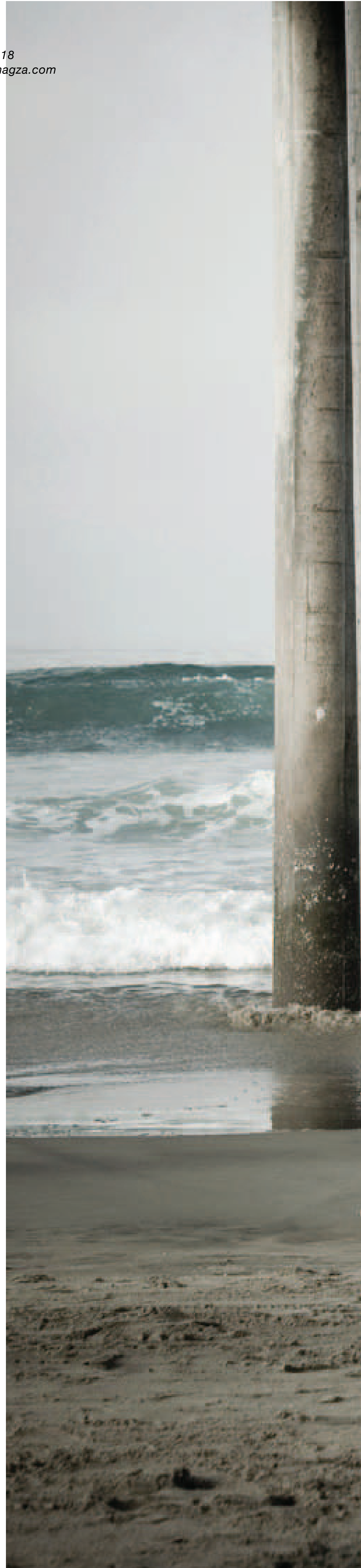
07
SCREWS AND NUTS

"ONE MILIMETRE IN THE MANUFACTURING OF A SURF BOARD IS THE DIFFERENCE BETWEEN RIDING THE WAVE OR SINKING TO THE BOTTOM."

TAJ BURROW
WORLD SURF CHAMPION 2006



SCREWS AND NUTS

INTRODUCTION

Screws transform a rotation movement into a transfer and vice versa; the latter depends on the type of screw and its dimensions.

NIASA offers an extensive range of screws for all types of applications, within sectors as varied as tool machining, aeronautics, transport and handling industry, renewable energies, etc. In this section you will find the most suitable screw for practically any requirement, regardless of size, load, speed, precision, efficiency, etc. requirements.

NIASA quality standards guarantee the highest levels of reliability on the entire range of screws and nuts.

NIASA supplies trapezoidal as well as ball screws. The benefits of ball screws over trapezoidal screws are the following:

- Greater positioning precision.
- Longer useful life.
- Greater efficiency.
- Possibility of working at higher speeds.
- Lower heat generation.
- No slipping or gripping effects.

Trapezoidal screws are usually the most economical and their features suit numerous application requirements.

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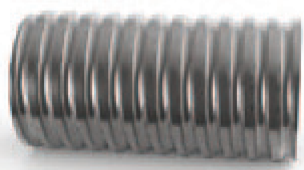
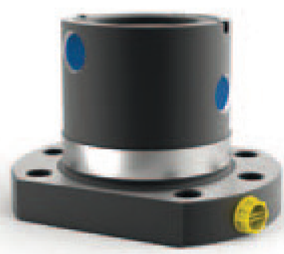
SCREWS AND NUTS

GENERAL PRODUCT OVERVIEW

KGS BALLS

Ball screw **KGS**	Nut according to DIN 69051 **KGF-D**
	
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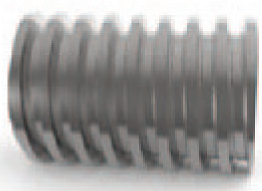
Tr TRAPEZ.

Trapezoidal screw **TR**	Nut **EFM**
	
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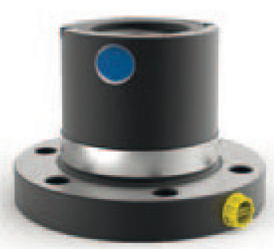
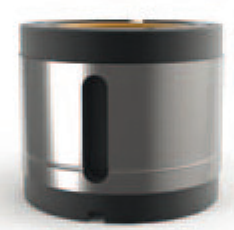
Nut according to NIASA standard **KGF-N**	Nut according to DIN 69051 **KGM-D**	Nut according to NIASA standard **KGM-N**
		
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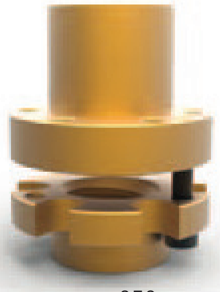
Safety nut **EFMS**	Nut **LRM**
	
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07

ROLLED BALL SCREWS

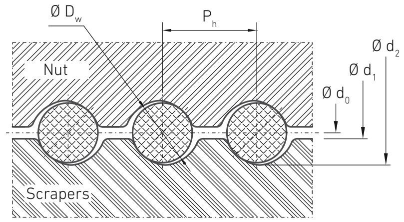
KGS BALLS

Cold pressed with no stock removal, with thermal treatment and polishing. Please ask NIASA about the supply of machined screws with stock removal and tempered, with tolerance class up to P0, and also for stainless materials.

NIASA manufactures screws with their sides machined according to your requirements. Please also ask if any thermal treatment is required.

Out of stock there are also many other screw diameters/pitches available, also with left thread. Also for several types of nuts (with threaded body, etc).

Standard material	Min. elastic limit	Min. resistance to breakage	Approx. surface hardness
	R_e (N/mm^2)	R_m (N/mm^2)	
Cf53 / 42CrMo4	610	380	60 HRC



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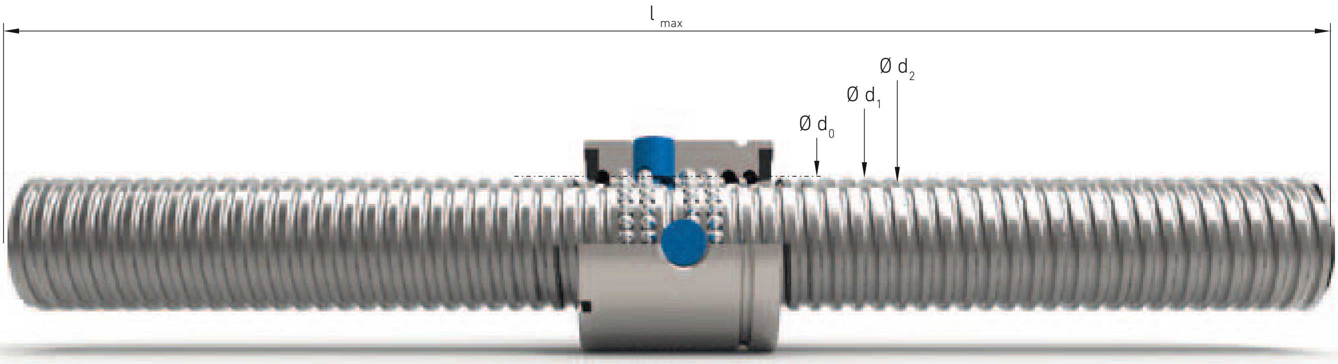


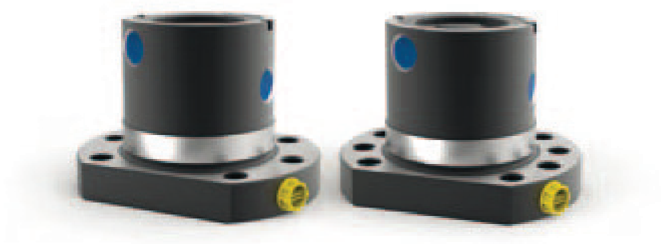
d_0 Nominal diameter (mm)	P_h Pitch (mm)	Thread entries	D_w Ball diameter (mm)	Standard tolerance class	d_1h11 Exterior diameter (mm)	d_2 Interior thread diameter (mm)	l_{max} Maximum length approx. (mm)	M Weight (kg/m)	a Transversal section area (mm²)	i Axial inertia moment (mm⁴)	Ip Polar inertia moment (mm⁴)	Nut type Available in stock			
												KGF		KGM	
												D	N	D	N
16	5	1	3,500	T7	15,55	12,88	6000	1,38	1,75E+02	2,22E+03	4,93E+03	•	•	•	
16	10	2	3,000	T7	15,35	12,89	6000	1,26	1,60E+02	1,69E+03	4,17E+03	•		•	
20	5	1	3,500	T7	19,50	16,87	6000	2,21	2,82E+02	5,85E+03	1,27E+04	•	•	•	•
20	20	4	3,500	T7	19,50	16,87	6000	2,03	2,59E+02	5,41E+03	1,08E+04		•		•
20	50	5	3,500	T7	19,10	16,40	6000	2,05	2,62E+02	5,53E+03	1,11E+04		•		•
25	5	1	3,500	T7	24,60	21,90	6000	3,32	4,23E+02	1,42E+04	2,85E+04	•	•	•	•
25	10	2	3,500	T7	24,60	21,92	6000	3,34	4,25E+02	1,27E+04	2,90E+04	•		•	
25	20	4	3,500	T7	24,60	21,92	6000	3,32	4,23E+02	1,44E+04	2,88E+04	•		•	
25	25	5	3,500	T7	24,60	21,92	6000	3,32	4,23E+02	1,44E+04	2,88E+04	•		•	
25	50	5	3,500	T7	24,15	21,47	6000	3,37	4,29E+02	1,48E+04	2,95E+04	•		•	
32	5	1	3,500	T7	31,50	28,87	6000	5,90	7,52E+02	4,29E+04	9,01E+04	•	•	•	•
32	10	1	7,144	T7	32,74	27,33	6000	5,57	7,10E+02	3,98E+04	8,03E+04	•	•		•
32	20	2	5,000	T7	31,70	27,81	6000	5,67	7,22E+02	3,63E+04	8,38E+04	•			•
32	32	4	3,969	T7	31,30	28,33	6000	5,74	7,31E+02	4,28E+04	8,56E+04	•			
32	40	4	3,500	T7	30,90	28,26	6000	5,63	7,17E+02	4,10E+04	8,21E+04		•		•
40	5	1	3,500	T7	39,53	36,90	6000	9,03	1,15E+03	1,05E+05	2,11E+05	•	•	•	•
40	10	1	7,144	T7	39,62	34,28	6000	8,43	1,07E+03	9,11E+04	1,83E+05	•	•	•	
40	20	2	5,000	T7	39,70	35,81	6000	9,05	1,15E+03	9,52E+04	2,13E+05	•		•	
40	40	4	3,500	T7	38,95	36,24	6000	9,02	1,15E+03	1,05E+05	2,11E+05	•		•	
50	10	1	7,144	T7	49,60	44,11	6000	13,53	1,72E+03	2,35E+05	4,73E+05	•	•	•	•
50	20	2	7,144	T7	49,50	43,99	6000	13,46	1,71E+03	2,05E+05	4,72E+05	•			•
63	10	1	7,144	T7	62,60	57,15	6000	22,07	2,81E+03	6,25E+05	1,26E+06	•	•	•	•
63	20	2	7,144	T7	62,70	57,16	6000	22,06	2,81E+03	5,70E+05	1,26E+06	•		•	
80	10	1	7,144	T7	79,65[1)]	74,20	6000	36,43	4,64E+03	1,71E+06	3,43E+06		•		•

... [1)] h12

07

NUT WITH KGF-D FLANGE

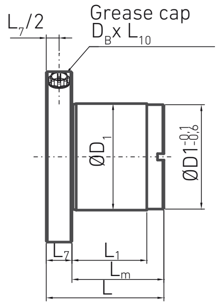
KGS BALLS



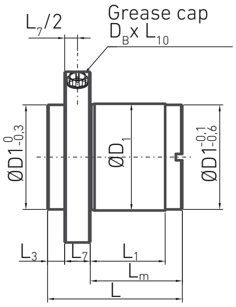
Dimensions according to DIN 69051

Out of stock there are also many other screw diameters/pitches available, also with left thread. Also for several types of nuts (with threaded body, etc).

Safety screws can also be supplied in combination with standard screws.



