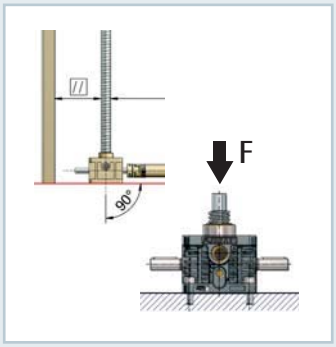
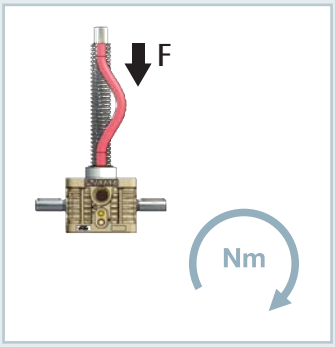
Technical appendix



Design advice, attachment, permissible loads

Page 150

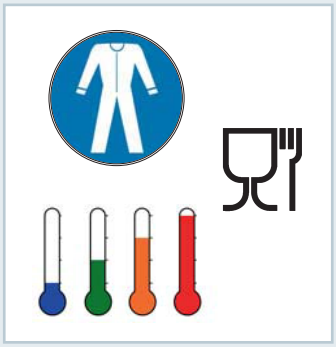


Calculations, design, tables

Page 160

Operation, maintenance

Page 172



Special application range

Page 176

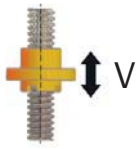
Design advice

Design and specification
Selection and dimensioning is the customer's responsibility, because we are not familiar with the design criteria such as installation location and type of application. On request we can provide support during selection and specification and make proposals with subassembly drawings and calculations based on your application parameters. You can then examine and approve these drawings and their parts lists.
These then serve as basis for production and preassembly and assist your employees during installation and fitting. We guarantee the quality of the machine elements as described in the catalogue. The gearboxes are designed for industrial use at the loads and duty cycles specified in the catalogue.

If your requirements are not covered by our catalogue descriptions, please contact our project technicians. We generally deliver according to our current Terms of Sales and Delivery (Section 10).

Lifting speed

$$\text{Lifting speed } v = \frac{\text{Screw pitch P}}{\text{Gear ratio i}} \times \text{motor speed n}$$



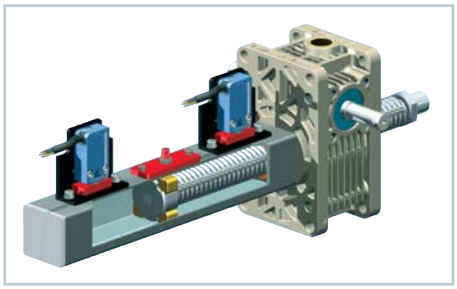
There are several parameters which affect the lifting speed:

Faster:
- double-pitch screw (not generally held in stock): This doubles the lifting speed (**CAUTION:** max. input torque, not self-locking - brake required!)
- increased screw for the R version (next larger size of gearbox): depending on the screw jack size, this will give a somewhat greater pitch / lifting speed
- Ball screw: Various pitches are available (**CAUTION:** not self-locking– brake required!)
- Frequency converter serves to increase the motor speed to more than 1500 rpm. Please note the maximum gearbox speed.

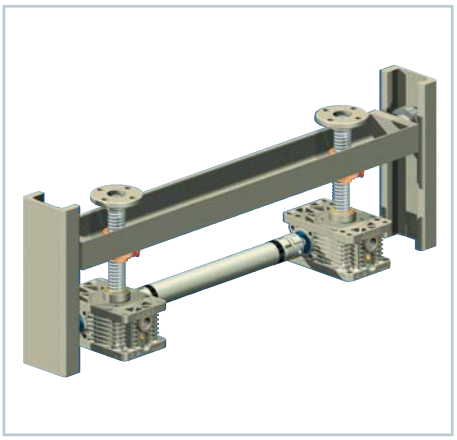
Slower:
- Motors with more poles/lower speed (6, 8, 10 or 12 poles)
- Frequency converter (**CAUTION:** if the motor is to be operated for extended periods at frequencies less than 25 Hz, adequate cooling must be assured, e.g.: separately driven fan)
- Geared motor (**CAUTION:** do not exceed the maximum input torque)
- Bevel gearbox with gear reduction (only suitable for certain applications)

Temperature and duty cycle
Screw jacks are generally not designed for continuous operation.
Refer to the diagram on the gearbox pages (Sections 2 + 3) for the maximum duty cycles (ED).
These are reference values but vary according to usage conditions. In borderline cases, select a larger screw jack or contact our project technicians.
Operating temperatures must not exceed 60°C (gearbox) or 80°C (screw) (higher values on request).

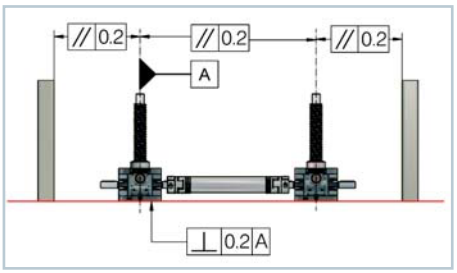
Rotation protection
On the version S, the translating screw is free running within the gearbox (worm wheel). The screw must be protected against rotation – otherwise it would rotate due to the friction in the worm wheel. This can be achieved by fixing the screw to an external guidance system or by using our rotation protection (VS) (in the protective tube).



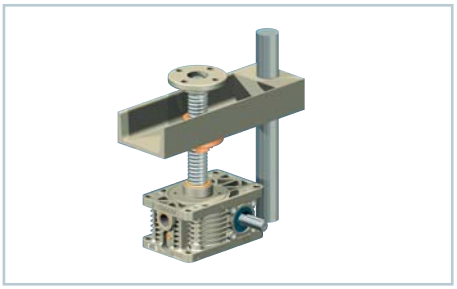
Parallelism and angular relationships



Attention must be paid to the parallelism and correct angular relationships of mounting surfaces, gears, nuts and guides to each other. The same applies for exact alignment of gears, pedestal bearings, connecting shafts and motors to each other.

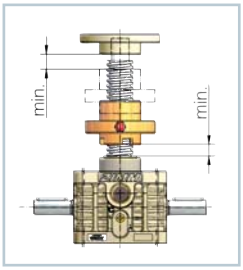


Guides
Guide bush play in the screw jack gearbox can be between 0.2 mm and 0.6 mm depending on the size. This is just a secondary support and does not replace a guide system specifically provided to cater for lateral forces.

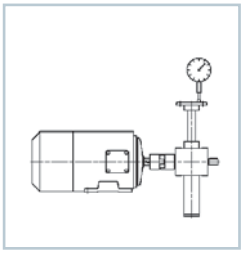


Design advice

Safety distance
Safety distances between moving and stationary components must be maintained otherwise there is the risk of the screw jack reaching a blocked position (see Gearbox Dimension Sheets).



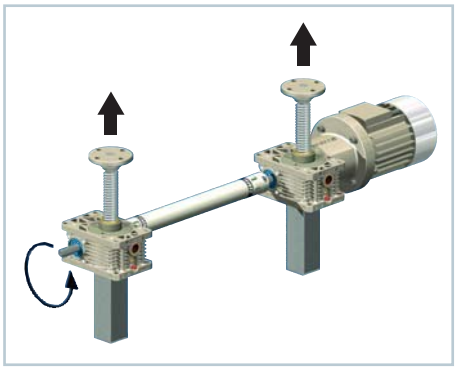
Accuracy
The repetition accuracy of the gearbox can be up to 0.05 mm when moving to the same position again under the same load conditions.
This requires measures on the drive side, such as a 3-phase AC motor with a brake in conjunction with a frequency converter, a rotary pulse encoder or a servomotor with encoder, etc.



The pitch accuracy for trapezoidal screws is 0.2 mm over a 300 mm screw length, and 0.05 mm for ball screws over a 300 mm screw length.

Under alternating loads, axial play can be up to 0.4 mm on trapezoidal screws and 0.08 mm on ball screws (when new).

Direction of rotation and movement

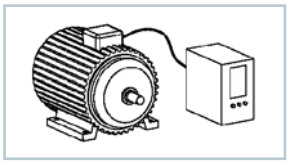


Check the direction of rotation required for the system and record this on the drawing or select one of our standard system layouts (Checklists). With T bevel gearboxes, the direction of rotation can be changed simply by turning the gearbox around.

Self-locking / overrunning
Screw jacks with a single-pitch trapezoidal screw have a limited self-locking capability which cannot always be relied upon, especially where impact loads or vibrations are present (brake recommended).

The overrun after the motor has been switched off varies depending on the application.
To minimize overrun, we recommend using a braked motor or a spring pressure brake FDB.
A braked motor is essential for double-pitch screws or ball screws, because these are not self-locking.

Drive
We recommend the use of a frequency converter to achieve smooth start-up and brake ramps.
This minimizes start-up noise and extends the service life of the gearbox.



Trial runs!
Trial runs without load and under load in normal operating conditions are necessary to ensure reliable operation. Do not exceed system duty cycle when loaded.
These on-site trial runs are necessary to achieve system alignment and to eliminate any factors which may impair operation.

Spare parts
To protect against loss of production caused by high duty cycles or high loads, we recommend keeping a set of screw jack spare parts (including screws, accessories and with assembly drawings) at your location or at your customer's location.

Theatre stage design
We supply lifting equipment which satisfies the current regulations on theatre stage design.

Land vehicles, aircraft and water craft
Our extended warranty terms generally do not apply to machine elements used in any land vehicles, aircraft and water craft. Special individual terms may be agreed on inquiry.

Ambient conditions
Please specify any ambient conditions that are outside normal industrial environmental conditions (Checklists - Section 7).

Design advice

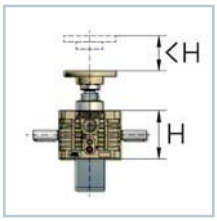
Lubrication

Adequate lubrication is determine for the service life of a screw jack. Therefore ensure adequate lubrication of screws, gearboxes and rotation protection. The red lubrication strip for rotation protection can be mounted in alternative positions to meet your requirements (please specify).

Please also refer to our lubricator and our Instruction manual.

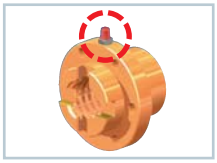
Lubrication for short stroke applications

S version:



For short stroke applications (stroke < gearbox height), take particular care to ensure lubrication of the trapezoidal screw. The simplest tactic is to specify the screw jack with a longer stroke than the gearbox height, and occasionally perform a lubrication stroke. Otherwise, contact our Engineering Department for a suitable solution.

R version:



If stroke length < nut height, use a nut with lubrication capability (such as a duplex nut DM).

Instruction manual

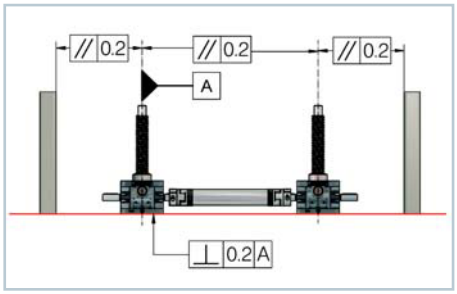
Please refer to our Instruction manual during the design phase (www.zimm.at).

Design advice for steel and plant construction:

Hardly any assembly problems arise when screw jacks are used in machine tools, because the relevant surfaces are machined faces.

In steel and plant construction however, frequent geometric errors can occur in welded structures, despite accurate fabrication work. The interaction between different components can also cause alignment issues.
Attention must be paid to the following:

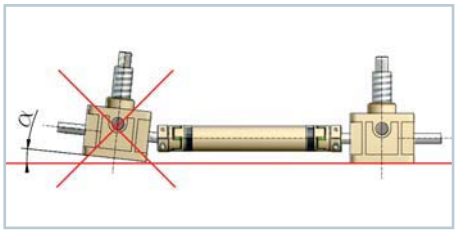
Parallelism / angular relationships:

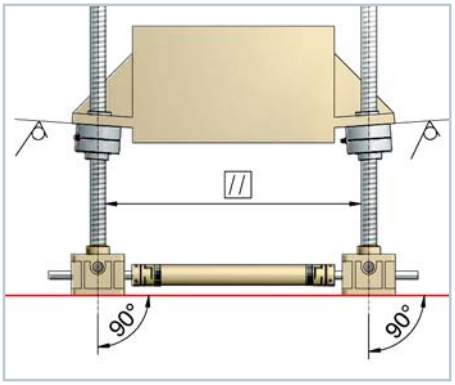


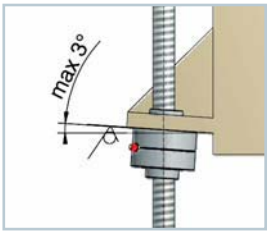
Screws and guides must be parallel to each other, otherwise the equipment can seize up during operation. All mounting surfaces for the gearboxes must be exactly at right angles to the guides, jamming may occur, leading to rapid wear and/or serious damage.

Squeaking noises can also occur on R versions. The mounting surfaces for the nuts must also be at right angles.

ZIMM has developed the self-aligning nut PM (see Section 4) to save time and costs here.



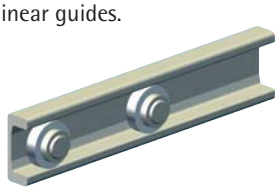




Additional features where alignment may be a problem are the integrated pivot bushings in the gearbox or the pivot bearing plate KAR (see Section 4).

