



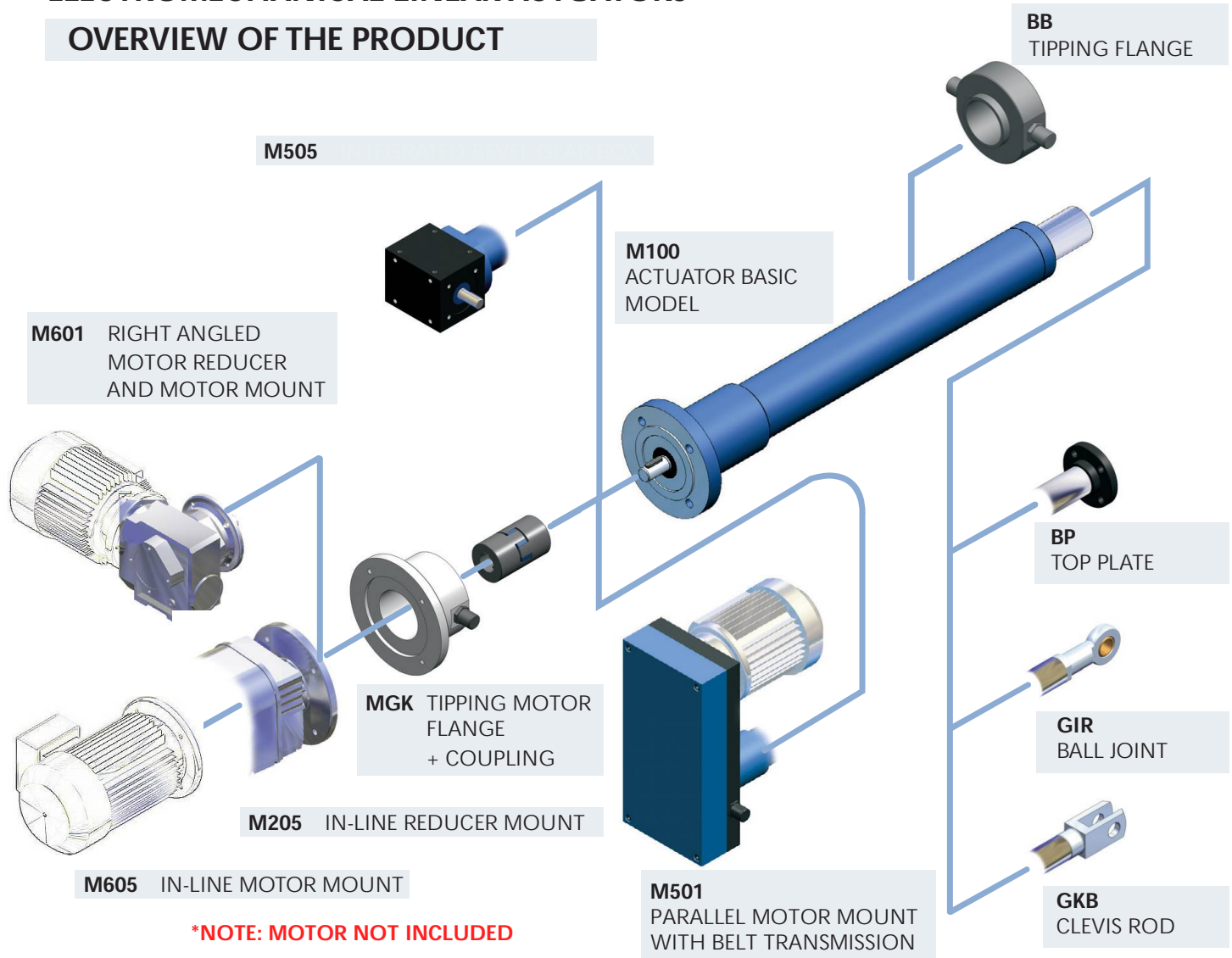
**VERSARAM
ELECTROMECHANICAL
LINEAR ACTUATORS
AND SCREW SUPPORTS**



**PRECISION
TECHNOLOGY**
The Art of Linear Thinking™

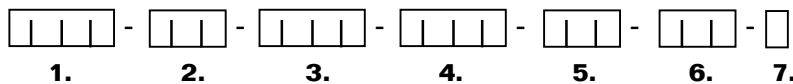
ELECTROMECHANICAL LINEAR ACTUATORS

OVERVIEW OF THE PRODUCT



***NOTE: MOTOR NOT INCLUDED**

ORDER CODE



1. Model

- M100 - Basic model
- M205 - In line reducer mount
- M501 - Parallel motor mount
- M505 - Integrated bevel gear box
- M601 - Right angle gear box and mount
- M605 - In-line motor mount

2. Size

- F16 - 16 mm dia. screw
- F20 - 20 mm dia. screw
- F30 - 30 mm dia. screw
- F40 - 40 mm dia screw
- F50 - 50 mm dia screw

3. Screw

- KGT - Ballscrew x Pitch
- TR - Trapezoidal x Pitch

4. Stroke

(mm) - specials upon request

5. Accessories

- SA - Without any
- BP - Top plate
- GKB/GK - Clevis rod
- GIR - Ball joint

6. Other

- MGK - Tipping motor flange + coupling
- BB - Tipping flange (confirm position)
- SB - Tipping supports

7. Special

- 0 - None
- S - Special

ELECTROMECHANICAL LINEAR ACTUATORS

GENERAL TECHNICAL DATA

LIFE DEFINITION

The life of an actuator is dependant on the life of the screw. It is the number of complete cycles in time that an actuator can perform. It is represented by Lc.

DEFINITION OF THE AVERAGE LOAD

It is the load that corresponds to the average of the different loads during one cycle. It is represented by Cm.

AVERAGE LOAD ESTIMATE

The load C can vary during the cycle and the distance the load is applied for varies (S). In order to calculate the average load the following formula is used:

$$C_m = \sqrt[3]{\frac{C_1^3 \times S_1 + C_2^3 \times S_2 + \dots}{S_1 + S_2 + \dots}}$$

Where: C1, C2, ... = Constant load in N, for travel S1, S2, ...

S = Travel in mm.

LIFE ESTIMATES

The life of a screw in complete cycles, i.e. both directions, will be primarily determined by the screw's pitch, the travel, the dynamic load and the average load.

The life of a ball-screw can be calculated from the dynamic load and the travel.

$$L_c = \frac{500.000 \times P}{S} \times \left(\frac{C}{C_m} \right)^3$$

Where: Lc = Life in complete cycles (one cycle is defined as movement in both directions)

P = Screw pitch in mm.

S = Travel in mm.

C = Dynamic load of the screw in N.

(Actuator size: F-15 = 3.000N; F-20 = 14.000N;

F-30 = 24.000N; F-40 = 42.000N; F-50 = 78.000N)

Cm = Constant average load in N.

EXAMPLES OF LIFE CALCULATION

An M501 F-20 with a stroke of 300 mm a pitch of 5 mm and a load of 3.000N in one direction and of 2.000N in the other.

We calculate the average load that will be applied during one cycle and then the life of the screw in cycles.

These calculations use the following average load formula:

$$C_m = \sqrt[3]{\frac{C_1^3 \times S_1 + C_2^3 \times S_2 + \dots}{S_1 + S_2 + \dots}}$$

$$C_m = \sqrt[3]{\frac{2.000^3 \times 300 + 3.000^3 \times 300}{300 + 300}} = 2.597N$$

Knowing the average load the life can be calculated, using the following formula:

$$L_c = \frac{500.000 \times P}{S} \times \left(\frac{C}{C_m} \right)^3$$

$$L_c = \frac{500.000 \times 5}{3.000} \times \left(\frac{14.000}{2.597} \right)^3 = 1.300.000 \text{ cycles}$$

LUBRICATION OF THE ACTUATORS

The electromechanical linear actuators require a similar lubrication to that used for ball bearings. In normal working conditions, the actuators should be greased between 800 and 2.000 operating hours (factors such as the load, the number of cycles and the screws revolutions must be taken into account).

The unit is delivered lubricated with KLUBER ISOFLEX TOPAS NLGI grease type 2, (DIN 51818). When using the unit at high speeds choose type 1, and for heavy loads type 3.

Continuous lubrication is not advised because the alternating motion deposits too much grease on the screw filling the spindle tube and reducing the available stroke together. There will also be an increase in temperature.

GENERAL TECHNICAL DATA

COMMENTS

This general data is applicable to all the electromechanical actuators, specific technical data is shown for each model.

DUTY CYCLE

The duty cycle can be defined as the relation between the running time, under load, and the total cycle time.

$$F_c = \text{Duty cycle} = \frac{T}{T + R} \times 100$$

Where: T = On-time with load.
 R = Idle time.
 T + R = Total cycle time.

MAXIMUM LOAD ALLOWABLE

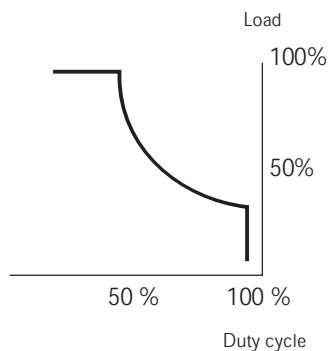
The maximum load allowable is defined as the load advised by the manufacturer. It should not be exceeded as the life of the units will be adversely effected.

BASIC ELEMENT OF MODEL

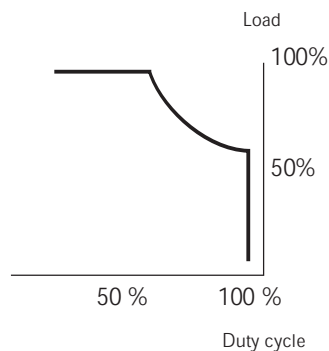
The screw is the basic drive element and can be either ball-screw or trapezoidal. Depending on the load applied the following graphs show the maximum duty cycle.

DUTY CYCLE DIAGRAM

TRAPEZOIDAL SCREW



BALL-SCREW



RELATIONSHIP BETWEEN LOAD AND DUTY CYCLE

The maximum allowable load depends on the duty cycle. The load should be reduced when the duty cycles increases. If the advised duty is exceeded the actuator can be damaged.

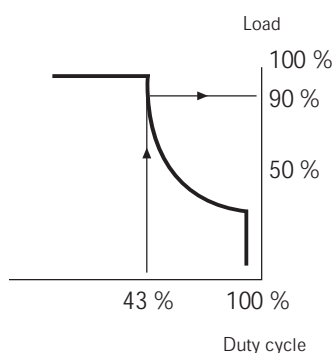
ELECTROMECHANICAL LINEAR ACTUATORS

GENERAL TECHNICAL DATA

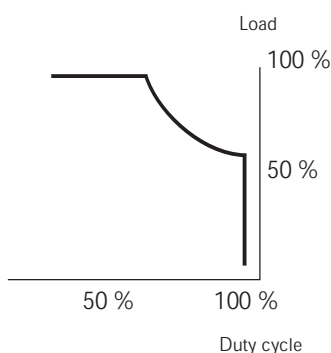
EXAMPLE

An M205 actuator with a trapezoidal screw moves for 15 seconds stops for 20 seconds then repeats this cycle.

TRAPEZOIDAL SCREW



BALL-SCREW



$$F_c = \text{Duty cycle} = \frac{T}{T + R} \times 100$$

$$\frac{15}{15 + 20} \times 100 = 43 \%$$

If we enter a duty cycle of 43% on the trapezoidal screw graph we obtain a maximum allowable load of 90%. For this load we apply the appropriate percentage to the maximum dynamic load. If we utilise the basic actuator F-30, we have a maximum dynamic load of 10.000N.

Maximum load = 10.000N, (each basic model has a specific maximum load see page 11)

Therefore the maximum allowable load is $0.9 \times 10.000N = 9.000N$

DEFINITION OF THE REQUIRED TORQUE

The required torque is defined as the force required in order to move actuator under load.

THE REQUIRED TORQUE CALCULATION

In order to calculate the required torque the following formula will be used:

$$\text{Torque} = \frac{P \times F}{2.000 \times \pi \times C}$$

P = The screw's pitch in mm.
 F = Force required in N.
 C = The efficiency constant; 0.8 for the ball-screw and 0.2 for the trapezoidal screw.

EXAMPLE OF A TORQUE CALCULATION

An electromechanical actuator F-30 with a ball screw having a pitch of 5 has to move a load of 250 Kg. in a vertical plane. What would be the required torque?.

$$\text{Force} = M \times g = 250 \times 9.81 = 2.500N$$

$$\text{Torque} = \frac{2.500 \times 5}{2.000 \times \pi \times 0.8} = 2.486 \text{ Nm} \quad (C = 0.8 \text{ because it is a ball screw})$$

SELECTION CRITERIA

We must take into account the fact that with the same actuator, for example with a screw actuator of $\varnothing 32$, several different speeds can be achieved dependant on the screw's pitch (in this case it could be of 5, 10 or 40 mm/revolution). Equally the gear ratio of the gear box affects the achievable travel speed.

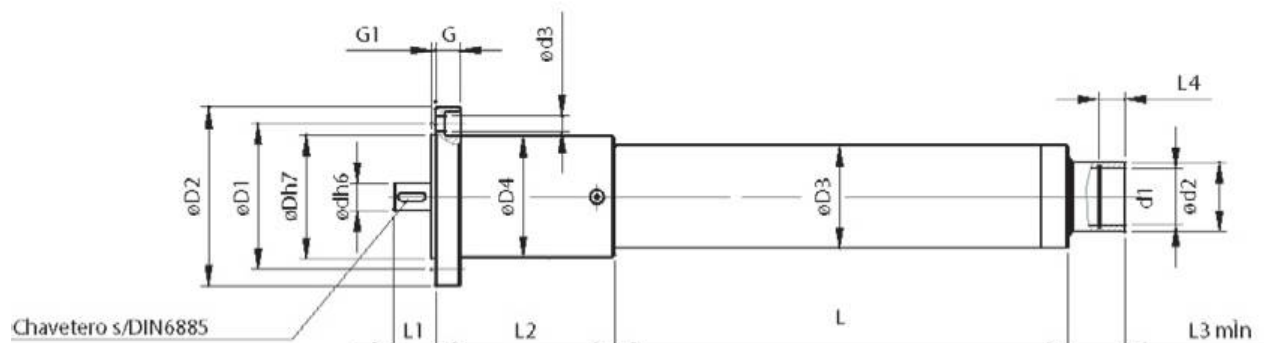
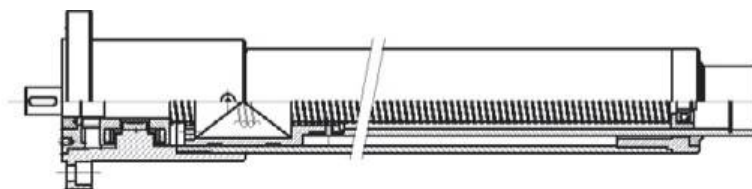
SPECIFIC MODELS

M100 BASIC MODEL ACTUATOR

The basic model actuator has been designed to easily attach several types of drive i.e. manual, electrical, mechanical, etc.

The linear speed is determined by the RPM of the motor and the pitch of the screw.

The thrust depends on the screw pitch and motor power.



Technical features

Model	Screw-pitch	ø	Load kN	Model	Screw-pitch	ø	Load kN	Model	Screw-pitch	ø	Load kN	Model	Screw-pitch	ø	Load kN
M100-F16	KGT 5	16	2,5	M100-F30	KGT 5	32	10	M100-F40	KGT 10	40	25	M100-F50	KGT 10	50	65
	Tr 4	16	2,5		KGT 10	32	15		KGT 20	40	25		KGT 20	50	70
M100-F20	KGT 5	20	5		KGT 40	32	10		KGT 40	40	20		Tr 9	60	70
	KGT 20	20	5		Tr 6	36	10	Tr 7	44	25					
	Tr 5	24	5												

Dimensions

Model	d	d ₁	d ₂	d ₃	D	D ₁	D ₂	D ₃	D ₄	G	G ₁	L	Standard strokes	L ₁	L ₂	L ₃	L ₄
M100-F16	11	M26 x 1,5	32	7(4x)	48	56	75	40	45	12	2	45 + Stroke	100, 200, 300, 400	15	61	21	20
M100-F20	14	M27 x 2	35	9(4x)	72	84	110	55	66	15	2	65 + Stroke	100, 200, 300, 500	30	100	16	25
M100-F30	19	M42 x 2	50	11(4x)	90	106	130	75	88	18	3	82 + Stroke	200, 400, 600, 1000	35	130	17	30
M100-F40	24	M60 x 2	70	11(6x)	110	130	150	90	110	20	4	115 + Stroke	250, 500, 750, 1000	40	150	48	35
M100-F50	35	M80 x 2	90	13(6x)	200	225	250	150	200	30	5	220 + Stroke	300, 600, 1000, 1500	60	300	75	40

ELECTROMECHANICAL LINEAR ACTUATORS

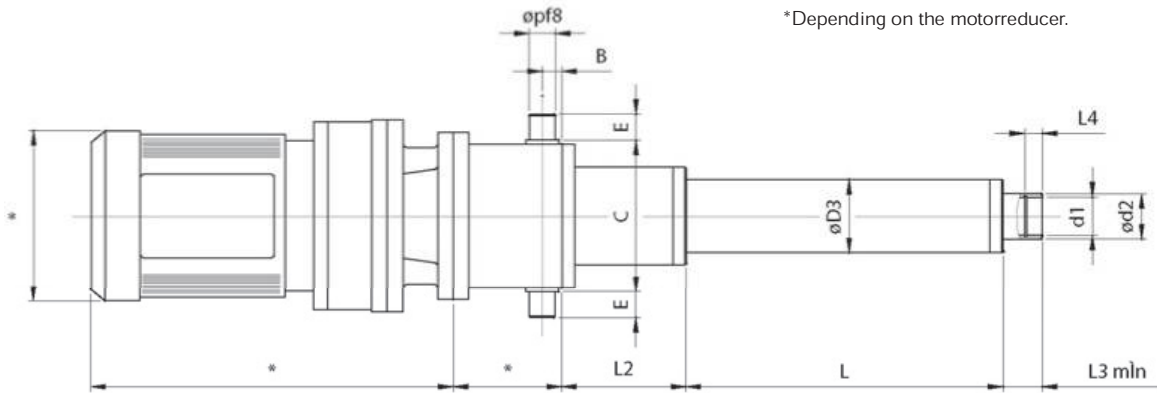
SPECIFIC MODELS

M205 ACTUATOR WITH IN LINE GEARBOX FOR MOTOR DRIVE

The M205 actuator has been designed for handling high loads with low to medium speeds.