SHAPE - E



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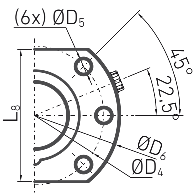
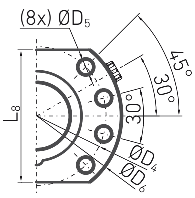


Drilled template 1



Drilled template 2

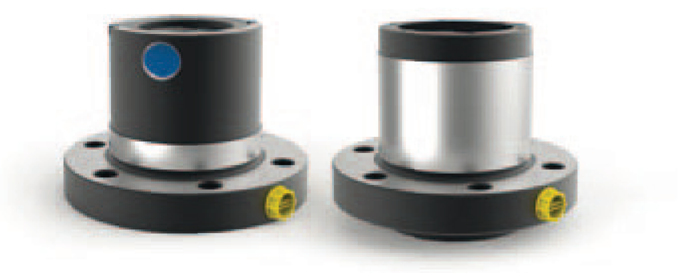
	Standard material	Min. elastic limit R_e (N/mm²)	Min. resistance to breakage R_m (N/mm²)	Approx. hardness treatment
Nut	16MnCr5 / 100Cr6	800	600	60 HRC Temple
Scraper	PPN 7190 TV 40 / NBR 33			
Ball	100 Cr6			64 HRC

d_0 Nominal diameter (mm)	P_h Pitch (mm)	Nut shape	Drilled template	Thread entries	D_w Ball diameter (mm)	D_1 g6 (mm)	D_4 (mm)	D_5 (mm)	D_6 h13 (mm)	L (mm)	L_m (mm)	L_1 (mm)	L_3 (mm)	L_7 h13 (mm)	L_8 h13 (mm)	D_B (mm)	L_B (mm)	L_{10} (mm)	Axial backlash nominal (mm)	Loaded ball turns	C_{am} Modified dynamic load capacity (kN)	C_{a0m} Modified static load capacity (kN)
16	5	E	1	1	3,500	28	38	5,5	48	42	32	10	0	10	40	M6x1	5	10	0,041	3	9,3	13,1
16	10	E	1	2	3,000	28	38	5,5	48	55	45	10	0	10	40	M6x1	5	10	0,041	6	15,4	26,5
20	5	E	1	1	3,500	36	47	6,6	58	42	32	10	0	10	44	M6x1	5	10	0,035	3	10,5	16,6
25	5	E	1	1	3,500	40	51	6,6	62	42	32	10	0	10	48	M6x1	5	10	0,041	3	12,3	22,5
25	10	E	1	2	3,500	40	51	6,6	62	55	45	16	0	10	48	M6x1	5	10	0,041	3	13,2	25,3
25	20	S	1	4	3,500	40	51	6,6	62	35	14,5	4	10,5	10	48	M6x1	5	8	0,041	4	13	23,3
25	25	S	1	5	3,500	40	51	6,6	62	35	17	9	8	10	-[2)]	M6x1	5	8	0,041	5	16,7	32,2
25	50	S	1	5	3,500	40	51	6,6	62	58	38	10	10	10	48	M6x1	5	8	0,041	5	15,4	31,7
32	5	E	1	1	3,500	50	65	9	80	55	43	10	0	12	62	M6x1	6	10	0,041	5	21,5	49,3
32	10	E	1	1	7,144	53[1)]	65	9	80	69	57	16	0	12	62	M8x1	6	10	0,084	3	33,4	54,5
32	20	E	1	2	5,000	53[1)]	65	9	80	80	68	16	0	12	62	M6x1	6	10	0,059	4	29,7	59,8
40	5	E	2	1	3,500	63	78	9	93	57	43	10	0	14	70	M6x1	7	10	0,041	5	23,8	63,1
40	10	E	2	1	7,144	63	78	9	93	71	57	16	0	14	70	M8x1	7	10	0,084	3	38	69,1
40	20	E	2	2	5,000	63	78	9	93	80	66	16	0	14	70	M8x1	7	10	0,059	4	33,3	76,1
40	40	S	2	4	3,500	63	78	9	93	85	63,5	16	7,5	14	-[2)]	M8x1	7	10	0,041	8	35	101,9
50	10	E	2	1	7,144	75	93	11	110	95	79	16	0	16	85	M8x1	8	10	0,084	5	68,7	155,8
50	20	E	2	2	7,144	85[1)]	103[1)]	11	125	95	77	22	0	18	95	M8x1	9	10	0,084	4	60	136,3
63	10	E	2	1	7,144	90	108	11	125	97	79	16	0	18	95	M8x1	9	10	0,084	5	76	197
63	20	E	2	2	7,144	95	115	13,5	135	99	79	25	0	20	100	M8x1	10	10	0,084	4	78,4	171,3

... [1)] Its dimensions are not consistent with DIN 69051 / [2)] Rounded flange

NUT WITH KGF-N FLANGE

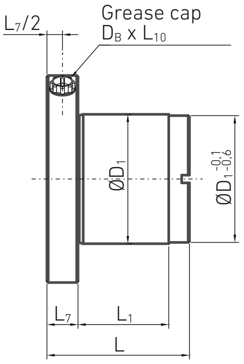
KGS BALLS



Dimensions according to NIASA standard

Out of stock there are also many other screw diameters/pitches available, also with left thread. Also for several types of nuts (with threaded body, etc).

Safety screws can also be supplied in combination with standard screws.



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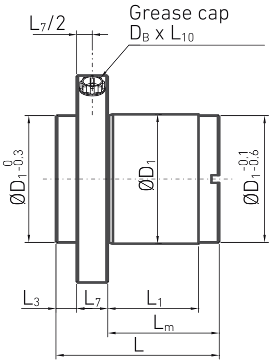
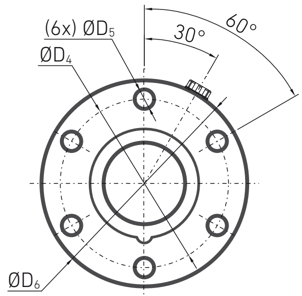


SHAPE - S



Drilled template 4

	Standard material	Min. elastic limit R_e (N/mm²)	Min. resistance to breakage R_m (N/mm²)	Approx. hardness treatment
Nut	16MnCr5 / 100Cr6	800	600	60 HRC Temple
Scraper	PPN 7190 TV 40 / NBR 33			
Ball	100 Cr6			64 HRC

d_0 Nominal diameter (mm)	P_h Pitch (mm)	Nut shape	Drilled template	Thread entries	D_w Ball diameter (mm)	D_1 g6 (mm)	D_4 (mm)	D_5 (mm)	D_6 h13 (mm)	L (mm)	L_m (mm)	L_1 (mm)	L_3 (mm)	L_7 h13 (mm)	L_8 h13 (mm)	D_B (mm)	L_B (mm)	L_{10} (mm)	Axial backlash nominal (mm)	Loaded ball turns	C_{am} Modified dynamic load capacity (kN)	C_{a0m} Modified static load capacity (kN)
16	5	E	4	1	3,500	28	38	5,5	48	44	32	8	0	12	-1)	M6x1	6	8	0,041	3	9,3	13,1
20	5	E	4	1	3,500	32	45	7	55	44	32	8	0	12	-1)	M6x1	6	8	0,041	3	10,5	16,6
20	20	S	4	4	3,500	35	50	7	62	30	12	4	8	10	-1)	M6x1	5	8	0,041	4	11,6	18,4
20	50	S	4	5	3,500	35	50	7	62	56	37	10	9	10	-1)	M6x1	5	8	0,041	5	13	24,6
25	5	E	4	1	3,500	38	50	7	62	46	32	8	0	14	-1)	M6x1	7	8	0,041	3	12,3	22,5
32	5	E	4	1	3,500	45	58	7	70	49	43	10	0	16	-1)	M6x1	8	8	0,041	5	21,5	49,3
32	10	E	4	1	7,144	53	68	7	80	73	57	10	0	16	-1)	M8x1	8	8	0,084	3	33,4	54,5
32	40	S	4	4	3,500	53	68	7	80	45	21.5	14	7.5	16	-1)	M6x1	8	10	0,041	4	14,9	32,4
40	5	E	4	1	3,500	53	68	7	80	59	43	10	0	16	-1)	M6x1	8	8	0,041	5	23,8	63,1
40	10	E	4	1	7,144	63	78	9	95	73	57	10	0	16	-1)	M8x1	8	8	0,084	3	38	69,1
50	10	E	4	1	7,144	72	90	11	110	97	79	10	0	18	-1)	M8x1	9	8	0,084	5	68,7	155,8
63	10	E	4	1	7,144	85	105	11	125	99	79	10	0	20	-1)	M8x1	10	8	0,084	5	76	197
80	10	E	4	1	7,144	105	125	14	145	101	79	10	0	22	-1)	M8x1	11	8	0,084	5	86,25	262,41

... 1) Rounded flange

07

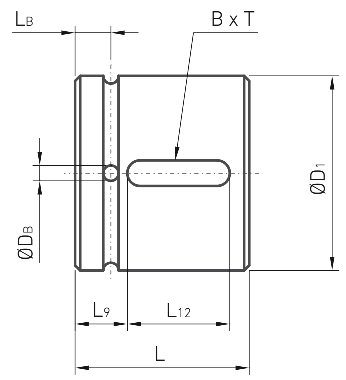
KGM-D CYLINDRICAL NUT

KGS BALLS

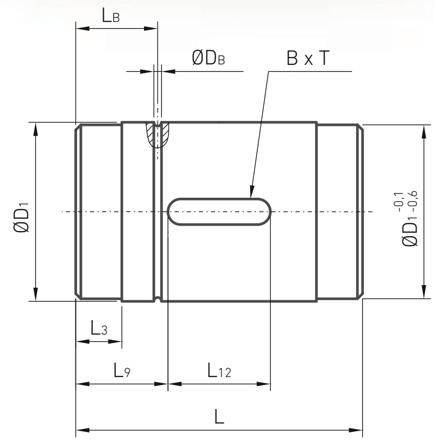
Dimensions according to DIN 69051

Out of stock there are also many other screw diameters/pitches available, also with left thread. Also for several types of nuts (with threaded body, etc).

Safety screws can also be supplied in combination with standard screws.



SHAPE - E



SHAPE - S

	Standard material	Min. elastic limit R_e (N/mm²)	Min. resistance to breakage R_m (N/mm²)	Approx. hardness treatment
Nut	16MnCr5 / 100Cr6	800	600	60 HRC Temple
Scraper	PPN 7190 TV 40 / NBR 33			
Ball	100 Cr6			64 HRC

d_0 Nominal diameter (mm)	P_h Pitch (mm)	Nut shape	Thread entries	D_w Ball diameter (mm)	D_1 g6 D (mm)	L (mm)	L_3 (mm)	D_B (mm)	L_B (mm)	L_9 (mm)	L_{12} (mm)	B P9 (mm)	T (mm)	Nominal axial backlash (mm)	Loaded ball turns	C_{am} Modified dynamic load capacity (kN)	C_{adm} Modified static load capacity (kN)
16	5	E	1	3,500	28	34	-	3	7	7	20	5	2	0,041	3	9,3	13,1
16	10	E	2	3,000	28	50	-	3	7	15	20	5	2	0,035	6	15,4	26,5
20	5	E[1]	1	3,500	36	34	-	3	7	7	20	5	2	0,041	3	10,5	16,6
25	5	E	1	3,500	40	34	-	3	7	7	20	5	2	0,041	3	12,3	22,5
25	10	E	2	3,500	40	45	-	3	7,5	12,5	20	5	2	0,041	3	13,2	25,3
25	20	S	4	3,500	40	35	10,5	1,5	14	11,5	12	5	3	0,041	4	13	23,3
25	25	S	5	3,500	40	35	8	1,5	11,5	11	13	5	3	0,041	5	16,7	32,2
25	50	S	5	3,500	40	58	10	1,5	17	19	20	5	3	0,041	5	15,4	31,7
32	5	E	1	3,500	50	45	-	3	7,5	8	30	6	2,5	0,041	5	21,5	49,3
40	5	E	1	3,500	63	45	-	3	7,5	8	30	6	2,5	0,041	5	23,8	63,1
40	10	E	1	7,144	63	60	-	4	10	15	30	6	2,5	0,084	3	38	69,1
40	20	E	2	5,000	63	70	-	3	7,5	20	30	6	2,5	0,059	4	33,3	76,1
40	40	S	4	3,500	63	85	7,5	1,5	15	27,5	30	6	3,5	0,041	8	35	101,9
50	10	E	1	7,144	75	82	-	4	11	23	36	6	2,5	0,084	5	68,7	155,8
63	10	E	1	7,144	90	82	-	4	11	23	36	6	2,5	0,084	5	76	197
63	20	E	2	7,144	95	82	-	4	10	23	36	6	2,5	0,084	4	78,4	171,3

... [1] Lubrication orifice in any position on the circumference

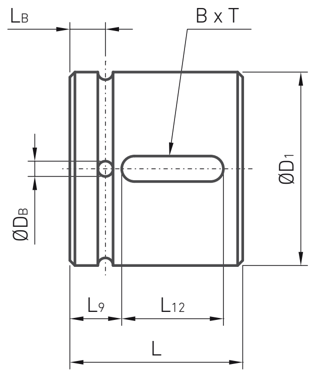
KGM-D CYLINDRICAL NUT

KGS BALLS

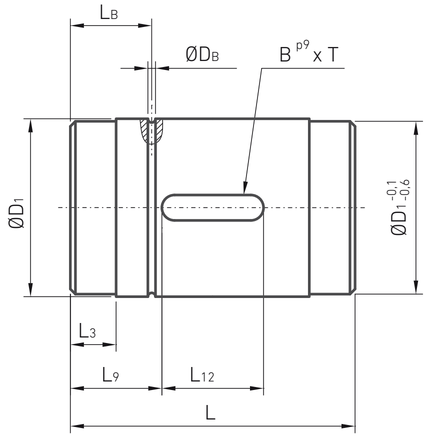
Dimensions according to NIASA standard

Out of stock there are also many other screw diameters/pitches available, also with left thread. Also for several types of nuts (with threaded body, etc).

