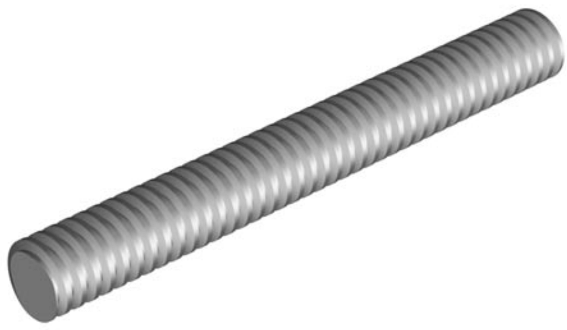
Trapezoidal screw drives TGT
General technical data

NEFF trapezoidal screws are manufactured in a rolled execution.

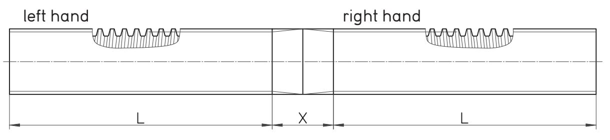
Precision trapezoidal screws RPTS



Technical data

- Thread ______ Metric ISO trapezoidal thread to DIN 103, 7c
- Diameter ______ 10 – 80 mm
- Lead ______ 2 – 24 mm
- No. of starts ______ Up to 6 starts
- Thread direction ______ Right hand thread; single start also available left hand thread, see table p. 35
- Length ______ Up to 3000 mm for screws up to Tr 18 x 4
  Up to 6000 mm for screws from Tr 20 x 4
- Material ______ 1.0401 (case hardened steel C15) stress relief annealed, weldable
- Lead accuracy ______ 50 to 300 µm/300 mm
- Straightness ______ 0.1 to 0.5 mm/300 mm
- Left and right hand screw ______ For thread leads of 2 – 10 mm
- End machining ______ In accordance with customer's specs

Trapezoidal screws with right and left hand thread



Technical data

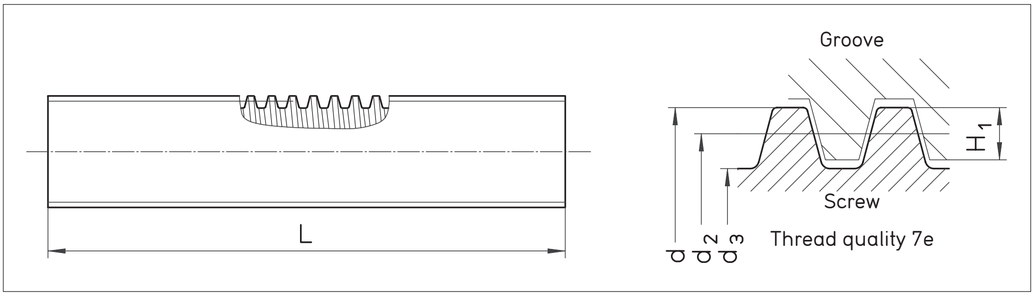
- Diameter ______ 10 – 80 mm
- Lead ______ 2 – 10 mm
- No. of starts ______ Single start
- Thread direction ______ Right hand thread and left hand thread
- Length ______ Max. 3000 mm, up to 6000 mm for screws from Tr 20 x 4, on request.
- Material ______ 1.0401 (C15)
- Lead accuracy ______ 50 to 300 µm/300 mm
- Straightness ______ 0.1 to 0.5 mm/300 mm
- Dimension X______ 100 mm
  Diameter in the area of dimension X smaller than nominal diameter

Trapezoidal screw drives
Summary of trapezoidal screws RPTS

Rolled precision trapezoidal screws RPTS

Standard length 3000 mm, from ø 20 mm up to 6000 mm available. Dimension L to customer's specs.

Material:
1.0401 (C15)



Type Outer diameter [mm] Lead [mm] Right/left hand thread	d	Dimensions [mm] $d_{2\,min}$	$d_{2\,max}$	d_3 6)	H_1	Accuracy [µm/300mm]	Straightness [mm/300mm]	α 2)	η 3)	Weight [kg/m]	Planar moment of inertia [cm⁴]	Moment of resistance 4) [cm³]	Mass moment of inertia [kg m²/m]
RPTS Tr 10x2 RPTS Tr 10x3	10	8.739 8.191	8.929 8.415	6.89 5.84	1 1.5	300 300	0.5 0.5	4° 2′ 6° 24′	0.40 0.51	0.500 0.446	0.011 0.0057	0.032 0.020	$0.51 \cdot 10^{-5}$ $0.40 \cdot 10^{-5}$
RPTS Tr 12x3 RPTS Tr 12x6 P3 1)	12 12	10.191 10.165	10.415 10.415	7.84 7.84	1.5 1.5	300 300	0.5 0.5	5° 11′ 10° 18′	0.46 0.62	0.68 0.68	0.019 0.019	0.047 0.047	$0.94 \cdot 10^{-5}$ $0.94 \cdot 10^{-5}$
RPTS Tr 14x3 RPTS Tr 14x4	14	12.191 11.640	12.415 11.905	9.84 8.80	1.5 2	300 300	0.5 0.5	4° 22′ 6° 3′	0.42 0.50	0.96 0.888	0.046 0.029	0.094 0.067	$1.88 \cdot 15^{-5}$ $1.60 \cdot 10^{-5}$
RPTS Tr 16x4 RPTS Tr 16x8 P4 1)	16 16	13.640 13.608	13.905 13.905	10.80 10.80	2 2	50 300	0.1 0.3	5° 11′ 10° 18′	0.46 0.62	1.21 1.21	0.067 0.067	0.124 0.124	$2.96 \cdot 10^{-5}$ $2.96 \cdot 10^{-5}$
RPTS Tr 18x4	18	15.640	15.905	12.80	2	50	0.1	4° 32′	0.43	1.58	0.132	0.206	$5.05 \cdot 10^{-5}$
RPTS Tr 20x4 RPTS Tr 20x8 P4 1) RPTS Tr 20x16 P4 1)	20	17.640 17.608 17.608	17.905 17.905 17.905	14.80 14.80 14.80	2 2 2	50 200 200	0.1 0.2 0.2	4° 2′ 8° 3′ 15° 47′	0.40 0.57 0.71	2.00 2.00 2.00	0.236 0.236 0.236	0.318 0.318 0.318	$8.10 \cdot 10^{-5}$ $8.10 \cdot 10^{-5}$ $8.10 \cdot 10^{-5}$
RPTS Tr 22x5 RPTS Tr 22x24 P4 S 1)5)	22	19.114 19.140	19.394 19.505	15.50 16.50	2.5 2.5	50 200	0.1 0.2	4° 39′ 21° 34′	0.43 0.75	2.34 2.34	0.283 0.364	0.366 0.441	$1.11 \cdot 10^{-4}$ $1.11 \cdot 10^{-4}$
RPTS Tr 24x5 RPTS Tr 24x10 P5	24	21.094 21.058	21.394 21.394	17.50 17.50	2.5 2.5	50 200	0.1 0.2	4° 14′ 8° 25′	0.41 0.58	2.85 2.85	0.460 0.460	0.526 0.526	$1.65 \cdot 10^{-4}$ $1.65 \cdot 10^{-4}$
RPTS Tr 26x5	26	23.094	23.394	19.50	2.5	50	0.1	3° 52′	0.39	3.40	0.710	0.728	$2.35 \cdot 10^{-4}$
RPTS Tr 28x5	28	25.094	25.394	21.50	2.5	50	0.1	3° 34′	0.37	4.01	1.050	0.976	$3.26 \cdot 10^{-4}$
RPTS Tr 30x6 RPTS Tr 30x12 P6 1)	30	26.547 26.507	26.882 26.882	21.90 21.90	3 3	50 200	0.1 0.2	4° 2′ 8° 3′	0.40 0.57	4.50 4.50	1.130 1.130	1.030 1.030	$4.10 \cdot 10^{-4}$ $4.10 \cdot 10^{-4}$
RPTS Tr 32x6	32	28.547	28.882	23.90	3	50	0.1	3° 46′	0.38	5.19	1.600	1.340	$5.45 \cdot 10^{-4}$
RPTS Tr 36x6	36	32.547	32.882	27.90	3	50	0.1	3° 18′	0.35	6.71	2.970	2.130	$9.10 \cdot 10^{-4}$
RPTS Tr 40x7 RPTS Tr 40x14 P7 1)	40	36.020 35.978	36.375 36.375	30.50 30.50	3.5 3.5	50 200	0.1 0.2	3° 29′ 6° 57′	0.37 0.53	8.21 8.21	4.250 4.250	2.790 2.790	$1.37 \cdot 10^{-3}$ $1.37 \cdot 10^{-3}$
RPTS Tr 44x7	44	40.020	40.275	34.50	3.5	50	0.1	3° 8′	0.34	10.10	6.950	4.030	$2.10 \cdot 10^{-3}$
RPTS Tr 48x8	48	43.468	43.868	37.80	4	100	0.1	3° 18′	0.35	12.00	10.000	5.300	$2.90 \cdot 10^{-3}$
RPTS Tr 50x8	50	45.468	45.868	39.30	4	100	0.1	3° 10′	0.34	13.10	11.700	5.960	$3.40 \cdot 10^{-3}$
RPTS Tr 60x9	60	54.935	55.360	48.15	4.5	200	0.3	2° 57′	0.33	19.00	26.400	11.000	$7.30 \cdot 10^{-3}$
RPTS Tr 70x10	70	64.425	64.850	57.00	5	200	0.3	2° 48′	0.32	26.00	51.800	18.200	$1.40 \cdot 10^{-2}$
RPTS Tr 80x10	80	74.425	74.850	67.00	5	200	0.3	2° 25′	0.29	34.70	98.900	29.500	$2.40 \cdot 10^{-2}$