Components of the actuator

- Actuator: Basic model.
- Fixing: Trunnion mount.
- Drive: Geared motor with a wide range of gear ratios.
Supply voltage 220/380 V A.C.
- Braked motor (optional).



Technical features															
Model	Screw-pitch	ø	Load kN	Model	Screw-pitch	ø	Load kN	Model	Screw-pitch	ø	Load kN	Model	Screw-pitch	ø	Load kN
M205-F20	KGT 5	20	5	M205-F30	KGT 5	32	10	M205-F40	KGT 10	40	25	M205-F50	KGT 10	50	65
	KGT 20	20	5		KGT 10	32	15		KGT 20	40	25		KGT 20	50	70
	Tr 5	24	5		KGT 40	32	10		KGT 40	40	20		Tr 9	60	70
					Tr 6	36	10		Tr 7	44	25				

Dimensions													
Model	d ₁	d ₂	D ₃	L	Standard strokes	L ₂	L ₃	L ₄	B	C	E	p	
M205-F20	M27 x 2	35	55	65 + Stroke	100, 200, 300, 500	100	16	25	15	116	20	20	
M205-F30	M42 x 2	50	75	82 + Stroke	200, 400, 600, 1000	130	17	30	20	138	25	25	
M205-F40	M60 x 2	70	90	115 + Stroke	250, 500, 750, 1000	150	48	35	30	160	35	35	
M205-F50	M80 x 2	90	150	220 + Stroke	300, 600, 1000, 1500	300	75	40	40	260	45	45	

SPECIFIC MODELS

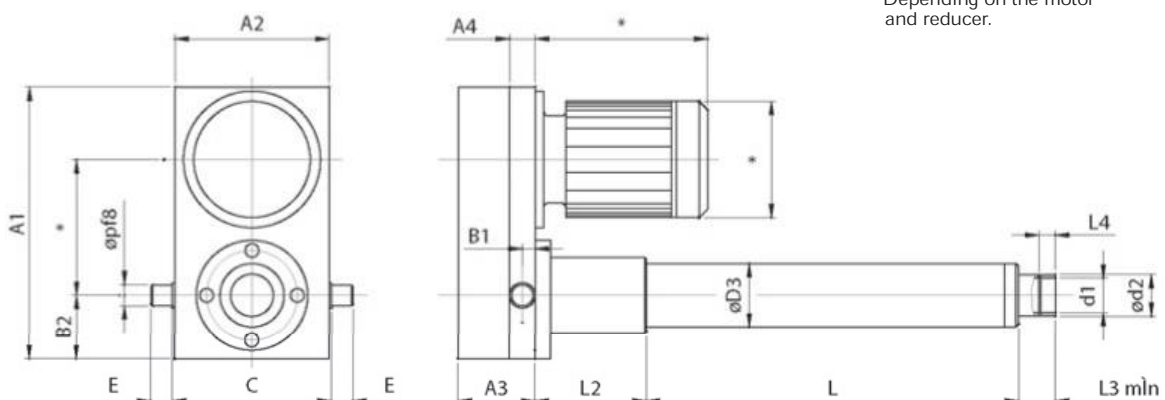
M501 ACTUATOR WITH RIGHT ANGLED BELT DRIVE FOR PARALLEL MOTOR MOUNT

This actuator has been designed for medium loads and a wide range of speeds.

It needs to be mounted with a motor or motor gearbox combination and a toothed belt drive. A braked motor can be supplied if needed.

Components of the actuator

- Actuator: Basic model.
- Fixing: Trunnion / clevis mount.
- Driving: Any kind of motor and toothed belt drive.
- Braked motor (optional).



*Depending on the motor and reducer.

Technical features

Model	Screw-pitch	ø	Load kN	Model	Screw-pitch	ø	Load kN	Model	Screw-pitch	ø	Load kN	Model	Screw-pitch	ø	Load kN
M501-F16	KGT 5	16	1,8	M501-F30	KGT 5	32	9	M501-F40	KGT 10	40	25	M501-F50	KGT 10	50	30
	Tr 4	16	1		KGT 10	32	4,5		KGT 20	40	15		KGT 20	50	15
					KGT 40	32	1,2		KGT 40	40	7		Tr 9	60	8
					Tr 6	36	2		Tr 7	44	10				
M501-F20	KGT 5	20	5												
	KGT 20	20	1,3												
	Tr 5	24	1,2												

Dimensions

Model	d ₁	d ₂	D ₃	L	Standard strokes	L ₂	L ₃	L ₄	A ₁	A ₂	A ₃	A ₄	B ₁	B ₂	C	E	p
M501-F16	M26 x 1,5	32	40	45 + Stroke	100, 200, 300, 400	61	21	20	245	130	70	20	10	50	138	18	12
M501-F20	M27 x 2	35	55	65 + Stroke	100, 200, 300, 500	100	16	25	300	150	85	25	12,5	65	160	20	20
M501-F30	M42 x 2	50	75	82 + Stroke	200, 400, 600, 1000	130	17	30	320	180	90	30	15	90	192	25	25
M501-F40	M60 x 2	70	90	115 + Stroke	250, 500, 750, 1000	150	48	35	490	250	135	40	20	135	270	35	35
M501-F50	M80 x 2	90	150	220 + Stroke	300, 600, 1000, 1500	300	75	40	600	300	182	50	25	135	320	45	45

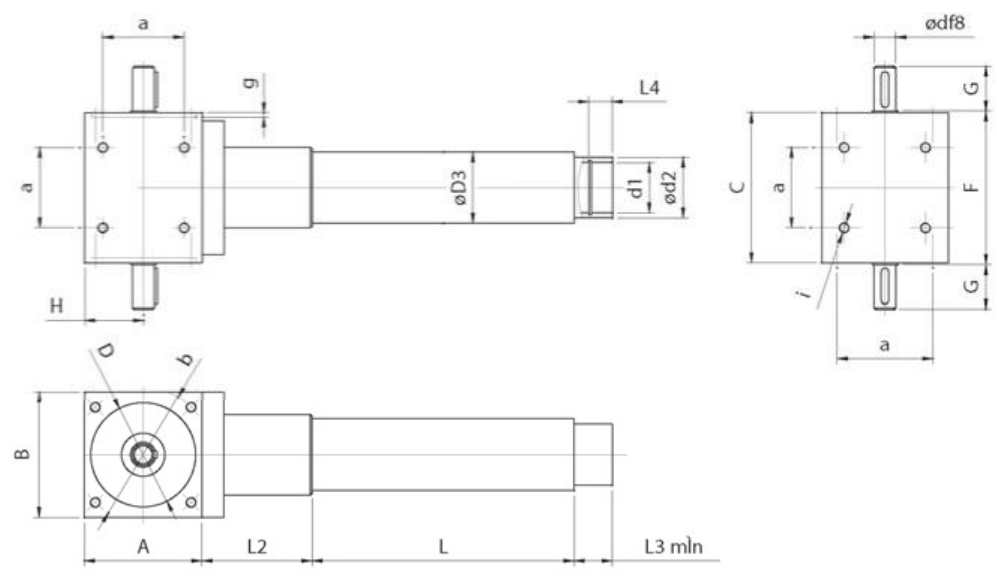
ELECTROMECHANICAL LINEAR ACTUATORS

SPECIFIC MODELS

M505 ACTUATOR WITH INTEGRATED RIGHT ANGLED BEVEL GEAR BOX

The M505 actuator has been designed for mounting several units in parallel and the drive to be at 90°.

*For sizes F40 & F50 get in touch with Precision Technology.



Technical features											
Model	Screw-pitch	ø	Load kN	Model	Screw-pitch	ø	Load kN	Model	Screw-pitch	ø	Load kN
M505-F16	KGT 5	16	2,5	M505-F20	KGT 5	20	5	M505-F30	KGT 5	32	10
	Tr 4	16	2,5		KGT 20	20	5		KGT 10	32	15
			Tr 5		24	5	KGT 40		32	10	
						Tr 6	36		10		

Dimensions																				
Model	d	d ₁	d ₂	D ₃	L	Standard strokes	L ₂	L ₃	L ₄	A	B	C	D	F	G	H	a	b	g	i
M505-F16	14	M26 x 1,5	32	40	45 + Stroke	100, 200, 300, 400	61	21	20	65	70	84	58	86	25	32,5	45	75	2	M6 x 10
M505-F20	16	M27 x 2	35	55	65 + Stroke	100, 200, 300, 500	100	16	25	90	90	110	62	112	34	45	70	75	3	M10 x 18
M505-F30	19	M42 x 2	50	75	82 + Stroke	200, 400, 600, 1000	130	17	30	120	120	154	75	158	40	60	100	100	5	M10 x 18

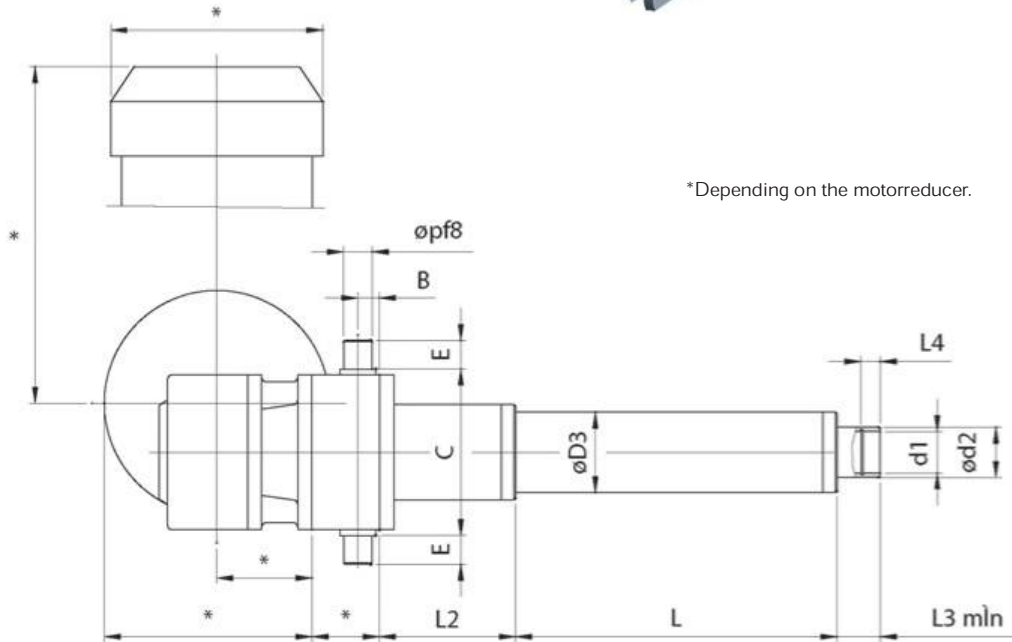
SPECIFIC MODELS

M601 ACTUATOR FOR MOTOR AND RIGHT ANGLED GEAR DRIVE

The M601 actuator has been designed for loads up to 750.000N and speeds ranging from 1 and 200 mm/sec.

Components of the actuator

- Actuator: Basic model.
- Fixing: Via motor housing.
- Driving: Low profile gearbox. Wide range of gear ratios.
- Brake-motor (optional).



*Depending on the motorreducer.

Technical features															
Model	Screw-pitch	ø	Load kN	Model	Screw-pitch	ø	Load kN	Model	Screw-pitch	ø	Load kN	Model	Screw-pitch	ø	Load kN
M601-F20	KGT 5	20	5	M601-F30	KGT 5	32	10	M601-F40	KGT 10	40	25	M601-F50	KGT 10	50	65
	KGT 20	20	5		KGT 10	32	15		KGT 20	40	25		KGT 20	50	70
	Tr 5	24	5		KGT 40	32	10		KGT 40	40	20		Tr 9	60	70
					Tr 6	36	10		Tr 7	44	25				

Dimensions													
Model	d ₁	d ₂	D ₃	L	Standard strokes	L ₂	L ₃	L ₄	B	C	E	p	
M601-F20	M27 x 2	35	55	65 + Stroke	100, 200, 300, 500	100	16	25	15	116	20	20	
M601-F30	M42 x 2	50	75	82 + Stroke	200, 400, 600, 1000	130	17	30	20	138	25	25	
M601-F40	M60 x 2	70	90	115 + Stroke	250, 500, 750, 1000	150	48	35	30	160	35	35	
M601-F50	M80 x 2	90	150	220 + Stroke	300, 600, 1000, 1500	300	75	40	40	260	45	45	

ELECTROMECHANICAL LINEAR ACTUATORS

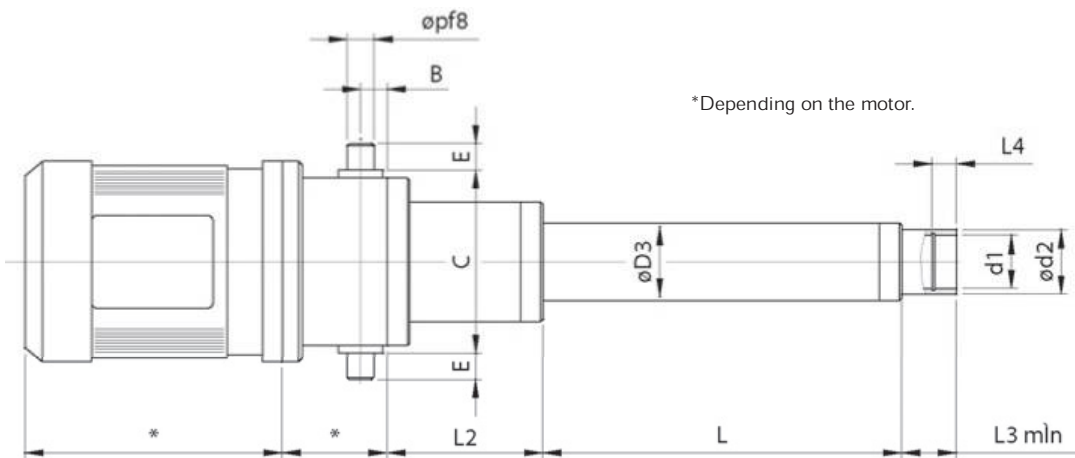
SPECIFIC MODELS

M605 ACTUATOR FOR MOTOR DRIVE AND IN-LINE ARRANGEMENT

The M605 actuator has been designed to work at high travel speed with low-medium loads.

Components of the actuator

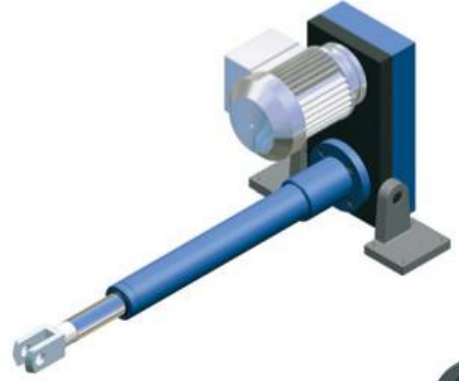
- Actuator: Basic model.
- Fixing: Trunnion mount.
- Drive: A.C. motor.
- Brake motor (optional).



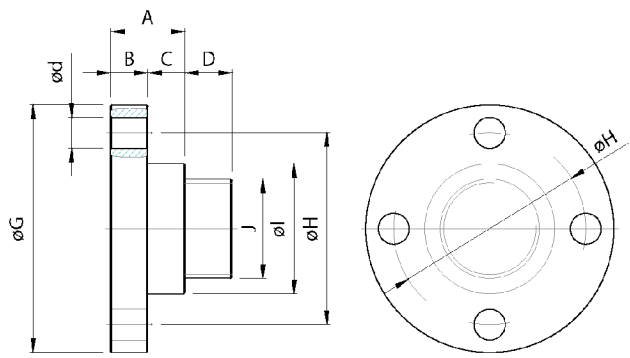
Technical features				Technical features				Technical features				Technical features			
Model	Screw-pitch	ø	Load kN	Model	Screw-pitch	ø	Load kN	Model	Screw-pitch	ø	Load kN	Model	Screw-pitch	ø	Load kN
M605-F16	KGT 5	16	2,5	M605-F30	KGT 5	32	10	M605-F40	KGT 10	40	25	M605-F50	KGT 10	50	65
	Tr 4	16	2,5		KGT 10	32	15		KGT 20	40	25		KGT 20	50	70
M605-F20	KGT 5	20	5		Tr 6	36	10		Tr 7	44	25		Tr 9	60	70
	KGT 20	20	5												
	Tr 5	24	5												

Dimensions													
Model	d ₁	d ₂	D ₃	L	Standard strokes	L ₂	L ₃	L ₄	B	C	E	p	
M605-F16	M26 x 1,5	32	40	45 + Stroke	100, 200, 300, 400	61	21	20	12	82	18	12	
M605-F20	M27 x 2	35	55	65 + Stroke	100, 200, 300, 500	100	16	25	15	116	20	20	
M605-F30	M42 x 2	50	75	82 + Stroke	200, 400, 600, 1000	130	17	30	20	138	25	25	
M605-F40	M60 x 2	70	90	115 + Stroke	250, 500, 750, 1000	150	48	35	30	160	35	35	
M605-F50	M80 x 2	90	150	220 + Stroke	300, 600, 1000, 1500	300	75	40	40	260	45	45	

ACCESSORIES



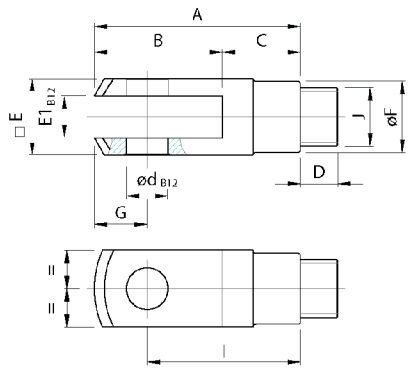
BP TOP PLATES



Dimensions in mm.