Safety screws can also be supplied in combination with standard screws.



SHAPE - E



SHAPE - S

	Standard material	Min. elastic limit R_e (N/mm²)	Min. resistance to breakage R_m (N/mm²)	Approx. hardness treatment
Nut	16MnCr5 / 100Cr6	800	600	60 HRC Temple
Scraper	PPN 7190 TV 40 / NBR 33			
Ball	100 Cr6			64 HRC

d_0 Nominal diameter (mm)	P_h Pitch (mm)	Nut shape	Thread entries	D_w Ball diameter (mm)	D_1g6 Ball diameter (mm)	L (mm)	L_3 (mm)	D_B (mm)	L_B (mm)	L_9 (mm)	L_{12} (mm)	B P9 (mm)	T(mm)	Nominal axial backlash (mm)	Loaded ball turns	C_{am} Modified dynamic load capacity (kN)	C_{a0m} Modified static load capacity (kN)
20	5	E	1	3,500	32	34	-	3	7	7	20	5	2	0,041	3	10,5	16,6
20	20	S	4	3,500	35	30	8	1,5	11,5	9	12	5	3	0,041	4	11,6	18,4
20	50	S	5	3,500	35	56	9	1,5	16	18	20	5	3	0,041	5	13	24,6
25	5	E	1	3,500	38	34	-	3	7	7	20	5	2	0,041	3	12,3	22,5
32	5	E	1	3,500	45	45	-	3	7,5	8	30	6	2,5	0,041	5	21,5	49,3
32	10	E	1	7,144	53	60	-	4	10	15	30	6	2,5	0,084	3	33,4	54,5
32	20	E	2	5,000	53	70	-	3	7,5	20	30	6	2,5	0,059	4	29,7	59,8
32	40	S	4	3,500	53	45	7,5	1,5	13	10	25	6	4	0,041	4	14,9	32,4
40	5	E	1	3,500	53	45	-	3	7,5	8	30	6	2,5	0,041	5	23,8	63,1
50	10	E	1	7,144	72	82	-	4	11	23	36	6	2,5	0,084	5	68,7	155,8
50	20	E	2	7,144	85	82	-	4	10	23	36	6	2,5	0,084	4	60	136,3
63	10	E	1	7,144	85	82	-	4	11	23	36	6	2,5	0,084	5	76	197
80	10	E	1	7,144	105	82	-	4	11	23	36	8	3	0,084	5	86,3	262,4

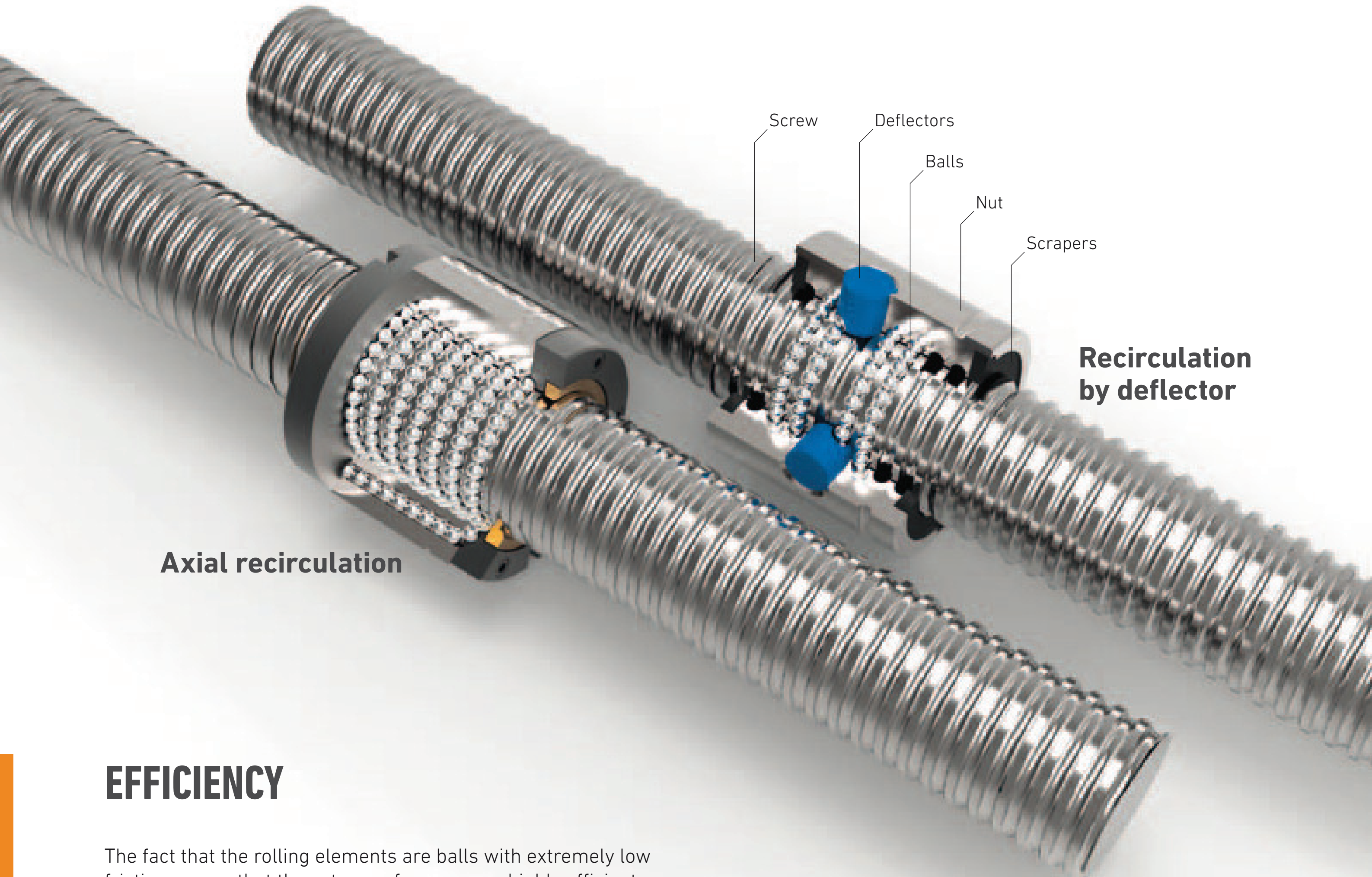
07

BALL SCREW
TECHNICAL SPECIFICATIONS

PARTS AND RECIRCULATION

The systems with ball screws are basically made up of the screw itself, a nut and a series of balls that roll between both elements, re-circulating through the nut. Protectors (scrapers) on their sides avoid the possible input of foreign bodies or aggressive products to the inside of the nut.

The geometric precision of the return is essential so that the rolling of the balls occurs with minimal friction. For short pitches, returns by radial deflector are often used, on which each circuit is independent and makes a complete turn. For long pitches, interior axial returns are usually used, where there is a single circuit of several turns to resend the balls from one end of the nut to the other. In both cases the nuts are compact, with no projections to the exterior.



EFFICIENCY

The fact that the rolling elements are balls with extremely low friction means that these types of screws are highly efficient (up to 98% in some cases).

SPEED

The reduced friction level of the balls means that the turning speed, in ideal conditions, can be 3,000 rpm, or 4,000 rpm for occasional peaks.

REVERSIBILITY

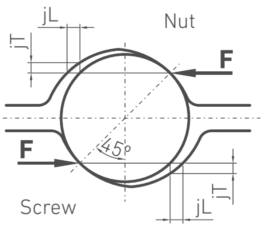
As opposed to what occurs with some trapezoidal screws, the ball screws are always reversible (no self-locking nuts). It is therefore necessary to use brake or retention elements, especially if mounted in a vertical position.

ASSEMBLY POSITION

The screw can be mounted in any position, paying special care to the possible lateral loads that are not supported by the screw itself, but by guide elements designed for this purpose.

THREAD PROFILE

NIASA screws and ball nuts are symmetric gothic arch (ogival arch), and the load angle is 45°. This design means that the roller is extremely smooth (optimal efficiency), and at the same time the axial (jL) and radial (jT) clearances are equalised and minimised between the parties. High rigidity of the set is achieved and the load capacity is maximised.



SERVICE TEMPERATURE

In general, the ambient operating temperature of the screws and ball nuts must be between -30°C and +80°C, with the exceptional possibility of working at higher temperatures (contact NIASA).

REPETITIVENESS

The repetitiveness of a ball screw refers to its capacity to return to a certain position, after having previously achieved it in identical conditions. This is dependent on the load, speed, acceleration, etc. It is defined in VDI/DGQ 3441, the currently widely accepted standard for checking and validating tool machines (contact NIASA).

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QRO (442) 1 95 72 60 ventas@industrialmagza.com

BALL SCREW
TECHNICAL SPECIFICATIONS

PRE-LOADED NUTS

The level of precision in the positioning can be increased, at the same time as reducing backlash, by pre-loading the balls of a pair of nuts. Pre-loading also increases rigidity in the nut area.

The standard value of the pre-load is 10% of the dynamic load and it is recommended not to surpass one third of the dynamic load value. The customer is advised to indicate the pre-load value depending on the type of application.

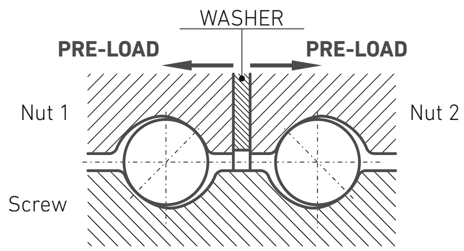
The pre-load can be obtained by separating or joining the balls from the pair of nuts. In the first case the screw will have traction when a washer is fitted between the nuts, therefore with an eventual increase in temperature, and the consequent lengthening of the screw, will reduce the value of the initial pre-load.

The nuts are joined in the pre-load at compression, therefore a possible temperature increase means that the pre-load will increase.

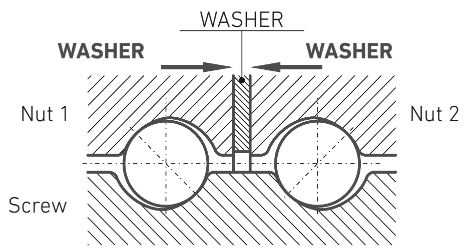
In any case, the pre-load washers are supplied divided into two parts, with the aim of making adjustment possible without taking the nuts off the screw.

In certain cases it may be advisable to carry out the pre-load based on making the balls larger having these four points of contact, instead of the two shown in the figures. The rolling elements in this option must be analysed.

Please contact the NIASA technical department if you would like to work with units without backlash or with lower than normal backlash.

