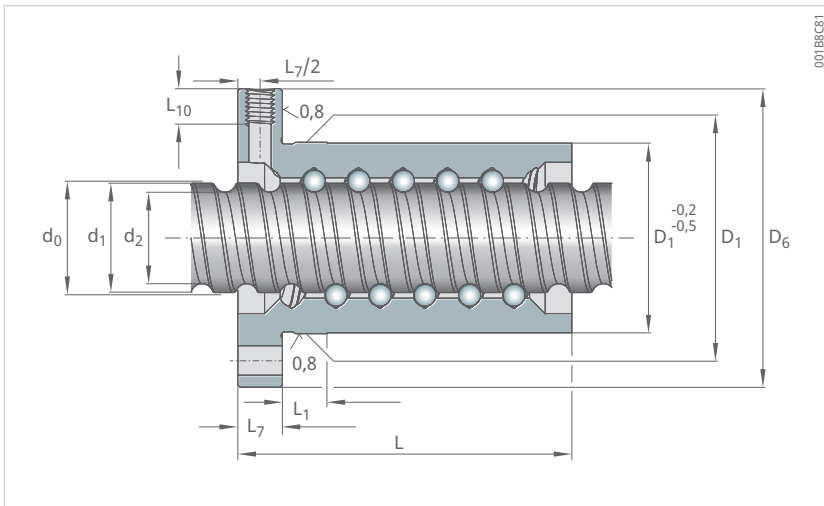


PN

Designation	d ₀	P _h	C _a	C _{0a}	i	T _{pr}	R _n	J _N	V _{gN}	m _N	m _s	J _s
-	mm	mm	kN	kN	-	Nm	N/μm	kg · mm ²	cm ³	kg	kg/m	kg · mm ² /m
PN 16×5 R	16	5	5.5	7.1	2×2	0.08	147	46	1	0.19	1.3	33
PN 20×5 R	20	5	8	11.9	2×2	0.14	248	91	1.1	0.26	2	85
PN 25×5 R	25	5	12.7	22.7	2×3	0.28	436	400	2.1	0.39	3.3	224
PN 25×10 R	25	10	13.3	19.5	2×2	0.3	264	245	4.1	0.53	3.2	255
PN 32×5 R	32	5	19	41.3	2×4	0.52	734	390	3.2	0.5	5.6	641
PN 32×10 R	32	10	21.9	39	2×3	0.61	490	830	7.6	1.13	5.6	639
PN 40×5 R	40	5	25.6	65.6	2×5	0.71	968	585	4.8	0.74	9	1639
PN 40×10 R	40	10	52.2	99.3	2×4	1.47	793	1530	14.6	1.8	8.4	1437
PN 50×10 R	50	10	71.3	157.3	2×5	2.47	1222	2930	27.5	2.6	13.6	3736
PN 63×10 R	63	10	81.5	206.9	2×5	3.46	1448	5980	26.8	3.2	22	9913

1) For high load application, use FLRBU type. Refer to TPI 291 for end shaft and support bearings definitions.

d ₀	mm	nominal diameter of screw
C _{0a}	kN	basic load rating static of nut
C _a	kN	basic load rating dynamic of nut
m _N	kg	mass of nut
m _s	kg/m	mass of screw
V _{gN}	cm ³	grease volume for initial lubrication of the nut
V _{gS}	cm ³ /m	grease volume for initial lubrication of the screw
P _h	mm	lead
R _n	N/μm	Stiffness of nut
T	mm	standard play (max. value)
T _{red}	mm	reduced play (on request)
T _{pr}	Nm	Preload torque zero play for nut
i	-	number of loaded turns
L _s	mm	length of screw
J _s	kg · mm ² /m	inertia of screw
J _N	kg · mm ²	inertia of nut



PN

Vgs	D1	D4	D5	D6	L	L1	L7	L10	M2	Ls	d2	d1	Recommended support bearings	
	g6		H13	h13					6H	max.			Thrust support bearings ¹⁾	Support pillow block
cm ³ /m	mm	mm	mm	mm	mm	mm	mm	mm	-	mm	mm	mm	-	-
2.1	28	38	6×5.5	48	48	10	10	8	M6	2000	12.7	15.2	FLBU 16/PLBU 16	BUF 16
2.4	33	45	6×6.6	57	50	10	10	8	M6	3700	16.7	19.4	FLBU 20/PLBU 20	BUF 20
3.4	38	50	6×6.6	62	62	10	10	8	M6	4700	21.7	24.6	FLBU 25/PLBU 25	BUF 25
2.8	43	55	6×6.6	67	75	10	10	8	M6	4700	20.5	24.6	FLBU 25/PLBU 25	BUF 25
4.4	45	58	6×6.6	70	74	10	12	8	M6	5700	28.7	31.6	FLBU 32/PLBU 32	BUF 32
4.1	54	70	6×9	87	100	10	12	10	M8×1	5700	27.8	32	FLBU 32/PLBU 32	BUF 32
5.5	53	68	6×6.6	80	88	10	14	8	M6	5700	36.7	39.6	FLBU 40/PLBU 40	BUF 40
4.9	63	78	6×9	95	126	20	14	10	M8×1	5700	34	39.4	FLBU 40/PLBU 40/FLRBU 4	BUF 40
7.9	72	90	6×11	110	151	10	16	10	M8×1	5700	44	49.7	FLBU 50/PLBU 50/FLRBU 5	BUF 50
7.9	85	105	6×11	125	153	10	18	10	M8×1	5700	57	62.8	FLBU 63/PLBU 63	BUF 63

3.10 Long lead screws SL/TL

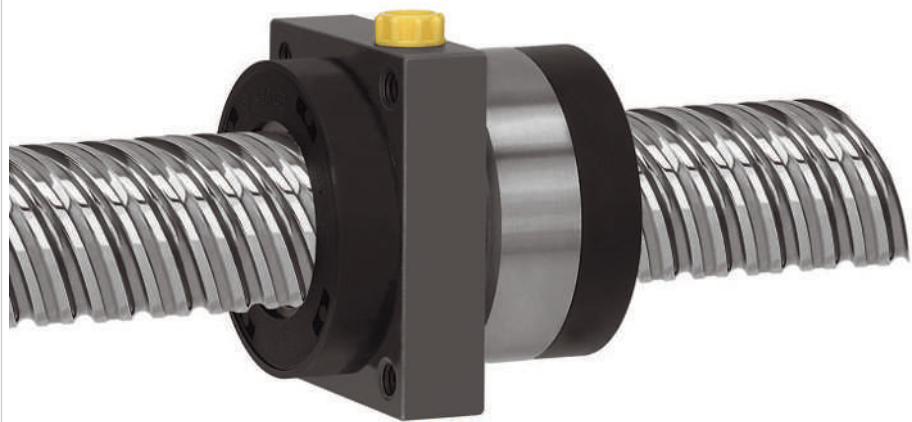
Rolled thread ball screw for high linear speed

☞56 Standard SL/TL



001B8C4C

☞57 SL nut with customized flange attachment



001B8C5C

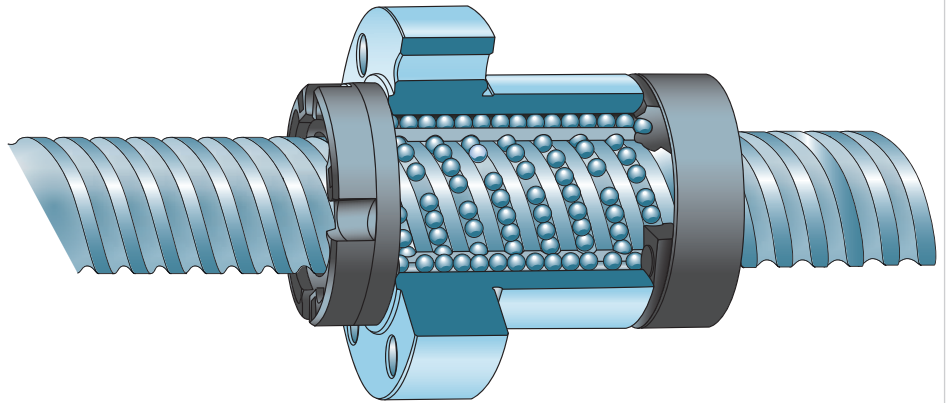
Features

- Nominal diameter from 25 mm to 50 mm
- Lead from 20 mm to 50 mm
- Lubrication hole for grease nipple or for automatic lubrication kit
- Standard protection at each end of the nut with composite wipers integrated into recirculation caps (NOWPR)
- Optional double protection at each end of the nut with additional brush wipers fitted into recirculation caps (WPR)
- Optional surface coating on shaft and nut
- Optional safety nuts. Please contact Schaeffler for selection and usage of this option

Benefits

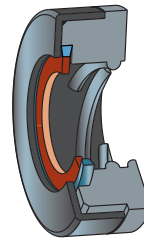
- High rotational speed up to $n \cdot d_0 = 90000$, resulting in high linear speed up to 110 m/min
- Nut design well suited for transport and positioning screw applications requiring high velocity (woodworking, some functions in plastic injection presses, Pick and Place)
- nut with play SL
- Backlash elimination, with light preload TL

