

Welcome to where precision is.





Welcome to Steinmeyer -

Your reliable partner for ball screws.

Ball screws in all sorts of designs.

The optimal implementation of your wishes are our main focus. The expertise of our technical advice combined with numerous standard and special solutions offers many options for your application and ball screws in all sorts of designs.

Precision and quality.

Innovation, precision, quality, reliability and durability have distinguished our ball screws for decades. First-class materials and sophisticated manufacturing technology are always utilized.

Reliable and individual counseling.

A skilled contact person at Steinmeyer is at your disposal before and after your purchase.

Whether it's for a comprehensive initial consultation or for a quick and simple repair, they look forward to hearing from you.

Contact:

Phone +49 (0) 7431 1288-0 E-Mail info@steinmeyer.com





Our aim is to find the right solution for you.

www.steinmeyer.com

Welcome to where precision is.

History.

Production of ball screws since the 60's.

The Steinmeyer company was founded by Mr. August Steinmeyer in 1920. One year later, in 1921, he decided to specialize in micrometers, which was to become the product range for which the small company was soon to be recognized in the domestic market and abroad.

When the founder suddenly passed away in 1940, Mr. Erwin Beck assumed leadership of the company, and subsequently acquired it in 1950. The house with its attached work shop, built by the founder in 1937, became the origin

of a factory plant which occupies some 8 acres of land today. The original house still exists, but has since been converted into office and meeting space.

Beginning in the late 1960's, ball screws have been manufactured at the Albstadt factory. About 10 years later, this new product line outgrew the legacy micrometer manufacturing, and the organization and production facility had to be tailored towards the new product line. The traditional micrometer line, which still stands for precision and reliability of Steinmeyer's products, is now manufactured at the FMS Suhl plant in Thuringia, an affiliated enterprise in the Steinmeyer group.



The production plant in Albstadt.

In the midst of the 35.000m² wide factory is the original building constructed by the founder. Together with the subsidiary companies in Suhl and Dresden

the Steinmeyer-Group is a leading manufacturer of high-precision ball screws and precision measuring equipment.



Our Philosophy.

Tradition, quality and innovation.

Modern machine design places high demands on precision and reliability of its linear drives. Ball screws, which have become an indispensable engineering element, require a high degree of product knowledge. And Steinmeyer is your key partner for development, production and application engineering.

Small screws specifically prove Steinmeyer's expertise. Still setting standards after 40 years, they have been developed to a degree of perfection second to none. Similarly, machine tool design expects continuously improving perfor-

mance and life figures from its linear drives. Steinmeyer is committed to being at the cutting edge – always.

Our standard: Highest quality.

Such success is impossible without careful consideration of our customers' requirements, which requires continued dialog with them. Experienced staff and the latest equipment ensure we stay at the top — which our customers have come to expect.

In aerospace applications, precision has an additional significance. It means applying ap-

proved processes over and over again — with not the slightest deviation. From raw material to the finished component to its maintenance during the entire life cycle, from design and development to qualification testing — everything must be done in a well controlled environment and an absolutely repeatable manner. On the ground as well as in the air.



Areas of application.

Precision where it counts.

Today ball screws are used in a widely varying range of applications. Precision ball screws from 20 to over 100 mm in diameter are an indispensable element for positioning and infeed applications in today's machinery and apparatus construction. The main challenge here is to provide a dynamic and backlash-free power transmission from rotational to linear motion while keeping a high level of stiffness and lifetime.

Miniature ball screws with diameters of 16 mm and smaller are commonly used for optical instruments, medical engineering and other me-

chatronic applications. Such applications require the lowest possible friction.

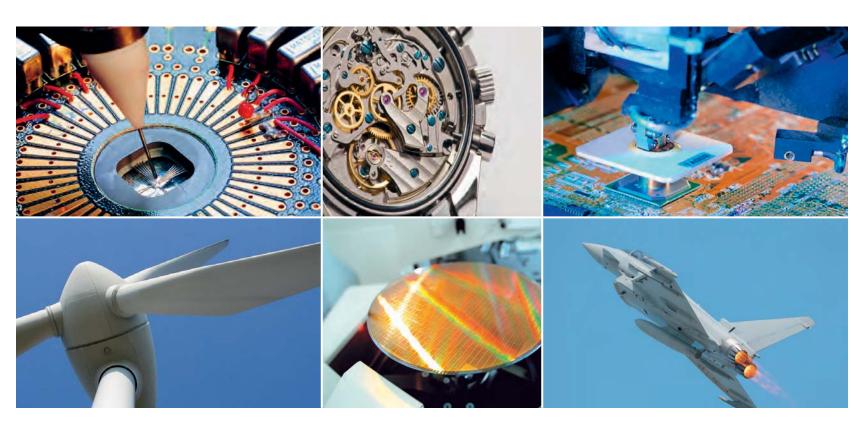
Ball screws quite often have to survive special environments such as Ultra High Vacuum in electron microscopes or high temperatures during sterilization of surgical instruments. Ultra Thrust ball screws not only require bigger dimensions but also need special design solutions e.g. for injection molding machines or lifting tables.

Contrary to that there are applications requiring very fine adjustment. Smallest increments, e.g. in analysis devices, are often achieved using precision ground lead screws. Since screw

shafts and nuts are matched to »nearly backlash free« they often perform better compared to other drive types.

Applications in aerospace have quite different demands on a ball screw. First of all there is uncompromising reliability under all imaginable operating conditions while the precision issue takes a back seat.

Of course design, manufacturing and testing of aerospace ball screws has to be continuously controlled to make sure that failure is impossible.





Certification.

Certified processes are a matter of course.

We achieve high precision products through our high quality standards. To ensure the comprehensive quality requirements by certified processes under quality management systems.







Precision at a glance.



This catalog contains the product range of Steinmeyer ball screws and is divided into several product categories. Because it is not possible to show all special forms and modifications please contact us to review your requirements. And please note that nearly every other nut design, diameter / lead combination and ball size as well as additional ball cir-

cuits are possible – as a custom unit.

Please contact us for details.





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Technology







TECHNICAL INFORMATION

The following chapters only show a small portion of the wide field of applications for ball screws. In order to meet all the technical and commercial demands for such a wide variety of different tasks, a deep understanding of the technology of ball screws is absolutely necessary. We have collected extensive information about ball screws in this section of this catalogue and hope that you will find it useful.

Please be aware that although we edited this information as carefully as possible, we cannot be held responsible for missing or incorrect information.

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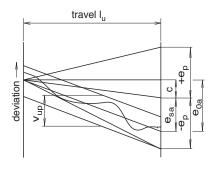
PRECISION (LEAD ERROR, FRICTION TORQUE, CRITICAL TOLERANCES)

Under the headline "precision" DIN / ISO standards are explained as they apply to ball screws, how accuracies are defined, and the acceptance or specification criteria derived from these standards.

- Lead accuracy
- Friction torque
- Roundness, concentricity and squareness of relevant surfaces

In general, all acceptance criteria should be reviewed and agreed upon between Steinmeyer and our customer. This is especially relevant for those applications where special demands are required, for example a lead accuracy of class 5 but friction torque variation consistent with accuracy class 1. In this example, Steinmeyer produces a ball screw with economical class 5 lead accuracy but with much lower friction torque variation.

LEAD ACCURACY PER DIN 69051 / ISO 3408



Both DIN and ISO standards use the following terms and definitions to describe lead accuracy. The corresponding JIS designations are given in parentheses:

- Lead compensation c is used to compensate lead errors resulting from thermal growth or pre-tensioning of the ball screw shaft (JIS: T).
- \blacksquare The permissible lead deviation $\boldsymbol{e}_{_{p}}$ is an averaged lead error over the entire useful travel (JIS: E)
- The permissible lead fluctuation v_{up} over the entire useful travel is defined as the vertical distance of two straight lines parallel to the line representing e_p which enclose the entire lead error graph (JIS: e).
- ullet The lead fluctuation v_{3000} represents the same for any 300 mm interval (JIS: e_{300}).
- And finally the lead wobble $v_{2\pi p}$ is the lead error within one revolution (JIS: $e_{2\pi}$).

Ball screws are normally categorized in accuracy classes, which not only define lead accuracy, but a number of different quality criteria like squareness and concentricity of mating surfaces, shaft straightness, friction torque fluctuation etc. Although this seems to be a trouble-free approach, ball screw users often choose to specify these other criteria by defining them in the source control drawing, while using ISO or DIN standard accuracy classes to only describe lead accuracy.

Steinmeyer uses accuracy classes 1, 3, 5, 7 and 10 per ISO / DIN standard. Accuracy classes 0, 2 and 4 are not contained in these standards, but have been added to match the JIS 1902 standard.





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Positioning ball screws
Transport ball screws

т

The DIN standard differentiates between positioning ball screws and transport ball screws.

Positioning ball screws are normally used in high-precision applications (like machine tool) and are usually equipped with a ground ball thread.

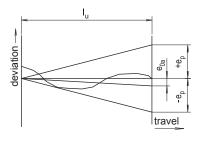
Transport ball screws are predominantly used for travelling and moving applications. Typical applications are axes for handling systems. Ball thread of such screws is usually rolled or whirled.

Per DIN standard the tolerance classes for positioning ball screws are described as "P" while the transport ball screws classes are described as "T".

Steinmeyer uses this designation as per DIN:

P0 – P5 for positioning ball screws T5 – T10 for transport ball screws

Lead error over the entire useful travel



			Lim	it e _p for t	he avera	ge lead e	rror e _{oa} [μm]
l _u [m	ım]				Toleran	ce class		
from	to	P0	P1	P2	P3	P4	P5	T7 T10
-	200	3	5	7	10	15	20	
200	315	4	6	8	12	18	23	
315	400	5	7	9	13	19	25	
400	500	6	8	10	15	21	27	
500	630	6	9	11	16	23	30	
630	800	7	10	13	18	27	35	
800	1000	8	11	15	21	31	40	0 - 2 · 1 · · · · · ·
1000	1250	9	13	18	24	35	46	$e_p = 2 \cdot {300} \cdot V_{300p}$
1250	1600	11	15	21	29	42	54	
1600	2000	-	18	25	35	50	65	
2000	2500	-	22	30	41	59	78	
2500	3150	-	26	36	50	72	96	
3150	4000	-	32	44	62	88	115	
4000	5000	-	-	-	76	108	140	
5000	6300	-	-	-	92	131	170	

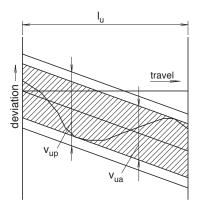
TECHNICAL TIP

The lead error e_p is defined via a straight line, which represents the optimum approximation of the actual lead error graph. This line will then be shifted parallel so it crosses the origin of the axis. This means that there can be a deviation at the beginning of the travel. Also, the lead error at the end of travel can actually be greater than the maximum permissible error as long as the average lies within the tolerance limits!

Nevertheless, a definition of the lead accuracy via e_p is a stronger criteria than the commonly used deviation per 300 mm, because the error may not be accumulated. For example, the maximum permissible lead error e_p of a screw 900 mm long is less than three times the permissible error in 300 mm.

PRECISION

Lead error fluctuation over entire travel



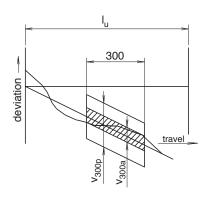
			Limits v_{up} for the variation v_{ua} [μ m]								
l _u [n	nm]		Accurac	y class [1	n/a for rol	led and w	hirled ball	screws]			
from	to	P0	P1	P2	P3	P4	P5	T7	T10		
-	200	3	5	7	10	15	20¹	-	-		
200	315	4	6	8	12	18	23¹	-	-		
315	400	4	6	8	12	19	25¹	-	-		
400	500	4	7	8	13	20	26¹	-	-		
500	630	4	7	8	14	22	29¹	-	-		
630	800	5	8	9	16	24	31¹	-	-		
800	1000	6	9	10	17	26	35¹	-	-		
1000	1250	6	10	11	19	29	39¹	-	-		
1250	1600	7	11	13	22	33	44¹	-	-		
1600	2000	-	13	15	25	38	51¹	-	-		
2000	2500	-	15	18	29	44	59¹	-	-		
2500	3150	-	17	21	34	52	69¹	-	-		
3150	4000	-	21	25	41	62	82¹	-	-		
4000	5000	-	-	-	49	74	99¹	-	-		
5000	6300	-	-	-	58	88	119¹	-	-		

TECHNICAL TIP

The fluctuation of the lead error is defined by two lines parallel to the line representing the average lead error, which include the entire lead error graph.

The lead error fluctuation is applicable to precision ground positioning screws in accuracy classes 0 - 5 only. It does not apply to general purpose screws which are typically either rolled or whirled in classes 5 - 10.

Lead error fluctuation per 300 mm



The variation over 300 mm is the most common definition. However it is also important to know whether the allowed variation is cumulative, or not. If the allowable variation is specified as "cumulative" then the permitted error over the full travel of a screw can result in a total error which is equivalent to the next lower accurancy class.

Example:

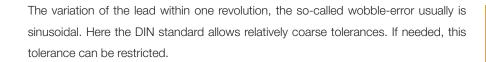
Stroke 900 mm, accuracy class P3, 3 x 300 mm would result in a total deviation of 3 x 12 μ m = 36 μ m. This result is equivalent to the total error of accuracy class P5 (35 μ m)! However, the admissible deviation e_p for such a screw in accuracy class P3 is 21 μ m.

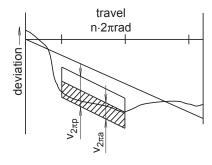
		Limits	i _{300p} for the t	fluctuation	ν _{300a} [μm]				
Accuracy class									
P0	P1	P2	P3	P4	P5	Т7	T10		
4	6	8	12	18	23	52	210		





Lead error fluctuation over one revolution (lead wobble)





	Limit $v_{2\pi\rho}$ for the lead error $v_{2\pi a}$ [µm] [1 n/a to rolled or whirled ball screws]												
	Accuracy class												
P0		P1		P2		P3		P4		P5		T7	T10
3		4		5		6		7		8 ¹		-	-

Ball screws are globally defined by the ISO standard 3408, which is compatible to DIN 69051 to a large extent. In Japan the JIS 1902 standard is valid while in the USA the ANSI standard B92.1 is still occasionally used.

Concerning nut dimensions, the ISO standard has achieved acceptance, at least where nuts are equipped with the space-saving internal deflection system.

Quite often old data or specifications from other standards are used to define a ball screw. Therefore, please be cautious when trying to directly compare parameters such as load capacity or stiffness.

While JIS and ISO standard are quite similar when describing accuracies or load capacities, the ANSI standard is quite different, especially regarding load capacity.

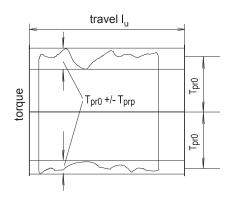
Steinmeyer exclusively uses the ISO definitions.

PRECISION

TOLERANCE OF TORQUE

The friction torque tolerance is solely defined for preloaded ball screws with double nuts and is mainly affected by the accuracy class, preload value and diameter/length ratio of a ball screw. The permissible torque fluctuation is given in % based on the nominal idling torque of a preloaded ball screw.

Variation of friction torque



(nom	i torque ninal) Ncm]		For sh	Friction torque variation in [%] For short screws (L ≤ 40 · d _v) For longer screws see table below! Accuracy class							
from	to	P0									
5	10	40	45	50	60	-					
10	20	35	40	45	50	-					
20	40	30	35	40	50	-					
40	60	25	30	35	40	-					
60	100	20	25	30	35	40					
100	250	15	20	25	30	35					
250	630	10	10 15 20 25 30								
630	1000	-	-	15	20	30					

Friction (nom		Friction torque variation in [%] For long screws (L \geq 40 · d _N)							
T _{pr0} [I	Ncm]	Accuracy class							
from	to	P0	P1	P3	P5	T7			
5	10	-	-	-	-	-			
10	20	50	50	60	60	-			
20	40	40	40	50	60	-			
40	60	35	35	40	45	-			
60	100	30	30	35	40	45			
100	250	25	25	30	35	40			
250	630	20	20	25	30	35			
630	1000	-	-	20	25	35			

The values of the interclasses can be determined by interpolating.

TECHNICAL TIP

Steinmeyer can provide a friction torque chart for preloaded ball screws upon request (for an extra charge!). The test method described in the ISO / DIN standard is to run the ball screw, with a thin film of oil, at 100 rpm and without wipers. Other test methods can be agreed upon. The values shown here apply to the test method per ISO / DIN standard.

Tolerances for the friction torque of preloaded single nuts are specified individually.

Aerospace ball screws are often tested for idling torque, although they are normally not preloaded. This test serves to determine proper operation of wipers and seals. This test can be part of the ATP; it is normally done with the ball nut greased and ready for shipment.



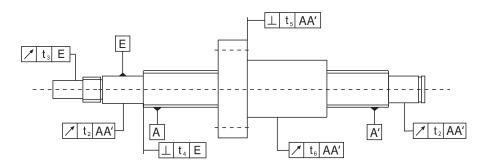


GENERAL GEOMETRIC TOLERANCES (ACCEPTANCE CRITERIA)

The values listed below represent general rules for run-out tolerances of ball screws. For specific applications tolerances may vary.

Tolerances of run-out and perpendicularity

Steinmeyer recommends supporting the screw using the outside diameter for all inspection of geometric tolerances. This will ensure optimum repeatability of the measurement. In some cases the center holes are used as reference.



Run-out t₂

			Rui	n-out t ₂ [µ	ım]						
Nominal-∅		Accuracy class									
d _N [mm]	P0	P0 P1 P2 P3 P4 P5 T7 T1									
3 - 6	5	7	7	8	10	-	-	-			
8 - 10	5	7	7	9	10	10	20	-			
12	5	7	8	9	10	10	20	-			
16 - 20	5	7	9	10	12	13	20	-			
25 - 32	6	8	10	11	12	14	25	-			
36 - 50	7	9	12	13	15	16	25	-			
60 - 125	8	10	13	14	16	18	25	-			

Run-out t₃

Run-out t ₃ [μm]											
Nominal-∅		Accuracy class									
d _N [mm]	P0	P0 P1 P2 P3 P4 P5 T7 T10									
3 - 6	3	4	6	7	8	10	-	-			
8 - 10	4	5	7	8	9	11	12	15			
12	4	5	7	8	9	11	13	17			
16 - 20	4	6	8	9	10	12	15	18			
25 - 32	5	7	9	10	12	13	16	19			
36 - 50	6	8	11	12	14	15	18	21			
60 - 125	7	9	12	13	15	17	20	23			

Technology

PRECISION

Perpendicularity t₄

Perpendicularity t ₄ [µm]												
Nominal-Ø		Accuracy class										
d _N [mm]	P0	P0 P1 P2 P3 P4 P5 T7 T10										
3 - 6	2	2	2	3	3	3	-	-				
8 - 10	2	2	2	3	3	4	5	7				
12	2	2	2	3	3	4	6	8				
16 - 20	2	3	3	4	4	5	7	9				
25 - 32	2	3	4	4	4	5	7	9				
36 - 50	2	3	4	4	4	5	7	9				
60 - 125	3	4	5	5	6	7	10	13				

Perpendicularity t₅

		Perpendicularity t _s [µm]										
Nominal-∅		Accuracy class										
d _N [mm]	P0	PO P1 P2 P3 P4 P5 T7 T10										
3 - 6	6	7	8	9	9	10	-	-				
8 - 10	6	7	8	9	9	10	15	-				
12	6	7	8	9	9	10	20	-				
16 - 20	7	8	9	10	10	12	25	-				
25 - 32	7	8	9	10	10	12	32	-				
36 - 50	8	9	10	10	12	13	32	-				
60 - 125	9	10	11	12	13	15	40	-				

Run-out t₆

Run-out of pilot diameter t _e [µm]											
Nominal-∅		Accuracy class									
d _N [mm]	P0	P1	P2	P3	P4	P5	T7	T10			
3 - 6	5	6	7	8	9	10	-	-			
8 - 10	5	6	7	8	9	10	20	-			
12	5	6	7	8	9	10	20	-			
16 - 20	5	6	7	8	9	10	20	-			
25 - 32	5	6	7	8	9	10	20	-			
36 - 50	6	7	8	8	10	11	25	-			
60 - 125	7	8	9	10	12	13	32	-			

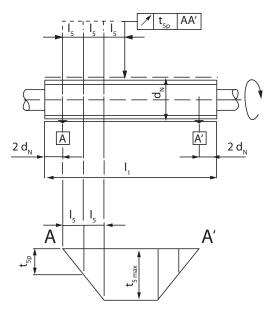
Steinmeyer's specified parameters for concentricity and perpendicularity are considerably lower compared to the DIN values.





Run-out tolerances

Run-out Tolerance t_{sp} of the shaft outside diameter for the length l_s (the shaft straightness with reference to AA') - according to DIN 69051 part 3 or ISO 3408-3.



d	N		Run-oı	u t tolerand Ad	ce t _{sp} for t		l ₅ [μm]
from	to	l ₅	P1	P3	P5	T7	T10
3	12	80			32	40	80
12	25	160		25			
25	50	315	20				
50	100	630					
100	200	1250					

		Run-out tolerance t_{5max} for the length $l_1 \ge 4l_5 [\mu]$							
Ļ	/ d _N	Accuracy class							
from	to	P1	Р3	P5	T7	T10			
	40	40	50	64	80	80			
40	60	60	75	96	120	240			
60	80	100	125	160	200	400			
80	100	160	200	256	320	640			

TECHNICAL TIP

Steinmeyer recommends supporting the screw by using V-blocks for all inspection of geometric tolerances. This will ensure optimum repeatability of the measurement. If necessary, dual gages can be used to measure the concentricity of two surfaces with respect to one another, e.g. the concentricity of drive journal and bearing journal. This measuring method includes the perpendicularity and run-out tolerance of the nut already.



Optimized ball screws for best running features.

Microscopic irregularities on the surface of the spindle thread can cause vibration and uneven running. Through the use of innovative production technologies, the smoothness of the thread surface of miniature ball screws can be significantly improved, whereby the operating characteristics of the optiSLITE ball screws are remarkably improved.

The improved running characteristics are achieved by increased material contact. The material contact area Rmr (c) indicates the percentage of material filled path lengths depending on the depth of cut "c". The plateau-like surface of the optiSLITE technology provides clean, smooth running, while offering improved lubricating properties.

More information about optiSLITE-Technology on page 55.

Technology

PRECISION

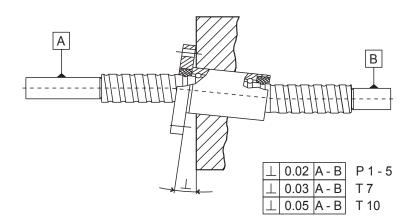
MOUNTING TOLERANCES

TECHNICAL TIP

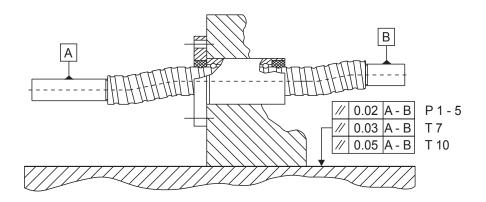
Steinmeyer recommends maintaining the mounting tolerances shown on this page. Optimum alignment of the screw with the guideways and square and concentric mounting of the nut will ensure proper operation of the drive system and long life of the ball screw.

After installation, check that the screw spins freely and without excessive friction over its entire travel. If there is any binding or considerable increase in effort necessary to turn the screw, especially near the support bearings, this indicates the alignment of the screw and the guideways should be improved. Binding indicates excessive side loads which can and will shorten the service life of the ball screw unless corrected.

Perpendicularity



Parallelism







PRELOAD AND RIGIDITY

NUT DESIGNS

This section deals with the various nut types and their preload. We also explain the different rigidity (stiffness) values.

TECHNICAL TIP

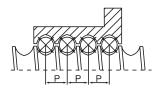
Preload primarily serves to eliminate play. But at the same time preload increases rigidity, which means the displacement of the nut under load is reduced.

Another reason why preload may be necessary is to prevent balls from skidding during high acceleration, or to ensure better load distribution if side loads on the ball nut cannot be avoided.

There are a number of ways to preload a ball nut. For a discussion of preload and its effects we have to first distinguish between preload with two contact points per ball (one in the nut, one in the shaft), and preload with 4-point contact (two contact points in the nut and two in the shaft), which requires the use of a "gothic arch" profile.

Steinmeyer always uses a gothic arch profile, so both kinds of preload are possible.

Single nut with 4-point-contact



Single nuts, as defined by Steinmeyer, are one-piece nuts without any shift or offset in their I.D. ball thread. They can only be preloaded by ball oversize and will always have 4-point contact. This differentiates them from all other preloaded nuts and their 4 point contact has an impact on technical data and some calculations.

4-point contact influences the kinematics of the balls with the following results:

- Efficiency of a single nut with preload is always somewhat lower than that
 of a double nut
- Single nuts with preload show a more pronounced reaction to manufacturing tolerances, which is why they are normally not suitable for very long screws

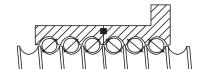
Caution: these statements are only true for single nuts with preload. Without preload, single nuts have 2-point contact with the same ball kinematics as double nuts!

Advantages of the single ball nut are:

- Cost effectiveness
- Compact envelope
- No unloading of balls when subjected to peak loads (see preload chart)

PRELOAD AND RIGIDITY

Double nut (UNILOCK)



Double nuts from Steinmeyer do not depend on the usual spacer ring or other hard-ware to separate the two nuts. Our patented UNILOCK coupling ensures a robust connection of the two nut halves. Thus Steinmeyer's double nut is almost as compact and stiff as a single-piece design. Moreover, it prevents radial slippage of the two halves, so the UNILOCK double nut cannot be misaligned by rough handling. The coupling is rugged and absolutely tight to prevent loss of lubricant.

Advantages of a double nut are:

- 2-point contact for higher rigidity and efficiency
- Simplified production compared to lead-offset nuts when the nut is long and helix angles are large
- Easier factory setting of preload without changing of balls, thus economical

Disadvantages are:

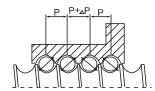
- Longer nut body compared to single nuts, and somewhat higher cost
- As in all nuts with 2-point contact, the maximum thrust should not exceed
 2.8 times the preload

TECHNICAL TIP

Steinmeyer labels all ball nuts that have 2-point ball contact a "double nut", regardless whether the nut body is made of two pieces or one. This definition makes sense because both of these nuts have very similar properties, and because all life calculations for these nuts are done in the same way. 4-point contact ball nuts on the other hand require different calculations, specifically how preload is handled in the life calculations.

Steinmeyer's patented UNILOCK coupling of two-piece double nuts results in a connection that is nearly as stiff and compact as a single-piece nut. This is why we do not distinguish between single-piece double nut design (the lead-offset nut) and a two-piece design (UNILOCK double nut) in this catalog. Steinmeyer will select whatever design is most suitable for the particular size of ball nut. All nuts with 2-point contact can be recognized by the "5" in the 2nd number of their series designation (for example 1516, 3526 etc.).

Lead-offset nut



When preloading a UNILOCK double nut, the two halves are rotated relative to each other until the balls are slightly compressed. Thus the threads of the second nut are no longer directly "in phase" with the threads of the first nut. There is a slight offset between the two nut halves.

The lead offset nut uses the same principle but the offset is created during machining of the threads in a nut made from a single piece of steel. Fine tuning of the preload is then accomplished by selecting "oversized" balls like in a single nut. Due to the offset, balls have 2-point contact.





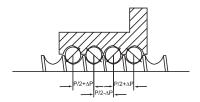
Advantage:

Slightly more compact than a double nut (shorter length)

Disadvantage: • More threads have to be machined from one end of the nut. Especially in nuts with many turns and large helix angle, grinding I.D. threads can be difficult or even impossible

NB: Steinmeyer often uses hard turning for such long nuts, eliminating the problems associated with long and relatively weak grinding arbors.

Pitch-offset nut



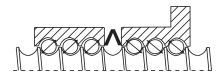
Like the lead-offset nut, the pitch-offset nut uses a shift machined in the I.D. threads to enable 2-point contact of balls. The only difference is that the pitch-offset nut uses a two-start thread and the offset is between the two starts.

Each thread start has its own set of balls and ball returns.

■ Pitch-offset nuts are extremely compact

Disadvantage: Pitch-offset preload can only be used in nuts with two (or more) starts

Spring preloaded double nut



Almost exclusively used with miniature ball screws, the spring preload maintains perfectly constant preload regardless of wear and manufacturing tolerances. Two nuts are installed in a housing. One is fixed, while the second one can slide longitudinally (a pin keeps it from rotating). A spring located in between the two nuts keeps the preload constant.

The advantages are obvious:

- Manufacturing tolerances will have no impact on preload and friction
- Preload can be very light and the ball nut will never have play regardless of wear etc.

There are also some disadvantages:

- The double nut with its housing is bulkier and more expensive
- The slip-fit of the second nut makes alignment more challenging
- The maximum thrust is limited by the spring when exceeded, the spring will collapse causing play in the nut

TECHNICAL TIP

The spring preloaded nut excels when it is not possible to keep manufacturing tolerances low enough to ensure very low and constant friction. This is the case when near zero friction is necessary while at the same time absolutely no play is acceptable, or if the screw is extremely long.

Please be aware that the spring preloaded nut has a maximum operating force equal to about 2/3 of the preload. We can increase preload to some degree upon request, but if peak loads exceeding the preload force cannot be avoided, then a single nut with rigid preload is preferred (miniature screw series 1112, 1214, 1412).

> E-mail: sales@reliance.co.uk Tel: +44 (0) 1484 601002 23 Internet: www.reliance.co.uk

PRELOAD AND RIGIDITY

STIFFNESS

TECHNICAL TIP

Higher preload results in increased rigidity. But rigidity increases only with the cubic root of preload. To compare stiffnesses based on different preload settings, multiply rigidity values by the cubic root of the ratio of the preloads. For example:

$$R_2 = R_1 \cdot \sqrt[3]{\frac{F_{pr2}}{F_{pr1}}}$$

where F_{pr1} and F_{pr2} are the preload settings to be compared, and R_1 and R_2 are the corresponding rigidities.

Rigidity of the nut and preload

The rigidity of a ball screw not only has a strong impact on positioning accuracy, but also plays an important role concerning the dynamic behavior of a linear drive. The importance to the latter is normally underestimated.

- Rigidity according to ISO 3408 or DIN 69051 is a value labeled R_{b/t}. This value is obtained from theoretical elastic deformations obtained from the theory of Hertzian pressure with the variables of track conformity, contact angle and the number of load carrying balls. R_{b/t} is a relatively high number.
- When the deformation of the nut body (diameter widening, longitudinal expansion) is included, the value is labeled R_{nu} , and is already significantly lower than $R_{b/t}$.
- To obtain a real value, the theoretical vaule of R_{nu} has to be corrected further, since not all balls carry the same load. Depending on the accuracy grade of the ball screw, the correction factor varies. The reduced value, which is closer to reality and measurable, is designated R_{nuar}.

Steinmeyer publishes only $R_{nu,ar}$ values in our catalog and on our website. Please be sure to compare these values only to similarly defined rigidities from other manufacturers, and also ensure that the comparison is based on the same preload value you want to use (see technical tip regarding the impact of preload on rigidity).

Besides number and size of loaded balls, track conformity and contact angle, the main driver for the rigidity of the nut is preload. However, the possibility to significantly increase rigidity by raising preload is very limited because rigidity increases only as the cubic root of preload. But the increase in heating is directly proportional plus the reduction of service life is substantial since preload increase is raised to power three in the life equation.