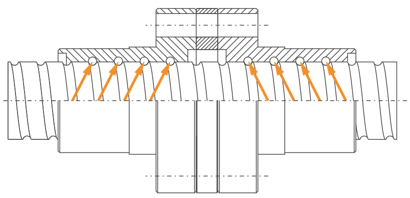


PRE-LOAD AT TRACTION << 0 >>
Large washer, increase the pre-load

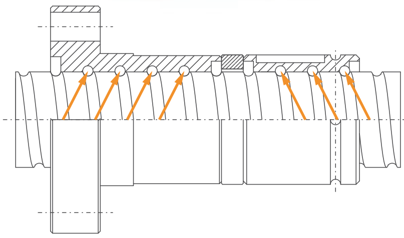


PRE-LOAD AT TRACTION << 0 >>
Large washer, increase the pre-load

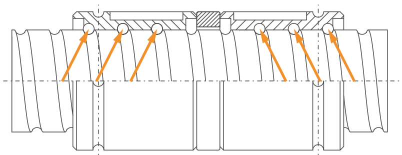




Preload with two nuts with KGF flange



Preload with a nut with KGF flange and with a KGM cylindrical screw



Preload with two KGM cylindrical screws

READJUST THE PRELOAD

To readjust the preload of a pair of nuts, follow the procedure below:

1. Separate the two nuts and remove the two halves of the washers.
2. Place gauges on three points (at approx. 120º) between the nuts, until the keyways of both are aligned.
3. Measure the turning torque of the nuts and change the gauges until the desired value is obtained.
4. Machine the washers with the thickness of the gauges defined at the previous point.

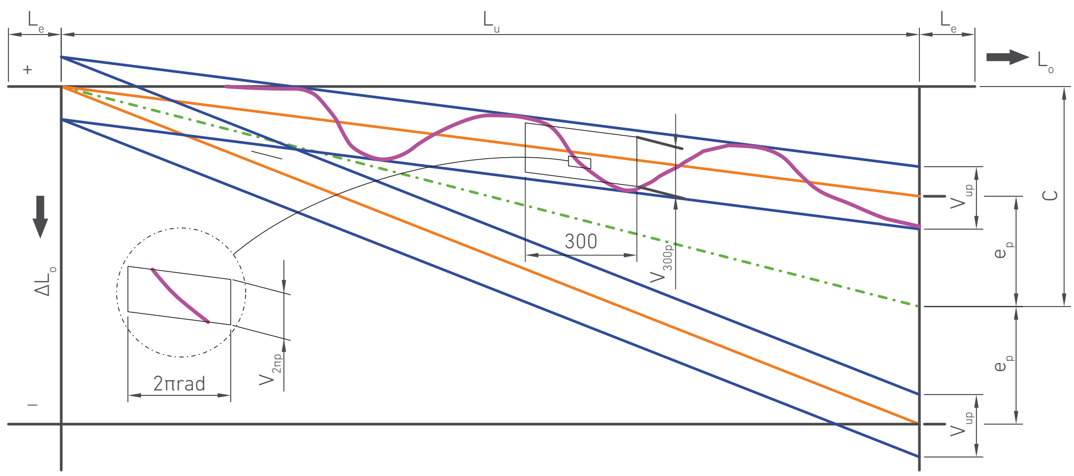
BALL SCREW

TECHNICAL SPECIFICATIONS

TOLERANCE CLASSES AND PERMISSIBLE DEVIATIONS

NIASA offers screws and nuts with the following tolerance classes, based on the maximum admissible error in the unit's positioning.

Tolerance class	Permissible positioning variation of a 300 mm movement (v_{300p})	Typical applications
P1 (non-standard)	6 μm	Positioning
P3	12 μm	
P4	18 μm	
P5 / T5	23 μm	
T7	52 μm	Transport



L_u Useful working length.
L_e Excess of length.
L_0 Nominal distance.
ΔL_0 Movement deviation.
V_{300p} Permissible movement variation in 300 mm.
V_{300p} Permissible movement variation in one turn.
C Movement compensation.
e_p Limit deviation.
V_{up} Permissible variation.

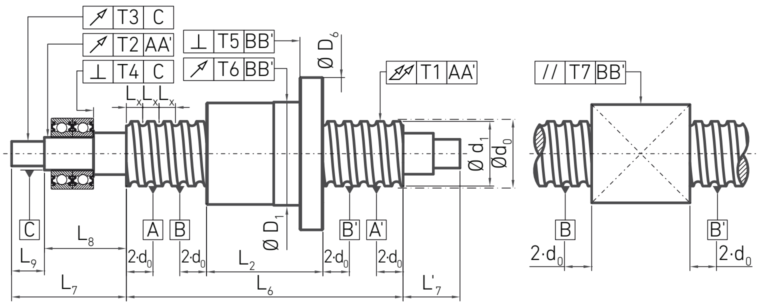
Based on the tolerance level (v_{300p}) and the useful working length (L_u), the following table covers the deviation limit (e_p) and the permissible variation (v_{up}).

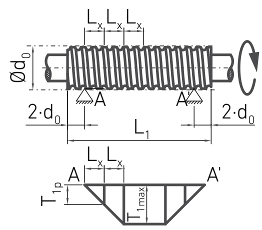
	Lu (mm)																			
		>	0	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500
		≤	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000
P1	e_p	Microns (μm)	6	7	8	9	10	11	13	15	18	22	26	32	39	48	60	76	94	115
	v_{up}		6	6	7	7	8	9	10	11	13	15	17	21	27	33	40	50	61	76
P3	e_p		12	13	15	16	18	21	24	29	35	41	50	62	76	92	115	140	175	220
	v_{up}		12	12	13	14	16	17	19	22	25	29	34	41	49	61	75	92	113	140
P4	e_p		18	18	20	22	25	28	33	39	46	55	68	84	102	125	159	199	240	290
	v_{up}		18	19	20	21	23	26	29	33	38	44	52	56	68	83	101	124	152	189
P5	e_p		23	25	27	32	36	40	47	55	65	78	96	115	140	170	210	270	330	410
	v_{up}		23	25	26	29	31	34	39	44	51	59	69	82	99	119	142	174	213	265

BALL SCREW
TECHNICAL SPECIFICATIONS

GEOMETRIC TOLERANCES

Below are the geometric tolerances of NIASA screws. Take them into consideration when designing the sets into which they will be integrated.



CLASS	DESCRIPTION	L_x (mm)				TOLERANCE CLASS			
						1	3	5	7
		>	≤	>	≤	Permissible deviation T_p (µm)			
T_1	Distance to select the straightness clamp. 	6	12	-	80	20	25	32	40
		12	25	-	160				
		25	50	-	315				
		50	100	-	630				
		100	200	-	1250				
		$T_{1max.}$ for $L_1 / d_0 \leq 40$				40	50	64	80
		$T_{1max.}$ for $40 < L_1 / d_0 \leq 60$				60	75	96	120
		$T_{1max.}$ for $60 < L_1 / d_0 \leq 80$				100	125	160	200
		$T_{1max.}$ for $80 < L_1 / d_0 \leq 100$				160	200	256	320
T_2	Concentricity according to d_0 y L_8. The higher of the values is applied.	d_0 (mm)		L_8 (mm)		Permissible deviation T_p (µm)			
		>	≤	>	≤				
		-	32	-	80	10	12	20	32
		-	63	80	160	12	16	20	40
		63	125	160	250	16	20	25	50
		125	-	250	400	20	25	32	63
		-	-	400	630	25	32	40	80
		-	-	630	-	32	40	50	100
T_3	Concentricity according to d_0 y L_9. The higher of the values is applied.	d_0 (mm)		L_9 (mm)		Permissible deviation T_p (µm)			
		>	≤	>	≤				
		-	32	-	80	5	6	8	10
		32	63	80	160	6	8	10	12
		63	125	160	250	8	10	12	16
		125	-	250	400	10	12	16	20
		-	-	400	-	-	16	20	25
T_4	Axial jump (perpendicularity)	6	63	-	-	3	4	5	6
		63	125	-	-	4	5	6	8
		125	200	-	-	-	6	8	10
T_5; T_6	Axial and radial jump only for pre-loaded nuts or nuts with no backlash.	D_1; D_6				Permissible deviation T_p (µm)			
		>		≤					
		16		32		10	12	16	20
		32		63		12	16	20	25
		63		125		16	20	25	32
		125		250		20	25	32	40
		250		500		-	32	40	50
T_7	Nut parallelism	Each 100mm of movement				Permissible deviation T_p (µm)			
						10	18	22	32

BALL SCREW
TECHNICAL SPECIFICATIONS

LUBRICATION

Correct lubrication of the ball screws is essential so that they do not deteriorate prematurely, and so that they function smoothly and with the expected efficiency. It also ensures that the idle torque is as expected and ensures correct evacuation of the heat generated in the bearing.

CL oils can be used as CLP type mixes with EP additives. The viscosity depends on the circumferential speed of the screw and the operating temperature. The oil flow required depends on speed, and is usually between 0.3 and 0.5 cm^3/h for each turn of the nut balls. In applications in which the nut is in a horizontal position and bathed in oil, it is sufficient that its level reaches half the height of the lower ball.

The VG ISO viscosity demanded for each case is obtained from the images below, knowing the screw's nominal diameter, turning speed and working temperature.

When grease is used as a lubricant instead of oil, the time between lubrications can be increased. The useful life of the screw can only be guaranteed if an automatic greasing system replaces the loss of grease on the nut when it moves with respect to the screw, even when it has radial seal rings to minimise it.

The time between two consecutive lubrications is related to the turning speed of the screw, its operating temperature, the load it is subject to, its assembly position, etc. For non-extreme conditions, NIASA recommends that no more than 100 operating hours or two years between lubrications.

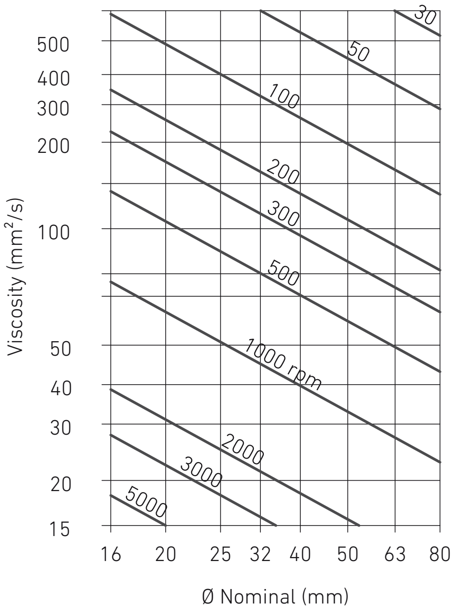
Use grease tips according to the table below.

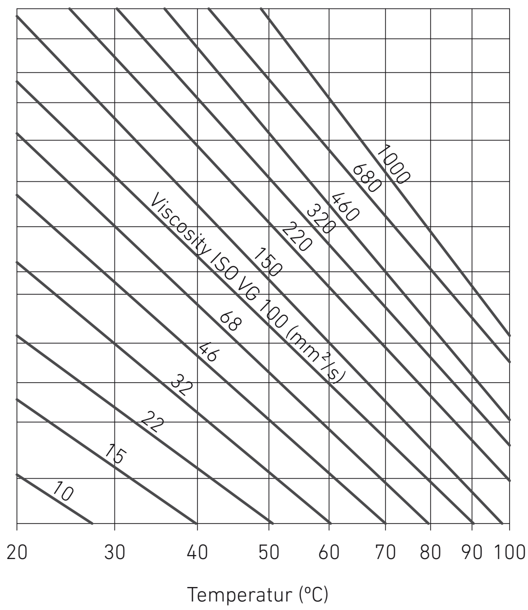
Ambient temperature -20ºC to 120ºC *	Grease S/DIN 51825
Normal conditions	K2K-20
Very high speeds	K1K-20
Very heavy loads or low speeds	KP2K-20

* Contact NIASA for other values

As general criteria, do not mix lubricants with different saponification and/or viscosity bases.

Do not excessively lubricate. As a general rule, only fill half of the available space and ensure that possible excesses can be evacuated.





STORAGE AND INSTALLATION

As standard, ball screws are supplied by NIASA lubricated with oil, protected with an anti-oxidant paper wrapping and covered with adhesive plastic tape, completely sealed.

As they are precision elements, they must be handled with great care and stored in clean and dry places, supported on several points along their length and in their original packaging until the time they are installed.

When transporting the ball screws to their final destination, sharp movements and positions with false support must be avoided, which may cause deformations due to flexion under their own weight.