For steel and plant construction:
We supply standard heavy-duty linear guides including bearings. Their stability, long service life, avoidance of geometric errors and ability to accept lateral side forces are decisive arguments for using such guides.

See Section 6 for linear guides.



Printing errors, dimensional mistakes etc. and also technical changes and improvements are excepted. Drawings are valid only when they have been checked and approved by both partners in accordance with the order acknowledgement.

Specification of a screw jack or lifting system – procedure

Refer to the design advice

Set parameters according to the checklist sheets 1 to 6

S version
Translating screw

S

R version
Rotating screw

R

Preselect the screw jack size
according to the diagram on the Screw Jack pages stat. / dyn. loading

Tension loads

Compression loads

Buckling calculation

F

Compression loads

Tension loads

Buckling calculation

Critical whirling speed

min. screw diameter
(may require a larger screw jack, repeat calculation)

min. screw diameter
(may require a larger screw jack, repeat calculation)

Drive torque required per gearbox

Layout of the system

Select the motor type and size

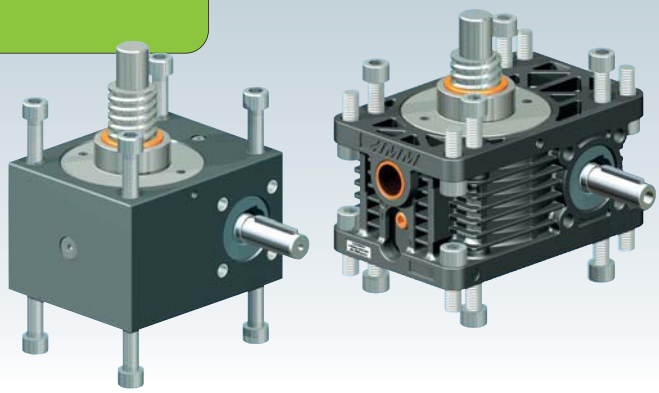
Check max. forces and torques
(may require a larger screw jack, repeat calculation)

Define accessories
see Section 4

Length calculation
(screw, protective tube)

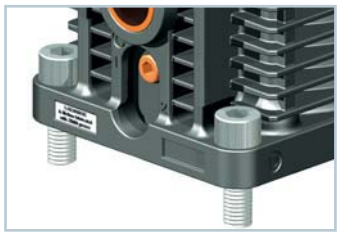
Ordering code

NOTE:
When submitting enquiries and placing orders please alwyas specify the parameters in accordance with the checklist (loads, speeds ...), so that we can check the application once again.

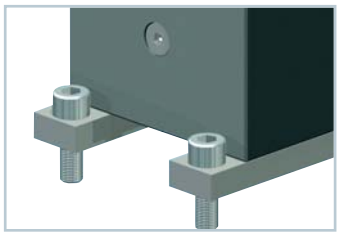


Fixing - fixed

From above:

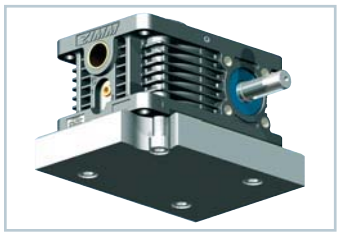


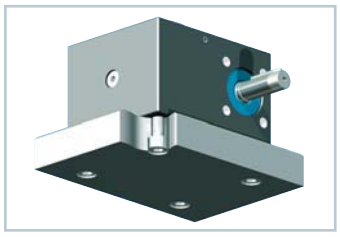
Through screws
(for the Z series)
The great advantage of the Z series is that it can easily be attached from above.



Fixing strips
(for the GSZ series)
Top mounting fixing strips BFL are required for attaching GSZ gearboxes from above.

Through the mounting plate:



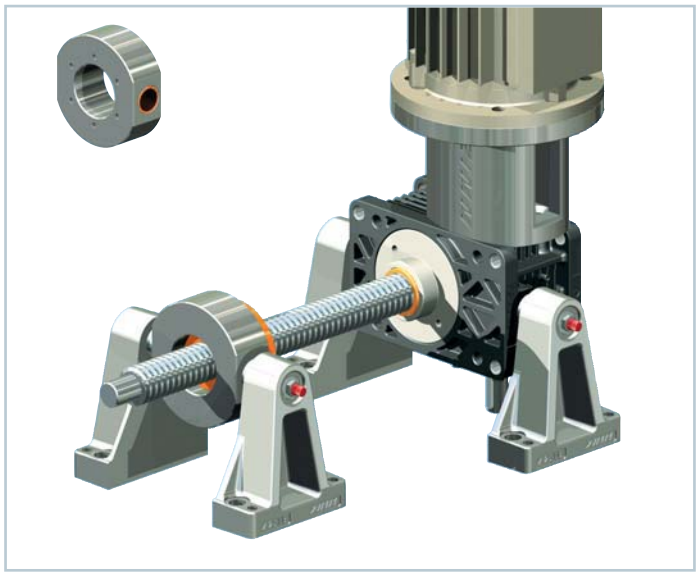


Blind tapped holes
(Z and GSZ series):
Z and GSZ series can be attached from underneath using the blind tapped holes in the gearbox.

GSZ: all sizes
Z: Z-5 to Z-25 (holes the same size as the previous MSZ gearboxes)

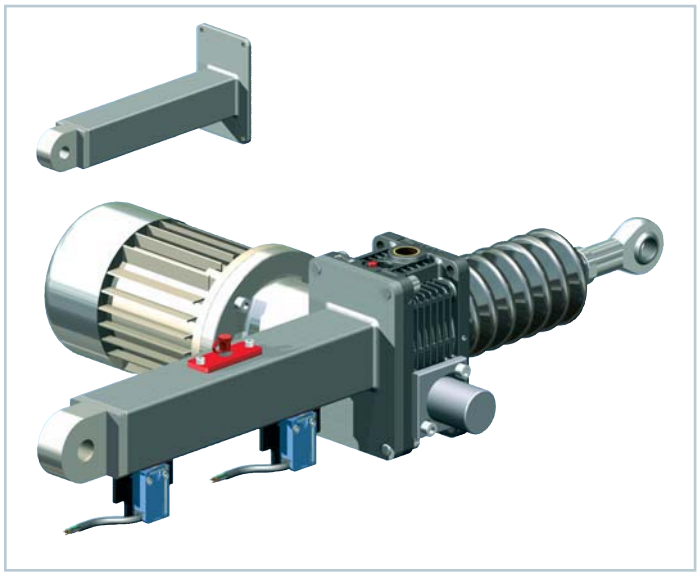
Fixing - pivoting

Duplex nut adapter DMA

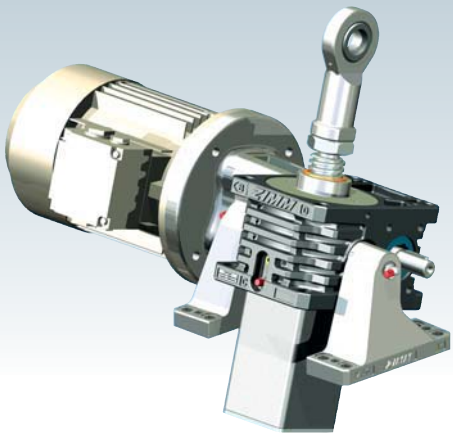


The **duplex nut adapter DMA** is simply bolted to the duplex nut DM. The pivot can be made with the pivot mounts LB or a mounting designed by the customer.

Pivoting support tube STRO



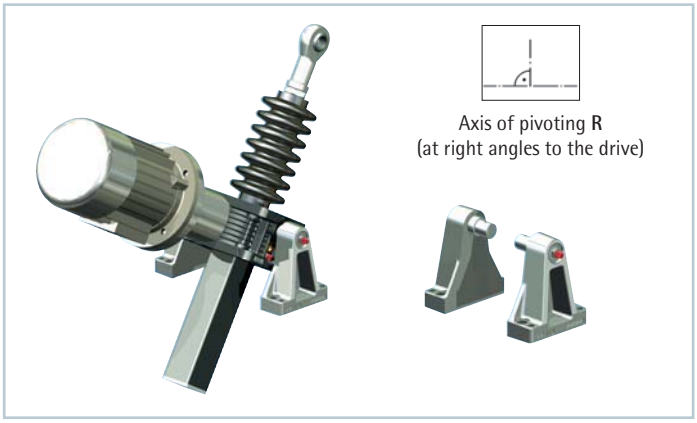
The **pivoting support tube STRO** has the advantage that the pivot points are entirely external. The disadvantage is that the gearbox and motor weights are in the centre. The manufacture is always customer-specific.



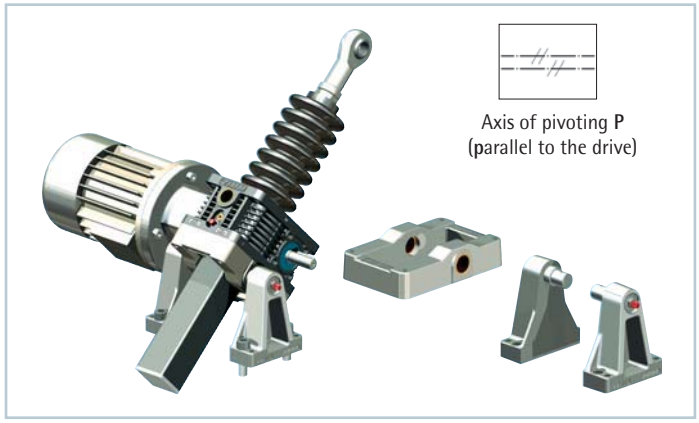
Fixing - pivoting

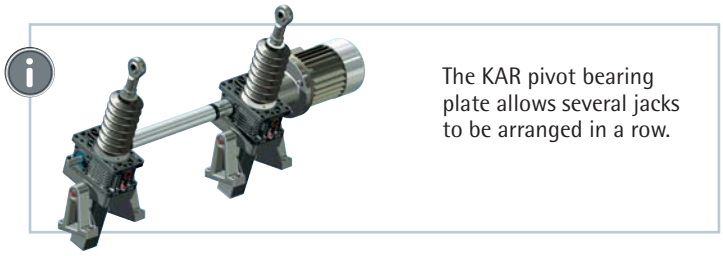
Z-5 to Z-25

Integrated pivot bearing
Simple and economical design: Pivot bushes are incorporated in the gearbox housing.



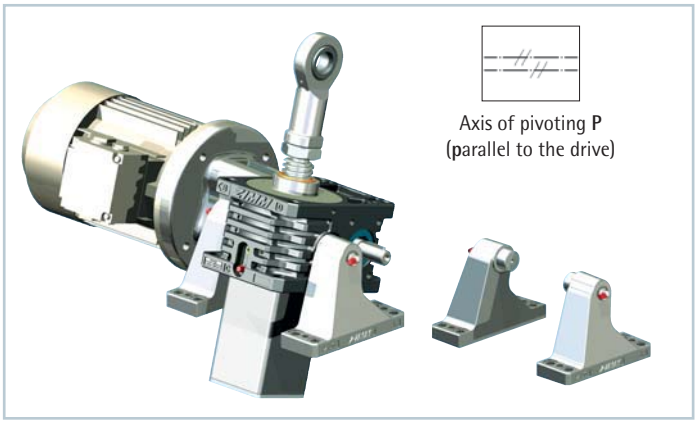
With pivot bearing plate KAR
For large motors, long strokes and high load cycles, the variant with the pivot bearing plate KAR is preferable, because the weight of the motor is then taken by the bearing points and does not affect the screw.





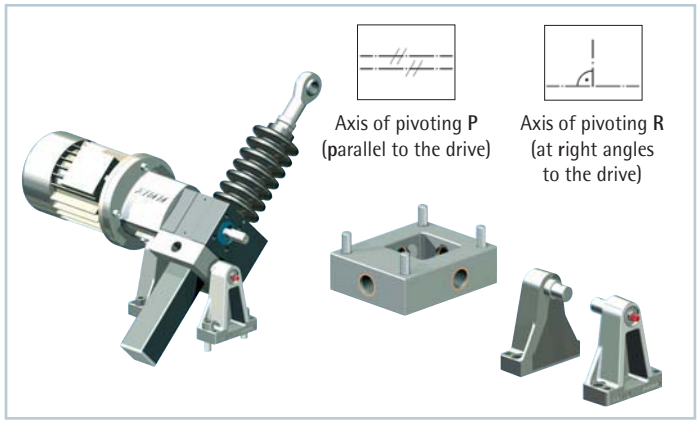
Z-35 to Z-1000

Integrated pivot bearing
Simple and economical design: Pivot bushes are incorporated in the gearbox housing.



GSZ-2 to GSZ-100

With pivot bearing plate KAR
For GSZ gearboxes, a pivot bearing plate can be mounted on face E (above) or F (underneath). In each case there are 4 holes available for the pivot plate P or R.

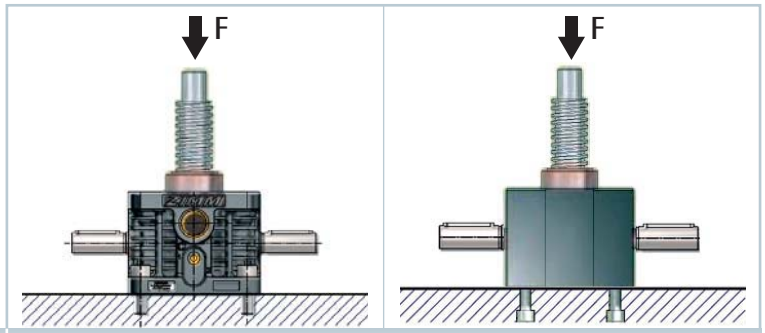


Pivot bearing plate KAR on request

Permissible loads - fixed

The screw jacks themselves are specified for full static nominal load under tension and compression.
The permissible load depends on the type of fastening.

