Gradel GB Baudin

Threads for transmission systems

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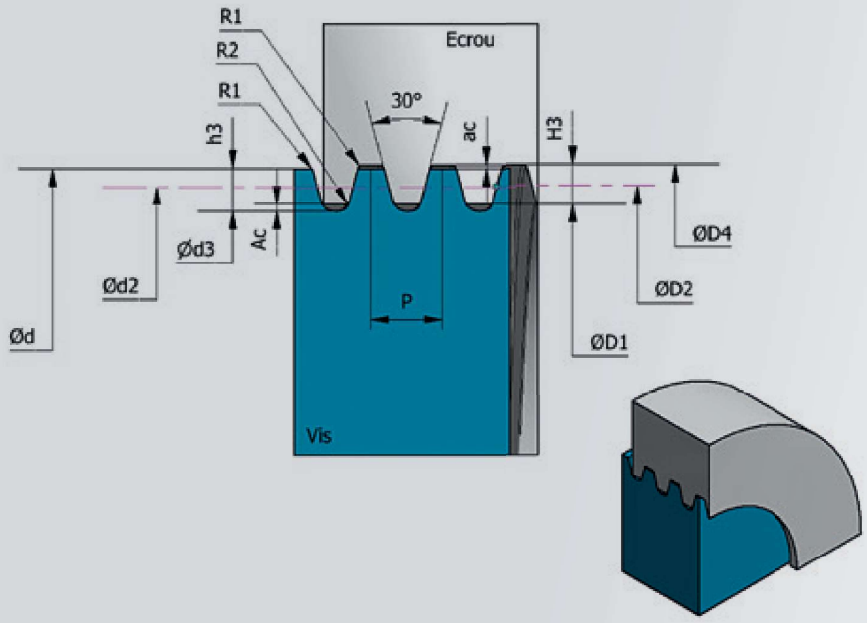
ELEMENTS OF THE BALL SCREW RANGE

TRAPEZOIDAL NUTS AND SCREWS

Our threaded rods with trapezoidal threads are manufactured using a cold working (rolling) process, in accordance with ISO 2901/2902 and DIN103 with 7e tolerance.
The nut threads are created by chip removal. Thanks to our extensive range, we offer high-performance and reliable products that are perfectly suited to meet market demand.

DEFINITION OF THE TRAPEZOIDAL PROFILE



Ød = nominal diameter of the thread
P = threading pitch
Ød2 = d - 0.5P
Ød3 = d - 2h3 = d - p - 2Ac
ac = thread root clearance values
Ac = ac + 0.075P
(in the case of a rolled thread)

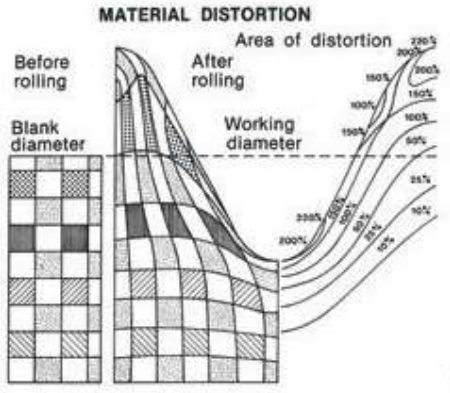
h3 = 0.5P + Ac = 0.5P + ac + 0.075P
H3 = 0.5P + ac
ØD1 = d – P
ØD2 = d – 0.5P
ØD4 = d + 2ac
R1 max = 0.5ac
R2max = ac

SCREWS

The roller burnished sides create an excellent surface that:

- increases the lifespan of the nuts by reducing abrasion.
- increases efficiency by reducing friction.
- improves movement fluidity by reducing vibrations.

The process allows also a high production rate and significant savings in terms of material used.