1) Only right hand thread
2) Lead angle at the flank diameter; ➲ see formula (XVI) p. 52
3) Theoretical efficiency for converting a rotary motion into a linear motion with a coefficient of friction μ = 0.1 efficency for other friction coefficients ➲ se formula (XVI) p. 52
4) The polar moment of inertia is double the moment of inertia.
5) Special profile.
6) For a wider filleting the core diameter is slightly smaller, deviating from DIN 103.

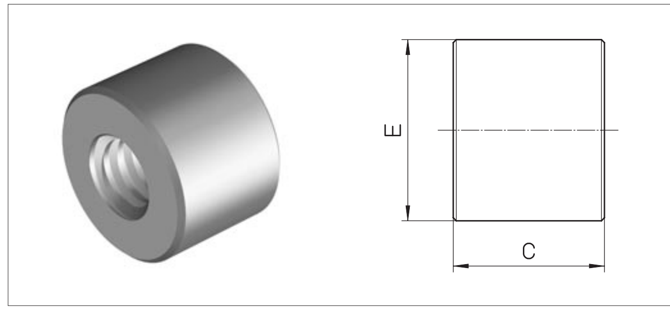
Trapezoidal screw drives
Trapezoidal nuts

Short steel nut blank, cylindrical KSM

Suitable for clamping operations, manual positioning and mounting. Not suitable for motion drives because the steel/steel friction tends to seizure.

Further processing: the thread serves as reference for precise machining and assembly.

Material:
free-cutting steel
1.0718 (9 SMn 28K)



Type	E [mm]	C [mm]	Weight [kg]
KSM Tr 10x2	22	15	0.037
KSM Tr 10x3	22	15	0.036
KSM Tr 12-3	26	18	0.064
KSM Tr 14x3	30	21	0.96
KSM Tr 14x4	30	21	0.96
KSM Tr 16x4	36	24	0.16
KSM Tr 18x4	40	27	0.22
KSM Tr 20x4	45	30	0.31
KSM Tr 22x5	45	33	0.33
KSM Tr 24x5	50	36	0.45
KSM Tr 26x5	50	39	0.47

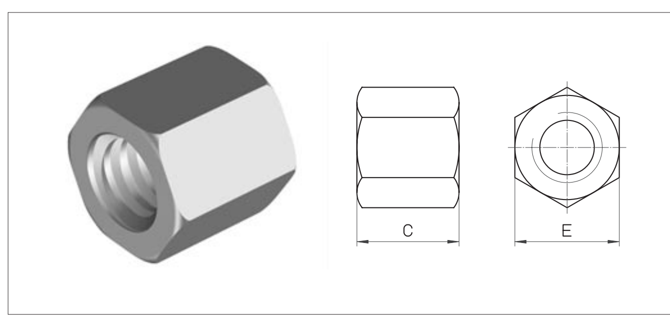
Type	E [mm]	C [mm]	Weight [kg]
KSM Tr 28x5	60	42	0.76
KSM Tr 30x6	60	45	0.79
KSM Tr 32x6	60	48	0.81
KSM Tr 36x6	75	54	1.5
KSM Tr 40x7	80	60	1.9
KSM Tr 44x7	80	66	2.7
KSM Tr 48x8	90	72	2.9
KSM Tr 50x8	90	75	2.7
KSM Tr 60x9	100	90	3.7
KSM Tr 70x10	110	105	4.9
KSM Tr 80x10	120	120	6.4

Hexagonal steel nut blank SKM

For clamping operations, manual positioning and mounting. Not suitable for motion drives because the steel/steel friction tends to seizure.

Further processing: the thread serves as reference for precise machining and assembly.

Material:
free-cutting steel
1.0718 (9 SMn 28K)



Type	E [mm]	C [mm]	Weight [kg]
SKM Tr 10x2	17	15	0.022
SKM Tr 10x3	17	15	0.022
SKM Tr 12x3	19	18	0.028
SKM Tr 14x3	22	21	0.044
SKM Tr 14x4	22	21	0.044
SKM Tr 16x4	27	24	0.084
SKM Tr 18x4	27	27	0.086
SKM Tr 20x4	30	30	0.17
SKM Tr 22x5	30	33	0.17
SKM Tr 24x5	36	36	0.20
SKM Tr 26x5	36	39	0.20

Type	E [mm]	C [mm]	Weight [kg]
SKM Tr 28x5	41	42	0.30
SKM Tr 30x6	46	45	0.43
SKM Tr 32x6	46	48	0.42
SKM Tr 36x6	55	54	0.73
SKM Tr 40x7	65	60	1.3
SKM Tr 44x7	65	66	1.2
SKM Tr 48x8	75	72	1.8
SKM Tr 50x8	75	75	1.8
SKM Tr 60x9	90	90	2.8
SKM Tr 70x10	90	105	3.1

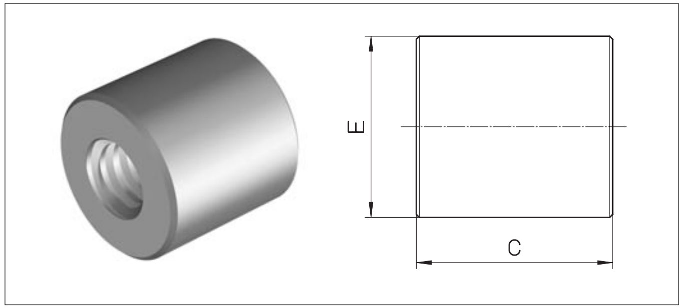
Trapezoidal screw drives
Trapezoidal nuts

Long gunmetal nut blank, cylindrical LRM

For slow and moderate speed motion drives with duty cycles below 20%.