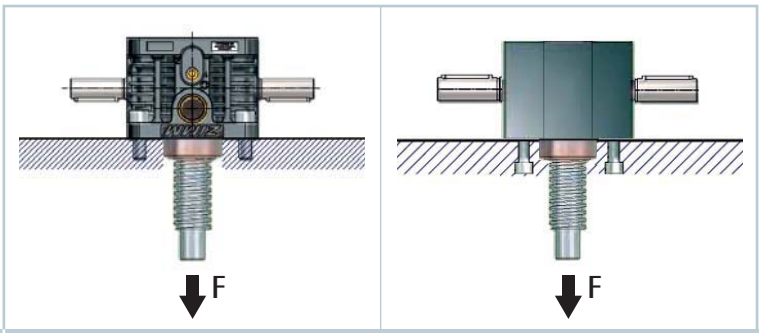
Compressive load



Z and GSZ	Rated load	Rated load

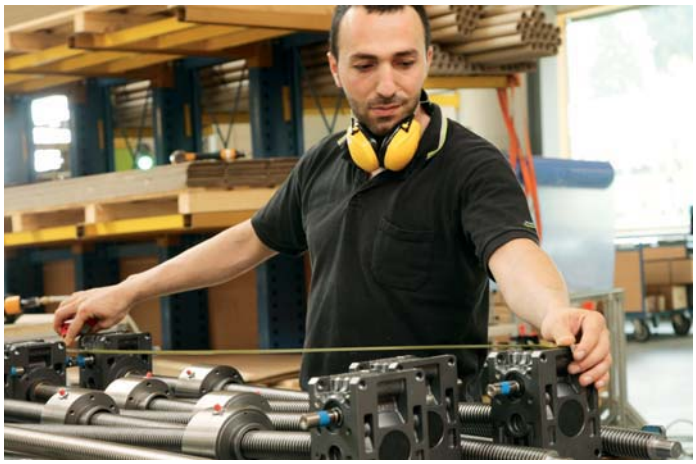
Full rated load
The gearbox can accept the full static rated load.

Mounting plate with tensile load



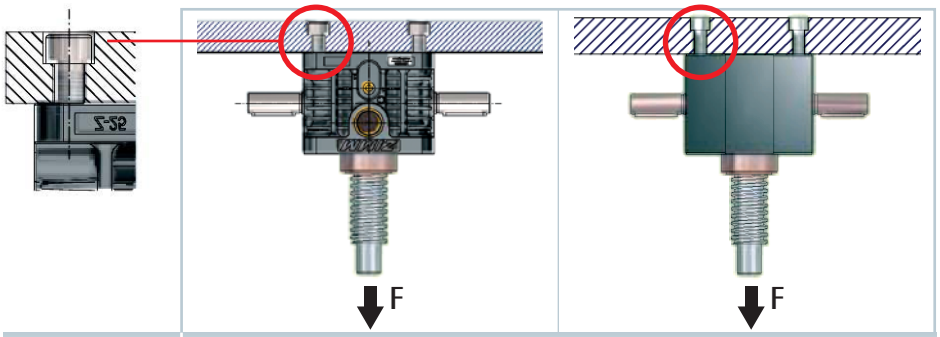
Z and GSZ	Rated load	Rated load

Full rated load
The gearbox can accept the full static rated load.



Permissible loads - fixed

Tensile load on the fixing screws (blind tapped holes) - Z and GSZ

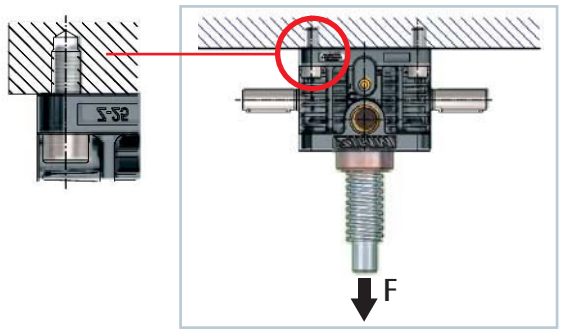


Z and GSZ | Rated load | Rated load

Full rated load
Providing the screw-in depth is maintained and the screws are tightened to the full tightening torque, the full rated load is permissible.

Gearbox	Thread*	Screw-in depth [mm]	Tightening torque [Nm]
GSZ-2	M6	8 to 10	8
GSZ-5, Z-5	M8	10 to 11.5	19
GSZ-10, Z-10	M8	10 to 15	17
GSZ-25, Z-25	M10	12 to 15	27
GSZ-50	M12	12 to 17	38
GSZ-100	M16	16 to 22	82

Tensile load on the fixing screws (though holes in the housing)



Screws 8.8

Gearbox	Permissible load
Z-5	2.5 kN
Z-10	3.5 kN
Z-25	10.0 kN
Z-35	29.8 kN
Z-50	27.5 kN
Z-100	27.0 kN
Z-150	56.5 kN
Z-250	70.0 kN
Z-350	180.0 kN
Z-500	110.0 kN
Z-750	210.0 kN
Z-1000	on request

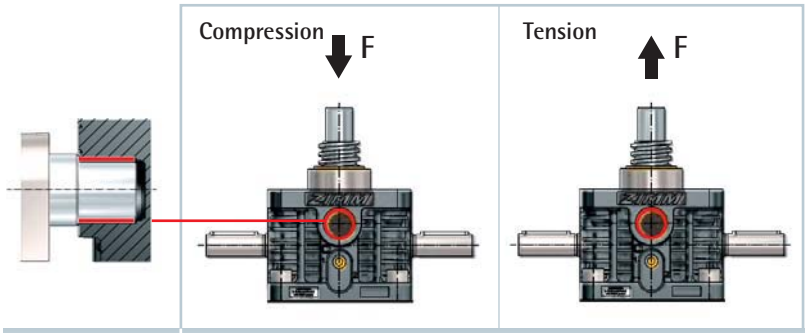
Reduced load
If the fixing screws on the housing are loaded in tension, only reduced loads are permissible.

For higher loads in tension, we can offer certain solutions on request.

Permissible loads - pivoting

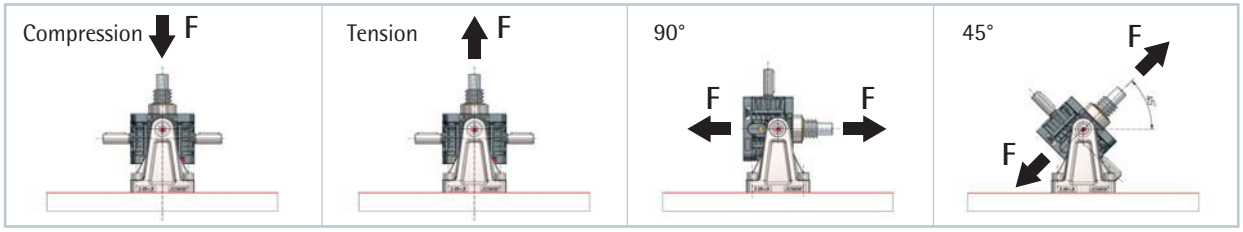
When dimensioning, include all the parts you will use

Z-5 to Z-25 – Pivot bearing in the housing



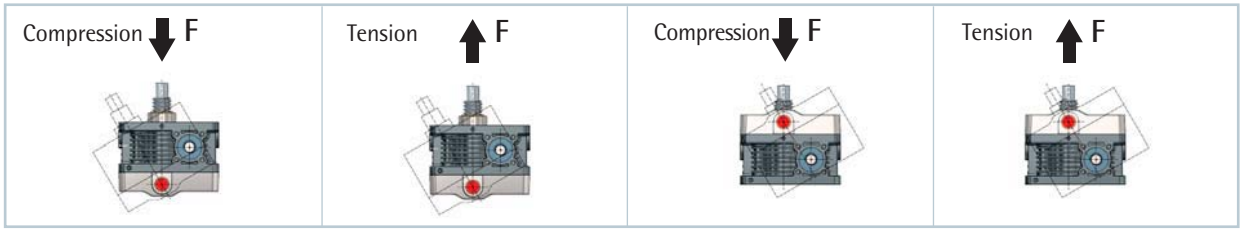
Z and GSZ	Rated load	Rated load

Z-5 to Z-25 – Pivot mounts LB



Z-5 (Z-5/10-LB)	Rated load 5 kN	Rated load 5 kN	Rated load 5 kN	Rated load 5 kN
Z-10 (Z-5/10-LB)	Rated load 10 kN	Rated load 10 kN	7 kN	6.5 kN
Z-25 (Z-25-LB)	19.5 kN	17.5 kN	10 kN	9.5 kN

Z-5 to Z-25 – Pivot bearing plate KAR



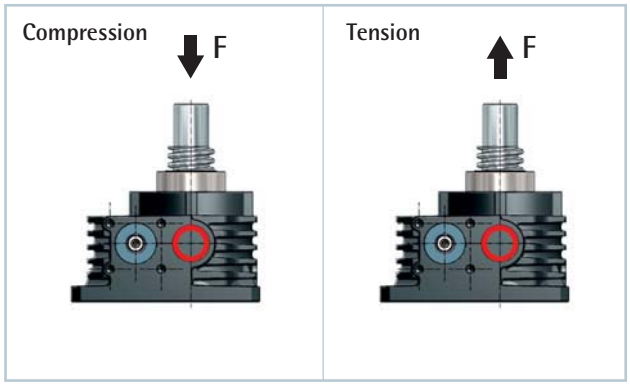
Z-5-KAR	Rated load 5 kN	2.5 kN	2.5 kN	Rated load 5 kN
Z-10-KAR	Rated load 10 kN	3.5 kN	3.5 kN	Rated load 10 kN
Z-25-KAR	Rated load 25 kN	10 kN	10 kN	Rated load 25 kN

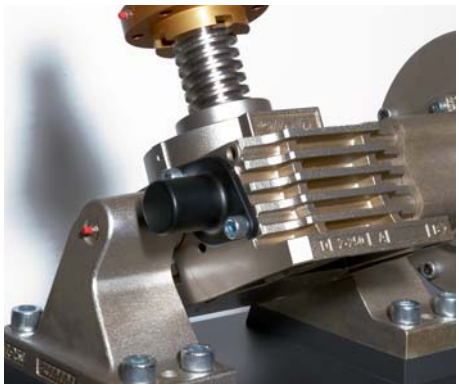
Direction of loading
The direction of loading should be selected so that the gearbox is pressed against the pivot bearing plate. When the load is in the opposite direction, reduced load values apply.

Permissible loads - pivoting

The gearbox housing is relevant to the specification.
The pivot mounts Z-35 to Z-1000 are specified for the full rated load in both directions.

Z-35 to Z-1000 – Pivot bearing in the housing

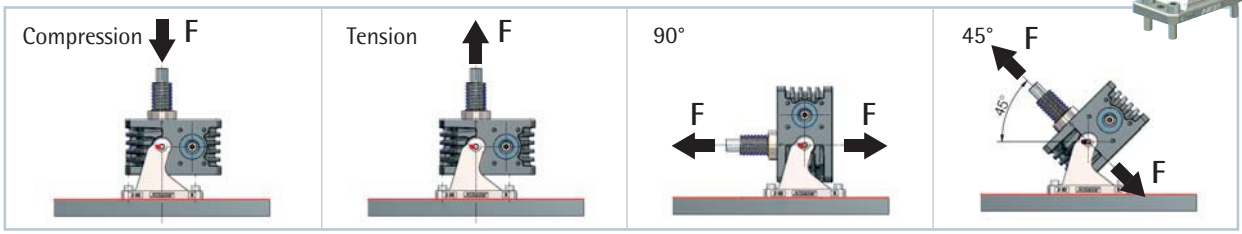




Z-35	Rated load 35 kN	Rated load 35 kN
Z-50	Rated load 50 kN	Rated load 50 kN
Z-100	Rated load 100 kN	Rated load 100 kN
Z-150	Rated load 150 kN	Rated load 150 kN
Z-250	177 kN	Rated load 250 kN
Z-350	250 kN	260 kN
Z-500	280 kN	310 kN
Z-750	on request	on request
Z-1000	on request	on request

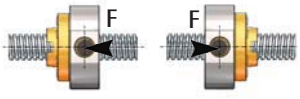
Z-35 to Z-1000 – Pivot mount LB

From Z-500 the gearbox is mounted the opposite way round, since the footplate is broader than the rest of the housing:



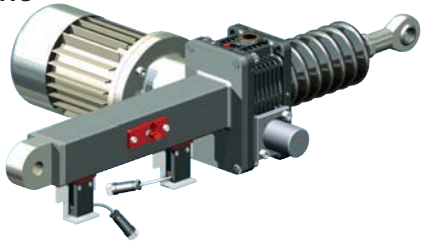
Z-35 to Z-1000	Rated load	Rated load	Rated load	Rated load

Duplex nut adapter DMA

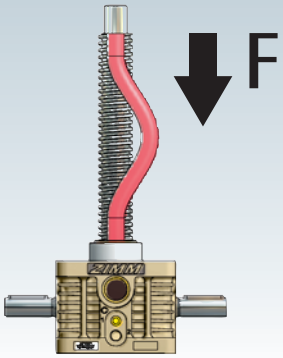


Main direction of loading
Select the main direction of loading so that tensile loads on the nut are avoided.