This is why preload should not be set too high: For a nut with 2-point contact, 10% of the dynamic load capacity is a reasonable number. Nuts with 4-point contact should not be preloaded to more than approximately 8% of their dynamic capacity.

Steinmeyer publishes rigidity values for these preload settings:

- 10% C_a for nuts with 2-point contact (series x5xx)
- 8% C₂ for nuts with 4-point contact (series x4xx)

Make sure when comparing with other manufacturer's rigidity data to check not only the definition of terms but also that the comparison is done using the same preload.





TECHNICAL TIP

According to the ISO / DIN standard, the nut theoretical stiffness R_{nu} is converted into the actual nut stiffness $R_{nu,ar}$ by applying a correction factor which depends on the accuracy class of the ball screw. For example a ball screw with accuracy class 1 would be more rigid than a screw of otherwise same design with an accuracy class 5. The reason for this is that better geometric tolerances of a more accurate screw, e.g. the lead wobble, result in more even ball loading.

Upon request (and extra cost), Steinmeyer will provide rigidity test protocols with every screw.

for better rigidity - static and dynamic

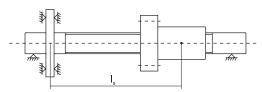
ball screws are not only significantly more rigid in a classic sense, which only considers the elastic deformation of a stationary screw under varying axial loads. They also have a much better "dynamic stiffness", which means that the screw has a "linear behavior" and delivers an axial movement perfectly proportional to its rotation, regardless of thrust, speed and direction. Even reversing will not cause deviations from this.

This linearity is especially significant in closed-loop controls, allowing considerably increased dynamics with substantially reduced following error. Unfortunately, this is not yet reflected in current ISO or DIN standards.

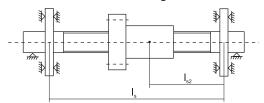
The screw stiffness depends on the elasticity modulus of the screw material, cross sectional area of the screw and the unsupported screw length.

On fixed-free bearing configuration the screw stiffness is calculated as follows:

Fixed-free mounting



Fixed-fixed mounting



$$R_{s1} = A \cdot \frac{E}{l_s} \cdot 10^{-3}$$

This is the calculation of the rigidity for fixed-fixed mounting method:

$$R_{s2} = 2 \cdot A \cdot \frac{E}{l_{s2}} \cdot 10^{-3}$$

A: Screw cross section [mm²]

E: Young's modulus [N/mm²] (for DIN 1.1213 = 210,000 N/mm²)

PRELOAD AND RIGIDITY

Total rigidity of a linear drive

Elasticity of a linear drive includes elastic deformations of thrust bearings, ball screw shaft and ball nut. This total, based on the "inverse" equation below, is what matters to the performance of the drive. But only the nut stiffness is normally given in the technical data of a ball screw.

$$R_{\rm t} = \frac{I}{\left(\frac{1}{R_{\rm nu,ar}} + \frac{1}{R_{\rm s}} + \frac{1}{R_{\rm b}}\right)} \qquad \begin{array}{c} {\rm R_t:} & {\rm Total\ rigidity\ [N/\mu m]} \\ {\rm R_{\rm nu,ar}:} & {\rm Actual\ nut\ rigidity\ [N/\mu m]} \\ {\rm R_s:} & {\rm Stiffness\ of\ the\ screw\ shaft\ \ [N/\mu m]} \end{array}$$

Axial stiffness of the thrust bearing [N/µm]

The rigidity of the thrust bearing can be obtained from the literature of the manufacturer. Rigidity of the screw shaft can be calculated from the elasticity modulus of steel (210,000 N/mm²), the shaft's cross section and the length of the loaded portion of the shaft. For screws with large lead / diameter ratio, torsion also plays an important role and must be considered as well.

If you want to do the calculation of axial and torsional stiffness yourself, just use the nominal diameter of the ball screw minus the ball diameter to calculate the cross section and moment of interia. Or, contact us and we will do this for you.

TECHNICAL TIP

Installing thrust bearings at both ends of the screw yields four times the axial shaft stiffness compared to a single thrust bearing at one end and no support on the opposite end. A factor of 2 results because forces are transmitted through the shaft on both sides of the nut. A second factor of 2 also applies because the weakest point is now in the middle of the shaft rather than at the extreme end. Thrust bearings at both ends normally require pre-tensioning the screw, against the support bearings, in order to avoid compressive loads on the shaft from thermal expansion (which may cause buckling). Make sure to check the impact this additional force has on the bearing life.

Linear drives with rotating nut and stationary screw allow a simple way of increasing torsional stiffness of the shaft by transmitting moments into the surrounding structure at both ends of the shaft. Then the same effect as described above applies to the torsional stiffness: A factor of 2 for twice the cross section, and again a factor of 2 for half the distance to the weakest point.





SERVICE LIFE CALCULATIONS

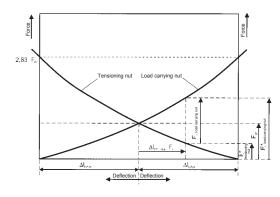
Ball screws are normally loaded with axial forces. Service life is determined by material fatigue in most cases. However, in some applications, abrasive or adhesive wear may cause a loss of preload and thus be considered a failure of the ball screw.

In the ISO 3408 or DIN 69051 standards, the math used to estimate ball screw life is based on material fatigue only. This is generally correct, but if the loading is very low and mean speeds are very high, this method may return an erroneous life estimation which cannot be reached in reality. If your application falls within this category, please consult our engineers.

ACCOUNTING FOR PRELOAD IN THE LIFE CALCULATION

In this step, we modify axial forces to reflect the impact of preload. The preload graph shows how internal forces in the ball nut are affected by external forces and preload.

Preload graph



The preload graph includes two lines which represent the forces and resulting deformation for both nut halves in a double (or pitch shift) nut. The center of the chart, where the two lines cross, shows the situation of the nut with no external forces. Both nut halves carry the same load - which is the preload $F_{\rm pr}$.

If an external force is added, then the load in one nut increases, while it decreases in the other. The resulting difference of the two forces is equal to the external load.

The load in each nut can be read from the two lines and this load is to be used for life calculations. As a simple approximation, the nut with the higher load has to carry the preload plus approximately half of the external load. Using this approximation for F_{i^*} is accurate enough.

Calculating modified loads for nuts with 2-point-contact

$$F_i^* = F_{pr} + \frac{F_i}{2}$$

*: Modified external load [N]

F_{pr}: Preload [N]
F_i: External load [N]

As a quick and simple approximation for the internal load in nuts with 2-point contact, just add or subtract half of the external thrust F_i to or from the preload F_{pr} . Whether you call a certain thrust direction positive or negative does not matter. But you have to keep this direction orientation the same for the whole duty cycle. The nut with the highest load then determines service life.

SERVICE LIFE CALCULATIONS

Calculating modified loads for nuts with 4-point contact

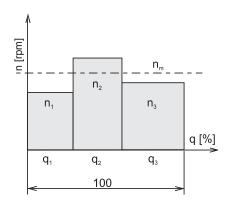
$$F_i^* = \frac{5}{4} F_{pr} + \left| \frac{F_i}{2} \right|$$

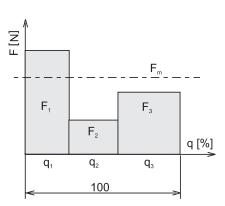
When calculating modified loads for nuts with 4-point contact, all external thrust has to be added regardless of load direction. The factor of 1.25 (5/4) is necessary to account for the fact that the balls have 4 contact points, causing fatigue much sooner than in a nut with 2 contact points. This approximation is accurate enough in cases with normal loads and duty cycle.

THE DUTY CYCLE AND ITS EQUIVALENT LOAD

To calculate the impact of actual duty on the fatigue life of the ball screw, it is necessary to convert the varying loads F_i into a mean load F_m which will have the same effect on life as the actual duty cycle. This mean load F_m is therefore called "equivalent" load.

To simplify things, the actual duty is normally divided into steps. Then the maximum thrust (or, if the ball screw is preloaded, its modified load), speed and duration are used to calculate the equivalent load. Instead of using time and speed $n_i \cdot q_i$, the absolute number of revolutions can be used in this calculation.





TECHNICAL TIP

The duty cycle of machine tools is normally provided as:

x₁% Rapid with thrust y₁

x₂% Roughing with thrust y₂

x₃% Finishing with thrust y₃

x₄% Dwell

etc. Such values can be modified to reflect preload and then directly entered into the equation for F_m.

If the duty cycle provided includes a detailed description of moves, the respective revolutions can be entered instead of q_i·n_i





EQUIVALENT LOAD

$$F_{m} = \sqrt[3]{\frac{q_{1} \cdot n_{1} \cdot F_{1}^{3} + q_{2} \cdot n_{2} \cdot F_{2}^{3} + \dots + q_{n} \cdot n_{n} \cdot F_{n}^{3}}{q_{1} \cdot n_{1} + q_{2} \cdot n_{2} + \dots + q_{n} \cdot n_{n}}}$$

$$n_{m} = \frac{q_{1} \cdot n_{1} + q_{2} \cdot n_{2} + ... + q_{n} \cdot n_{n}}{q_{1} + q_{2} + ... + q_{n}}$$

The mean or equivalent load is calculated using the above equation.

 F_m : Dynamic equivalent load [N]

n_m: Equivalent speed [rpm]

q: Time percentage [%]

n_i: Speed [rpm]

F_i: Thrust (which may need to be modified - due to preload - first) [N]

The service life estimate obtained from ISO / DIN calculations represents a dependable method to predict useful life of a ball screw under the conditions and for the duty cycles found in most machines. Other necessary conditions include proper lubrication, suitable protection from contamination, and operation of the ball screw at temperatures not exceeding 70° C.

Should the calculated life fall outside the range mentioned on the following page, or if there are special requirements or unusual conditions, please contact our application engineers.

TECHNICAL TIP

By definition, the dynamic load capacity is the load at which the ball screw will reach a useful life of 1 million revolutions. More accurately, this means 90% of a sufficiently large number of identical ball screws will reach this useful life. This life is designated as L_{10} and is usually the basis for ball screw selection in normal machine design. For higher reliabilities than 90%, an additional correction factor must be applied. In regular machine design, such higher reliabilities are normally not needed because there are much greater uncertainties, for example in the estimate of thrust.

FATIGUE LIFE

$$F_m = \frac{C_a}{\sqrt[3]{\frac{L_{10}}{10^6}}}$$

 $F_{\!_{m}}$: Permissible mean load for a given dynamic load capacity and life [N]

$$C_a = F_m \cdot \sqrt[3]{\frac{L_{10}}{10^6}}$$

 $\mathrm{C_a}\colon$ Dynamic load capacity required for a given mean load and life [N]

$$L_{10} = \left(\frac{C_a}{F_m}\right)^3 \cdot 10^6$$

 L_{10} : Fatigue life for a given dynamic load capacity and mean load [revolutions]

SERVICE LIFE CALCULATIONS

The useful life L_{10} can be expected to be reached by 90% of a sufficiently large number of identical ball screws having a load capacity C_a , when subjected to the mean load F_m .

As an example, the life L_5 , which is 62% of L_{10} , will be reached by 95% of the ball screws. Aerospace applications require a more detailed reliability analysis, for which the FMEA (Failure Mode and Effects Analysis) and fault trees are used to determine MTBF (Mean Time Between Failure) or MTBUR (Mean Time Between Unscheduled Removal).

Reliability (probability of survival)	90%	95%	96%	97%	98%	99%
Correction factor	1	0.62	0.53	0.44	0.33	0.21

TECHNICAL TIP

Calculation of the life expectancy is based, according to ISO / DIN standards, on Hertzian pressure. Theoretical load capacities are then modified with factors derived from experience. These corrected values allow very dependable predictions of ball screw life, under normal conditions, if the calculated life expectancy falls within this range:

$$3 \cdot 10^7 \le L_{10} \le 10^9$$
 [revolutions]

ANSI load capacity: According to ANSI ball screw standards, the dynamic load capacity is the load whereby the ball screw reaches a life of 1 million inches of travel (ISO/DIN: 1 million revolutions). For a direct comparison with ISO/DIN numbers, the ANSI load capacity must be converted as follows

LOAD CAPACITY ACCORDING TO ANSI STANDARD

According to the ANSI standard, dynamic load capacity of a ball screw is the load under which it will reach a life of 1 million inches of travel. If the lead is smaller than 1 inch, then the load capacity per ANSI definition is smaller than the load capacity of the same ball screw expressed according to ISO / DIN standard. This is because the ANSI load capacity defines a load for which the resulting life in this case (lead less than 1 inch) is greater than 1 million revolutions.

$$C_a = P_i \cdot 4.45 \cdot \sqrt[3]{\frac{25.4}{P}}$$

The opposite holds true for a ball screw with lead larger than 1 inch. For such a case, the ANSI load capacity will be higher than the ISO load capacity, although the ball

C_a: DIN / ISO-load capacity [N] P_i: Load capacity per ANSI [lbf]

To compare load capacity of a ball screw per ANSI standard to one per ISO / DIN standard, a conversion must be made. This equation will also convert lbf into Newtons:

P: Lead [mm]

TECHNICAL TIP

Preload is usually defined as a percentage of dynamic load capacity. Nuts with 4-point contact normally have a preload of 5 - 8% of dynamic load capacity, while for nuts with 2-point contact it is 8 - 10%. Keep in mind this refers to ISO/ DIN load capacity only. If the ANSI standard is used, then the percentages may change!

screw itself is identical!





MAXIMUM LOAD (LIMIT LOAD)

There are five ways a ball screw may fail due to overload:

- Excessive dynamic loading, which means the screw makes too many revolutions under a certain load resulting in material fatigue. This can be avoided by selecting a ball screw with sufficient dynamic load capacity (or by reducing the number of revolutions and/or reducing the load). This is the subject of the load capacity discussion.
- Exceeding the static load capacity, which causes instant and permanent damage to the ball screw due to brinelling of balls and races, and prevents any further normal operation of the ball screw. Static load capacities are listed as technical data.
- Buckling of the shaft under compressive load. Buckling load value depends on bearing method and free length of the loaded ball screw shaft.
- Failure of the nut body or of the bolts that connect it to the slide. This may happen even before the static capacity is reached. Safe loads are discussed on the following pages.
- Radial loads. It means the load capacities given in this catalogue apply only to pure axial loading. As there are always tolerances in the alignment of bearings and linear guideways, there may be a small amount of radial force, which should be minimized. Under normal conditions, a radial load less than 5% of the minimum axial load will not cause any problems. When considering a ball screw for use under radial load, please consult Steinmeyer engineers.

TECHNICAL TIP

A reasonable load for a ballscrew, which may be sustained for significant travel, is about 10% of its dynamic capacity. A mean load of 10% of its dynamic capacity results in a theoretical life of 1 billion revolutions, which is the upper limit of the range where the life equation is valid. Mean loads of a reasonably sized ball screw will therefore be somewhat higher than this, but normally not exceed 20% of its dynamic capacity.

For short peak loads, the loading may be higher, but normally the loading of a ball nut with 2-point contact should not exceed 2.8 times the preload. And preload is around 5% - 10% of dynamic capacity.

As a rule of thumb, this all means the load range for a ball screw is really about 10% to 30% of its dynamic capacity.

BUCKLING

There are several analytical ways to demonstrate safety from buckling. In machine design, the most frequently used is a simple calculation using formulas based on Euler equations.

Other, more accurate methods include non-linear FEM analysis and more involved mathematics. These methods are normally used in aerospace applications, where excess safety margins are not possible due to weight limitations. Please contact us if you require such an analysis.

On the following page we describe a simple form of buckling analysis.

MAXIMUM LOAD (LIMIT LOAD)

TECHNICAL TIP

Because of the logarithmic scale on the chart below, data for long screws or screws with large diameter may be difficult to read. You may prefer to use this equation instead:

 $P_B = \frac{m \cdot d_N^4}{l_s^2} \cdot 10^4$

P_B: Buckling [N]

d_N: Nominal-Ø [mm]

I_s: unsupported screw length [mm]

m: bearing coefficient

The following factors refer to the bearing methods shown in the chart. Choose the appropriate one and use it as the variable m in the equation to the left:

Fixed - fixed (1): 22.4

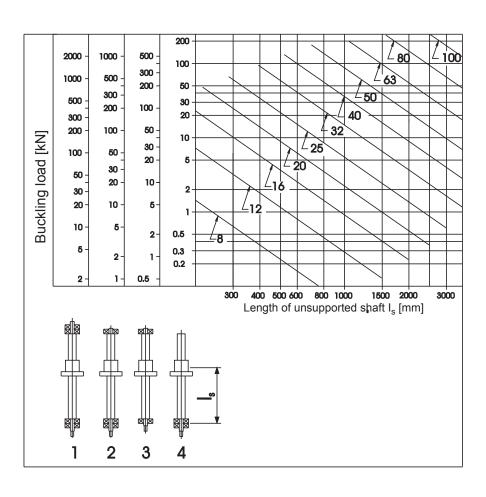
Fixed - supported (2): 11.2

Supported - supported (3): 5.6

Fixed - free (4): 1.4

For safety reasons, a factor of 0.5 should be applied to the buckling load obtained.

$$F_{max} = 0.5 \cdot P_B$$







FRACTURE LOAD

Some ball screws cannot be loaded all the way to their static capacity. Screws with high dynamic load capacity (which might be selected to obtain a long enough service life at a much lighter load) will necessarily have a high static capacity. But the term "static capacity" is misleading, since the ball screw may actually fail due to fracture of the nut flange, nut body, or connecting bolts before reaching this load!



	Max a	Standard nut	UltraThrust nut									
	DIN 69051											
Nominal diameter [mm]	DIN 69051 bolt pattern	Dynamic bolt tension Fb* [kN]	Static bolt tension Fb* [kN]	Bolt torque [Nm]	Maximum permis- sible axial load [kN]	Maximum permis- sible axial load [kN]						
5/6	4xM3	5	20	1.5	C _{0a}							
8	4xM3	5	20	1.5	C _{0a}							
10	4xM4	7	28	3	C _{0a}							
12	4xM4	7	28	3	7							
16	6xM5	12	40	6	12							
20	6xM6	16	63	10	16							
25	6xM6	16	63	10	16							
32	6xM8	32	100	25	32							
40	8xM8	40	150	25	40							
50	8xM10	80	225	49	80	120						
60/63	8xM10	80	225	49	80	180						
80	8xM12	125	320	86	125	200						
100	8xM12	125	320	86	125	200-250						
100	8xM16	250	630	210	250	250						
125	8xM16	250	630	210	150¹	300						
125	8xM16	250	630	210	250 ²	350						

^[1] Flange 25 mm thick

Please note: The highest permissible load is the minimum of static capacity C_{0a} (to prevent brinelling) and fracture load (to prevent failure of ball nut or bolts). Necessary condition for both is proper alignment and squareness of the mounting surfaces and also concentric applied load.

TECHNICAL TIP

The structural strength of ball screws for aerospace applications is first predicted using analytical methods including FEM analysis. In some cases, tests are performed in the development phase to demonstrate safety and avoid costly and time consuming redesigns once the qualification phase of the project has started.

For the final qualification, tests under exactly the same conditions as in the aircraft must be passed. These tests often require test rigs specific to the aircraft program, called "iron bird". The documentation of these tests becomes part of the aircraft qualification. In addition to static tests (limit load, ultimate load), fatigue tests are conducted. In these fatigue tests, an alternating or pulsating load is applied to a ball screw that is not operating. This is not to be confused with endurance tests, which aim at fatigue also (to confirm dynamic load capacity), but with the pulsating load generated by balls running repetitively over the same spot of the ball track.

^[2] Flange 30 mm thick

^{*} Bolts DIN ISO 4762, Strength 8.8 (90% load, safety factor 0.8, μ = 0.14)

ROTATIONAL SPEED

TECHNICAL TIP

The maximum nut speed should not be exceeded under any circumstances. There are, however, special executions available that are suitable for higher speeds, so please inquire. Critical speed may be exceeded in certain cases - contact our application engineers for further advice. And critical speed is not a significant limitation in applications with rotating nuts. When operating at prolonged high speeds, heating of the ball screw may become the limiting factor. Hollow screws for internal cooling are available, but this requires an expensive additional system with its often troublesome rotating unions. Nuts with cooling jacket, which prevents heat migration into the slide, have been tested but are not practical. Another possibile solution to running at high speeds for prolonged time is Steinmeyer's technology. This advanced ball screw design produces less than half the heat compared to a regular ball screw of same size. So steady-state temperatures remain much lower. This may eliminate the need to use a forced cooling system for the ball screw shaft. Pre-tensioning amounts to compensate for thermal expansion are lower too, significantly reducing the burden on the support bearings from tensioning forces.



Optimized ball screws for best running features.

Microscopic irregularities on the surface of the spindle thread can cause noise and vibration as well as uneven running characteristics.

Through the use of innovative production technologies, the smoothness of the thread surface on the ball nut of precision ball screws can be significantly improved. Xi-Plus ball screws are characterized by markedly improved running characteristics, smooth running and low noise.

Comparative measurements on ball screws show that frequencies which generate audible noise can be completely eliminated. Moreover a reduction up to 40% in the variation of friction torque can be achieved, resulting in a significant improvement in the running smoothness.

More information about Xi-Plus-Technology on page 89.

CRITICAL SPEED

Critical speed is the first (lowest) speed at which the ball screw shaft is in resonance. In applications with rotating shafts it limits the rpm of the screw. Variables that influence it are shaft diameter, unsupported length and support bearing configuration.

Similar to buckling, critical speed depends on the support bearing configuration. Fixed support bearings are assumed to resist angular deflection of the shaft, while simple support bearings do not. A bearing assembly consisting of two simple bearings with a spacer would however qualify as "fixed" bearing for the purpose here.

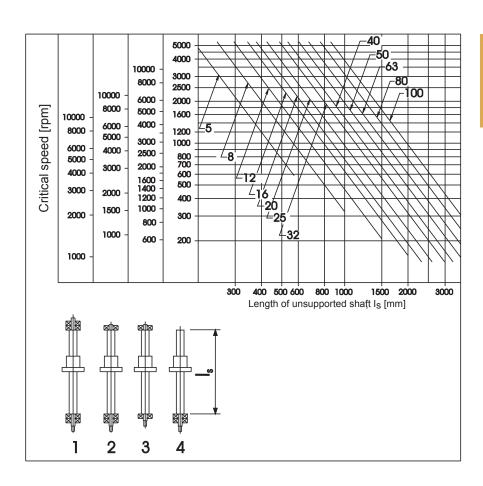
For long screws, we recommend using the following equation. Make sure to select the proper factor for the bearing configuration used:

$$n_k = k \cdot d_N \cdot \frac{1}{l_s^2} \cdot 10^7$$

 n_k :Critical Speed [rpm]Fixed - fixed (1):25.5 d_N :Nominal diameter [mm]Fixed - supported (2):17.7 I_s :Unsupported length [mm]Supported - supported (3):11.5k:Support bearing factorFixed - free (4):3.9







TECHNICAL TIP

Critical speed is the first resonant frequency (speed) of the rotating shaft. Resonance in a rotating shaft can be catastrophic and even break the shaft. However, not all ball screws will necessarily exhibit such behavior since the nut represents another support of the shaft, permanently changing the unsupported length of the shaft and its resonant frequency. Nevertheless Steinmeyer recommends operating a ball screw only up to a maximum speed not to exceed approximately 80% of the critical speed, or to discuss the possibility of higher speed with our engineers. For ball screws with rotating nuts, critical speed may be exceeded if the run-out of the rotating nut is kept within tight tolerances. A perfectly concentric nut will not "pump" critical amounts of energy into the shaft even if it is at or near its critical speed.

Pre-tensioning and critical speed: Contrary to general belief, pre-tensioning the ball screw shaft does not change the critical frequency of the shaft. It is the stiffness against bending that resists centrifugal forces in a rotating shaft, not tension.

ROTATIONAL SPEED

MAXIMUM SPEED

A second limitation is imposed by the mass forces upon balls. It depends on internal construction of the ball nut and in particular the ball return, and ball diameter (or mass).

The DN value does not take lead and ball size into consideration. In general, ball screws with very small balls have somewhat lower speed limits than screws with larger balls. We strongly recommend observing the speeds in the two tables below instead of DN values.

Maximum speeds [rpm] nominal diameter 3 - 125 mm (rolled ball screws 30% lower)																			
Lead P	3	5	6	8	10	12	16	20	25	28	32	36	40	50	60	63	80	100	125
0,5	4500	2900	2900	1800															
1	4500	4500	4500	3000	2000	2000													
1,5		4500	4500	3500	2500	2500													
2		4500	4500	4500	3700	3700	2800	2200	1800										
2,5		4500	4500	4500	4000	4000	3500	4100	2500										
3		4500	4500	4500	4500	4500	4000	4100	3000										
4			4500	4500	4500	4500	4300	4100	3600		2800								
5			4500	4500	4500	4500	4300	4100	3800	3800	3300	3300	2600	2100		1700	1200	1000	800
6			4500	4500	4500	4500	4300	4100	3800	3800	3400	3400	3000	2200		1700	1200	1000	800
8				4500	4500	4500	4300	4100	3800	3800	3400	3400	3000	2400		1800	1200	1000	800
10					4500	4500	4300	4100	3800	3800	3400	3400	3000	2500		2000	1500	1200	100
12						4500	4300	4100	3800	3800	3500	3500	3000	2500		2000	1500	1200	1000
15						4500	4300	4100	3800	3800	3600	3600	3000	2500		2000	1500	1200	100
20						4500	4300	4100	4000	4000	4000	4000	3000/ 4000	2500/ 3000		2000/ 2500	1500	1600	1000
25							4300	4100	4000	4000	4000	4000	4000	3000	2500	2000	2000	1600	120
30							4300	4100	4000	4000	4000	4000	4000	3000	2500	2000	2000	1600	120
35								4100	4000				4000	3000	2500	2000	2000	1600	120
40								4100	4000				4000	3000	2500	2000	2000	1600	1200
50									4000					3000	2500		2000	1600	

Maximum speeds [rpm] for UltraThrust ball screws diameter 32 - 125 mm												
Lead P	32	36	40	50	63	80	100	125				
10	3000	3000	3000	2500								
12	3000		3000	2500								
16				2500	2000							
20					2000	1500	1200	1000				
25					2000	1500	1200	1000				
30			3500									
40				2800	2200	1800	1400	1100				
50						1800	1400	1100				

First number: Maximum speed with internal ball return (1XXX) Second number: Maximum speed with external ball return (3XXX)





TECHNICAL TIP

DN values only yield a preliminary idea of the maximum speed, because there are more factors than just the nominal diameter and the type of ball return that affect speed rating. Specifically the mass of balls plays an important role, which is not reflected in DN ratings. Also, the DN method to determine maximum speeds is not applicable for very small screws.

DN VALUE

TECHNICAL TIP

When using only the DN method to determine maximum rpm for a 3 mm ball screw, the result would be 120.000 / 3 = 40,000 rpm, which is certainly not realistic. The DN method returns unreasonably high numbers when used for very small ball screws! Always check the maximum speed tables.

The concept of DN is a simplified way of determining the maximum rotational speed of a ball screw. DN is simply the multiplication of nominal diameter of the ball screw in mm times the maximum allowable speed in rpm. Keep in mind that for very small and very large screws this will not return valid numbers.

DN values allow easy comparison between different ball screw designs. More sophisticated ball return systems result in higher DN values and, conversely, lower DN values are associated with less sophisticated ball return methods. DN values provide direct correlation to ball velocity.

$$DN = n_{max} \cdot d_N$$

n_{max}: Maximum speed [rpm]

d_N: Nominal diameter [mm]

DN: Driving speed value [mm/min]

Most ball screws available today have maximum DN values between 60,000 and 120,000, and in some cases even higher. However, Steinmeyer recommends observing the maximum speeds published here for each size. Use the following values for orientation purposes and of course for Steinmeyer ball screws only:

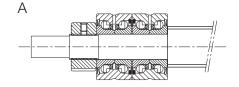
- Internal return (Series 1xxx): DN ≤ 120,000
- External return (UltraSpeed and end-cap return) (Series 2xxx and 3xxx): DN ≤ 160,000
- High-load ball screws (UltraThrust)
 (Series 9xxx with ball diameter 15 mm and 19 mm): DN ≤ 120,000

Always check the maximum speed tables on page 36.

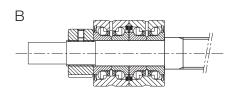
BEARING JOURNAL DESIGN AND PRE-TENSIONING BALL SCREWS

Journal design

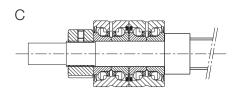
Support bearings facilitate rotation of the shaft while transmitting axial loads from the ball screw into the surrounding structure. They have to do that with minimum friction and the smallest possible deformation under changing loads. Modern ball screws have high load capacity and rigidity, which places high demands on bearings as well. Only high-end bearings which have been designed specifically for use with ball screws can match the load capacity and rigidity numbers. Using inferior bearings yields unsatisfactory results. It is also important that the interface between ball screw and support bearings is designed properly.



A: The simplest journal design is a bearing seat that is small compared to the root diameter of the ball thread. If the shoulder surface between the bearing journal diameter and the root diameter (= nominal diameter - ball diameter) of the ball thread is sufficient to support the bearing preload plus the maximum thrust with reasonable surface pressure, then this cost-effective solution is recommended.



B: Should the shoulder surface be too small, then the shaft could actually bend when the locknut is tightened to preload the bearings. In this case, a full shoulder is needed, that is the ball thread has to be incomplete instead of cutting through the shoulder - sometimes referred to as a "dead start thread". This is possible for ground and whirled screws, but impossible for rolled screws. Make sure that the other end of the ball thread is complete to allow mounting of the nut. Two incomplete ends of the ball thread means costly complications of nut mounting!



C: If the shoulder surface is still insufficient, then a collar becomes necessary. Collars can be heat shrunk onto the ball screw if there is still some difference between bearing bore diameter and screw O.D. Shrunk collars are also possible for rolled screws. If there is not enough shoulder for the shrunk collar to prevent axial slippage, then the collar has to be solid, which means considerable machining time. This is the most expensive solution.

TECHNICAL TIP

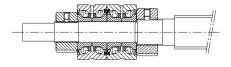
If a long screw is to be pre-tensioned to compensate for thermal expansion, thrust bearings are required at both ends. One of them needs to be adjustable to set exact tension of the shaft. A way to do that is by using a second locknut thread. Other possibilities include shims to set pre-tension. Always make sure to check elongation of the screw with a dial gage while tensioning it.

Sufficient shoulder area is important, since creeping of the metal and loss of bearing preload results from excessive surface loading. If the shoulder surface is not symmetric (for example when the thread cuts through it and the shoulder surface below the root is insufficient to support the bearing), then cocking of the bearing will cause bending of the shaft with unsatisfactory runout of the ball screw.

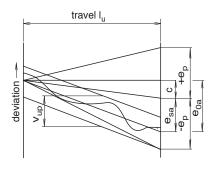




PRE-TENSIONING A BALL SCREW



The purpose to pre-tension a ball screw is to compensate for thermal expansion during operation and thus avoid compressive forces as the shaft expands between the two fixed bearings. The goal is to stretch the screw sufficiently to maintain at least some tension at the highest anticipated temperature.



TECHNICAL TIP

There is only a minimal change in the resonant frequency (critical speed) of the shaft when tensioned. But tensioning is necessary when the screw is supported by fixed bearings at both ends. The fixed bearings do of course result in raising critical speed.

Ball screws may be ordered with a negative lead compensation c, so that after tensioning the lead deviation is near zero.