58 Recirculation



001B8C52

59 Optional double protection



001B8C68

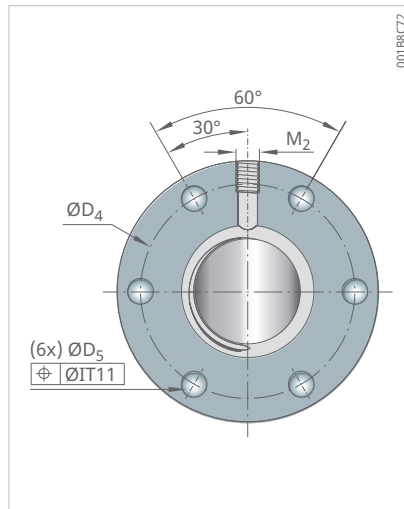
3.10.1 Technical data

SL, TL

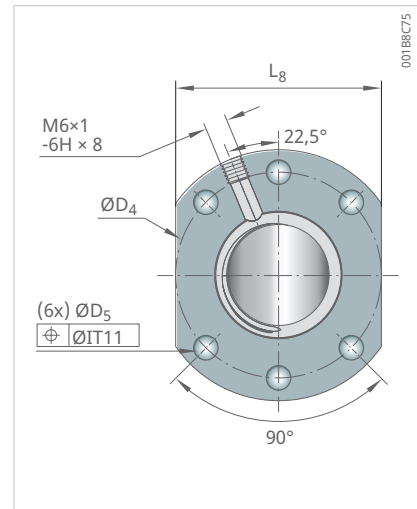
Rollled screw shaft

Long lead

3



Type 1

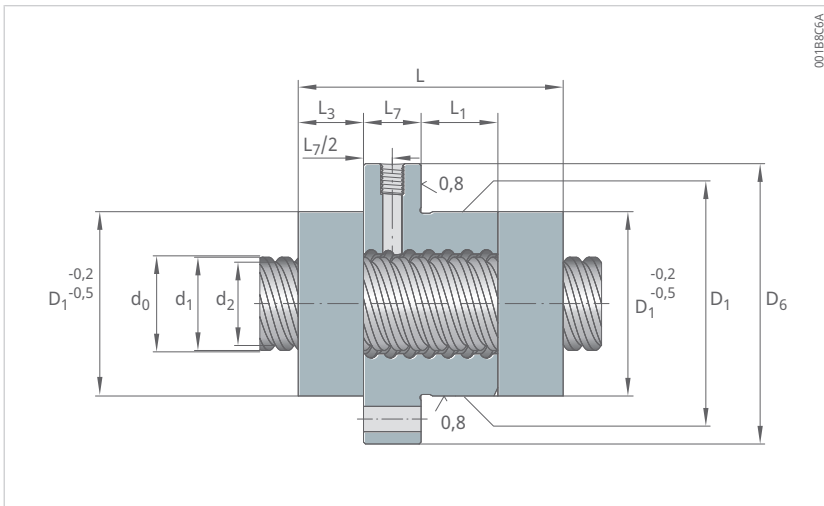


Type 2

Designation	d ₀	P _h	Nut SL (with play)			Nut TL (zero play)			i	J _N	V _{gN}	m _N	Screw		
			C _a	C _{a0}	T	C _a	C _{a0}	T _{pr}					m _s	J _s	V _{gS}
-	mm	mm	kN	kN	mm	kN	kN	Nm	-	kg · mm ²	cm ³	kg	kg/m	kg · mm ² /m	cm ³ /m
SL/TL 25×20 R	25	20	22.8	51.5	0.08	12.6	25.8	0.04...0.36	4×1.7	480	3	0.57	3.3	215	3.4
SL/TL 25×25 R	25	25	22.3	50.6	0.08	12.3	25.3	0.04...0.36	4×1.7	400	3.6	0.66	3.2	210	3.3
SL/TL 32×20 R	32	20	25.4	65.2	0.08	14	32.6	0.05...0.45	4×1.7	550	3.4	0.7	5.1	530	4.4
SL/TL 32×32 R	32	32	26.1	69.3	0.08	14.4	34.7	0.05...0.50	4×1.8	450	4.5	0.7	5.4	600	4.3
SLD/TLD 32×32 R	32	32	26.1	69.3	0.08	14.4	34.7	0.05...0.50	4×1.8	450	4.5	0.7	5.4	600	4.3
SL/TL 32×40 R	32	40	12.6	29.8	0.08	6.9	14.9	0.05...0.50	4×0.8	515	3	0.65	4.9	490	4.4
SL/TL 40×20 R	40	20	41.3	128.8	0.08	22.8	64.4	0.05...0.55	4×2.7	1 420	6.6	1.2	8.2	1 380	5.5
SL/TL 40×40 R	40	40	51.7	130.5	0.1	28.5	65.3	0.05...0.55	4×1.7	3 300	12.5	2.4	8.1	1 330	5.2
SL/TL 50×50 R	50	50	92.9	235.1	0.12	51.2	117.6	0.1...0.9	4×1.7	6 060	19.4	3.3	13.2	3 560	6.4

1) For high load application, use FLRBU type. Refer to TPI 291 for end shaft and support bearings definitions.

C _{0a}	kN	basic load rating static of nut
C _a	kN	basic load rating dynamic of nut
d ₀	mm	nominal diameter of screw shaft
J _s	kg · mm ² /m	inertia of screw
J _N	kg · mm ²	inertia of nut
m _N	kg	mass of nut
m _s	kg/m	mass of screw
V _{gN}	cm ³	grease volume for initial lubrication of the nut
V _{gS}	cm ³ /m	grease volume for initial lubrication of the screw
i	-	number of loaded turns
P _h	mm	lead
T	mm	standard play (max. value)
T _{pr}	Nm	Preload torque zero play for nut



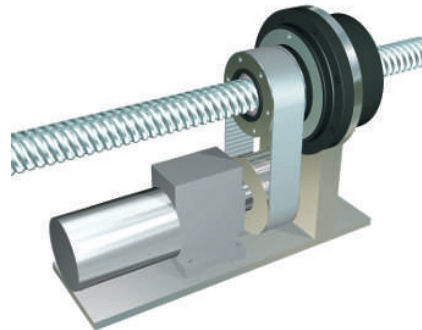
SL/TL

D1	D4	Type	D5	D6	L	L1	L3	L7	L8	L10	M2	Screw			Recommended support bearing ¹⁾	
												Length max.	d2	d1	Thurst support bearing	Pillow block
g9	j12		H13						h13							
mm	mm	-	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	-	-
48	60	1	6×6.6	73	66.8	18	17.6	15	-	8	M6	4700	21.7	24.3	FLBU 25/PLBU 25	BUF 25
48	60	1	6×6.6	73	78.2	27	18.7	15	-	8	M6	4700	21.5	24.4	FLBU 25/PLBU 25	BUF 25
56	68	1	6×6.6	80	67.4	18	17.9	15	-	8	M6	5700	27.5	30	FLBU 32/PLBU 32/FLRBU 3	BUF 32
56	68	1	6×6.6	80	80.3	41	13	15	-	8	M6	5700	28.4	31.1	FLBU 32/PLBU 32/FLRBU 3	BUF 32
50	65	2	6×9	80	80.3	41	13	15	62	8	M6	5700	28.4	31.1	FLBU 32/PLBU 32/FLRBU 3	BUF 32
53	68	1	6×6.6	80	54.8	17	12.2	15	-	8	M6	5700	26.9	29.6	FLBU 32/PLBU 32	BUF 32
63	78	1	6×9	95	87.3	38	18	15	-	8	M6	5700	35.2	37.7	FLBU 40/PLBU 40	BUF 40
72	90	1	6×11	110	110.8	44	21.6	25	-	10	M8×1	5700	34.2	38.3	FLBU 40/PLBU 40/FLRBU 4	BUF 40
85	105	1	6×11	125	134	60	25.5	25	-	10	M8×1	5700	43.5	49.1	FLBU 50/PLBU 50/FLRBU 5	BUF 50

3.11 Rotating nut SLT/TLT

Long lead rolled ball screw with rotating nut

⊕60 SLT/TLT



001B8C5E

Concept

The main purpose of this solution is to minimize the inertia phenomenon associated with long rotating shafts.

The long lead screw shaft is rigidly fixed to the machine frame. The ball nut, rotating inside a bearing housing and driven via a tension belt, moves along the screw shaft.

The customers are responsible for the sourcing and assembly of the electric motor, belt, pulleys and frame holding the bearing housing.

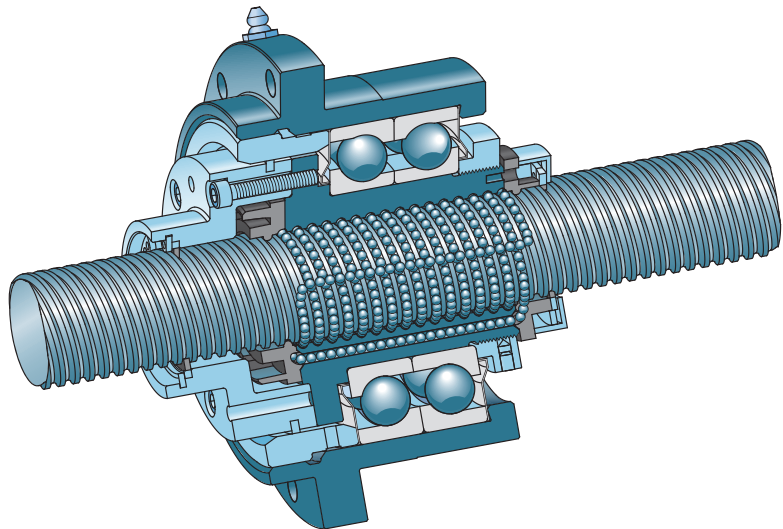
Features

- Nominal diameter from 25 mm to 50 mm
- Lead from 20 mm to 50 mm
- 72 series angular contact bearings are directly mounted on the nut outer diameter
- Bearings are preloaded in back-to-back arrangement in order to fully support the moment created by the belt tension
- 2 Nilos rings protect the bearings against pollution and permit lubrication for life
- Brush wipers are mounted at each end of the nut in the standard configuration for better protection against contamination
- The ball screw assembly is lubricated through a nipple mounted on the housing external diameter in the standard version

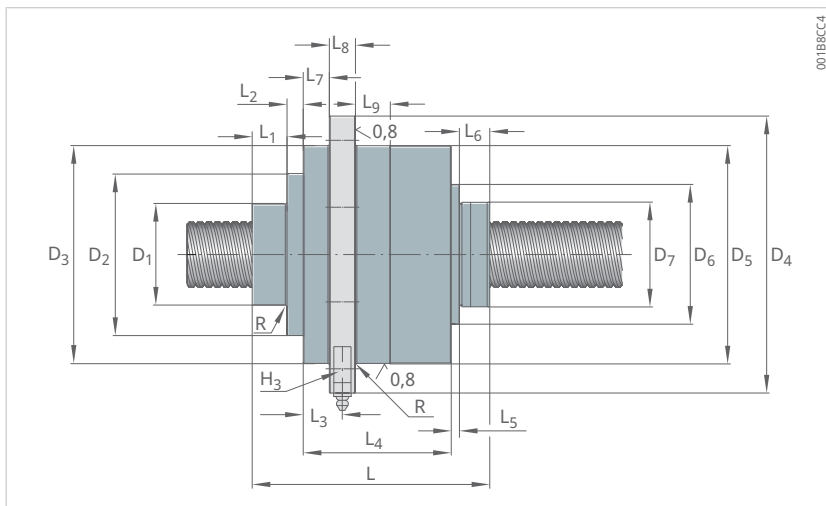
Benefits

- High rotational speed up to $nd_0 = 90000$, resulting in high linear speed up to 110 m/min
- Compact, easy and simple solution to incorporate into application
- Fixed screw shaft for simplified mounting into application
- Inertia is considerably reduced: $3800 \text{ kg} \cdot \text{mm}^2$ instead $6000 \text{ kg} \cdot \text{mm}^2$ for a screw shaft 40×40 with 4.5 m stroke
- Lower motor power requirements resulting from lower system inertia
- Backlash elimination (TLT designation).