Our offer includes three product ranges:

- **RPTS a precision range in C35 (1.0501) or C45 (1.0503).**

  Appreciated for its excellent rectitude and pitch precision features, and for its high resistance. We keep single left and right threads and double right threads in lengths of 3 meters up to and including Ø28, and in lengths of 6 meters for larger diameters.

- **RTS a standard range in C15 (1.0401).**

  For simple and cost effective applications. This range is available exclusively in single right thread, in a length of 3 meters.

- **RATS a stainless steel range in 316L (1.4404).**

  We keep single left and right threads and double right threads in lengths of 3 meters up to and including Ø28, and in lengths of 6 meters for larger diameters. This range features improved corrosion resistance compared with common stainless steels, such as 1.4301, 1.4305, etc.

NUTS

Our offer includes three material ranges:

- **Nuts made of CuSn7ZnPb bronze.**

  Used for manual or motorised drives with low to medium speeds and for use under heavy loads. Combination with steel or stainless steel screws provides good results, especially with adequate lubrication.

- **Nuts made of PA6.6 plastic.**

  Used for manual or motorised drives with low to medium speeds and for use under moderate loads. Combination with steel or stainless steel screws provides good results, and reduced noise. These nuts can be used without lubrication, although this will shorten their lifespan.

- **Nuts made of stainless steel 11SMnPb37 (1.0737) or 11SMn37 (1.0736).**

  Used for manual or motorised drives with low speeds, for tightening or blocking functions, or for static loads. Use with stainless steel screws is not advised.

PITCH PRECISION

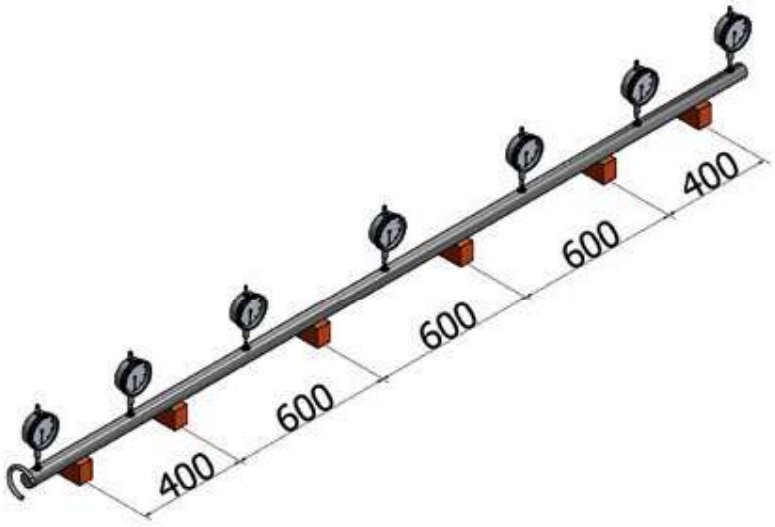
The precision of our screws is measured in microns for 300 mm of thread. This value is applicable as ± in relation to the theoretical value.

Example : for a class 50 screw, the actual measured value of the pitch is included between 299.95 and 300.05

STRAIGHTNESS

Our screws are produced with straightness controls. This feature is measured according to the protocol given below. For one bar revolution, the maximum deviation is equal to ± the declared rectitude value. Effective straightness features remove vibrations and permit use at higher speeds.

Example: for a given reference with a rectitude of 0.5, the value measured on each comparator, spaced as shown in the figure, must be less than 1mm for a full revolution of the bar.



LUBRICATION

The screw and nut system must be lubricated as often as possible. In principle, the system must be lubricated every 500 cycles. Obviously, this interval and the quality of lubricant must adjusted to suit the application and the system's working environment.

We recommend you clean and grease the screw to ensure optimum lubrication:

- When it is dirty.
- Yearly, under normal operating conditions.
- Every 2 years, if used in a clean environment.

For standard use in a normal environment, use KP2K-30-type grease in accordance with DIN 51502.

This quality must be checked for each application.

Quantity of grease required for initial lubrication or after the screw has been thoroughly cleaned. Provided for information only.