Anticipating the temperature

$$\Delta l_T = l_s \cdot \Delta t \cdot \alpha$$

Δt: Temperature rise [°C]

 α : Coeff. of thermal expansion [1/°C] (for DIN 1.1213 = 11.5 x 10⁻⁶/°C)

I: Shaft length [mm]

Steinmeyer is capable of determining the steady-state temperature for your duty cycle. Please contact us for details.

Calculating the elongation

$$\Delta l_p \geq \! \Delta l_T$$

 ΔI_p : Amount of elongation [mm]

 ΔI_{τ} : Thermal expansion [mm]

The elongation of the shaft should at least be equal to the thermal expansion for the anticipated steady-state temperature, or slightly larger.

Calculating the tensioning force

$$F_T = E \cdot A \cdot \varepsilon$$

$$\varepsilon = \frac{\Delta l_p}{l_s}$$

 F_{τ} : Tensioning Force [N]

E: Elasticity modulus [N/mm²]

A: Shaft cross section [mm²]

ε: Elongation relative to length

Pre-tensioning requires considerable forces. In applications with rotating shaft, the support bearings have to withstand these forces, which becomes a main consideration for the selection of the bearings.

To calculate the tensioning force, assume that the root diameter of the screw is approximately the nominal diameter minus the ball diameter.

BEARING JOURNAL DESIGN

SELECTING SUPPORT BEARINGS

TECHNICAL TIP

Miniature ball screws are normally supported using either a pair of angular contact bearings on one end, or by a single-row bearing at both ends of the screw, preloaded against one another. It is better to use bearings with increased play here, since this will establish a more desirable contact angle when the bearings are preloaded. Bearings with minimal or no play may generate excessive forces on their balls when preloaded this way, causing potential premature bearing failure and rough motion.

Support bearings must be able to carry not only the thrust produced by the ball screw, but also any additional forces from pre-tensioning the ball screw shaft, plus any side forces generated by belt drives. Ball nuts with many ball circles and/or large balls and shafts with considerable pre-tension may make it difficult to find bearings with sufficient load capacity, especially when the bore (ID) of the bearing has to be no larger than the shaft's root diameter, and the journal shoulder diameter no larger than the ball screw's nominal diameter.

This discussion is only meant to highlight areas of concern. We cannot give detailed recommendations on which bearing to select. Criteria for the selection include:

- Axial dynamic load capacity of the bearing should be approximately equal to the dynamic load capacity of the ball screw, or higher if the screw is pre-tensioned.
- Minimum shoulder diameter for the bearing's inner ring should be no greater than the root diameter of the ball screw (journal shape A), or no greater than the screw's nominal diameter (journal shape B).
- The bearing should be suitable for the same lubrication method (grease/oil) and equipped with the proper seals for that lubricant. Speed ratings must be sufficient with the lubricant selected.

Steinmeyer recommends using INA support bearings. The following table gives examples of typical ballscrew / bearing assemblies. However, it is not possible to cover all combinations in this catalog. Please refer to our engineering service for further information.

Ballscrew nominal diameter	INA-bearing	with journal configuration	on acc. to fig.
d _N [mm]	А	В	С
16	ZKLN1034	-	ZKLN1242
20	ZKLN1242	-	ZKLN1545
25	ZKLN1747	-	ZKLN2052
32 (P≤5)	ZKLN2557	-	-
32 (P>5)	ZKLN2052	ZKLN2557	-
40 (P≤5)	ZKLN3062	-	-
40 (P>5)	-	ZARN3062LTN	-
50 (P≤5)	ZKLN4075	-	-
50 (P>5)	-	ZARN4075LTN	-
63 (P≤5)	ZKLN5090	-	-
63 (P>5)	ZARN4090LTN	ZARN45105LTN	-
80	-	ZARN50110LTN	-
100	-	ZARN60120LTN	-

This brief overview cannot give a final selection aid to determinate an optimum bearing solution. Radial loads due to drive belt tension or increased axial loads due to pretensioning a ballscrew need to be considered, too.





LUBRICATION AND WIPERS / SEALS

Supply of fresh lubricant and wipers must be considered together. The selection not only depends on environmental conditions, but also on loads and speeds. In this section we discuss whether grease or oil is the right lubricant, and which grease or oil should be used.

Plastic Wiper



Plastic wipers, sometimes called "labyrinth seals", are widely used in machine applications. They prevent contamination of the nut from chips and other larger particles, while at the same time letting some oil exit the nut. Combined with automatic grease or oil lubrication, they help to flush the nut. The result is higher reliability of the ball screw.

Felt Wiper



Felt wipers are an excellent solution for ball screws operated in an environment with abrasive or otherwise troublesome dirt as in grinding or woodworking machines (for example oil absorbing particles like wood chips). The felt wiper seals the nut effectively, even from fine particles, and also stores some lubricant. Felt wipers are contact wipers and add some friction.

Combination Wiper



Combination wipers are plastic wipers with an additional felt wiper (inside the ball nut). They are used where felt wipers are desirable, but need to be protected from water or water based fluids. Felt tends to absorb water, so it should not be used without the additional plastic wiper in such cases.

Combination wipers add to the nut length - please consult Steinmeyer for details.

TECHNICAL TIP

If the duty cycle is such that an EHD lubrication film can build over a significant part of the motion, then oil lubrication with a properly selected oil grade and viscosity will always outperform grease in terms of wear. On the other hand, grease has an edge at slow speeds because it offers better wear protection under mixed friction or boundary friction conditions. Grease can also be used for long-term or for-life lubrication. Lubricant loss with grease is lower than with oil.

A general discussion for oil vs. grease lubrication and the results of a scientific test of several commonly used lubricants by the tribology lab of CSEM at Neuchâtel/Switzerland (www.csem.ch) is shown on the next pages.

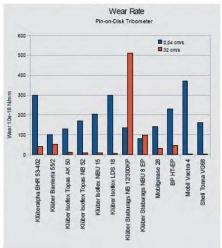
LUBRICATION AND WIPERS / SEALS

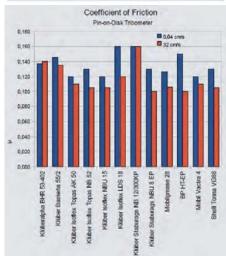
TRIBILOGY OIL / GREASE

On behalf of Steinmeyer and under the scope of a EUREKA project sponsored by the KTI (Commission for Technological Interchange) in Switzerland, the tribology lab of CSEM (Centre Suisse d'Electronique et Microtechnique) designed and conducted a test for commonly used lubricants under the specific tribological conditions found in ball screws. A modified pin-on-disc tribometer was used, with the pin replaced by a regular bearing ball made from 52100 steel, which rode on a rotating disc made from the same material, heat treated and ground similar to the raceway of a ball screw.

The disc and the ball closely resembled the friction partners in a ball nut in terms of material and surface finish.

Surface loads and relative speeds in two test series were selected to simulate a slow moving ball screw and a fast moving one. Since the pin-on-disc tribometer causes pure sliding instead of the sliding/rolling typical for a ball screw, the speeds were adjusted to the sliding portion of typical mid-size ball screw kinematics, running at about 50 rpm (0,04 cm/s in the tribometer) and at approximately 1000 rpm (32 cm/s in the tribometer). This simulated as closely as possible the real tribological conditions in a ball screw, both in terms of lubrication film build-up, and wear.





Results:

First of all, the coefficient of friction does not seem to be correlated to the wear rate. Some lubricants yielded low friction, but higher wear at the same time!

- The wear rates of some greases show that these lubricants can really be seen as "universal", because they offer moderate wear protection at both slow and fast speeds.
- At the higher speed, both oils built a hydrodynamic lube film, which can be concluded from the extremely low wear rates.
- A plain mineral oil without wear-inhibiting additive (Vactra4) yielded excessive wear rate at slow speed, despite its high viscosity. It was obviously unable to protect the friction partners once speed fell below the threshold to build a hydrodynamic film. It was squeezed out of the contact patch and did not sufficiently reduce wear in boundary conditions.
- Oil with high-pressure, wear inhibiting additives (EP oil), which is able to bond its hydrocarbon molecules to metal surfaces through chemical or physical reaction, performs much better during conditions of boundary friction.

With the exception of a high-pressure grease, which caused the lube film to collapse at high speeds, all greases performed well and yielded acceptable wear rates throughout the test scenario. At the same time it was proven that greases are unable to build a perfect fluid film like oils of proper viscosity, so the wear rate with grease lubrication is higher than the wear rate of oil when an EHD film is present.





Theory of elasto-hydrodynamic (EHD) lubrication

Life calculations for ball screws assume sufficient lubrication, which means that there is an adequate lubrication film. In case of oil lubrication this means that whenever the speed is sufficient, a fluid film develops which separates the contact partners as much as possible. This requires that

- sufficient oil is available at all times
- contamination is minimal
- lubricant is in adequate condition
- viscosity is selected so that over most of the duty cycle a hydrodynamic lube film is maintained

The necessary condition to form such a fluid film is described by the theory of elasto-hydrodynamic lubrication. Whether a fluid film, able to withstand the pressure in the friction contact zone, will build depends on the actual viscosity of the lubricant and the speed and, to a lesser extent, the pressure. However, a certain minimum load is required (for example by preloading the ball screw) to cause a consistent rolling motion of the balls.

Whether an EHD film will build can be determined from the viscosity ratio $k=u / u_1$. The operational viscosity u is the viscosity the lubricant exhibits under the conditions in the contact patch in terms of speed, temperature and pressure. The viscosity needed to build a sufficient EHD film is u_1 .

The viscosity ratio can be classified in 3 parts.

- ${f k} \ge 4$ full EHD lubrication contact partners are mostly separated
- 0.4 ≤ k < 4 mixed friction lubricant with wear inhibiting additives is necessary, since
 EHD film is only partially able to separate contact partners (EP grease, CLP oil)
- k < 0.4 no separation accelerated wear through micro welding will occur

Since a high viscosity ratio is desirable, oil with high viscosity seems to be the solution. But high oil viscosity also causes high temperatures, which in turn could lower the actual viscosity again. High viscosity oil is also difficult to deliver to all lubrication points and will not aid in cooling the ball nut.

We recommend using oil viscosities as close as possible to the ones per the following table.

LUBRICATION AND WIPERS / SEALS

OIL LUBRICATION

Oil lubrication requires an oil port in the nut and wipers. Steinmeyer ships all ball screws lubricated ready for use. If the screw is to be used with oil lubrication, please notify us when ordering - we will then pack the nut with a special grease, which requires no cleaning prior to use. The grease will be washed away with time and be dissolved in the oil. The grease fill protects the screw during shipping and storage, and keeps it lubricated until the oil supply is operational.

Oil should be injected approximately four times per hour. Recirculating oil systems should include a filter with a 10 micron mesh and a cooler to keep the oil temperature below 50° C as it enters the ball nut. Oil mist is only recommended when there are no wipers and contamination is very low. Oil bath lubrication can only be used for very low speeds. Oil drip and loss lubrication is possible, but oil quantities must be observed.

Recommended oil quantities

Nominal diameter [mm]	Oil quantity oil circ	Oil quantity in mm³/min for	
	without extra cooling	with extra cooling	minimum quantity lubrication (MQL) or oil mist lubrication
16	0.12	0.3	1
20	0.15	0.4	1.5
25	0.2	0.5	2
32	0.25	0.7	2.5
40	0.3	0.9	3
50	0.4	1.5	4
63	0.5	2	5.0
80	0.6	3.0	6.0
100	0.8	4.0	8.0
125	1.0	5.0	10.0

Suitable oil grades

Only oils with wear inhibiting additives should be used. These have the ability to lubricate in conditions of boundary friction, when speeds for EHD-lubrication are insufficient. We strongly recommend CLP grade gear oil per DIN 51517-3 or equivalent. Do not use way oils or hydraulic oils, even if they are labeled "high pressure"!





Recommended oil viscosity for EHD lubrication

Nominal diameter [mm]	Mean speed [rpm]	Viscosity u1 [mm²/s]	Lubricant temperature [°C]	Viscosity grade ISO VG	Actual viscosity u [mm²/s]
up to 16	10	ca. 3000	30	680	ca. 3000
	50	500	35	320	500
	200	180	40	220	220
	500	70	45	100	80
	1000	40	50	68	42
	2000	28	55	68	35
20 to 32	10	ca. 1200	30	460	ca. 1200
	50	350	35	320	500
	200	120	40	150	150
	500	50	45	68	50
	1000	30	50	46	30
over 40	10	ca. 900	30	320	ca. 900
	50	250	35	220	300
	200	80	40	100	100
	500	35	45	46	35

TECHNICAL TIP

Felt or combination wipers seal the nut. It is therefore important, when using such wipers, that the recommended oil flow rates are not exceeded. The nut may become overfilled causing overheating at higher speeds.

Service life of oil lubricated ball screws exceeds the life that can be expected with grease lubrication in many cases, but only if EHD lubrication can be reached over most of the duty cycle.

LUBRICATION AND WIPERS / SEALS

GREASE LUBRICATION

Re-lubrication of ball screws should be done with grease having the same, or compatible, thickener as the grease used for factory lubrication. The base oil viscosity should also be approximately the same. If not specified otherwise, Steinmeyer uses Kluber Staburags NBU 8 EP for factory grease fill of the nut. Please note that the factory grease fill is only enough for initial operation, until the first required re-lubrication.

Manual re-lubrication

Ball screws with regular plastic wipers should be re-greased every 500 hours of continuous operation, or four times a year. Ball screws with felt wipers have a recommended re-greasing interval of 1000 hours of operation, or twice a year.

If the ball screw is fitted with felt or combination wipers and is adequately protected from dirt and liquids (e.g. water, coolant), then the re-lubrication interval may be extended to 2000 hours or once a year. In such cases, Steinmeyer will pack the ball nut with long-term grease Kluber Isoflex NBU 15, and impregnate the felt wiper with an oil compatible with this grease. Please consult with our application engineers if you want your ball screw prepared for long-term lubrication.

Automatic grease lubrication

There are two possible ways to automatically re-lubricate ball screws. Either the nut is connected to an automatic lubrication pump with multiple ports, or a lubrication cartridge is used. Both require a grease which is not too viscous and can be reliably pumped through piping to its destination. Grease cartridges powered by chemical gas generators keep the grease pressurized all the time, which can cause the base oil to separate from the thickener resulting in clogged lines and lubrication breakdown. We recommend electromechanical cartridges, which use a gear motor and a lead screw to pump the lubricant. These do not keep the grease under continuous pressure, thus preventing such problems.

Normally, liquid greases NLGI class 0 or 00 are used for automatic grease lubrication, because they can be pumped through long lines more easily. With large enough pipe diameters, grease class 1 or even 2 can be used as well - but should first be tested.

The intervals and quantities are shown on page 47.

TECHNICAL TIP

Mineral oil based lubricants degrade with time in two ways:

- They are attacked by aggressive chemicals (for example oxygen) from their environment, which causes a polymerization of the hydrocarbon or oxidation. The lubricant turns into a solid with time, but the process is slow in a normal environment, so re-lubrication in normal intervals replaces the lubricant before it becomes too degraded. However, this chemical aging limits the storage period of pre-greased components to 2 5 years. Specifics can be obtained from grease manufacturers.
- During use, the hydrocarbon molecules are subjected to mechanical stresses when they are passed through the contact patches. This mechanical stress causes the molecule chains to break up over time, reducing the viscosity. The maximum usage time of the lubricant can be calculated - please contact us.





Manual re-lubrication

Nomina diameter [mm]	Grease quantity on the shaft [g]	Grease quantit	y of the nut [g]
		Single nut	Double nut
3	0.15	-	-
5	0.3	-	-
8	0.7	-	-
12	1	-	-
16	4	0.2	0.3
20	7	0.5	0.8
25	10	0.7	1
32	17	1.1	1.7
40	25	1.8	2.7
50	35	2.4	3.6
63	50	3	4.5
80	70	4	6

Automatic re-lubrication

Nominal diameter [mm]	Grease per sho	Lube interval [h] *	
	Single nut	Double nut	interval
16	0.01	0.03	4 - 8
20	0.03	0.06	4 - 8
25	0.03	0.06	4 - 8
32	0.06	0.1	4 - 8
40	0.06	0.1	4 - 8
50	0.1	0.16	4 - 8
63	0.16	0.2	4 - 8
80	0.2	0.3	4 - 8

* The automatic re-lubrication should use grease class NLGI 00 or NLGI 000 and grease quantity as specified per shot. A re-lubrication interval should be between 4 and 8 operating hours or after a distance of 500 m. In addition, every time the machine axis is initially turned on a lubrication impulse should also occur.

TECHNICAL TIP

For non-aerospace applications, when re-lubricating manually using a grease gun, make sure not to pump more grease than indicated in the table. Exceeding the recommended quantities will not only overfill the nut, but can actually pressurize it and push the wipers out of their locations!

Ball screws for aerospace use are normally greased to a point where fresh grease appears either at both ends of the nut underneath the wipers or ice scrapers, or at a relief valve. Filling the nut completely is desirable in aerospace applications because the grease keeps water from entering the nut. Due to the low average speeds of most aerospace actuator screws there is no risk of overheating from excessive amounts of grease inside the nut, as would be the case in machine tools with their rapid motion.

Technology

LUBRICATION AND WIPERS / SEALS

Recommended Grease

Application	Kluber	Low temp. limit [C°]	Upper temp. limit [C°]	Base oil viscosity [mm²/s] at 40°C	Lubcon	Low temp. limit [°C]	Upper temp. limit [°C]	Base oil viscosity [mm²/s] at 40°C
General purpose, long-term grease for high surface pressure	Staburags NBU 8 EP	-20	140	100	Turmogrease PHS 1002	-40	160	105
Long-term grease with felt wipers	Isoflex NBU 15	-30	130	23	Turmogrease Highspeed L252	-50	120	25
Long-term grease without felt wipers, low speeds only	Stabu- rags NBU 12/300KP	-20	140	220	Turmogrease CAK 4002	-20	150	400
Low friction grease	Isoflex LDS 18 Spezial A	-50	120	15	Thermoplex 2 TML Spezial	-70	130	20
High temperature grease	Klüberalpha BHR 53-402	-40	260	400	Turmotemp Super 2 EP	-30	280	500
Low temperature grease	Isoflex PDL 300 A	-70	110	9	Thermoplex TTF 122	-70	150	12
Vacuum grease, clean room	Barrierta L55/2	-40	260	400	Turmotemp II/400 KL	-30	260	400
					Turmotemp II/400 RS2	-30	260	550
Food grade grease	Klübersynth UH1 14-151	-45	120	150	Turmosynth- grease ALN 2501	-40	160	250

Hybrid ball screws

Hybrid design of ball screw means screw and nut are made from steel and balls are made from ceramic.

Most suitable ceramic is Silicon Nitride in HIP-quality (not isostatic pressed).

Hybrid ball screws are designed to operate with very minimal lubrication. When adequate lubrication is available there is no difference compared to conventional ball screws equipped with steel balls.

The high hardness and Young's modulus of Silicon Nitride (Si_3N_4) results in a higher applied load to the steel-ball race. Hybrid ball screws however must be assembled using smaller steel spacer balls which means that only 50% of the balls are carrying load. Therefore, the application of hybrid ball screws must be carefully reviewed.





BALL RETURN

TECHNICAL TIP

Ball nuts require a means to recirculate balls. Without it, the ball path would not be closed and balls would fall out at the rear end of the nut. Design of the ball return is the determining factor for the maximum speed at which the ball nut can safely operate. This is normally expressed by the D_N -value. The better the ball return system deals with mass forces of the balls, the higher the D_N value. Manufacturers typically quote D_N values from 60.000 for basic tube returns to 160.000 and higher, e.g. the UltraSpeed return from Steinmeyer.

Steinmeyer uses all commonly known designs for ball returns. However, the multi-liner and the tube return are only used for aerospace "build-to-print" applications, since staying with a previously qualified design simplifies the qualification procedure.

Track-to-track (internal return)



The track-to-track return uses ball deflectors to lift the balls across the O.D. of the shaft and guide them directly into the next (or previous) track. Internal ball return is very compact and yields the smallest nut diameters among all ball return systems. It is also the ball return of choice for very small ball sizes and small leads.

Each deflector serves one turn, which is one circuit (or ball circle).

Through-the-nut return (external return)



Steinmeyer's "UltraSpeed" return is normally used for lead/diameter ratios greater than 0.5. It is normally used with dual start threads. Balls are lifted off the shaft using a deflector at one end of the nut and then guided through a bore (internal to the nut body) to the other end of the nut, where a similar piece guides the balls back onto the thread. One pair of deflectors serves one circuit (i.e. one of the threads) which includes several turns.

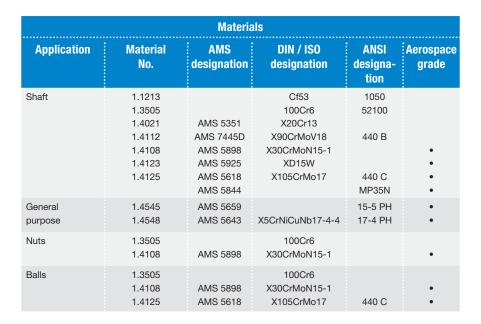
End cap return



End cap return works very much like the previously described through-the-nut return, with the exception that the ball deflector function is executed using a (plastic) cap at both ends of the ball nut. Each cap serves as the ball return and also includes wipers. End cap return is normally used for very large lead/diameter ratios. This style ball nut is only available as a flange nut.

Technology

MATERIALS AND PROCESSES



Processes								
SAE designation		AS 7003 / NADCAP cer- tified	Certified through 3rd party/customer audit	External process				
AS 7102	Heat treatment	•	•	•				
AS 7114	Induction hardening	•		•				
AS 7108	Chemical processes	•		•				
AS 1701	NDT	•		•				
AS 7117	Surface treatment	•		•				
AS 7115	Elastomer Seals/ Gaskets	•	•	•				
AS 7200	Sealants	•	•	•				
AS 7101	Non-standard treatment	•	•	•				





DEFINITIONS

A: Shaft cross section [mm²] Coefficient of thermal expansion [1/°C] α: C: Lead compensation Static axial load capacity [N] C_{oa}: C_a: Dynamic axial load capacity [N] Required dynamic axial load capacity [N] $\Delta l_{b/t}$: Axial elastic deformation due to external load F, [µm] Axial elastic deformation due to preload F_{nr} [µm] $\Delta I_{b/t,pr}$: Elongation of the shaft [mm] Δl_n :

 ΔI_p : Elongation of the shaft [mm] ΔI_T : Thermal expansion [mm] d_N : Nominal diameter [mm] DN: Driving speed value [mm/min] Δt : Temperature increase [°C]

"E": Tolerance of the cumulative lead error (JIS)

E: Elasticity modulus [N/mm2] ϵ : Elongation relative to length e_{0a} : Mean lead deviation over entire travel I_u

 $e_{2\pi}$: Lead error in one revolution (JIS)

 $e_{_{300}}$: Lead error in 300 mm (JIS)

 $\mathbf{e}_{\mathbf{p}}$: Tolerance for the average lead deviation over entire travel $\mathbf{I}_{\mathbf{u}}$

 $\mathbf{e}_{\mathrm{sa}}\text{:}\quad$ Actual lead deviation over entire travel \mathbf{I}_{u}

F_i: External load [N]

 F_i^* : Modified external load [N] F_m : Dynamic equivalent load [N]

F_{m*}: Modified dynamic equivalent load [N]

F_n: Preload [N]

F_T: Tensioning force [N]i: Number of ball circles

JIS: Japanese Industrial Standardk: Support coefficient (critical speed)

L₁₀: Nominal life 90% reliability [revolutions]

I_s: Unsupported shaft length [mm]

I_{..}: Travel [mm]

m: Support coefficient (buckling]

n_i: Speed [rpm]

 n_k : Critical speed [rpm] n_m : Equivalent Speed [rpm] n_{max} : Maximum Speed [rpm]

P: Lead [mm]

P_R: Buckling load [N]

P_i: Load capacity per ANSI [lbf]

q: Time percentage [%]

R_b: Axial bearing rigidity [N/μm]
 R_{nu,ar}: Actual nut rigidity [N/μm]
 R_s: Shaft rigidity [N/μm]

 $\begin{array}{ll} R_t \!\!: & \text{Rigidity of ball screw [N/\mu m]} \\ T \!\!: & \text{Travel compensation (JIS)} \end{array}$

T_{nr}: Preload torque

 $v_{2\pi a}$: Lead fluctuation in one revolution

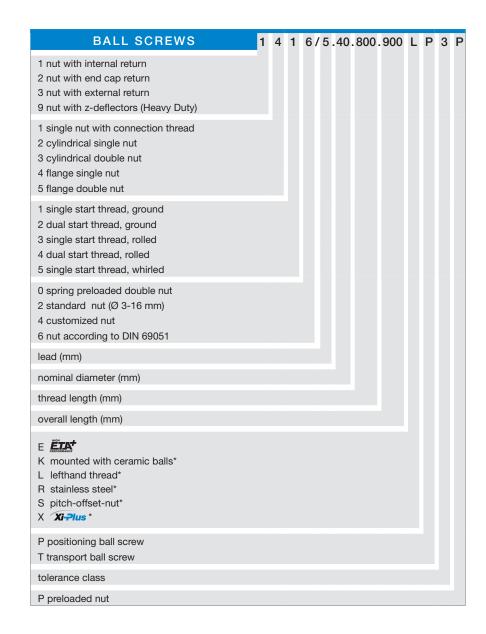
 v_{300a} : Lead fluctuation in 300 mm

 $\rm v_{\rm 300p}$: Tolerance of the lead fluctuation in 300 mm

 v_{ua} : Lead deviation over entire travel lu v_{up} : Tolerance of the lead deviation

over entire travel I

NUMBERING SYSTEM LARGE BALL SCREWS



Note:

This item number describes a ball screw with flange single nut acc. to DIN with internal return. Single start thread, ground. Lead 5 mm, nominal diameter 40 mm, thread length = 800 mm, overall length = 900 mm, left hand thread, tolerance class P3, preloaded nut.

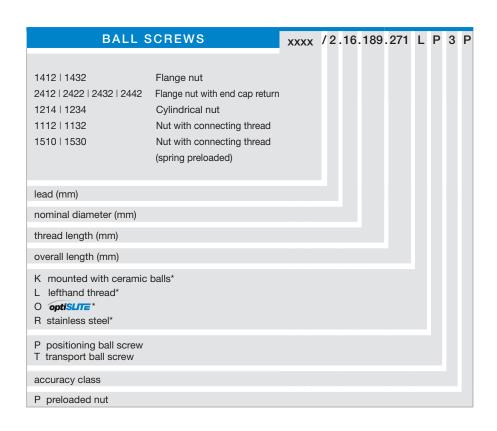
You can get further information about our **Xi-Plus**-ball screws on page 34 and 89. Please follow the advices on page 12 to 20.

*upon request





NUMBERING SYSTEM MINIATURE BALL SCREWS



1. Selection of Screw

Choose screw type A, B or customized

2. Selection of Nut

According to the table above

Ordering Example ball screw:

1412/2.16.189.271 P3P

Ball screw with flange single nut, series 1412, screw type B, backlash-free, stroke 100 mm, accuracy class 3

Ordering Example ball nut:

1412/2.16.1,5.3

Flange single nut, series 1412, mounted on customized screw shaft, ball- \emptyset 1,5 mm, 3 circuits. Please specify the accuracy class.

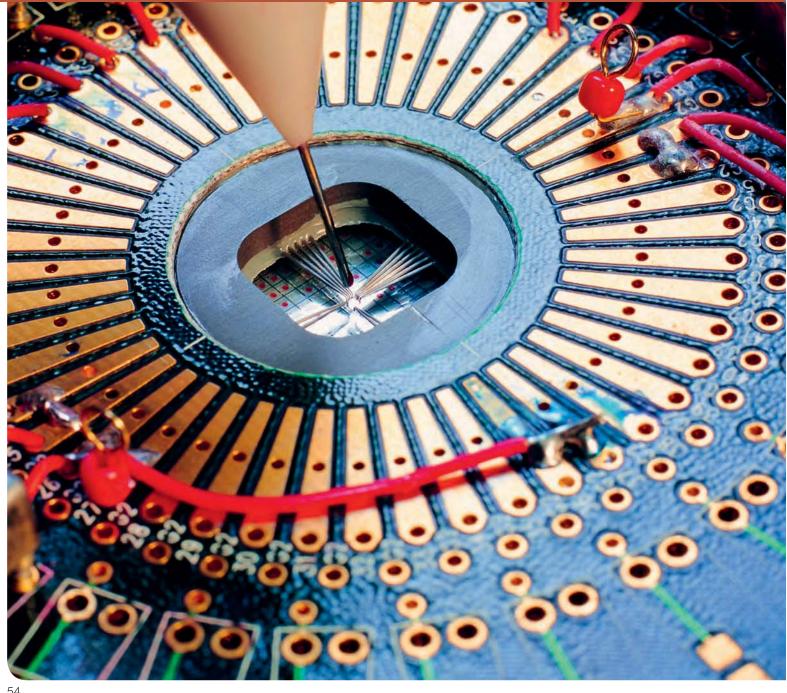
You can get further information about our optistie-ball screws on page 19 and 55.

Please follow the advices on pages 12 to 20.

*upon request



Miniature Ball Screws Diameter 3 - 1







BALL SCREWS 3 - 16 MM

Miniature ball screws are used for precision positioning in semiconductor, optics, medical instrument, and metrology applications. There are two different standard shaft styles, Type A and Type B, which are also available in different lengths.

In addition to the ground execution to an accuracy class P5, you can find in this chapter for 8 mm diameter and larger the rolled version in accuracy classes T5 to T10.

Our miniature ball screw product line consists of two spindle series, which can be combined with a total of six different nuts. There are various diameters and pitches as well as several classes of accuracy available.

New technology in miniature ball screws.



Steinmeyer offers miniature ball screws from 3 mm to 16 mm with the optimized technology optiSLITE, providing significant advantages.

Through the use of innovative production technologies, the roughness of the raceway surface of the spindles can be reduced and significantly optimized. By eliminating microscopic irregularities on the raceway surface of the spindle thread, the running characteristics of optiSLITE ball screws can be remarkably improved. Another advantage it provides is a more uniform idling torque over the entire spindle length.

The improved running characteristics are achieved by increased material contact. The material contact area Rmr (c) indicates the percentage of material filled path lengths, depending on the depth of cut "c". The plateau-like surface of the optiSLITE ball screws provide clean, smooth running, while offering improved lubricating properties.

The markedly improved running characteristics also allows ball screws to achieve greater energy efficiency.

In addition to the standard spindle shafts, you can specify reduced or even completely different special designs. These special spindle shafts can again be combined with the standard nuts shown here, or with differing versions.

Please contact us with your applications to find the possibilities with OptiSLITE. We will gladly provide a quotation. For budgetary pricing and lead times, a sketch is sufficient.

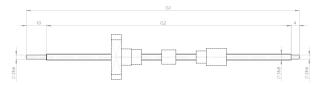
For more information please visit: www.steinmeyer.com

Positioning ball screws 3 - 16 mm

NOMINAL DIAMETER 3 mm

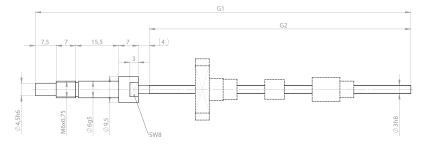
Ground execution with standard bearing journal P0 - P5 Series 1412, 1214, 1112

■ Shaft style A



Screw Type A							
Stroke	Thread length	Overall length					
	G2	G1					
[mm]	[mm]	[mm]					
50	76	90					

■ Shaft style B



Screw Type B							
Stroke	Thread length G2	Overall length G1					
[mm]	[mm]	[mm]					
20	44	85					
40	64	105					
70	94	135					

Nuts shown in standard orientation. Select one nut from table. Please follow the advice on page 24/25.

optisLITE Detailed information page 55.