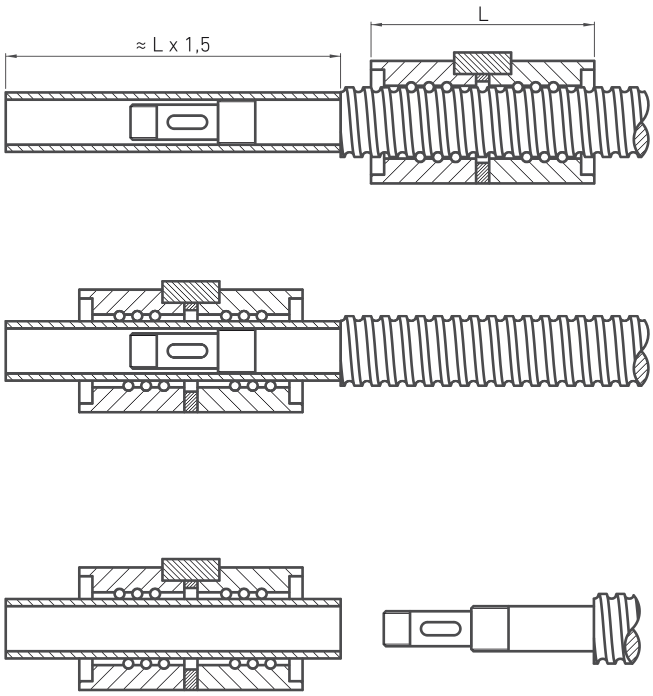
The housings for the assembly of the nuts, or any other element (rollers, bearings, etc.) must be perfectly free from dust, paint or any other impurity. It is essential that the screws are assembled with roller, bearing, etc. supports perfectly perpendicular and aligned between each other.

Finally, apply the loads in the most central and uniform manner as possible on the screw or nut. If lateral loads need to be applied, please contact the NIASA technical department.

SCREW DISASSEMBLY

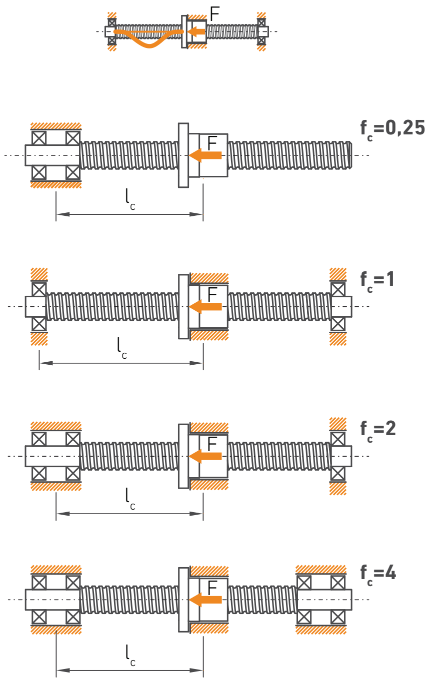
When the nuts need to be removed from the screw, do this with an extraction tube, following the pitches provided below:

1. Machine a tube longer than the screws, with its hole fitted to the screw's terminal and with an exterior diameter equal to that on the base of the thread.
2. Place the tube on the end of the screw and unthread the nuts until they come off the screw and are mounted on the tube.
3. Immobilise the nuts on the tube with adhesive tape or another means so that they do not fall off.
4. Remove the package thus formed by the tube and the nuts.
5. Follow the procedure in reverse to replace the nuts on the screw, paying special attention to the nut protectors when beginning the threading on the screw.



BALL SCREW
CALCULATIONS

BUCKLING CRITICAL LOAD



$$F \leq 0.8 \times f_c \times \frac{101.7 \times d^4}{l_c^2}$$

With safety factor: 1.25

F Force applied (kN)

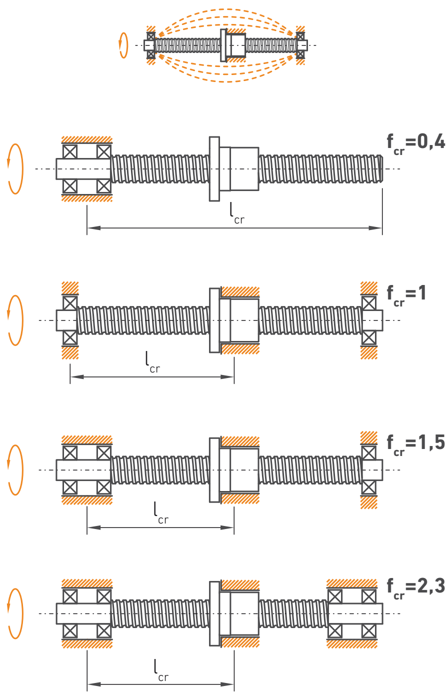
f_c Correction factor, depending on the type of support on the sides of the screw. See figures

$d \approx (2.d_0 - D_w)/2$

- **d_0** Nominal diameter of the screw (mm)
- **D_w** Diameter of the ball (mm)

l_c Buckling length (mm). See figures

RESONANCE CRITICAL SPEED



$$n \leq 0.8 \times f_{cr} \times \frac{1.2 \times 10^8 \times d}{l_{cr}^2}$$

With safety factor: 1.25

n Application speed (rpm)

f_{cr} Correction factor, depending on the type of support on the sides of the screw. See figures

$d \approx (2.d_0 - D_w)/2$

- **d_0** Nominal diameter of the screw (mm)
- **D_w** Diameter of the ball (mm)

l_{cr} Resonance length (mm). See figures

LIMIT SPEED

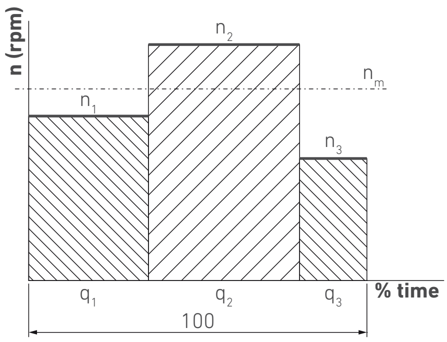
$n \times d_0 \leq 140{,}000$ For tolerance classes P1, P3, P4, P5, T5

$n \times d_0 \leq 100{,}000$ For T7 tolerance classes

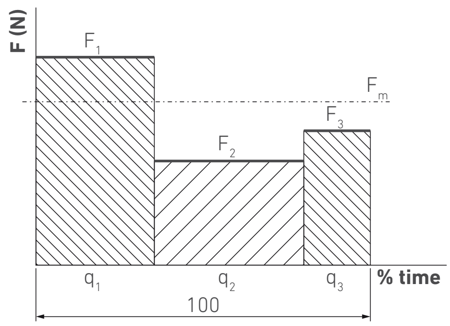
n Application speed (rpm)

d_0 Nominal diameter of the screw (mm). See screw data table

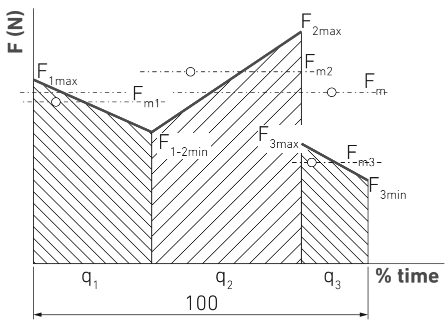
SERVICE TIME



$$n_m\ (rpm) = \sum_{i=1}^{i=n} n_i \times \frac{q_i}{100}$$



$$F_m (kN) = \left(\sum_{i=1}^{i=n} F_i^{\,3} \times \frac{n_i}{n_m} \times \frac{q_i}{100} \right)^{1/3}$$



$$F_m (kN) = \left(\sum_{i=1}^{i=n} F_{mi}^{\,3} \times \frac{n_i}{n_m} \times \frac{q_i}{100} \right)^{1/3}$$

$$L_{10} \leq \left(\frac{C_{am}}{F_m} \right)^3 \times 10^6$$

L_{10} Service time (revolutions)
C_{am} Modified nominal dynamic load (kN)
F_m Equivalent applied load (kN)

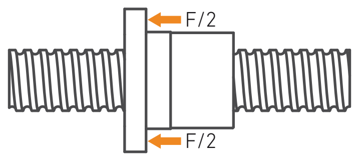
$$L_{h10} = \frac{L_{10}}{n_m \times 60}$$

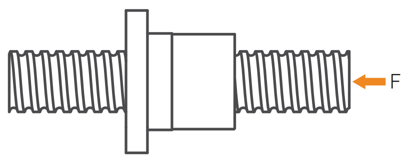
L_{h10} Service time (hours)
n_m Equivalent application speed (rpm)

The above service times refer to the useful life achieved by 90% of a sufficient group of identical ball screws, before the first evident signs of material fatigue appear on any of the bearing elements.

INSTALLATION

Apply the loads in the most central and uniform manner possible on the screw or nut. If lateral loads need to be applied, please contact the NIASA technical department.

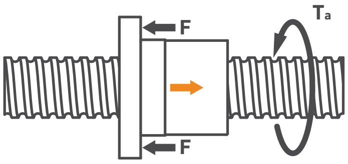




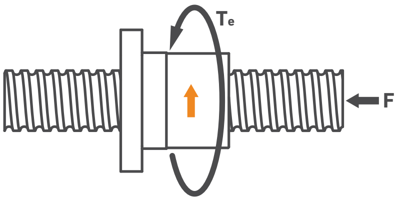
07

BALL SCREW
CALCULATIONS

PERFORMANCE (EFFICIENCY)



$$\eta = 0{,}95 \times f_l \times \frac{\tan \varphi}{\tan(\varphi - \rho'')}$$



$$\eta' = 0{,}95 \times f_l \times \frac{\tan(\varphi - \rho'')}{\tan \varphi}$$

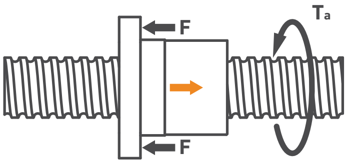
- **η** Performance when turning torque is converted into axial load on the screw
- **η'** Performance when axial load is converted into turning torque on the screw
- **0.95** Reduction factor to cover variations due to speed, temperature and lubrication differences
- **f_l** Reduction factor if the load applied (F) is less than 50% of the modified nominal dynamic load (C_{am}).

F/C_{am}	f_l
0,4	0,99
0,3	0,98
0,2	0,97
0,1	0,96

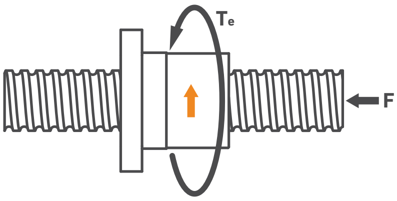
$$\varphi = \text{atan}\,[P_h/(d_o \times \pi)]$$

- **P_h** Nominal pitch of the screw. See screw data table
- **d_o** Nominal diameter of the screw (mm). See screw data table
- **ρ"** Friction angle
  - **0,23°** For tolerance classes P1, P3, P4 y P5
  - **0,34** For tolerance classes T5 and T7

DRIVE AND RETENTION TORQUE



$$T_a = \frac{F \times P_h}{2 \times \pi \times \eta}$$



$$T_e = \frac{F \times P_h \times \eta'}{2 \times \pi}$$

- **T_a** Drive torque(Nm) when turning torque is converted into axial load on the screw
- **T_e** Retention torque (Nm) when axial load is converted into turning torque on the screw
- **F** Force applied (kN)
- **P_h** Nominal pitch of the screw. See screw data table
- **η** Performance when turning torque is converted into axial load on the screw
- **η'** Performance when axial load is converted into torque on the screw

Add to the above the torque required for the acceleration/deceleration of the set if the acceleration/deceleration values are important (applications with high speeds that change in short times).

$$T_{rot} = J_{rot} \times \alpha_0$$

- **T_{rot}** Acceleration/deceleration torque (Nm)
- **J_{rot}** Moment of rotation inertia of the screw (kgm^2)
- **α_o** Angular acceleration (s^{-2})

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BALL SCREW
CALCULATIONS

DRIVE POWER

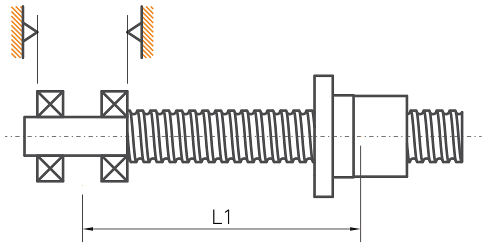
$$P_a = \frac{T_a \times n}{9550}$$

P_a Drive power (kW)
T_a Drive torque (Nm)
n Application speed (rpm)

Please contact the NIASA technical department for detailed motor sizing (motor/brake).