Ø	10	12	14	16	18	20	22	24	26	28	30	32	36	40	44	50	60	70	80	100	120	140	160
Quantity (ml/m)	15	18	21	24	27	30	33	36	39	42	45	48	54	60	66	75	90	105	120	150	180	210	240

Less grease required for maintenance lubrication.

ORDER

All of our screws can be delivered, cut to a specified length. Unless specifically requested, the bars are delivered rough-cut with standard rectitude. We can deliver chamfered and/or straightened bars on request.

For all requests outside reference lengths and outside standard manufacturing characteristics, a preliminary costing is required.

According to your needs, we can also machine the ends of the screws or perform additional operations on our standard nuts.

SIZING THE SCREW/NUT SET

The load applied to the nut/screw set depends on the materials used, surface states, lubrication, frequency of use, speed, etc.

Force is transferred from the screw to the nut through sliding friction, and a proportion of this force is transformed into heat. It is therefore important to size the system properly to reduce these losses. Contact pressure on the thread must be as low as possible to ensure the screw and nut function efficiently, while preventing premature wear and overheating (long-lasting lubrication).

The following calculations are used to correctly define the diameter of the screw and nut based on axial loads, speeds and assembly types.

CALCULATIONS

SLIDING SPEED	$Vg = \frac{N.D2.\pi}{60000}$	Vg = sliding speed in **m/s** N = screw speed in **rpm** D2 = diameter on side of the screw in **mm**
NUT SPEED	$V = \frac{N.P}{60}$	V = linear nut speed in **m/s** N = screw speed in **rpm** P = pitch of the system in **mm**
NUT LENGTH	$L1 = \frac{F.P}{Pz.D2.\pi.H1.n}$	L1 = nut length in **mm** F = total axial load in **N** P = pitch of the system in **mm** Pz = contact pressure in **N/mm²** (see table) H1 = contact height on the side in **mm** (≈ 0.5.P) n = number of threads
CONTACT PRESSURE ACCORDING TO THE LENGTH OF THE NUT	$Pz = \frac{F.P}{L1.D2.\pi.H1.n}$	Pz = contact pressure in **N/mm²** F = total axial load in **N** P = pitch of the system in **mm** L1 = nut height in **mm** D2 = diameter on the side of the screw in **mm** H1 = contact height on the side in **mm** (= 0.5.P) n = number of threads
HELIX ANGLE	$\text{Tan } \alpha = \frac{P}{D2.\pi}$	α = helix angle of the thread in ° P = pitch in **mm** D2 = diameter on the side of the screw in **mm**

The acceptable contact pressure depends on the sliding speed and the material of the nut. The table shown below lists standard values for our nuts. For other materials, use 10 N/mm² as the standard value.

Material	Sliding speed (m/s)	Pz (N/mm²)
Steel	1.5	10
Bronze	1.5	10
Polyamide	0.6	1

FRICTION ANGLE

$\tan \rho = \mu G$

ρ = friction angle in °
μG = see table below

REVERSIBILITY

Nut material	μG	
	dry	lubricated
Steel	0.15	0.10
Bronze	0.10	0.05
Polyamide	0.10	0.05

The system cannot be inverted if $\alpha < \rho$

The values can be changed lubrication, contact surface states, etc.

EFFICIENCY

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

η = efficiency of a translational rotational motion
α = helix angle
ρ = friction angle

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

η' = efficiency of a translational rotational motion
α = helix angle
ρ = friction angle

DRIVE TORQUE

$$Ma = \frac{F.P}{2000.\pi.\eta}$$

Ma = drive torque (converted from translational rotation) in Nm
F = total axial load in N
P = pitch of the system in mm
η = efficiency of a translational rotational motion

$$Me = \frac{F.P.\eta'}{2000.\pi}$$

Me = drive torque (converted from translational rotation) in Nm
F = total axial load in N
P = pitch of the system in mm
η' = efficiency of a translational rotational motion