61 Recirculation SLT/TLT



001B8CC8



SLT/TLT

D6	D7	R	J1	J2	Z1	H1	Z2	US	H2	H3	L	L1	L2	L3	L4	L5	L6	L7	L8	L9
		max																		
mm	mm	mm	mm	mm	mm	mm	mm	mm	-	-	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
65	48	0.8	116	55	6	9	6	20	M6	M6 1	121.2	15	12.4	19.9	74	2.9	16.9	12.4	15	15
65	48	0.8	116	55	6	9	6	20	M6	M6×1	126.3	15	12.4	19.9	74	2.9	22	12.4	15	15
76	56	0.8	135	68	6	9	6	20	M6	M6×1	132.9	20	3.8	27.5	89	2.2	17.9	20	15	20
76	50	0.8	135	68	6	9	6	20	M6	M6×1	126.8	20	3.8	27.5	89	2.2	11.8	20	15	20
76	53	0.8	135	68	6	9	6	20	M6	M6×1	125.9	20	3.8	27.5	89	2.2	10.9	20	15	20
80	63	0.8	142	75	8	9	6	20	M6	M8×1	136.7	20	9.3	22.5	85	4.7	17.7	15	15	20
-	72	1.6	153	80	8	9	6	20	M6	M8×1	159.6	47	8.8	19	83	-	20.8	11.5	15	20
110	85	1.6	190	106	8	11	6	30	M8	M8×1	163.5	20	15.5	25.4	100	4.5	23.5	15.7	20	25

3.12 Shaft end combinations

- In the ordering code, shaft ends machining is defined by::
 - One letter for nominal diameter $d_0 < 16$ mm
 - Two letters for nominal diameter $d_0 \geq 16$ mm
 - Detailing the combination of two machined ends ▶96|3.18
- Machined ends are detailed for nominal diameter $d_0 < 16$ mm ▶76|3.13.1
- Machined ends are detailed for nominal diameter $d_0 \geq 16$ mm ▶78|3.13.2

6 Shaft end combinations

$d_0 < 16$ mm		$d_0 \geq 16$ mm	
Order code	Two machined ends	Order code	Two machined ends
A (without length indication)	cut only	AA (without length indication)	cut only
A (+ length)	cut + annealed		
B	1 + 2	BA	1A + 2A
F ¹⁾	2 + 2	FA ¹⁾	2A + 2A
G ¹⁾	2 + 3	GA ¹⁾	2A + 3A
H	2 + 4	HA	2A + 4A
J	2 + 5	JA	2A + 5A
M	3 + 5	MA	3A + 5A
S ²⁾ (+ length)	end machined to root diameter d_2 , any length	SA ²⁾ (+ length)	end machined to root diameter d_2 , any length
		UA ²⁾ (+ length)	end machined to diameter d_3 under induction hardening, any length
K	keyway	K	keyway
Z	end machined according to customer drawing on request	Z	end machined according to customer drawing on request

¹⁾ Attention! This mounting requires the greatest care. Please contact Schaeffler.

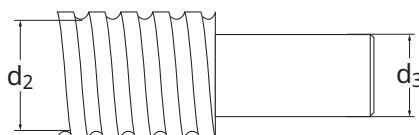
²⁾ Note the information regarding end machining types S, SA und UA.

S, SA and UA end machining types

S and SA: end is machined to thread root diameter d_2 . It is available for all screw shaft nominal diameters.

UA: end is machined to diameter d_3 under induction hardened layer. Any length can be used. UA end machining is available for ball screws with nominal diameter d_0 starting from 16 mm.

62 S, SA und UA end machining types



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7 Dimensions S, SA und UA end machining types

$d_0 \times P_h$	d_2	d_3
mm	mm	mm
6×2	4.7	-
8×2.5	6.3	-
10×2	8.3	-
10×3	7.8	-
10×4	7.4	-
12×2	9.9	-
12×4	9.4	-
12×5	9.3	-
12.7×12.7	10.2	-
14×4	11.9	-
16×2	14.3	12
16×5	12.7	9
16×10	12.6	9
20×5	16.7	14
25×5	21.7	19
25×10	20.5	18
25×20	21.7	19
25×25	21.5	18
32×5	28.7	26
32×10	27.8	25
32×20	27.4	24
32×32	28.4	26
32×40	26.9	24
40×5	36.7	34
40×10	34.0	31
40×20	35.1	32
40×40	34.2	31
50×10	44.0	41
50×50	43.4	40
63×10	57.0	54

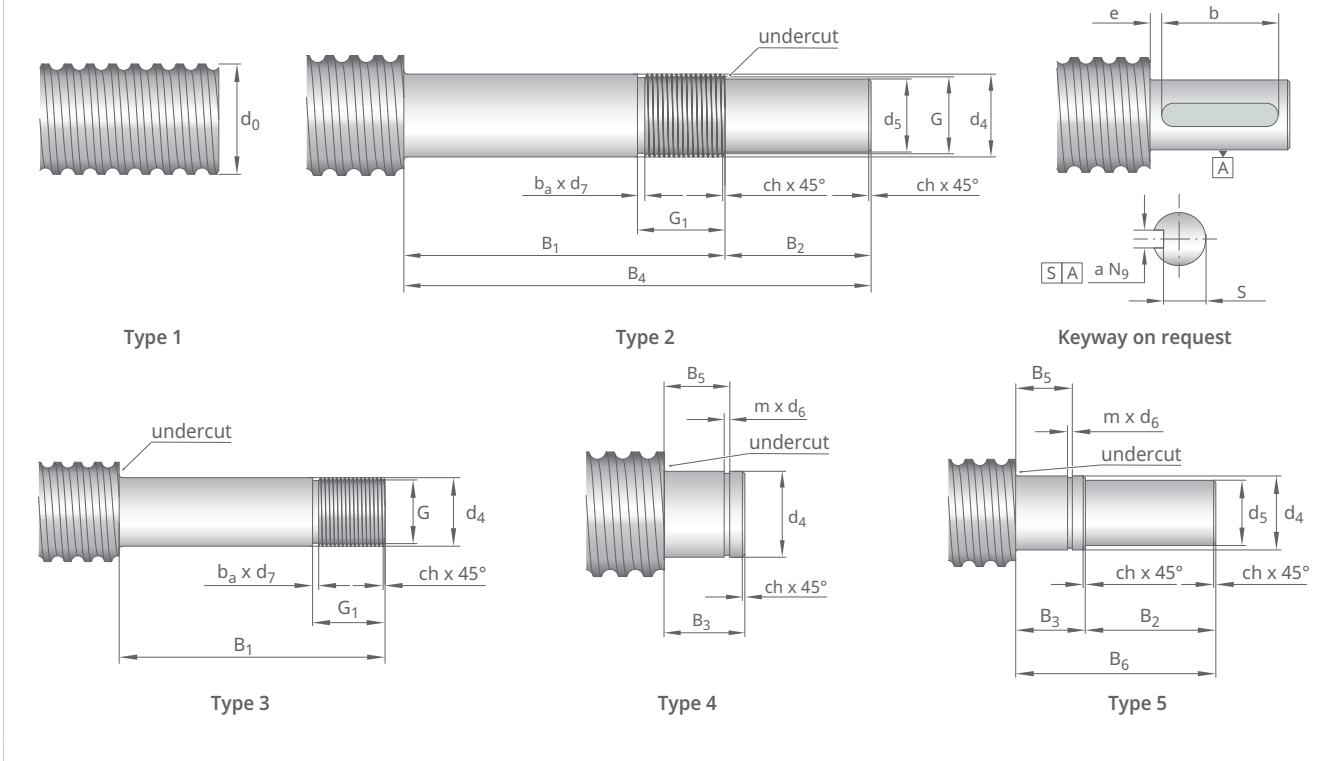
3.13 Standard machine ends

3.13.1 Standard end machining for nominal diameter < 16 mm

For SD/BD/SH and SDS/BDS/SHS

3

63 Standard end machining $d_0 < 16$ mm



8 Standard end machining for nominal diameter < 16 mm

d_0	d_5	d_4 ¹⁾	B_1	B_2	B_3	B_4	B_5	B_6	G	G_1
	h7	js7	js12		js12	js12	H11	js12	g6	
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
6	3	4	22	10	7	32	5.4	17	M4×0.7	7
8	4	5	24	12	7	36	5.6	19	M5×0.8	7.2
10	5	6	26	12	9	38	6.7	21	M6×1	7.5
12	6	8	38	12	10	50	7.8	22	M8×1	12.5
12.7	6	8	38	12	10	50	7.8	22	M8×1	12.5
14	8	10	40	16	12	56	9	28	M10×1.5	13.3

¹⁾ For applications with radial loads on support bearings, please consult Schaeffler for best selection of tolerance on diameter d_4 .