Size	A	B	C	D	d	G	H	I	J
BP-16	21	8	13	18	11	80	60	38,7	M26 x 1,5
BP-20	23	10	13	23	11	90	67	46	M27 x 2
BP-30	30	15	15	27	13	110	85	60	M42 x 2
BP-40	50	20	30	33	17	150	117	85	M60 x 2
BP-50	60	30	30	38	25	200	155	105	M80 x 2

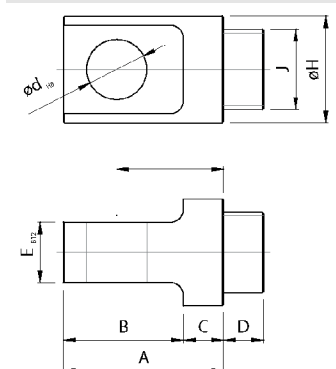
GKB CLEVIS ROD



Dimensions in mm.

Size	A	B	C	D	E	E ₁	F	d	G	I	J
GKB-16	83	51	32	18	32	16	30	16	19	64	M26x1,5
GKB-20	105	65	40	23	40	20	37	20	25	80	M27x2
GKB-30	148	92	56	27	55	30	51	30	38	110	M42x2

GK CLEVIS ROD



Dimensions in mm.

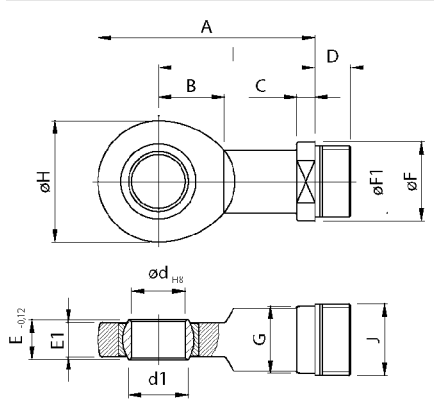
Size	A	B	C	D	E	H	d	I	J
GK-40	120	90	30	33	60	80	45	80	M60 x 2
GK-50	150	110	40	38	70	100	60	100	M80 x 2

ELECTROMECHANICAL LINEAR ACTUATORS

ACCESSORIES

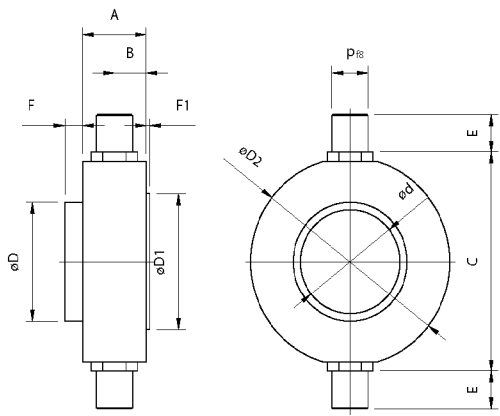


GIR BALL JOINTS



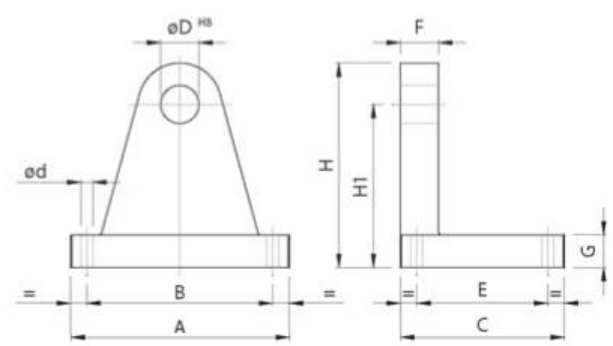
Size	A	B	C	D	E	E ₁	F	F ₁	G	H	d	d ₁	I	J
GIR-16	81	20	8	18	12	10	26	21	22	40	15	18,4	61	M26 x 1,5
GIR-20	103,5	27	10	23	16	13	35	27,5	32	53	20	24,1	77	M27 x 2
GIR-30	146,5	37	15	27	22	19	50	40	41	73	30	34,2	110	M42 x 2
GIR-40	196	52	20	33	32	27	70	58	60	102	45	50,7	145	M60 x 2
GIR-50	242,5	75	20	38	44	38	88	70	75	135	60	66,8	175	M80 x 2

BB TRUNNION MOUNT



Size	A	B	C	d	D	D ₁	D ₂	E	F	F ₁	p
BB-16	30	15	82	40	48	48	75	18	10	2	12
BB-20	35	17,5	116	55	63	72	110	20	10	2	20
BB-30	40	20	138	75	85	90	130	25	12	3	25
BB-40	50	25	160	90	102	110	150	35	14	4	35
BB-50	60	30	260	150	170	200	250	45	20	5	45

SB TIP SUPPORT



Size	A	B	C	D	E	F	G	H	H ₁	d
SB-16	80	60	65	12	45	18	12	80	65	7
SB-20	100	80	80	20	60	20	15	107	85	9
SB-30	130	110	100	25	80	25	20	137	110	9
SB-40	200	170	150	35	120	35	30	188	150	11
SB-50	240	210	180	45	150	45	35	222	175	13



MULI®, JUMBO®

Lifting >> Tilting >> Lowering >> Feeding

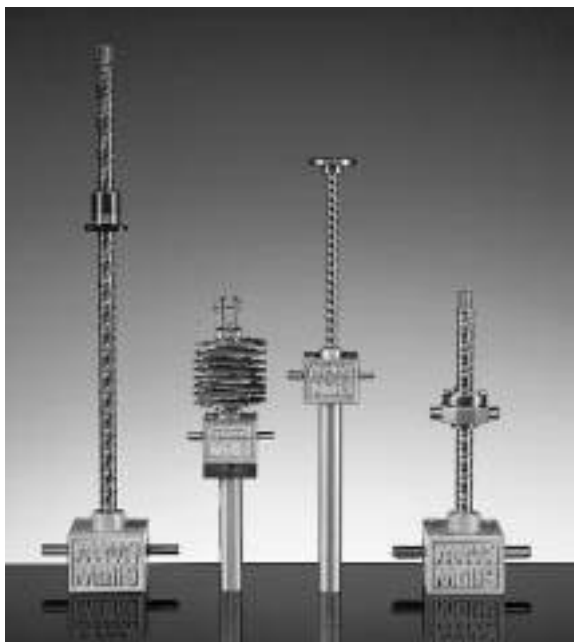


Precision Technology USA **Screw Jacks**

Superior performance. Superior design.

PRECISIONTM
 TECHNOLOGY

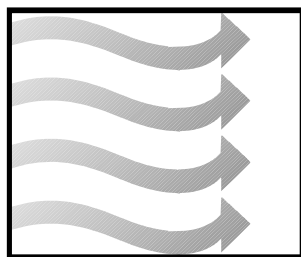
Redefining the performance limits with a new class of screw jacks



The range of Precision Technology USA, Inc. worm gear screw jacks is comprised of ten models with lifting capacities from 5 kN to 500 kN (5.6 to 56 tons). All versions are designed for both tensile and compressive loads and will operate in any orientation or mounting position.

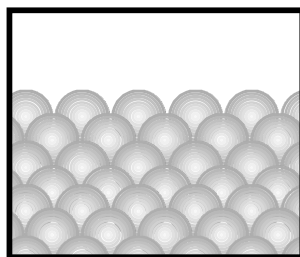
They meet the most demanding technical standards:

- Wide range of load capacities
- High and low speeds
- Cubic shape of the housing with predrilled flange bores allows ideal attachment of a motor, gearbox or rotary encoder
- Standard mounting parts and end fittings
- Easy synchronization of several worm gear screw jack units
- Ball screw or trapezoidal screw, as required for the application concerned
- Extensive variations can accommodate special requirements (e.g. safety nut)
- Complete range of accessories



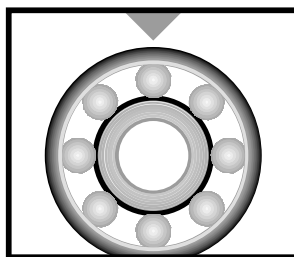
The design

The cubic shape with integrated cooling fins permits a longer duty cycle, as the heat is dissipated more effectively, thus extending the service life of the lubricant. The surface coating also protects the jack against corrosion.



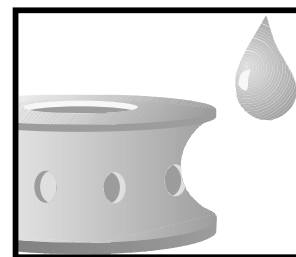
The housing material

The mechanical strength of the housing has been improved, particularly at high temperature, through the use of spheroidal graphite iron instead of the former cast iron. This ensures greater reliability, even in tough service conditions.



The bearings

Taper roller bearings on the worm shaft and heavy-duty ball bearings as the main thrust bearings make it possible to move higher loads, increase the safety reserve and extend the service life.



The lubrication

The trapezoidal screw (version N) is greased by radial lubrication holes on the worm wheel. This lowers friction and temperature and extends the service life, particularly when operating with longer stroke lengths.

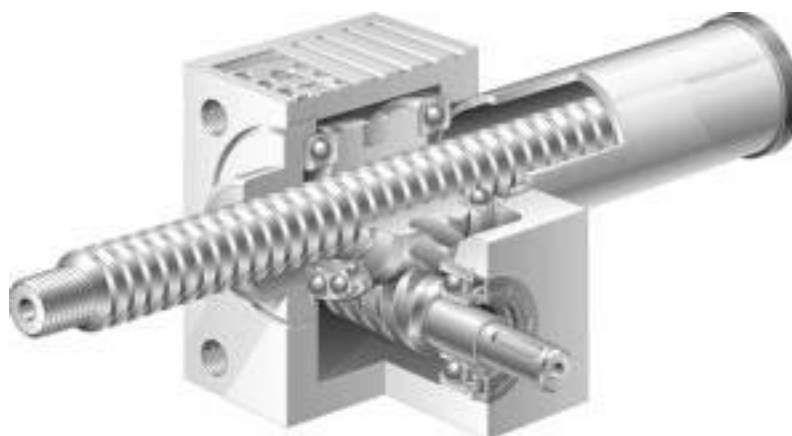
Cubic face screw jacks

Design versions

**MULI® 1
to
MULI® 5
5 to 100 kN
(0.56 to
11.2 tons)**

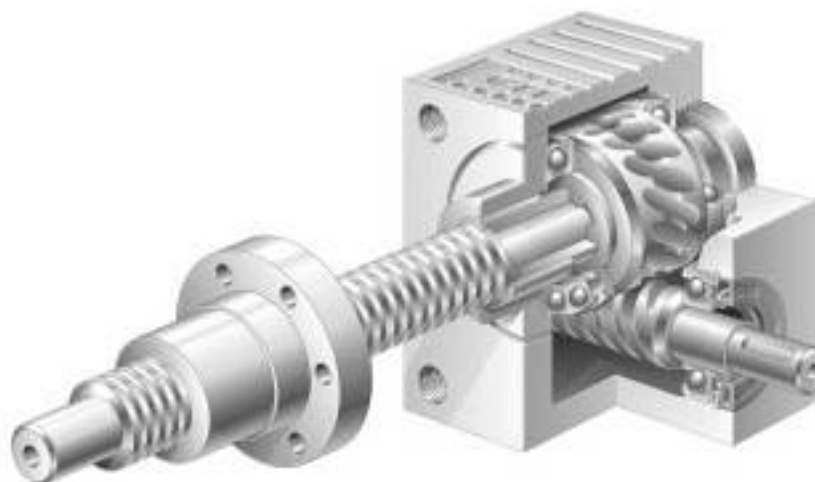
Axially translating screw—version N or V

The rotary motion of precision worm gearing (worm shaft and internally threaded worm wheel) is converted into axial linear motion of the screw, which travels/ translates through the gearbox housing. The load is attached to the end of the screw.

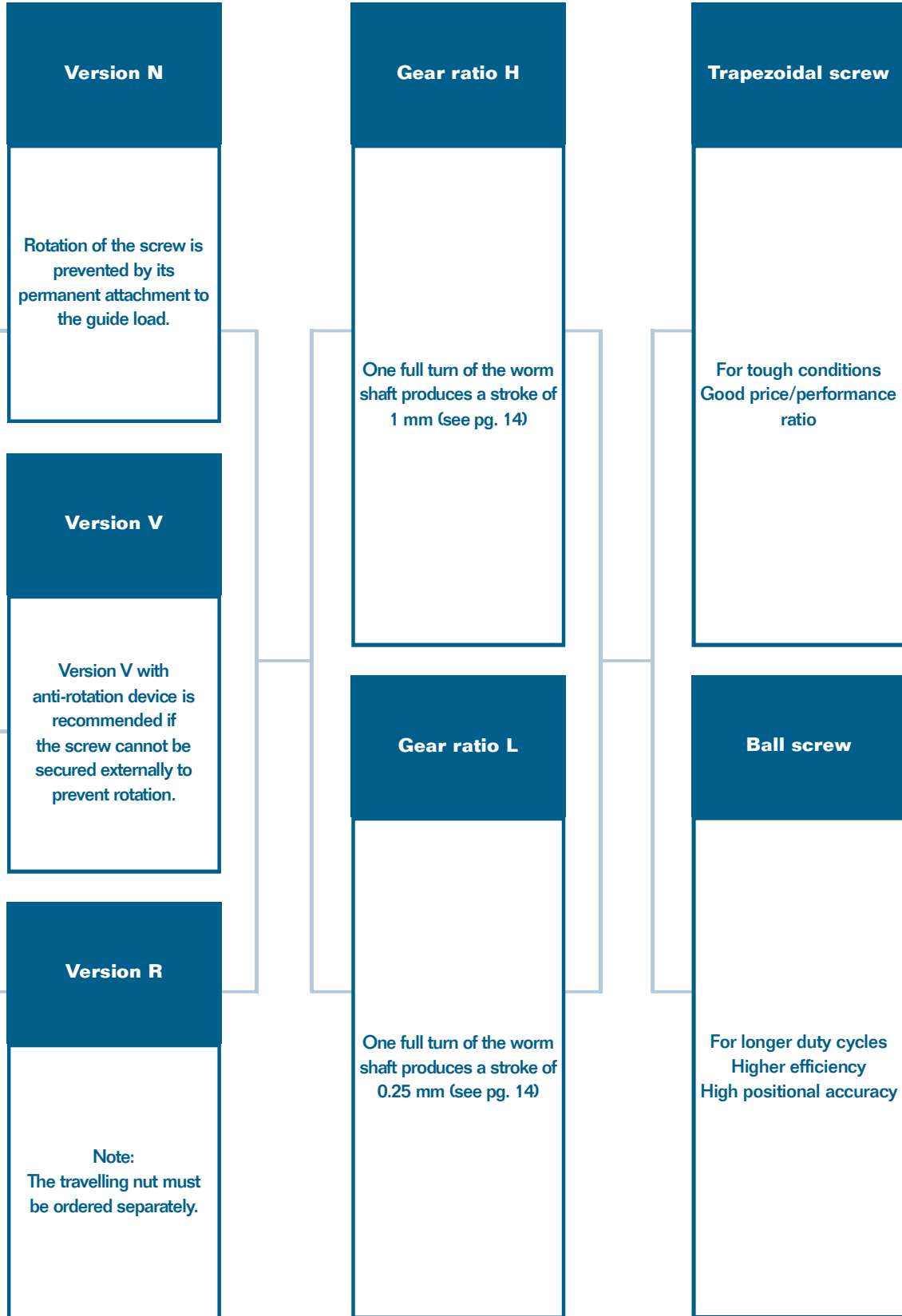


Rotating screw—version R

Driven by a precision worm gearing (screw keyed to the worm wheel), the rotary motion of the screw is translated into linear motion of the traveling nut on the screw.



**JUMBO® 1
to
JUMBO® 5
150 to 500 kN
(16.8 to
56 tons)**



Technical data

Cubic face screw jacks

The range includes a total of ten worm gear screw jack models in two series: MULI® 1 to MULI® 5 with lifting capacities up to 100 kN (11 tons) and JUMBO® 1 to JUMBO® 5 with lifting capacities from 150 kN (16 tons) to 500 kN (56 tons) statically.

Speed of travel

Gear ratio H (high speed)

For worm gear screw jacks fitted with standard trapezoidal screws, one full turn of the worm shaft produces a stroke of 1 mm and a linear speed of 1500 mm/minute at 1500 rpm. The figures for units fitted with ball screws range from 1071 mm/minute to 2142 mm/minute depending on size and pitch.