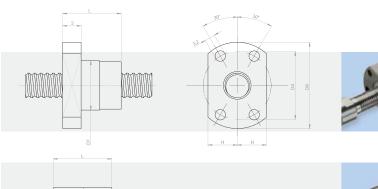
Technical data								
							Nut with axial backlash	Nut backlash-free
Nut type	Lead [mm]	Nomi- nal-Ø [mm]	Circuits		Dyn. Load Ratin [kN]	Stat. Load Rating [kN]	Max. Axial Play [mm]	Max. Friction Torque Tpr0 [Ncm]
0,5.3.0,6.2	0.5	3	2	0.6	0.09	0.09	0.01	1.0
1.3.0,8.2	1	3	2	0.8	0.24	0.25	0.01	1.0

For engineering consultation or to place an order, please contact us by phone +49 (0) 7431 1288-0





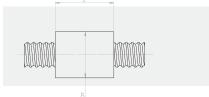




FLANGE NUT

■ Series 1412:

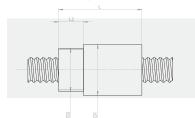
Nut with flange and standard wipers on both ends





CYLINDRICAL NUT

■ Series 1214: Cylindrical nut without wipers





NUT WITH CONNECTING THREAD

■ Series 1112:

Nut with connecting thread without wipers

Dimensions						:		:	
Flange nut 1412							ut 1214	Nut with connect	ing thread 1112
	D1g6		D6	L3	2xH	:	Pilot-Ø D1h6 [mm]	L	Pilot-Ø D1 [mm]
15	8	15	22	0	14	7	7	15	8.5
15	8	15	22	0	14	7		15	8.5

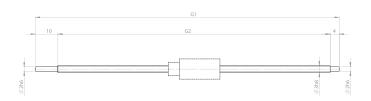
E-mail: sales@reliance.co.uk Tel: +44 (0) 1484 601002 57 Internet: www.reliance.co.uk

Positioning ball screws 3 - 16 mm

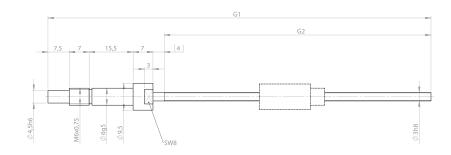
NOMINAL DIAMETER 3 mm

Ground execution with standard bearing journal P0 - P5 Series 1510

■ Shaft style A



■ Shaft style B



Screw Type A							
Stroke	Thread length G2	Overall length G1					
[mm]	[mm]	[mm]					
50	76	90					

Screw Type B						
Stroke	Thread length G2	Overall length G1				
[mm]	[mm]	[mm]				
20	44	85				
40	64	105				
70	94	135				

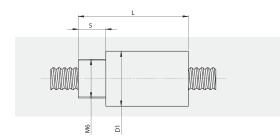
Please follow the advice on page 24/25.

optisLife Detailed information page 55.

Technical data			1				:
							Nut spring preloaded
		Nomi- nal-Ø [mm]			Rating	Rating	Max. Friction Torque Tpr0 [Ncm]
0,5.3.0,6.2	0.5	3	2	0.6	0.09	0.09	0.8
1.3.0,8.2	1	3	2	0.8	0.2	0.3	0.8









NUT WITH CONNECTING THREAD

■ Series 1510:

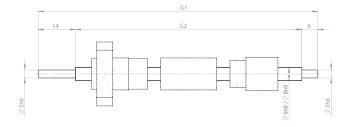
Spring preloaded double nut in housing with connecting thread without wipers

Dimensions	'				
Nut with connecting thread 1510					
L	D1	Fprmax	Max. Axial Load Fmax [N]		
23	9	10	6		
23	9	15	10		

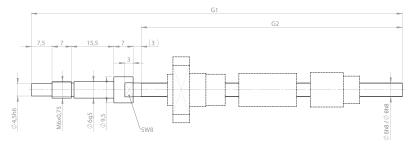
NOMINAL DIAMETER 5 mm / 6 mm

Ground execution with standard bearing journal P0 - P5 Series 1412, 1214, 1112

■ Shaft style A



■ Shaft style B



Screw Type A						
Stroke	Thread length G2	Overall length G1				
[mm]		[mm]				
60	90	110				

Screw Type B						
Stroke	Thread length G2	Overall length G1				
[mm]	[mm]	[mm]				
40	65	105				
70	95	135				
100	125	165				

Nuts shown in standard orientation. Select one nut from table. Please follow the advice on page 24/25.

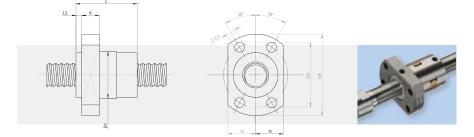
optiSLITE Detailed information page 55.

Technical data			1					
							Nut with axial backlash	Nut backlash-free
Nut type	Lead [mm]	Nomi- nal-Ø [mm]	Circuits		Dyn. Load Rating [kN]	Stat. Load Rating [kN]	Max. Axial Play [mm]	Max. Friction Torque Tpr0 [Ncm]
0,5.5.0,6.3	0.5	5	3	0.6	0.17	0.24	0.01	1.5
1.6.0,8.3	1	6	3	0.8	0.55	0.92	0.01	1.5
1,5.6.1.3	1.5	6	3	1	0.71	1.08	0.02	1.5
2.6.1.3	2	6	3	1	0.71	1.08	0.02	1.5





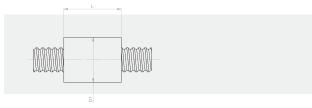




FLANGE NUT

■ Series 1412:

Nut with flange and standard wipers on both ends

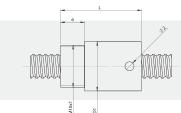




CYLINDICAL NUT

■ Series 1214:

Cylindrical nut without wipers





NUT WITH CONNECTING THREAD

■ Series 1112:

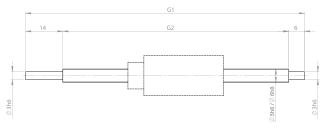
Nut with connecting thread without wipers

D	Dimensions										
F	Flange nut 1412 / 2412							Cylindrical nut 1214		Nut with connecting thread 1112	
L		D1g6	Circle-Ø D4	D6	,	Flange Flats 2xH [mm]	•	Pilot-Ø D1h6 [mm]		Pilot-Ø D1 [mm]	
22	22	12	18	24	0	16	12	13	19	12.5	
2	21	12	18	24	0	16	12	12	18	12.5	
23	23	12	18	24	0	16	14	12	20	12.5	
22	22	12	18	24	0	16	13	12	20	12.5	

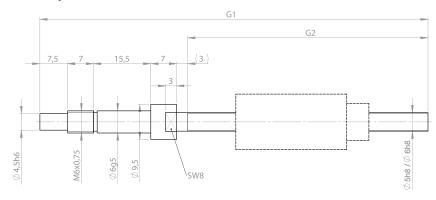
NOMINAL DIAMETER 5 mm / 6 mm

Ground execution with standard bearing journal P0 - P5 Series 1510

■ Shaft style A



■ Shaft style B



Screw Type A						
Stroke	Thread length G2	Overall length G1				
[mm]	[mm]	[mm]				
60	90	110				

Screw Type B						
Stroke	Thread length G2	Overall length G1				
[mm]		[mm]				
40	65	105				
70	95	135				
100	125	165				

Please follow the advice on page 24/25.

optiSLITE Detailed information page 55.

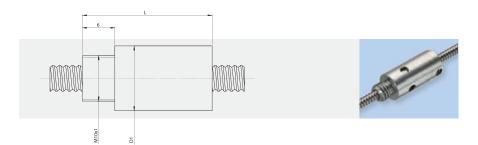
Technical data							:
							Nut spring preloaded
Nut type	Lead [mm]	Nomi- nal-Ø [mm]	Circuits		Dyn. Load Rating [kN]	Stat. Load Rating [kN]	Max. Friction Torque Tpr0 [Ncm]
0,5.5.0,6.2	0.5	5	2	0.6	0.12	0.16	1.0
1.6.0,8.2	1	6	2	0.8	0.39	0.61	1.0
1,5.6.1.2	1.5	6	2	1	0.50	0.72	1.0

 $\label{prop:complex} \textbf{For more information please visit: } \textbf{www.steinmeyer.com}$









NUT WITH CONNECTING THREAD

■ Series 1510:

Spring preloaded double nut in housing with connecting thread without wipers

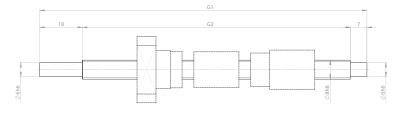
Dimensions						
Nut with connecting thread 1510						
Nut Length L [mm]	D1	Fprmax	Max. Axial Load Fmax [N]			
36	15	10	6			
36	15	20	15			
36	15	20	15			

Positioning ball screws 3 - 16 mm

NOMINAL DIAMETER 8 mm

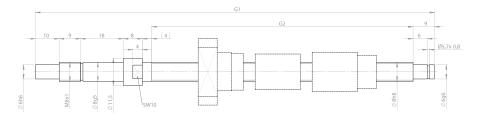
Ground execution with standard bearing journal P0 - P5 Series 1412, 2412, 1214, 1112

■ Shaft style A



Screw	Screw Type A						
Stroke	Thread length G2	Overall length G1					
[mm]	[mm]	[mm]					
100	145	170					
200	245	270					

■ Shaft style B



Screw Type B									
Stroke	Thread length G2	Overall length G1							
[mm]	[mm]	[mm]							
40	80	138							
70	110	168							
100	140	198							
150	190	248							

Nuts shown in standard orientation. Select one nut from table. Please follow the advice on page 24/25.

optiSLITE Detailed information page 55.

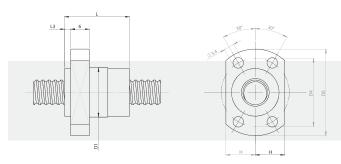
Technical data								
							Nut with axial backlash	Nut backlash-free
Nut type	Lead [mm]	Nomi- nal-Ø [mm]	Circuits	Ball-Ø [mm]	Dyn. Load Ratin [kN]	Stat. Load Rating [kN]	Max. Axial Play [mm]	Max. Friction Torque Tpr0 [Ncm]
0,5.8.0,6.3	0.5	8	3	0.6	0.40	0.50	0.01	2.0
1.8.0,8.3	1	8	3	0.8	0.90	1.20	0.01	2.0
2.8.1,5.3	2	8	3	1.5	2.00	2.10	0.02	2.0
2,5.8.1,5.3	2.5	8	3	1.5	2.00	2.10	0.02	2.0
4.8.1,5.3	4	8	3	1.5	2.00	2.10	0.02	2.0
4.8.1,5.5	4	8	5	1.5	3.00	3.60	0.02	2.0
5.8.1,5.3	5	8	3	1.5	1.90	2.10	0.02	2.0
8.8.1,5.2	8	8	2	1.5	1.20	1.20	0.02	2.0

^{*}nut type 2412 only











FLANGE NUT

■ Series 1412:

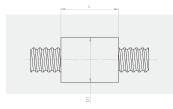
Nut with flange and standard wipers on both ends



■ Series 2412:

Nut with flange and standard wipers on both ends

*nut type 2412 only

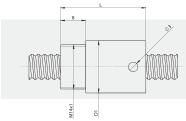




CYLINDRICAL NUT

■ Series 1214:

Cylindrical nut without wipers





NUT WITH CONNECTING THREAD

■ Series 1112:

Nut with connecting thread without wipers

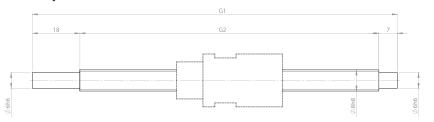
Dimensions									
Flange nut 14	12 / 2412		Cylindrical nu	ıt 1214	Nut with connecting thread 1112				
L		Pitch Circle-Ø D4 [mm]	Flange-Ø D6 [mm]		Flange Flats 2xH [mm]		Pilot-Ø D1h6 [mm]		Pilot-Ø D1 [mm]
22	16	22	28	0	19	13	15	21	16.5
23	16	22	28	0	19	14	15	22	16.5
28	16	22	28	0	19	19	15	27	16.5
30	16	22	28	0	19	21	15	29	16.5
31	16	22	28	0	19	22	15	30	16.5
27	16	22	28	6*	19				
22	16	22	28	6*	19				
22	16	22	28	6*	19				

Positioning ball screws 3 - 16 mm

NOMINAL DIAMETER 8 mm

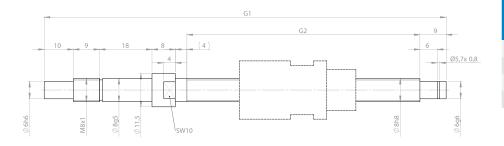
Ground execution with standard bearing journal P0 - P5 Series 1510

■ Shaft style A



Screw Type A									
Stroke	Thread length G2	Overall length G1							
[mm]	[mm]	[mm]							
100	145	170							
200	245	270							

■ Shaft style B



Screw Type B										
Stroke	Thread length G2	Overall length G1								
[mm]	[mm]	[mm]								
40	80	138								
70	110	168								
100	140	198								
150	190	248								

Please follow the advice on page 24/25.

optisure Detailed information page 55.

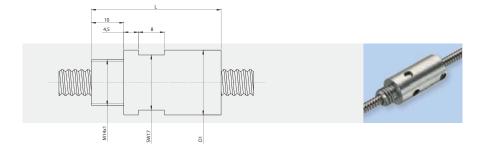
Technical data							
							Nut spring preloaded
Nut type	Lead [mm]	Nomi- nal-Ø [mm]	Circuits		Dyn. Load Rating [kN]	Rating	Max. Friction Torque Tpr0 [Ncm]
0,5.8.0,6.2	0.5	8	2	0.6	0.20	0.30	1.5
1.8.0,8.2	1	8	2	0.8	0.60	0.80	1.5
2.8.1,5.2	2	8	2	1.5	1.40	1.40	1.5
2,5.8.1,5.2	2.5	8	2	1.5	1.40	1.40	1.5



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NUT WITH CONNECTING THREAD

■ Series 1510:

Spring preloaded double nut in housing with connecting thread without wipers

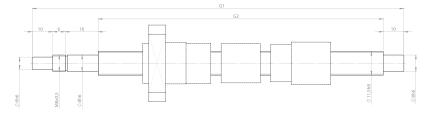
Dimensions			
Nut with connecting th	read 1510		
Nut Length L [mm]	Nut-Ø D1 [mm]	Max. Preload Fprmax [N]	Max. Axial Load Fmax [N]
40	20	15	10
40	20	30	20
40	20	50	40
40	20	50	40

Positioning ball screws 3 - 16 mm

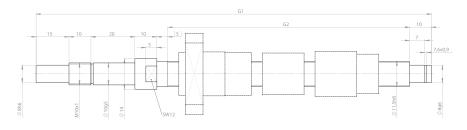
NOMINAL DIAMETER 12 mm

Ground execution with standard bearing journal P0 - P5 Series 1412, 2412, 2422, 1214, 1112

■ Shaft style A



■ Shaft style B



Screw Type A									
Stroke	Thread length G2	Overall length G1							
[mm]	[mm]	[mm]							
300	355	397							

Screw Type B									
Stroke	Thread length G2	Overall length G1							
[mm]	[mm]	[mm]							
50	110	180							
100	160	230							
150	210	280							
200	260	330							
250	310	380							
350	410	480							
450	510	580							

Nuts shown in standard orientation. Select one nut from table. Please follow the advice on page 24/25.

optistife Detailed information page 55.

Technical data								
							Nut with axial backlash	Nut backlash-free
Nut type	Lead	Nomi- nal-Ø	Circuits	Ball-Ø	Dyn. Load Ratin	Stat. Load Rating	Max. Axial Play	Max. Friction Torque Tpr0
	[mm]	[mm]		[mm]	[kN]	[kN]	[mm]	[Ncm]
1.12.0,8.3	1	12	3	0.8	1.10	2.00	0.01	3.0
2.12.1,5.3	2	12	3	1.5	2.50	3.40	0.02	3.0
3.12.2.3	3	12	3	2	3.60	4.30	0.02	3.0
4.12.2.3	4	12	3	2	3.60	4.30	0.02	3.0
5.12.2.3	5	12	3	2	3.60	4.30	0.02	3.0
5.12.2.5	5	12	5	2	5.60	7.60	0.02	3.0
10.12.2,5.4*	10	12	2 + 2 *	2.5	5.80	7.00	0.03	3.0
10.12.2,5.6*	10	12	3 + 3 *	2.5	8.50	11.00	0.03	3.0

^{*}Please specify the number of circuits

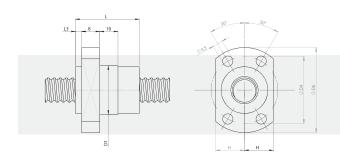
^{*}nut type 2412 / 2422 only



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FLANGE NUT

■ Series 1412 :

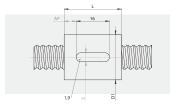
Nut with flange and standard wipers on both ends



■ Series 2412 / 2422:

Nut with flange and standard wipers on both ends

*nut type 2412 / 2422 only

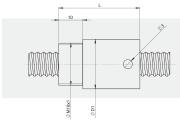




CYLINDRICAL NUT

■ Series 1214:

Cylindrical nut without wipers





NUT WITH CONNECTING THREAD

■ Series 1112:

Cylindrical nut without wipers

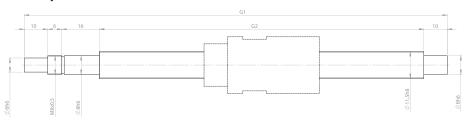
Dimensions						:	1		:	
Flange nut 14	12 / 2412 / 24	22		Cylindrical n	ut 1214		Nut with connecting thread 1112			
	Nut-Ø D1g6 [mm]			L3	Flange Flats 2xH [mm]	L	Pilot-Ø D1h6 [mm]	AP		Pilot-Ø D1 [mm]
25	20	29	37	0	24	17	19	2.5	24	20.5
30	20	29	37	0	24	19	19	1.5	29	20.5
37	22	29	37	0	24	26	19	5	36	20.5
36	22	29	37	0	24	22	19	3.5	33	22.5
39	22	29	37	0	24	26	19	5	36	22.5
33	24	32	40	8*	26					
29	24	32	40	9*	26					
39	24	32	40	9*	26					

Positioning ball screws 3 - 16 mm

NOMINAL DIAMETER 12 mm

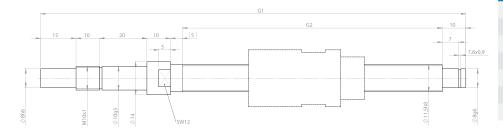
Ground execution with standard bearing journal P0 - P5 Series 1510

■ Shaft style A





■ Shaft style B



Screw Type B										
Stroke	Thread length G2	Overall length G1								
[mm]	[mm]	[mm]								
50	110	180								
100	160	230								
150	210	280								
200	260	330								
250	310	380								
350	410	480								
450	510	580								

Please follow the advice on page 24/25.

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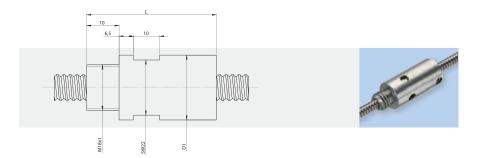
Technical data			1				
							Nut spring preloaded
Nut type	Lead [mm]	Nomi- nal-Ø [mm]	Circuits		Dyn. Load Rating [kN]	Rating	Max. Friction Torque Tpr0 [Ncm]
1.12.0,8.2	1	12	2	0.8	0.80	1.30	2.0
2.12.1,5.2	2	12	2	1.5	1.80	2.20	2.0
3.12.2.2	3	12	2	2	2.50	2.80	2.0
4.12.2.2	4	12	2	2	2.50	2.80	2.0
5.12.2.2	5	12	2	2	2.50	2.80	2.0

For engineering consultation or to place an order, please contact us by phone +49 (0) 7431 1288-0









NUT WITH CONNECTING THREAD

■ Series 1510:

Spring preloaded double nut in housing with connecting thread without wipers

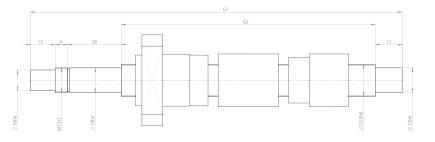
Dimensions	'							
Nut with connecting t	Nut with connecting thread 1510							
Nut Length L [mm]	Nut-Ø D1 [mm]	Max. Preload Fprmax [N]	Max. Axial Load Fmax [N]					
49	24	50	40					
49	24	80	70					
49	24	80	70					
49	24	80	70					
49	24	80	70					

Positioning ball screws 3 - 16 mm

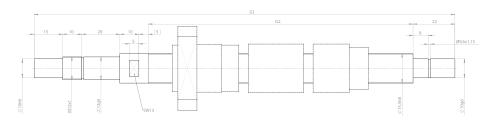
NOMINAL DIAMETER 16 mm

Ground execution with standard bearing journal P0 - P5 Series 1412, 2422, 1214, 1112

■ Shaft style A



■ Shaft style B



Screw Type A					
Stroke	Thread length	Overall length			
[mm]	G2 [mm]	G1 [mm]			
400	470	527			

Screw Type B						
Stroke [mm]	Thread length G2 [mm]	Overall length G1 [mm]				
firmi	[111111]	[iiiiii]				
50	139	221				
100	189	271				
150	239	321				
200	289	371				
300	389	471				
400	489	571				
600	689	771				
800	889	971				

Nuts shown in standard orientation. Select one nut from table. Please follow the advice on page 24/25.

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Technical data								
	Nut with axial backlash	Nut backlash-free						
Nut type	Lead [mm]	Nomi- nal-Ø [mm]	Circuits		Dyn. Load Ratin [kN]	Rating	Max. Axial Play [mm]	Max. Friction Torque Tpr0 [Ncm]
2.16.1,5.3	2	16	3	1.5	2.90	4.90	0.02	4.0
4.16.3.3	4	16	3	3	8.90	11.40	0.03	4.0
5.16.3,5.3	5	16	3	3.5	10.10	12.00	0.03	4.0
10.16.3,5.6*	10	16	3 + 3 *	3.5	19.60	27.70	0.03	4.0
10.16.3,5.10*	10	16	5 + 5 *	3.5	31.40	47.30	0.03	4.0

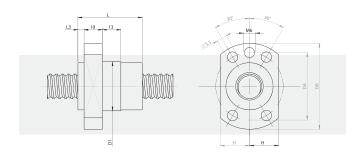
^{*}Please specify the number of circuits

^{*}nut type 2422 only











FLANGE NUT

■ Series 1412:

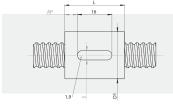
Nut with flange and standard wipers on both ends



■ Series 2422:

Nut with flange and standard wipers on both ends

*nut type 2422 only

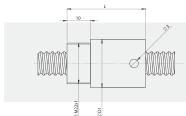




CYLINDRICAL NUT

■ Series 1214:

Cylindrical nut without wipers





NUT WITH CONNECTING THREAD

■ Series 1112:

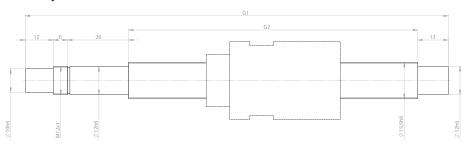
Nut with connecting thread without wipers

Dimensions				:						
Flange nut 14	12 / 2422			Cylindrical n	ut 1214	Nut with connecting thread 1112				
	Nut-Ø D1g6 [mm]	Pitch Circle-Ø D4 [mm]	Flange-Ø D6 [mm]	L3	Flange Flats 2xH [mm]	L	Pilot-Ø D1h6 [mm]	Length AP [mm]	Nut Length L [mm]	Pilot-Ø D1 [mm]
32	25	35	44	0	29	19	28	1.5	29	25.5
38	28	38	48	0	31	21	28	2.5	36	28.5
44	28	38	48	0	31	27	28	5.5	43	28.5
44	32	42	52	12*	40					
64	32	42	52	12*	40					

NOMINAL DIAMETER 16 mm

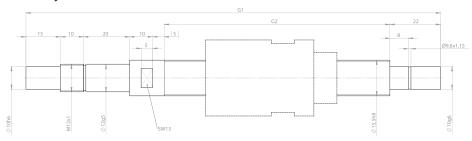
Ground execution with standard bearing journal P0 - P5 Series 1510

■ Shaft style A



Screw Type A									
Stroke	Thread length G2	Overall length G1							
[mm]	[mm]	[mm]							
400	470	527							

■ Shaft style B



Screw Type B										
Stroke	Thread length G2	Overall length G1								
[mm]	[mm]	[mm]								
50	139	221								
100	189	271								
150	239	321								
200	289	371								
300	389	471								
400	489	571								
600	689	771								
800	889	971								

Please follow the advice on page 24/25.

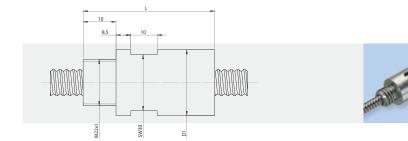
optisLife Detailed information page 55.

Technical data							
							Nut spring preloaded
Nut type	Lead [mm]	Nomi- nal-Ø [mm]	Circuits		Dyn. Load Rating [kN]	Stat. Load Rating [kN]	Max. Friction Torque Tpr0 [Ncm]
2.16.1,5.2	2	16	2	1.5	2.10	3.20	3.0
2,5.16.1,5.2	2.5	16	2	1.5	2.10	3.20	3.0
4.16.2.2	4	16	2	2	3.00	4.00	3.0
5.16.2,5.2	5	16	2	2.5	3.90	4.70	3.0









NUT WITH CONNECTING THREAD

■ Series 1510:

Spring preloaded double nut in housing with connecting thread without wipers

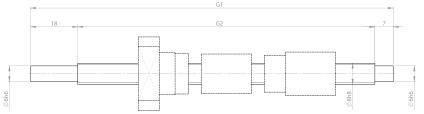
Dimensions			
Nut with connecting thr	ead 1510		
Nut Length L [mm]	Nut-Ø D1 [mm]	Max. Preload Fprmax [N]	Max. Axial Load Fmax [N]
57	33	120	100
57	33	120	100
57	33	120	100
57	33	150	130

Transport ball screws 8 - 16 mm

NOMINAL DIAMETER 8 mm

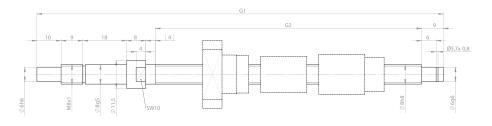
Rolled execution with standard bearing journal T5 - T10 Series 1432, 2432, 1234, 1132

■ Shaft style A



Screw	Screw Type A										
Stroke	Thread length G2	Overall length G1									
[mm]	[mm]	[mm]									
100	145	170									
200	245	270									

■ Shaft style B



Screw Type B										
Stroke	Thread length G2	Overall length G1								
[mm]	[mm]	[mm]								
40	80	138								
70	110	168								
100	140	198								
150	190	248								

Nuts shown in standard orientation. Select one nut from table. Please follow the advice on page 24/25.

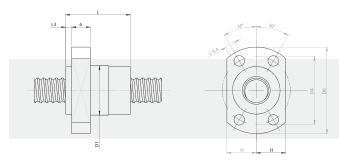
Technical data								
							Nut with axial backlash	Nut backlash-free
Nut type	Lead [mm]	Nomi- nal-Ø [mm]	Circuits	Ball-Ø [mm]	Dyn. Load Ratin [kN]	Stat. Load Rating [kN]	Max. Axial Play [mm]	Max. Friction Torque Tpr0 [Ncm]
1.8.1.3	1	8	3	1	1.20	1.50	0.01	0.5
2.8.1,5.3	2	8	3	1.5	2.00	2.10	0.02	0.5
2,5.8.1,5.3	2.5	8	3	1.5	2.00	2.10	0.02	0.5
4.8.1,5.3	4	8	3	1.5	2.00	2.10	0.02	0.5
4.8.1,5.5	4	8	5	1.5	3.00	3.50	0.02	0.5

^{*}nut type 2432 only











FLANGE NUT

■ Series 1432:

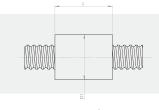
Nut with flange and standard wipers on both ends



■ Series 2432:

Nut with flange and standard wipers on both ends

*nut type 2432 only

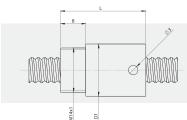




CYLINDRICAL NUT

■ Series 1234:

Cylindrical nut without wipers





NUT WITH CONNECTING THREAD

■ Series 1132:

Nut with connecting thread without wipers

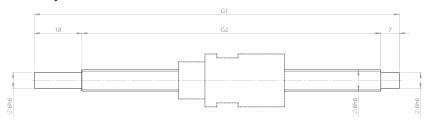
Dir	Dimensions											
Fla	ange nut 143	32 / 2432		Cylindrical nu	ıt 1234	Nut with connecting thread 1132						
Nu L [m		D1g6		D6		Flange Flats 2xH [mm]		Pilot-Ø D1h6 [mm]		Pilot-Ø D1 [mm]		
23	3	16	22	28	0	19	14	15	22	16.5		
28	3	16	22	28	0	19	19	15	27	16.5		
30)	16	22	28	0	19	21	15	29	16.5		
31	ļ	16	22	28	0	19	22	15	30	16.5		
27	7	16	22	28	6*	19						

Transport ball screws 8 - 16 mm

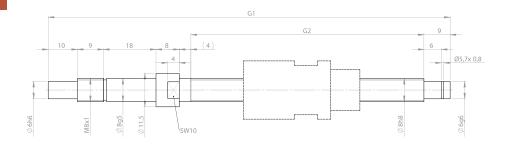
NOMINAL DIAMETER 8 mm

Rolled execution with standard bearing journal T5 - T10 Series 1530

■ Shaft style A



■ Shaft style B



Screw Type A									
Stroke	Thread length G2	Overall length G1							
[mm]	[mm]	[mm]							
100	145	170							
200	245	270							

Screw Type B										
Stroke	Thread length G2	Overall length G1								
[mm]	[mm]	[mm]								
40	80	138								
70	110	168								
100	140	198								
150	190	248								

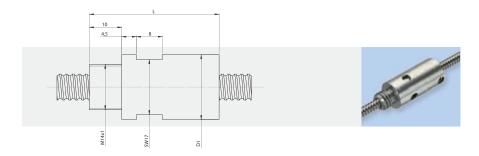
Please follow the advice on page 24/25.