 9 Standard end machining for nominal diameter < 16 mm

d ₀	m	d ₆	ch	b _a	d ₇	a	b	e	j	S	Keyway DIN 6885
	+0.14 0	h11/h12			h11	N9	+0.5 0				
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
6	0.5	3.8	0.5	1.2	2.9	-	-	-	-	-	-
8	0.7	4.8	0.5	1.2	3.7	-	-	-	-	-	-
10	0.8	5.7	0.5	1.5	4.5	-	-	-	-	-	-
12	0.9	7.6	0.5	1.5	6.5	2	8	3	4.8	0.1	A2×2×8
12.7	0.9	7.6	0.5	1.5	6.5	2	8	3	4.8	0.1	A2×2×8
14	1.1	9.6	0.5	2.3	7.8	2	10	3	6.8	0.1	A2×2×10

3.13.2 Standard end machining for shaft nominal diameter ≥ 16 mm

For SD/BD, SDS/BDS, SX/BX, SND/BND/PND and SN/BN/PN

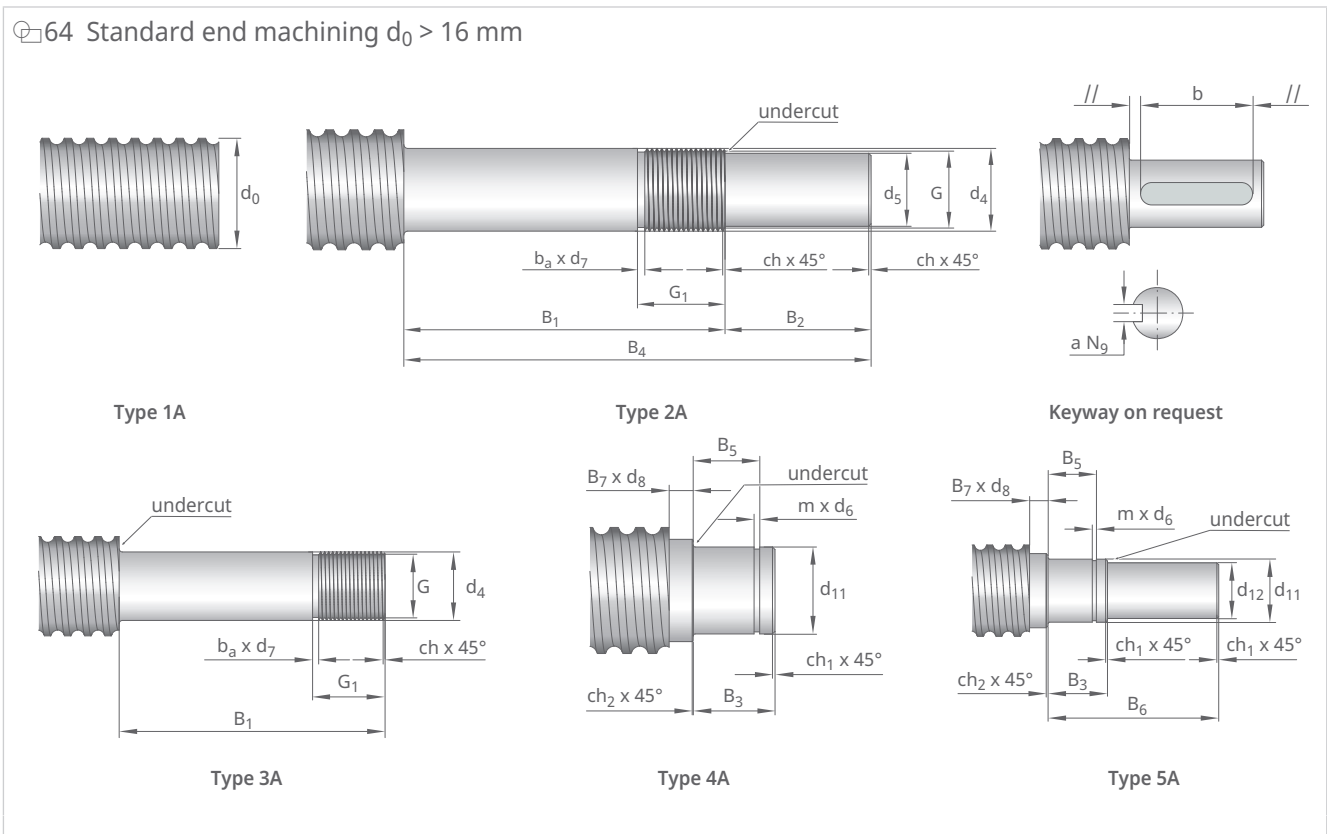
Standard shaft ends for ball screws with nominal diameter ≥ 16 mm have been developed to fit with the support bearings FLBU, PLBU and BUF.

10 Machined end type

Support bearing	Machined end type
FLBU	2A or 3A
PLBU	2A or 3A
BUF	4A or 5A

For these types of machined ends, the maximum permissible dynamic load is 75 % of the ball screw dynamic load carrying capacity.


64 Standard end machining $d_0 > 16$ mm



11 Standard end machining for shaft nominal diameter ≥ 16 mm

d_0	d_5	d_4 ¹⁾	d_{11}	d_{12}	B_1	B_2	B_3	B_4	B_5	B_6	B_7	d_8
	h7	h6	h6	h7	js12		js12	js12	H11	js12		
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
16	8	10	10	8	53	16	13	69	10	29	2	12.5
20	10	12	10	8	58	17	13	75	10	29	2	14.5
25 ¹⁾	15	17	17	15	66	30	16	96	13	46	4.5	20
32 ¹⁾	17	20	17	15	69	30	16	99	13	49	4.5	28.7
40 ¹⁾	25	30	30	25	76	45	22	121	17.5	67	4.5	33.5
50 ¹⁾	30	35	30	25	84	55	22	139	17.5	67	4.5	35.2
63	40	50	45	40	114	65	28	179	20.75	93	3	54

¹⁾ For applications with radial loads on support bearings, please consult Schaeffler for best selection of tolerance on diameter d_4 .

 12 Standard end machining for shaft nominal diameter ≥ 16 mm

d ₀	G	G ₁	m	d ₆		ch ₁	ch ₂	b _a	d ₇	a	Keyway to DIN 6885	
	g6		+0.14 0	h11	h12						h11	N9
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	2A	5A
16	M10×0.75	17	1.1	9.6	-	0.5	0.5	1.2	8.8	2	A2×2×12	A2×2×12
20	M12×1	18	1.1	9.6	-	0.5	0.5	1.5	10.5	2	A3×3×12	A2×2×12
25	M17×1	22	1.1	16.2	-	0.5	0.5	1.5	15.5	5	A5×5×25	A5×5×25
32	M20×1	22	1.1	16.2	-	0.5	0.5	1.5	18.5	5	A5×5×25	A5×5×25
40	M30×1.5	25	1.6	-	28.6	1	0.5	2.3	27.8	8	A8×7×40	A8×7×40
50	M35×1.5	27	1.6	-	28.6	1	0.5	2.3	32.8	8	A8×7×45	A8×7×40
63	M50×1.5	32	1.85	-	42.5	1.5	1	2.3	47.8	12	A12×8×50	A12×8×50

3.13.3 Standard end machining for SL/TL only

Standard shaft ends for SL/TL ball screws have been developed to fit with the Ewellix support bearings FLBU, PLBU and BUF.

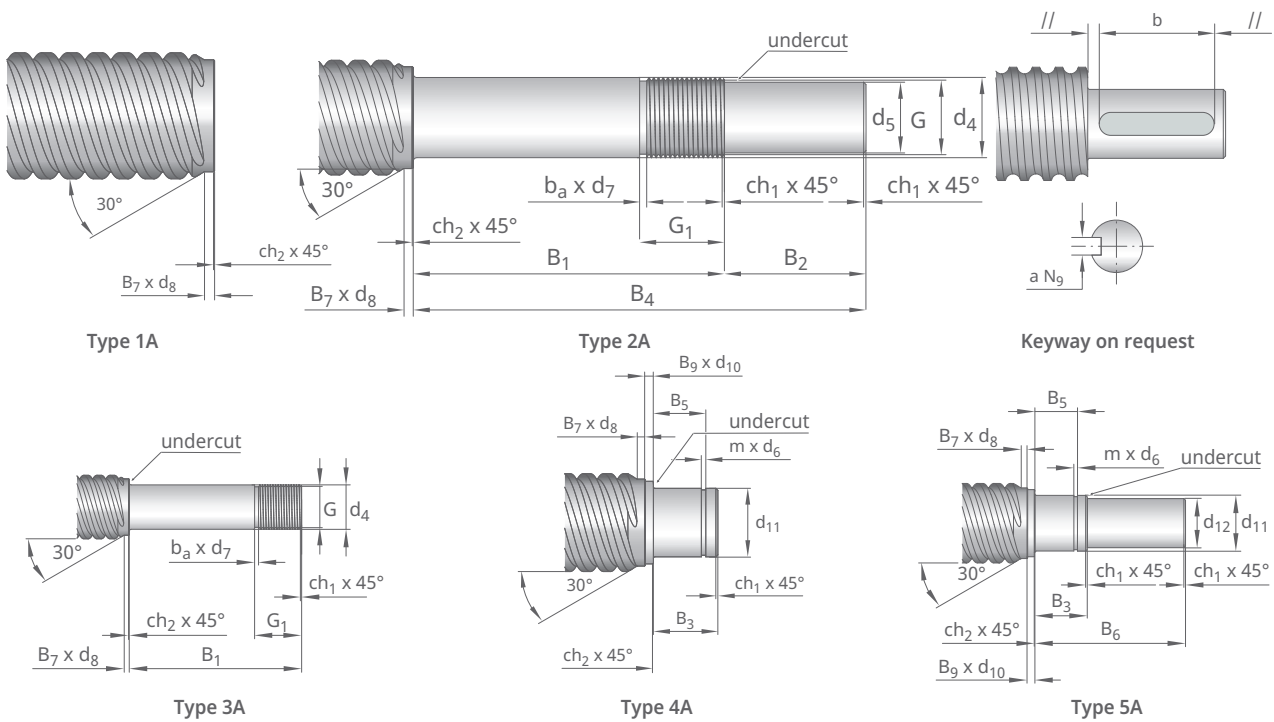
For the SL/TL long lead screw, an additional centering diameter, part of the threaded length, will be machined at both ends of the screw shaft to facilitate the nut assembly.