Support tube STRO



In compression the full rated load permissible. In tension the support tube should be subjected only to limited loads.



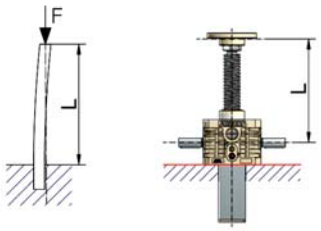
Critical buckling force of the screw

Explanatory notes:
I = 2nd moment of area expressed in mm⁴
F = Max. load/gearbox in N
L = Free screw length in mm
E = Modulus of elasticity for steel (210,000N/mm²)
v = Safety factor (normally 3)
d = Minimum core diameter of the screw

Example:

F = 45,000N/gearbox
L = 1320 mm
v = 3

Euler 1



unguided

Formula:

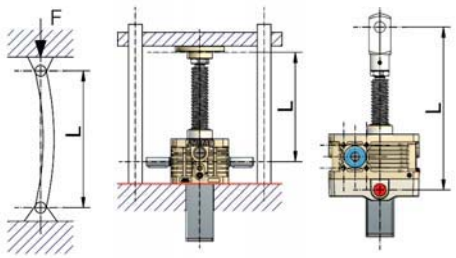
$$I = \frac{F \times v \times (L \times 2)^2}{\pi^2 \times E} \quad \text{then} \quad d = \sqrt[4]{\frac{I \times 64}{\pi}}$$

Example:

$$I = \frac{45{,}000\ N \times 3 \times (1{,}320\ mm \times 2)^2}{\pi^2 \times 210{,}000\ N/mm^2} = \frac{9.0896^{11}\ mm^4}{2{,}072{,}616.924} = 453{,}965.22\ mm^4$$

$$d = \sqrt[4]{\frac{453{,}965.22\ mm^4 \times 64}{\pi}} = 55.15\ mm \text{ minimum core diameter}$$
$$= \text{Z-250 (screw core Ø = 59.6 mm)}$$

Euler 2



S version guided Pivot drive

Formula:

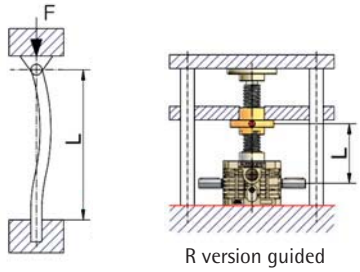
$$I = \frac{F \times v \times L^2}{\pi^2 \times E} \quad \text{then} \quad d = \sqrt[4]{\frac{I \times 64}{\pi}}$$

Example:

$$I = \frac{45{,}000\ N \times 3 \times (1{,}320\ mm)^2}{\pi^2 \times 210{,}000\ N/mm^2} = \frac{2.35224^{11}\ mm^4}{2{,}072{,}616.924} = 113{,}491.305\ mm^4$$

$$d = \sqrt[4]{\frac{113{,}491.305\ mm^4 \times 64}{\pi}} = 38.99\ mm \text{ minimum core diameter}$$
$$= \text{Z-100 (screw core Ø = 43.6 mm)}$$

Euler 3



R version guided

Formula:

$$I = \frac{F \times v \times (L \times 0.7)^2}{\pi^2 \times E} \quad \text{then} \quad d = \sqrt[4]{\frac{I \times 64}{\pi}}$$

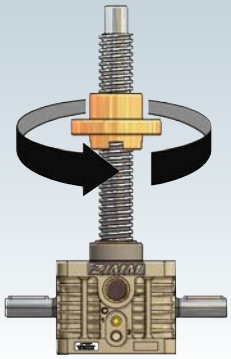
Example:

$$I = \frac{45{,}000\ N \times 3 \times (1{,}320\ mm \times 0.7)^2}{\pi^2 \times 210{,}000\ N/mm^2} = \frac{1.15259^{12}\ mm^4}{2{,}072{,}616.924} = 55{,}610.7396\ mm^4$$

$$d = \sqrt[4]{\frac{55{,}610.739\ mm^4 \times 64}{\pi}} = 32.62\ mm \text{ minimum core diameter}$$
$$= \text{Z-50/Tr50 (screw core Ø = 39.8 mm)}$$

	GSZ-2	Z-5	Z-10	Z-25	Z-35/50	Z-50/Tr50	Z-100	Z-150	Z-250	Z-350	Z-500	Z-750	Z-1000
Trapezoidal screw Tr	16x4	18x4	20x4	30x6	40x7	50x8	55x9	60x9	80x16	100x16	120x16	140x20	160x20
Core Ø in mm (minimum)	10.9	12.9	14.9	22.1	31.0	39.8	43.6	48.6	59.6	80.6	99.6	115.0	135.0
Ball screw KGT Ø mm	16	16	25	32	40	-	50	63	80	100	125	140	160
Core Ø in mm (minimum*)	12.9	12.9	21.5	27.3	34.1	-	43.6	51.8	67	87.4	107.8	117	132.8

*Depending on the pitch, the core Ø may be even larger. See the KGT pages in Sections 2 and 3 for the exact core Ø values.



Critical whirling speed for R gearboxes

Maximum permissible screw rotational speed

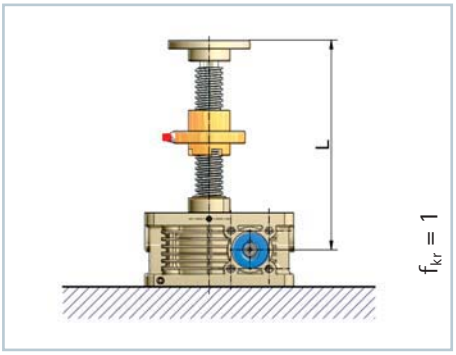
$n_{zul} = 0.8 \times n_{kr} \times f_{kr}$

n_{zul} Maximum permissible screw speed (rpm)

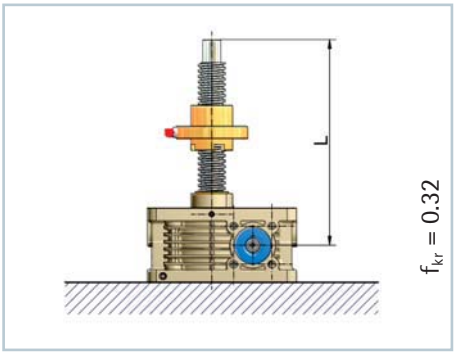
n_{kr} Theoretical critical screw speed (rpm) leading to resonant vibrations (see diagram)

f_{kr} Correction factor which makes allowance for the type of screw bearing

The operating rotational speed must not exceed 80% of the maximum rotational speed

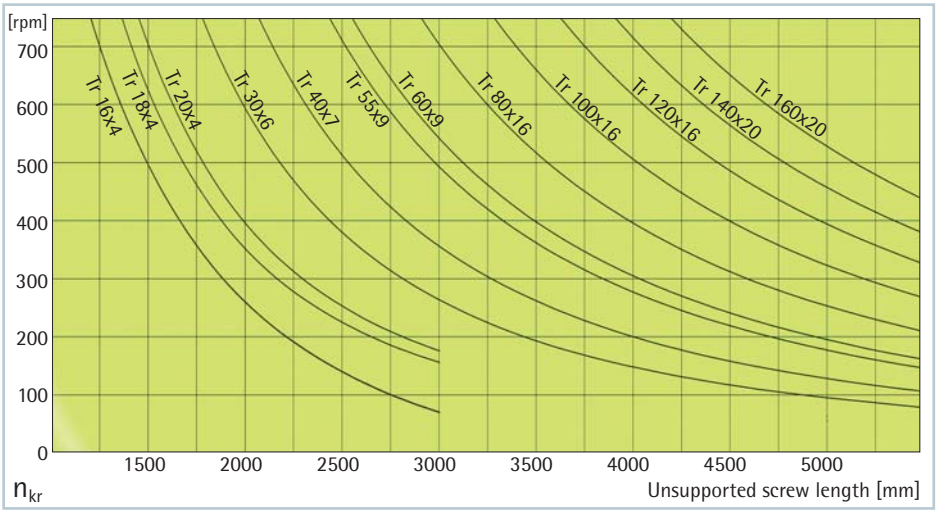


with end mounted bearings
(preferred solution)



without end mounted bearings
(avoid as far as possible)

$$\text{Screw speed} = \frac{\text{Input drive speed}}{i_{gearbox}}$$

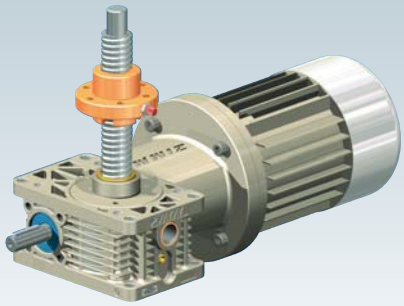


The maximum allowable screw speed must be calculated for R version gearboxes (with rotating screws) with long thin screws.
To do this, read the theoretical critical speed n_{kr} from the diagram. Take into account also the additional lengths for screw covers etc. when calculating unsupported screw lengths.
Now use the formula together with the correction factor for the screw bearing arrangement to calculate the maximum allowable screw speed.

If the calculated maximum screw speed is lower than the required speed, select a larger screw or a double-pitch screw with half the speed. This must then be checked also.
You have the option to use a "increased screw" for the R version (screw for the next larger gearbox).

Bear in mind that a larger pitch demands a higher drive torque.

CAUTION:
Long, thin screws can tend to squeak even though they satisfy the critical whirling speed! Therefore allow a sufficient margin of safety in the calculation.



Determining the drive torque [M_G] of a single screw jack

Explanatory notes:

M_G	necessary drive torque [Nm] for a screw jack
F	Lifting load (dynamic) [kN]
$\eta_{gearbox}$	Efficiency of the screw jack (without screw)
η_{screw}	Efficiency of the screw
P	Screw pitch [mm]
i	Drive ratio of the screw jack
M_L	Idling torque [Nm]
P_M	Motor drive power

The following specifications serve to calculate the required drive torque.
For gearboxes with single-pitch trapezoidal screws the load can simply be multiplied by the factor stated on the corresponding gearbox page (Sections 2 + 3).

Use at least 10% of the gearbox rated load for the calculation, even if the effective load is less than this (i.e. for the Z-250 use at least 25 kN).

Formula:

1) Drive torque: $M_G = \dfrac{F\,[kN] \cdot P\,[mm]}{2 \cdot \pi \cdot \eta_{gearbox} \cdot \eta_{screw} \cdot i} + M_L\,[Nm]$

2) Motor power: $P_M[kW] = \dfrac{M_G\,[Nm] \cdot n\,[rpm]}{9550}$

3) We recommend multiplying the calculated value by a safety factor of 1.3 to 1.5 (up to 2 for small systems and for low speeds).

Example:

Z-25-SN
F = 12 kN (dynamic lift load)
$\eta_{gearbox}$ = 0.87 η_{screw} = 0.391
P = 6 i = 6

1) $M_G = \dfrac{12\ kN \cdot 6\ mm}{2 \cdot \pi \cdot 0.87 \cdot 0.391 \cdot 6} + 0.36\ Nm =$ **5.97 Nm**

2) $P_M = \dfrac{5.97\ Nm \cdot 1500\ rpm}{9550} =$ **0.938 kW**

3) Example: 0.938 kW · 1.5 = 1.407 kW ⟶ **motor 1.5 kW**

Efficiencies of the screw jack $\eta_{gearbox}$ (without screw)

i	rpm	GSZ-2	Z-5	Z-10	Z-25	Z-35	Z-50	Z-100	Z-150	Z-250	Z-350	Z-500	Z-750	Z-1000
N	3000	0.87	0.81	0.83	0.87	-	-	-	-	-	-	-	-	-
N	1500	0.87	0.82	0.84	0.87	0.87	0.87	0.88	0.89	0.91	-	-	-	-
N	1000	0.86	0.82	0.82	0.86	0.87	0.86	0.87	0.89	0.90	0.91	0.92	0.88	0.90
N	750	0.86	0.82	0.84	0.85	0.86	0.85	0.87	0.88	0.90	0.91	0.92	0.88	0.90
N	500	0.85	0.82	0.84	0.83	0.85	0.84	0.85	0.87	0.89	0.90	0.92	0.87	0.89
N	100	0.74	0.77	0.79	0.78	0.78	0.78	0.78	0.80	0.83	0.86	0.87	0.81	0.84
L	3000	0.78	0.74	0.78	0.76	-	-	-	-	-	-	-	-	-
L	1500	0.77	0.70	0.74	0.72	0.64	0.66	0.67	0.67	0.78	-	-	-	-
L	1000	0.75	0.67	0.72	0.70	0.64	0.66	0.65	0.66	0.77	0.78	0.76	0.67	0.76
L	750	0.74	0.65	0.70	0.68	0.64	0.66	0.65	0.65	0.76	0.78	0.75	0.66	0.76
L	500	0.71	0.62	0.67	0.65	0.63	0.65	0.65	0.63	0.75	0.77	0.73	0.65	0.75
L	100	0.54	0.53	0.59	0.54	0.52	0.55	0.57	0.53	0.65	0.67	0.61	0.58	0.66

Efficiencies of the screws η_{screw} calculated for coefficient of friction μ = 0.11

Tr screw, single-pitch	16x4	18x4	20x4	30x6	40x7	50x8	55x9	60x9	80x16	100x16	120x16	140x20	160x20	Ball screw
Efficiency	0.453	0.420	0.391	0.391	0.357	0.335	0.340	0.320	0.391	0.335	0.293	0.308	0.278	
Tr screw, double-pitch	16x8P4	18x8P4	20x8P4	30x12P6	40x14P7	50x16P8	55x18P9	60x18P9	80x32P16	100x32P16	120x32P16	140x40P20	160x40P20	0.9
Efficiency	0.623	0.591	0.563	0.563	0.526	0.502	0.508	0.484	0.563	0.502	0.453	0.471	0.436	

Idling torques M_L of screw jacks [Nm] (without screw, at 20°C - significantly higher at low temperatures)

Z	2	5	10	25	35	50	100	150	250	350	500	750	1000
N	0.08	0.10	0.26	0.36	0.56	0.76	1.68	1.90	2.64	3.24	3.96	7.28	9.70
L	0.06	0.08	0.16	0.26	0.40	0.54	1.02	1.20	1.94	2.20	2.84	4.42	5.90

These are indicative values for calculation. Series production models may vary!