Further processing: The thread serves as a reference for precise machining and assembly.

Material:
2.1090 (G-CuSn 7Zn Pb (Rg7)), Characteristics ➲ page 40



Type	E [mm]	C [mm]	Weight [kg]	Bearing surface [mm²]
LRM Tr 10x2	22	20	0.056	200
LRM Tr 10x3	22	20	0.056	190
LRM Tr 12x3	26	24	0.092	280
LRM Tr 12x6 P3 1)	26	24	0.092	280
LRM Tr 14x3	30	28	0.14	380
LRM Tr 14x4	30	28	0.14	370
LRM Tr 16x2 1)	36	32	0.25	490
LRM Tr 16x4	36	32	0.25	490
LRM Tr 16x8 P4 1)	36	32	0.25	490
LRM Tr 18x4	40	36	0.34	630
LRM Tr 20x4	45	40	0.48	790
LRM Tr 20x8 P4 1)	45	40	0.45	790
LRM Tr 22x5	45	40	0.46	850
LRM Tr 22x24 P4 1) 2)	45	40	0.46	880
LRM Tr 24x5	50	48	0.69	1130

Type	E [mm]	C [mm]	Weight [kg]	Bearing surface [mm²]
LRM Tr 24x10 PS 1)	50	48	0.65	1130
LRM Tr 26x5	50	48	0.58	1240
LRM Tr 28x5	60	60	1.2	1680
LRM Tr 30x6	60	60	1.2	1780
LRM Tr 30x12 P6 1)	60	60	1.2	1780
LRM Tr 32x6	60	60	1.2	1910
LRM Tr 36x6	75	72	2.2	2610
LRM Tr 40x7	80	80	2.8	3210
LRM Tr 40x14 P7 1)	80	80	2.8	3210
LRM Tr 44x7	80	80	2.6	3560
LRM Tr 48x8	90	100	4.3	4840
LRM Tr 50x8	90	100	4.2	5060
LRM Tr 60x9	100	120	5.7	7320
LRM Tr 70x10	110	140	7.6	10000
LRM Tr 80x10	120	160	9.7	13200

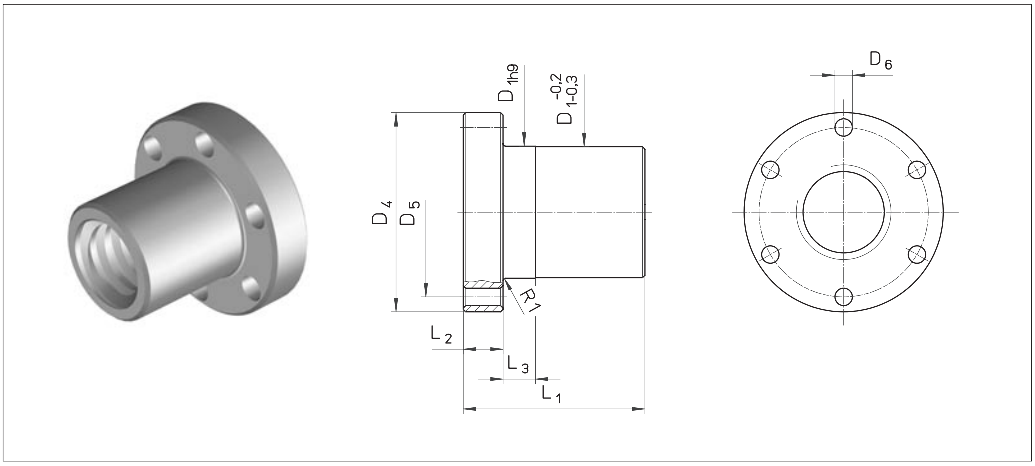
1) Not available in left hand thread
2) Special profile; nominal diameter 21,5

Trapezoidal screw drives
Trapezoidal nuts

Complete bronze nut EFM

For motion drives in continuous operation, with particularly good wear characteristics. Suitable for use as a safety nut. EFM nuts can be installed with the KON an KAR adapters (➲ page 41 – 42).

Material:
2.1090 (G-CuSn 7Zn Pb (Rg7))
Characteristics ➲ page 40



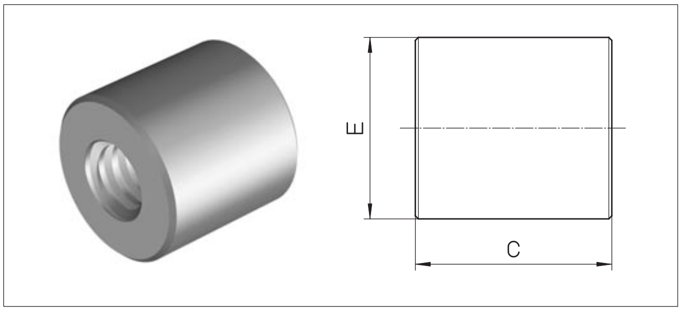
Type	Dimensions [mm]							Weight [kg]	Bearing surface [mm²]
	D_1	D_4	D_5	$6 \times D_6$	L_1	L_2	L_3		
EFM Tr 16x4	28	48	38	6	44	12	8	0.25	670
EFM Tr 18x4	28	48	38	6	44	12	8	0.25	770
EFM Tr 20x4	32	55	45	7	44	12	8	0.30	870
EFM Tr 24x5	32	55	45	7	44	12	8	0.30	1040
EFM Tr 30x6	38	62	50	7	46	14	8	0.40	1370
EFM Tr 36x6	45	70	58	7	59	16	10	0.60	2140
EFM Tr 40x7	63	95	78	9	73	16	10	1.7	2930
EFM Tr 50x8	72	110	90	11	97	18	10	2.6	4900
EFM Tr 60x9	85	125	105	11	99	20	10	3.7	6040

Long plastic nut blank, cylindrical LKM

For low-noise motion drives with higher speeds and longer operation time. Especially recommended in combination with rolled trapezoidal screws. Good emergency running characteristics.

Material:
PEPT, Characteristics ➲ page 40

Lubrication: synthetic oil-based gear grease
FUCHS LUBRITEC, URETHYN EM 1



Type	E [mm]	C [mm]	Weight [kg]	Bearing surface [mm²]
LKM Tr 12x3	26	24	0.012	280
LKM Tr 12x6 P3	26	24	0.012	280
LKM Tr 16x4	36	32	0.032	490
LKM Tr 16x8 P4	36	32	0.032	490
LKM Tr 20x4	45	40	0.06	790
LKM Tr 20x8 P4	45	40	0.06	790

Type	E [mm]	C [mm]	Weight [kg]	Bearing surface [mm²]
LKM Tr 24x5	50	48	0.088	1130
LKM Tr 30x6	60	60	0.15	1780
LKM Tr 30x12 P6	60	60	0.15	1780
LKM Tr 36x6	75	72	0.30	2610
LKM Tr 40x7	80	80	0.37	3210
LKM Tr 50x8	90	100	0.55	5060

LKM with left hand thread on request.