CRITICAL SPEED

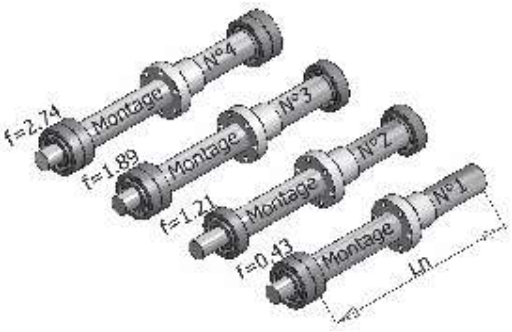
When rotating, the screws are subjected to axial loads and vibration. These depend on the free length of the screw, the assembly direction and the direction of the force (traction or compression). In the later case, a buckling calculation verification is required.

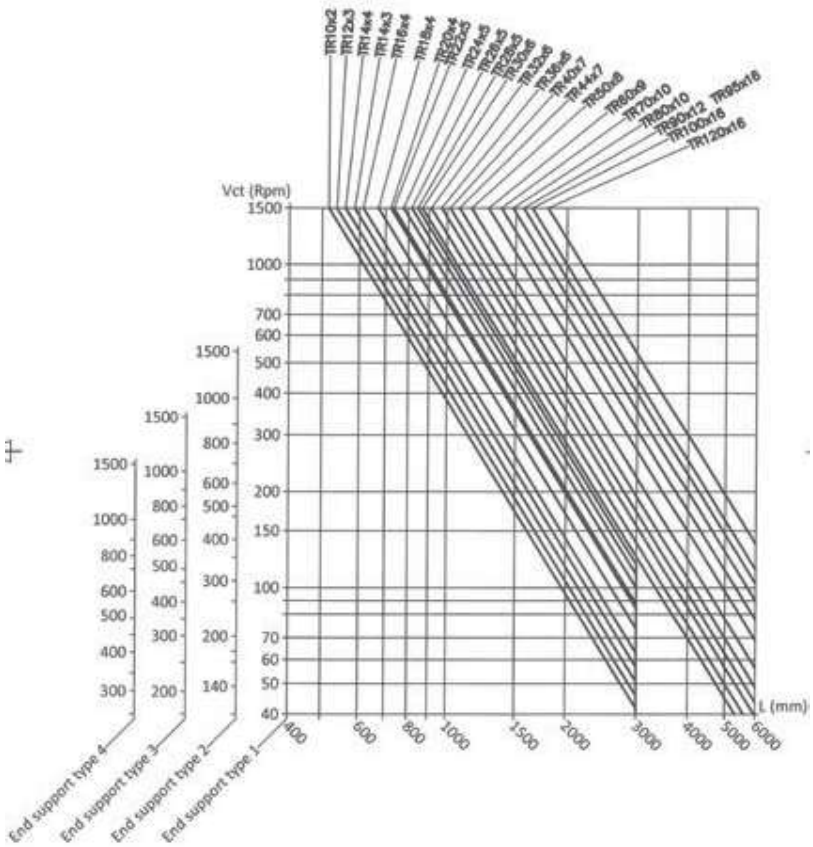
$$Vct = \frac{D_3}{L^2} \; 1{,}1.10^8$$

Vct = critical speed in **rpm**
D_3 = diameter of the screw core in **mm**
L = screw length in **mm**

Vadm = Vct.0,8.f

Vadm = corrected acceptable speed in **rpm**
Vct = critical speed in **rpm**
f = correction factor due to the nature of the supports