Nm

Maximum torques

Maximum input torque

In order to achieve optimum service life, do not exceed the values shown. If operating hours are lower, higher values may be achieved. Please contact us for advice.

max. input drive torques M_R [Nm]

i	rpm	GSZ-2	Z-5	Z-10	Z-25	Z-35	Z-50	Z-50/Tr50	Z-100	Z-150	Z-250	Z-350	Z-500	Z-750	Z-1000
N	3000	1.2	4.0	11.0	17.0	-	-	-	-	-	-	-	-	-	-
N	1500	1.4	4.7	13.5	18.0	19.8	31.5	31.5	53.4	75.1	152	-	-	-	-
N	1000	1.5	5.6	14.0	22.0	20.8	36.8	36.8	60.8	77.1	152	265	408	480	680
N	500	1.6	6.1	16.7	28.0	24.8	46.5	46.5	75.3	95.0	160	350	500	640	960
L	3000	0.5	1.4	5.7	8.5	-	-	-	-	-	-	-	-	-	-
L	1500	0.5	1.5	7.5	10.0	9	10.4	10.4	13.5	20.7	41.4	-	-	-	-
L	1000	0.5	1.8	8.7	11.0	9.7	14.9	14.9	15.4	23.7	47.4	100	170	210	450
L	500	0.6	2.2	10.7	14.0	11.1	19.2	19.2	18.9	29.4	63.5	112	220	240	580

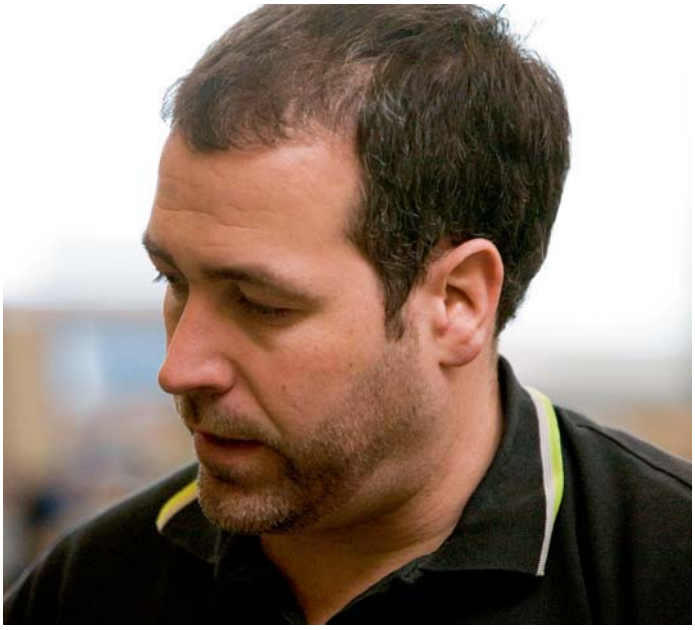
The stated limit values are mechanically-based - thermal factors may be relevant depending on the duty cycle

Max. drive-through torque

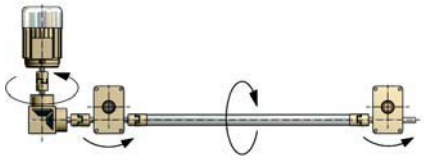
Where several gearboxes are arranged in series the drive-through torque may be significantly greater than the maximum input drive torque. Only the torsional load on the shaft needs to be considered, not the load on the gear teeth.

max. worm shaft drive-through torque [Nm]

GSZ-2	Z-5	Z-10	Z-25	Z-35	Z-50	Z-50/Tr50	Z-100	Z-150	Z-250	Z-350	Z-500	Z-750	Z-1000
9	39	57	108	130	260	260	540	540	770	1800	1940	4570	4570



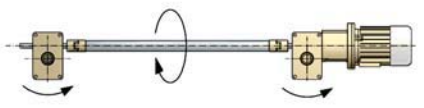
Drive torque for screw jacks - approximate calculation



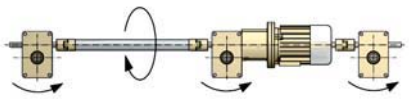
$M_R = M_G \times 2.4$

Calculation
The drive torque required for a lifting system is the sum of the torques for the individual screw jacks and increases due to frictional losses on transfer components such as couplings, connecting shafts, bevel gearboxes etc.

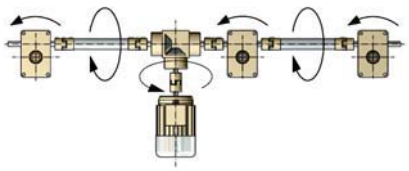
To simplify the calculation, the following factors are used to determine the drive torque for the most common system layouts.



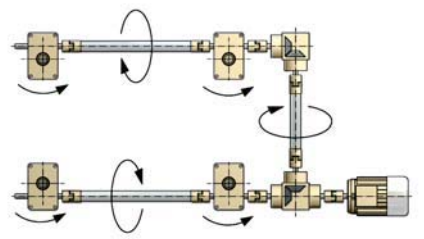
$M_R = M_G \times 2.1$



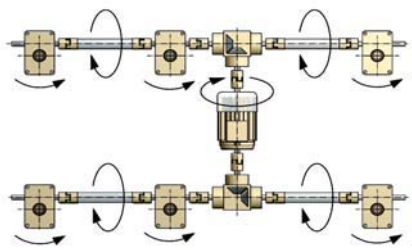
$M_R = M_G \times 3.1$



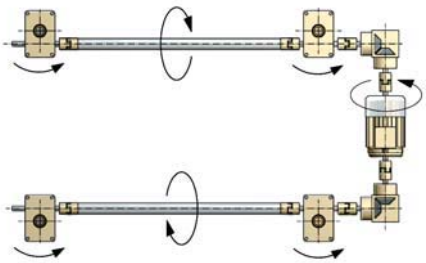
$M_R = M_G \times 3.6$



$M_R = M_G \times 4.9$



$M_R = M_G \times 7.1$

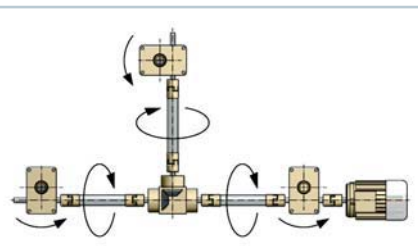


$M_R = M_G \times 4.8$

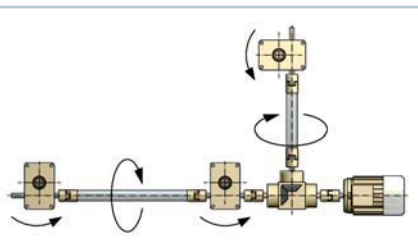
M_R - Overall drive torque for the entire system.

M_G - Drive torque for an single gearbox

M_A - Starting torque max. 1.5 x M_R

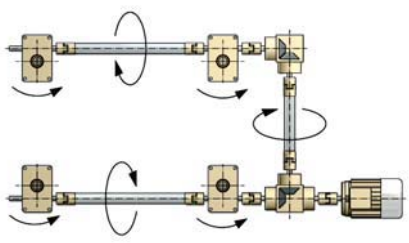


$M_R = M_G \times 3.5$



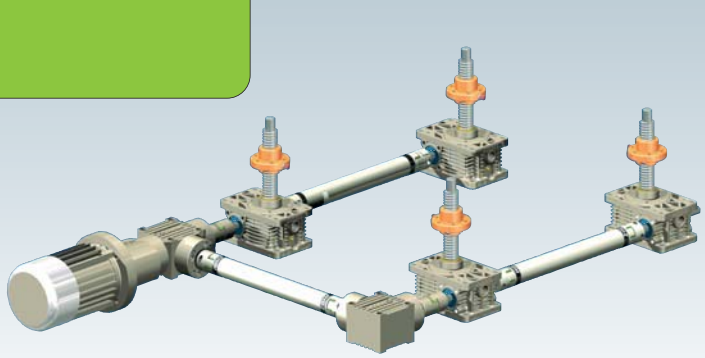
$M_R = M_G \times 3.6$

Example (example from page 162, 12 kN per gearbox)

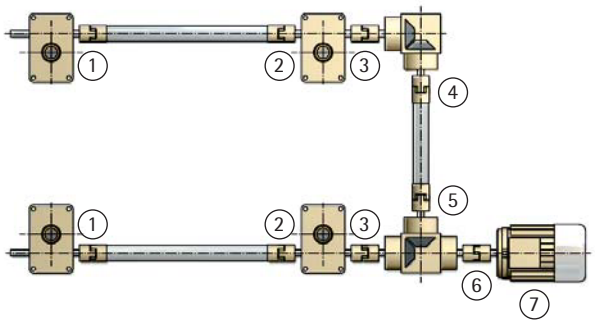


$M_R = M_G \times 4.9 = 5.97$ Nm $\times 4.9 =$ **29.25 Nm**
→ x safety factor 1.4 = **40.95 Nm**

CAUTION:
We recommend multiplying the calculated value by a safety factor of 1.3 to 1.5 (up to 2 for small systems and for low speeds).
The values stated assume equal distribution of the load across all gearboxes!



Drive torque for screw jacks – precise calculation



The following calculation example takes account of the efficiency of the connecting shafts (η 0.95) and bevel gearboxes (η 0.9).

Formula for the gearbox::

Drive torque: $M_G = \frac{F\,[kN] \cdot P\,[mm]}{2 \cdot \pi \cdot \eta_{gearbox} \cdot \eta_{screw} \cdot i} + M_L\,[Nm]$

Efficiencies:
Connecting shafts: η 0.95
Bevel gearbox: η 0.90

Example:

1) $M_G = \frac{12\ kN \cdot 6\ mm}{2 \cdot \pi \cdot 0.87 \cdot 0.391 \cdot 6} + 0.36\ Nm = \mathbf{5.97\ Nm}$

Z-25-SN
F = 12 kN (dynamic lift load per gearbox)
$\eta_{gearbox}$ = 0.87 η_{screw} = 0.391
P = 6 i = 6

2) $\frac{5.97\ Nm}{0.95} = \mathbf{6.28\ Nm}$
(efficiency of the connecting shaft)

3) 5.97 Nm + 6.28 Nm = **12.25 Nm**

12.25 Nm · 1.5 = 18.38 Nm
-> so KSZ-25-L is OK (see Section 5)

4) $\frac{12.25\ Nm}{0.9} = \mathbf{13.61\ Nm}$
(efficiency of the bevel gearbox)

5) $\frac{13.61\ Nm}{0.95} = \mathbf{14.33\ Nm}$

6) 12.25 Nm + 14.33 Nm/0.9 = **29.53 Nm**

7) 29.53 Nm · 1.4 = 41.34 Nm

41.34 Nm –> we need a KSZ-50-L
(see Section 5)

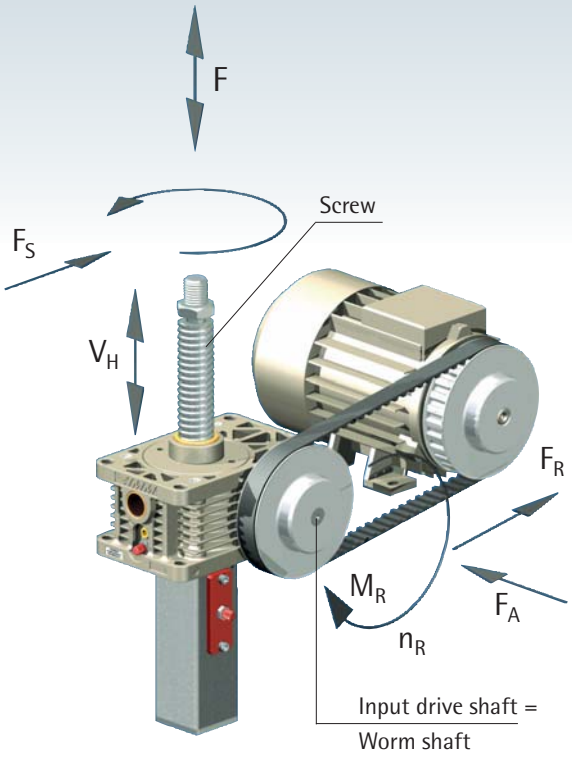
We recommend multiplying the calculated value by a safety factor of 1.3 to 1.5 (up to 2 for small systems and for low speeds).