Gear ratio L (low speed)

For worm gear screw jacks fitted with standard trapezoidal screws, one full turn of the worm shaft produces a stroke of 0.25 mm and a linear speed of 375 mm/minute at 1500 rpm. The figures for units fitted with ball screws range from 312 mm/minute to 535 mm/minute depending on size and pitch.

Please note that higher speeds of travel can be achieved with larger screw pitches or multiple start screws.

Tolerances and backlash

- The gearbox housings are machined on the four mounting sides. The tolerances conform to DIN ISO 2768-mH. The sides that are not machined (the cooling ribs) conform to DIN 1685, GTB 18.
- The axial backlash of the jack screw under alternating load is as follows:
 - Trapezoidal screws: up to 0.4 mm
 - Ball screws: 0.08 mm
- The lateral play between the outside diameter of the screw and the guide diameter is 0.2 mm.
- The backlash in the worm gears is $\pm 4^\circ$ of the input shaft. A predetermined axial float is built into the input shaft bearing assembly of all models from MULI® 4 upwards to accommodate thermal expansion during operation.
- Trapezoidal screws are manufactured to a straightness of 0.3-1.5 mm/meter, ball screws to a straightness of 0.08 mm/meter over a length of 1000 mm and to the following pitch accuracies:
 - MULI® 1–MULI® 5: 0.05 mm/300 mm length
 - JUMBO® 1–JUMBO® 5: 0.2 mm/300 mm length

Lateral forces on the jack screw

Any lateral forces that may occur should be taken by an external guide rail.

Stop collar A

Prevents the screw from being removed from the jack gearbox. Fitted as standard on ball screw versions N and V. Optionally available for screw jacks with trapezoidal screws. The stop collar cannot be used as a fixed stop.

Self-locking

The self-locking function depends on a variety of parameters:

- Large pitches
- Different gear ratios
- Lubrication
- Friction parameters
- Ambient influences, such as high or low temperatures, vibrations, etc.
- The mounting position

Versions with ball screw and large pitches are consequently not self-locking. Suitable brakes or braking motors must therefore be considered in such cases. Limited self-locking is available for smaller pitches (single-start).

Special versions

In addition to the extensive standard range, Precision Technology USA, Inc. can also supply anti-clockwise, multi-start and special material worm gear screw jacks on request.

Technical data

Trapezoidal screws and ball screws

Trapezoidal screws

	MULI 1	MULI 2	MULI 3	MULI 4	MULI 5	JUMBO 1	JUMBO 2	JUMBO 3	JUMBO 4	JUMBO 5
Maximum lifting capacity [kN] ²⁾	5	10	25	50	100	150	200	250	350	500
Maximum lifting capacity [tons]	0.6	1.1	2.8	5.6	11.2	16.8	22.4	28.0	39.2	56.0
Screw diameter and pitch [mm]	18 x 4	20 x 4	30 x 6	40 x 7	55 x 9	60 x 9	70 x 10	80 x 10	100 x 10	120 x 14
Stroke in mm per full turn of the worm shaft	Ratio H ¹⁾	1	1	1	1	1	1	1	1	1
	Ratio L ¹⁾	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Gear ratio	Ratio H ¹⁾	4:1	4:1	6:1	7:1	9:1	9:1	10:1	10:1	14:1
	Ratio L ¹⁾	16:1	16:1	24:1	28:1	36:1	36:1	40:1	40:1	56:1
Efficiency [%] ³⁾	Ratio H ¹⁾	31	29	29	26	24	23	22	20	19
	Ratio L ¹⁾	25	23	23	21	19	18	17	15	15
Weight [kg] (zero stroke)		1.2	2.1	6.0	17.0	32.0	41.0	57.0	57.0	160.0
Weight [kg per 100 mm stroke]		0.26	0.42	1.14	1.67	3.04	3.1	4.45	6.13	11.5
Idling torque [Nm]	H	0.04	0.11	0.15	0.35	0.84	0.88	1.28	1.32	1.98
	L	0.03	0.10	0.12	0.25	0.51	0.57	0.92	0.97	1.42

Ball screws

	MULI 1	MULI 2	MULI 3	MULI 4	MULI 5	JUMBO 3	
Maximum lifting capacity [kN] ²⁾	5	10	12.5	22	42	65	
Maximum lifting capacity [tons]	0.6	1.1	1.4	2.5	4.7	7.3	
Screw diameter and pitch [mm]	1605	2005	2505	4005	4010	5010	
Stroke in mm per full turn of the worm shaft	Ratio H ¹⁾	1.25	1.25	0.83	0.71	1.43	1.1
	Ratio L ¹⁾	0.31	0.31	0.21	0.18	0.36	0.28
Gear ratio	Ratio H ¹⁾	4:1	4:1	6:1	7:1	9:1	10:1
	Ratio L ¹⁾	16:1	16:1	24:1	28:1	36:1	40:1
Efficiency [%] ³⁾	Ratio H ¹⁾	57	56	55	53	56	47
	Ratio L ¹⁾	46	44	43	43	45	37
Weight [kg] (zero stroke)		1.3	2.3	7.0	19.0	35.0	63.0
Weight [kg per 100 mm stroke]		0.26	0.42	1.14	1.67	3.04	6.13
Idling torque [Nm]	H	0.04	0.11	0.15	0.35	0.84	1.32
	L	0.03	0.10	0.12	0.25	0.51	0.97

1) H = High speed, L = Low speed

2) Depending on speed of travel, operating hours, etc.

3) The specified efficiencies are average values

Unit conversions

Length:	1 m=1000 mm=39.37 inches 1 inch=25.4 mm	Geometrical moment of inertia:	1 m ⁴ =10 ¹² mm ⁴ =2.4025 x 10 ⁶ in ⁴
Force:	1 N=0.225 lbf 1 lbf=4.45 N	Mass moment of inertia:	1 kg · m ² =10 ⁴ kg · cm ² =0.738 lb · ft · s ²
Moment of Force:	1 Nm=0.738 lb · ft=8.85 lb · inches 1 lb · ft=1.36 Nm	Mass:	1 kg=2.2 lb

Technical data

Assembly and maintenance

Assembly of worm gear screw jack systems

Direction of rotation: Before starting assembly work, the direction of rotation of all worm gear screw jacks, bevel gearboxes and the drive motor must be checked with regard to the feed direction of each individual worm gear screw jack.

Alignment errors: All components must be carefully aligned during assembly. Alignment errors and stresses increase power consumption and lead to overheating and premature wear. Before a drive unit is attached, each worm gear screw jack should be turned through its entire length by hand without load. Variations in the amount of force required and/or axial marks on the outside diameter of the screw indicate alignment errors between the worm gear screw jack and its additional guides. In this case, the relevant mounting bolts must be loosened and the worm gear screw jack turned through by hand again. If the amount of force required is now constant throughout, the appropriate components are aligned.

If not, the alignment error must be localized by loosening additional mounting bolts.

Test run: The direction of rotation of the complete system and correct operation of the limit switches must be checked again before attaching the drive motor. In the case of version N (translating screw jack), check that the screw is lubricated with grease from the interior of the gearbox and lubricate if necessary. In the case of version R (rotating screw jack), the jack screw should be coated with suitable grease to

provide lubrication for lifting operation. The first test runs can then be carried out without load. A maximum operating time of 30% must not be exceeded at trial runs under weight for worm gear screw jacks with trapezoidal screws.

Operation: The loads, speeds and operating conditions specified for the worm gear screw jacks and transmission components must not be exceeded even briefly. Failure to observe this condition will invalidate all claims under guarantee.

Maintenance of worm gear screw jacks

Safety: All mounting bolts must be tightened after a short period of operation. The wear of the screw nut (worm gear) must be checked by measuring the thread backlash after approximately 200 hours of operation or sooner if operating conditions are harsh. The screw nut (worm gear) must be replaced if the axial backlash with a single-start thread is more than one-quarter of the thread pitch.

Lubrication: The worm gear screw jacks are lubricated by the manufacturer and are ready for operation on delivery. The versions N and V must be lubricated via their grease nipples with one of the greases specified below at intervals of 30 - 50 operating hours. The screw should be cleaned and greased at the same time. The service life of screw and screw nut can be extended by applying screw spray, particularly before being greased for the first time. We recommend that the gearbox be cleaned to remove old grease and refilled with fresh grease after approximately 700 operating hours

or 18 months. The worm gear screw jacks can be dismantled relatively easily:

- Unscrew the two threaded pins securing the bearing cover.
- Unscrew the screw and remove the screw protection if necessary.
- Unscrew the bearing cover with the aid of an open-ended spanner.

Proceed as follows to refit the bearing cover: fit the bearing cover firmly (using approximately ten times the force shown in the table "Guideline values for fitting bearing cover"). Then release it and refit it with the guideline value from the table, checking the axial backlash and smoothness.

Standard grease:
Lithogrease G 421

Recommended or equivalent greases:
Castrol Spheerol BM2
Mobil Mobilgrease XHP
Shell retinax HD2

Guideline values for fitting bearing cover

Size	Torque [Nm]
MULI® 1	5
MULI® 2	9
MULI® 3	13
MULI® 4	32
MULI® 5	60
JUMBO® 1	70
JUMBO® 2	150
JUMBO® 3	150
JUMBO® 4	220
JUMBO® 5	300

Application design considerations

Examples: direction of rotation

Fig. 1

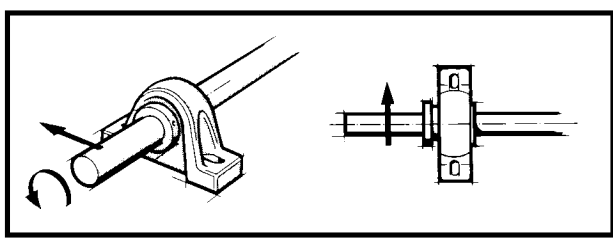


Fig. 1:
Illustration of direction of rotation

Fig. 2

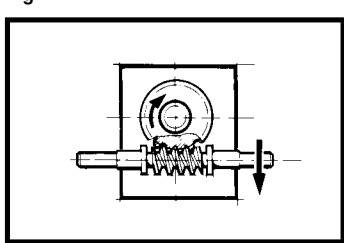


Fig. 2:
Direction of rotation of a worm gear screw jack for lifting motion, top view.

Fig. 3

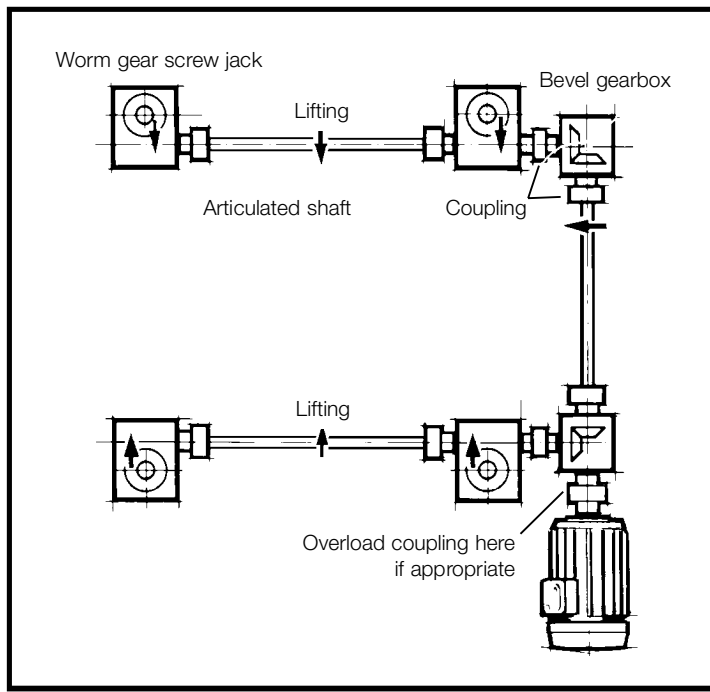


Fig. 3:
Jack system with four worm gear screw jacks and two bevel gearboxes

Fig. 4 (left)
Fig. 5 (right)

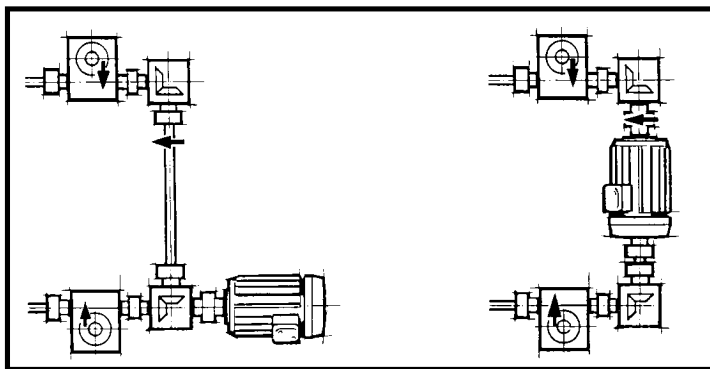


Fig. 4:
Jack system, variant 1:
Different position of drive motor, but only ratio 1:1 possible. Overload coupling also possible.

Fig. 5:
Jack system, variant 2:
Very economical, but overload coupling not possible.

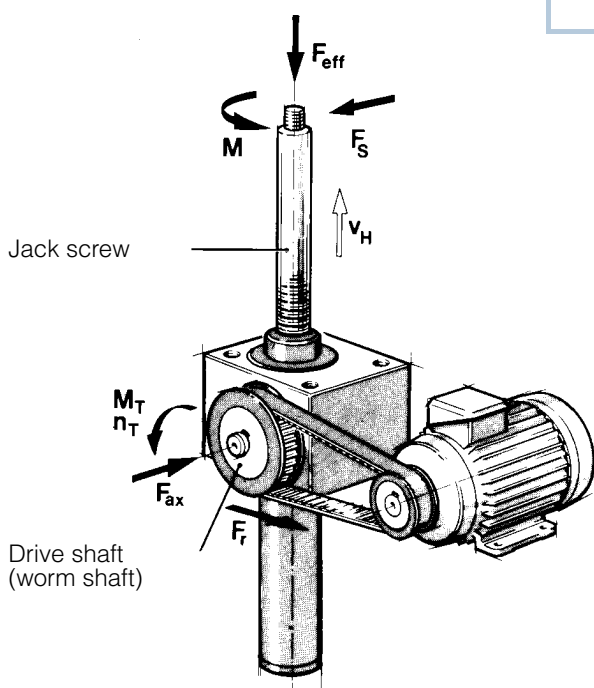
Selection and calculation

Selection of a worm gear screw jack and corresponding drive unit

After selecting the drive unit, it is important to check whether the worm gear screw jack or any transmission components may be overloaded by the drive unit (see page 25).

The following points should also be established:

1. On which side is the motor to be mounted
2. Direction of rotation of the jack systems



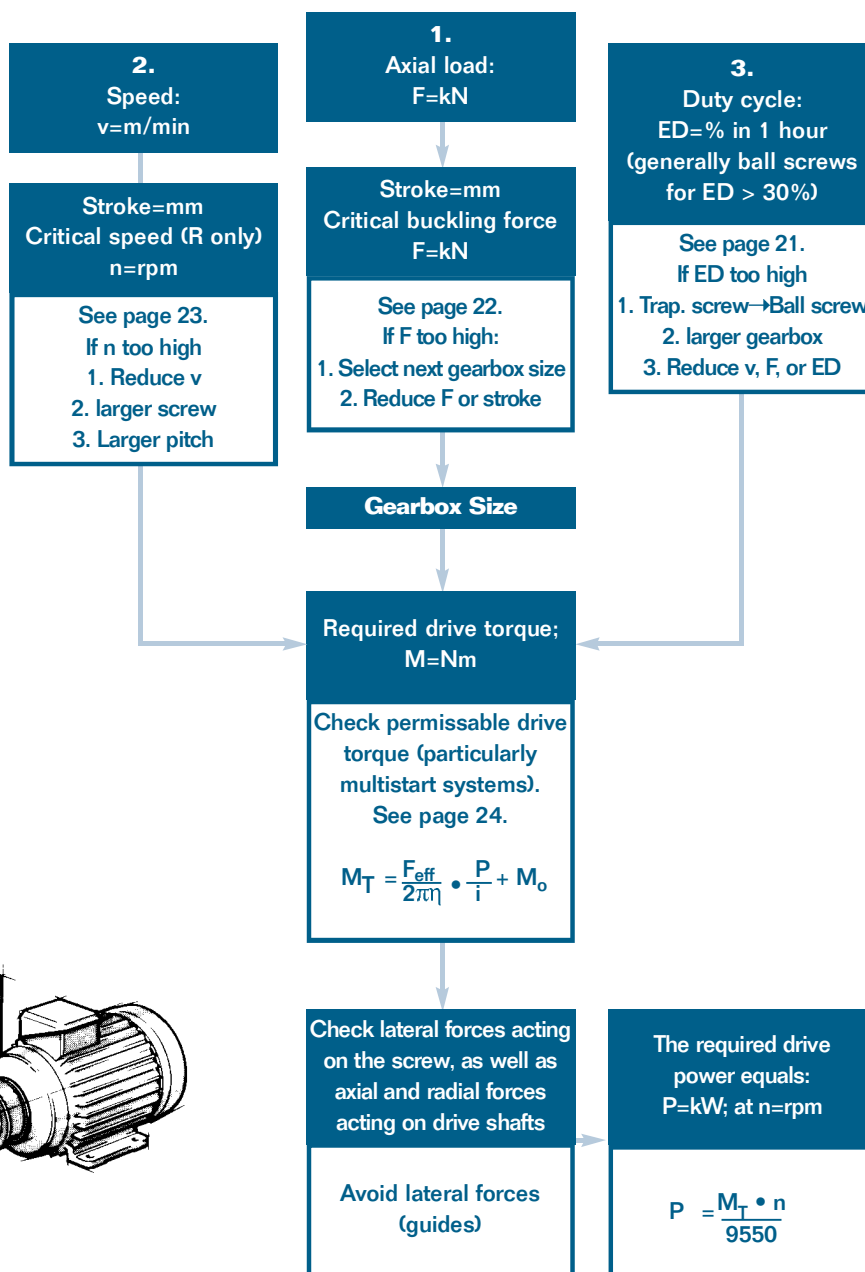
Forces and torque values acting on the worm gear screw jack (See figure above)