Order code see page 62

Trapezoidal screw drives
Trapezoidal nuts

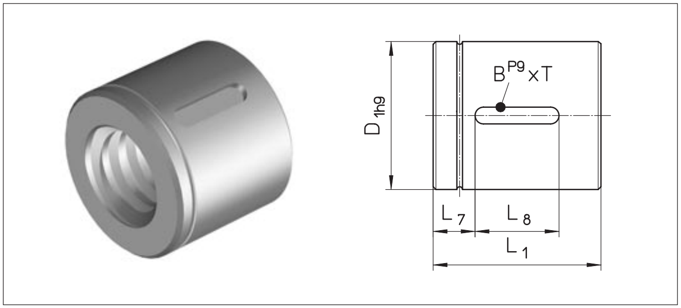
Complete plastic nut EKM

For low-noise motion drives with higher speeds and longer operation time under moderate load.

Good emergency running characteristics.

Especially recommended in combination with rolled trapezoidal screws.

Material:
PETP, Characteristics see below.



Type	Dimensions [mm]					Weight [kg]	Bearing surface [mm²]
	ø D_1	L_1	L_7	L_8	BxT		
EKM Tr 16x4	28	34	7	20	5x2.9	0.02	520
EKM Tr 20x4	32	34	7	20	5x2.9	0.03	670
EKM Tr 20x8 P4	32	34	7	20	5x2.9	0.03	670
EKM Tr 20x16 P4	32	34	7	20	5x2.9	0.03	670

EKM with left hand thread on request.

Material Characteristics

Material 2.1090

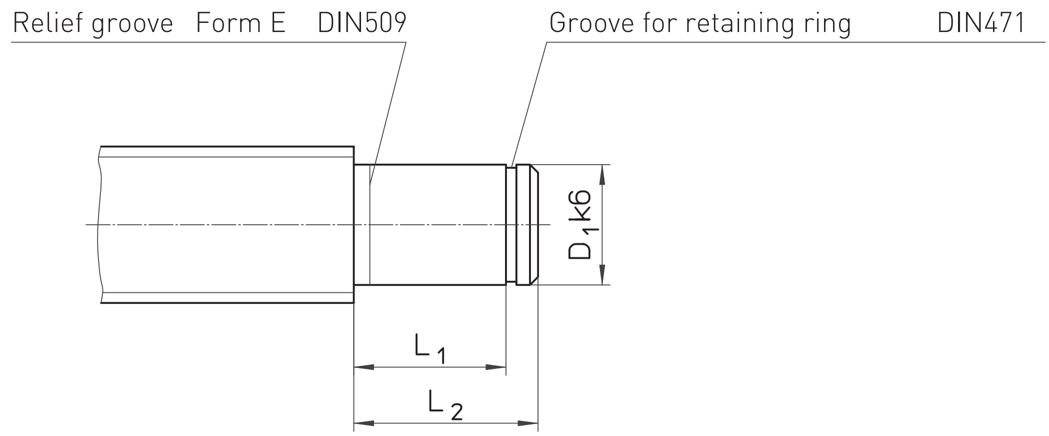
0,2% yield strength R_{ρ} 0.2:	120 N/mm²
Tensile strength R_m (δ_B):	240 N/mm²
Min. strain ar break A5 min.:	15%
Brinell hardness 10/1000:	65
Density:	8.8 kg/dm³
Modulus of elasticity:	90000 N/mm³
pv factor:	300 N/mm² · m/min

Material PETP

Tensile strength:	80 N/mm²
Modulus of elasticity:	2800 – 3000 N/mm²
Impact strength:	40 kJm²
Notch impact strength:	4 kJm²
Thermal expansion:	$8.5 \cdot 10^{-5}$/°C
Water absorption:	0.25%
Water saturation:	0.6%
Density:	1.38 kg/dm³
Friction against steel:	0.05 – 0.08
Ball pressure H 358/30:	150 N/mm²
Strain with a yield stress of 80 N/mm²:	4 – 5%
pv factor:	100 N/mm² · m/min
Max. pressure per unit area:	10 N/mm²
Max. rubbing speed:	120 m/min

Trapezoidal screw drives
Screw end treatment for movable/fixed bearing

Form S – W



Form S	Dimensions [mm]				
TGS	D_1	L_1	L_2	Spacer sleeve	Bearing
Tr18/20x…	12	40	45	18x12.1x24	6001 RS
Tr22/24/26x…	15	46	51	21x15.1x28	6002 RS
Tr28/30/32x…	20	53	58	27x20.1x29	6004 RS
Tr36x…	25	53	58	32x25.1x23	6205 RS
Tr40/44/48/50x…	30	60	68	40x30.1x28	6206 RS
Tr60x…	40	80	88	50x40.1x44	6208 RS
Tr70/80x…	55	102	110	65x55.1x60	6211 RS

Form T	Dimensions [mm]				
TGS	D1	L1	L2	Inner ring	Roller bearing
Tr18/20x…	12	40	45	2 IR 12x16x20	HK 1614 RS
Tr22/24/26x…	15	46	51	2 IR 15x20x23	HK 2018 RS
Tr28/30/32x…	20	53	58	2 LR 20x25x26.5	HK 2518 RS
Tr36x…	25	53	58	2 LR 25x30x26.5	HK 3018 RS
Tr40/44/48/50x…	30	60	68	2 LR 30x35x30	HK 3518 RS
Tr60x…	40	80	88	4 LR 40x45x20	HK 4518 RS

Form W	Dimensions [mm]			
TGS	D1	L1	L2	Cuscinetto
Tr14/16x…	10	8	12	6000 RS
Tr18/20x…	12	8	12	6001 RS
Tr22/24/26x…	15	9	13	6002 RS
Tr28/30/32x…	20	12	16	6004 RS
Tr36x…	25	15	20	6205 RS
Tr40/44/48/50x…	30	16	21	6206 RS
Tr60x…	40	18	25	6208 RS
Tr70/80x…	55	21	29	6211 RS

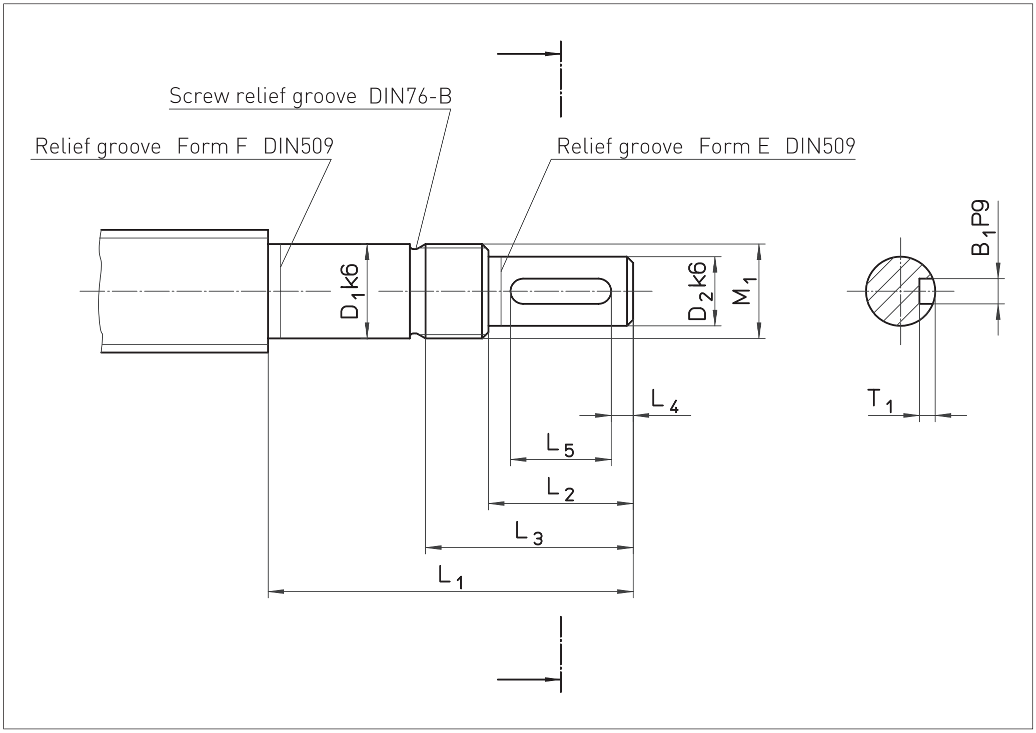
Form K: Produced specially to customer's drawing.