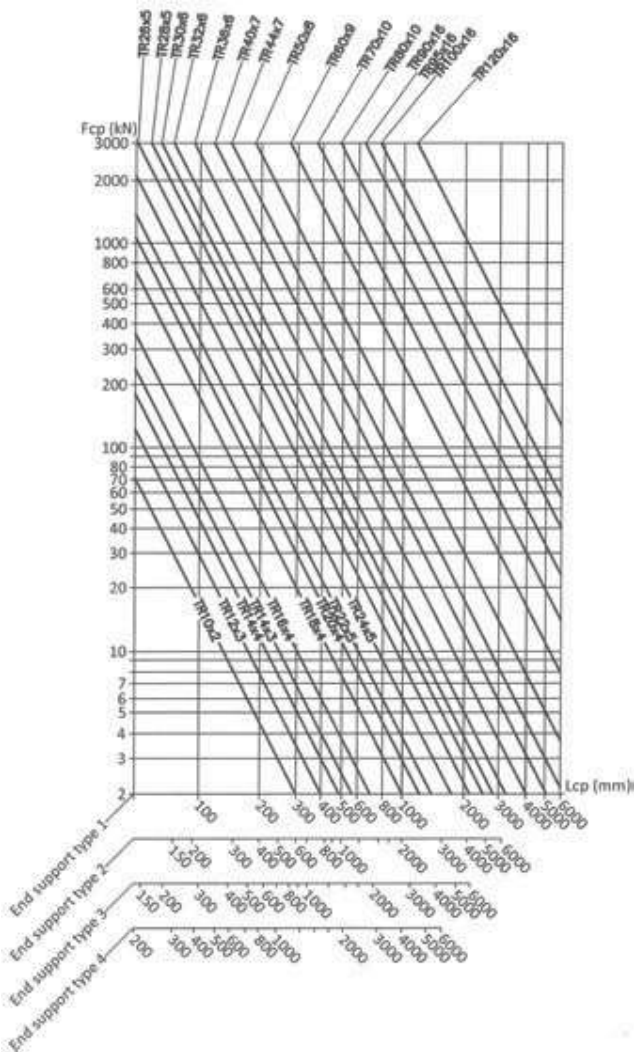


BUCKLING

When a screw is working under compression, the effect of buckling increases in proportion to the screw length/Ø ratio. It is therefore important to determine the diameter of the screw correctly, depending on load.

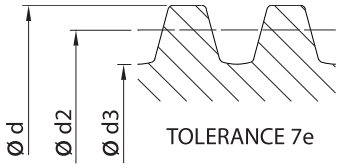
$$F_{cp} = \frac{21.10^4.D_3^4.\pi^3.f}{64.L_{cp}^2}$$

F_{cp} = maximum acceptable axial compression force on the nut in **N**
D_3 = thread root diameter of the screw in **mm**
f = bucking correction factor due to the nature of the supports
L_{cp} = length of the screw subject to compression in **mm**



TRAPEZOIDAL SCREW RPTS

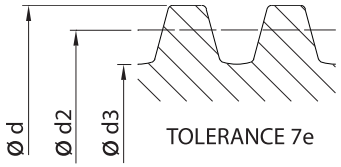
Material:	C35 (1.0501) or C45 (1.0503)
Type of thread:	Trapezoidal in accordance with ISO 2901/2903 and DIN103, 7e tolerance
Length kept in stock:	3 meters up to and including Ø 28/6 for larger diameters