Note: Forces and torque values can only be estimated by making simplified assumptions. The coefficients of friction of sliding pairs, the heat which these generate and the resultant service life depend on load, speed, temperature and lubrication conditions. Critical speeds

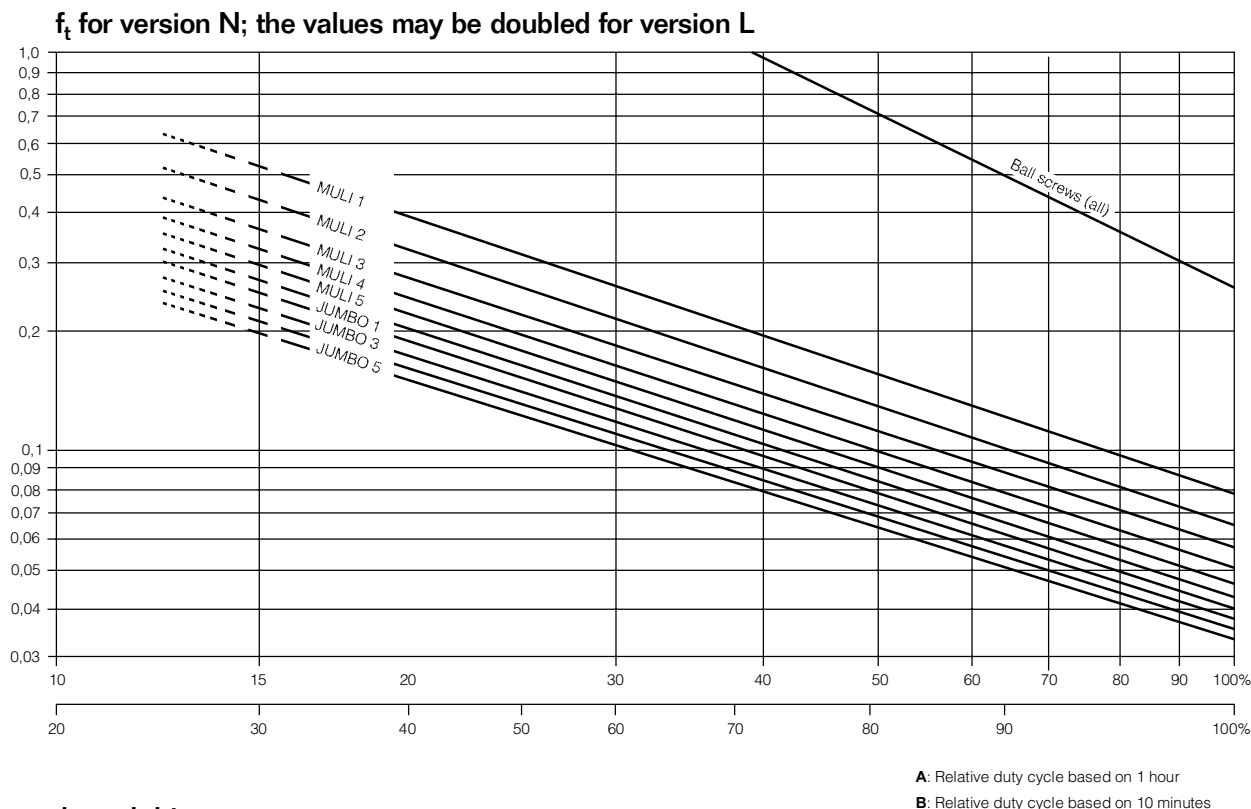
and buckling lengths depend on the rigidity and mass of the clamping systems, machine frames, etc. The results of calculations should therefore be examined critically with regard to the assumptions made. Please contact us if in doubt.

- F_{eff} = Axial force acting on the jack screw
- F_S = Result of all lateral forces acting on the jack screw

- M = Torque of the jack screw or nut (not applicable in the case of version V)
- v_H = Lifting speed
- F_{ax} = Axial force acting on drive shaft
- F_r = Radial force acting on drive shaft
- M_T = Drive torque
- n_T = Drive speed



Selection and calculation



Duty cycle and drive power

In order to limit the heat generated by friction within a worm gear screw jack, the lifting force and lifting speed are limited as a function of the relative duty cycle. The maximum permissible lifting force and lifting speed can be estimated with the aid of the following method.

$$F_{\text{eff}} \cdot V_H \leq F_{\text{stroke max}} \cdot V_{H \text{ max}} \cdot f_t$$

F_{eff} Actual axial force acting on the jack screw in kN.

V_H Lifting speed in mm/min.

$F_{\text{stroke max}}$ Maximum permissible lifting force in kN (see table on page 14).

$V_{H \text{ max}}$ Maximum permissible lifting speed in mm/min. It is calculated from the maximum permissible speed of the worm shaft of 1500 rpm (higher speeds on request) and the transmission ratio of the worm gear screw jack.

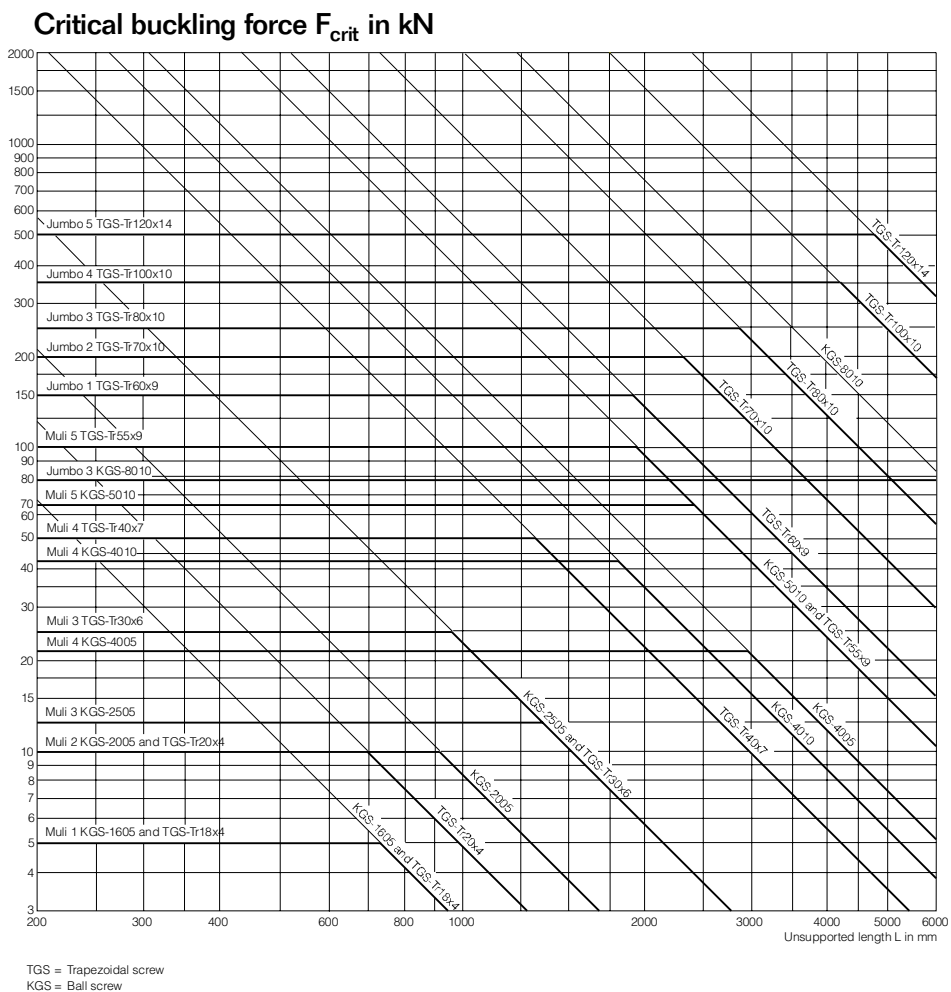
f_t Temperature factor which is dependent on the relative duty factor based on a period of 10 or 60 minutes at 20 °C.

The values determined here do not apply for very short reciprocating strokes. Please consult us in such cases. f_t can be extrapolated to the left-hand edge of the graph in the case of very low relative duty cycles (less than 10 minutes – for occasional positioning operations, adjustments of levels, etc.). This yields the following approximate drive power values in kW with allowance for the efficiency in each case.

	MULI 1	MULI 2	MULI 3	MULI 4	MULI 5	JUMBO 1	JUMBO 2	JUMBO 3	JUMBO 4	JUMBO 5
Ratio H (Trapezoidal)	0.3	0.55	1.18	2.3	4.7	6.5	8.4	10.9	14.7	19
Ratio L (Trapezoidal)	0.19	0.35	0.75	1.4	3	4.2	5.4	7.3	9.3	12
Ball screws	0.3	0.56	0.95	1.7/3.2	5.9	-	-	13.9	-	-

These values are not a criterion for selecting the drive motor; it should be selected on the basis of torque, speed and operating conditions.

Selection and calculation



Critical buckling force of a screw jack under compressive loads

Thin lifting screws may buckle sideways when subjected to compressive loads. Before the permissible compressive force is defined for the screw, allowances must be made for safety factors as appropriate to the installation.

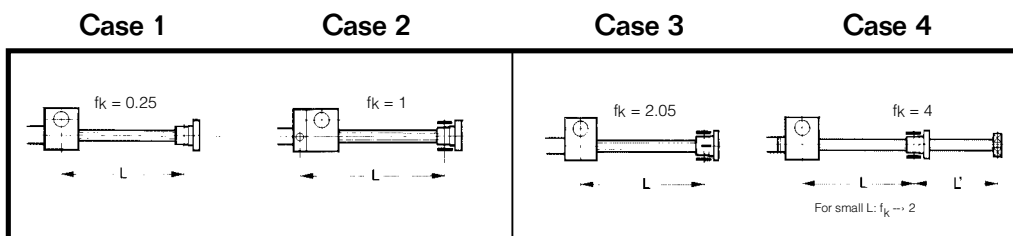
$$F_{eff} \leq f_k \cdot F_{crit} \cdot 1/S_k$$

F_{eff} Actual axial force (compressive force) acting on the jack screw in kN.

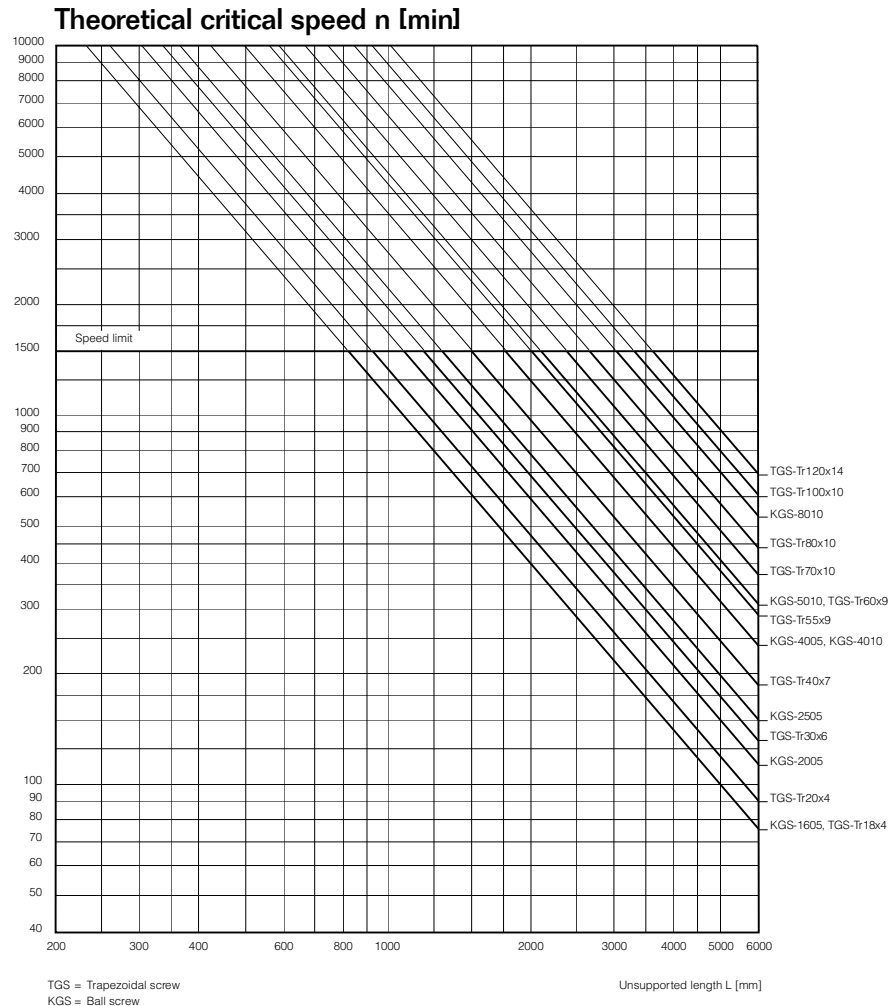
f_k Correction factor which makes allowance for the type of screw bearing. Sufficiently rigid mounting of the worm gear screw jack is required for cases 2, 3 and 4.

F_{crit} Critical buckling force as a function of the unsupported length L .

S_k Safety factor that depends on the application in question. Values between 3 and 6 are customary in general mechanical engineering.



Selection and calculation



Cubic Screw Jacks

Critical speed of jack screws (version R only)

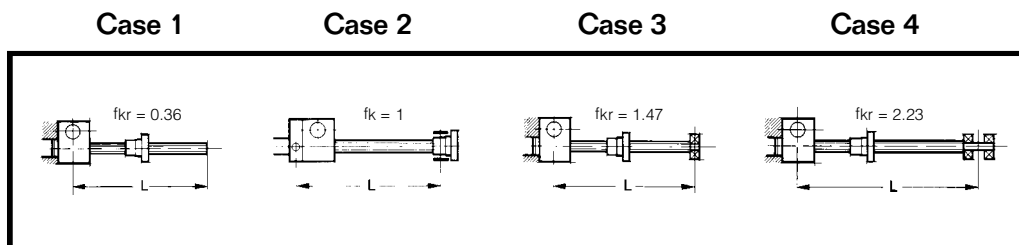
Resonant bending vibration may develop with thin screws rotating at high speed. Assuming a sufficiently rigid assembly, the resonant frequency can be estimated with the aid of the following method.

$$n_{perm} = f_{kr} \cdot n_{crit} \cdot 0.8$$

n_{perm} Maximum permissible screw speed in rpm.

f_{kr} Correction factor which makes allowance for the type of screw bearing. Sufficiently rigid mounting of the worm gear screw jack and bearing is required for cases 2, 3 and 4.

n_{crit} Critical screw speed. Corresponds to the basic bending vibration of the screw and leads to resonance effects.



Worm gear screw jacks with multi-start screws are also available for applications with high lifting speeds. These versions run at a considerably lower screw speed with better efficiency for the same lifting speed. They are generally not self-locking.

Selection and calculation

Required drive torque for a worm gear screw jack

The required drive torque for a worm gear screw jack is governed by the axial load acting on the jack screw, the transmission ratio and the efficiency. It should be noted that the breakaway torque may be considerably higher than the torque required for continuous running. This applies in particular to worm gear screw jacks with low efficiency after a long standstill period. The acceleration torque should be checked if necessary in cases with large screw pitches and very short run-up times.

$$M_T = \frac{F_{eff}}{2 \cdot \pi \cdot \eta} \cdot \frac{P}{i} + M_o$$

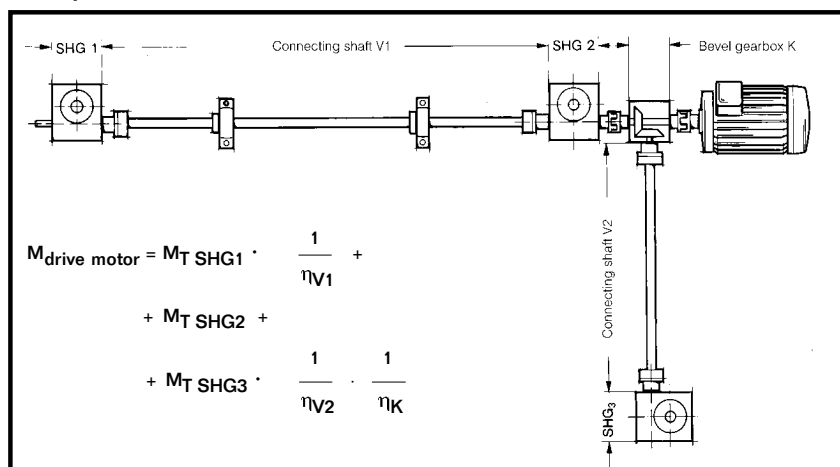
M_T	Required drive torque of the worm gear screw drive at the worm shaft in Nm.	η	Efficiency of the worm gear screw jack in decimal notation. e.g. 0.32 instead of 32% (for values, see table on page 11). η is an average value determined by measurement.	grease lubrication at room temperature. It represents an average value which may vary to a greater or lesser extent, depending on the running-in state, lubricant and temperature. For values, see table on page 14.
F_{eff}	Actual force acting on the jack screw in kN.			
$\frac{P}{i}$	Transmission ratio of the worm gear screw drive in mm stroke length per revolution of the worm shaft.	M_o	Idle torque of the worm gear screw drive in Nm. M _o is determined by measurements undertaken after a brief running-in period with liquid	

Required drive torque for a worm gear screw jack system

The required drive torque for a worm gear screw jack system is governed by the drive torque values for the individual jacks, with allowance for the static and dynamic frictional losses in transmission components (coupling, connecting shafts, pedestal bearings, angle gearboxes, etc.). It is useful to draw a diagram illustrating the flow of forces.