Trapezoidal screw drives
Screw end machining for movable/fixed bearing

Screw end machining for movable/ fixed bearing

The type of bearing influences the stiffness of the screw drive as a whole, as well as the vibration and buckling behaviour of the screw. End machining of the trapezoidal screw is carried out as appropriate for the various types of bearing.

Note: Bearings are not part of our delivery programme.



Form D	Dimensions [mm]									Bearing
TGS	D_1	D_2	L_1	L_2	L_3	L_4	L_5	M_1	B_1xT_1	ZKLF…2RS
Tr18/20/22x…	12	9	55	20	32	2.5	16	M 12x1	3x1.8	1255
Tr24/26x…	15	11	58	23	35	3.5	16	M 15x1	4x2.5	1560
Tr28/30/32x…	20	14	70	30	44	4	22	M 20x1	5x3	2068
Tr36x…	25	19	82	40	57	6	28	M 25x1.5	6x3.5	2575
Tr40/44/48/50x…	30	24	92	50	67	7	36	M 30x1.5	8x4	3080

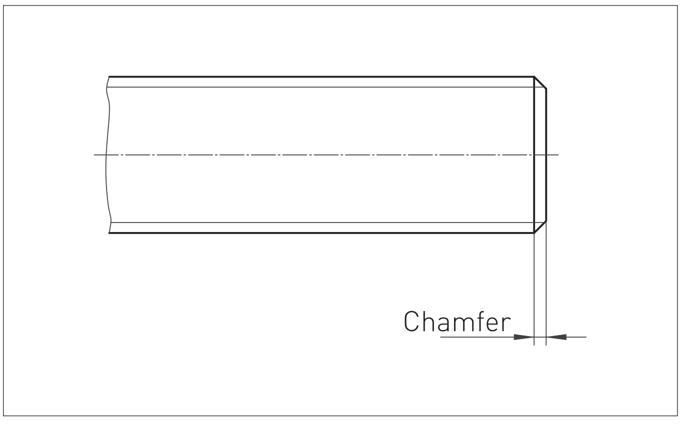
Form F	Dimensions [mm]									Bearing
TGS	D_1	D_2	L_1	L_2	L_3	L_4	L_5	M_1	B_1xT_1	ZARN…LTN
Tr22/24/26x…	15	11	73	23	35	3.5	16	M 15x1	4x2.5	1545
Tr28/30/32x…	20	14	88	30	45	4	22	M 20x1	5x3	2052
Tr28/30/32x…	20	14	107	30	50	4	22	M 20x1	5x3	2062
Tr36/40/44x…	25	19	105	40	58	6	28	M 25x1.5	6x3.5	2557
Tr36/40/44x…	25	19	120	40	63	6	28	M 25x1.5	6x3.5	2572
Tr48/50x…	35	28	145	60	82	10	40	M 35x1.5	8x4	3585
Tr60/70x…	40	36	175	80	103	8.5	63	M 40x1.5	10x5	4090
Tr80x…	55	48	215	110	136	10	90	M 55x2	14x5.5	55115

Trapezoidal screw drives
Screw end machining for movable/fixed bearing

Form H	Dimensions [mm]								Bearing
TGS	D_1	D_2	L_1	L_2	L_3	L_4	L_5	M_1	B_1xT_1	ZARF...LTN
Tr22/24/26x...	15	11	85	23	35	3.5	16	M 15x1	4x2.5	1560
Tr28/30/32x...	20	14	102	30	44	4	22	M 20x1	5x3	2068
Tr28/30/32x...	20	14	122	30	49	4	22	M 20x1	5x3	2080
Tr36/40/44x...	25	19	120	40	57	6	28	M 25x1.5	6x3.5	2575
Tr36/40/44x...	25	19	135	40	63	6	28	M 25x1.5	6x3.5	2590
Tr48/50x...	35	28	160	60	81	10	40	M 35x1.5	8x4	35110
Tr60/70x...	40	36	195	80	105	8.5	63	M 40x1.5	10x5	40115
Tr80x...	55	48	235	110	135	10	90	M 55x2	14x5.5	55145

Form J	Dimensions [mm]									Bearing
TGS	D_1	D_2	L_1	L_2	L_3	L_4	L_5	M_1	B_1xT_1	FDX
Tr20/22x...	12	9	88	20	32	2.5	16	M 12x1	3x1.8	12
Tr24/26x...	15	11	92	23	35	3.5	16	M 15x1	4x2.5	15
Tr28/30/32x...	20	14	107	30	44	4	22	M 20x1	5x3	20
Tr36/40/44x...	25	19	122	40	57	6	28	M 25x1.5	6x3.5	25
Tr48/50x...	30	24	136	50	72	7	36	M 30x1.5	8x4	30
Tr60x...	40	36	182	80	102	8.5	63	M 40x1.5	10x5	40

Form L	Dimensions [mm]									
TGS	D_1	D_2	L_1	L_2	L_3	L_4	L_5	M_1	B_1xT_1	Bearing
Tr16/18x...	10	8	55	20	30	–	–	M 10x0.75	–	7200 BE RS
Tr20/22x...	12	9	58	20	30	2.5	16	M 12x1	3x1.8	7201 BE RS
Tr24/26x...	15	11	73	23	33	3.5	16	M 15x1	4x2.5	7202 BE RS
Tr28/30/32x...	20	14	88	30	43	4	22	M 20x1	5x3	7204 BE RS
Tr36/40/44x...	25	19	120	40	55	6	28	M 25x1.5	6x3.5	7205 BE RS
Tr48/50x...	35	28	145	60	77	10	40	M 35x1.5	8x4	7207 BE RS
Tr60x...	40	36	175	80	103	8.5	63	M 40x1.5	10x5	7208 BE RS
Tr70/80x...	55	48	215	110	133	10	90	M 55x2	14x5.5	7211 BE RS



Form Z
Chamfer 2 x 45°: TGS with ø 12 – 25 mm
Chamfer 3 x 45°: TGS with ø 26 – 40 mm
Chamfer 4 x 45°: TGS with ø 44 – 50 mm

Trapezoidal screw drives
Sizing and selection

Load rating of trapezoidal screw drives
As a general principle, the load rating of trapezoidal screw drives is dependent on their material, surface quality, state of wear, surface pressure, lubrication conditions, running speed and temperature, and thus on the duty cycle and the provision for the heat dissipation.

The permissible surface pressure is primarily dependent on the running speed of the screw drive.

With motion drives the surface pressure should not exceed 5 N per mm^2.