Dimension			7e tolerance thread						Precision of the pitch	Rectitude	Helix angle	Weight / m
			d max	d min	d2 max	d2 min	d3 max	d3 min				
Profile	Right	Left	mm	mm	mm	mm	mm	mm	µ/300mm	mm/300mm	α	(Kg)
8X1.5	*		8	8.85	8.183	8.013	7.2	6.763	150	0.4	3°50'	0.311
10X2	*	*	10	9.82	8.929	8.739	7.5	6.962	150	0.4	4°07'	0.482
10X3	*		10	9.764	8.415	8.191	6.5	5.770	200	0.5	6°33'	0.424
12X3	*	*	12	11.764	10.415	10.191	8.5	7.770	150	0.4	5°17'	0.653
14X3	*	*	14	13.764	12.415	12.191	10.5	9.770	100	0.4	4°26'	0.932
14X4	*		14	13.7	11.905	11.640	9.5	8.569	150	0.5	6°11'	0.879
16X4	*	*	16	15.7	13.905	13.640	11.5	10.569	50	0.5	5°16'	1.173
18X4	*	*	18	17.7	15.905	15.640	13.5	12.569	50	0.5	4°36'	1.528
20X4	*	*	20	19.7	17.905	17.640	15.5	14.569	50	0.5	4°05'	1.94
22X5	*	*	22	21.665	19.394	19.114	16.5	15.400	50	0.2	4°43'	2.294
24X5	*	*	24	23.665	21.394	21.094	18.5	17.375	50	0.2	4°17'	2.781
26X5	*		26	25.665	23.394	23.094	20.5	19.375	50	0.2	3°55'	3.329
28X5	*	*	28	27.665	25.394	25.094	22.5	21.375	50	0.2	3°36'	3.905
30X6	*	*	30	29.625	26.882	26.547	23	21.681	70	0.2	4°05'	4.358
32X6	*		32	31.625	28.882	28.547	25	23.681	70	0.2	3°48'	5.038
36X6	*	*	36	35.625	32.882	32.547	29	27.681	70	0.2	3°20'	6.546
40X7	*	*	40	39.575	36.375	36.020	32	30.506	80	0.2	3°31'	7.983
44X7	*	*	44	43.575	40.375	40.020	36	34.506	80	0.2	3°10'	9.856
50X8	*	*	50	49.55	45.868	45.468	41	39.300	100	0.2	3°11'	12.696
55X9	*		55	54.5	50.360	49.935	45	43.119	100	0.2	3°16'	15.4
60X9	*	*	60	59.47	55.360	54.935	50	48.119	100	0.2	2°58'	18.498
70X10	*	*	70	69.47	64.850	64.425	59	56.969	100	0.4	2°49'	25.627
80X10	*	*	80	79.47	74.850	74.425	69	66.969	100	0.4	2°27'	34.189
90X12	*		90	89.4	83.840	83.365	77	74.606	200	0.5	2°36'	43
95X16	*		95	94.29	86.810	86.250	77	73.900	200	1	3°22'	45.6
100X16	*		100	99.29	91.810	91.250	82	78.900	200	1	3°11'	51
120X16	*		120	119.29	111.810	111.250	102	98.900	200	1	2°36'	76
Double threads												
10X4P2	*		10	9.82	8.929	8.716	7.5	6.962	200	0.4	8°12'	0.482
12X6P3	*		12	11.764	10.415	10.164	8.5	7.770	150	0.4	10°30'	0.653
14X6P3	*		14	13.764	12.415	12.164	10.5	9.770	100	0.4	8°49'	0.932
16X8P4	*		16	15.7	13.905	13.608	11.5	10.569	100	0.5	10°29'	1.173
18X8P4	*		18	17.7	15.905	15.608	13.5	12.569	100	0.5	9°20'	1.528
20X8P4	*		20	19.7	17.905	17.608	15.5	14.569	100	0.5	8°09'	1.94
22X10P5	*		22	21.665	19.394	19.058	16.5	15.400	200	0.3	9°23'	2.294
24X10P5	*		24	23.665	21.394	21.058	18.5	17.375	200	0.3	8°31'	2.781
28X10P5	*		28	27.665	25.394	25.058	22.5	21.375	200	0.3	7°12'	3.905
30X12P6	*		30	29.625	26.882	26.507	23	21.681	200	0.3	8°08'	4.358
32X12P6	*		32	31.625	28.882	28.507	25	23.681	200	0.3	7°34'	5.038
36X12P6	*		36	35.625	32.882	32.507	29	27.681	200	0.3	6°39'	6.546
40X14P7	*		40	39.575	36.375	35.977	32	30.506	200	0.3	7°01'	7.983
44X14P7	*		44	43.575	40.375	39.977	36	34.506	200	0.3	6°20'	9.856