M_{T SHG1}	The required drive torque for the worm gear screw jack SHG 1. It should be noted that the start-up torque (breakaway torque and possibly acceleration torque) may be considerably higher than the torque required for continuous running. This applies in particular to worm gear screw jacks with low efficiency after a long standstill period.	η_{v1}	The efficiency of connecting shaft V1.	η_K	The efficiency of the bevel gearbox (only for the force flow via the toothing, i.e. between connecting shaft V2 and the drive motor). η _K = 0.90
		η_{v2}	(V2) includes the static and dynamic frictional losses in the pedestal bearings and couplings.		
		η_v	0.75...0.95 depending on the length of the shaft and number of pedestal bearings.		

Example



Selection and calculation

Maximum drive torque

If the worm gear screw jack jams as a result of the screw coming into contact with an obstacle, the teeth can still absorb the following maximum torque values M_T at the drive shaft.

In the case of screw jacks connected in series, the screw jack closest to the drive can absorb this torque at its drive shaft.

Size	M_T max [Nm]
MULI® 1	3.4
MULI® 2	7.1
MULI® 3	18
MULI® 4	38
MULI® 5	93
JUMBO® 1	148
JUMBO® 2	178
JUMBO® 3	240
JUMBO® 4	340
JUMBO® 5	570

Forces and torque values acting on the drive shaft

If worm gear screw jacks are not driven free of lateral forces by means of a coupling connected to the motor shaft, but are instead driven by chains or belts, care must be taken to ensure that the radial force acting on the drive shaft does not become excessive. The values are specified in the following table.

In the worst case, the worm shaft will bend under radial force F_R and lift off the worm gear. This must be avoided, since it impairs the engagement between worm shaft and worm gear and leads to higher wear.

Size	F_R max [kN]
MULI® 1	0.1
MULI® 2	0.2
MULI® 3	0.3
MULI® 4	0.5
MULI® 5	0.8
JUMBO® 1	0.8
JUMBO® 2	1.3
JUMBO® 3	1.3
JUMBO® 4	2.1
JUMBO® 5	3.1

Selection of drive motor

A suitable drive motor can be selected when the required drive torque and drive speed are known. After selecting a drive motor, check that it will not overload any of the worm gear screw jacks or transmission components. This risk may occur, in particular, in installations with several screw jacks if they are loaded unevenly. It will generally be necessary to install limit switches or torque-limiting couplings to protect the installation against impacting against end positions and obstacles.

Forces and torque values on the motor shaft

Toothed-belt or chain drives may exert considerable radial forces on the motor shaft if a very small sprocket is used. Please consult the motor manufacturer in cases of doubt.

Selection of a bevel gearbox

Selection of a bevel gearbox is governed by the following factors:

- Drive torque
- Drive speed (see dimensional tables)
- Duty cycle and drive power
- Forces and torque values acting on the ends of the shaft (please consult us in cases of doubt)

Required drive speed

The required drive speed is governed by the desired lifting speed, the transmission ratio of the jack and the transmission ratio of the other transmission components. A particular lifting speed can normally be achieved in several ways. Correct selection depends on the following criteria:

- Favorable efficiency
- Minimum load on transmission components in order to achieve compact, low-cost design
- Avoiding critical speeds for jack screws and connecting shafts

Jack screw nut torques

The nut torque (M) of the jack screw is the torque that the jack screw exerts on the mounting plate (all N versions except V), or the torque that the screw applies to the travelling nut (R version). It is not to be confused with the drive torque (M_T) of the screw jack gears on the worm shaft.

$$M \text{ [Nm]} = F_{\text{eff}} \text{ [kN]} \cdot f_M$$

(applicable in the areas of moderate and high loads)

M The jack screw nut torque in Nm for the "lift under load" movement.

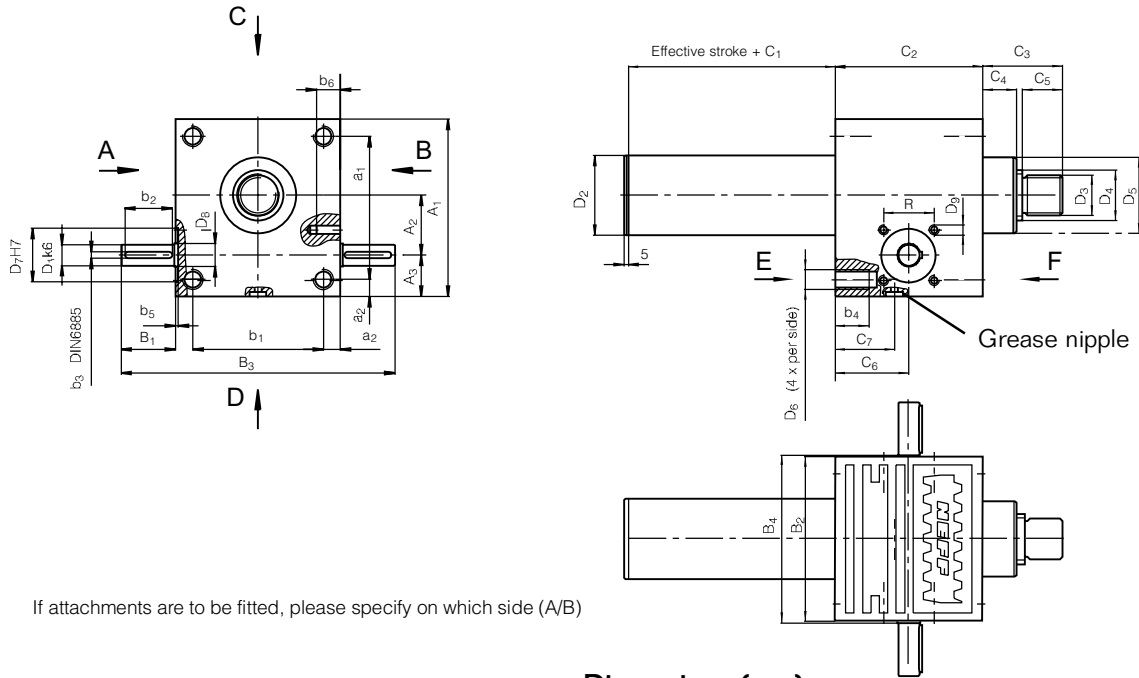
F_{eff} The actual supported axial force in kN.

f_M A conversion factor that accounts for screw geometry and friction. The value is applicable under normal lubrication conditions. The higher value should be applied in the case of dry and static friction. In the case of ball screw drives, f_M is practically constant.

Size	f_M [Nm]	
	Trapezoidal	Ball Screw
MULI® 1	1.6	1.6
MULI® 2	1.8	1.6
MULI® 3	2.7	1.6
MULI® 4	3.4	1.6/3.2
MULI® 5	4.6	3.2
JUMBO® 1	5.5	-
JUMBO® 2	6.4	-
JUMBO® 3	7.2	3.2
JUMBO® 4	8	-
JUMBO® 5	10.6	-

Outline drawing and table of dimensions

Versions N, V



If attachments are to be fitted, please specify on which side (A/B)

Size

Dimensions (mm)

	A1 ⁵⁾ Metric	A2 Metric	A3 Metric	a1 Metric	a2 Metric	B1 Metric	B2 Metric	B3 Metric	B4 Metric	b1 Metric	b2 Metric	b3 Metric	b4 Metric	b5 Metric	C1 Metric	C2 Metric	C3 ¹⁾ Metric
MULI® 1	80	25	24	60	10	24	72	120	77	52	18	3	13	1.5	20	62	35(46)
MULI® 2	100	32	28	78	11	27.5	85	140	90	63	20	5	15	1.5	30	75	45(48.5)
MULI® 3	130	45	31	106	12	45	105	195	110	81	36	5	15	2	30	82	50
MULI® 4	180	63	39	150	15	47.5	145	240	150	115	36	6	16	2	45	117	65
MULI® 5	200	71	46	166	17	67.5	165	300	170	131	56	8	30	2.5	55	160	95
JUMBO® 1	210	71	49	170	20	65	195	325	200	155	56	8	40	8	55	175	95
JUMBO® 2	240	80	60	190	25	67.5	220	355	225	170	56	8	45	8	55	165	110
JUMBO® 3	240	80	60	190	25	67.5	220	355	225	170	56	8	45	8	55	165	110
JUMBO® 4	290	100	65	230	30	65	250	380	255	190	56	10	54	8	65	220	140
JUMBO® 5	360	135	75	290	35	100	300	500	305	230	90	14	80	8	90	266	200

Size

Dimensions (mm)

	C4 ²⁾ Metric	C5 Metric	C6 Metric	C7 Metric	D1k6 ⁴⁾ Metric	D2 ³⁾ Metric	D3 ⁶⁾ Metric	D4Tr Metric	D4KGT Metric	D5 ²⁾ Metric	D6 Metric	D7H7 Metric	D8 Metric	D9Xb6 ⁷⁾ Metric	R(TK) ⁷⁾ Metric	V-KGT Metric
MULI® 1	12(23)	19	31	22	10 X 21.5	33	M12 X 1.75	Tr18 x 4	1605	29.6(48)	M8	28	12	M5 x 10	32(45.25)	30 x 30
MULI® 2	18(21.5)	20	37.5	27	14 X 25	40	M14 X 2.0	Tr20 x 4	2005	38.7(61)	M8	35	15	M6 x 12	35(49.5)	40 x 40
MULI® 3	23	22	41	29	16 X 42.5	50	M20 X 2.5	Tr30 x 6	2505	46	M10	35	17	M8 x 12	44(62.2)	50 x 50
MULI® 4	32	29	58.5	42.5	20 X 45	60	M30 X 3.5	Tr40 x 7	4005/4010	60	M12	52	25	M10 x 15	55(77.8)	60 x 60
MULI® 5	40	48	80	53	25 X 65	82	M36 X 4	Tr55 x 9	5010	85	M20	52	28	M12 x 18	60(84.85)	80 x 80
JUMBO® 1	40	48	87.5	60	25 X 62.5	90	M48 X 2	Tr60 x 9	-	90	M24	52	28	M12 x 18	60(84.85)	-
JUMBO® 2	40	58	82.5	60	30 X 65	115	M56 X 2	Tr70 x 10	-	105	M30	58	32	M12 x 18	(80)	-
JUMBO® 3	40	58	82.5	60	30 X 65	115	M64 X 3	Tr80 x 10	8010	120	M30	58	32	M12 x 18	(80)	120 x 120
JUMBO® 4	50	78	110	86	35 X 62.5	133	M72 X 3	Tr100 x 10	-	145	M36	72	40	M16 x 30	(100)	-
JUMBO® 5	60	118	133	109	48 X 97.5	153	M100 X 3	Tr120 x 14	-	170	M42	80	50	M16 x 40	(115)	-

1) This dimension refers to the closed height and represents a minimum. It must be increased if bellows are used (see page 34).

2) The values in brackets refer to version with ball screw.

3) Square tube for version with ball screw and anti-rotation device.

4) Diameter and length to shoulder.

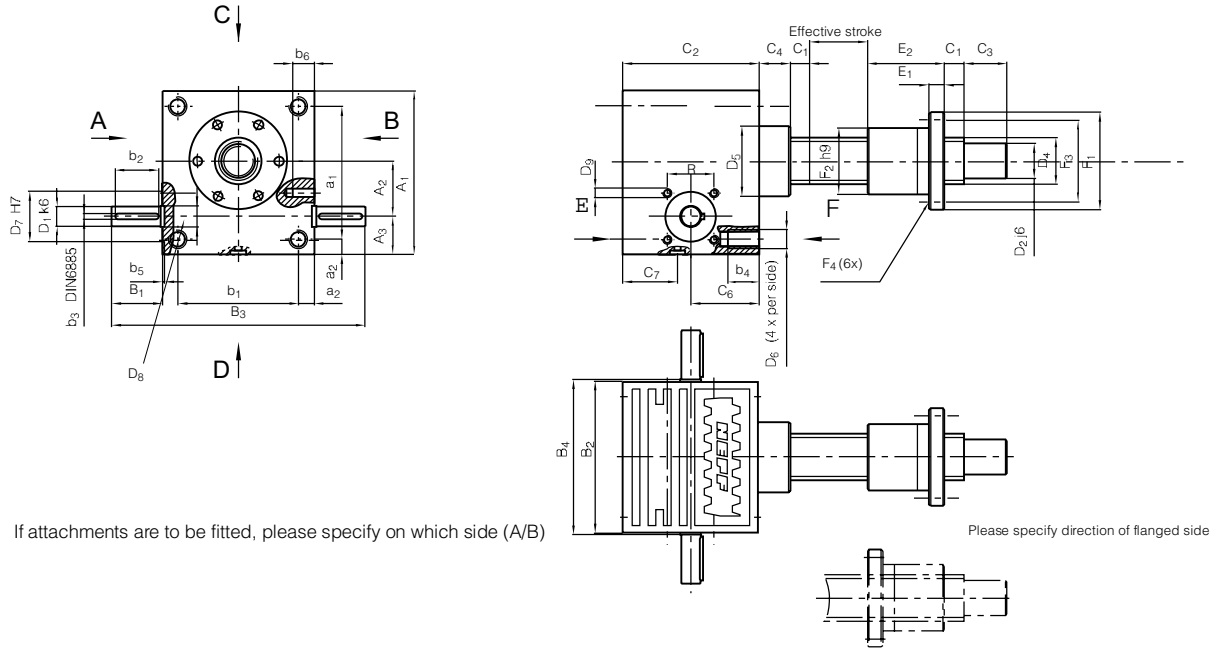
5) Dimension A1 in accordance to DIN 1685 GTB 18.

6) In accordance to DIN 13 screw thread: MULI®. In accordance to DIN 13 fine pitch thread: JUMBO®.

7) JUMBO® 2 – JUMBO® 5, only 3 holes are present.

Outline drawing and table of dimensions

Version R



Size

Dimensions (mm)

	A ₁	A ₂	A ₃	a ₁	a ₂	B ₁	B ₂	B ₃	B ₄	b ₁	b ₂	b ₃	b ₄	b ₅	C ₁	C ₂	C ₃	C ₄	C ₆	C ₇	
	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric
MULI® 1	80	25	24	60	10	24	72	120	77	52	18	3	13	1.5	12	62	15	12	31	22	
MULI® 2	100	32	28	78	11	27.5	85	140	90	63	20	5	15	1.5	15	75	20	18	37.5	27	
MULI® 3	130	45	31	106	12	45	105	195	110	81	36	5	15	2	20	82	25	23	41	29	
MULI® 4	180	63	39	150	15	47.5	145	240	150	115	36	6	16	2	25	117	30	32	58.5	42.5	
MULI® 5	200	71	46	166	17	67.5	165	300	170	131	56	8	30	2.5	25	160	45	40	80	53	
JUMBO® 1	210	71	49	170	20	65	195	325	200	155	56	8	40	8	25	175	55	40	87.5	60	
JUMBO® 2	240	80	60	190	25	67.5	220	355	225	170	56	8	45	8	25	165	70	40	82.5	60	
JUMBO® 3	240	80	60	190	25	67.5	220	355	225	170	56	8	45	8	25	165	75	40	82.5	60	
JUMBO® 4	290	100	65	230	30	65	250	380	255	190	56	10	54	8	25	220	100	50	110	86	
JUMBO® 5	360	135	75	290	35	100	300	500	305	230	90	14	80	8	30	266	120	60	133	109	

Size

Dimensions (mm)

	D _{1k6} ³⁾	D ₂	D _{4TR}	D _{4KGT}	D ₅ ²⁾	D ₆	D _{7H7}	D ₈	D _{9x6}	R(TK)	E ₁ ¹⁾	E ₂ ¹⁾	F ₁ ¹⁾²⁾	F ₂ ¹⁾²⁾	F ₃ ¹⁾²⁾	F ₄ ¹⁾²⁾
	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric	Metric
MULI® 1	10 x 21.5	12	Tr18 x 4	1605	29.6/48	M8	28	12	M5x10	32(45.25)	12/12	44/44	48/48	28/28	38/38	6/5.5
MULI® 2	14 x 25	15	Tr20 x 4	2005	38.7/61	M8	35	15	M6x12	35(49.5)	12/12	44/44	55/55	32/32	45/45	7/7
MULI® 3	16 x 42.5	20	Tr30 x 6	2505	46	M10	35	17	M8x12	44(62.2)	14/14	46/46	62/62	38/38	50/50	7/7
MULI® 4	20 x 45	25	Tr40 x 7	4005/4010	60	M12	52	25	M10x15	55(77.8)	16/16	73/59	95/80	63/53	78/68	7/9
MULI® 5	25 x 65	40	Tr55 x 9	5010	85	M20	52	28	M12x18	60(84.85)	18/18	97/97	110/110	72/72	90/90	11/11
JUMBO® 1	25 x 62.5	45	Tr60 x 9	---	90	M24	52	28	M12x18	60(84.85)	20	99	125	85	105	11
JUMBO® 2	30 x 65	55	Tr70 x 10	---	105	M30	58	32	M12x18	(80)	30	100	180	95	140	17
JUMBO® 3	30 x 65	60	Tr80 x 10	8010	120	M30	58	32	M12x18	(80)	30/22	110/101	190/145	105/105	150/125	17/14
JUMBO® 4	35 x 62.5	80	Tr100 x 10	---	145	M36	72	40	M16x30	(100)	35	130	240	130	185	25
JUMBO® 5	48 x 97.5	95	Tr120 x 14	---	170	M42	80	50	M16x40	(115)	40	160	300	160	230	28

1) The first values in the table apply to the trapezoidal screw nut EFM. For dimension 4010 the first values in the table are valid.