Motor selection: 132M-P4-7.5 kW (50 Nm)
(for motors see Section 4)

maximum forces / torques

Loading definitions:

F - Lifting load tensile and/or compressive
F_S - Lateral loads on the screw
v_H - Lifting speed of the screw (or nut if the R version)
F_A - Axial load on the input shaft
F_R - Radial load on the input shaft
M_R - Input torque
n_R - Input speed



Lateral forces on the lifting screw
The maximum permissible lateral forces are shown in the table on the right. Lateral forces should generally be taken by linear guides. The guide bushing in the gearbox functions only as a secondary guide.
The maximum lateral forces actually occurring must be less than the values shown in the table!

CAUTION: only applies to static forces.

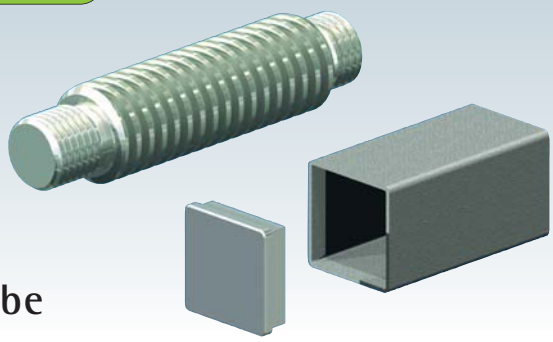
maximum lateral force F_S [N] (only static) — extended screw length in mm

Z	100	200	300	400	500	600	700	800	900	1000	1200	1500	2000	2500	3000
5	360	160	100	70	55	45	38	32	28	25	20	18	12	–	–
10	600	280	180	130	100	80	70	60	50	47	40	30	20	15	–
25	900	470	300	240	180	150	130	110	100	90	70	60	45	35	30
35	1300	700	450	360	270	220	190	160	150	130	100	90	60	50	40
50	3000	2000	1300	900	700	600	500	420	380	330	280	230	160	130	100
100	5000	4000	3000	2300	1800	1500	1300	1100	950	850	700	600	400	350	250
150	5500	5000	3900	2800	2300	1800	1500	1300	1200	1000	850	750	500	400	350
250	9000	9000	6500	4900	3800	3000	2500	2200	2000	1900	1450	1250	900	760	660
350	15000	13000	12000	10000	8800	7000	6000	5500	4800	4300	3500	3000	2000	1600	1400
500	29000	29000	29000	29000	29000	24000	20000	17000	15000	14000	12000	9000	7000	5600	4900
750	34800	34800	34800	34800	34800	28800	24000	20400	18000	16800	14400	10800	8400	6720	5880
1000	46000	46000	39000	36000	32000	30000	25000	29000	25000	23500	20000	17000	12000	10000	8000

Radial load on the input shaft
Make sure that the radial forces arising where chain or belt drives are used do not exceed the values stated in the table alongside.

maximum radial load on the input shaft F_R [N]

	Z-5	Z-10	Z-25	Z-35	Z-50	Z-100	Z-150	Z-250	Z-350	Z-500	Z-750	Z-1000
F_R max.	110	190	260	260	420	650	670	1100	1400	2600	3000	3400



Length calculation – screw and protective tube

A quicker method
The tables on the following pages allow you to calculate the required screw length and protective tube extension length yourself. This lets you quickly calculate the fitting dimensions of your screw jack.

Principle
Depending on the version and accessories used the screw (and the protective tube on the S version) are extended.
These dimensions are minimum requirements. For special fitting situations, please provide a drawing or contact our project technicians.

Stroke + basic length (+ various extensions for variants/accessories)

Example S:

Z-25-SN, stroke: 250 mm
Bellows Z-25-FB-300 (ZD=70mm)
Fixing flange BF (means the bellows do not require an fixing ring)
Rotation protection VS
Limit switch ES

Screw length Tr:

250 Stroke	+	180 Basic length	+	44 Bellows (70-26=44) Section 4	+	45 Limit switch + rotation protection	=	519 mm Screw length

Protective tube length SRO:

250 Stroke	+	53 Basic length	+	72 Limit switch + Rotation protection	=	375 Protective tube length

Example R:

Z-25-RN, stroke 250 mm
Screw with end support (opposed bearing plate GLP)
Bellows Z-25-FB-300 (ZD=70mm) above and underneath
Duplex nut DM

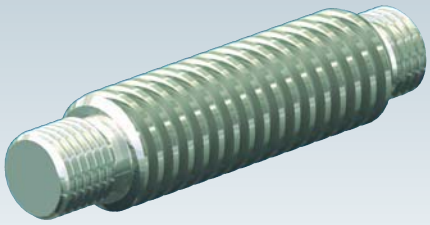
Screw length Tr:

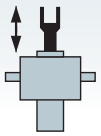
250 Stroke	+	139 Basic length	+	60 Bellows gearbox side (70-10=60)	+	55 2nd bellows (70-15=55)	+	50 Duplex nut	=	554 mm Screw length

See Section 4 for the length calculation for connecting shafts.

Abbreviations:

Tr	Trapezoidal screw	KGT	Ball screw
AS	Escape protection	KAR	Pivot bearing plate
BF	Fixing flange	KGK	Rod end
ES	Limit switch	SLK	Pivot bearing end
FBR	Bellows fixing ring	ZD	Compressed length
GK	Forked end		





S

Length calculation – screw, translating version S

(The length calculation is identical for Z and GSZ)

GSZ-2 to Z-150:		GSZ-2	Z-5	Z-10	Z-25	Z-35	Z-50	Z-50/Tr50	Z-100	Z-150
Tr basic length	Tr	118	139	161	180	219	240	263	338	342
KGT basic length	KGT	-	16x05 203	25x05 240	32x05 272	-	40x05 324	-	50x10[3] 420	63x10[5] 432
		-	16x10 224	25x10 260	32x10 282	-	40x10 324	-	50x20[3] 460	63x20[6] 506
		-	-	25x25 330	32x20 312	-	40x20 354	-	50x10[4] 456	63x10[7] 460
		-	-	25x50 460	32x40 382	-	40x40 414	-	50x20[4] 496	63x20[7] 500
		-	-	-	-	-	-	-	50x40[4] 576	63x40[7] 580
		-	-	-	-	-	-	-	-	63x60[7] 660
Tr basic length with safety nut	Tr	-	-	219	239	280	305	-	411	423
Escape/rotation protection AS/VS	Tr/KGT	15	15	20	20	30	30	30	30	30
Limit switch ES[2]	Tr	43	43	45	45	59	55	55	45	45
ES[2] and pivot bearing plate KAR	Tr	65	64	65	69	85	80	80	90	95
Limit switch ES[2]	KGT	-	16x05 38	25x05 40	32x05 40	-	40x05 50	-	50x10 45	63x10 45
		-	16x10 28	25x10 30	32x10 35	-	40x10 50	-	50x20 30	63x20 30
		-	-	25x25 20	32x20 20	-	40x20 35	-	50x40 30	63x40 30
		-	-	25x50 20	32x40 20	-	40x40 30	-	-	63x60 30
ES[2] and pivot bearing plate KAR	KGT	-	16x05 59	25x05 60	32x05 64	-	40x05 75	-	50x10 90	63x10 95
		-	16x10 49	25x10 50	32x10 59	-	40x10 75	-	50x20 70	63x20 75
		-	-	25x25 20	32x20 44	-	40x20 60	-	50x40 30	63x40 35
		-	-	25x50 20	32x40 20	-	40x40 30	-	-	63x60 30
Bellows with bellows fixing ring (GK/KGK)[1]		ZD-1	ZD-2	ZD+1	ZD+5	ZD+10	ZD+10	ZD+8	ZD-2	ZD-2
Bellows without bellows fixing ring (BF/SLK)[1]		ZD-18	ZD-22	ZD-24	ZD-26	ZD-36	ZD-36	ZD-40	ZD-50	ZD-22
Bellows and KAR with FBR (GK/KGK)[1]		ZD+32	ZD+31	ZD+28	ZD+46	ZD+63	ZD+63	ZD+81	ZD+60	ZD+68
Bellows and KAR without FBR (BF/SLK)[1]		ZD+15	ZD+11	ZD+3	ZD+15	ZD+17	ZD+17	ZD+33	ZD+12	ZD+48

Z-250 to Z-1000:		Z-250	Z-350	Z-500	Z-750	Z-1000
Tr basic length	Tr	370	424	552	619	643
KGT basic length	KGT	80x10 561	100x20 663	125x25 823	140x25 976	160x25 1024
		80x20 601	100x40 743	125x40 883	140x40 1036	160x40 1084
		80x40 681	100x60 823	125x60 963	140x60 1116	160x60 1164
		80x60 761	100x80 943	125x80 1043	140x80 1196	160x80 1244
Tr basic length with safety nut		507	-	-	-	-
Escape/rotation protection AS/VS	Tr/KGT	30	35	40	40	40
Limit switch ES[2]	Tr	43	46	40	48	48
Limit switch ES[2]	KGT	80x10 43	100x20 35	125x25 40	140x25 40	160x25 40
		80x20 30	100x40 35	125x40 40	140x40 40	160x40 40
		80x40 30	100x60 35	125x60 40	140x60 40	160x60 40
		80x60 30	100x80 35	125x80 40	140x80 40	160x80 40
Bellows with bellows fixing ring (GK/KGK)[1]		ZD-2	ZD-2	ZD-22	ZD-22	ZD-22
Bellows without bellows fixing ring (BF/SLK)[1]		ZD-22	ZD-22	ZD-42	ZD-42	ZD-42

Safety distances are already included in the basic lengths!
(Tr screws: 10 mm up to Z-50, 20 mm for Z-100 to Z-500, 40 mm for Z-750 and Z-1000)

1) The value will be added to or subtracted from the ZD dimension of the bellows depending on the sign and the result then added to the screw length.
Applicable only to Tr single-pitch screws, not to double-pitch and KGT screws.

2) Limit switches ES are always used in combination with rotation protection VS (VS is included in the extension).

3) KGT 50: L6=82

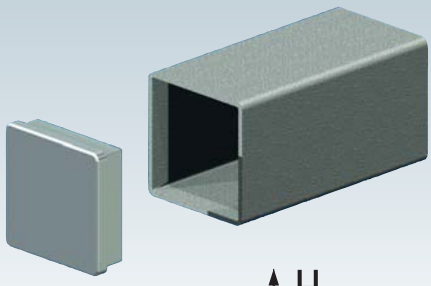
4) KGT 50: L6=118

5) KGT 63: L6=90

6) KGT 63: L6=124

7) KGT 63: L6=118

Screw extension for spiral spring cover SF:
Since the extension for spiral spring covers varies according to the fitting, this variant must be determined from a drawing. We would be pleased to prepare this drawing for you.



Length Calculation – protective tube SRO, translating version S

(The length calculation is identical for Z and GSZ)

S

GSZ-2 to Z-150:		GSZ-2	Z-5	Z-10	Z-25	Z-35	Z-50	Z-50/Tr50	Z-100	Z-150
Tr basic length[1]	Tr	47	46	49	53	57	62	62	82	87
KGT basic length[1]	KGT	–	16x05 56	25x05 59	32x05 63	–	40x05 72	–	50x10 82	63x10 87
		_	16x10 76	25x10 79	32x10 73	–	40x10 72	–	50x20 122	63x20 127
		_	–	25x25 149	32x20 103	–	40x20 102	–	50x40 202	63x40 207
		_	–	25x50 279	32x40 173	–	40x40 162	–	–	63x60 287
Escape/rotation protection AS/VS	Tr/KGT	15	15	20	20	30	30	30	30	30
Limit switch ES[3]	Tr	70	73	72	72	86	82	82	62	62
ES[3] and pivot bearing plate KAR	Tr	92	94	92	96	112	107	107	107	112
Limit switch ES[3]	KGT	–	16x05 63	25x05 62	32x05 62	–	40x05 72	–	50x10 62	63x10 62
		–	16x10 43	25x10 52	32x10 52	–	40x10 72	–	50x20 30	63x20 30
		–	–	25x25 20	32x20 22	–	40x20 42	–	50x40 30	63x40 30
		–	–	25x50 20	32x40 20	–	40x40 30	–	–	63x60 30
ES[3] and pivot bearing plate KAR	KGT	–	16x05 84	25x05 82	32x05 86	–	40x05 97	–	50x10 107	63x10 112
		–	16x10 64	25x10 72	32x10 76	–	40x10 97	–	50x20 70	63x20 75
		–	–	25x25 20	32x20 46	–	40x20 67	–	50x40 30	63x40 35
		–	–	25x50 20	32x40 20	–	40x40 30	–	–	63x60 30

Z-250 to Z-1000[4]:		Z-250	Z-350	Z-500	Z-750	Z-1000
Tr basic length[1]	Tr	92	107	157	157	157
KGT basic length[1]	KGT	80x10 92	100x20 147	125x25 177	140x25 177	160x25 177
		80x20 132	100x40 227	125x40 237	140x40 237	160x40 237
		80x40 212	100x60 307	125x60 317	140x60 317	160x60 317
		80x60 292	100x80 387	125x80 397	140x80 397	160x80 397
Escape/rotation protection AS/VS	Tr/KGT	30	35	40	40	40
Limit switch ES[3]	Tr	58	59	40	48	48
Limit switch ES[3]	KGT	80x10 58	100x20 35	125x25 40	140x25 40	160x25 40
		80x20 30	100x40 35	125x40 40	140x40 40	160x40 40
		80x40 30	100x60 35	125x60 40	140x60 40	160x60 40
		80x60 30	100x80 35	125x80 40	140x80 40	160x80 40

CAUTION: minimum stroke with limit switch ES[2]:

GSZ-2 to Z-150:	GSZ-2	Z-5	Z-10	Z-25	Z-35	Z-50	Z-50/Tr50	Z-100	Z-150
minimum stroke with limit switch ES	53	50	51	51	41	42	42	42	42
minimum stroke with ES and lubrication strip SL	123	120	121	121	111	112	112	112	112

Z-250 to Z-1000:	Z-250	Z-350	Z-500	Z-750	Z-1000
minimum stroke with limit switch ES	47	42	46	46	46
minimum stroke with ES and lubrication strip SL	117	112	116	116	116

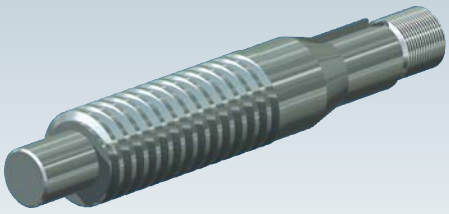
1) Basic length of the protective tube without a cap.
The cap height is 5 mm.