The permissible speed can be calculated from the supporting surface of the respective nut (see tables pp. 37 – 40) and the pv-factor of the respective nut materials (see p. 40).

pv-factors

Material	pv-factors [N/mm^2 · m/min]
G-CuSn 7 ZnPb (Rg 7)	300
G-CuSn 12 (G Bz 12)	400
Plastic (PETP)	100
Cast iron GG 22 / GG25	200

Required bearing surface

$$A_{erf} = \frac{F_{ax}}{P_{zul}} \quad \text{(VIII)}$$

A_{erf}	Required bearing surface [mm^2]
F_{ax}	Total axial load [N]
P_{zul}	Maximum permissible surface pressure = 5 N/mm^2

Maximum linear running speed

$$v_{Gzul} = \frac{pv - factor}{P_{zul}} \quad \text{(IX)}$$

pv-factor	see table
V_{Gzul}	Maximum linear running speed [m/min]

Maximum permissible speed of rotation

$$n_{zul} = \frac{v_{Gzul} \cdot 1000}{D \cdot \pi} \quad \text{(X)}$$

D	Flank diameter [mm]
n_{zul}	Maximum permissible speed of rotation [rpm]

Permissible feed speed

$$s_{zul} = \frac{n_{zul} \cdot P}{1000} \quad \text{(XI)}$$

P	Thread lead [mm]
S_{zul}	Permissible feed speed [m/min]

Trapezoidal screw drives
Sizing and selection

Example load rating calculation

Given: Screw drive,
Trapezoidal screw drive with bronze nut $P_{zul} = 5\ N/mm^2$,
Total axial load $F_{ax} = 10000\ N$

Required: What travel speed is still permissible at this load?

A_{erf} Required bearing surface [mm²]

from (VIII) $$A_{erf} = \frac{F_{ax}}{P_{zul}} = \frac{10000N}{5N/mm^2} = 2000mm^2$$

Selection of bronze nut EFM of technical data
➲ page 39

36x6 with bearing surface A = 2140 mm²

P Thread lead = 6 mm

D Flank diameter $= d - \frac{P}{2}$
$= 36 - \frac{6}{2}$ [mm]
= 33 mm

V_{Gzul} Maximum linear running speed [m/min]

from (IX)
$$v_{Gzul} = \frac{pv - factor}{P_{zul}} = \frac{300N/mm^2 \cdot m/min}{5N/mm^2} = 60\ \ m/min$$

With pv-factor for RG 7 = 300 m/min
(see table)

n_{zul} Maximum permissible speed [rpm]

from (X)
$$n_{zul} = \frac{v_{Gzul} \cdot 1000}{D \cdot \pi} = \frac{60m/min \cdot 1000mm/m}{33mm \cdot \pi} = 579\ rpm$$

S_{zul} Permissible feed speed

from (XI)
$$s_{zul} = \frac{n_{zul} \cdot P}{1000} = \frac{579\ \ 1/min \cdot 6mm}{1000mm/m} = 3.474\ \ m/min$$

Result:

At a load of 10.000 N, the trapezoidal screw drive can be operated at a speed of 3.474 metres per min.

Trapezoidal screw drives
Sizing and selection

Critical speed of trapezoidal screws

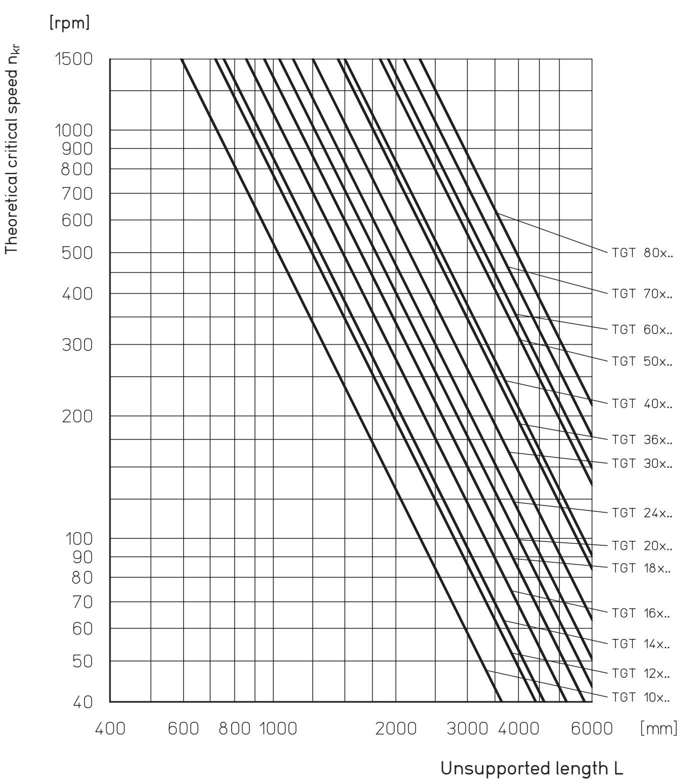
With thin, fast-rotating screws, there is the danger of "whipping". The method described below allows the resonant frequency to be estimated assuming a sufficiently rigid assembly. Furthermore, speeds in the vicinity of the critical speed considerably increase the risk of lateral buckling. The critical speed is therefore included in the calculation of the critical buckling force.

Maximum permissible speed

$$n_{zul} = 0.8 \cdot n_{kr} \cdot f_{kr} \qquad \text{(XII)}$$

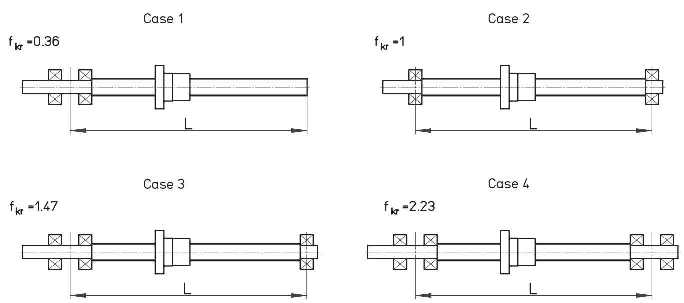
n_{zul}	Maximum permissible speed [rpm]
n_{kr}	Theoretical critical speed [rpm], that can lead to resonance effects ➲ see diagram
f_{kr}	Correction factor considering the bearing support of the screw. ➲ see table
!	The operating speed must not exceed 80% of the maximum speed

Theoretical critical speed n_{kr}



Bearing support

Typical values of correction factor f_{kr} corresponding to the usual cases of installation for standard screw bearings.



Trapezoidal screw drives
Sizing and selection

Critical buckling force of trapezoidal screws

With thin, fast-rotating screws under compressive load, there is the danger of lateral buckling. The procedure described below can be used to calculate the permissible axial force according to Euler.

Before the permissible compressive force is defined, allowance must be made for safety factors appropriate to the installation.

Maximum permissible axial force

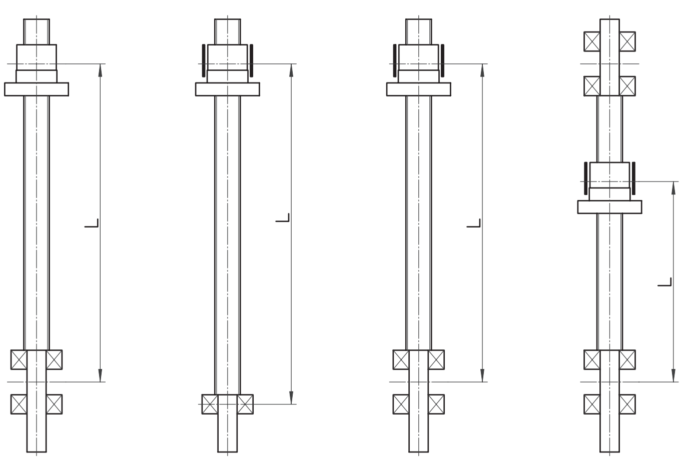
$$F_{zul} = 0.8 \cdot F_k \cdot f_k \qquad \text{(XIII)}$$