13 Machined end type

Support bearing	Machined end type
FLBU	2A or 3A
PLBU	2A or 3A
BUF	4A or 5A

For these types of machined ends, the maximum permissible dynamic load is 75 % of the ball screw dynamic load carrying capacity, except for size 50×50 for which the dynamic load must not exceed 40 kN.


65 Standard end machining, SL/TL



 14 Standard end machining for SL/TL

d ₀	d ₅	d ₄ ¹⁾	d ₁₀	d ₁₁	d ₁₂	B ₁	B ₂	B ₃	B ₄	B ₅	B ₆	B ₇	B ₉	d ₈
	h7	h6		h6	h7	js12		js12	js12	H11	js12			
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
25×20	15	17	-	17	15	66	30	16	96	13	46	4.5	0	21.6
25×25	15	17	-	17	15	66	30	16	96	13	46	4.5	0	21.4
32×20	17	20	21.5	17	15	69	30	16	99	13	46	4.5	2	27.3
32×32	17	20	21.5	17	15	69	30	16	99	13	46	4.5	2	28.3
32×40	17	20	21.5	17	15	69	30	16	99	13	46	4.5	2	26.8
40×20	25	30	-	30	25	76	45	22	121	17.5	67	6.5	0	35.1
40×40	25	30	-	30	25	76	45	22	121	17.5	67	6.5	0	34.1
50×50	30	35	37	30	25	84	55	22	139	17.5	67	9	3	43.3

1) For applications with radial loads on support bearings, please consult Schaeffler for best selection of tolerance on diameter d₄.

 15 Standard end machining for SL/TL

d ₀	G	G ₁	m	d ₆		ch ₁	ch ₂	b _a	d ₇	a	Keyway to DIN 6885	
	g6		+0.14 0	h11	h12				h11	N9	a × l × b	
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	2A	5A	
25×20	M17×1	22	1.1	16.2	-	0.5	0.5	1.5	15.5	5	A5×5×25	A5×5×25
25×25	M17×1	22	1.1	16.2	-	0.5	0.5	1.5	15.5	5	A5×5×25	A5×5×25
32×20	M20×1	22	1.1	16.2	-	0.5	0.5	1.5	18.5	5	A5×5×25	A5×5×25
32×32	M20×1	22	1.1	16.2	-	0.5	0.5	1.5	18.5	5	A5×5×25	A5×5×25
32×40	M20×1	22	1.1	16.2	-	0.5	0.5	1.5	18.5	5	A5×5×25	A5×5×25
40×20	M30×1.5	25	1.6	-	28.6	1	0.5	2.3	27.8	8	A8×7×40	A8×7×40
40×40	M30×1.5	25	1.6	-	28.6	1	0.5	2.3	27.8	8	A8×7×40	A8×7×40
50×50	M35×1.5	27	1.8	-	28.6	1	0.5	2.3	32.8	8	A8×7×45	A8×7×40

3.14 Ball screw support bearings FLBU

Axially locating flanged housings fitted with angular contact ball bearings in back-to-back arrangement

66 Ball screw support bearings FLBU



001DE5BD

Features

- Precision machined housing made of burnished steel
- Two preloaded angular contact ball bearings, 72 or 73, in back-to-back arrangement
- Two garter seals
- Standard self-locking Nylstop nut or or precision lock nut with locking pins upon request.

Benefits

- Complete support bearing ready to use, simplified application design, easy ordering process
- Quick assembly onto shaft end
- Elimination of most technical risks with bearings and seals assembly
- Support bearing dimensions and load carrying capacity matched to the ball screw characteristics
- Bearings back-to-back assembly with preload for stiff and accurate ball screw positioning
- Greased for life / maintenance-free

67 Exploded view FLBU



001B8BAB

3.14.1 Technical data

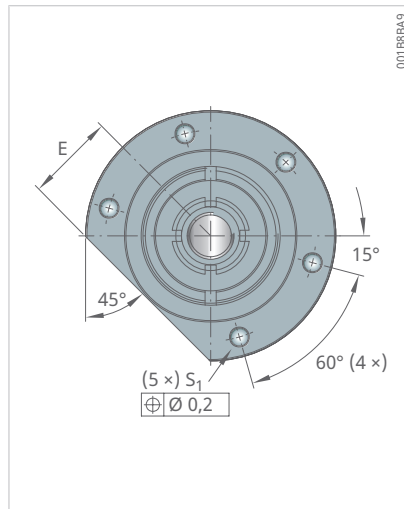
FLBU

Flanged housing unit

Angular contact ball bearing

Back-to-back arrangement

3



FLBU

Designation	d ₀	Angular contact ball bearing 40 °				Self-locking nut		High precision nut ¹⁾				
		C _a	C _{0a}	R _a	Designation ²⁾	Designation	Hook spanner	Designation	Hook spanner	T _A	M _{GS}	T _{GS max.}
-	mm	kN	kN	N/μm	-	-	-	-	-	Nm	-	Nm
FLBU 16	16	9.8	10	-	7200	CN 70-10	HN 1	KMT 0	HN 2/3	4	M5	4.5
FLBU 20	20	13.9	13.7	140	7201-B-XL-TVP-UO	CN 70-12	HN 1	KMT 1	HN 3	8	M5	4.5
FLBU 25	25	32.8	34.6	215	7203-B-XL-TVP-UO	CN 70-17	HN 3	KMT 3	HN 4	15	M6	8
FLBU 32	32	26.1	30	215	7204-B-XL-TVP-UO	CN 70-20	HN 4	KMT 4	HN 5	18	M6	8
FLBU 40	40	40.5	54.2	300	7206-B-XL-TVP-UO	CN 70-30	HN 6	KMT 6	HN 6	32	M6	8
FLBU 50	50	49.7	73.1	345	7207-B-XL-TVP-UO	CN 70-35	HN 7	KMT 7	HN 7	40	M6	8
FLBU 63	63	132.5	192.3	490	7310-B-XL-TVP-UO	CN 70-50	HN 10	KMT 10	HN 10/11	60	M8	18

¹⁾ Optional

²⁾ UO: light preload

d ₀	mm	nominal diameter of screw
C _a	kN	dynamic axial load rating
C _{0a}	kN	static axial load rating
R _a	N/μm	axial stiffness
T _A	Nm	Tightening torque lock nut
M _{GS}	-	Grub screws size
T _{GS}	Nm	Tightening torque grub screw

3.15 Ball screw support bearings PLBU

Fixed pillow blocks fitted with angular contact ball bearings in back-to-back arrangement

68 Ball screw support bearings PLBU



001DE5DD

Features

- Precision machined housing made of burnished steel
- Precision machined side faces of the housing can be used as reference assembly surfaces for screw alignment
- Two preloaded angular contact ball bearings, 72 or 73, in back-to-back arrangement
- Two garter seals
- Standard self-locking Nylstop nut or or precision lock nut with locking pins upon request.

Benefits

- Complete support bearing ready to use, simplified application design, easy ordering process
- Quick assembly onto shaft end
- Elimination of most technical risks with bearings and seals assembly
- Support bearing dimensions and load carrying capacity matched to the ball screw characteristics
- Bearings back-to-back assembly with preload for stiff and accurate ball screw positioning
- Good rigidity provided by the base mounting with dowel pins
- Greased for life / maintenance-free