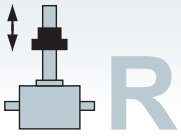
2) If a shorter stroke than specified is is required, the limit switches and lubrication strip may be fitted on different faces.

3) Limit switches ES are always used in combination with rotation protection VS (VS is included in the extension).

4) Z-250 - Z-1000:
- only screw, or screw with escape protection AS (round protective tube)
- with rotation protection VS or VS + limit switch ES (square protective tube)

Abbreviations:
Tr Trapezoidal screw
KGT Ball screw
KAR Pivot bearing plate





Length Calculation – screw, rotating version R

(The length calculation is identical for Z and GSZ)

GSZ-2 to Z-150:	GSZ-2	Z-5	Z-10	Z-25	Z-35	Z-50	Z-100	Z-150
Tr basic length without journal	78	86	102	114	132	148	222	250
Tr basic length with journal (= standard for opposed bearing plate GLP)	90	101	122	139	162	178	267	305
Tr basic length increased screw with journal[1]	93	106	127	144	177	193	277	325
KGT basic length with journal[2]	16x05 100 16x10 120	16x05 111 16x10 131	25x05 132 25x10 152 25x25 222 25x50 352	32x05 149 32x10 159 32x20 189 32x40 259	40x05 172 40x10 172 40x20 202 40x40 262	40x05 188 40x10 188 40x20 218 40x40 278	50x10 267 50x20 307 50x40 387 50x50 427	63x10 305 63x20 345 63x40 425 63x60 505
KGT basic length increased screw with journal[1][2]		25x05 116 25x10 136 25x25 206 25x50 336	32x05 137 32x10 147 32x20 177 32x40 247	40x05 154 40x10 154 40x20 184 40x40 244	50x10 197 50x20 237 50x40 317 50x50 357	50x10 213 50x20 253 50x40 333 50x50 373	63x10 277 63x20 317 63x40 397 63x60 477	80x10 325 80x20 365 80x40 445 80x60 525
KGT basic length without journal[2]	16x05 88 16x10 108	16x05 96 16x10 116	25x05 112 25x10 132 25x25 202 25x50 332	32x05 124 32x10 134 32x20 164 32x40 234	40x05 142 40x10 142 40x20 172 40x40 232	40x05 158 40x10 158 40x20 188 40x40 248	50x10 222 50x20 262 50x40 342 50x50 382	63x10 250 63x20 290 63x40 370 63x60 450
KGT basic length increased screw without journal[1][2]		25x05 96 25x10 116 25x25 186 25x50 316	32x05 112 32x10 122 32x20 152 32x40 222	40x05 124 40x10 124 40x20 154 40x40 214	50x10 152 50x20 192 50x40 272 50x50 312	50x10 168 50x20 208 50x40 288 50x50 328	63x10 222 63x20 262 63x40 342 63x60 422	80x10 250 80x20 290 80x40 370 80x60 450
Flange nut FM	35	35	44	46	66	66	-	90
Duplex nut DM	45	45	45	50	70	70	90	115
Self-aligning nut PM	-	78	83	95	129	129	190	210
Greaseless duplex nut FFDM	-	53	53	59	85	85	-	-
DM + safety nut SIFA	70	70	84	95	133	133	173	211
PM + safety nut SIFA	-	123	128	158	212	212	298	330
1. Bellows[3]	ZD-10	ZD-12	ZD-12	ZD-10	ZD-12	ZD-12	ZD-22	ZD-22
2. Bellows[3]	ZD-10	ZD-10	ZD-14	ZD-15	ZD-15	ZD-15	ZD-20	ZD-30
KAR screw face and 1st bellows[3]	ZD+23	ZD+21	ZD+15	ZD+31	-	-	-	-
KGT flange nut KGF	add the respective nut length							

Z-250 to Z-1000:	Z-250	Z-350	Z-500	Z-750	Z-1000
Tr basic length without journal	265	288	366	417	438
Tr basic length with journal (= standard for opposed bearing plate GLP)	340	388	486	537	613
Tr basic length increased screw with journal[1]	365	408	486	592	-
KGT basic length with journal[2]	80x10 340 80x20 380 80x40 460 80x60 540	100x20 428 100x40 508 100x60 588 100x80 668	125x25 506 125x40 566 125x60 646 125x80 726	140x25 557 140x40 617 140x60 697 140x80 777	160x25 633 160x40 693 160x60 773 160x80 853
KGT basic length without journal[2]	80x10 265 80x20 305 80x40 385 80x60 465	100x20 328 100x40 408 100x60 488 100x80 568	125x25 386 125x40 446 125x60 526 125x80 606	140x25 437 140x40 497 140x60 577 140x80 657	160x25 458 160x40 518 160x60 598 160x80 678
Duplex nut DM	140	160	180	220	320
Self-aligning nut PM	224	275	-	-	-
DM + safety nut SIFA	250	270	303	365	500
PM + safety nut SIFA	369	455	-	-	-
1. Bellows[3]	ZD-22	ZD-22	-	-	-
2. Bellows[3]	ZD-40	ZD-60	-	-	-
KGT flange nut KGF	add the respective nut length				

Safety distances are already included in the basic lengths (2x: 1x above and 1x underneath)!
(Tr screws: 10 mm up to Z-50, 20 mm for Z-100 to Z-500, 40 mm for Z-750 and Z-1000)

1) When using a larger diameter screw, select the components for the next size gearbox (Z-10 increased screw has a screw Tr 30x6 which means component Z-25 - this is then the calculated screw extension for size 25).

2) The basic length for KGT screws includes the safety clearance L3 shown on the gearbox dimension sheet.
The nut length must then be added to this.

3) The value will be added to or subtracted from the ZD (compression) dimension of the bellows depending on the sign and the result then added to the screw length.
Applicable only to Tr single-pitch screws, not to double-pitch and ball screws.

Screw extension for spiral spring cover SF:
Since the extension for spiral spring covers varies according to the fitting, this variant must be determined from a drawing.
We would be pleased to prepare this drawing for you.

Ordering code

Gearbox type	Size	Version	Drive ratio	Screw version	Screw Ø / pitch	Number of screw starts, material	Stroke	List of accessories
	–		–		–	–	H	– – – –
Z **GSZ**	**2** **5** **10** **25** **35** **50** **100** **150** **250** **350** **500** **750** **1000**	**S** Translating version **R** Rotating version	**N** Normal e.g. i = 4:1 **L** Low speed e.g. i = 16:1	**Tr** Trapezoidal screw (not stated = Tr) **Tr/SIFA** Tr with safety nut SIFA OP EL ELV ELD NO **KGT** Ball screw	**Tr** 1804 2004 ... **KGT** 1605 1610 ...	**1** single-pitch (not stated = single-pitch) **2*** double-pitch **I** INOX (stainless steel) **LH*** left-handed	**Stroke** H + stroke in mm	**List of accessories** (in any sequence) see Section 4

*is available but not ex stock. Lead time on request

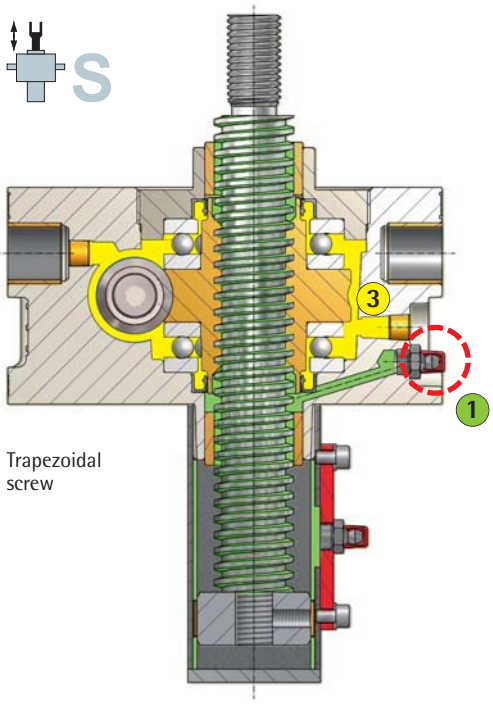
For enquiries or orders you may optionally:
- either list the parts individually
- or define the complete screw jack in an ordering code in the format specified here

Ordering example:

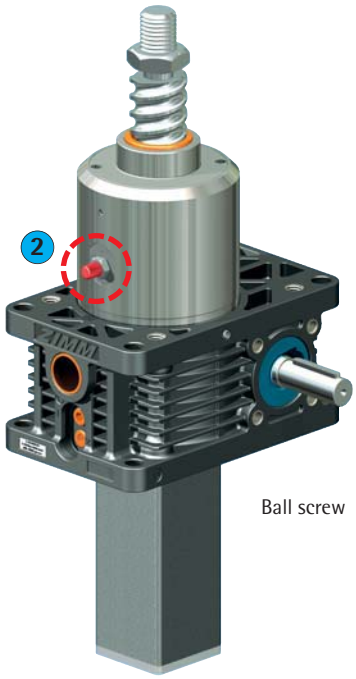
Z-10-SN-Tr-2004-1-H 300-FB390-VS-BF

- Gearbox, type
- Size
- Version S or R
- Drive ratio N or L
- Screw version
- Screw diameter, screw pitch
- Number of starts
- Stroke
- List of accessories (in any sequence)

Innovative separate lubrication



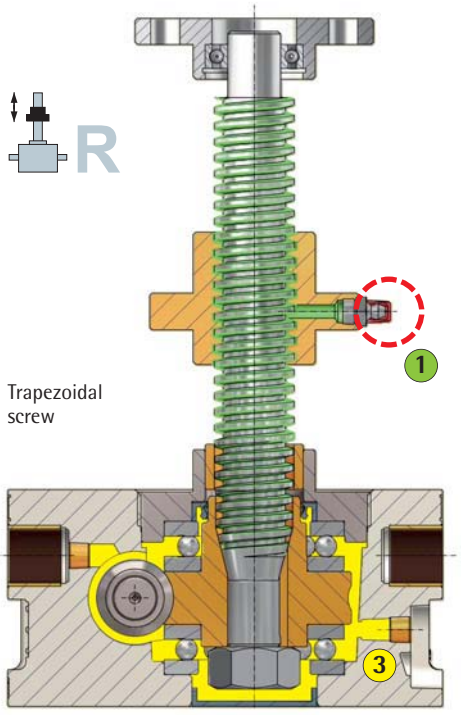
Trapezoidal screw



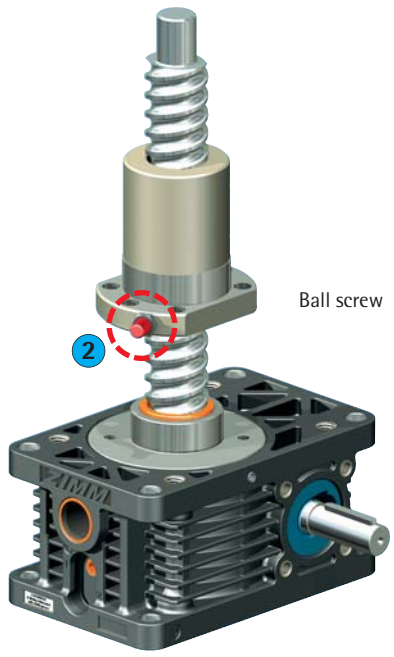
Ball screw

The separate lubrication system is essential for high performance.

1. The **INNOVATION:** Screw lubrication **during operation** provides optimum grease distribution.
2. The same **INNOVATION** is also available for the ball screw version (KGT).

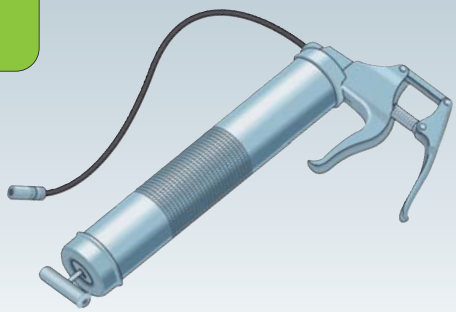


Trapezoidal screw



Ball screw

1. Screw lubrication **during operation** provides optimum grease distribution.
2. The same lubrication system is also available for the ball screw version (KGT).



Screw lubrication

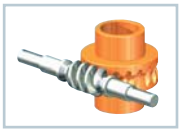
1 Trapezoidal screw
Inspect the trapezoidal screw regularly and regrease it depending on the operating cycle.
Use the grease that we recommend. These greases are ideally matched to the operating requirements of our screw jack systems.