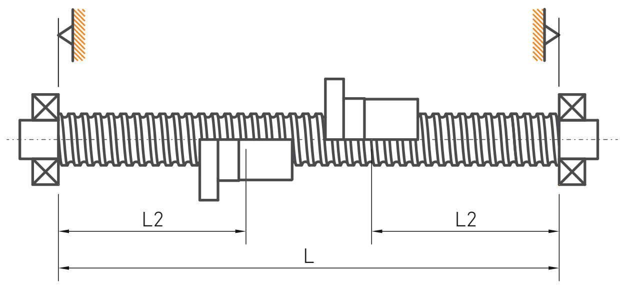
RIGIDITY

Support bearings on one end



$$R_{s1} = \frac{\pi \times d^2 \times E}{4 \times L_1 \times 10^6}$$

Support bearings on both sides



$$R_{s2} = \frac{\pi \times d^2 \times E}{4 \times L_2 \times 10^6} \times \frac{L}{L - L_2}$$

R_{s1} Axial rigidity of the screw (kN/μm), with bearings fixed on one end
R_{s2} Axial rigidity of the screw (kN/μm), with bearings on both sides
$d \approx (2.d_0 - D_w)/2$
d_0 Nominal diameter of the screw (mm)
D_w Diameter of the ball (mm)
E Steel elastic module (210,000 N/mm2)
L / L1 / L2 Length (mm), according to figures. Always take L2≤L/2; Rs2 as minimum when L2=L/2

$$\frac{1}{R_{tot}} = \frac{1}{R_s} + \frac{1}{R_{nu,ar}}$$

R_{tot} Axial rigidity of the screw+nut (kN/μm)
R_s Axial rigidity of the screw (kN/μm)
$R_{nu,r}$ Axial rigidity of the nut (kN/μm). Please ask NIASA for values

The deformations of the nuts are small as they are very compact elements, often negligible against deformations of the screw.

ROLLED TRAPEZOIDAL SCREWS

Tr TRAPEZ.

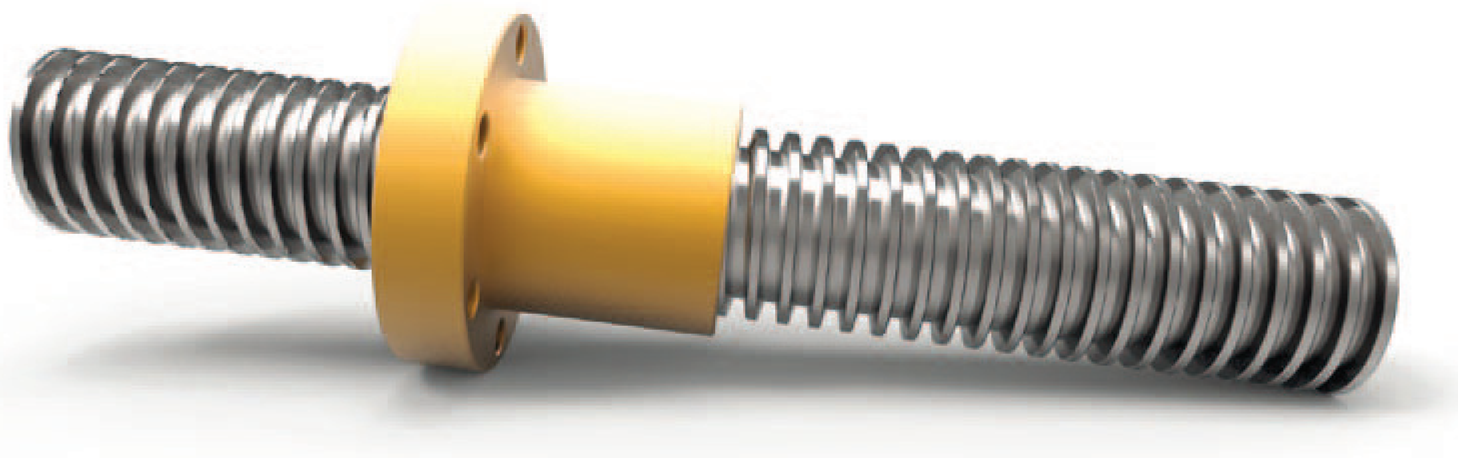
NIASA trapezoidal screws are usually obtained using a cold deformation lamination process, in which the fires on the teeth are shaped without cutting. Against others obtained by machining with stock removal, they have the following advantages:

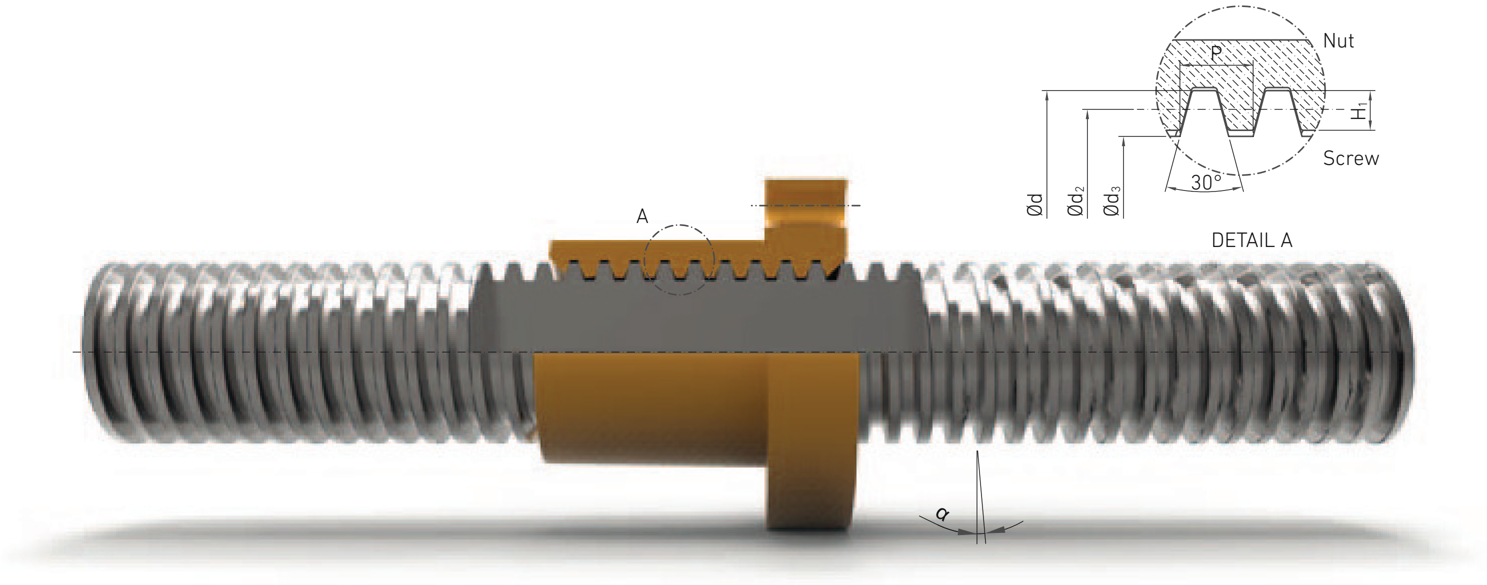
- ... High resistance to fatigue.
- ... Higher resistance to wear.
- ... More polished thread flanks.
- ... Higher resistance to corrosion.
- ... More precise profile.

NIASA manufactures screws with their sides machined according to your requirements. Please also ask if any thermal treatment is required.

The maximum standard length is 3,000 mm and its precision is 100 µm/300 mm; for higher values, please contact NIASA. Out of stock NIASA has many other screw diameters/pitches, also with left thread, and also in other materials (AISI 304, AISI 316, etc). Nuts can also be supplied in plastic materials, with threaded body, etc.

Standard Material	Approx. surface hardness
1.0401 (C15 SH) / F1110	500 Brinell





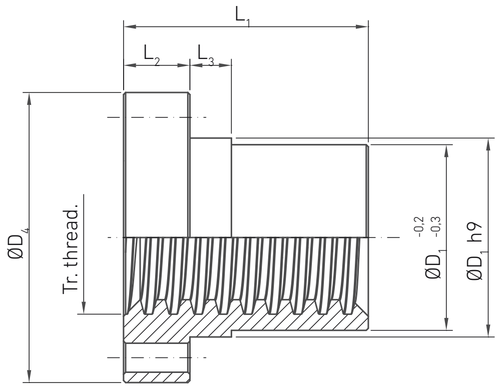
Ext. diam. (mm) x Pitch (mm)	d_o (mm)	$d_{2,min}$ (mm)	$d_{2,max}$ (mm)	d_3	H_1	Thread angle $\alpha^{1)}$	Performance $\eta^{2)}$	Weight (kg/m)	Inertia moment (mm^4)	Module section (cm^3)	Mass inertia moment J_{rot} ($kg.m^2/m$)
Tr 16x4	16	13,640	13,905	10,80	2	5°11'	0,46	1,21	0,067	0,124	$2,96 \cdot 10^{-5}$
Tr 18x4	18	15,640	15,905	12,80	2	4°32'	0,43	1,58	0,132	0,206	$5,05 \cdot 10^{-5}$
Tr 20x4	20	17,640	17,905	14,80	2	4°2'	0,40	2,00	0,236	0,318	$8,10 \cdot 10^{-5}$
Tr 22x5	22	19,114	19,394	15,50	2.5	4°39'	0,43	2,34	0,283	0,366	$1,11 \cdot 10^{-4}$
Tr 24x5	24	21,094	21,394	17,50	2.5	4°14'	0,41	2,85	0,460	0,526	$1,65 \cdot 10^{-4}$
Tr 26x5	26	23,094	23,394	19,50	2.5	3°52'	0,39	3,40	0,710	0,728	$2,35 \cdot 10^{-4}$
Tr 28x5	28	25,094	25,394	21,50	2.5	3°34'	0,37	4,01	1,050	0,976	$3,26 \cdot 10^{-4}$
Tr 30x6	30	26,547	26,882	21,90	3	4°2'	0,40	4,50	1,130	1,030	$4,10 \cdot 10^{-4}$
Tr 32x6	32	28,547	28,882	23,90	3	3°46'	0,38	5,19	1,600	1,340	$5,45 \cdot 10^{-4}$
Tr 36x6	36	32,547	32,882	27,90	3	3°18'	0,35	6,71	2,970	2,130	$9,10 \cdot 10^{-4}$
Tr 40x7	40	36,020	36,375	30,50	3.5	3°29'	0,37	8,21	4,250	2,790	$1,37 \cdot 10^{-3}$
Tr 44x7	44	40,020	40,275	34,50	3.5	3°8'	0,34	10,10	6,950	4,030	$2,10 \cdot 10^{-3}$
Tr 48x8	48	43,468	43,868	37,80	4	3°18'	0,35	12,00	10,000	5,300	$2,90 \cdot 10^{-3}$
Tr 50x8	50	45,468	45,868	39,30	4	3°10'	0,34	13,10	11,700	5,960	$3,40 \cdot 10^{-3}$
Tr 60x9	60	54,935	55,360	48,15	4.5	2°57'	0,33	19,00	26,400	11,000	$7,30 \cdot 10^{-3}$
Tr 70x10	70	64,425	64,850	57,00	5	2°48'	0,32	26,00	51,800	18,200	$1,40 \cdot 10^{-2}$
Tr 80x10	80	74,425	74,850	67,00	5	2°25'	0,29	34,70	98,900	29,500	$2,40 \cdot 10^{-2}$

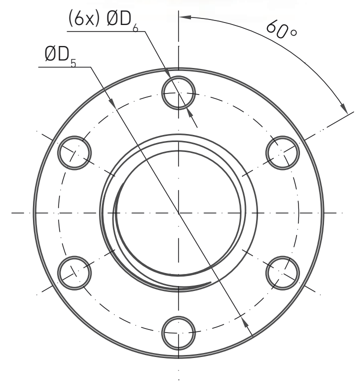
1) Pitch angle on the pitch diameter.

2) Theoretical efficiency on transforming a turning movement into an axial transfer of the screw, with friction coefficient μ = 0.1. For other cases, contact the corresponding calculation section.

BRONZE NUT WITH EFM FLANGE

Out of stock NIASA has many other screw diameters/pitches, also with left thread, and also in other materials (AISI 304, AISI 316, etc). Nuts can also be supplied in plastic materials, with threaded body, etc.