69 Exploded view PLBU



001B8BD9

3.15.1 Technical data

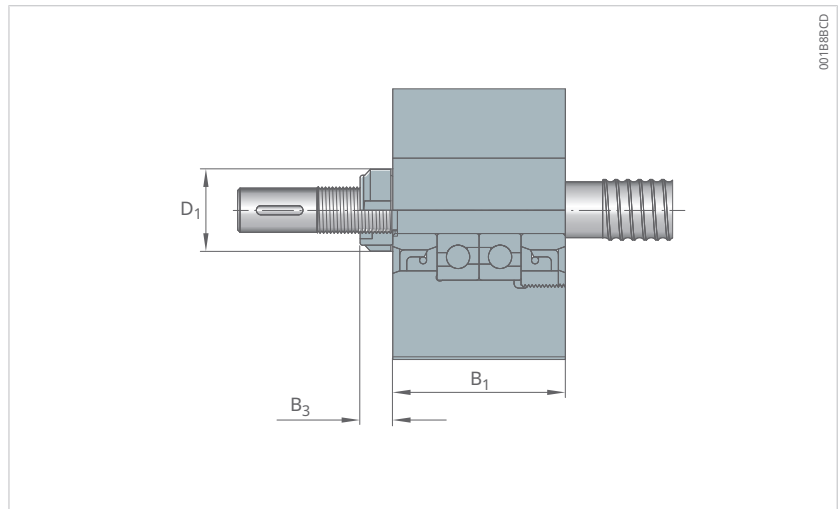
PLBU

Pillow block housing unit

Angular contact ball bearing

Back-to-back arrangement

3



PLBU

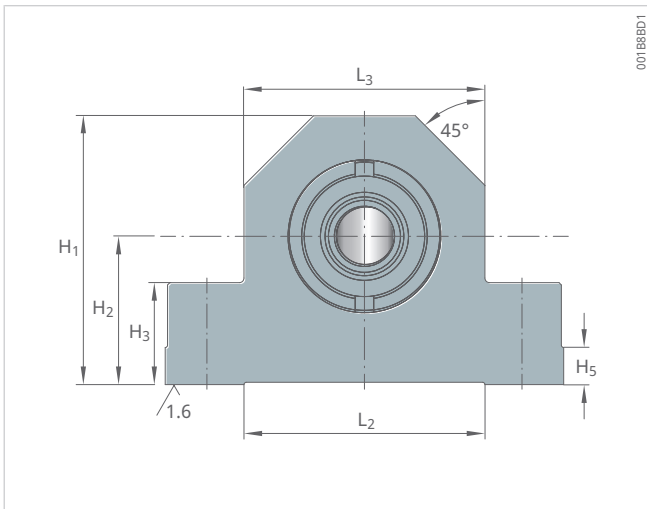
001B5BCD

Designation	d ₀	Angular contact ball bearing 40 °				Self-locking nut		High precision nut ¹⁾				
		C _a	C _{0a}	R _a	Designation ²⁾	Designation	Hook spanner	Designation	Hook spanner	T _A	M _{GS}	T _{GS max.}
-	mm	kN	kN	N/μm	-	-	-	-	-	Nm	-	Nm
PLBU 16	16	9.8	10	-	7200	CN 70-10	HN 1	KMT 0	HN 2/3	4	M5	4.5
PLBU 20	20	13.9	13.7	140	7201-B-XL-TVP-UO	CN 70-12	HN 1	KMT 1	HN 3	8	M5	4.5
PLBU 25	25	32.8	34.6	215	7203-B-XL-TVP-UO	CN 70-17	HN 3	KMT 3	HN 4	15	M6	8
PLBU 32	32	26.1	30	215	7204-B-XL-TVP-UO	CN 70-20	HN 4	KMT 4	HN 5	18	M6	8
PLBU 40	40	40.5	54.2	300	7206-B-XL-TVP-UO	CN 70-30	HN 6	KMT 6	HN 6	32	M6	8
PLBU 50	50	49.7	73.1	345	7207-B-XL-TVP-UO	CN 70-35	HN 7	KMT 7	HN 7	40	M6	8
PLBU 63	63	132.5	192.3	490	7310-B-XL-TVP-UO	CN 70-50	HN 10	KMT 10	HN 10/11	60	M8	18

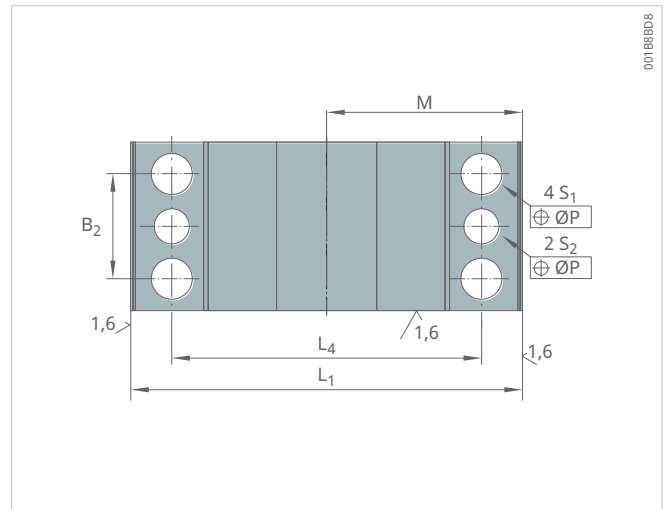
¹⁾ Optional

²⁾ UO: light preload

d ₀	mm	nominal diameter of screw
C _a	kN	dynamic axial load rating
C _{0a}	kN	static axial load rating
R _a	N/μm	axial stiffness
T _A	Nm	Tightening torque lock nut
M _{GS}	-	Grub screws size
T _{GS}	Nm	Tightening torque grub screw



PLBU



PLBU

L1	L2	L3	L4	M	B1	B2	B3	D1	B3	D1	H1	H2	H3	H4	H5	S1	P	S2	Fixing screws	Tapered (hardened) / straight pin (DIN6325)
				js8			Self-locking nut			High precision nut 1)		js8						H12		
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	-	-
86	52	52	68	43	37	23	7	18	14	28	58	32	22	15	8	9	0.15	7.7	M8×35	8×40
94	52	60	77	47	42	25	7.5	21	14	30	64	34	22	17	8	9	0.15	7.7	M8×35	8×40
108	65	66	88	54	46	29	8.3	28	18	37	72	39	27	19	10	11	0.2	9.7	M10×40	10×50
112	65	70	92	56	49	29	8.3	32	18	40	77	45	27	20	10	11	0.2	9.7	M10×40	10×50
126	82	80	105	63	53	32	11	44	20	49	98	58	32	23	12	13	0.2	9.7	M12×50	10×50
144	80	92	118	72	59	35	11	50	22	54	112	65	38	25	12	13	0.2	9.7	M12×55	10×55
190	110	130	160	95	85	40	11.7	68	25	75	130	65	49	35	15	13	0.2	9.7	M12×65	10×65

3.16 Ball screw support bearings BUF

Axially free pillow blocks fitted with deep groove ball bearing

70 Ball screw support bearings BUF



001DE5FD

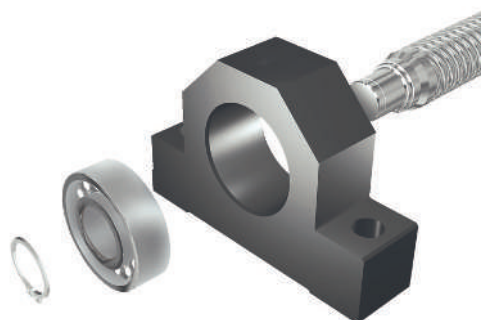
Features

- Precision machined housing made of burnished steel
- Precision machined side faces of the housing can be used as reference assembly surfaces for screw alignment
- One deep groove ball bearing of type 62...2RS1
- Bearing is sealed and greased for life
- Retaining ring is supplied with the BUF assembly

Benefits

- Complete support bearing ready to use, simplified application design, easy ordering process
- Quick assembly onto shaft end
- Elimination of most technical risks with bearings and seals assembly
- Greased for life / maintenance-free

71 Exploded view BUF



001B8B62

3.16.1 Technical data

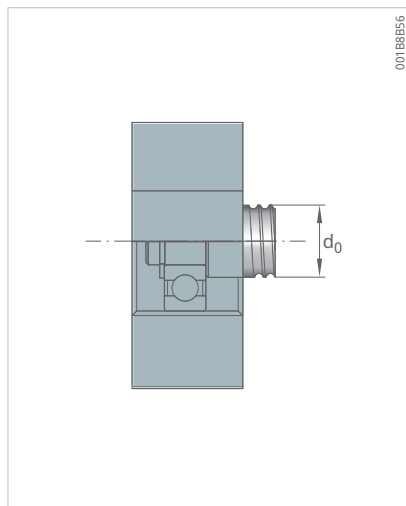
BUF

Axial displacement facility

Pillow block housing unit

Deep groove ball bearing

3

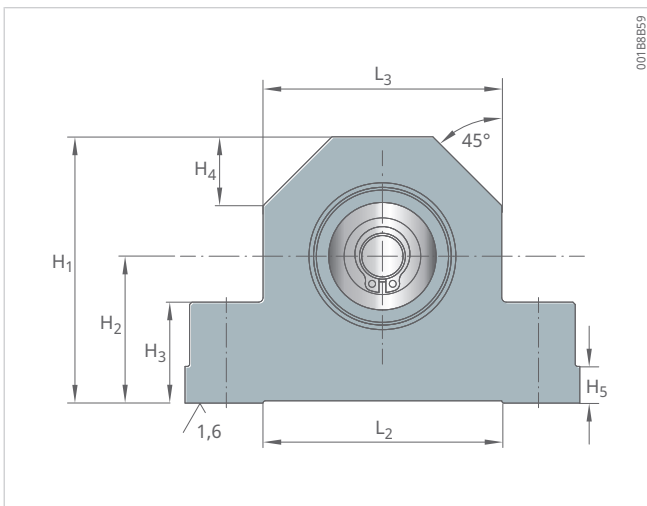


BUF

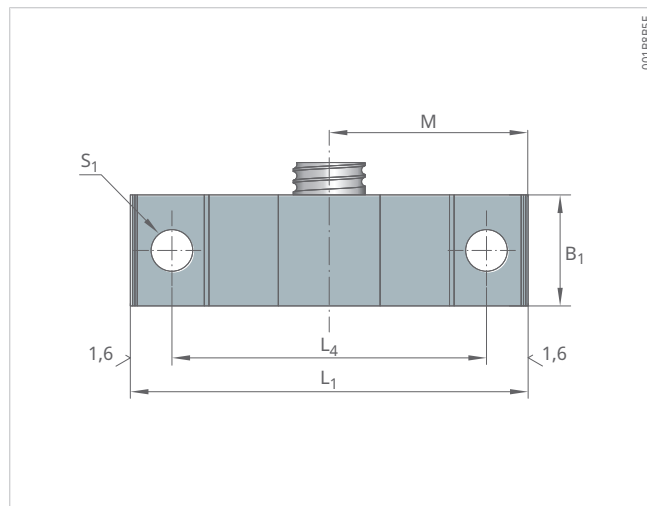
Designation	d ₀	Deep groove ball bearing						Retaining ring
		C	C ₀	Designation	d	D	B	DIN471
-	mm	kN	kN	-	mm	mm	mm	-
BUF 16	16	5.07	2.36	6200.2RS1	10	30	9	10×1
BUF 20	20	5.07	2.36	6200.2RS1	10	30	9	10×1
BUF 25	25	9.56	4.75	6203.2RS1	17	40	12	17×1
BUF 32	32	9.56	4.75	6203.2RS1	17	40	12	17×1
BUF 40	40	19.5	11.2	6206.2RS1	30	62	16	30×1.5
BUF 50	50	19.5	11.2	6206.2RS1	30	62	16	30×1.5
BUF 63	63	33.2	21.6	6209.2RS1	45	85	19	45×1.75

C kN
 C₀ kN

Basic dynamic radial load rating, deep groove ball bearing
 Basic static radial load rating, deep groove ball bearing