F_{zul}	Maximum permissible axial force [kN]
F_k	Theoretical critical buckling force [kN] ➲ see diagram
f_k	Correction factor considering the bearing support of the screw. ➲ see table
!	The operating force must not exceed 80% of the maximum permissible axial force

Bearing support

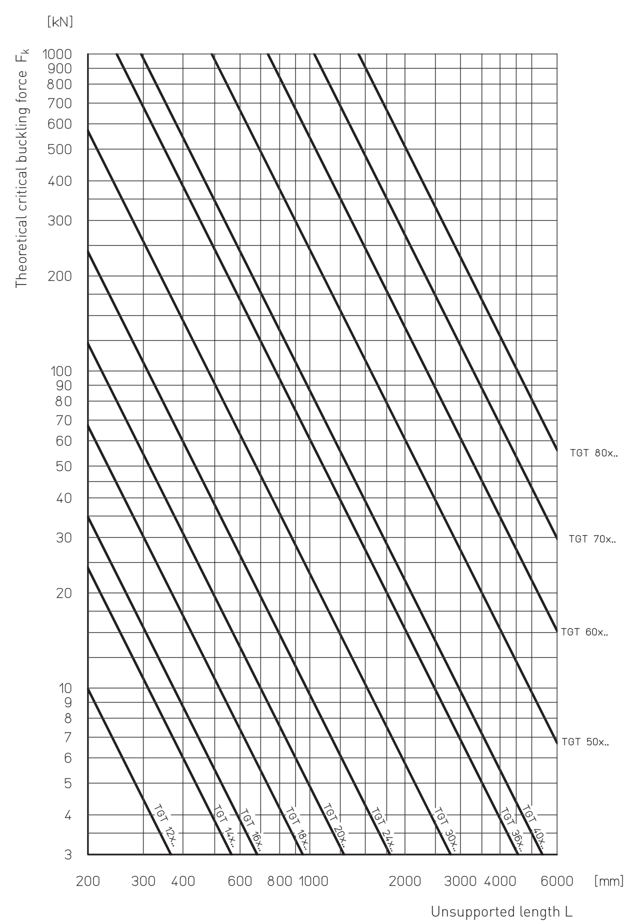
Typical values of correction factor f_k corresponding to the usual cases of installation for standard screw bearings.

Case 1 | Case 2 | Case 3 | Case 4



f_k=0.25 | f_k=1 | f_k=2.05 | f_k=4

Theoretical critical buckling force F_k



Trapezoidal screw drives
Sizing and selection

Deflection of the screw under its own weight

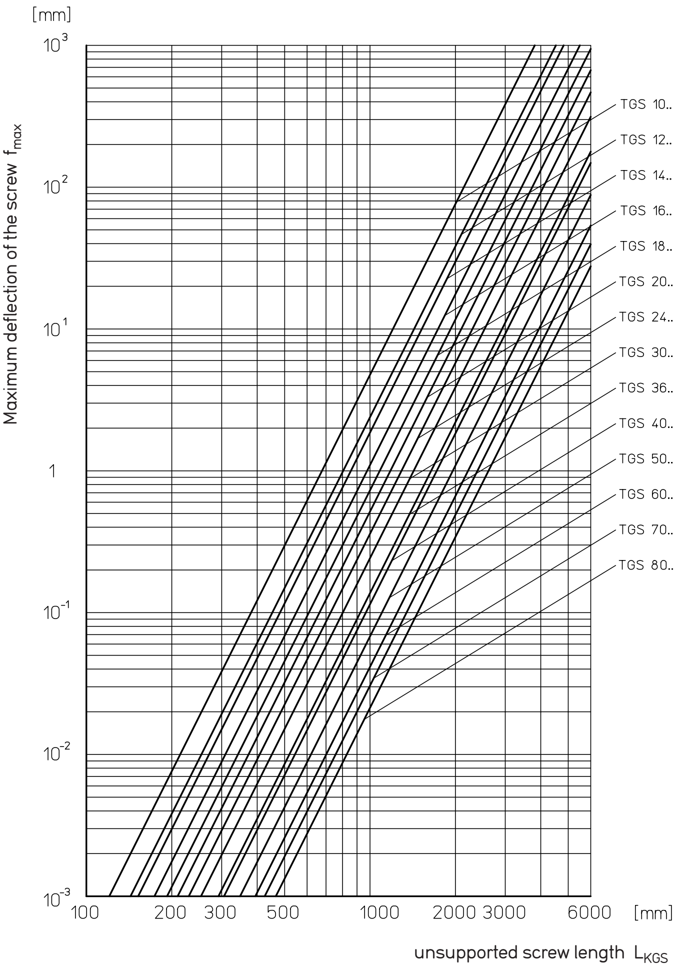
Even in the case of correctly installed screw drives where the resulting radial forces are absorbed by external guides, the weight of the unsupported screw itself may lead to deflection. The formula below allows you to calculate the maximum deflection of the screw.

Maximum deflection of screw

$$f_{max} = f_B \cdot 0.061 \cdot \frac{m'_{TGS} \cdot L_{TGS}{}^4}{I_Y} \qquad \text{(XIV)}$$

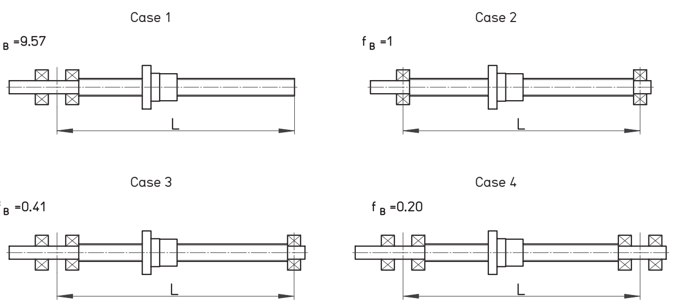
f_{max}	Maximum deflection of the screw [mm]
f_B	Correction factor considering the bearing support of the screw. ➲ see table
I_Y	Planar moment of inertia [10^4 mm^4] ➲ see table page 35
L_{TGS}	Unsupported screw length [mm]
m'_{TGS}	Weight [kg/m]

Theoretical maximum deflection of screw



Bearing support

Typical values of correction factor f_B corresponding to the usual cases of installation for standard screw bearings.



Trapezoidal screw drives
Sizing and selection

Example calculation for a trapezoidal screw drive

Given: !
Trapezoidal screw drive,
Screw RPTS Tr 24x5
Length L = 1500 mm
Installation case 2
Maximum operating speed: n_{max} = 500 [rpm]

Required: ?
Is the operating speed uncritical?
What is the permissible axial force?
What is the maximum deflection?

Maximum permissible speed n_{zul}

from (XII)

$$n_{zul} = 0.8 \cdot n_{kr} \cdot f_{kr} = 0.8 \cdot 830\,\text{rpm} \cdot 1 = 664\,\text{rpm}$$

Theoretical critical speed n_{kr} = 830 rpm

➲ from diagram "Theoretical critical speed"

from (XIII)

$$F_{zul} = 0.8 \cdot F_k \cdot f_k = 0.8 \cdot 4.2\,\text{kN} \cdot 1 = 3.36\,\text{kN}$$

Theoretical critical buckling force F_k = 4.2 kN

➲ from diagram "Theoretical critical buckling force"

from (XIV)

$$f_{max} = f_B \cdot 0.061 \cdot \frac{m'_{TGS} \cdot L_{TGS}}{I_Y} = 1 \cdot 0.061 \cdot \frac{2.85\,\text{kg/m} \cdot 1.5\,\text{m}}{0.460\,\text{cm}^4}$$

$$f_{max} = 0.57\,\text{mm}$$

Weight m'_{TGS} = 2.85 kg/m
Planar moment of inertia I_y = 0.460 cm^4

➲ from table page 35

Result:

The selected screw drive is uncritical at n_{max} = 500 rpm.
It can be loaded with a maximum axial force of 3.36 kN,
and when installed horizontally has a maximum deflection of 0.57 mm

(Note surface pressure and pv-factor)

Trapezoidal screw drives
Sizing and selection

Required drive torque and drive power

The required drive torque of a screw drive results from the axial load, the screw lead and the efficiency of the screw drive and bearings. With short run-up times and high speeds, the acceleration moment should be checked.