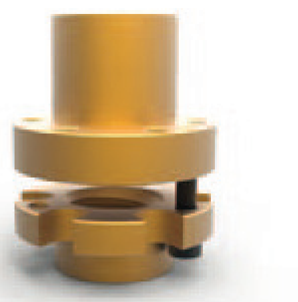




Standard Material	Elastic limit 0.2% $R_{p0.2}$ (N/mm²)	Min. resistance to breakage R_m (N/mm²)	Elongation to breakage A5 min.	Approx. (HB 10/1000)	Density (kg/dm³)	Module of elasticity (N/mm²)	Max. cinematic pressure Pc (N/mm².m/min)
G-CuSn 12 (G Bz 12)	150	280-350	5%	100-110	8.8	90000	400

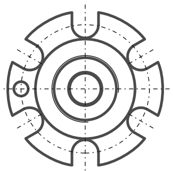
For screw	D_1 (mm)	D_4 (mm)	D_5 (mm)	D_6 (mm)	L_1	L_2	L_3	Weight (kg)	Surface support A_s (mm²)
Tr 16x4	28	48	38	6	44	12	8	0,25	670
Tr 18x4	28	48	38	6	44	12	8	0,25	770
Tr 20x4	32	55	45	7	44	12	8	0,30	870
Tr 24x5	32	55	45	7	44	12	8	0,30	1040
Tr 30x6	38	62	50	7	46	14	8	0,40	1370
Tr 36x6	45	70	58	7	59	16	10	0,60	2140
Tr 40x7	63	95	78	9	73	16	10	1,70	2930
Tr 50x8	72	110	90	11	97	18	10	2,60	4900
Tr 60x9	85	125	105	11	99	20	10	3,70	6040
Tr 70x10	95	180	140	17	100	30	16	7,80	8250
Tr 80x10	105	190	150	17	110	30	16	8,90	10890

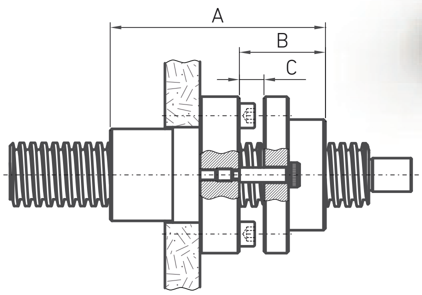
BRONZE SAFETY NUT WITH EFMS FLANGE



Nut applicable to R Series screw jacks and SH screw supports. The same standard material as the EFM type flange.

	A	B	C	Guide screw ISO 7379
Tr 18 x 4	69	25	8	M5
Tr 20 x 4	69	25	8	M5
Tr 30 x 6	78	32	10	M5
Tr 36 x 6	94	35	10	M5
Tr 40 x 7	108	35	10	M6
Tr 50 x 8	132	35	10	M8
Tr 55 x 9	132	35	10	M8
Tr 60 x 9	144	45	15	M8
Tr 70 x 10	155	55	15	M10

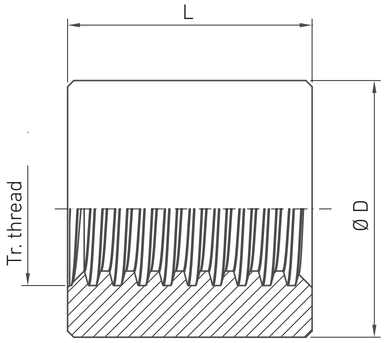




LRM TYPE CYLINDRICAL BRONZE NUT

Tr TRAPEZ.

Out of stock NIASA has many other screw diameters/pitches, also with left thread, and also in other materials (AISI 304, AISI 316, etc). Nuts can also be supplied in plastic materials, with threaded body, etc.



Standard Material	Elastic limit 0.2% $R_{p0.2}$ (N/mm²)	Min. resistance to breakage R_m (N/mm²)	Elongation to breakage A5 min.	Approx. (HB 10/1000)	Density (kg/dm³)	Module of elasticity (N/mm²)	Max. cinematic pressure Pc (N/mm².m/min)
G-CuSn 12 (G bz 12)	150	280-350	5%	100-110	8.8	90000	400

For screw	Ø D (mm)	L (mm)	Weight (kg)	Support surface A_s (mm²)
Tr 16x4	36	32	0.25	490
Tr 18x4	40	36	0.34	630
Tr 20x4	45	40	0.48	790
Tr 22x5	45	40	0.46	850
Tr 24x5	50	48	0.69	1130
Tr 26x5	50	48	0.58	1240
Tr 28x5	60	60	1.2	1680
Tr 30x6	60	60	1.2	1780
Tr 32x6	60	60	1.2	1910
Tr 36x6	75	72	2.2	2610
Tr 40x7	80	80	2.8	3210
Tr 44x7	80	80	2.6	3560
Tr 48x8	90	100	4.3	4840
Tr 50x8	90	100	4.2	5060
Tr 60x9	100	120	5.7	7320
Tr 70x10	110	140	7.6	10000
Tr 80x10	120	160	9.7	13200

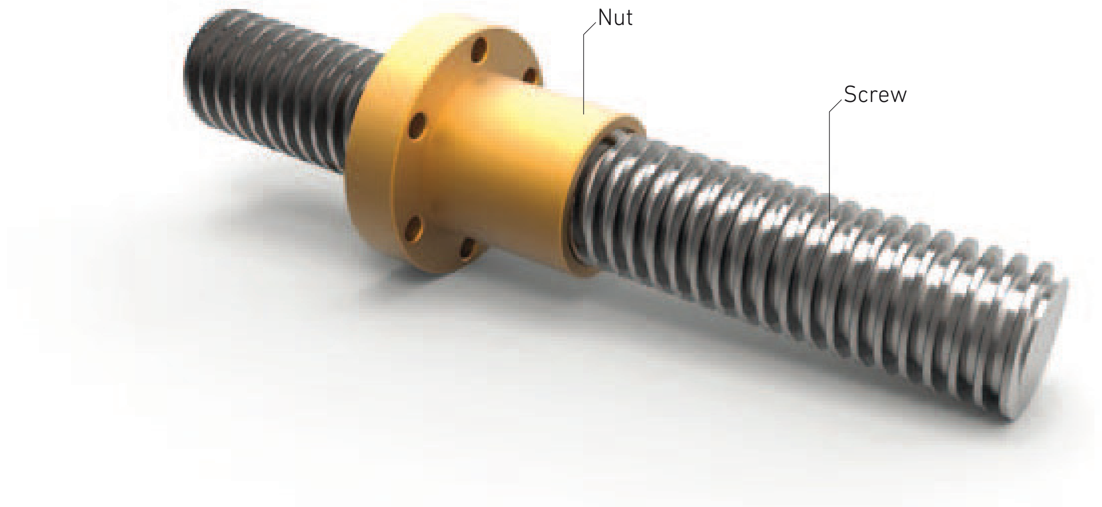
TRAPEZOIDAL SCREWS

TECHNICAL SPECIFICATIONS

PARTS

The systems with trapezoidal screws are made up of simply the screw itself and a nut that moves along it.

These systems are less sensitive to the input of dirtiness than those based on ball bearings. Therefore they usually do not include protectors on the sides of the nut, except in the case of very high turning speeds. Please contact NIASA if this is the case.



EFFICIENCY

The efficiency of the trapezoidal screws basically depends on the geometry of the screw (diameter and pitch) and the friction coefficient between the screw and the nut. It is therefore essential that the lubrication conditions are those indicated so that the losses due to friction do not surpass the established values.

For the most usual sizes and with standard lubrication conditions, in general, the efficiency of these types of systems is 30% to 40%.

SPEED

The turning speed of a trapezoidal screw is limited in its maximum value by the lower of the following:

... Critical resonance speed of the column.

... Critical velocity of the nut/screw to avoid premature wear on the nut. This depends on the specifications of the materials of both elements, on the contact surface between them and the load applied.

REVERSIBILITY

Opposite to what happens with ball screws, the trapezoidal screws are not always reversible. Only those with a helix angle with a larger thread than the friction angle are reversible (or not self-locking). The efficiency for converting axial force on the screw on turning torque is always less than that corresponding to the transformation of the turning torque on axial force.

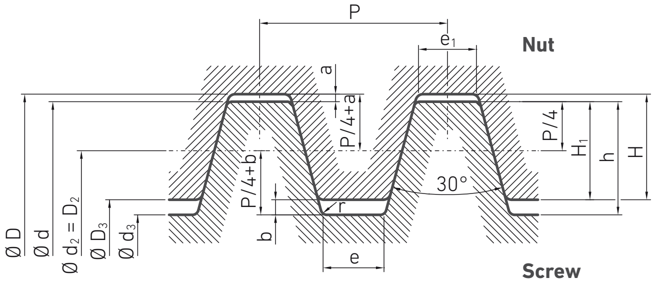
However, especially on vertical assemblies, it is in any case advisable to incorporate motors with brakes that avoid small movements in the case of vibrations and that stop the movement without excessive slipping from the inertia of the set.

ASSEMBLY POSITION

The screw can be mounted in any position, paying special care to the possible lateral loads that are not supported by the screw, but by guide systems designed for this purpose.

THREAD PROFILE

NIASA screws and nuts have metric ISO trapezoidal thread according to DIN 103 (screw tolerance: 7e on the flanks and 4h on the exterior diameter; nut tolerance: 7H).



Pitch (mm)	2	3 - 4	5 - 12	13 - 26
a and **r** (mm)	0,5	0,25		0,5
b (mm)	0,3	0,5	0,75	1,5

$$H_1 = \frac{P}{2}$$

$$h = H1 + b = \frac{P}{2} + b$$

$$H = H1 + a = \frac{P}{2} + a$$

$$D = d + 2a$$

$$d_3 = d - 2h = d - (P + 2b)$$

$$D_3 = D - 2H = D - (P + 2a)$$

$$d_2 = D_2 = d - 2\frac{P}{4} = d - \frac{P}{2}$$

$$e = e_1 = 0{,}634P - 0{,}536h$$

SERVICE TEMPERATURE

The maximum admissible working ambient temperature depends on the friction conditions between the nut and the screw. That is, the materials of both and the lubrication conditions.

In general, it is recommended not to operate in environments with temperatures over 100°C. Please contact NIASA about this.

PRECISION AND STRAIGHTNESS.

The usual precision of NIASA trapezoidal screws varies according to their nominal diameter and the thread pitch, which is usually 100 µm for each 300 mm of length.

LUBRICATION

The greases recommended for the trapezoidal screws and nuts are the same as the usual greases for roller bearings. Oils are not normally used.

Before greasing, perfectly clean the surface of the screw to leave it free from any kind of impurity. The time between two consecutive greasings depends on the application conditions (temperature, velocity and load).

STORAGE AND INSTALLATION

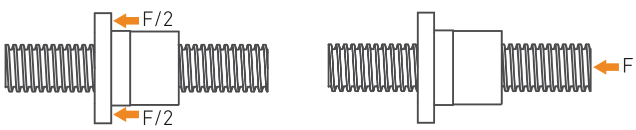
As standard, trapezoidal screws are supplied by NIASA lightly lubricated and protected with a completely sealed plastic film.

As they are precision elements, they must be handled with great care and stored in clean and dry places, supported on several points along their length and in their original packaging until the time they are installed.

When transporting the trapezoidal screws to their final destination, sharp movements and positions with false supports must be avoided, which may cause deformations due to flexion under their own weight.

The housings for the assembly of the nuts, or any other element (rollers, bearings, etc.) must be perfectly free from dust, paint or any other impurity. It is essential that the screws are assembled with roller, bearing, etc. supports perfectly perpendicular and aligned between each other.

Finally, apply the loads in the most central and uniform manner as possible on the screw or nut. If lateral loads need to be applied, please contact the NIASA technical department.