TRAPEZOIDAL SCREW RTS

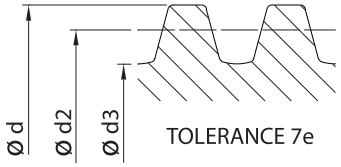
Material:	C15 (1.0401)
Type of thread:	Trapezoidal in accordance with ISO 2901/2903 and DIN103, 7e tolerance
Length kept in stock:	3 meters



Dimension			7e tolerance thread						Precision of the pitch	Rectitude	Helix angle	Weight / m
			d max	d min	d2 max	d2 min	d3 max	d3 min				
Profile	Right	Left	mm	mm	mm	mm	mm	mm	µ/300mm	mm/300mm	α	(Kg)
10X2	*		10	9.82	8.929	8.739	7.5	6.962	200	0.7	4°07'	0.482
12X3	*		12	11.764	10.415	10.191	8.5	7.770	200	0.7	5°17'	0.653
14X3	*		14	13.764	12.415	12.191	10.5	9.770	200	0.7	4°26'	0.932
16X4	*		16	15.7	13.905	13.640	11.5	10.569	100	0.7	5°16'	1.173
18X4	*		18	17.7	15.905	15.640	13.5	12.569	100	0.7	4°36'	1.528
20X4	*		20	19.7	17.905	17.640	15.5	14.569	100	0.7	4°05'	1.94
22X5	*		22	21.665	19.394	19.114	16.5	15.400	100	0.7	4°43'	2.294
24X5	*		24	23.665	21.394	21.094	18.5	17.375	100	0.7	4°17'	2.781
26X5	*		26	25.665	23.394	23.094	20.5	19.375	100	0.7	3°55'	3.329
28X5	*		28	27.665	25.394	25.094	22.5	21.375	100	0.7	3°36'	3.905
30X6	*		30	29.625	26.882	26.547	23	21.681	100	0.7	4°05'	4.358
32X6	*		32	31.625	28.882	28.547	25	23.681	100	0.7	3°48'	5.038
36X6	*		36	35.625	32.882	32.547	29	27.681	100	0.7	3°20'	6.546
40X7	*		40	39.575	36.375	36.020	32	30.506	100	0.7	3°31'	7.983

TRAPEZOIDAL SCREW RATS

Material:	Stainless steel 316L (1.4404)
Type of thread:	Trapezoidal in accordance with ISO 2901/2903 and DIN103, 7e tolerance
Length kept in stock:	3 meters up to and including Ø 28/6 for larger diameters



Dimension			7e tolerance thread						Precision of the pitch	Rectitude	Helix angle	Weight / m
			d max	d min	d2 max	d2 min	d3 max	d3 min				
Profile	Right	Left	mm	mm	mm	mm	mm	mm	µ/300mm	mm/300mm	α	(Kg)
10X2	*	*	10	9.82	8.929	8.739	7.5	6.962	200	0.8	4°07'	0.482
12X3	*	*	12	11.764	10.415	10.191	8.5	7.770	200	0.8	5°17'	0.653
14X3	*	*	14	13.764	12.415	12.191	10.5	9.770	200	0.8	4°26'	0.932
16X4	*	*	16	15.7	13.905	13.640	11.5	10.569	100	0.8	5°16'	1.173
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28X5	*	*	28	27.665	25.394	25.094	22.5	21.375	100	0.8	3°36'	3.905
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32X6	*	*	32	31.625	28.882	28.547	25	23.681	100	0.8	3°48'	5.038
36X6	*	*	36	35.625	32.882	32.547	29	27.681	100	0.8	3°20'	6.546
40X7	*	*	40	39.575	36.375	36.020	32	30.506	100	0.8	3°31'	7.983
50X8	*	*	50	49.55	45.868	45.468	41	39.300	100	0.8	3°11'	12.696