BUF



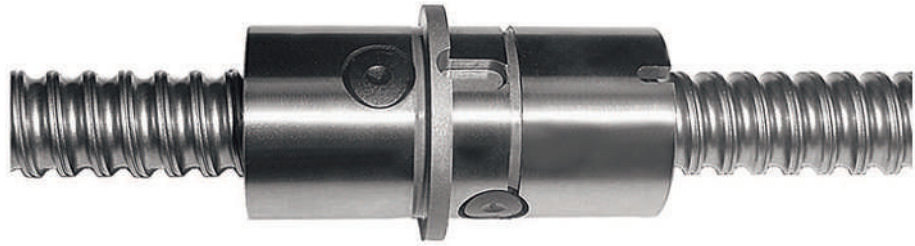
BUF

3

L1	L2	L3	L4	M	B1	H1	H2	H3	H4	H5	S1	Fixing screw
				js8			js8				H12	
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	-
86	52	52	68	43	24	58	32	22	15	8	9	M8×35
94	52	60	77	47	26	64	34	22	17	8	9	M8×35
108	65	66	88	54	28	72	39	27	19	10	11	M10×40
112	65	70	92	56	34	77	45	27	20	10	11	M10×40
126	82	80	105	63	38	98	58	32	23	12	13	M12×50
144	80	92	118	72	39	112	65	38	25	12	13	M12×55
190	110	130	160	95	38	130	65	49	35	15	13	M12×65

3.17 Examples of customized nuts

☞72 Customized SD, rotating nut with flange and bearing journals



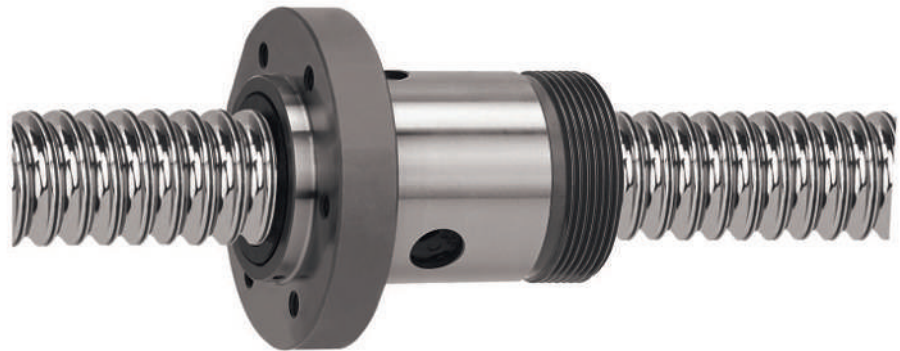
001B8C16

☞73 Customized SDS nut with integrated trunnions



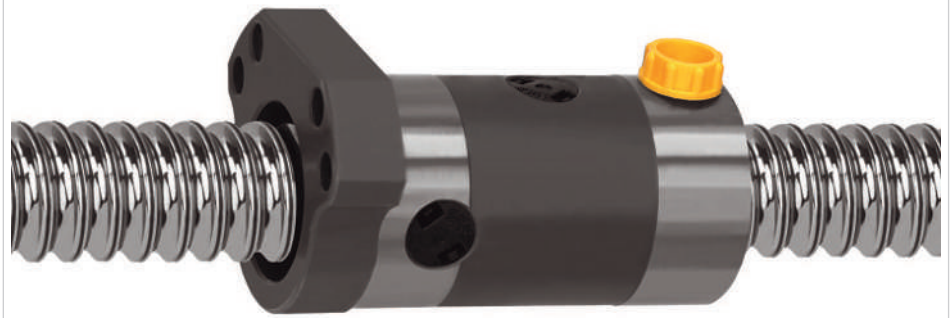
001B8C21

☞74 Customized SN, rotating nut with flange and bearing journals



001B8C8E

75 PN nut with customized compact flange



001B8BE4

76 SL nut with customized flange attachment



001B8C5C

3.18 Ordering designation

77 Ordering designation ball screws

3

SN 32x5 R 330/445 G7 L - HA +K **/** WPR

Nut type

- SD Miniature screw, axial play, recirculation by inserts
- BD Miniature screw, backlash elimination, recirculation by inserts
- SH Miniature screw, axial play, recirculation by integrated tube
- SDS Miniature screw, axial play, stainless steel
- BDS Miniature screw, backlash elimination, stainless steel
- SHS Miniature screw, axial play, stainless steel, recirculation by integrated tube
- SP High performance miniature screw, axial play
- BP High performance miniature screw, backlash elimination
- SX Universal screw, axial play
- BX Universal screw, backlash elimination
- SND Precision screw, axial play, DIN nut
- BND Precision screw, backlash elimination, DIN nut
- PND Precision screw, preloaded, DIN nut
- SN Precision screw, axial play, cylindrical flange
- BN Precision screw, backlash elimination, cylindrical flange
- PN Precision screw, preloaded, cylindrical flange
- SL Long lead screw, axial play
- TL Long lead screw, backlash elimination
- SLD Long lead screw, axial play, DIN nut
- TLD Long lead screw, backlash elimination, DIN nut
- SLT Rotating nut, axial play
- TLT Rotating nut, backlash elimination

Nominal diameter x Lead [mm]

Hand

- R Right
- L Left (on request)

Threaded length / Total length [mm]

Lead precision G5, G7, G9

Nut orientation

- S Nut threaded nose or nut flange towards shorter machined end of shaft
- L Nut threaded nose or nut flange towards longer machined end of shaft
- Identical machining at both shaft ends

Machined end combination

Ø d0 < 16 mm		Ø d0 ≥ 16 mm	
A (without length indication)	cut only	AA (without length indication)	cut only
A (+length)	cut + annealed	BA	1A + 2A
B	1 + 2	FA	2A + 2A
F	2 + 2	GA	2A + 3A
G	2 + 3	HA	2A + 4A
H	2 + 4	JA	2A + 5A
J	2 + 5	MA	3A + 5A
M	3 + 5	SA (+length)	End machined to root diameter d2, any length
S (+length)	End machined to root diameter d2, any length	UA (+length)	Ø d3 under induction hardening, any length
Z	End machined according to customer drawing on request	Z	End machined according to customer drawing on request

Option

- +K Keyway

Required lengths for A-S-SA-UA (both ends)

Options

- WPR With wipers
- NOWPR Without wipers
- RING Safety ring (for miniature ball screws only)
- REDPLAY Reduced axial play

78 Ordering designation nut on sleeve

NND 20x5 R N/S WPR CI

Nut type

- ND Miniature nut, recirculation by inserts
- NDS Miniature nut, recirculation by inserts, stainless steel
- NH Miniature nut, recirculation by integrated tube
- NHS Miniature nut, recirculation by integrated tube, stainless steel
- NP High-performance miniature nut, recirculation by inserts
- NX Universal nut, recirculation by inserts
- NND Precision nut, recirculation by inserts, DIN nut
- NN Precision nut, recirculation by inserts
- NL Long lead nut, recirculation by faces
- NLD Long lead nut, recirculation by faces, DIN nut

Nominal diameter × Lead [mm]

Hand

- R Right

Nut on sleeve

Options

- WPR With wipers
- NOWPR Without wipers
- RING Safety ring (for miniature ball screws only)

Option

- CI Standard (Composite material, except for NH/NHS)
- SI Steel recirculation inserts

001DE749

79 Ordering designation rolled shafts

VD 20x5 R 3700 G9

Designation

- VD carbon steel, all nut types
- VDI stainless steel, only nut type SDS/SHS

Nominal diameter × Lead [mm]

Hand

- R Right

Total length [mm]

Lead precision G5, G7, G9

001DE739

4 Mounting instructions and support

4.1 Assembly procedure

Ball screw assemblies are precision components and should be handled with care to avoid damaging shocks, contamination or corrosion.

Further information



MON 110 | Ball Screws |
<https://www.schaeffler.de/std/2267>

4.1.1 Storage

Storage location must ensure that ball screw assemblies are not exposed to contamination, shocks, humidity and other detrimental actions.

When stored out of the shipping crate, ball screw assemblies must lie on wooden or plastic V-shaped blocks and should not be allowed to bounce. The assembly must not be supported on the shelf by the nut body.

During shipping, ball screw assemblies are wrapped in heavy gauge plastic bags, which protect them from foreign material and possible contamination. They should remain wrapped until they are used.

4.1.2 Alignment

After assembly, any radial load or moment loading on the nut will overload some of the contact surfaces, thus significantly reducing the service life.

Schaeffler linear guidance components should be used to ensure correct alignment and to avoid non-axial loading. The parallelism of the screw shaft with the guiding devices must be checked carefully. If external linear guidance proves impractical, we suggest mounting the nut on trunnions or gimbals, and mounting the screw shaft on self-aligning bearings.

Mounting the screw in tension helps to align it properly and eliminates buckling.

4.1.3 Lubrication

Good lubrication is essential for the proper operation and long term reliability of the ball screw assembly. If necessary, please consult Schaeffler.

Before shipping, the complete ball screw assembly is coated with a protective fluid that dries to a film. This protective film is not a lubricant. Depending on the lubricant selected for the application, it may be necessary to remove the protective film before applying the lubricant in order to eliminate any risk of incompatibility.

To remove the protective film Schaeffler recommends the following procedure:

1. Dip the ball screw assembly into a solvent.
2. Shake and rotate the assembly to allow the solvent to penetrate.
3. Remove the assembly from the solvent and allow the solvent to drain.

4.1.4 Removing and assembling the nut on the shaft

Removing the nut from the screw shaft

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.

Never unscrew the nut from the shaft without a mandrel or sleeve to prevent the balls from falling off the nut.