07

TRAPEZOIDAL SCREWS
CALCULATIONS

NUT AND SCREW SIZE PRE-SELECTION

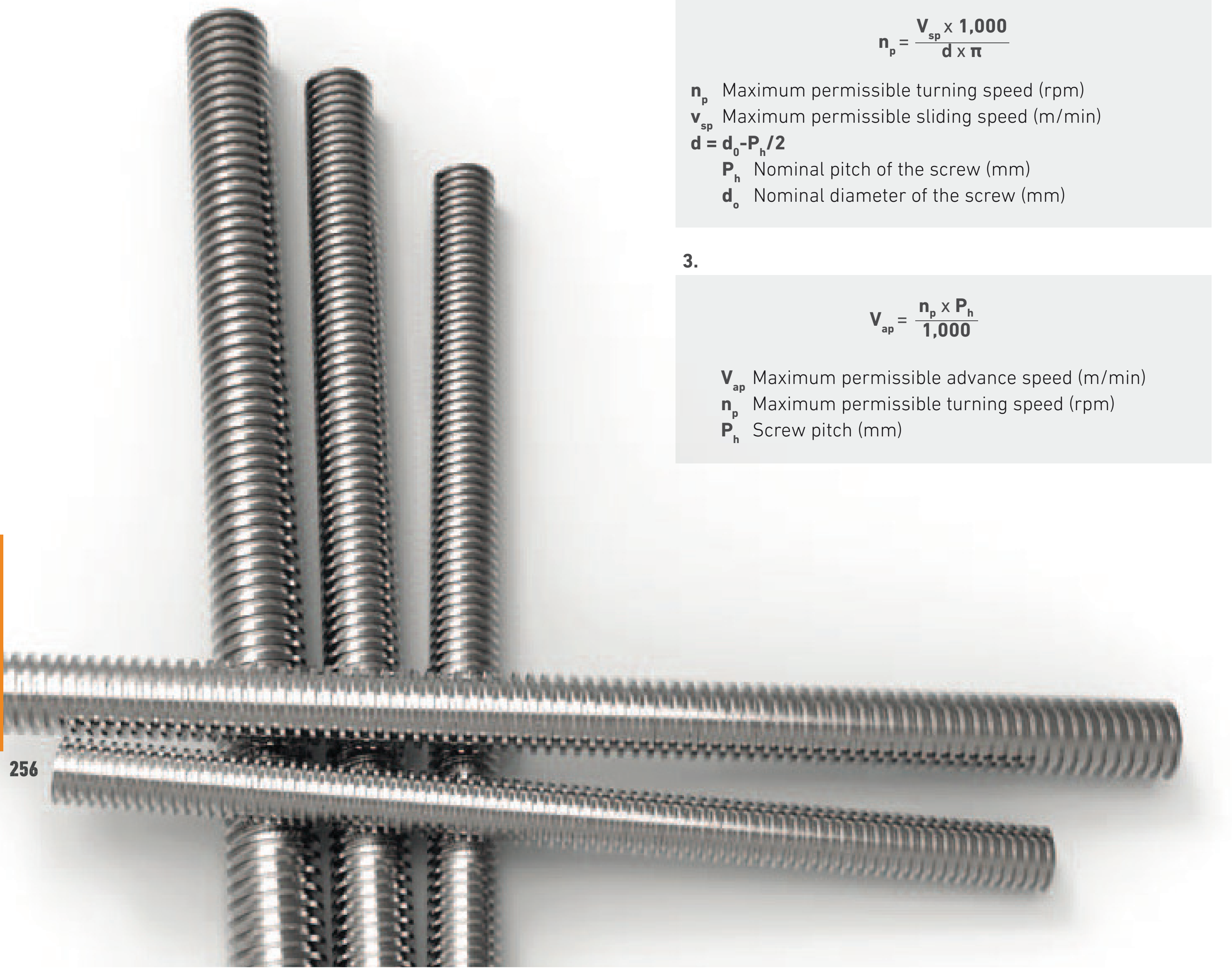
Calculation process:

1.

$$A_s = \frac{F}{P_p}$$

A_s Support area required (mm^2)
F Force applied (N)
P_p Maximum permissible pressure (5 N/mm^2, for sets with movement)

2. Select a nut size with an "A_s" higher than that calculated.



MAXIMUM ADVANCE SPEED

Calculation process:

1.

$$V_{sp} = \frac{P_c}{P_p}$$

v_{sp} Maximum permissible sliding speed (m/min)
P_c Cinematic precision (N/mm^2.m/min). See table
P_p Maximum permissible pressure (5 N/mm^2)

Material	P_c (N/mm^2.m/min)
G-CuSn 7 ZnPb (Rg 7)	300
G-CuSn 12 (G Bz 12)	400

2.

$$n_p = \frac{V_{sp} \times 1{,}000}{d \times \pi}$$

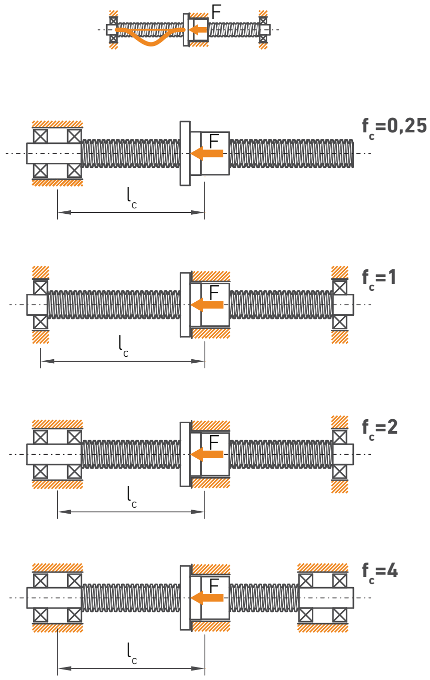
n_p Maximum permissible turning speed (rpm)
v_{sp} Maximum permissible sliding speed (m/min)
$d = d_0 - P_h/2$
P_h Nominal pitch of the screw (mm)
d_o Nominal diameter of the screw (mm)

3.

$$V_{ap} = \frac{n_p \times P_h}{1{,}000}$$

V_{ap} Maximum permissible advance speed (m/min)
n_p Maximum permissible turning speed (rpm)
P_h Screw pitch (mm)

BUCKLING CRITICAL LOAD

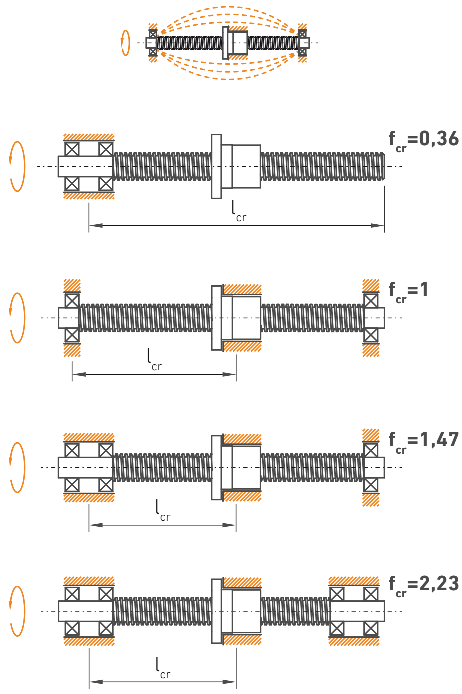


$$F \leq 0.8 \times f_c \times \frac{101.7 \times d_3^4}{l_c^2}$$

With safety factor: 1.25

- **F** Force applied (kN)
- **f_c** Correction factor, depending on the type of support on the sides of the screw. See figures
- **d_3** Screw core diameter (mm)
- **l_c** Buckling length (mm). See figures

RESONANCE CRITICAL SPEED



$$n \leq 0.8 \times f_{cr} \times \frac{1.2 \times 10^8 \times d_3}{l_{cr}^2}$$

With safety factor: 1.25

- **n** Application speed (rpm)
- **f_{cr}** Correction factor, depending on the type of support on the sides of the screw. See figures
- **d_3** Screw core diameter (mm)
- **l_{cr}** Resonance length (mm). See figures

SERVICE TIME

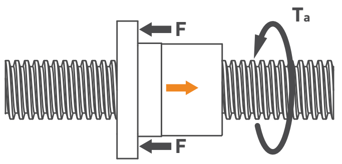
Periodically check the axial clearance between the screw and the nut. On screws with single-input threads, the nut must be replaced before the value of this set surpasses 25%of the pitch.

NIASA has tools that help manual measurement of the axial clearance, including automatic detection systems.

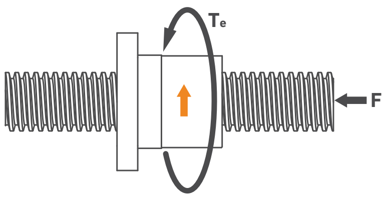
TRAPEZOIDAL SCREWS

CALCULATIONS

PERFORMANCE (EFFICIENCY)



$$\eta = \frac{\tan \alpha}{\tan(\alpha + \rho')}$$



$$\eta' = \frac{\tan(\alpha - \rho')}{\tan \alpha} = 0.7 \times \eta$$

- η Performance when turning torque is converted into axial load on the screw
- η' Performance when axial load is converted into turning torque on the screw

$\alpha = \text{atan}\,[P_h/(d_2 \cdot \pi)]$

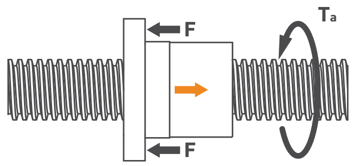
- P_h Nominal pitch of the screw. See screw data table
- d_2 Diameter pitch of the screw (mm). See data table screw

ρ' Friction angle (for ISO trapezoidal thread):

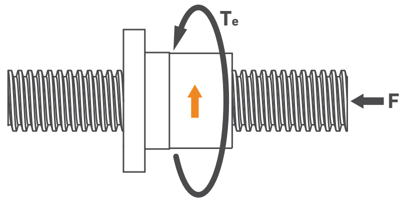
$\rho' = \text{atan}\,(\mu \times 1.07)$

μ Friction coefficient for bronze nuts			
On start-up		In movement	
Dry		Lubricated	
0.3	0.1	0.1	0.04

DRIVE TORQUE AND RETENTION



$$T_a = \frac{F \times P_h}{2 \times \pi \times \eta}$$



$$T_e = \frac{F \times P_h \times \eta'}{2 \times \pi}$$

- T_a Drive torque(Nm) when turning torque is converted into axial load on the screw
- T_e Retention torque (Nm) when axial load is converted into turning torque on the screw
- F Force applied (kN)
- P_h Nominal pitch of the screw
- η Performance when turning torque is converted into axial load on the screw
- η' Performance when axial load is converted into turning torque on the screw

Add to the above the torque required for the acceleration/deceleration of the set if the acceleration/deceleration values are important (applications with high speeds that change in short times).

$$T_{rot} = J_{rot} \times \alpha_0$$

- T_{rot} Acceleration/deceleration torque (Nm)
- J_{rot} Screw rotation inertia moment (kgm^2)
- α_0 Angular acceleration (s^{-2})

DRIVE POWER

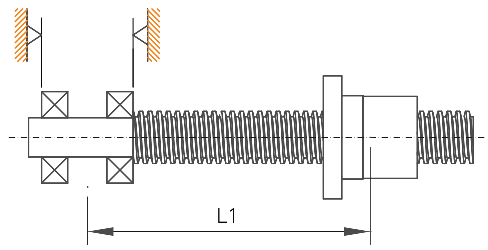
$$P_a = \frac{T_a \times n}{9550}$$

P_a	Drive power (kW)
T_a	Drive torque (Nm)
n	Application speed (rpm)

Please contact the NIASA technical department for detailed motor sizing (motor/brake).

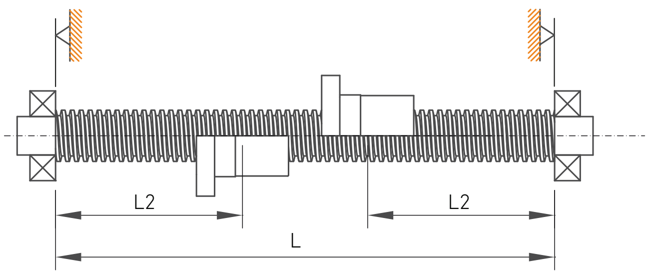
RIGIDITY

Support bearings on one end



$$R_{S1} = \frac{\pi \times d_3^{\,2} \times E}{4 \times L_1 \times 10^6}$$

Support bearings on both sides



$$R_{S2} = \frac{\pi \times d_3^{\,2} \times E}{4 \times L_2 \times 10^6} \times \frac{L}{L - L_2}$$

R_{s1}	Axial rigidity of the screw (kN/µm), with bearings fixed on one end
R_{s2}	Axial rigidity of the screw (kN/µm), with bearings on both sides
d_3	Screw core diameter (mm)
E	Steel elastic module (210,000 N/mm²)
L / L1 / L2	Length (mm), according to figures. Always take $L_2 \leq L/2$; R_{s2} as minimum when L2=L/2

$$\frac{1}{R_{tot}} = \frac{1}{R_S} + \frac{1}{R_{nu,ar}}$$

R_{tot}	Axial rigidity of the screw+nut (kN/µm)
R_s	Axial rigidity of the screw (kN/µm)
$R_{nu,r}$	Axial rigidity of the nut (kN/µm). Ask NIASA for their values

The deformations of the nuts are small as they are very compact elements, often negligible against deformations of the screws.

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