Note: In case of trapezoidal screw drives, in principle, there is always a breakaway moment to be overcome.

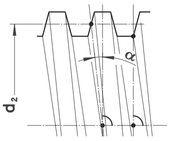
Required drive torque

$$M_d = \frac{F_{ax} \cdot P}{2000 \cdot \pi \cdot \eta_A} + M_{rot} \qquad \text{(XV)}$$

F_{ax} Total axial load [N]
P Thread lead [mm]
η_A Efficiency of the overall drive
$= \eta_{TGT} \cdot \eta_{fixed\ bearing} \cdot \eta_{movable\ bearing}$
$\eta_{TGT\ (\mu = 0.1)}$ ➲ see table page 35
$\eta_{fixed\ bearing} = 0.9 \ldots 0.95$
$\eta_{movable\ bearing} = 0.95$
M_d Required drive torque [Nm]
M_{rot} Rotational acceleration torque [Nm]
$= J_{rot} \cdot \alpha_0$
$= 7.7 \cdot d^4 \cdot L \cdot 10^{-13}$
- J_{rot} Rotational mass moment of inertia [kgm^2]
- d Nominal screw diameter [mm]
- L Screw length [mm]
- α_0 Angular acceleration [1/s^2]

Efficiency η for coefficients of friction other than μ = 0.1

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



η Efficiency for converting a rotary motion into a linear motion
α Helical angle of the thread [°]
➲ see table page 35 or in general

$$\tan\alpha = \frac{P}{d_2 \cdot \pi}$$

with P screw lead [mm]
d_2 flank diameter [mm]
ρ' Thread friction angle [°]

$\tan\rho' = \mu \cdot 1.07$ for ISO-trapezoidal thread
μ is the coefficient of friction

	μ during start-up (= μ_0)		μ in motion	
	dry	lubricated	dry	lubricated
Metal nuts	≈ 0.3	≈ 0.1	≈ 0.1	≈ 0.04
Plastic nuts	≈ 0.1	≈ 0.04	≈ 0.1	≈ 0.03

Required drive power

$$P_a = \frac{M_d \cdot n}{9550} \qquad \text{(XVII)}$$

M_d Required drive torque [Nm] ➲ from (XV)
n Screw speed [rpm]
P_a Required drive power [kW]

Trapezoidal screw drives
Sizing and selection

Torque resulting from an axial load

Trapezoidal screw drives with a helical angle α greater than the friction angle ρ', are not self-locking, i.e. the application of an axial load produces a screw torque.

Efficiency η' for converting a linear motion into a rotary motion is lower than the conversion of a rotary motion into a linear motion.

Required holding moment

$$M_d' = \frac{F_{ax} \cdot P \cdot \eta'}{2000 \cdot \pi} + M_{rot} \qquad \text{(XVIII)}$$

F_{ax} Total axial load [N]
P Thread lead [mm]
η' Efficiency for converting a linear motion into a rotary motion.

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

The effect of the efficiency of the bearing is negligible.

M_d' Required holding moment [Nm]
M_{rot} Rotational acceleration torque [Nm]
$= J_{rot} \cdot \alpha_0$
$= 7.7 \cdot d^4 \cdot L \cdot 10^{-13}$

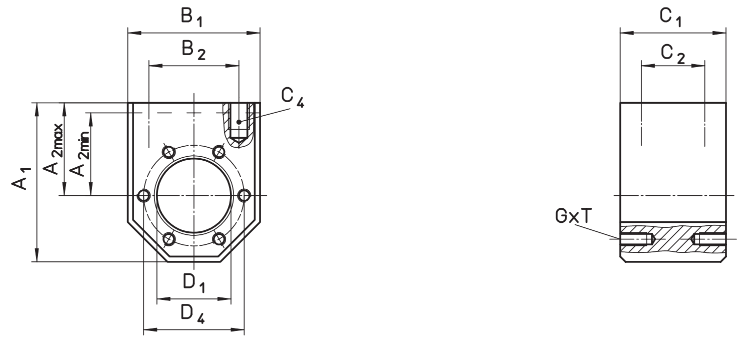
- J_{rot} Rotational mass moment of inertia [kgm^2]
- d Nominal screw diameter [mm]
- L Screw length [mm]
- α_0 Angular acceleration [$1/s^2$]

Accessories trapezoidal screw drives
Adapter bracket

Adapter bracket KON

Adapter bracket for radial attachment of trapezoidal nut EFM

Material:
1.0065 (St37) / 1.0507 (St52)



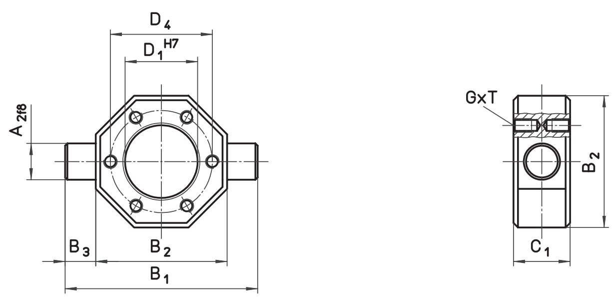
Type for EFM	A_1	$A_{2\ max}$ [1]	$A_{2\ min}$	B_1	B_2	C_1	C_2	C_4	D_1	D_4	G x T
	Dimensions [mm]										
KON Tr 16x4/Tr 18x4	60	35	25	50	34	40	24	M 8x15	28	38	M 5x10
KON Tr 20x4/Tr 24x5	68	37.5	29	58	39	40	24	M 8x15	32	45	M 6x12
KON Tr 30x6	75	42.5	32.5	65	49	40	24	M 10x15	38	50	M 6x12
KON Tr 36x6	82	45	37	75	54	50	30	M 10x12	45	58	M 6x12
KON Tr 40x7	120	70	50	100	76	65	41	M 14x25	63	78	M 8x14
KON Tr 50x8	135	77.5	57.5	115	91	88	64	M 16x25	72	90	M 10x16
KON Tr 60x9	152	87.5	65	130	101	88	64	M 16x30	85	105	M 10x16

[1] Standard = $A_{2\ max}$ (Actual dimension on delivery)

Universal joint adapter KAR

Universal joint adapter for cardanic suspension of trapezoidal nut EFM.

Material:
1.0065 (St37) / 1.0507 (St52)



Type for EFM	A_2	B_1	B_2	B_3	C_1	D_1	D_4	G x T
	Dimensions [mm]							
KAR Tr 16x4/Tr 18x4	12	70	50	10	20	28	38	M 5x10
KAR Tr 20x4/Tr24x5	16	85	58	13.5	25	32	45	M 6x12
KAR Tr 30x6	18	95	65	15	25	38	50	M 6x12
KAR Tr 36x6	20	110	75	17.5	30	45	58	M 6x12
KAR Tr 40x7	30	140	100	20	40	63	78	M 8x14
KAR Tr 50x8	40	165	115	25	50	72	90	M 10x16
KAR Tr 60x9	40	180	130	25	50	85	105	M 10x16