Technical data							:
Nut type	Lead [mm]	Nomi- nal-Ø [mm]	Circuits	Ball-Ø	Dyn. Load Rating [KN]	Stat. Load Rating [kN]	Nut spring preloaded Max. Friction Torque Tpr0 [Ncm]
1.8.1.2	1	8	2	1	0.90	1.00	1.5
2.8.1,5.2	2	8	2	1.5	1.40	1.40	1.5
2,5.8.1,5.2	2.5	8	2	1.5	1.40	1.40	1.5









NUT WITH CONNECTING THREAD

■ Series 1530:

Spring preloaded double nut in housing with connecting thread without wipers

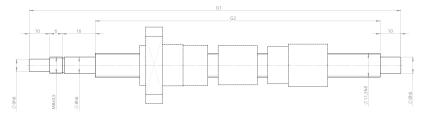
Nut with connecting thread 1530 Max. Preload Fprmax [N] Max. Axial Load Fmax [N] Nut-Ø D1 Nut Length [mm] [mm] 40 20 30 20 40 20 50 40 40 20 50 40

Transport ball screws 8 - 16 mm

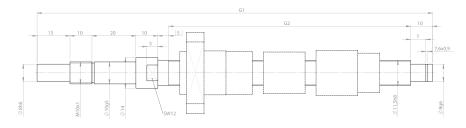
NOMINAL DIAMETER 12 mm

Rolled execution with standard bearing journal T5 - T10 Series 1432, 2432, 2442, 1234, 1132

■ Shaft style A



■ Shaft style B



Screw Type A										
Stroke	Thread length G2	Overall length G1								
[mm]	[mm]	[mm]								
300	355	397								

Screw Type B									
Stroke	Thread length G2	Overall length G1							
[mm]	[mm]	[mm]							
50	110	180							
100	160	230							
150	210	280							
200	260	330							
250	310	380							
350	410	480							
450	510	580							

Nuts shown in standard orientation. Select one nut from table. Please follow the advice on page 24/25.

Technical data			1					'
							Nut with axial backlash	Nut backlash-free
Nut type	Lead [mm]	Nomi- nal-Ø [mm]	Circuits	Ball-Ø [mm]	Dyn. Load Ratin [kN]	Stat. Load Rating [kN]	Max. Axial Play [mm]	Max. Friction Torque Tpr0 [Ncm]
1.12.1.3	1	12	3	1	1.50	2.40	0.01	1.0
2.12.1,5.3	2	12	3	1.5	2.50	3.40	0.02	1.0
3.12.2.3	3	12	3	2	3.60	4.30	0.02	1.0
4.12.2.3	4	12	3	2	3.60	4.30	0.02	1.0
5.12.2.3	5	12	3	2	3.60	4.30	0.02	1.0
5.12.2.5	5	12	5	2	5.60	7.60	0.02	1.0
10.12.2,5.4*	10	12	2 + 2 *	2.5	5.80	7.00	0.03	1.0
10.12.2,5.6*	10	12	3 + 3 *	2.5	8.50	10.90	0.03	1.0

^{*}Please specify the number of circuits

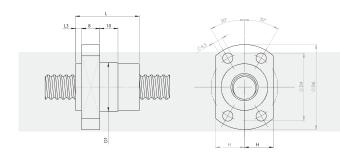
^{*}nut type 2432 / 2442 only



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FLANGE NUT

■ Series 1432:

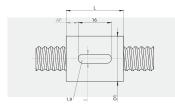
Nut with flange and standard wipers on both ends



■ Series 2432 / 2442:

Nut with flange and standard wipers on both ends

*nut type 2432 / 2442 only

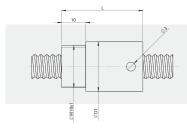




CYLINDRICAL NUT

■ Series 1234:

Cylindrical nut without wipers





NUT WITH CONNECTING THREAD

■ Series 1132:

Nut with connecting thread without wipers

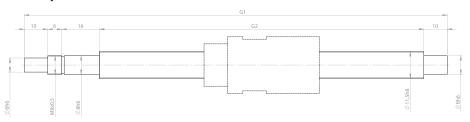
Dimensions						:				
Flange nut 1	432 / 2432 / 24	42		Cylindrical r	nut 1234	Nut with connecting thread 1132				
Nut Length L [mm]	Nut-Ø D1g6 [mm]	Pitch Circle-Ø D4 [mm]	Flange-Ø D6 [mm]	Length L3 [mm]	Flange Flats 2xH [mm]	Nut Length L [mm]	Pilot-Ø D1h6 [mm]	Length AP [mm]	Nut Length L [mm]	Pilot-Ø D1 [mm]
25	20	29	37	0	24	17	19	2.5	24	20.5
30	20	29	37	0	24	19	19	1.5	29	20.5
37	22	29	37	0	24	26	19	5	36	20.5
36	22	29	37	0	24	22	19	3.5	33	22.5
39	22	29	37	0	24	26	19	5	36	22.5
33	24	32	40	8*	26					
29	24	32	40	9*	26					
39	24	32	40	9*	26					

Transport ball screws 8 - 16 mm

NOMINAL DIAMETER 12 mm

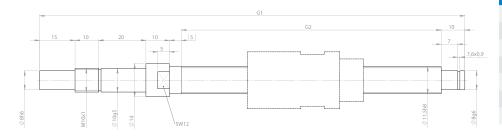
Rolled execution with standard bearing journal T5 - T10 Series 1530

■ Shaft style A



Screw Type A										
Stroke	Thread length G2	Overall length G1								
[mm]	[mm]	[mm]								
300	355	397								

■ Shaft style B



Screw	Screw Type B										
Stroke	Thread length G2	Overall length G1									
[mm]	[mm]	[mm]									
50	110	180									
100	160	230									
150	210	280									
200	260	330									
250	310	380									
350	410	480									
450	510	580									

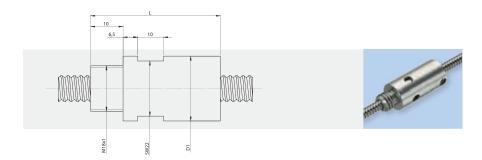
Please follow the advice on page 24/25.

Technical data			1				:
							Nut spring preloaded
Nut type	Lead [mm]	Nomi- nal-Ø [mm]	Circuits		Dyn. Load Rating [kN]	Stat. Load Rating [kN]	Max. Friction Torque Tpr0 [Ncm]
1.12.1.2	1	12	2	1	1.10	1.60	2.0
2.12.1,5.2	2	12	2	1.5	1.80	2.20	2.0
3.12.2.2	3	12	2	2	2.50	2.80	2.0
4.12.2.2	4	12	2	2	2.50	2.80	2.0
5.12.2.2	5	12	2	2	2.50	2.80	2.0





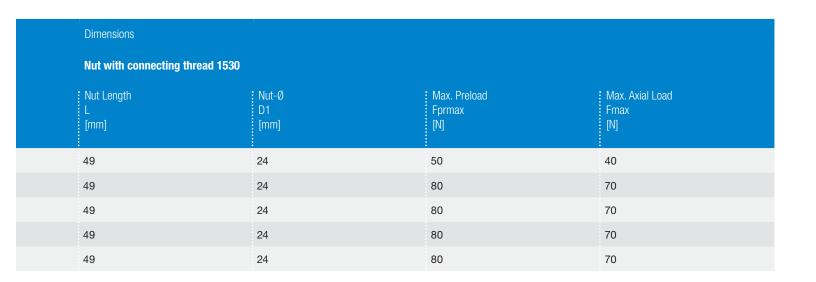




NUT WITH CONNECTING THREAD

■ Series 1530:

Spring preloaded double nut in housing with connecting thread without wipers

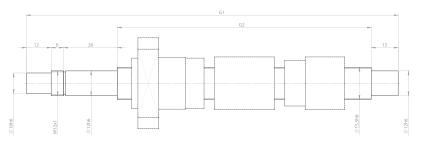


Transport ball screws 8 - 16 mm

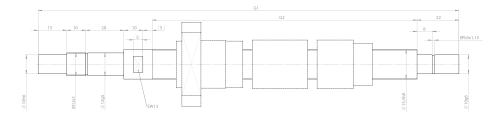
NOMINAL DIAMETER 16 mm

Rolled execution with standard bearing journal T5 - T10 Series 1432, 2442, 1234, 1132

■ Shaft style A



■ Shaft style B



S	Screw Type A										
St	roke	Thread length G2	Overall length G1								
[r	nm]	[mm]	[mm]								
4	00	470	527								

Screw Type B									
Stroke [mm]	Thread length G2 [mm]	Overall length G1 [mm]							
50	139	221							
100	189	271							
150	239	321							
200	289	371							
300	389	471							
400	489	571							
600	689	771							
800	889	971							

Nuts shown in standard orientation. Select one nut from table. Please follow the advice on page 24/25.

Technical data								
							Nut with axial backlash	Nut backlash-free
Nut type	Lead [mm]	Nomi- nal-Ø [mm]	Circuits	Ball-Ø [mm]	Dyn. Load Ratin [kN]	Stat. Load Rating [kN]	Max. Axial Play [mm]	Max. Friction Torque Tpr0 [Ncm]
2.16.1,5.3	2	16	3	1.5	2.90	4.90	0.02	1.4
4.16.3.3	4	16	3	3	8.90	11.40	0.03	1.4
5.16.3,5.3	5	16	3	3.5	10.10	12.00	0.03	1.4
10.16.3,5.6*	10	16	3 + 3 *	3.5	19.60	27.70	0.03	1.4
10.16.3,5.10*	10	16	5 + 5 *	3.5	31.40	47.80	0.03	1.4

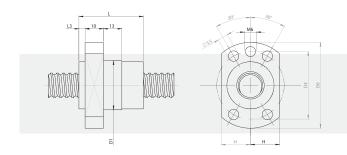
^{*}Please specify the number of circuits

^{*}nut type 2442 only











FLANGE NUT

■ Series 1432:

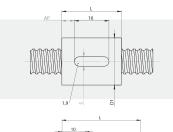
Nut with flange and standard wipers on both ends



■ Series 2442:

Nut with flange and standard wipers on both ends

*nut type 2442 only

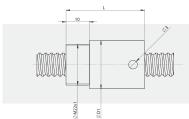




CYLINDRICAL NUT

■ Series 1234:

Cylindrical nut without wipers





NUT WITH CONNECTING THREAD

■ Series 1132:

Nut with connecting thread without wipers

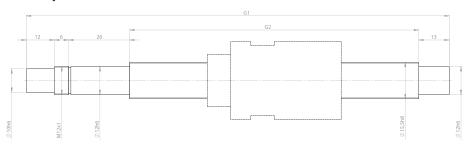
'	Dimensions				;						
	Flange nut 14	32 / 2442		Cylindrical n	ut 1234	Nut with connecting thread 1132					
		Nut-Ø D1g6 [mm]	Circle-Ø D4	D6	L3	Flange Flats 2xH [mm]	Nut Length L [mm]	Pilot-Ø D1h6 [mm]	Length AP [mm]	Nut Length L [mm]	Pilot-Ø D1 [mm]
	32	25	35	44	0	29	19	28	1.5	29	25.5
	38	28	38	48	0	31	21	28	2.5	36	28.5
	44	28	38	48	0	31	27	28	5.5	43	28.5
	44	32	42	52	12*	40					
	64	32	42	52	12*	40					

Transport-Kugelgewindetriebe 8 - 16 mm

NOMINAL DIAMETER 16 mm

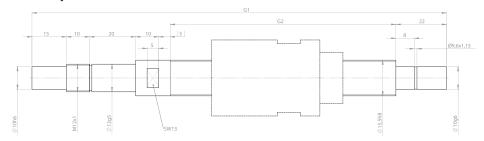
Rolled execution with standard bearing journal T5 - T10 Series 1530

■ Shaft style A



Screw Type A										
Stroke	Thread length G2	Overall length G1								
[mm]	[mm]	[mm]								
400	470	527								

■ Shaft style B



Screw	Туре В	
Stroke	Thread length G2	Overall length G1
[mm]	[mm]	[mm]
50	139	221
100	189	271
150	239	321
200	289	371
300	389	471
400	489	571
600	689	771
800	889	971

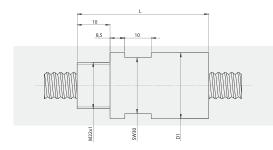
Please follow the advice on page 24/25.

Technical data							:
							Nut spring preloaded
Nut type		Nomi- nal-Ø [mm]	Circuits		Rating	Rating	Max. Friction Torque Tpr0 [Ncm]
4.16.2.2	4	16	2	2	3.00	4.00	3.0
5.16.2,5.2	5	16	2	2.5	3.90	4.70	3.0







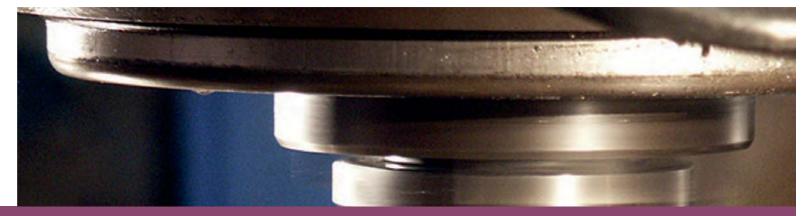




NUT WITH CONNECTING THREAD

■ Series 1530:

Spring preloaded double nut in housing with connecting thread without wipers



Large Ball Screws Diameter 16 - 125 mm







BALL SCREWS 16 - 125 MM FOR INDUSTRIAL APPLICATIONS

New technology in the precision range.



Steinmeyer offers in the precision range the optimized technology Xi-Plus, with significant advantages in smooth, quiet operation.

Through the use of innovative production technologies, the roughness of the raceway surface of the spindles can be reduced and therefore performance is optimized. By eliminating microscopic irregularities on the raceway surface of the spindle thread, vibrations and restless running characteristics are virtually eliminated.

This results in a lower noise level and smoother running when installed in the machine. Through studies on in-house test beds, a reduction in torque variation of up to 40% can be demonstrated, which significantly improves the running characteristics. By FFT analysis (Fast Fourier Transformation) of this signal, improvements in the noise of ball screws can also be shown.

The improved properties of the Xi-Plus technology enable greater energy efficiency and a longer service life of the ball screw.

Selection of suitable nut

In this section you will find nuts with connecting dimensions according to DIN 69051 or ISO 3408. All sizes can be selected with various flange shapes (round, single flat, and double flat) and different load capacities.



Most models are available as a single nut with 4-point contact, as a double nut, or as a double nut with ETA+ execution. The specifications and dimensions of the ETA+ version can be found in the descriptions of the double nuts.

Nuts of ETA+ ball screws are often shorter than conventional double nuts, have lower friction, and have improved durability with excellent rigidity. The technical data are presented in the following tables.

Due to the great success of ETA+ some sizes are no longer produced in conventional designs.

Please contact us with your applications to find the possibilities with **Xi-Plus** and **EIR**. We will gladly provide a quotation.

Ball screws are available only according to customer-provided drawings. To receive a formal quotation, please send us a drawing that defines the spindle shaft exactly. For budgetary pricing and lead times, a sketch is sufficient.

For more information please visit: www.steinmeyer.com

NOMINAL DIAMETER 16 - 20 mm

Single nut, 4-point contact Execution grade P0 – P5



■ Series 1416: DIN standard flanged nut, ball oversize preload



■ Series 2426: End cap nut with flange, dual start, ball oversize preload



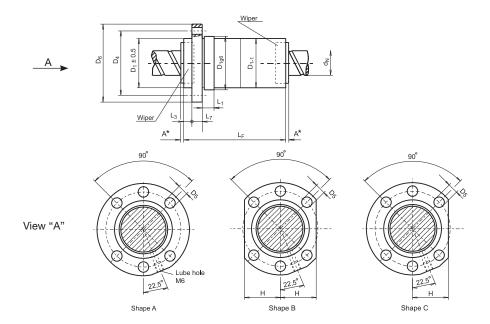
	Technical data							
	Nut type	Lead P [mm]	Nominal diameter d _N [mm]	No. of circuits i	Ball diameter d _W [mm]	Dyn. load rating C _a [kN]	Stat. load rating C _{0a} [kN]	Stiffness* R _{nu, ar} [N/µm]
1416	2.16.1,5.3	2	16	3	1.5	2.9	4.9	160
	2.16.1,5.4	2	16	4	1.5	3.8	6.5	210
	4.16.3.3	4	16	3	3.0	8.9	11.4	170
	4.16.3.4	4	16	4	3.0	11.4	15.2	220
	5.16.3,5.3	5	16	3	3.5	10.1	12.0	150
	5.16.3,5.4	5	16	4	3.5	12.9	16.0	200
2426	10.16.3,5.6	10	16	3 + 3	3.5	19.6	27.4	270
	10.16.3,5.8	10	16	4 + 4	3.5	25.6	37.7	360
	10.16.3,5.10	10	16	5 + 5	3.5	31.4	47.8	450
1416	2.20.1,5.3	2	20	3	1.5	3.2	6.2	190
	2.20.1,5.4	2	20	4	1.5	4.1	8.2	250
	2.20.1,5.5	2	20	5	1.5	5.0	10.3	310
	4.20.3.3	4	20	3	3.0	10.1	14.9	220
	4.20.3.4	4	20	4	3.0	13.0	19.9	290
	5.20.3,5.3	5	20	3	3.5	12.1	16.7	210
	5.20.3,5.4	5	20	4	3.5	15.5	22.3	270
2426	10.20.3,5.6	10	20	3 + 3	3.5	22.8	36.5	390
	10.20.3,5.10	10	20	5 + 5	3.5	36.4	63.0	630
	20.20.3,5.4	20	20	2 + 2	3.5	14.7	22.4	140
	20.20.3,5.6	20	20	3 + 3	3.5	21.7	35.2	220

 $^{^{\}star}$ Actual stiffness at preload equal to 0.08 x $\mathrm{C_{a}}$

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	Dimensions Flanged nut	Dimensions Flanged nut with wipers both ends													
	L _F [mm]	D ₁ g6 [mm]	L ₁ [mm]	D ₄ [mm]	D ₅ [mm]	D ₆ [mm]	L ₇ [mm]	L ₃ [mm]	H [mm]	A [mm]	LA* [mm]				
1416	39 43	28 28	10 10	38 38	5.5 5.5	48 48	10 10	6 6	20 20	0 0	9				
	49 53	28 28	10 10	38 38	5.5 5.5	48 48	10 10	6	20 20	0	9				
	54 59	28 28	10 10	38 38	5.5 5.5	48 48	10 10	6 6	20 20	0	9				
2426	44 54 64	32 32 32	16 16 16	42 42 42	5.5 5.5 5.5	52 52 52	10 10 10	12 12 12	20 20 20	0 0 0	- - -				
1416	48 52 56	36 36 36	10 10 10	47 47 47	6.6 6.6 6.6	58 58 58	10 10 10	6 6 6	22 22 22	0 0 0	9 9 9				
	49 53	36 36	10 10	47 47	6.6 6.6	58 58	10 10	6	22 22	0	9				
	55 60	36 36	10 10	47 47	6.6 6.6	58 58	10 10	6 6	22 22	0	9				
2426	49 69	36 36	16 16	47 47	6.6 6.6	58 58	10 10	7 7	22 22	0	-				
	57 77	36 36	16 16	47 47	6.6 6.6	58 58	10 10	7 7	22 22	0	-				

LA *: Additional nut length at each end when using combination wipers

NOMINAL DIAMETER 25 mm

Single nut, 4-point contact Execution grade P0 – P5



■ Series 1416: DIN standard flanged nut, ball oversize preload



■ Series 2426: End cap nut with flange, dual start, ball oversize preload



'	Technical data	1		1			ı	
	Nut type	Lead P [mm]	Nominal diameter d _N [mm]	No. of circuits i	Ball diameter d _W [mm]	Dyn. load rating C _a [kN]	Stat. load rating C _{0a} [kN]	Stiffness* R _{nu, ar} [N/µm]
1416	2.25.1,5.3	2	25	3	1.5	3.5	7.8	220
	2.25.1,5.4	2	25	4	1.5	4.5	10.4	290
	2.25.1,5.5	2	25	5	1.5	5.5	13.0	370
	4.25.3.3	4	25	3	3.0	11.4	19.3	270
	4.25.3.4	4	25	4	3.0	14.6	25.7	360
	5.25.3,5.3	5	25	3	3.5	13.7	21.5	260
	5.25.3,5.4	5	25	4	3.5	17.5	28.7	350
	5.25.3,5.5	5	25	5	3.5	21.2	35.9	430
2426	10.25.3,5.6	10	25	3 + 3	3.5	25.2	45.4	500
	10.25.3,5.10	10	25	5 + 5	3.5	40.3	78.4	830
	15.25.3,5.4	15	25	2 + 2	3.5	16.8	28.6	270
	15.25.3,5.6	15	25	3 + 3	3.5	24.9	45.0	410
	20.25.3,5.4	20	25	2 + 2	3.5	17.1	29.5	230
	20.25.3,5.6	20	25	3 + 3	3.5	25.2	46.4	340
	25.25.3,5.4	25	25	2 + 2	3.5	16.7	29.0	180

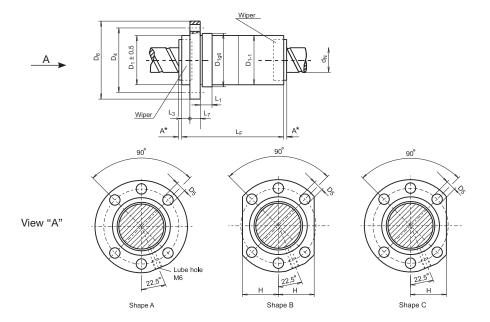
^{*} Actual stiffness at preload equal to 0.08 x Ca

For engineering consultation or to place an order, please contact us by phone +49 (0) 7431 1288-0

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		Dimensions Flanged nut with wipers both ends													
	L _F [mm]	D ₁ g6 [mm]	L ₁ [mm]	D ₄ [mm]	D ₅ [mm]	D ₆ [mm]	L ₇ [mm]	L ₃ [mm]	H [mm]	A [mm]	LA * [mm]				
1416	43 51 55	40 40 40	10 10 10	51 51 51	6.6 6.6 6.6	62 62 62	10 10 10	6 6 6	24 24 24	0 0 0	9 9 9				
	49 53	40 40	10 10	51 51	6.6 6.6	62 62	10 10	6 6	24 24	0	9				
	55 60 66	40 40 40	10 10 10	51 51 51	6.6 6.6 6.6	62 62 62	10 10 10	6 6 6	24 24 24	0 0 0	9 9 9				
2426	49 69	40 40	16 16	51 51	6.6 6.6	62 62	10 10	7 7	24 24	0	-				
	48 63	40 40	16 16	51 51	6.6 6.6	62 62	10 10	7 7	24 24	0	-				
	57 77	40 40	16 16	51 51	6.6 6.6	62 62	10 10	7 7	24 24	0					
	66	40	16	51	6.6	62	10	7	24	0	-				

LA *: Additional nut length at each end when using combination wipers

NOMINAL DIAMETER 32 mm

Single nut, 4-point contact Execution grade P0 – P5



■ Series 1416: DIN standard flanged nut, ball oversize preload



UltraSpeed nut with flange, dual start,

■ Series 3426:

ball oversize preload



■ Series 3416: UltraSpeed nut with flange, single start, ball oversize preload

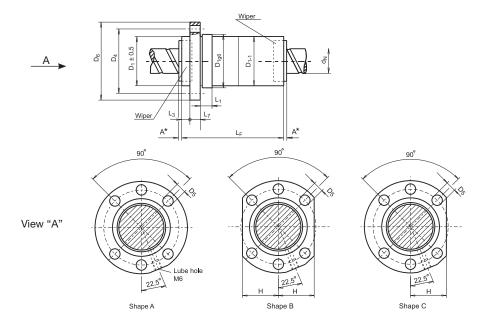


	Technical data			1			l	
	Nut type	Lead P [mm]	Nominal diameter d _N [mm]	No. of circuits i	Ball diameter d _W [mm]	Dyn. load rating C _a [kN]	Stat. load rating C _{0a} [kN]	Stiffness* R _{nu, ar} [N/µm]
1416	4.32.3.3	4	32	3	3.0	13.1	26.3	350
	4.32.3.4	4	32	4	3.0	16.8	35.0	460
	5.32.3,5.3	5	32	3	3.5	16.0	29.8	350
	5.32.3,5.4	5	32	4	3.5	20.4	39.8	460
	5.32.3,5.5	5	32	5	3.5	24.8	49.7	570
	5.32.3,5.6	5	32	6	3.5	29.0	59.0	680
	6.32.4.3	6	32	3	4.0	18.7	32.7	340
	6.32.4.4	6	32	4	4.0	24.0	43.7	450
	8.32.5.3	8	32	3	5.0	24.6	39.0	320
	8.32.5.4	8	32	4	5.0	31.5	52.0	420
	10.32.6.3	10	32	3	6.0	30.8	45.6	300
	10.32.6.4	10	32	4	6.0	39.4	60.8	400
	10.32.6.5	10	32	5	6.0	47.8	76.0	490
	12.32.5.3	12	32	3	5.0	24.5	38.8	280
	15.32.6.3	15	32	3	6.0	30.5	45.3	250
	20.32.6.3	20	32	3	6.0	30.2	44.9	200
3416	15.32.6.3	15	32	3	6.0	28.5	43.1	270
	15.32.6.4	15	32	4	6.0	38.1	60.4	360
	15.32.6.5	15	32	5	6.0	47.3	77.7	450
3426	20.32.6.4	20	32	2 + 2	6.0	39.3	63.6	360
	20.32.6.6	20	32	3 + 3	6.0	57.9	100.0	530
	20.32.6.8	20	32	4 + 4	6.0	75.6	136.4	710
	25.32.6.4	25	32	2 + 2	6.0	38.7	63.0	300
	30.32.6.4	30	32	2 + 2	6.0	38.1	62.2	250

^{*} Actual stiffness at preload equal to 0.08 x Ca







	Dimensions Flanged nut	with wipers	both ends		1						
	L _F [mm]	D ₁ g6 [mm]	L ₁ [mm]	D ₄ [mm]	D ₅ [mm]	D ₆ [mm]	L ₇ [mm]	L ₃ [mm]	H [mm]	A [mm]	LA* [mm]
1416	51 55	50 50	10 10	65 65	9 9	80 80	12 12	6 6	31.0 31.0	0 0	9 9
	57 62 67 73	50 50 50 50	10 10 10 10	65 65 65 65	9 9 9	80 80 80 80	12 12 12 12	6 6 6	31.0 31.0 31.0 31.0	0 0 0 0	9 9 9 9
	61 68	50 50	10 10	65 65	9	80 80	12 12	6	31.0 31.0	0 0	9
	72 84	50 50	16 16	65 65	9 9	80 80	12 12	7 7	31.0 31.0	0	12 12
	84 95 107	50 50 50	16 16 16	65 65 65	9 9 9	80 80 80	12 12 12	7 7 7	31.0 31.0 31.0	0 0 0	12 12 12
	88	50	16	65	9	80	12	7	31.0	0	12
	101	50	16	65	9	80	12	7	32.5	0	12
3416	122 74 106 104	50 56 56 56	20 20 20 20	71 71 71 71	9 9 9 9	80 86 86 86	14 14 14 14	7 7 7 7	32.5 32.5 32.5 32.5	0 0 0 0	12 12 12 12
3426	68 88 108	56 56 56	20 20 20	71 71 71	9 9 9	86 86 86	14 14 14	7 7 7	32.5 32.5 32.5	0 0 0	12 12 12
	78 88	56 56	20 20	71 71	9	86 86	14 14	7	32.5 32.5	5 5	22 22

LA *: Additional nut length at each end when using combination wipers

NOMINAL DIAMETER 40 mm

Single nut, 4-point contact Execution grade P0 – P5



■ Series 1416: DIN standard flanged nut, ball oversize preload



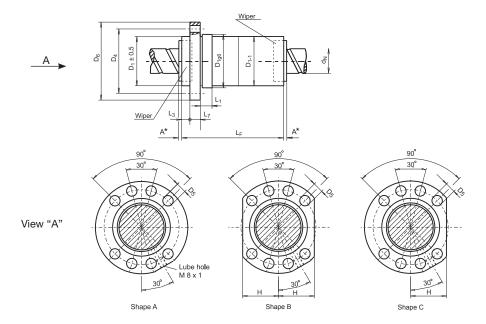
■ Series 3416: UltraSpeed nut with flange, single start, ball oversize preload



	Technical data	l .						
	Nut type	Lead P [mm]	Nominal diameter d _N [mm]	No. of circuits i	Ball diameter d _W [mm]	Dyn. load rating C _a [kN]	Stat. load rating C _{0a} [kN]	Stiffness* R _{nu, ar} [N/µm]
1416	5.40.3,5.3	5	40	3	3.5	17.7	38.2	430
	5.40.3,5.4	5	40	4	3.5	22.7	50.9	570
	5.40.3,5.5	5	40	5	3.5	27.5	63.6	700
	5.40.3,5.6	5	40	6	3.5	32.1	76.4	840
	6.40.4.4	6	40	4	4.0	26.7	56.1	560
	6.40.4.6	6	40	6	4.0	37.9	84.2	820
	8.40.5.4	8	40	4	5.0	35.8	68.2	540
	8.40.5.6	8	40	6	5.0	50.7	102.3	800
	10.40.7,5.3	10	40	3	7.5	46.1	71.3	390
	10.40.7,5.4	10	40	4	7.5	59.0	95.1	520
	10.40.7,5.5	10	40	5	7.5	71.5	118.9	650
	10.40.7,5.6	10	40	6	7.5	83.7	142.7	770
	12.40.7,5.4	12	40	4	7.5	58.9	95.0	500
	15.40.7,5.3	15	40	3	7.5	45.9	71.1	350
	15.40.7,5.4	15	40	4	7.5	58.7	94.8	460
	16.40.7,5.5	16	40	5	7.5	71.1	118.3	550
	20.40.7,5.3	20	40	3	7.5	45.5	70.7	300
	20.40.7,5.4	20	40	4	7.5	58.3	94.2	390
3416	10.40.7,5.3 N	10	40	3	7.5	43.1	67.9	420
	10.40.7,5.4 N	10	40	4	7.5	57.5	95.1	560
	10.40.7,5.5 N	10	40	5	7.5	71.4	122.3	700
	10.40.7,5.6 N	10	40	6	7.5	84.9	149.5	840
	12.40.7,5.4 N	12	40	4	7.5	57.4	95.0	530
	15.40.7,5.3 N	15	40	3	7.5	42.9	67.7	370
	15.40.7,5.4 N	15	40	4	7.5	57.2	94.8	490
	15.40.7,5.5 N	15	40	5	7.5	71.1	121.8	620
	15.40.7,5.6 N	15	40	6	7.5	84.4	148.9	740







	Dimensions Flanged nut	Dimensions Flanged nut with wipers both ends												
	L _f [mm]	D ₁ g6 [mm]	L ₁ [mm]	D ₄ [mm]	D ₅ [mm]	D ₆ [mm]	L ₇ [mm]	L ₃ [mm]	H [mm]	A [mm]	LA* [mm]			
1416	59 64 69 75	63 63 63 63	10 10 10 10	78 78 78 78	9 9 9 9	93 93 93 93	14 14 14 14	6 6 6	35 35 35 35	0 0 0 0	9 9 9			
	70 85	63 63	10 10	78 78	9 9	93 93	14 14	6 6	35 35	0 0	9 9			
	86 104	63 63	16 16	78 78	9 9	93 93	14 14	7 7	35 35	0	12 12			
	86 97 110 122	63 63 63 63	16 16 16 16	78 78 78 78	9 9 9 9	93 93 93 93	14 14 14 14	7 7 7 7	35 35 35 35	0 0 0	12 12 12 12			
	105	63	16	78	9	93	14	7	35	0	12			
	104 121	63 63	16 16	78 78	9 9	93 93	14 14	7 7	35 35	0	12 12			
	144	63	16	78	9	93	14	7	35	0	12			
	121 142	63 63	16 16	78 78	9 9	93 93	14 14	7 7	35 35	0	12 12			
3416	62 72 82 92	70 70 70 70	25 25 25 25	85 85 85 85	9 9 9	100 100 100 100	14 14 14 14	7 7 7 7	37.5 37.5 37.5 37.5	0 0 0	12 12 12 12			
	81	70	25	85	9	100	14	7	37.5	0	12			
	76 91 106 121	70 70 70 70	25 25 25 25 25	85 85 85 85	9 9 9 9	100 100 100 100	14 14 14 14	7 7 7 7	37.5 37.5 37.5 37.5	0 0 0	12 12 12 12			