2 Ball screw KGT
Lubricate the ball screw KGT every 300 hours of effective operation.
For heavy-duty systems every 100 hours.

Grease quantity: Guidance value approx. 1 ml per cm screw diameter.

Gearbox lubrication

3 Gearbox lubrication
The gearbox is sealed and is filled with high-preformance synthetic grease (gearboxes from Z-250 are oil-filled). The gearbox is lubricated for life in normal operation.



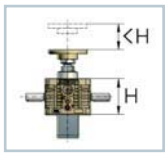
See Section 4 for the list of lubricants.

Cartridge 400 g

Lubricator
Z-LUB, ZIMM lubricator

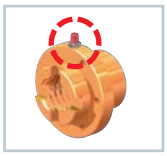
Lubrication for short stroke applications

S version:
For short stroke applications (stroke < gearbox height), take particular care to ensure lubrication of the trapezoidal screw.



The simplest tactic is to specify the screw jack with a longer stroke than the gearbox height, and periodically perform a lubrication stroke. Otherwise, contact our Engineering Department for a suitable solution.

R version:
If stroke length < nut height, use a nut with lubrication capability (such as a duplex nut DM).

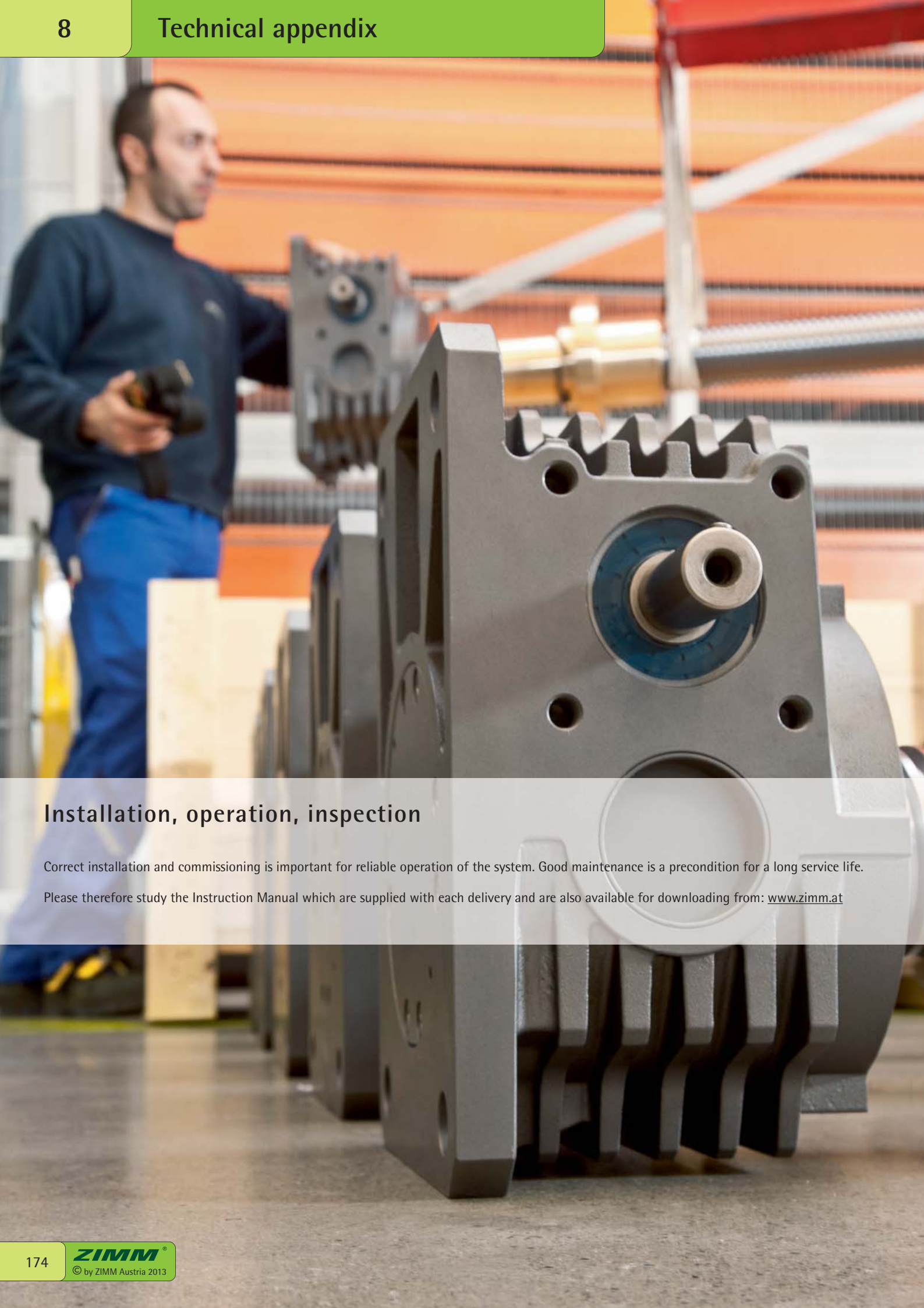


General

Special lubricants
For special applications and for the earlier MSZ gearboxes we can offer suitable lubricants in each case.
These include amongst others:
- High-temperature grease
- Low-temperature grease
- Food grade grease
- Clean room grease, etc.

Other greases, contamination
Using multipurpose greases and other greases can significantly impair operation and shorten the service life.
If the screw becomes dirty, clean and regrease it.

Long-life systems
The grease used in long-life systems (such as working platforms and theatre stages) loses its lubricating properties after about 5 years.
Dust and dirt penetration intensify this effect. We recommend complete cleaning and regreasing after 5 years.
If mineral greases are used, this may be necessary after only 2-3 years.



Installation, operation, inspection

Correct installation and commissioning is important for reliable operation of the system. Good maintenance is a precondition for a long service life.

Please therefore study the Instruction Manual which are supplied with each delivery and are also available for downloading from: www.zimm.at

Operational reliability and safety

Operational reliability and safety
Operational reliability and safety are just as important for industrial systems as for theatre stages and other systems.

Design and specification
During the design and specification phase, pay special attention to the load capacity of the drives and accessories in their proposed installation situation. Plan your system with appropriate safety for attachment, movement and transport elements.

Please note the design advice given in Section 8.

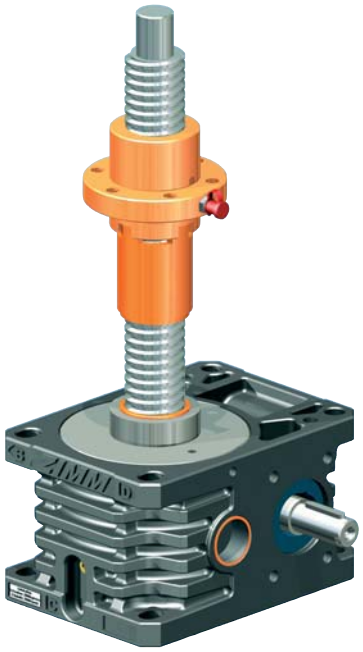
Where the system is safety-relevant, fit a safety nut SIFA. If the nut thread is stripped due to wear, the SIFA takes the load. An electronic control is available on request.

Installation
Correct and careful installation is essential for trouble-free and safe system operation.
Please refer to our instruction manual included with each delivery. You can download these from the Internet at www.zimm.at

Inspection and maintenance
Regular inspection and maintenance are necessary to maintain reliability.

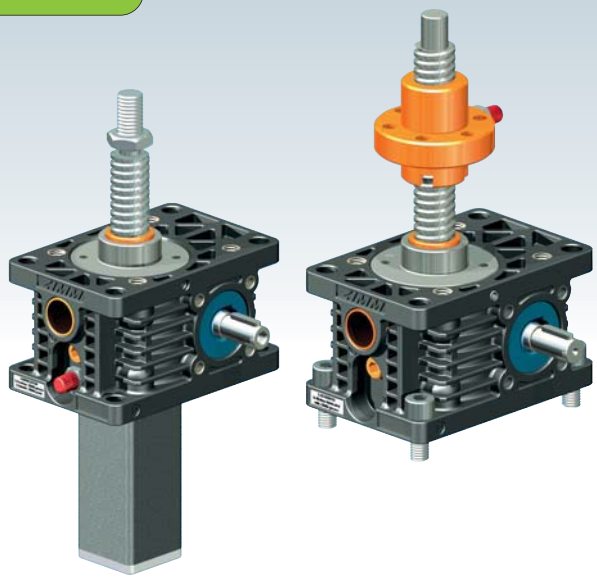
Check the following during the regular inspections:
Visual condition, attachments and connections, wear on the trapezoidal thread and the level of lubrication.
Comply with our lubrication instructions and use only the lubricants we recommend.
Please consider our automatic lubricator Z-LUB.

Spare parts
To protect against loss of production caused by high duty cycles or high loads, we recommend keeping a set of screw jack spare parts (including screws, accessories and with assembly drawings) at your location or at your customer's location. A screw jack can most economically be repaired by a complete exchange.



Screw jack with safety nut SIFA

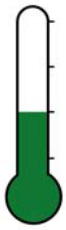
ZIMM Instruction Manual in other languages and for special products are available on request or by downloading from www.zimm.at



Temperature

The ambient temperature is very important for system operation.
Always inform us about ambient temperature and conditions, especially if these deviate from the usual 20°C to 25°C.

Normal temperature (-20°C to +60°C)
A normal temperature range is up to about 60°C gearbox operating temperature. The highest temperature rise is at the shaft seal ring and on the trapezoidal screw. Various tests have shown that the temperature rise of a Tr screw is twice that of the gearbox housing.



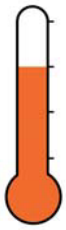
Example:
At an ambient temperature of 20°C, the housing reached about 60°C (rise of 40°C) and the Tr screw about 100°C (rise of 80°C).

We recommend the temperature of Tr screws should not exceed 100°C when using standard gearboxes.

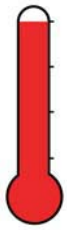
Low temperature (-20°C to -40°C):
Seals and most of our greases are specified in principle for temperatures down to -40°C. Experience has however shown that applications below -20°C are critical. The grease becomes very viscous and hard to move and it becomes difficult in particular to satisfy the breakaway torque.
Generally speaking, all components must be sized adequately for minus temperatures because the material strength is reduced (apart from aluminium).

We recommend low temperature grease for temperatures less than -20°C. Our standard gearboxes up to size Z-150 are filled as standard with a synthetic fluid grease that is already suitable down to -40°C.

High temperatures (+60°C to +160°C):
For ambient and operating temperatures (gearbox housing) higher than 60°C we recommend gearboxes with high-temperature grease and FPM seals. These can generally permit operating temperatures up to 160°C.



High temperatures (up to +200°C):
At temperatures up to 200°C we use FPM seals and a special grease.



We offer appropriate heat-resistant components for high temperature applications.

Temperature range of standard parts:	
Standard screw jacks	-25°C to +80°C (-40°C to +100°C)
High temperature screw jacks	up to 160°C, or 200°C
Round bellows	-32°C to +70°C (max. +85°C)
Polygonal bellows	-15°C to +70°C (no exposure to direct sunlight)
Limit switch	-30°C to +85°C
Rotary pulse encoder DIG	-40°C to +80°C
Motors	above 40°C reduced power, e.g. factor 0.8 at 60°C
Connecting shafts VWZ+KUZ-KK	0°C to + 70°C, reduced from -20°C to +100°C (max. +120°C)
Couplings KUZ	-20°C to +70°C, reduced from -40°C to +100°C
Bevel gearboxes	-10°C to +90°C
Ball screws KGT	-20°C to +80°C

For lower and higher temperatures, please request information on the component from us, with your checklist (Section 7).

Ambient and operating temperatures:
The ambient temperature is relevant for components such as limit switches or bellows. For gearboxes, the operating temperature is slightly or considerably higher than the ambient temperature, depending on the duty cycle.

Clean room

Sectors
Various fields such as semiconductor production, flat screen production, optical and laser technology, spacecraft production etc. demand high cleanliness, which means that clean room standards must be maintained.

Clean room
A clean room is a room where the concentration of particles in the air is controlled and satisfies defined cleanliness classes. It is important to keep the particle contamination caused by work materials, lubricants and drives to a minimum.

Your system
Use the checklist in Section 7 to enquire about the system you require and also specify the particular requirements for your application. We can then offer you a system to meet your requirements.

Food industry

Food industry sector
The foodstuffs sector operates at a very high level of automation. On the one hand this promotes a very high level of hygiene, on the other hand it permits intelligent and efficient systems for economic production

Resistant against corrosion
Our Z and GSZ series are corrosion-resistant and are therefore very suitable for most applications in the food industry. The GSZ gearbox with its smooth surfaces is particularly suitable.
The Z and GSZ series are not suitable for special applications where stainless steel is mandatory.

Screw jack systems
We supply gearboxes and systems with food grade grease to the food industry. Our food grade greases are FDA-approved. Use the checklist in Section 7 to enquire about the system you require and also specify the particular requirements for your application.

Resistant against corrosion

Corrosion-resistant as standard – no need for painting
All relevant components of the ZIMM – Z series and GSZ series are coated as standard with various single-layer and multi-layer systems resistant against corrosion.
This eliminates the need for time-consuming and cost-intensive painting.

The colours black, anthracite and silver are visually neutral and fit in with any colour combination. The coating are specially matched to the various base materials and their functions. This ensures high-quality protection against corrosion for many application areas.