2) The second values in the table apply to the ball screw nut KGF.

3) Diameter and length to shoulder.

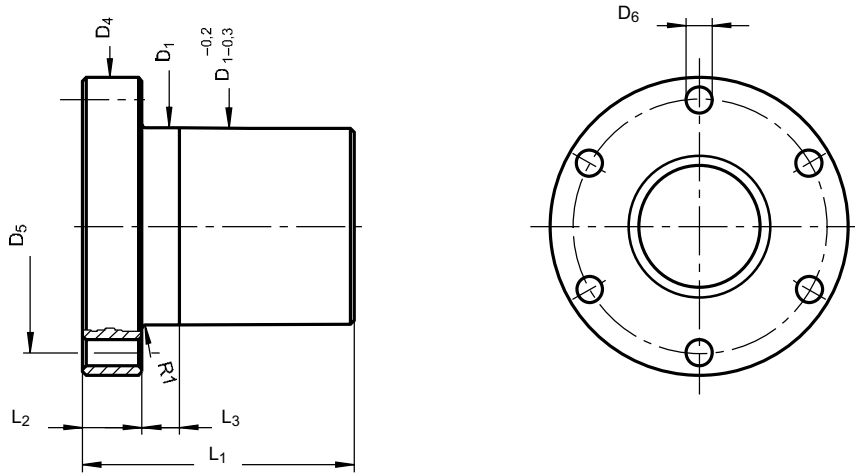
4) Dimension A1 in accordance with DIN 1685 GTB 18.

Accessories

Trapezoidal screw nuts

Preassembled bronze nut EFM

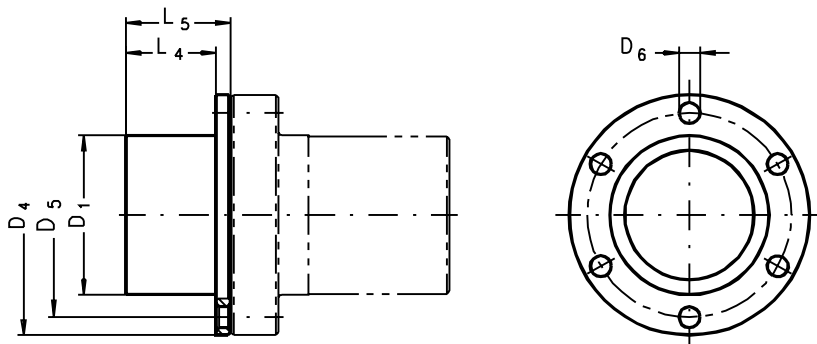
For drive units in continuous operation with particularly good wear properties. Can be used as safety nut and are sea water resistant in combination with stainless screws. EFM nuts have the same dimensions as ball screw nuts KGF-N and can be fitted together with the nut mountings KON-N and KAR-N (see accessories).



Size	Product / Size	Dimensions (mm)								
		D ₁ Metric	D ₄ Metric	D ₅ Metric	6xD ₆ Metric	L ₁ Metric	L ₂ Metric	L ₃ Metric	L ₄ Metric	L ₅ Metric
MULI® 1	EFM Tr 18 x 4	28	48	38	6	44	12	8	15	22
MULI® 2	EFM Tr 20 x 4	32	55	45	7	44	12	8	15	25
MULI® 3	EFM Tr 30 x 6	38	62	50	7	46	14	8	20	25
MULI® 4	EFM Tr 40 x 7	63	95	78	9	73	16	10	20	35
MULI® 5	EFM Tr 55 x 9	72	110	90	11	97	18	10	20	40
JUMBO® 1	EFM Tr 60 x 9	85	125	105	11	99	20	10	20	40
JUMBO® 2	EFM Tr 70 x 10	95	180	140	17	100	30	16	20	40
JUMBO® 3	EFM Tr 80 x 10	105	190	150	17	110	30	16	20	40
JUMBO® 4	EFM Tr 100 x 10	130	240	185	25	130	35	16	20	50
JUMBO® 5	EFM Tr 120 x 14	160	300	230	28	160	40	20	20	55

Adapter for attachment of the second bellows

Version R only



Accessories

Ball screw nuts

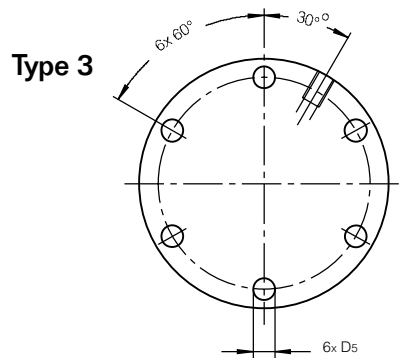
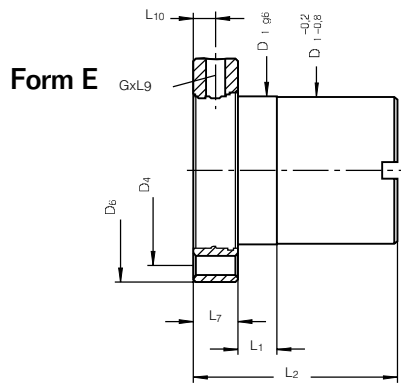
Flanged ball screw nut KGF

Flanged ball screw nut with mounting and lubrication holes and with profiled gaskets (reduces lubricant leakage and prevents ingress of dirt particles) for ball screw KGS.

Zero-backlash units KGT-FF/KGT-MM/KGT-FM

Factory adjusted and assembled combinations of two cylindrical nuts (MM), two flanged nuts (FF) or one flanged and one cylindrical nut (FM).

Only available as screw mechanism, i.e. nut preassembled on the corresponding ball screw.

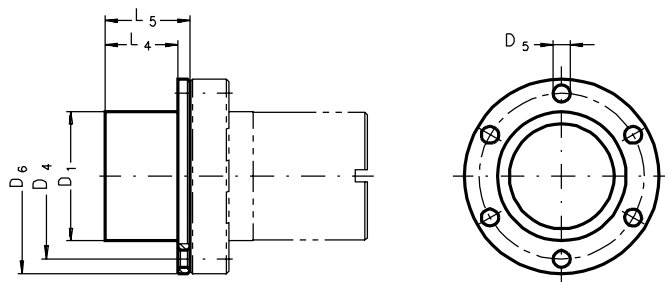


Size	Product / Size	Dimensions (mm)													Max. Axial Backlash	Number of Reversals	C ²⁾ kN	C ³⁾ kN	C ₀ = C _{0a} kN
		D ₁ Metric	D ₄ Metric	D ₅ Metric	D ₆ Metric	L ₁ Metric	L ₂ Metric	L ₄ Metric	L ₅ Metric	L ₇ Metric	L ₉ Metric	L ₁₀ Metric	G Metric						
MULI® 1	KGF 1605 RH-EE(4)	28	38	5.5	48	8	44	15	22	12	8	6	M6	0.08	3	12.0	7.0	12.7	
MULI® 2	KGF 2005 RH-EE(4)	32	45	7	55	8	44	15	25	12	8	6	M6	0.08	3	14.0	8.0	17.0	
MULI® 3	KGF 2505 RH-EE(4)	38	50	7	62	8	46	20	25	14	8	7	M6	0.08	3	15.0	9.5	22.4	
MULI® 4	KGF 4005 RH-EE(4)	53	68	7	80	10	59	20	35	16	8	8	M6	0.08	5	26.0	19.0	63.5	
MULI® 5	KGF 4010 RH-EE(4)	63	78	9	95	10	73	20	35	16	8	8	M8x1	0.08	3	50.0	30.0	70.0	
JUMBO® 1	KGF 5010 RH-EE(4)	72	90	11	110	10	97	20	40	18	8	9	M8x1	0.08	5	78.0	55.0	153.0	
JUMBO® 3	KGF 8010 RH-EE(4)	105	125	14	145	10	101	20	40	22	8	11	M8x1	0.08	5	93.0	69.0	260.0	

- 1) Only 75% of the specified values are permitted for a pitch accuracy of 200 µm/300 mm screw length.
- 2) Dynamic load rating to DIN 69051 Part 4, draft version 1978.
- 3) Dynamic load rating to DIN 69051 Part 4, draft version 1989.
- 4) EE = rubber wiper

Adapter for attachment of the second bellows

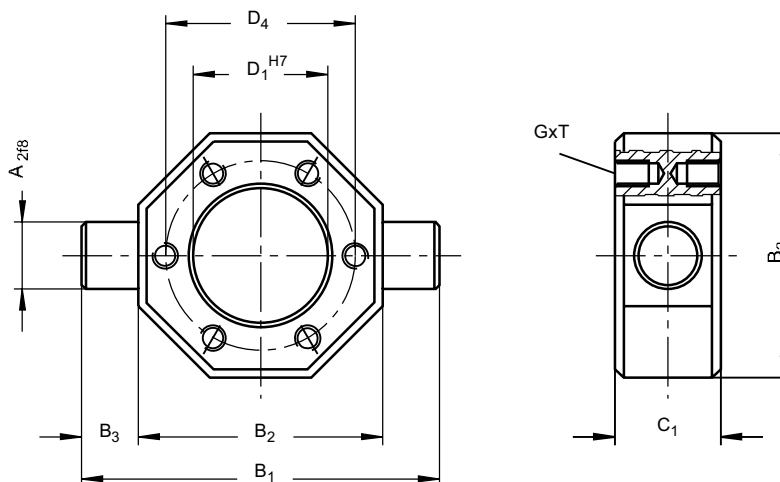
Version R only



Accessories

Trunnion nut mountings KAR

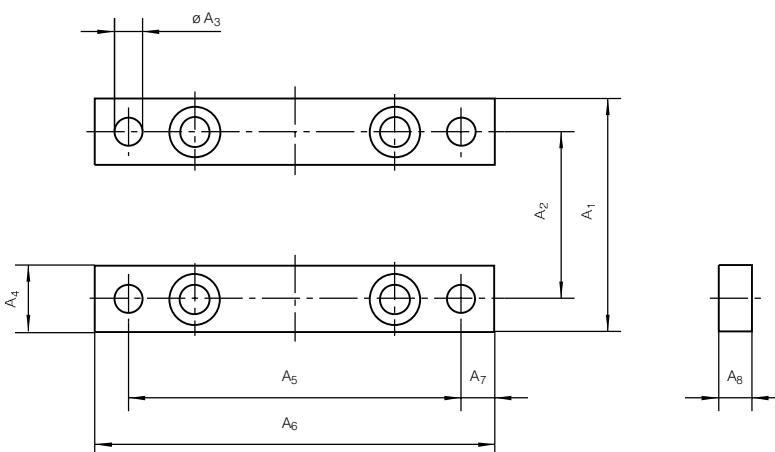
Trunnion nut mounting for trunnion mounting of the flanged ball screw nut KGF and flanged trapezoidal screw nut EFM.



Size	Type		Dimensions (mm)								G x T	Weight [kg]
	for KGF	for EFM	A_2	B_1	B_2	B_3	C_1	D_1	D_4			
KAR MULI® 1	KAR 1605	Tr 16x4/Tr 18x4	12	70	50	10	20	28	38	M 5x10	0.2	
KAR MULI® 2	KAR 2005	Tr 20x4/Tr 24x4	16	85	58	13.5	25	32	45	M 6x12	0.3	
KAR MULI® 3	KAR 2505	Tr 30x6	18	95	65	15	25	38	50	M 6x12	0.5	
KAR MULI® 4	KAR 4005		25	125	85	20	30	53	68	M 6x12	1.2	
	KAR 4010	Tr 40x7	30	140	100	20	40	63	78	M 8x14	2.5	
KAR MULI® 5	KAR 5010	Tr 55x9	40	165	115	25	50	72	90	M10x16	2.8	
KAR JUMBO® 1	KAR 6310	Tr 60x9	40	180	130	25	50	85	105	M10x16	3.3	
KAR JUMBO® 3	KAR 8010		50	200	150	25	60	105	125	M12x18	4.8	

Mounting feet L

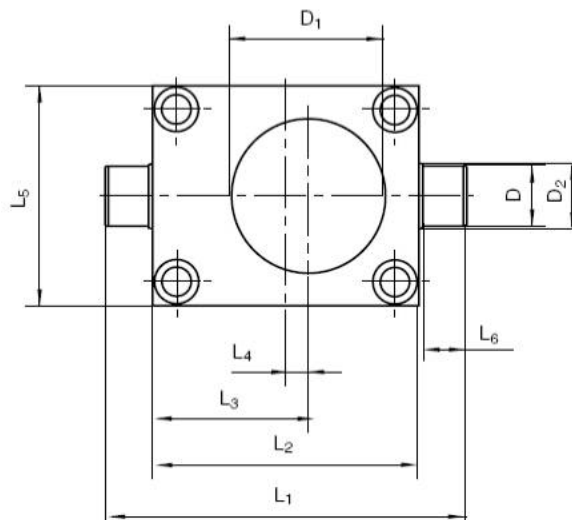
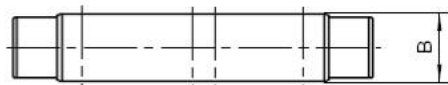
Supplied loose with mounting bolts for jack.



Size	Dimensions (mm)								Weight [kg]
	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	
L MULI® 1	72	52	8.5	20	100	120	10	10	0.3
L MULI® 2	85	63	8.5	20	120	140	10	10	0.4
L MULI® 3	105	81	11	24	150	170	10	12	0.8
L MULI® 4	145	115	13.5	30	204	230	13	16	1.7
L MULI® 5	171	131	22	40	236	270	17	25	3.9
L JUMBO® 1	205	155	26	50	250	290	20	30	5.8
L JUMBO® 2	230	170	32	65	290	340	25	40	10
L JUMBO® 3	230	170	32	65	290	340	25	40	10
L JUMBO® 4	270	190	39	80	350	410	30	50	20.8
L JUMBO® 5	330	230	45	100	430	500	35	60	34.4

Trunnion mountings K

Supplied loose with mounting bolts for jack.

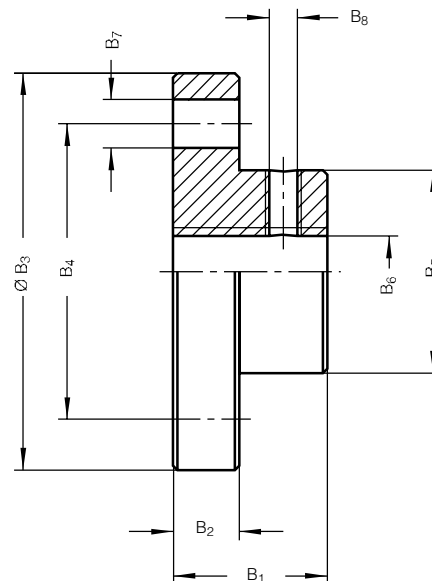


Size Dimensions (mm)

Size	L ₁	L ₂	L ₃	L ₄	L ₅	L ₆	D _{f8}	D ₁	D ₂	B	Weight [kg]
K MULI® 1	110	80	49	9	72	13	15	44	18	20	0.76
K MULI® 2	140	100	60	10	85	18	20	58	23	25	1.44
K MULI® 3	170	130	76	11	105	18	25	72	28	30	2.8
K MULI® 4	240	180	102	12	145	28	35	86	38	40	7.4
K MULI® 5	270	200	117	17	165	33	45	115	48	50	10.72
K JUMBO® 1	290	210	120	15	195	38	50	130	56	60	11.8
K JUMBO® 2	330	240	140	20	220	43	70	170	76	80	26.1
K JUMBO® 3	330	240	140	20	220	43	70	170	76	80	26.1
K JUMBO® 4	410	290	165	20	250	58	80	160	88	90	40.2
K JUMBO® 5	520	360	210	30	300	78	90	175	96	100	67.7

Top plate BP

Screwed onto the mounting thread of the jack screw and protected against rotation.

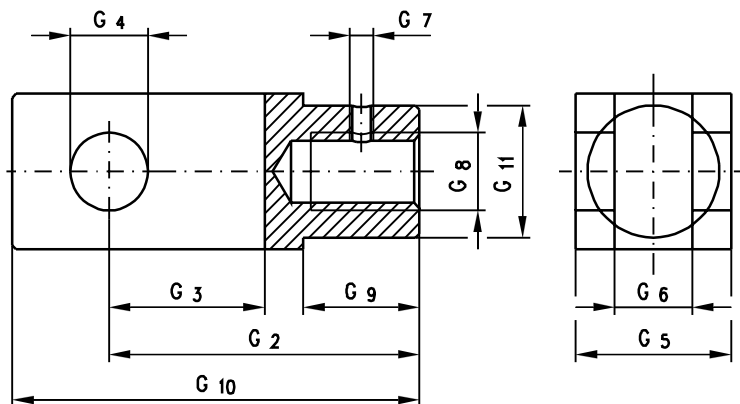


Size Dimensions (mm)

Size	B ₁	B ₂	ØB ₃	B ₄	B ₅	B ₆	B _{7x4}	B ₈	Weight [kg]
BP MULI® 1	20	7	65	48	29.3	M12	9	M5	0.2
BP MULI® 2	21	8	80	60	38.7	M14	11	M6	0.3
BP MULI® 3	23	10	90	67	46	M20	11	M8	0.6
BP MULI® 4	30	15	110	85	60	M30	13	M8	1.2
BP MULI® 5	50	20	150	117	85	M36	17	M10	4.8
BP JUMBO® 1	50	25	170	130	90	M48x2	21	M10	5
BP JUMBO® 2	60	30	200	155	105	M56x2	25	M12	7.7
BP JUMBO® 3	60	30	220	170	120	M64x3	25	M12	9.8
BP JUMBO® 4	80	40	260	205	145	M72x3	32	M12	18.4
BP JUMBO® 5	120	40	310	240	170	M100x3	38	M12	29.6

Fork end GA

Screwed onto the mounting thread of the jack screw and protected against rotation. Supplied with split pins and collar pins. Galvanized.