NOMINAL DIAMETER 40 mm

Single nut, 4-point contact Execution grade P0 – P5



■ Series 3426: UltraSpeed nut with flange, dual start, ball oversize preload

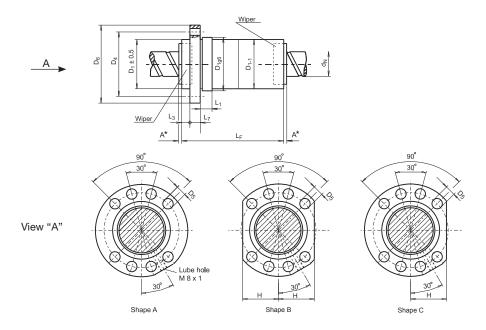


	Technical data							
	Nut type	Lead P [mm]	Nominal diameter d _N [mm]	No. of circuits i	Ball diameter d _W [mm]	Dyn. load rating C _a [kN]	Stat. load rating C _{0a} [kN]	Stiffness* R _{nu, ar} [N/µm]
3426	20.40.6.4	20	40	2 + 2	6.0	44.0	80.4	490
	20.40.6.6	20	40	3 + 3	6.0	64.9	126.3	730
	20.40.6.8	20	40	4 + 4	6.0	84.7	172.2	960
	20.40.7,5.6 N	20	40	3 + 3	7.5	83.8	148.1	710
	20.40.7,5.8 N	20	40	4 + 4	7.5	109.5	201.9	940
	25.40.6.4 25.40.6.6 25.40.6.8 25.40.7,5.6 N 25.40.7,5.8 N	25 25 25 25 25 25	40 40 40 40 40	2 + 2 3 + 3 4 + 4 3 + 3 4 + 4	6.0 6.0 6.0 7.5 7.5	43.6 64.3 84.0 86.5 113.0	79.8 125.4 171.0 156.3 213.1	430 630 840 650 870
	30.40.6.6	30	40	3 + 3	6.0	63.6	124.4	550
	30.40.6.8	30	40	4 + 4	6.0	83.1	169.6	730
	30.40.7,5.6 N	30	40	3 + 3	7.5	85.6	155.0	570
	30.40.7,5.8 N	30	40	4 + 4	7.5	111.8	211.3	750
	40.40.6.4	40	40	2 + 2	6.0	42.0	77.5	270
	40.40.6.6	40	40	3 + 3	6.0	61.9	121.9	410
	40.40.7,5.4 N	40	40	2 + 2	7.5	56.5	96.6	280

 $^{^{\}star}$ Actual stiffness at preload equal to 0.08 x $\rm C_a$ N: Alternate sizes acc. to DIN 69051







	Dimensions Flanged nu	Dimensions Flanged nut with wipers both ends													
	L _F [mm]	D ₁ g6 [mm]	L ₁ [mm]	D ₄ [mm]	D ₅ [mm]	D ₆ [mm]	L ₇ [mm]	L ₃ [mm]	H [mm]	A [mm]	LA * [mm]				
3426	69 89 109 90 110	63 63 63 70 70	20 20 20 25 25	78 78 78 85 85	9 9 9 9	93 93 93 100 100	14 14 14 14 14	7 7 7 7 7	35 35 35 37.5 37.5	0 0 0 0	12 12 12 12 12				
	90 107 132 104 129	63 63 63 70 70	20 20 20 25 25	78 78 78 85 85	9 9 9 9	93 93 93 100 100	14 14 14 14 14	7 7 7 7 7	35 35 35 37.5 37.5	5 5 5 5 5	22 22 22 22 22				
	121 151 119 149	63 63 70 70	20 20 25 25	78 78 85 85	9 9 9	93 93 100 100	14 14 14 14	7 7 7 7	35 35 37.5 37.5	5 5 5 5	22 22 22 22				
	108 148 107	63 63 70	20 20 25	78 78 85	9 9 9	93 93 100	14 14 14	7 7 7	35 35 37.5	5 5 5	22 22 22				

LA *: Additional nut length at each end when using combination wipers

NOMINAL DIAMETER 50 mm

Single nut, 4-point contact Execution grade P0 – P5



■ Series 1416: DIN standard flanged nut, ball oversize preload



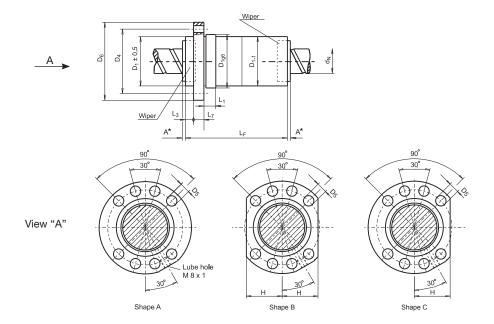
■ Series 3426: UltraSpeed nut with flange, dual start, ball oversize preload

Xi-Plus Detailed information page 89.

	Technical data	ı		ı				
	Nut type	Lead P [mm]	Nominal diameter d _N [mm]	No. of circuits i	Ball diameter d _w [mm]	Dyn. load rating C _a [kN]	Stat. load rating C _{0a} [kN]	Stiffness* R _{nu, ar} [N/µm]
1416	5.50.3,5.3	5	50	3	3.5	19.6	48.9	520
	5.50.3,5.4	5	50	4	3.5	25.1	65.2	680
	5.50.3,5.5	5	50	5	3.5	30.4	81.5	850
	5.50.3,5.6	5	50	6	3.5	35.6	97.8	1010
	10.50.7,5.3	10	50	3	7.5	52.7	93.2	510
	10.50.7,5.4	10	50	4	7.5	67.4	124.3	670
	10.50.7,5.5	10	50	5	7.5	81.7	155.4	830
	10.50.7,5.6	10	50	6	7.5	95.6	186.5	990
	15.50.7,5.3	15	50	3	7.5	52.5	93.0	470
	15.50.7,5.4	15	50	4	7.5	67.2	124.0	610
	15.50.7,5.5	15	50	5	7.5	81.4	155.0	760
	15.50.9.3 N	15	50	3	9.0	77.2	130.4	520
	15.50.9.4 N	15	50	4	9.0	98.8	173.9	690
	15.50.9.5 N	15	50	5	9.0	119.7	217.4	850
	20.50.9.3	20	50	3	9.0	76.8	130.0	470
	20.50.9.3 N	20	50	3	9.0	76.8	130.0	470
	20.50.9.4	20	50	4	9.0	98.4	173.3	620
	20.50.9.4 N	20	50	4	9.0	98.4	173.3	620
3426	20.50.7,5.6 N	20	50	3 + 3	7.5	97.5	198.2	980
	20.50.7,5.8 N	20	50	4 + 4	7.5	127.3	270.3	1300
	25.50.6.6	25	50	3 + 3	6	71.4	158.2	860
	25.50.6.8	25	50	4 + 4	6	93.3	215.7	1140
	25.50.7,5.8 N	25	50	4 + 4	7.5	126.6	269.1	1180
	30.50.6.6	30	50	3 + 3	6.0	70.9	157.3	780
	30.50.6.8	30	50	4 + 4	6.0	92.6	214.6	1030
	30.50.7,5.6 N	30	50	3 + 3	7.5	96.3	196.3	800
	30.50.7,5.8 N	30	50	4 + 4	7.5	125.7	267.6	1060
	35.50.7,5.6 N	35	50	3 + 3	7.5	95.5	195.0	720
	35.50.7,5.8 N	35	50	4 + 4	7.5	124.7	265.9	950
	40.50.6.6	40	50	3 + 3	6	71.5	161.2	640
	40.50.7,5.6 N	40	50	3 + 3	7.5	94.6	193.6	640







	Dimensions Flanged nut	t with wipers	both ends		I			1			
	L _F	D ₁ g6	L ₁	D ₄	D ₅	D ₆	L ₇	L ₃	H	A	LA *
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
1416	61 66 71 76	75 75 75 75	10 10 10 10	93 93 93 93	11 11 11 11	110 110 110 110	16 16 16 16	6 6 6	42.5 42.5 42.5 42.5	0 0 0 0	9 9 9 9
	88	75	16	93	11	110	16	7	42.5	0	12
	99	75	16	93	11	110	16	7	42.5	0	12
	111	75	16	93	11	110	16	7	42.5	0	12
	124	75	16	93	11	110	16	7	42.5	0	12
	107	75	16	93	11	110	16	7	42.5	0	12
	124	75	16	93	11	110	16	7	42.5	0	12
	142	75	16	93	11	110	16	7	42.5	0	12
	112	82	25	100	11	118	16	7	46.0	0	12
	129	82	25	100	11	118	16	7	46.0	0	12
	147	82	25	100	11	118	16	7	46.0	0	12
	129	75	16	93	11	110	16	7	42.5	0	12
	129	82	25	100	11	118	16	7	46.0	0	12
	150	75	16	93	11	110	16	7	42.5	0	12
	150	82	25	100	11	118	16	7	46.0	0	12
3426	91 111	82 82	25 25	100 100	11 11	118 118	16 16	7 7	46.0 46.0	0	12 12
	109	75	16	93	11	110	16	7	42.5	5	22
	128	75	16	93	11	110	16	7	42.5	5	22
	130	82	25	100	11	118	16	7	46.0	5	22
	118	75	16	93	11	110	16	7	42.5	5	22
	148	75	16	93	11	110	16	7	42.5	5	22
	120	82	25	100	11	118	16	7	46	5	22
	150	82	25	100	11	118	16	7	46.0	5	22
	135	82	25	100	11	118	16	7	46.0	5	22
	170	82	25	100	11	118	16	7	46.0	5	22
	149	75	16	93	11	110	16	7	42.5	5	22
	149	82	25	100	11	118	16	7	46.0	5	22

NOMINAL DIAMETER 60 - 63 mm

Single nut, 4-point contact Execution grade P0 – P5



■ Series 1416: DIN standard flanged nut, ball oversize preload



■ Series 3426: UltraSpeed nut with flange, dual start, ball oversize preload

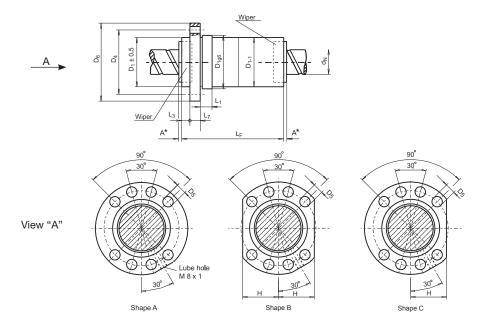


	Technical data							
	Nut type	Lead P [mm]	Nominal diameter d _N [mm]	No. of circuits i	Ball diameter d _W [mm]	Dyn. load rating C _a [kN]	Stat. load rating C _{0a} [kN]	Stiffness* R _{nu, ar} [N/µm]
3426	25.60.9.6	25	60	3 + 3	9.0	164.3	361.5	1350
	25.60.9.8	25	60	4 + 4	9.0	214.5	492.9	1790
	30.60.9.6	30	60	3 + 3	9.0	163.5	360.1	1250
	30.60.9.8	30	60	4 + 4	9.0	213.5	491.0	1650
	35.60.9.6	35	60	3 + 3	9.0	162.5	358.5	1140
	40.60.9.4	40	60	2 + 2	9.0	109.5	227.0	700
	40.60.9.6	40	60	3 + 3	9.0	161.5	356.7	1040
1416	5.63.3,5.4	5	63	4	3.5	27.8	84.3	820
	5.63.3,5.5	5	63	5	3.5	33.7	105.4	1010
	5.63.3,5.6	5	63	6	3.5	39.5	126.5	1200
	10.63.7,5.3	10	63	3	7.5	59.2	120.7	630
	10.63.7,5.4	10	63	4	7.5	75.8	160.9	830
	10.63.7,5.5	10	63	5	7.5	91.8	201.1	1030
	10.63.7,5.6	10	63	6	7.5	107.4	241.3	1230
	15.63.9.4	15	63	4	9.0	116.7	239.9	940
	15.63.9.6	15	63	6	9.0	165.3	359.9	1390
	20.63.11.3	20	63	3	11.0	115.3	209.1	660
	20.63.11.4	20	63	4	11.0	147.7	278.8	870
	20.63.11.5	20	63	5	11.0	179.0	348.5	1070
	20.63.11.6	20	63	6	11.0	209.3	418.2	1280
3426	20.63.7,5.6	20	63	3 + 3	7.5	107.6	249.1	1260
	20.63.7,5.8	20	63	4 + 4	7.5	140.5	339.7	1660

^{*} Actual stiffness at preload equal to 0.08 x Ca







	Dimensions Flanged nut	with wipers	both ends								
	L _F [mm]		L ₁ [mm]	D ₄ [mm]	D ₅ [mm]	D ₆ [mm]	L ₇ [mm]	L ₃ [mm]	H [mm]	A [mm]	LA * [mm]
3426	106 131	95 95	25 25	115 115	13.5 13.5	135 135	20 20	7 7	50.0 50.0	5 5	22 22
	121 151	95 95	25 25	115 115	13.5 13.5	135 135	20 20	7 7	50.0 50.0	5 5	22 22
	135	95	25	115	13.5	135	20	7	50.0	5	22
	110 150	95 95	25 25	115 115	13.5 13.5	135 135	20 20	7 7	50.0 50.0	5 5	22 22
1416	68 73 78	90 90 90	10 10 10	108 108 108	11.0 11.0 11.0	125 125 125	18 18 18	6 6 6	47.5 47.5 47.5	0 0 0	9 9 9
	91 102 112 124	90 90 90 90	16 16 16 16	108 108 108 108	11.0 11.0 11.0 11.0	125 125 125 125	18 18 18 18	7 7 7 7	47.5 47.5 47.5 47.5	0 0 0	12 12 12 12
	133 167	95 95	25 25	115 115	13.5 13.5	135 135	20 20	7 7	50.0 50.0	0	12 12
	136 157 182 207	95 95 95 95	25 25 25 25	115 115 115 115	13.5 13.5 13.5 13.5	135 135 135 135	20 20 20 20	7 7 7 7	50.0 50.0 50.0 50.0	0 0 0	12 12 12 12
3426	91 111	95 95	25 25	115 115	13.5 13.5	135 135	20 20	7 7	50.0 50.0	0 0	12 12

LA *: Additional nut length at each end when using combination wipers

NOMINAL DIAMETER 80 mm

Single nut, 4-point contact Execution grade P0 – P5



■ Series 1416: DIN standard flanged nut, ball oversize preload



■ Series 3426: UltraSpeed nut with flange, dual start, ball oversize preload

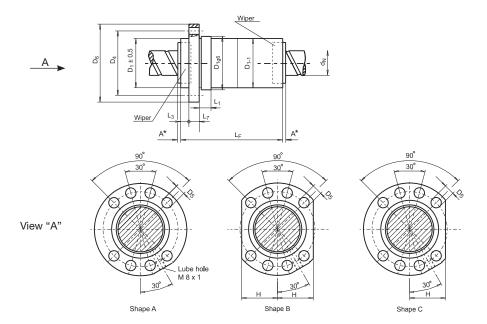


	Technical data						l	
	Nut type	Lead P [mm]	Nominal diameter d _N [mm]	No. of circuits i	Ball diameter d _W [mm]	Dyn. load rating C _a [kN]	Stat. load rating C _{0a} [kN]	Stiffness* R _{nu, ar} [N/µm]
1416	5.80.3,5.3	5	80	3	3.5	23.9	81.2	700
	5.80.3,5.4	5	80	4	3.5	30.6	108.2	930
	5.80.3,5.5	5	80	5	3.5	37.1	135.3	1150
	5.80.3,5.6	5	80	6	3.5	43.4	162.4	1370
	10.80.7,5.3	10	80	3	7.5	68.2	164.3	790
	10.80.7,5.4	10	80	4	7.5	87.3	219.1	1040
	10.80.7,5.5	10	80	5	7.5	105.8	273.8	1280
	10.80.7,5.6	10	80	6	7.5	123.8	328.6	1530
	15.80.11.3	15	80	3	11.0	134.4	283.9	940
	15.80.11.4	15	80	4	11.0	172.2	378.5	1240
	15.80.11.5	15	80	5	11.0	208.6	473.1	1540
	15.80.11.6	15	80	6	11.0	244.0	567.7	1830
	20.80.11.3 20.80.11.4 20.80.11.5 20.80.11.6	20 20 20 20 20	80 80 80 80	3 4 5 6	11.0 11.0 11.0 11.0	134.2 171.9 208.2 243.6	283.5 377.9 472.4 566.9	900 1180 1470 1750
	30.80.11.3	30	80	3	11.0	133.5	282.4	790
3426	25.80.9.10	25	80	5 + 5	9.0	301.0	847.9	3090
	30.80.11.6	30	80	3 + 3	11.0	246.8	595.3	1820
	30.80.11.8	30	80	4 + 4	11.0	322.3	811.8	2420
	30.80.11.10	30	80	5 + 5	11.0	394.9	1028.2	3000
	40.80.11.4	40	80	2 + 2	11.0	166.1	376.8	1090
	40.80.11.6	40	80	3 + 3	11.0	245.1	592.1	1620
	40.80.11.8	40	80	4 + 4	11.0	320.0	807.4	2150

 $^{^{\}star}$ Actual stiffness at preload equal to 0.08 x $\mathrm{C_{a}}$







	Dimensions Flanged nut	with wipers	both ends					1			
	L _F	D ₁ g6	L ₁	D ₄	D ₅	D ₆	L ₇	L ₃	H	A	LA *
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
1416	64	105	16	125	13.5	145	20	7	55.0	0	9
	69	105	16	125	13.5	145	20	7	55.0	0	9
	74	105	16	125	13.5	145	20	7	55.0	0	9
	79	105	16	125	13.5	145	20	7	55.0	0	9
	93	105	16	125	13.5	145	20	7	55.0	0	12
	104	105	16	125	13.5	145	20	7	55.0	0	12
	114	105	16	125	13.5	145	20	7	55.0	0	12
	125	105	16	125	13.5	145	20	7	55.0	0	12
	121	125	25	145	13.5	165	25	7	65.0	0	12
	138	125	25	145	13.5	165	25	7	65.0	0	12
	153	125	25	145	13.5	165	25	7	65.0	0	12
	169	125	25	145	13.5	165	25	7	65.0	0	12
	143	125	25	145	13.5	165	25	7	65.0	0	12
	164	125	25	145	13.5	165	25	7	65.0	0	12
	185	125	25	145	13.5	165	25	7	65.0	0	12
	206	125	25	145	13.5	165	25	7	65.0	0	12
3426	190 157	125 125	25	145	13.5	165 165	25 25	7 7	65.0 65.0	5 5	22 22
3420	136 154 184	125 125 125 125	25 25 25 25	145 145 145 145	13.5 13.5 13.5 13.5	165 165 165 165	25 25 25 25	7 7 7 7	65.0 65.0 65.0	5 5 5 5	22 22 22 22
	113	125	25	145	13.5	165	25	7	65.0	5	24
	153	125	25	145	13.5	165	25	7	65.0	5	24
	193	125	25	145	13.5	165	25	7	65.0	5	24

LA *: Additional nut length at each end when using combination wipers

NOMINAL DIAMETER 100 - 125 mm

Single nut, 4-point contact Execution grade P0 – P5



■ Series 1416: DIN standard flanged nut, ball oversize preload



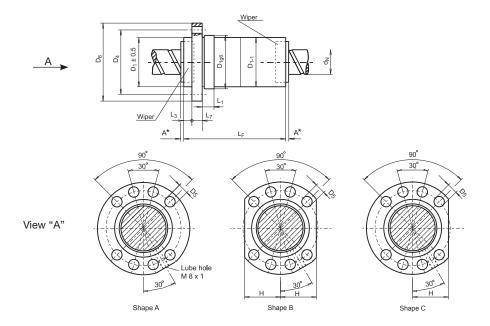
■ Series 3426: UltraSpeed nut with flange, dual start, ball oversize preload

	Technical data	ı		1			ı	
	Nut type	Lead P [mm]	Nominal diameter d _N [mm]	No. of circuits i	Ball diameter d _W [mm]	Dyn. load rating C _a [kN]	Stat. load rating C _{0a} [kN]	Stiffness* R _{nu, ar} [N/µm]
1416	10.100.7,5.3	10	100	3	7.5	75.0	208.2	910
	10.100.7,5.4	10	100	4	7.5	96.0	277.6	1200
	10.100.7,5.5	10	100	5	7.5	116.3	347.0	1480
	10.100.7,5.6	10	100	6	7.5	136.1	416.4	1770
	15.100.11.3	15	100	3	11.0	152.2	373.2	1180
	15.100.11.4	15	100	4	11.0	195.3	497.6	1560
	15.100.11.5	15	100	5	11.0	236.7	622.0	1930
	15.100.11.6	15	100	6	11.0	276.8	746.4	2300
	20.100.11.3	20	100	3	11.0	152.4	372.9	1160
	20.100.11.4	20	100	4	11.0	195.1	497.1	1520
	20.100.11.5	20	100	5	11.0	236.4	621.4	1890
	20.100.11.6	20	100	6	11.0	276.5	745.7	2250
3426	30.100.11.8	30	100	4 + 4	11.0	350.8	1001.4	3010
	30.100.11.10	30	100	5 + 5	11.0	429.9	1268.4	3740
	40.100.11.4	40	100	2 + 2	11.0	181.3	465.7	1400
	40.100.11.6	40	100	3 + 3	11.0	267.5	731.8	2090
1416	10.125.7,5.4	10 20	125 125	4 6	7.5 12.7	105.1 369.5	350.8 1074.7	1340 2710
	20.125.12,7.8	20	125	8	12.7	473.2	1433.0	3580

 $^{^{\}star}$ Actual stiffness at preload equal to 0.08 x $\mathrm{C_{a}}$







	Dimensions Flanged nu	Dimensions Flanged nut with wipers both ends												
	L _F [mm]	D ₁ g6 [mm]	L ₁ [mm]	D ₄ [mm]	D ₅ [mm]	D ₆ [mm]	L ₇ [mm]	L ₃ [mm]	H [mm]	A [mm]	LA * [mm]			
1416	93 104 114 126	125 125 125 125	16 16 16 16	145 145 145 145	13.5 13.5 13.5 13.5	165 165 165 165	22 22 22 22	7 7 7 7	65 65 65	0 0 0	12 12 12 12			
	127 144 159 175	150 150 150 150	25 25 25 25	176 176 176 176	17.5 17.5 17.5 17.5	202 202 202 202	30 30 30 30	7 7 7 7	77.5 77.5 77.5 77.5	0 0 0	12 12 12 12			
	144 164 185 206	150 150 150 150	25 25 25 25	176 176 176 176	17.5 17.5 17.5 17.5	202 202 202 202	30 30 30 30	7 7 7 7	77.5 77.5 77.5 77.5	0 0 0	12 12 12 12			
3426	155 185	150 150	25 25	176 176	17.5 17.5	202 202	30 30	7 7	77.5 77.5	5 5	22 22			
	128 168	150 150	25 25	176 176	17.5 17.5	202 202	30 30	7 7	77.5 77.5	5 5	22 22			
1416	139	150	10	176	17.5	202	25	7	77.5	0	12			
	217 264	170 170	25 25	196 196	17.5 17.5	222 222	30 30	7 7	87.5 87.5	0	12 12			

LA *: Additional nut length at each end when using combination wipers

NOMINAL DIAMETER 16 - 20 mm

Double nut, 2-point contact Execution grade P0 – P5



■ Series 1516: DIN standard flanged nut with UNILOCK preload



■ Series 2526: End cap nut with flange, dual start, pitch offset preload



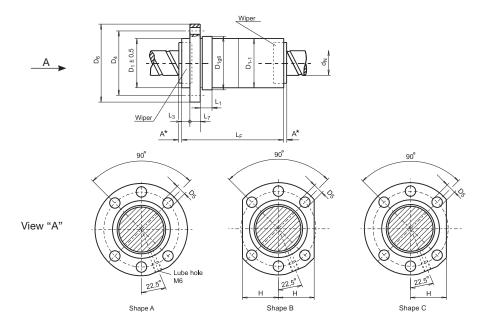


	Technical data	·										
	Nut type	Lead P [mm]	Nominal diameter d _N [mm]	No. of circuits i 2x	MICH ELEVANANCE	Ball diameter d _W [mm]	Dyn. loa rating C _a [kN]	ad	Stat. loa rating C _{0a} [kN]	ad	Stiffnes R _{nu, ar} [N/µm]	
1516	2.16.1,5.3 2.16.1,5.4	2 2	16 16	3 4		1.5 1.5	2.9 3.8		4.9 6.5		240 330	
	4.16.3.3 4.16.3.4	4 4	16 16	3 4		3.0 3.0	8.9 11.3		11.4 15.2		270 360	
	5.16.3,5.3 5.16.3,5.4	5 5	16 16	3 4	2 x 3	3.5 3.5	10.1 12.9	13.2	12.0 16.0	13.1	240 320	270
2526	10.16.3,5.3 10.16.3,5.4 10.16.3,5.5	10 10 10	16 16 16		3 + 3 4 + 4 5 + 5	3.5 3.5 3.5		13.0 17.3 21.5		13.7 19.2 24.7		260 340 430
1516	2.20.1,5.3 2.20.1,5.4 2.20.1,5.5	2 2 2	20 20 20	3 4 5		1.5 1.5 1.5	3.2 4.1 5.0		6.2 8.2 10.3		300 390 480	
	4.20.3.3 4.20.3.4	4 4	20 20	3 4		3.0 3.0	10.1 13.0		14.9 19.9		350 460	
	5.20.3,5.3 5.20.3,5.4	5 5	20 20	3 4		3.5 3.5	12.1 15.5		16.7 22.3		330 440	
2526	10.20.3,5.5	10	20		5 + 5	3.5		25.2		32.5		590
	20.20.3,5.2 20.20.3,5.3	20 20	20 20		2 + 2 3 + 3	3.5 3.5		9.3 14.5		10.5 17.4		150 220

^{*} Actual stiffness at preload equal to 0.1 x Ca







	Dimer Flang		with wipers	s both ends								
	L _F [mm]	MON ETAT	D ₁ g6 [mm]	L ₁ [mm]	D ₄ [mm]	D ₅ [mm]	D ₆ [mm]	L ₇ [mm]	L ₃ [mm]	H [mm]	A [mm]	LA * [mm]
1516	62 70		28 28	10 10	38 38	5.5 5.5	48 48	10 10	6 6	20 20	0 0	9 9
	73 81		28 28	10 10	38 38	5.5 5.5	48 48	10 10	6 6	20 20	0	9
	84 95	85	28 28	10 10	38 38	5.5 5.5	48 48	10 10	6 6	20 20	0 0	9
2526		44 54 64	32 32 32	16 16 16	42 42 42	5.5 5.5 5.5	52 52 52	10 10 10	12 12 12	20 20 20	0 0 0	- - -
1516	72 80 89		36 36 36	10 10 10	47 47 47	6.6 6.6 6.6	58 58 58	10 10 10	6 6 6	22 22 22	0 0 0	9 9 9
	73 82		36 36	10 10	47 47	6.6 6.6	58 58	10 10	6 6	22 22	0	9
	85 95		36 36	10 10	47 47	6.6 6.6	58 58	10 10	6	22 22	0	9
2526		69	36	16	47	6.6	58	10	7	22	0	-
		57 77	36 36	16 16	47 47	6.6 6.6	58 58	10 10	7 7	22 22	0	-

LA *: Additional nut length at each end when using combination wipers

Positioning ball screws 16 - 125 mm

NOMINAL DIAMETER 25 mm

Double nut, 2-point contact Execution grade P0 – P5



■ Series 1516: DIN standard flanged nut with UNILOCK preload



■ Series 2526: End cap nut with flange, dual start, pitch offset preload



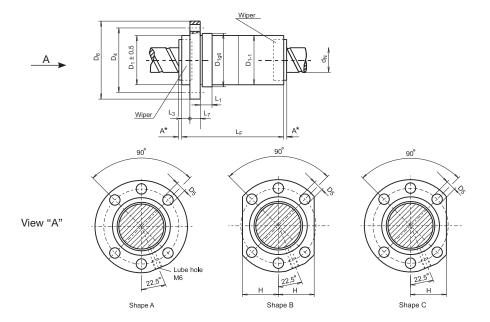


	Technical data			1								
	Nut type	Lead P [mm]	Nominal diameter d _N [mm]	No. of circuits i 2x	MICH PENTANGAN	Ball diameter d _W [mm]	Dyn. loa rating C _a [kN]	nd FERTONIANO	Stat. loa rating C _{0a} [kN]	ad	Stiffnes R _{nu, ar} [N/µm]	
1516	2.25.1,5.3 2.25.1,5.4 2.25.1,5.5 2.25.1,5.7	2 2 2 2	25 25 25 25	3 4 5 7		1.5 1.5 1.5 1.5	3.5 4.5 5.5 7.3		7.8 10.4 13.0 18.1		350 460 570 790	
	4.25.3.3 4.25.3.4	4 4	25 25	3 4		3.0 3.0	11.4 14.6		19.3 25.7		430 570	
	5.25.3,5.3 5.25.3,5.4 5.25.3,5.5	5 5 5	25 25 25	3 4 5	3 + 3 4 + 4 5 + 5	3.5 3.5 3.5	13.7 17.5 21.2	18.1 23.1 28.0	21.5 28.7 35.9	23.4 31.2 39.0	420 550 680	460 610 750
2526	10.25.3,5.3 10.25.3,5.5	10 10	25 25		3 + 3 5 + 5	3.5 3.5		16.9 28.0		22.5 40.4		460 750
	15.25.3,5.2 15.25.3,5.3	15 15	25 25		2 + 2 3 + 3	3.5 3.5		10.7 16.7		13.3 22.2		250 390
	20.25.3,5.2 20.25.3,5.3	20 20	25 25		2 + 2 3 + 3	3.5 3.5		10.9 16.9		13.8 22.9		220 330
	25.25.3,5.2	25	25		2 + 2	3.5		10.6		13.5		180

 $^{^{\}ast}$ Actual stiffness at preload equal to 0.1 x C_{a}







	Dimer Flang		with wipers	both ends								
	L _F [mm]	MIGH ETAF	D ₁ g6 [mm]	L ₁ [mm]		D ₅ [mm]	D ₆ [mm]	L ₇ [mm]	L ₃ [mm]	H [mm]	A [mm]	LA * [mm]
1516	72 77 81 99		40 40 40 40	10 10 10 10	51 51 51 51	6.6 6.6 6.6 6.6	62 62 62 62	10 10 10 10	6 6 6	24 24 24 24	0 0 0 0	9 9 9
	73 82		40 40	10 10	51 51	6.6 6.6	62 62	10 10	6 6	24 24	0	9
	85 95 107	76 90 107	40 40 40	10 10 10	51 51 51	6.6 6.6 6.6	62 62 62	10 10 10	6 6 6	24 24 24	0 0 0	9 9 9
		49 69	40 40	16 16	51 51	6.6 6.6	62 62	10 10	7 7	24 24	0	- -
2526		48 63	40 40	16 16	51 51	6.6 6.6	62 62	10 10	7 7	24 24	0	-
		57 77	40 40	16 16	51 51	6.6 6.6	62 62	10 10	7 7	24 24	0	- -
		66	40	16	51	6.6	62	10	7	24	0	-