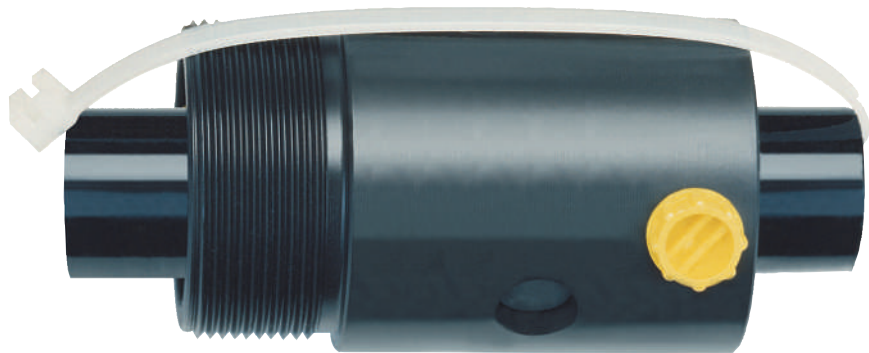
Once the nut is engaged on the sleeve, use a tie wrap to secure the nut assembly.

Fitting sleeved nut onto screw shaft

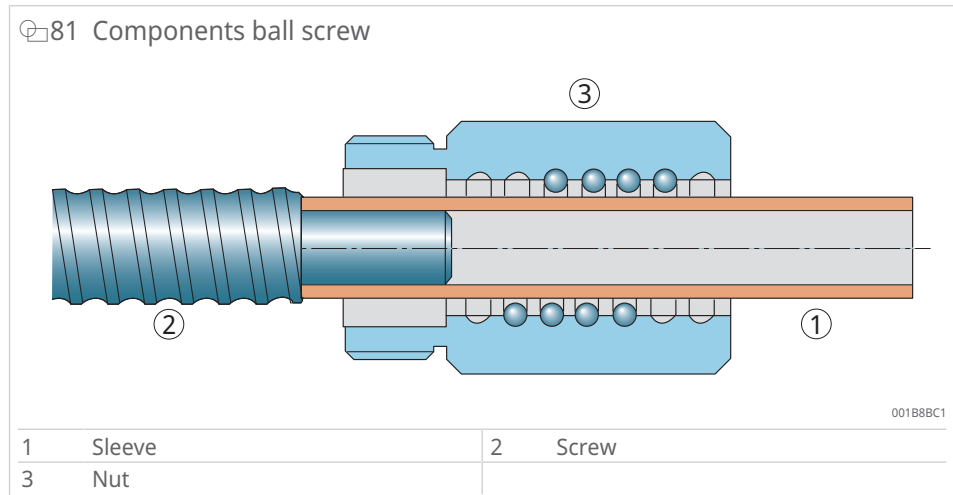
Sleeved nuts should not be removed from the sleeve until final assembly.

1. Remove the retaining strap.
2. Check the assembly drawing to confirm the nut orientation.
3. Hold the sleeve against the ball track of the screw shaft and smoothly engage the ball nut. If the sleeve does not cover the diameter next to the ball track (for example, the sleeve bore diameter is smaller than the screw shaft end), then adhesive tape can be used to match the shaft end to the sleeve outer diameter. Otherwise, the sleeve can be held against the un-machined end, if available, with extreme care to prevent the balls from falling off the nut.
4. Without using force, completely engage the nut in the screw thread, and run the nut to full engagement on the screw shaft.

80 Retaining strap



001B8B4C



4.1.5 Wiper assembly

If optional wipers have been ordered, please refer to the fitting instructions enclosed with the shipment.

4.1.6 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 light load (not to exceed 5 % of the ball screw dynamic carrying capacity) in order to check the proper positioning of the limit switches or reversing mechanism. Then, normal load and speed can be applied.

- ! Instructions for most operations such as fitting a nut onto a screw shaft, a wiper onto a nut, etc. are available in separate sheets delivered with the product. Please refer to them before assembling the screw.

4.2 Service range

Quick service for precision rolled ball screws

For reduced delivery time, Schaeffler operates quick service facilities in Europe and in North America, where standard screw shafts, nuts and accessories are stocked.

Ball screw orders

Customers can order ball screws with the following options:

- Stock items of screws shafts and nuts, without machined ends. Nuts with axial play mounted on screw shaft, or on sleeve. Nuts with backlash elimination or with preload mounted on shaft.
- Ball screw assemblies with shaft ends machined according to standard ends as defined in this catalogue.
- Ball screw assemblies with shaft ends machined according to customer requirements: In this case, please send a drawing with all dimensional and tolerance requirements with all specifications.
All specifications written in English.
- Complete ball screw assemblies, including accessories presented in this catalogue. Accessories already mounted on nut or shaft, or delivered separately.

General rules

Delivery time

- From a couple of days to maximum two weeks is possible for orders fulfilling the following conditions.

Quantity

- SX/BX: Maximum 5 pieces
- SND/BND/PND: Maximum 5 pieces
- SN/BN/PN: Maximum 5 pieces
- SL/TL: Maximum 5 pieces
- SLD/TLD: Maximum 5 pieces
- SD/BD/SH: Maximum 15 pieces

Materials

- Both shaft and nut should be made of standard steel, as stated in the present catalogue.

Capabilities

- Standard nuts, including DIN nuts.
- Screw shafts machined according to customer drawing.
- BD, BX, BND/BN: Backlash elimination by oversized balls
- PND/PN, TL/TLD: Preload available
- General precision on tolerances ISO IT7 (ISO 3408-3)
- 1 nut per screw shaft

Other conditions for quick delivery

- Rotating nut SLT/TLT types are excluded from this program.
- Stainless steel or special treatments, including annealed shaft ends, splines are excluded from this program.
- Material certificates, special reports, or orders that require special procedure and approval by the French authorities are excluded for this program.

Available range

16 Available range

Diameter	6 mm ... 63 mm
Lead	2 mm ... 50 mm
Nut types	Cylindrical and flanged nuts with axial play, backlash elimination, or preload, Schaeffler designs or DIN designs
Lead precision	G5, G7, G9
Accessories	Flanges for nuts, and ball screw support bearings

4.3 Design calculation and inquiry form

Customer and project information

Company name	
Address	
Contact name Surname, First name	
Email	
Phone number	
Website	
Project name	
Application type	
Short description of application (please attach a sketch if possible)	
Annual ball screw requirements and start of production date	
Prototype requirements and suitable delivery date	
For existing or modified application, type of ball screw already used	

4

Ball screw data

82 Ball screw parameters

00188848

s	Max. stroke	I _G	Thread length
L _S	Total length		

Design parameter	Unit	Value
Maximum stroke	mm	
Thread length	mm	
Total length	mm	
Pre-selection of screw shaft nominal diameter d ₀	mm	

Design parameter	Unit	Value
Pre-selection of lead P_h	mm	
Pre-selection of nut type	-	
Lead precision grade according to ISO 3408	-	
Pre-selection of axial play, backlash elimination or preload	-	
If axial play is selected, preferred min/max range	μm	
Request for accessories (flanges, support bearings, etc.)	-	
Other pertinent information	-	

Operating conditions

Maximum loads	• Maximum static load or shock load		N
	• Maximum dynamic load in tension		N
	• Maximum dynamic load in compression		N
	• Average linear speed		m/min
	• Maximum linear speed		m/min
	• Maximum acceleration		m/s^2
Lubrication	• Brand name		
	• Type		
	• Viscosity at average operating temperature		cSt
Operating temperature	• Minimum		$^{\circ}\text{C}$
	• Average		$^{\circ}\text{C}$
	• Maximum		$^{\circ}\text{C}$
Required service life	• Travel		m
	• Or revolutions		rev
	• Or duration		h

Duty cycle description

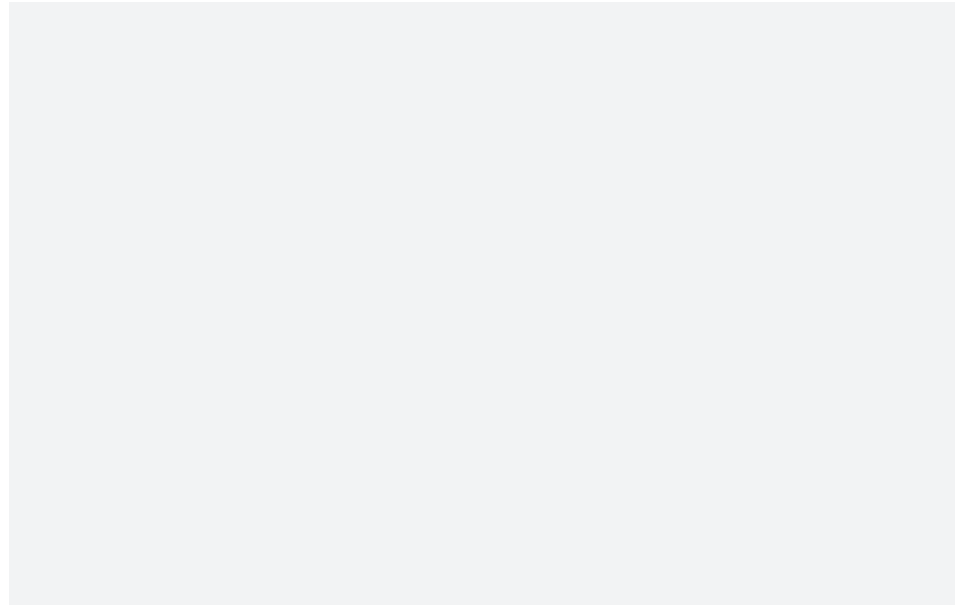
Step	Axial force	Speed, either rotational speed	Linear speed	Travel
	N	min^{-1}	m/min	mm
1				
2				
3				

Step	Axial force	Speed, either rotational speed	Linear speed	Travel
	N	min ⁻¹	m/min	mm
4				
5				
Etc.				

Mounting conditions

- Position of the screw Vertical Horizontal
- Rotating part Screw Nut
- Screw end fixing conditions
 - N ● ● ————— (fixed, free)
 - N ● ● ————— ● (fixed, radial support)
 - N ● ● ————— ● ● (fixed, fixed)

Other pertinent information



3D models

Product configurators for 3D models are available to download from medias.



medias | Ball screws | <https://www.schaeffler.de/std/226B>

Manuals

Supporting documents are available for download from medias.



medias | Ball screws | <https://www.schaeffler.de/std/226B>

Please send inquiry form to your Schaeffler sales office.

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