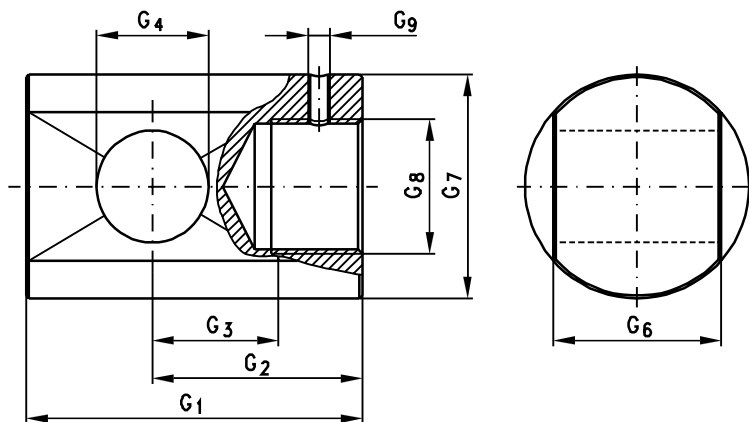
Size

Dimensions (mm)

	G ₂	G ₃	G ₄ (h9 tolerance)	G ₅	G ₆ (h12 tolerance)	G ₇	G ₈	G ₉	G ₁₀	G ₁₁	Weight [kg]
GA MULI® 1	48	24	12	24	12	115	M12	18	62	20	0.15
GA MULI® 2	56	28	14	28	14	116	M14	22	72	24.5	0.2
GA MULI® 3	80	40	20	40	20	118	M20	30	105	34	0.8
GA MULI® 4	120	60	30	60	30	118	M30	43	160	52	2.5
GA MULI® 5	144	72	35	70	35	1110	M36	40	188	60	3.8

Clevis end GK

Screwed onto the mounting thread of the jack screw and protected against rotation.



Size

Dimensions (mm)

	G ₁	G ₂	G ₃	G ₄ (h8 tolerance)	G ₆ (h10 tolerance)	G ₇	G ₈	G ₉	Weight [kg]
GK MULI® 1	55	40	15	10	15	30	M12	115	0.2
GK MULI® 2	63	45	18	12	20	39	M14	116	0.3
GK MULI® 3	78	53	20	16	30	45	M20	118	0.6
GK MULI® 4	100	70	30	20	35	60	M30	118	1.2
GK MULI® 5	130	97	33	22	40	85	M36	1110	2.5
GK JUMBO® 1	120	75	45	40	60	90	M48x2	1110	4.8
GK JUMBO® 2	130	90	50	50	70	105	M56x2	1112	4.8
GK JUMBO® 3	155	105	60	60	80	120	M64x3	1112	8
GK JUMBO® 4	220	135	85	80	110	145	M72x3	1112	22.5
GK JUMBO® 5	300	200	100	90	120	170	M100x3	1112	31.5

Accessories

Attachments

Bellows F

Length: For each 150 mm of open length up to 1.80 m, allow 8 mm when calculating the closed length. Allow 10 mm for each 150 mm over 1.80 m. The calculated length is added to value C3 (see page 26) as screw extension.

Diameter F2 may differ on the opposite side, depending on the attachment fitted.

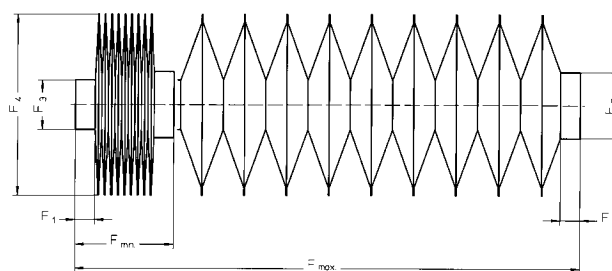
Important: The installation position must be specified, as internal support rings must be fitted when the jack is operated in a horizontal position. When installed vertically, bellows over 2 meters have textile tapes.

The same information is also required for the second bellows when ordering version R (rotating screw).

Material: PVC-coated polyester, stitched construction. Temperature range -30 °C to 70 °C. Secured in position by clamping rings. Special versions on request.

Flat spiral spring covers SF

Available on request (refer also to the catalog: Screw drives GT, KOKON®).



Size	Jack Type	Dimensions (mm)			
		F ₁	F ₂	F ₃	F ₄
F MULI® 1	N/V TGS(1)	12	30	30	101
	N/V KGS(1)	12	48	30	101
	R	12	30	28	101
F MULI® 2	N/V TGS(1)	12	39	39	113
	N/V KGS(1)	12	61	39	113
	R	12	39	32	113
F MULI® 3	N/V	20	46	46	127
	R	20	46	38	127
F MULI® 4	N/V	20	60	60	140
	R TGS/KGS-4010(1)	20	60	63	140
	R KGS-4005(1)	20	60	53	140
F MULI® 5	N/V	20	85	85	152
	R	20	85	72	152
F JUMBO® 1	N/V	20	90	90	165
	R	20	90	85	165
F JUMBO® 2	N/V	20	105	105	175
	R	20	105	95	175
F JUMBO® 3	N/V	20	120	120	191
	R	20	120	105	191
F JUMBO® 4	N/V	20	145	145	201
	R	20	145	130	201
F JUMBO® 5	N/V	20	170	170	245
	R	20	170	160	245

1) TGS = Trapezoidal screw

KGS = Ball screw

Accessories

Protection

Limit switches with roller lever

Particularly suitable for end-position shutoff (also available in explosion-proof design).

Actuating cam 30° in accordance with DIN 69 639:

Ve (Approach velocity):
0.001 to 0.1 m/s

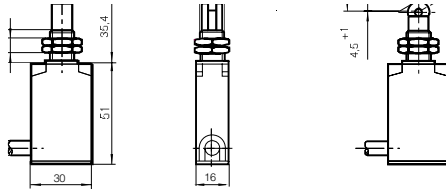
Connection:

5-core cable with PVC sheath, 1m long
Conductor cross-section
0.75 mm²
Brown/blue: NO contact
Black/black: NC contact
Green/yellow: PE conductor

A (Minimum actuating stroke):
2.6 ± 0.5 mm

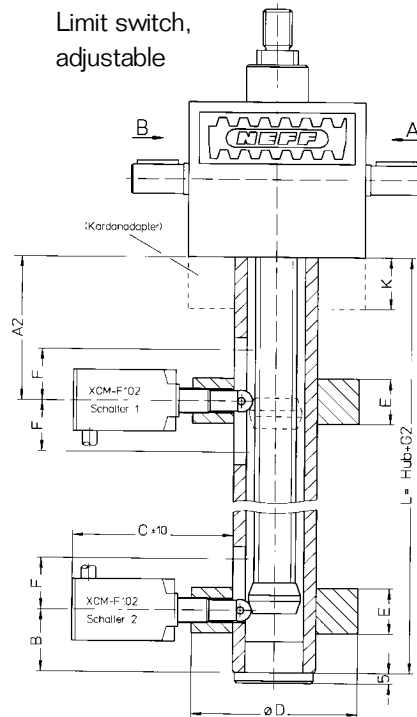
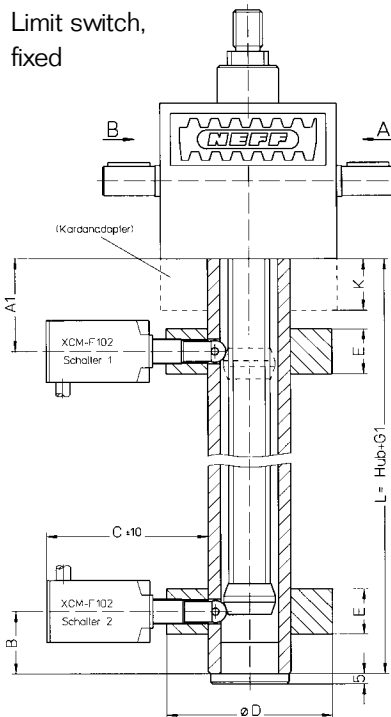
B (Differential stroke):
0.85 ± 0.25 mm

FO (Minimum switch-on force):
1 N



Switching capacity: NF C 63 146
(IEC 947-5-1)
Ident No. 92203259

Limit switch installation position



Size

Dimensions (mm)

	A ₁	A ₂	B	C	ØD	E	F	G ₁	G ₂	K
MULI® 1	40	65	30	80	80	20	25	82	107	20
MULI® 2	45	70	30	80	80	20	25	87	112	25
MULI® 3	50	75	30	80	90	20	25	92	117	30
MULI® 4	60	85	30	80	100	20	25	102	127	40
MULI® 5	70	95	30	80	120	20	25	112	137	50
JUMBO® 1	80	105	30	80	140	20	25	122	147	60
JUMBO® 2	100	125	30	80	160	20	25	142	167	80
JUMBO® 3	100	125	30	80	160	20	25	142	167	80
JUMBO® 4	110	135	30	80	170	20	25	152	177	90
JUMBO® 5	120	145	30	80	190	20	25	162	187	100

Accessories

Safety nuts

Safety nuts SFM-TGS/KGS⁽¹⁾

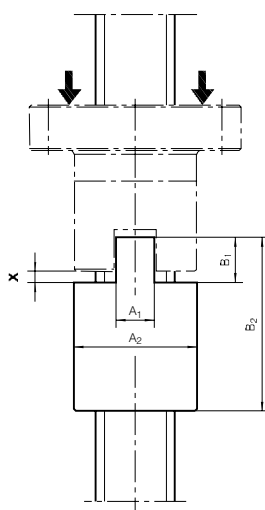
For version R: The safety nut is positioned below the travelling nut without axial load and is therefore not subjected to wear. The functioning of the safety nuts is guaranteed only when installation and applied forces are as shown in the illustration (see below). As the travelling nut wears, the distance "x" between the two nuts decreases, which provides a visual check of wear without the need for dismantling.

The travelling nut must be replaced when the axial play on a single-thread screw is more than 25% of the lead of the thread (dimension X). Otherwise, safety cannot be guaranteed.

Wear greater than 25% of the lead of the thread can endanger persons and property. Dimension X must be checked regularly.

The safety nut supports the load if the thread form of the travelling nut fails as a result of excessive wear (dirt, lubrication starvation, overheating, etc.). The safety nut can only be ordered together with the flanged nut (we reserve the right to make design changes).

For version N: The design is similar to that for version R. A visual check for wear is also possible in this case. Please specify the load direction when ordering.



Size Dimensions (mm)

Size	A ₁	A ₂ (-0.5)	B ₁	B ₂	X	Weight [kg]
SFM MULI® 1	10	28	10	44	1	0.45
SFM MULI® 2	10	32	10	44	1	0.55
SFM MULI® 3	12	38	10	46	1.5	0.7
SFM MULI® 4	16	63	15	73	1.75	3.1
SFM MULI® 5	20	72	16	97	2.25	4.3
SFM JUMBO® 1	20	85	16	99	2.25	5.7
SFM JUMBO® 2	25	95	20	100	2.5	11.3
SFM JUMBO® 3	25	105	20	110	2.5	13.7
SFM JUMBO® 4	30	130	25	130	2.5	23.3
SFM JUMBO® 5	40	160	25	160	3.5	45.7

1) KGS on request.

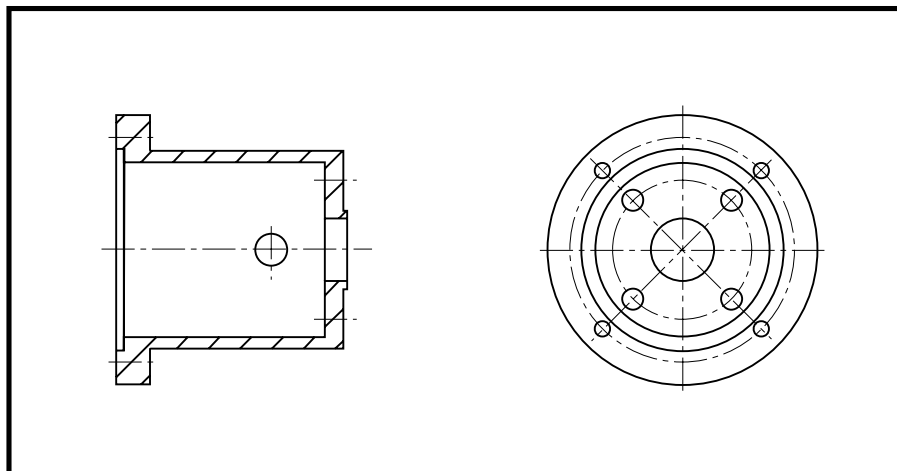
Cubic face screw jacks

Screw jack accessories

These and other accessories are available upon request. Please ask any of our technical sales representatives.

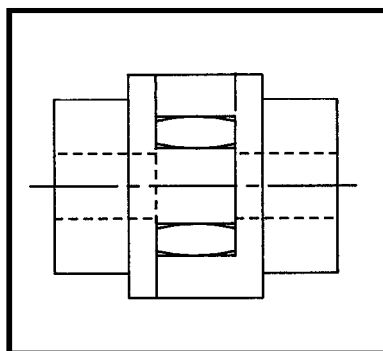
Motor adaptor flanges MG

Motor adapter flanges are used to mount motors to worm gear screw jacks and house the coupling for connecting the motor to the drive shaft.



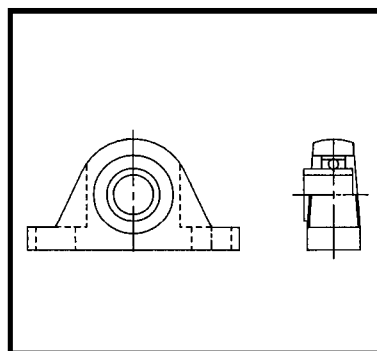
Flexible couplings

Flexible couplings provide impact proof transmission of torque and compensate for axial offset and displacements and for angular alignment errors.

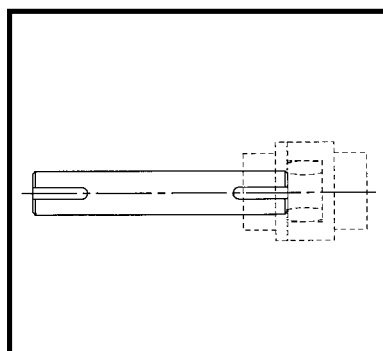


Pillow blocks

Pillow blocks are used to support drive shafts, where required.

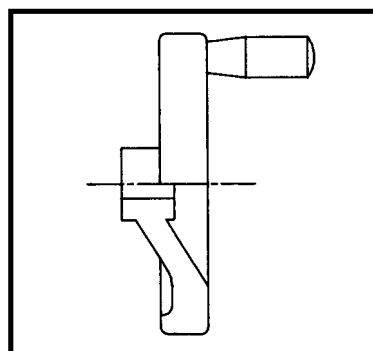


Drive shafts



Handwheels

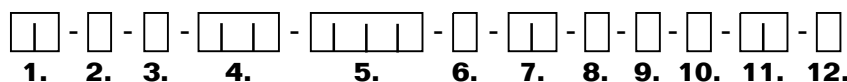
Handwheels allow manual screw jack operation.



How to order

MULI®/JUMBO®

Configuration of the order code:



1. Size

M1 – M5
 J1 – J5

2. Version

N
 R
 V

3. Gear ratio

H
 L

4. Screw type

TGS (trapezoidal screw)
 KGS (ball screw)

5. Stroke

[mm]

6. Stroke end

G = Standard screw D3
 Z = With cylindrical end
 D_{2j6}
 0 = No end machining
 S = Special end
 (as specified by
 customer)

7. End fitting

0 = Without
 BP = Top plate
 GA = Fork end
 GK = Clevis end

8. Bellows

0 = Without
 F = With bellows

9. Nut

0 = Without
 1 = EFM (trapezoidal)
 2 = KGF (flanged ball
 screw nut)
 3 = KGM (cylindrical ball
 screw nut)

10. Stop collar

0 = Without
 A = With

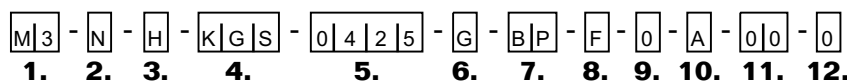
11. Special features

0 = Without
 Z = Standard accessories
 as per catalog, for
 direct mounting on
 the gears (attachment
 strips, motor,
 motor adapter
 flange with coupling)
 S = Special accessories,
 or accessories for
 constructional
 alterations to the
 standard version
 (special screw,
 special screw end)
 alignment GK/GA in
 V Version

12. Screw dimensions

MULI® 4-KGS
 0 = for all sizes except
 MULI® 4-KGS
 1 = 4005
 2 = 4010

Example order code:



1. Size

MULI®3

2. Version

N

3. Gear ratio

H

4. Screw type

KGS

5. Stroke

425 mm

6. Screw end

Standard thread D3

7. End fitting

BP = Top plate

8. Bellows

With bellows

9. Nut

Without

10. Stop collar

With

11. Special features

Without

12. Screw dimensions

MULI® 4-KGS

0 = for all sizes except
 MULI® 4-KGS