LA *: Additional nut length at each end when using combination wipers

Positioning ball screws 16 - 125 mm

NOMINAL DIAMETER 32 mm

Double nut, 2-point contact Execution grade P0 – P5



■ Series 1516: DIN standard flanged nut with UNILOCK preload



■ Series 3526: UltraSpeed nut with flange, dual start, pitch offset preload



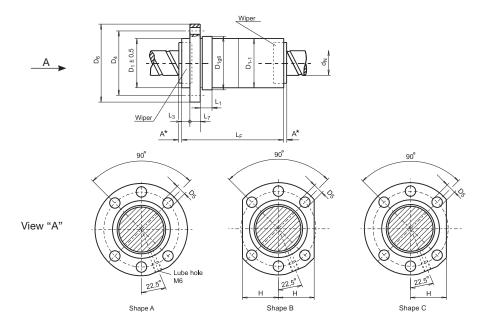


	Technical data			l							1	
	Nut type	Lead P [mm]	Nominal diameter d _N [mm]	No. of circuits i 2x	mon ETA	Ball diameter d _W [mm]	Dyn. loa rating C _a [kN]	ad :: Eta	Stat. loa rating C _{0a} [kN]	ad	Stiffnes R _{nu, ar} [N/µm]	s*
1516	2.32.1,5.3	2	32	3	PERFORMANCE	1.5	3.9	РЕИГОКМАНСЕ	10.2	PERFORMANCE	420	PERFORMANCE
	4.32.3.3 4.32.3.4	4 4	32 32	3 4		3.0 3.0	13.1 16.8		26.3 35.0		550 730	
	5.32.3,5.3 5.32.3,5.4 5.32.3,5.5 5.32.3,5.6	5 5 5 5	32 32 32 32	3 4 5 6	3+3 4+4 5+5 2×6	3.5 3.5 3.5 3.5	16.0 20.4 24.8 29.0	21.3 27.3 33.0 38.6	29.8 39.8 49.7 59.6	32.4 43.2 54.0 64.9	550 730 900 1070	610 800 990 1180
	6.32.4.3 6.32.4.4	6 6	32 32	3 4	3 + 3	4.0 4.0	18.7 24.0	24.8	32.7 43.7	35.6	530 710	600
	8.32.5.3 8.32.5.4	8 8	32 32	3 4	4 + 4	5.0 5.0	24.6 31.5	41.5	39.0 52.0	56.6	510 680	740
	10.32.6.3 10.32.6.4 10.32.6.5	10 10 10	32 32 32	3 4 5	3 + 3 4 + 4 2 x 5	6.0 6.0 6.0	30.8 39.4 47.8	40.3 51.6 62.6	45.6 60.8 76.0	49.7 66.3 82.9	490 650 800	540 710 880
	12.32.5.3 12.32.5.4 12.32.5.5	12 12 12	32 32 32	4 5	3 + 3	5.0 5.0 5.0	31.3 37.9	32.2	51.8 64.7	42.3	620 760	510
	15.32.6.3	15	32		2 x 3	6.0		40.0		49.4		470
3526	20.32.6.2 20.32.6.3 20.32.6.4	20 20 20	32 32 32		2 + 2 3 + 3 4 + 4	6.0 6.0 6.0		24.8 38.5 51.4		29.8 49.6 69.4		330 500 670
	25.32.6.2 30.32.6.2	25 30	32 32		2 + 2 2 + 2	6.0 6.0		24.5 24.1		29.4 29.1		290 250

^{*} Actual stiffness at preload equal to 0.1 x C_a







	Dimen Flang		with wipers	both ends								
	L _F [mm]		D ₁ g6 [mm]	L ₁ [mm]		D ₅ [mm]	D ₆ [mm]	L ₇ [mm]	L ₃ [mm]	H [mm]	A [mm]	LA * [mm]
1516	75		50	10	65	9	80	12	6	31.0	0	9
	75 84		50 50	10 10	65 65	9 9	80 80	12 12	6 6	31.0 31.0	0	9
	87 97 107 114	78 92 102 114	50 50 50 50	10 10 10 10	65 65 65 65	9 9 9	80 80 80 80	12 12 12 12	6 6 6	31.0 31.0 31.0 31.0	0 0 0 0	9 9 9 9
	97 110	91	50 50	10 10	65 65	9 9	80 80	12 12	6 6	31.0 31.0	0	9
	125 140	132	50 50	16 16	65 65	9 9	80 80	12 12	7 7	31.0 31.0	0	12 12
	144 165 187	130 140 187	50 50 50	16 16 16	65 65 65	9 9 9	80 80 80	12 12 12	7 7 7	31.0 31.0 31.0	0 0 0	12 12 12
	191 218	166	50 50 50	16 16 16	65 65 65	9 9 9	80 80 80	12 12 12	7 7 7	31.0 31.0 31.0	0 0 0	12 12 12
		177	50	16	65	9	80	12	7	31.0	0	12
3526		68 88 108	56 56 56	20 20 20	71 71 71	9 9 9	86 86 86	14 14 14	7 7 7	32.5 32.5 32.5	0 0 0	12 12 12
		78 88	56 56	20 20	71 71	9 9	86 86	14 14	7 7	32.5 32.5	5 5	22 22

LA *: Additional nut length at each end when using combination wipers

NOMINAL DIAMETER 40 mm

Double nut, 2-point contact Execution grade P0 – P5



■ Series 1516: DIN standard flanged nut with UNILOCK preload



■ Series 3526: UltraSpeed nut with flange, dual start, pitch offset preload

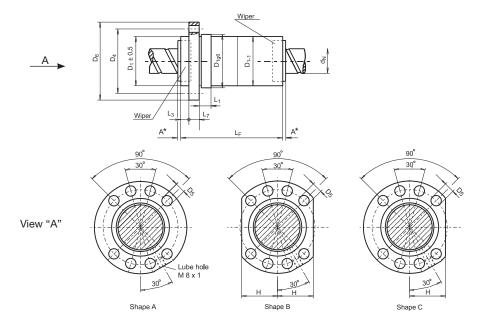




	Technical data										'	
	Nut type	Lead P [mm]	Nominal diameter d _N [mm]	No. of circuits i 2x	мон Ета	Ball diameter d _W [mm]	Dyn. loa rating C _a [kN]	id	Stat. loa rating C _{0a} [kN]	ad 	Stiffnes R _{nu, ar} [N/µm]	s* Eta *
1516	5.40.3,5.3 5.40.3,5.4 5.40.3,5.5 5.40.3,5.6	5 5 5	40 40 40 40	3 4 5 6	3+3 4+4 5+5 6+6	3.5 3.5 3.5 3.5	17.7 22.7 27.5 32.1	23.8 30.5 36.9 43.2	38.2 50.9 63.6 76.4 56.1	41.5 55.3 69.1 83.0	670 890 1100 1310 880	750 990 1230 1460
	6.40.4.4 6.40.4.6 8.40.5.4	6 6 8	40 40 40	4 6 4	4 + 4	4.0 4.0 5.0	26.7 37.9 35.8	35.8 47.5	84.2 68.2	61.0 74.2	1300 870	980
	8.40.5.6 10.40.7,5.3 10.40.7,5.4 10.40.7,5.5	8 10 10 10	40 40 40 40	6 3 4 5	3+3 4+4 2×5	5.0 7.5 7.5 7.5	50.7 46.1 59.0 71.5	60.4 77.3 93.7	102.3 71.3 95.1 118.9	77.8 103.8 129.7	1280 630 830 1030	700 920 1140
	12.40.7,5.3 12.40.7,5.4	12 12	40 40	3 4	2 x 3	7.5 7.5	46.0 58.9	60.3	71.2 95.0	77.7	610 810	670
	15.40.7,5.3 15.40.7,5.4	15 15	40 40	3 4	2 x 3 2 x 4	7.5 7.5	45.9 58.7	60.1 76.9	71.1 94.8	77.5 103.4	570 760	630 830
3526	20.40.6.2 20.40.6.3 20.40.6.4 20.40.6.5	20 20 20 20	40 40 40 40		2 + 2 3 + 3 4 + 4 5 + 5	6.0 6.0 6.0 6.0		28.0 43.4 58.0 72.0		37.5 62.5 87.5 112.5		440 670 890 1110
	20.40.7,5.3 N 20.40.7,5.4 N 20.40.7,5.5 N	20 20 20	40 40 40		3 + 3 4 + 4 5 + 5	7.5 7.5 7.5		55.7 74.4 92.4		73.4 102.8 132.2		650 870 1080
	25.40.6.3 25.40.6.4	25 25	40 40		3 + 3 4 + 4	6.0 6.0		43.1 57.5		62.1 86.9		600 800
	25.40.7,5.3 N 25.40.7,5.4 N	25 25	40 40		3 + 3 4 + 4	7.5 7.5		57.5 76.8		77.5 108.5		620 820
	30.40.6.3 30.40.6.4	30 30	40 40		3 + 3 4 + 4	6.0 6.0		42.6 56.9		61.6 86.2		540 710
	40.40.6.2 40.40.6.3 40.40.7,5.2 N	40 40 40	40 40 40		2 + 2 3 + 3 2 + 2	6.0 6.0 7.5		26.7 41.5 35.7		36.2 60.3 45.2		280 420 290







	Dimen Flang		with wipers	both ends		l			1			1
	L _F [mm]	ETA [†]	D ₁ g6 [mm]	L ₁ [mm]	D ₄ [mm]	D ₅ [mm]	D ₆ [mm]	L ₇ [mm]	L ₃ [mm]	H [mm]	A [mm]	LA * [mm]
1516	89 99 109 125	84 94 104 114	63 63 63 63	10 10 10 10	78 78 78 78	9 9 9	93 93 93 93	14 14 14 14	6 6 6	35.0 35.0 35.0 35.0	0 0 0	9 9 9
	112 137 142 176	106	63 63 63 63	10 10 10 10	78 78 78 78	9 9 9	93 93 93 93	14 14 14 14	6 6 7 7	35.0 35.0 35.0 35.0	0 0 0	9 9 9 9
	147 167 189	136 157 189	63 63 63	16 16 16	78 78 78	9 9 9	93 93 93	14 14 14	7 7 7	35.0 35.0 35.0	0 0 0	12 12 12
	152 177 180	152 180	63 63 63	16 16	78 78 78	9	93 93 93	14 14 14	7 7 7	35.0 35.0 35.0	0 0 0	12 12 12
3526	211	211	63 63	16	78 78	9 9 9	93	14 14 14	7	35.0 35.0	0	12 12 12
3526		89 109 129	63 63 63	20 20 20 20	78 78 78 78	9 9	93 93 93	14 14 14 14	7 7 7 7	35.0 35.0 35.0 35.0	0 0	12 12 12 12
		90 110 130	70 70 70	25 25 25	85 85 85	9 9 9	100 100 100	14 14 14	7 7 7	37.5 37.5 37.5	0 0 0	12 12 12
		107 132	63 63	16 16	78 78	9	93 93	14 14	7 7	35.0 35.0	5 5	22 22
		104 129	70 70	25 25	85 85	9	100 100	14 14	7	37.5 37.5	5 5	22 22
		121 151	63 63	16 16	78 78	9	93 93	14 14	7 7	35.0 35.0	5 5	22 22
		108 148 107	63 63 70	20 20 25	78 78 85	9 9 9	93 93 100	14 14 14	7 7 7	35.0 35.0 37.5	5 5 5	22 22 22

LA *: Additional nut length at each end when using combination wipers

NOMINAL DIAMETER 50 mm

Double nut, 2-point contact Execution grade P0 – P5



■ Series 1516: DIN standard flanged nut with UNILOCK preload



■ Series 3526: UltraSpeed nut with flange, dual start, pitch offset preload



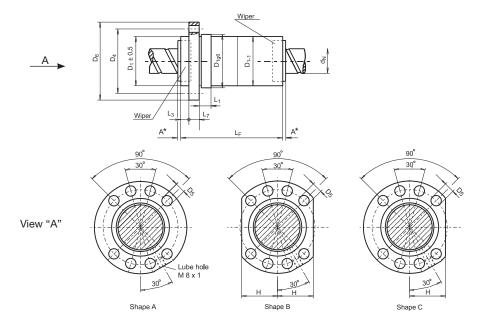


	Technical data			l							1	
	Nut type	Lead P [mm]	Nominal diameter d _N [mm]	No. of circuits i 2x	MIGH PERFORMANCE	Ball diameter d _W [mm]	Dyn. loa rating C _a [kN]	ad	Stat. loa rating C _{0a} [kN]	ad	Stiffnes R _{nu, ar} [N/µm]	s*
1516	5.50.3,5.3 5.50.3,5.4 5.50.3,5.5 5.50.3,5.6	5 5 5 5	50 50 50 50	3 4 5 6	4 + 4 5 + 5 6 + 6	3.5 3.5 3.5 3.5	19.6 25.1 30.4 35.6	34.0 41.2 48.2	48.9 65.2 81.5 97.8	70.8 88.5 106.3	810 1070 1320 1570	1190 1470 1760
	10.50.7,5.3 10.50.7,5.4 10.50.7,5.5	10 10 10	50 50 50	3 4 5	3 + 3 4 + 4 2 x 5	7.5 7.5 7.5	52.7 67.4 81.7	69.5 89.0 107.8	93.2 124.3 155.4	101.5 135.4 169.2	810 1060 1310	890 1180 1460
	12.50.7,5.3 12.50.7,5.4	12 12	50 50	3 4		7.5 7.5	52.6 67.4		93.1 124.2		790 1040	
	15.50.7,5.3 15.50.7,5.4 15.50.7,5.5 15.50.9.3 N	15 15 15 15	50 50 50 50	3 4 5 3	2 x 3	7.5 7.5 7.5 9.0	52.5 67.2 81.4 77.2	69.2 99.2	93.0 124.0 155.0 130.4	101.3 142.2	760 990 1230 850	830 890
	20.50.9.3 20.50.9.3 N 20.50.9.4 20.50.9.4 N 20.50.9.5	20 20 20 20 20 20	50 50 50 50 50	3 3 4 4 5	2 x 3 2 x 4	9.0 9.0 9.0 9.0 9.0	76.8 76.8 98.4 98.4 119.2	98.7 126.4	130.0 130.0 173.3 173.3 216.6	141.7 189.0	780 780 1020 1020 1270	810 1070
3526	20.50.7,5.3 N 20.50.7,5.4 N 20.50.7,5.5 N	20 20 20	50 50 50		3 + 3 4 + 4 5 + 5	7.5 7.5 7.5		65.3 87.2 108.2		98.1 137.4 176.6		890 1180 1470
	25.50.7,5.3 N 25.50.7,5.4 N	25 25	50 50		3 + 3 4 + 4	7.5 7.5		64.9 86.7		97.7 136.8		820 1090
	30.50.6.4 30.50.7,5.3 N 30.50.7,5.4 N	30 30 30	50 50 50		4 + 4 3 + 3 4 + 4	6.0 7.5 7.5		63.9 64.5 86.1		108.9 97.2 136.0		980 750 1010
	35.50.7,5.3 N 35.50.7,5.4 N	35 35	50 50		3 + 3 4 + 4	7.5 7.5		63.9 85.4		96.6 135.2		690 920
	40.50.7,5.3 N	40	50		3 + 3	7.5		63.3		95.9		630

 $^{^{\}star}$ Actual stiffness at preload equal to 0.1 x C $_{\!a}$ \mid N: Alternate sizes acc. to DIN 69051







	Dimen Flang		with wipers	both ends		l						'
	L _F [mm]	ETA+	D ₁ g6 [mm]	L ₁ [mm]	D ₄ [mm]	D ₅ [mm]	D ₆ [mm]	L ₇ [mm]	L ₃ [mm]	H [mm]	A [mm]	LA * [mm]
1516	91 101 111 122	93 103 113	75 75 75 75	10 10 10 10	93 93 93 93	11 11 11 11	110 110 110 110	16 16 16 16	6 6 6 6	42.5 42.5 42.5 42.5	0 0 0 0	9 9 9
	148 169 191 153	138 159 191	75 75 75 75	16 16 16 16	93 93 93 93	11 11 11	110 110 110 110	16 16 16 16	7 7 7 7	42.5 42.5 42.5 42.5	0 0 0	12 12 12 12
	179 182 213 245 199	182 199	75 75 75 75 82	16 16 16 16 25	93 93 93 93 100	11 11 11 11 11	110 110 110 110 118	16 16 16 16 16	7 7 7 7 7	42.5 42.5 42.5 42.5 46.0	0 0 0 0	12 12 12 12 12
	229 229 271 271 310	229 229 271	75 82 75 82 75	16 25 16 25 16	93 100 93 100 93	11 11 11 11	110 118 110 118 110	16 16 16 16	7 7 7 7	42.5 46.0 42.5 46.0 42.5	0 0 0 0	12 12 12 12 12
3526		91 111 131	82 82 82	25 25 25	100 100 100	11 11 11	118 118 118	16 16 16	7 7 7	46.0 46.0 46.0	0 0 0	12 12 12
		105 130 148 120 150	82 82 75 82 82	25 25 16 25 25	100 100 93 100	11 11 11 11	118 118 110 118	16 16 16 16	7 7 7 7 7	46.0 46.0 42.5 46.0	5 5 5 5 5	22 22 22 22 22 22
		135 170	82 82	25 25	100 100 100	11 11 11	118 118 118	16 16	7 7	46.0 46.0 46.0	5 5	22 22
		149	82	25	100	11	118	16	7	46.0	5	22

LA *: Additional nut length at each end when using combination wipers

Positioning ball screws 16 - 125 mm

NOMINAL DIAMETER 60 - 63 mm

Double nut, 2-point contact Execution grade P0 – P5



■ Series 1516: DIN standard flanged nut with UNILOCK preload



■ Series 3526: UltraSpeed nut with flange, dual start, pitch offset preload





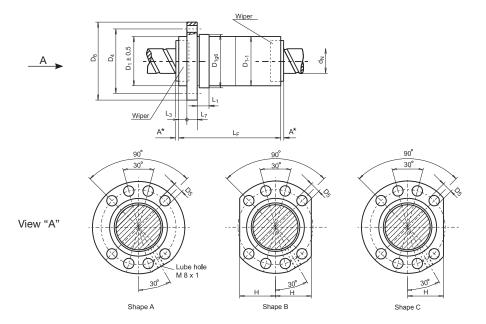
·	Technical data			1								
	Nut type	Lead P [mm]	Nominal diameter d _N [mm]	No. of circuits i 2x	MOH ETS* PENFORMANCE	Ball diameter d _W [mm]	Dyn. loa rating C _a [kN]	ad mon	Stat. loa rating C _{0a} [kN]	ad	Stiffness R _{nu, ar} [N/µm]	s*
3526	25.60.9.3 25.60.9.4 30.60.9.3 30.60.9.4	25 25 30 30	60 60 60		3 + 3 $4 + 4$ $3 + 3$ $4 + 4$	9.0 9.0 9.0 9.0		107.4 143.4 106.8 142.7		179.0 250.5 178.3 249.6		1160 1560 1090 1460
	35.60.9.3	35	60		3 + 3	9.0		106.2		177.5		1020
	40.60.9.2 40.60.9.3 40.60.9.4	40 40 40	60 60 60		2 + 2 3 + 3 4 + 4	9.0 9.0 9.0		68.0 105.5 140.9		106.0 176.6 247.2		620 950 1260
3526	20.63.7,5.4 20.63.7,5.5	20 20	63 63		4 + 4 5 + 5	7.5 7.5		97.0 120.4		172.5 221.7		1500 1870
1516	5.63.3,5.4 5.63.3,5.5 5.63.3,5.6	5 5 5	63 63 63	4 5 6		3.5 3.5 3.5	27.8 33.7 39.5		84.3 105.4 126.5		1260 1560 1870	
	10.63.7,5.3 10.63.7,5.4 10.63.7,5.5 10.63.7,5.6	10 10 10 10	63 63 63 63	3 4 5 6	3+3 4+4 5+5 2×6	7.5 7.5 7.5 7.5	59.2 75.8 91.8 107.4	78.8 100.7 122.0 142.8	120.7 160.9 201.1 241.3	131.3 175.0 218.8 262.5	1000 1310 1620 1930	1110 1460 1800 2150
	15.63.9.3 15.63.9.4	15 15	63 63	3 4	2 x 4	9.0 9.0	91.1 116.7	150.3	179.9 239.9	261.2	1140 1510	1590
	20.63.11.3 N 20.63.11.3 N 20.63.11.4 20.63.11.5	20 20 20 20	63 63 63 63	3 4 5	2 x 3 2 x 3 2 x 4 2 x 5	11.0 11.0 11.0 11.0	115.3 147.7 179.0	148.3 148.3 189.9 230.1	209.1 278.8 348.5	228.0 228.0 303.9 379.9	1070 1410 1740	1120 1120 1480 1830

 $^{^{\}star}$ Actual stiffness at preload equal to 0.1 x C_{a}

N: Alternate sizes acc. to DIN 69051







	Dimer Flang		with wipers	both ends	1							
	L _F [mm]	MIGH ETA PERFORMANCE		L ₁ [mm]	D ₄ [mm]	D ₅ [mm]	D ₆ [mm]	L ₇ [mm]	L ₃ [mm]	H [mm]	A [mm]	LA * [mm]
3526		106 131	95 95	25 25	115 115	13.5 13.5	135 135	20 20	7 7	50.0 50.0	5 5	22 22
		121 151	95 95	25 25	115 115	13.5 13.5	135 135	20 20	7 7	50.0 50.0	5 5	22 22
		135	95	25	115	13.5	135	20	7	50.0	5	22
		110 150 190	95 95 95	25 25 25	115 115 115	13.5 13.5 13.5	135 135 135	20 20 20	7 7 7	50.0 50.0 50.0	5 5 5	22 22 22
3526		111 131	95 95	25 25	115 115	13.5 13.5	135 135	20 20	7 7	50.0 50.0	0	12 12
1516	103 113 124		90 90 90	10 10 10	108 108 108	11.0 11.0 11.0	125 125 125	18 18 18	6 6 6	47.5 47.5 47.5	0 0 0	9 9 9
	151 172 192 214	141 162 182 214	90 90 90 90	16 16 16 16	108 108 108 108	11.0 11.0 11.0 11.0	125 125 125 125	18 18 18 18	7 7 7 7	47.5 47.5 47.5 47.5	0 0 0 0	12 12 12 12
	206 239	239	95 95	25 25	115 115	13.5 13.5	135 135	20 20	7 7	50.0 50.0	0	12 12
	237 277 319	237 237 277 319	95 105 95 95	25 25 25 25	115 125 115 115	13.5 13.5 13.5 13.5	135 145 135 135	20 20 20 20	7 7 7 7	50.0 55.0 50.0 50.0	0 0 0 0	12 12 12 12

LA *: Additional nut length at each end when using combination wipers

Positioning ball screws 16 - 125 mm

NOMINAL DIAMETER 80 mm

Double nut, 2-point contact Execution grade P0 – P5



■ Series 1516: DIN standard flanged nut with UNILOCK preload



■ Series 3526: UltraSpeed nut with flange, dual start, pitch offset preload



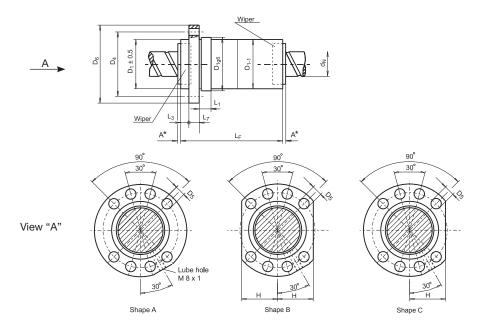


	Technical data	1		l								
	Nut type	Lead P [mm]	Nominal diameter d _N [mm]	No. of circuits i 2x	ETR	Ball diameter d _W [mm]	Dyn. loa rating C _a [kN]	ad man	Stat. Io: rating C _{0a} [kN]	ad	Stiffnes R _{nu, ar} [N/µm]	
1516	5.80.3.5.3 5.80.3.5.4 5.80.3.5.5 5.80.3.5.6	5 5 5 5	80 80 80 80	3 4 5 6		3.5 3.5 3.5 3.5	23.9 30.6 37.1 43.4		81.2 108.2 135.3 162.4		1080 1430 1770 2110	
	10.80.7.5.3 10.80.7.5.4 10.80.7.5.5 10.80.7.5.6	10 10 10 10	80 80 80 80	3 4 5 6	3+3 2x4 2x5 2x6	7.5 7.5 7.5 7.5	68.2 87.3 105.8 123.8	91.4 117.1 141.8 165.9	164.3 219.1 273.8 328.6	178.6 238.1 297.6 357.1	1230 1620 2000 2390	1370 1810 2240 2670
	15.80.11.3 15.80.11.4 15.80.11.5 15.80.11.6	15 15 15 15	80 80 80 80	3 4 5 6	2 x 5	11.0 11.0 11.0 11.0	134.4 172.2 208.6 244.0	268.8	283.9 378.5 473.1 567.7	515.0	1490 1960 2430 2890	2570
	20.80.11.3 20.80.11.4 20.80.11.5 20.80.11.6	20 20 20 20	80 80 80 80	3 4 5 6	2 x 4 2 x 5 2 x 6	11.0 11.0 11.0 11.0	134.2 171.9 208.2 243.6	221.5 268.3 313.9	283.5 377.9 472.4 566.9	411.5 514.3 617.2	1440 1900 2350 2800	2000 2480 2950
3526	30.80.11.3 30.80.11.4 30.80.11.5	30 30 30	80 80 80		3 + 3 4 + 4 5 + 5	11.0 11.0 11.0		161.4 215.6 267.6		294.6 412.4 530.2		1560 2090 2600
	40.80.11.2 40.80.11.3 40.80.11.4	40 40 40	80 80 80		2 + 2 3 + 3 4 + 4	11.0 11.0 11.0		103.3 160.3 214.1		175.8 293.0 410.2		940 1420 1900

 $^{^{\}star}$ Actual stiffness at preload equal to 0.1 x $\mathrm{C_{a}}$







Dimensions Flanged nut with wipers both ends												
	L _F [mm]	ETA+ PERFORMACE	D ₁ g6 [mm]	L ₁ [mm]	D ₄ [mm]	D ₅ [mm]	D ₆ [mm]	L ₇ [mm]	L ₃ [mm]	H [mm]	A [mm]	LA * [mm]
1516	94 104 114 127		105 105 105 105	16 16 16 16	125 125 125 125	13.5 13.5 13.5 13.5	145 145 145 145	20 20 20 20	7 7 7 7	55.0 55.0 55.0 55.0	0 0 0 0	9 9 9 9
	153 174 194 215	143 174 194 215	105 105 105 105	16 16 16 16	125 125 125 125	13.5 13.5 13.5 13.5	145 145 145 145	20 20 20 20	7 7 7 7	55.0 55.0 55.0 55.0	0 0 0 0	12 12 12 12
	211 243 274 304	274	125 125 125 125	25 25 25 25	145 145 145 145	13.5 13.5 13.5 13.5	165 165 165 165	25 25 25 25	7 7 7 7	65.0 65.0 65.0 65.0	0 0 0 0	12 12 12 12
	243 284 346 386	284 346 386	125 125 125 125	25 25 25 25	145 145 145 145	13.5 13.5 13.5 13.5	165 165 165 165	25 25 25 25	7 7 7 7	65.0 65.0 65.0 65.0	0 0 0 0	12 12 12 12
3526		124 154 184	125 125 125	25 25 25	145 145 145	13.5 13.5 13.5	165 165 165	25 25 25	7 7 7	65.0 65.0 65.0	5 5 5	22 22 22
		113 153 193	125 125 125	25 25 25	145 145 145	13.5 13.5 13.5	165 165 165	25 25 25	7 7 7	65.0 65.0 65.0	5 5 5	24 24 24

LA *: Additional nut length at each end when using combination wipers

Positioning ball screws 16 - 125 mm

NOMINAL DIAMETER 100 - 125 mm

Double nut, 2-point contact Execution grade P0 - P5



■ Series 1516: DIN standard flanged nut with UNILOCK preload



■ Series 3526: UltraSpeed nut with flange, dual start, pitch offset preload

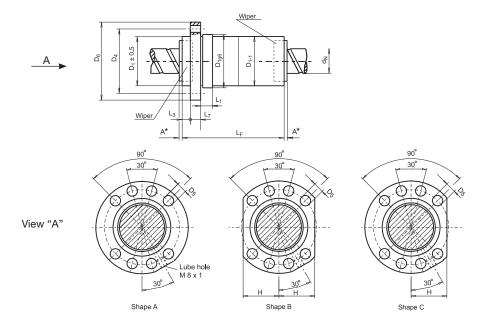


	Technical data											
	Nut type	Lead P [mm]	Nominal diameter d _N [mm]	No. of circuits i 2x	ETA [†]	Ball diameter d _W [mm]	Dyn. loa rating C _a [kN]	id	Stat. loa rating C _{0a} [kN]	ad Eta	Stiffnes R _{nu, ar} [N/µm]	s* <i>Ēti</i>s *
1516	10.100.7.5.3 10.100.7.5.4 10.100.7.5.5 10.100.7.5.6	10 10 10 10	100 100 100 100	3 4 5 6		7.5 7.5 7.5 7.5	75.0 96.0 116.3 136.1		208.2 277.6 347.0 416.4		1410 1860 2300 2740	
	15.100.11.3 15.100.11.4 15.100.11.5 15.100.11.6	15 15 15 15	100 100 100 100	3 4 5 6		11.0 11.0 11.0 11.0	152.5 195.3 236.7 276.8		373.2 497.6 622.0 746.4		1860 2450 3040 3610	
	20.100.11.3 20.100.11.4 20.100.11.5 20.100.11.6	20 20 20 20	100 100 100 100	3 4 5 6		11.0 11.0 11.0 11.0	152.4 195.1 236.4 276.5		372.9 497.1 621.4 745.7		1840 2420 3000 3560	
3526	30.100.11.4 30.100.11.5 30.100.11.6	30 30 30	100 100 100		4 + 4 5 + 5 6 + 6	11.0 11.0 11.0		235.4 292.2 347.3		508.2 653.4 798.6		2570 3210 3840
	40.100.11.2 40.100.11.3	40 40	100 100		2 + 2 3 + 3	11.0 11.0		113.1 175.5		217.0 361.7		1190 1680
1516	10.125.7.5.4 20.125.12.7.6 20.125.12.7.8	10 20 20	125 125 125	4 6 8		7.5 12.7 12.7	105.1 369.5 473.2		350.8 1074.7 1433.0		2060 4260 5620	

 $^{^{\}star}$ Actual stiffness at preload equal to 0.1 x $\rm C_a$







	Dimensions Flanged nut with wipers both ends													
	L _F [mm]	ETA [‡]	D ₁ g6 [mm]	L ₁ [mm]	D ₄ [mm]	D ₅ [mm]	D ₆ [mm]	L ₇ [mm]	L ₃ [mm]	H [mm]	A [mm]	LA * [mm]		
1516	154 175 195 217		125 125 125 125	16 16 16 16	145 145 145 145	13.5 13.5 13.5 13.5	165 165 165 165	22 22 22 22	7 7 7 7	65.0 65.0 65.0 65.0	0 0 0	12 12 12 12		
	217 249 279 310		150 150 150 150	25 25 25 25	176 176 176 176	17.5 17.5 17.5 17.5	202 202 202 202	30 30 30 30	7 7 7 7	77.5 77.5 77.5 77.5	0 0 0 0	12 12 12 12		
	247 288 329 396		150 150 150 150	25 25 25 25	176 176 176 176	17.5 17.5 17.5 17.5	202 202 202 202	30 30 30 30	7 7 7 7	77.5 77.5 77.5 77.5	0 0 0 0	12 12 12 12		
3526		155 185 215	150 150 150	25 25 25	176 176 176	17.5 17.5 17.5	202 202 202	30 30 30	7 7 7	77.5 77.5 77.5	5 5 5	22 22 22		
		128 168	150 150	25 25	176 176	17.5 17.5	202 202	30 30	7 7	77.5 77.5	5 5	22 22		
1516	239 397 484		150 170 170	10 25 25	176 196 196	17.5 17.5 17.5	202 222 222	25 30 30	7 7 7	77.5 87.5 87.5	0 0 0	12 12 12		

LA *: Additional nut length at each end when using combination wipers

Transport ball screws 16 - 32 mm

NOMINAL DIAMETER 16 - 20 mm

Single nut with backlash Execution grade T5 – T10



■Series 1436: DIN standard flanged nut



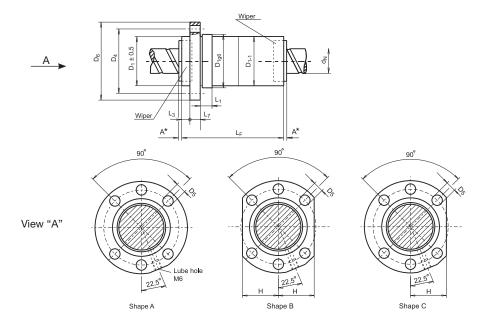
■ Series 2446: End cap nut with flange, dual start

,	Technical data			'				1
	Nut type	Lead P [mm]	Nominal diameter d _N [mm]	No. of circuits i	Ball diameter d _W [mm]	Dyn. load rating* C _a [kN]	Stat. load rating* C _{0a} [kN]	Axial play [mm]
1436	2.16.1.5.3	2	16	3	1.5	2.9	4.9	0.02
	2.16.1.5.4	2	16	4	1.5	3.8	6.5	0.02
	5.16.3.5.3	5	16	3	3.5	10.1	12.0	0.04
	5.16.3.5.4	5	16	4	3.5	12.9	16.0	0.04
2446	10.16.3.5.6	10	16	3 + 3	3.5	19.6	27.7	0.04
	10.16.3.5.8	10	16	4 + 4	3.5	25.6	37.7	0.04
	10.16.3.5.10	10	16	5 + 5	3.5	31.4	47.8	0.04
1436	2.20.1.5.3	2	20	3	1.5	3.2	6.2	0.02
	2.20.1.5.4	2	20	4	1.5	4.1	8.2	0.02
	5.20.3.5.3	5	20	3	3.5	12.1	16.7	0.04
	5.20.3.5.4	5	20	4	3.5	15.5	22.3	0.04
	5.20.3.5.5	5	20	5	3.5	18.8	27.9	0.04
	5.20.3.5.6	5	20	5	3.5	22.0	33.5	0.04
2446	10.20.3.5.6	10	20	3 + 3	3.5	22.8	36.5	0.04
	10.20.3.5.10	10	20	5 + 5	3.5	36.4	63.0	0.04
	20.20.3.5.4	20	20	2 + 2	3.5	14.7	22.4	0.04
	20.20.3.5.6	20	20	3 + 3	3.5	21.7	35.2	0.04

^{*} The load ratings listed here apply to accuracy class T5.
Use factor 0.9 for T7 and factor 0.7 for T10 in order to reduce load ratings.







	Dimensions Flanged nut with wipers both ends													
	L _F [mm]	D ₁ g6 [mm]	L ₁ [mm]	D ₄ [mm]	D ₅ [mm]	D ₆ [mm]	L ₇ [mm]	L ₃ [mm]	H [mm]	A [mm]	LA* [mm]			
1436	39 43	28 28	10 10	38 38	5.5 5.5	48 48	10 10	6 6	20 20	0 0	9 9			
	54 59	28 28	10 10	38 38	5.5 5.5	48 48	10 10	6 6	20 20	0	9			
2446	44 54 64	32 32 32	16 16 16	42 42 42	5.5 5.5 5.5	52 52 52	10 10 10	12 12 12	20 20 20	0 0 0	- - -			
1436	48 52	36 36	10 10	47 47	6.6 6.6	58 58	10 10	6 6	22 22	0	9			
	55 60 61 66	36 36 36 36	10 10 10 10	47 47 47 47	6.6 6.6 6.6 6.6	58 58 58 58	10 10 10 10	6 6 6	22 22 22 22	0 0 0	9 9 9 9			
2446	49 69	36 36	16 16	47 47	6.6 6.6	58 58	10 10	7 7	22 22	0	- -			
	57 77	36 36	16 16	47 47	6.6 6.6	58 58	10 10	7 7	22 22	0	-			

LA *: Additional nut length at each end when using combination wipers

Transport ball screws 16 - 32 mm

NOMINAL DIAMETER 25 - 32 mm

Single nut with backlash Execution grade T5 - T10



■Series 1436: DIN standard flanged nut



■ Series 2446: End cap nut with flange, dual start



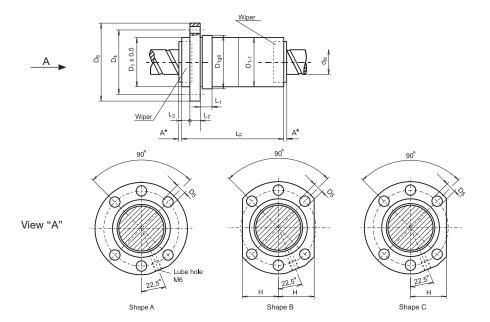
■ Series 3446: UltraSpeed nut with flange, dual start

	Technical data			l				
	Nut type	Lead P [mm]	Nominal diameter d _N [mm]	No. of circuits i	Ball diameter d _W [mm]	Dyn. load rating* C _a [kN]	Stat. load rating* C _{0a} [kN]	Axial play [mm]
1436	5.25.3.5.3	5	25	3	3.5	13.7	21.5	0.04
	5.25.3.5.4	5	25	4	3.5	17.5	28.7	0.04
	5.25.3.5.5	5	25	5	3.5	21.2	35.9	0.04
	5.25.3.5.6	5	25	6	3.5	24.8	43.0	0.04
2446	10.25.3.5.4	10	25	2 + 2	3.5	17.1	28.9	0.04
	10.25.3.5.6	10	25	3 + 3	3.5	25.2	45.4	0.04
	10.25.3.5.10	10	25	5 + 5	3.5	40.3	78.4	0.04
	20.25.3.5.4	20	25	2 + 2	3.5	17.1	29.5	0.04
	20.25.3.5.6	20	25	3 + 3	3.5	25.2	46.4	0.04
	25.25.3.5.4	25	25	2 + 2	3.5	16.7	29.0	0.04
1436	5.32.3.5.3	5	32	3	3.5	16.0	29.8	0.04
	5.32.3.5.4	5	32	4	3.5	20.4	39.8	0.04
	5.32.3.5.5	5	32	5	3.5	24.8	49.7	0.04
	5.32.3.5.6	5	32	6	3.5	29.0	59.6	0.04
	10.32.6.3	10	32	3	6.0	30.8	45.6	0.06
	10.32.6.4	10	32	4	6.0	39.4	60.8	0.06
	10.32.6.5	10	32	5	6.0	47.8	76.0	0.06
3446	20.32.6.4	20	32	2 + 2	6.0	39,3	63,6	0.06
	20.32.6.6	20	32	3 + 3	6.0	57,9	100,0	0.06
	20.32.6.8	20	32	4 + 4	6.0	75,6	136,4	0.06
	32.32.6.2	32	32	1 + 1	6.0	18.2	26.5	0.06

 $^{^{\}star}$ The load ratings listed here apply to accuracy class T5. Use factor 0.9 for T7 and factor 0.7 for T10 in order to reduce load ratings.







	Dimensions Flanged no	ut with wipers	both ends									
	L _F [mm]	D ₁ g6 [mm]	L ₁ [mm]	D ₄ [mm]	D ₅ [mm]	D ₆ [mm]	L ₇ [mm]	L ₃ [mm]	H [mm]	A [mm]	LA * [mm]	
1436	55 60 66 71	40 40 40 40	10 10 10 10	51 51 51 51	6.6 6.6 6.6 6.6	62 62 62 62	10 10 10 10	6 6 6	24 24 24 24	0 0 0 0	9 9 9	
2446	39 49 69	40 40 40	16 16 16	51 51 51	6.6 6.6 6.6	62 62 62	10 10 10	7 7 7	24 24 24	0 0 0	- - -	
	57 77 66	40 40 40	16 16 16	51 51 51	6.6 6.6 6.6	62 62 62	10 10 10	7 7 7	24 24 24	0 0 5	-	
1436	57 62 67 73	50 50 50 50	10 10 10 10	65 65 65 65	9.0 9.0 9.0 9.0	80 80 80 80	12 12 12 12	6 6 6 6	31 31 31 31	0 0 0 0	9 9 9	
	84 95 107	50 50 50	16 16 16	65 65 65	9.0 9.0 9.0	80 80 80	12 12 12	7 7 7	31 31 31	0 0 0	12 12 12	
3446	68 88 108	56 56 56	20 20 20	71 71 71	9.0 9.0 9.0	86 86 86	14 14 14	7 7 7	32.5 32.5 32.5	0 0 0	12 12 12	
	60	56	20	71	9.0	86	14	7	32.5	5	12	

LA *: Additional nut length at each end when using combination wipers

Transport ball screws 16 - 32 mm

NOMINAL DIAMETER 40 - 63 mm

Single nut with backlash Execution grade T5 - T10



■ Series 1436: DIN standard flanged nut



■ Series 2446: End cap nut with flange, dual start



■ Series 3446: UltraSpeed nut with flange, dual start

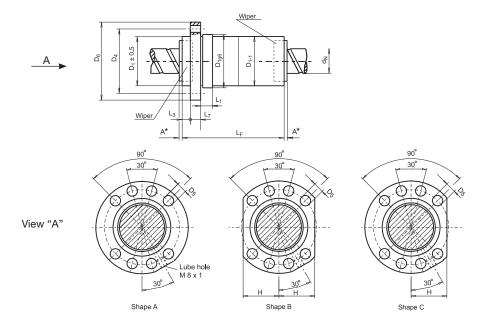
	Technical data							1
	Nut type	Lead P [mm]	Nominal diameter d _N [mm]	No. of circuits i	Ball diameter d _W [mm]	Dyn. load rating* C _a [kN]	Stat. load rating* C _{0a} [kN]	Axial play [mm]
1436	5.40.3.5.3 5.40.3.5.4 5.40.3.5.5 5.40.3.5.6	5 5 5 5	40 40 40 40	3 4 5 6	3.5 3.5 3.5 3.5	17.7 22.7 27.5 32.1	38.2 50.9 63.6 76.4	0.04 0.04 0.04 0.04
	10.40.7.5.3 10.40.7.5.4	10 10	40 40	3 4	7.5 7.5	46.1 59.0	71.3 95.1	0.08 0.08
3446	20.40.6.4 20.40.6.6 20.40.6.8 20.40.6.10	20 20 20 20	40 40 40 40	2 + 2 3 + 3 4 + 4 5 + 5	6 6 6	44.0 64.9 84.7 103.8	80.4 126.3 172.2 218.1	0.06 0.06 0.06 0.06
	40.40.7.5.4 N	40	40	2 + 2	7.5	56.5	96.6	0.06
1436	10.50.7.5.3 10.50.7.5.4 10.50.7.5.5	10 10 10	50 50 50	3 4 5	7.5 7.5 7.5	52.7 67.4 81.7	93.2 124.3 155.4	0.08 0.08 0.08
1436	10.63.7.5.3 10.63.7.5.4 10.63.7.5.5 10.63.7.5.6	10 10 10 10	63 63 63 63	3 4 5 6	7.5 7.5 7.5 7.5	59.2 75.8 91.8 107.4	120.7 160.9 201.1 241.3	0.08 0.08 0.08 0.08
3446	20.63.7.5.6	20	63	3 + 3	7.5	107.6	249.1	0.08

^{*} The load ratings listed here apply to accuracy class T5.
Use factor 0.9 for T7 and factor 0.7 for T10 in order to reduce load ratings.

N: Alternate sizes acc. to DIN 69051







'	Dimensions Flanged nut with wipers both ends													
	L _F [mm]	D ₁ g6 [mm]	L ₁ [mm]	D ₄ [mm]	D ₅ [mm]	D ₆ [mm]	L ₇ [mm]	L ₃ [mm]	H [mm]	A [mm]	LA * [mm]			
1436	59 64 69 75	63 63 63 63	10 10 10 10	78 78 78 78 78	9 9 9	93 93 93 93	14 14 14 14	6 6 6	35 35 35 35	0 0 0 0	9 9 9			
	88 97	63 63	16 16	78 78	9	93 93	14 14	7 7	35 35	0 0	12 12			
3446	69 89 109 129	63 63 63 63	20 20 20 20	78 78 78 78	9 9 9	93 93 93 93	14 14 14 14	7 7 7 7	35 35 35 35	0 0 0 0	12 12 12 12			
	107	70	25	85	9	100	14	21	37.5	0	12			
1436	88 99 111	75 75 75	16 16 16	93 93 93	11 11 11	110 110 110	16 16 16	7 7 7	42.5 42.5 42.5	0 0 0	12 12 12			
1436	91 102 112 124	90 90 90 90	16 16 16 16	108 108 108 108	11 11 11 11	125 125 125 125	18 18 18 18	7 7 7 7	47.5 47.5 47.5 47.5	0 0 0 0	12 12 12 12			
3446	91	95	25	115	13.5	135	20	7	50	0	12			

LA *: Additional nut length at each end when using combination wipers



Heavy Duty Ball Screws Diameter 32 - 125 mm







HEAVY DUTY BALL SCREWS (ULTRA THRUST)

UltraThrust ball screws from Steinmeyer are not merely larger sizes of conventional ball screws. They have been specifically designed for the purpose of transmitting very high loads. The ball returns for example have been optimized for large ball sizes and for the specific use of such large screws. Also the robust nut body and the flange differ from conventional designs. Material selection and heat treatment take into account the special application requirements.

Please keep in mind that the extremely high static capacities of such screws are a result of the high dynamic load capacities. They are not to be mistaken as operating loads. Maximum permissible loads are defined on the following pages.

These ball screws are usually assembled either without any or with low preload.

NOMINAL DIAMETER 32-125 MM HEAVY DUTY Single nut



FLANGE NUT

■ Series 9414: Nut with flange, single start, with Z deflectors

Assembled with minimal clearance (Max. 0.02 mm) or very light preload (Max. 2% of dyn. Load Capacity)

	Allgemeine technise	che Daten	1						
	Nut type	Lead P [mm]	Nominal-Ø d _N [mm]	Number of deflectors	Ball-Ø d _w [mm]	dyn. load rating C _a [kN]	stat. load rating C _{0a} [kN]	Shaft outer-Ø [mm]	Minor-Ø [mm]
9414	10.32A.7,5.6 10.36A.7,5.6 10.40A.7,5.9 10.50A.7,5.9	10 10 10 10	32 36 40 50	2 2 3 3	7.5 7.5 7.5 7.5	107.10 117.00 182.80 203.40	182.80 213.50 377.40 473.80	32.0 36.0 40.0 50.0	26.3 30.3 34.3 44.3
	12.32A.9.6 12.40A.9.9 12.50A.9.9	12 12 12	32 40 50	2 3 3	9 9 9	132.90 226.80 252.50	217.80 440.00 545.20	32.0 40.0 50.0	25.4 33.4 43.4
	16.50A.11.9 16.63A.11.9	16 16	50 63	3 3	11 11	427.90 493.80	922.00 1210.00	50.0 63.0	41.9 53.9
	20.63A.15.9 20.80A.15.9 20.80A.15.12 20.100A.15.9	20 20 20 20	63 80 80 100	3 4 3 3	15 15 15 15	542.70 825.60 636.60 708.10	1128.10 2042.30 1509.50 1895.10	63.0 80.0 80.0 100.0	50.8 67.8 67.8 87.8
	25.125.19.9	25	125	3	19	1386.20	4052.60	124.0	107.9

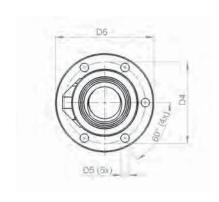
¹ deflector = 3 circuits (2,7 circuits)

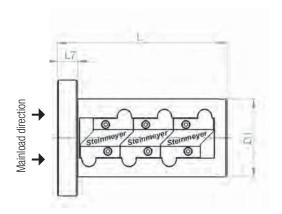
More Ultra Thrust designs and further technical details are available on request.

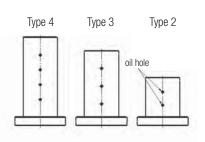
For engineering consultation or to place an order, please contact us by phone +49 (0) 7431 1288-0





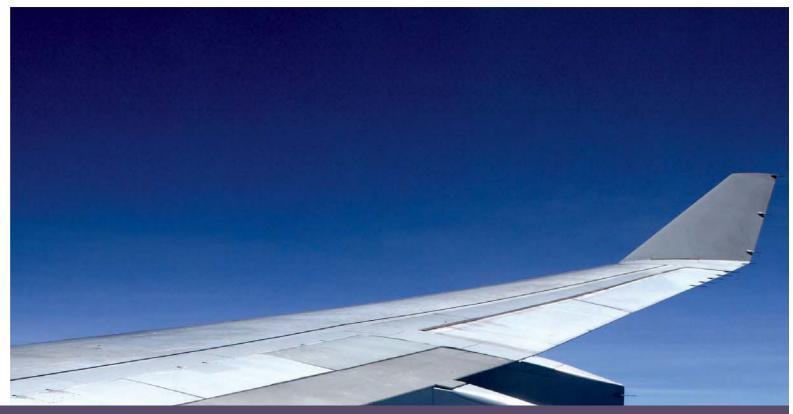






Minimum nut dimensions

	Abmessungen						
	Nut length	Nut-Ø	PCD-Ø	Flange hole-Ø	Flange-Ø	Flange thickness	Lube hole
	L	D_1	D_4	D_5	D_6	L ₇	
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	
9414	98 98 135 135	58 62 66 78	71 75 82 94	6.6 6.6 9 9	85 89 100 112	15 15 15 15	Type 2: 2 x M6 Type 2: 2 x M6 Type 3: 3 x M6 Type 3: 3 x M6
	116 152 152	66 70 80	82 86 96	9 9 9	100 104 114	18 18 18	Type 2: 2 x M6 Type 3: 3 x M6 Type 3: 3 x M6
	211 211	95 105	113 122	9 9	135 139	28 28	Type 3: 3 x Rc1/8 Type 3: 3 x Rc1/8
	252 310 252 252	117 134 134 154	137 154 154 174	11 11 11 11	157 174 174 195	32 32 32 32	Type 3: 3 x Rc1/8 Type 3: 3 x Rc1/8 Type 4: 4 x Rc1/8 Type 3: 3 x Rc1/8
	310	173	193	11	213	40	Type 3: 3 x Rc1/8



Ball Screws for Aerospace Applications







BALL SCREW DRIVES FOR AEROSPACE APPLICATIONS

Steinmeyer develops customized solutions for many applications in the aerospace industry. The focus during the entire development right up to the start of production is the close customer relationship. Already the first contacts were conducted in close cooperation between the customer and the aerospace team of Steinmeyer. This ensures that the initial designs are already close to the customers needs. Through a regular exchange of information, reliable and customer-specific products are developed. After a joint qualification of the components, approval is made for serial production, according to industry standards. Quality during the entire process from the request for the production of the first ball screw drive and beyond is ensured by implementing a EN9100-certified QM system.

In addition to more than 50 years of experience in the development and manufacture of ball screw drives, Steinmeyer has been developing and manufacturing special ball screw drives for various aerospace applications for 10 years. The fulfillment of the additional requirements of this sector was built through a long-term development phase. Meanwhile, Steinmeyer has extensive experience in Aerospace and has established itself in the market.

A brief overview of the possibilities of Steinmeyer Aerospace:

- Built-to-print: Production of existing programs according to the present designs.
 Short-term realization of your needs.
- Built-to-spec: Reliable partner in the development, design and manufacture of ball screws according to your specifications.
- Engineering services in the field of design and development of ball screw drives.
 Support of the qualification process.

On the following pages you will find an overview of the different product groups of Steinmeyer Aerospace.





BALL SCREW DRIVES FOR APPLICATIONS IN FLAP ACTUATORS



For actuators in various flap applications, Steinmeyer Aerospace offers a wide range of ball screw drives. Already realized and tested in the series have been used for many years and are characterized by different characteristics. These include specific solutions with spherical suspension, with gimbal suspension, and modular systems.

BALL SCREWS FOR APPLICATIONS IN ELECTROMECHANICAL ACTUATORS



For various other actuators in aviation applications, Steinmeyer can draw on a broad spectrum of products. Various applications such as solutions for air-conditioning, cost-optimized solutions for electromechanical actuators or door actuators.





BALL SCREW DRIVES FOR APPLICATIONS IN ACTUATORS FOR BRAKING SYSTEMS





In the field of ball screw drives for brake actuators, Steinmeyer has already implemented several products. The focus here is on the development of specific solutions with extremely high load capacity, optimized solutions with minimized installation space as well as customer-specific designs.

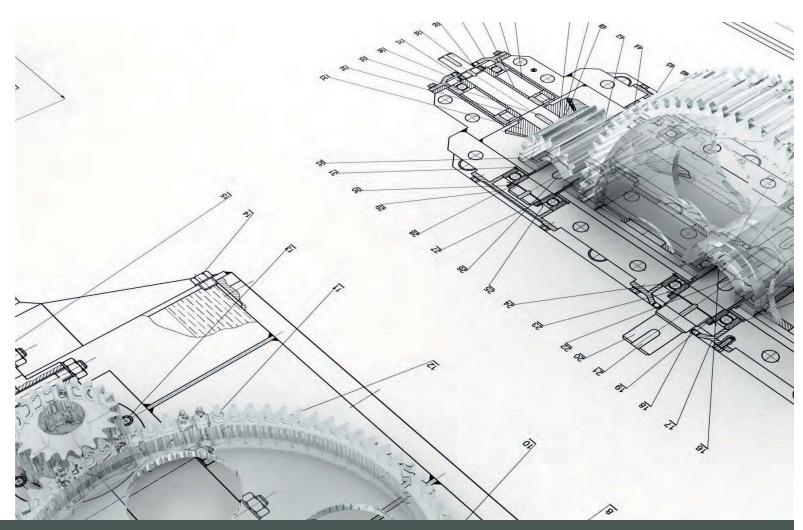
BALL SCREWS FOR APPLICATIONS IN THE AEROSPACE AND UNMANNED AIR VEHICLES



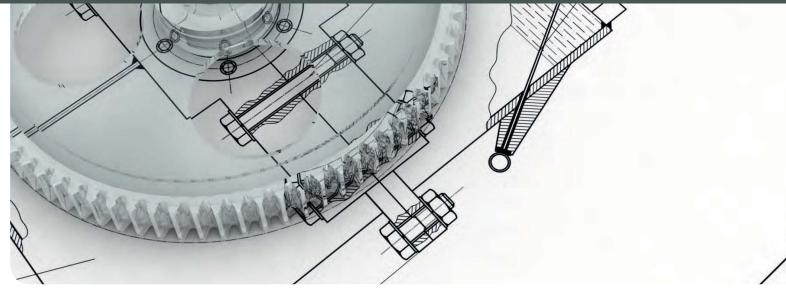




Steinmeyer is also a reliable partner in the field of space travel. We offer titanium versions in the field of space travel and ball screw drives for the control of missiles and for unmanned missiles.



Rotating Nuts Diameter 25 - 63 mm







ROTATING NUTS

This section describes ball nuts that mate directly with angular ball bearings. The nut body includes a metric thread for a locknut to secure the bearing. The nut flange is ground on both sides and has threaded bolt holes so a pulley can be installed opposite the bearing.

The standard rotating nut has 4-point contact preload. Special executions with 2-point contact, or as , are also possible. Please inquire.

Steinmeyer ball nuts are ideal for rotating nut designs because they are inherently mass balanced due to the symmetrical orientation of the ball deflectors. Driven (rotating) nuts and stationary shafts offer a number of advantages over conventional layouts (and some disadvantages):

- Resonance of the shaft is not as critical. Higher speeds may be reached when the shaft is not rotating.
- Pre-tensioning of the shaft is simplified, since the necessary forces do not need to be transmitted through bearings. Heating is reduced significantly.
- Stationary shafts allow easy internal cooling of the screw.
- Axial and torsional stiffness is higher, when axial loads and moments can be transmitted into the surrounding structure at both ends of the shaft rather than just one. Particularly long shafts with high lead/diameter ratio exhibit a clear increase in total rigidity compared to conventional layouts with rotating shafts.
- Lubrication of the nut is complicated since rotating unions are necessary to feed lubricant directly into the nut, and centrifugal forces push all lubricant away from the balls and ball tracks.
- Thrust bearings to be installed on the nut are relatively large in diameter and may restrict speeds.
- Direct drive requires a hollow shaft motor, which may be critical due to heat emission of the motor.

TECHNICAL TIP

Rotating unions, used to feed oil into a rotating nut, can be quite troublesome because their leak rate can (with time) be higher than the actual oil flow. This means the oil can be thrown out of the nut before it reaches the balls, resulting in complete lubrication breakdown.

A simple and effective alternate solution is to drill a hole through the center of the shaft from one end and cross-drill another hole at a position where the nut passes over regularly - for example a tool change position or similar. The lube pump, which needs to be connected to the NC control, will then shoot a small quantity of oil into the nut when it is positioned over this cross hole. With proper lubricant and wiper selection, this technique should be sufficient until the nut returns to this position again.

This feature can even be combined, if necessary, with a coolant channel through the shaft.

NOMINAL DIAMETER 25 - 63 mm ROTATING NUT

Single nut, 4-point contact Execution grade P0 - P5



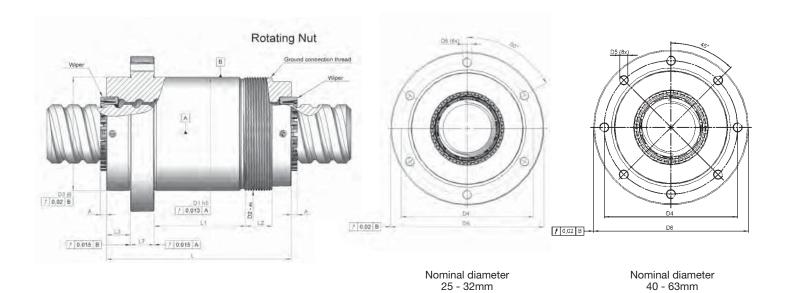
■ Series 1414: Flange single nut, ball oversize preload ■ Series 2424: End cap nut with flange, dual start, ball oversize preload ■ Series 3424: UltraSpeed nut with flange, dual start, ball oversize preload

		Technical data							
		Nut type	Lead P	Nominal diameter d _N	No. of circuits i	Ball diameter d _w	dyn. load rating C _a	stat. load rating C _{0a}	Stiffness R _{nu, ar}
			[mm]	[mm]		[mm]	[kN]	[kN]	[N/µm]
	1414	5.25.3.5.5 10.25.3.5.3 20.25.3.5.4	5 15 20	25 25 25	1 x 5 1 x 3 1 x 4	3.5 3.5 3.5	21.2 13.6 17.1	35.9 21.4 29.5	430 220 230
	2424	20.25.3.5.4	20	25	2 + 2	3.5	17.1	29.5	230
	1414	5.32.3.5.6 10.32.6.5 15.32.6.3	5 10 15	32 32 32	1 x 6 1 x 5 1 x 3	3.5 6 6	29.0 47.8 30.5	59.0 76.0 45.3	680 490 250
	3424	20.32.6.6	20	32	3 + 3	6	57.9	100.0	530
Ī	1414	10.40.7.5.6 15.40.7.5.4 20.40.7.5.3	10 15 20	40 40 40	1 x 6 1 x 4 1 x 3	7.5 7.5 7.5	83.7 58.7 45.5	142.7 94.8 70.7	770 460 300
	3424	20.40.6.8 25.40.6.6	20 25	40 40	4 + 4 3 + 3	6 6	84.7 64.3	172.2 125.4	960 630
	1414	10.50.7.5.6 15.50.9.4 20.50.9.3	10 15 20	50 50 50	1 x 6 1 x 4 1 x 3	7.5 9 9	95.6 98.8 76.8	186.5 173.9 130.0	990 690 470
	3424	25.50.7.5.8 30.50.7.5.6 40.50.7.5.6	25 30 40	50 50 50	4 + 4 3 + 3 3 + 3	7.5 7.5 7.5	126.6 96.3 94.6	269.1 196.3 193.6	1180 800 640
	3424	25.60.9.8 30.60.9.8 40.60.9.6	25 30 40	60 60 60	4 + 4 4 + 4 3 + 3	9 9 9	214.5 213.5 161.5	492.9 491.0 356.7	1790 1650 1040
	1414	10.63.7.5.6 15.63.9.4 20.63.11.3	10 15 20	63 63 63	1 x 6 1 x 4 1 x 3	7.5 9 11	107.4 116.7 115.3	241.3 239.9 209.4	1230 940 660

LA *: Additional nut length at each end when using combination wipers Actual stiffness at preload equal to 0.08 x $\rm C_a$







	Dimensions Flanged nut with wipers both ends												
	D1	L1	:	L2	D3	L3	D6	L7	L	D4	D5	LA*	А
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
1414	40	34	M40x1.5	20	40	7	62	10	72	51	M6	9	0
	40	34	M40x1.5	20	40	7	62	10	82	51	M6	12	0
	40	34	M40x1.5	20	40	7	62	10	82	51	M6	-	0
2424	40	34	M40x1.5	20	40	7	62	10	82	51	M6	-	0
1414	50	34	M50x1.5	20	50	7	80	12	74	65	M6	9	0
	50	34	M50x1.5	20	50	7	80	12	104	65	M6	12	0
	50	34	M50x1.5	20	50	7	80	12	99	65	M6	12	0
3424	60	45	M60x2	20	60	7	86	14	88	71	M6	12	0
1414	70	45	M70x2	23	65	7	93	14	119	78	M6	12	0
	70	45	M70x2	23	65	7	93	14	117	78	M6	12	0
	70	45	M70x2	23	65	7	93	14	117	78	M6	12	0
3424	70	45	M70x2	23	65	7	93	14	109	78	M6	12	0
	70	45	M70x2	23	65	7	93	14	107	78	M6	22	10
1414	80	45	M80x2	23	75	7	110	16	120	93	M8	12	0
	80	45	M80x2	23	75	7	110	16	125	93	M8	12	0
	80	45	M80x2	23	75	7	110	16	128	93	M8	12	0
3424	90	55	M90x2	25	85	7	125	18	130	108	M10	22	10
	90	55	M90x2	25	85	7	125	18	120	108	M10	22	10
	90	55	M90x2	25	85	7	125	18	149	108	M10	22	10
3424	100	55	M100x2	25	95	7	135	20	131	115	M10	22	10
	100	55	M100x2	25	95	7	135	20	151	115	M10	22	10
	100	55	M100x2	25	95	7	135	20	150	115	M10	22	10
1414	90	55	M90x2	25	85	7	125	18	120	115	M10	12	0
	100	55	M100x2	25	95	7	135	20	131	115	M10	12	0
	100	55	M100x2	25	95	7	135	20	132	115	M10	12	0

Welcome to where precision is.



August Steinmeyer GmbH & Co. KG

Riedstraße 7 72458 Albstadt Germany

Phone +49 (0) 7431 1288-0 Fax +49 (0) 7431 1288-89

E-mail info@steinmeyer.com Internet www.steinmeyer.com









Rowley Mills Penistone Road Lepton Huddersfield HD8 0AA England

Phone +44 (0)1484 601002

E-mail: sales@reliance.co.uk Internet: www.reliance.co.uk