Technical appendix

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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!)

Slower:
- Frequency converter serves to increase the motor speed to more than 1500 rpm. Please note the maximum gearbox speed.
- 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)

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.

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).
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).

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.

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).

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 determined 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

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

S version
Translating screw

R version
Rotating screw

Tension loads
Compression loads
Buckling calculation

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

Tension loads
Compression loads
Buckling calculation

Critical whirling speed

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 always 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.

Through the mounting plate:

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

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

<table>
<thead>
<tr>
<th></th>
<th>Rated load</th>
<th>Rated load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z and GSZ</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

Mounting plate with tensile load

<table>
<thead>
<tr>
<th></th>
<th>Rated load</th>
<th>Rated load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z and GSZ</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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.

<table>
<thead>
<tr>
<th>Gearbox</th>
<th>Thread*</th>
<th>Screw-in depth</th>
<th>Tightening torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSZ-2</td>
<td>M6</td>
<td>8 to 10</td>
<td>8</td>
</tr>
<tr>
<td>GSZ-5, Z-5</td>
<td>M8</td>
<td>10 to 11.5</td>
<td>19</td>
</tr>
<tr>
<td>GSZ-10, Z-10</td>
<td>M8</td>
<td>10 to 15</td>
<td>17</td>
</tr>
<tr>
<td>GSZ-25, Z-25</td>
<td>M10</td>
<td>12 to 15</td>
<td>27</td>
</tr>
<tr>
<td>GSZ-50</td>
<td>M12</td>
<td>12 to 17</td>
<td>38</td>
</tr>
<tr>
<td>GSZ-100</td>
<td>M16</td>
<td>16 to 22</td>
<td>82</td>
</tr>
</tbody>
</table>

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.

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

<table>
<thead>
<tr>
<th>Gearbox</th>
<th>Permissible load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-5</td>
<td>2.5 kN</td>
</tr>
<tr>
<td>Z-10</td>
<td>3.5 kN</td>
</tr>
<tr>
<td>Z-25</td>
<td>10.0 kN</td>
</tr>
<tr>
<td>Z-35</td>
<td>29.8 kN</td>
</tr>
<tr>
<td>Z-50</td>
<td>27.5 kN</td>
</tr>
<tr>
<td>Z-100</td>
<td>27.0 kN</td>
</tr>
<tr>
<td>Z-150</td>
<td>56.5 kN</td>
</tr>
<tr>
<td>Z-250</td>
<td>70.0 kN</td>
</tr>
<tr>
<td>Z-350</td>
<td>180.0 kN</td>
</tr>
<tr>
<td>Z-500</td>
<td>110.0 kN</td>
</tr>
<tr>
<td>Z-750</td>
<td>210.0 kN</td>
</tr>
<tr>
<td>Z-1000</td>
<td>on request</td>
</tr>
</tbody>
</table>
Permissible loads - pivoting

When dimensioning, include all the parts you will use

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

<table>
<thead>
<tr>
<th></th>
<th>Rated load 5 kN</th>
<th>Rated load 10 kN</th>
<th>Rated load 15 kN</th>
<th>Rated load 20 kN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-5</td>
<td>19.5 kN</td>
<td>22.5 kN</td>
<td>27.5 kN</td>
<td>32.5 kN</td>
</tr>
<tr>
<td>Z-10</td>
<td>22.5 kN</td>
<td>27.5 kN</td>
<td>32.5 kN</td>
<td>37.5 kN</td>
</tr>
<tr>
<td>Z-25</td>
<td>27.5 kN</td>
<td>32.5 kN</td>
<td>37.5 kN</td>
<td>42.5 kN</td>
</tr>
</tbody>
</table>

Z-5 to Z-25 – Pivot mounts LB

<table>
<thead>
<tr>
<th></th>
<th>Rated load 5 kN</th>
<th>Rated load 10 kN</th>
<th>Rated load 15 kN</th>
<th>Rated load 20 kN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-5-LB</td>
<td>5 kN</td>
<td>10 kN</td>
<td>15 kN</td>
<td>20 kN</td>
</tr>
<tr>
<td>Z-10-LB</td>
<td>10 kN</td>
<td>15 kN</td>
<td>20 kN</td>
<td>25 kN</td>
</tr>
<tr>
<td>Z-25-LB</td>
<td>15 kN</td>
<td>20 kN</td>
<td>25 kN</td>
<td>30 kN</td>
</tr>
</tbody>
</table>

Z-5 to Z-25 – Pivot bearing plate KAR

<table>
<thead>
<tr>
<th></th>
<th>Rated load 5 kN</th>
<th>Rated load 10 kN</th>
<th>Rated load 15 kN</th>
<th>Rated load 20 kN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-5-KAR</td>
<td>5 kN</td>
<td>10 kN</td>
<td>15 kN</td>
<td>20 kN</td>
</tr>
<tr>
<td>Z-10-KAR</td>
<td>10 kN</td>
<td>15 kN</td>
<td>20 kN</td>
<td>25 kN</td>
</tr>
<tr>
<td>Z-25-KAR</td>
<td>15 kN</td>
<td>20 kN</td>
<td>25 kN</td>
<td>30 kN</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Z-35</th>
<th>Rated load 35 kN</th>
<th>Rated load 35 kN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-50</td>
<td>Rated load 50 kN</td>
<td>Rated load 50 kN</td>
</tr>
<tr>
<td>Z-100</td>
<td>Rated load 100 kN</td>
<td>Rated load 100 kN</td>
</tr>
<tr>
<td>Z-150</td>
<td>Rated load 150 kN</td>
<td>Rated load 150 kN</td>
</tr>
<tr>
<td>Z-250</td>
<td>177 kN</td>
<td>Rated load 250 kN</td>
</tr>
<tr>
<td>Z-350</td>
<td>260 kN</td>
<td>260 kN</td>
</tr>
<tr>
<td>Z-500</td>
<td>280 kN</td>
<td>310 kN</td>
</tr>
<tr>
<td>Z-750</td>
<td>on request</td>
<td>on request</td>
</tr>
<tr>
<td>Z-1000</td>
<td>on request</td>
<td>on request</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Z-35 to Z-1000</th>
<th>Rated load</th>
<th>Rated load</th>
<th>Rated load</th>
<th>Rated load</th>
</tr>
</thead>
</table>

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 \( \text{mm}^4 \)
- \( F = \) Max. load/gearbox in N
- \( L = \) Free screw length in mm
- \( E = \) Modulus of elasticity for steel (210,000 N/mm\(^2\))
- \( v = \) Safety factor (normally 3)
- \( d = \) Minimum core diameter of the screw

**Example:**
- \( F = 45,000 \text{N/gearbox} \)
- \( L = 1320 \text{ mm} \)
- \( v = 3 \)

**Formula:**
\[
I = \frac{F \times v \times (L \times 2)^2}{\pi^2 \times E}
\]
\[
d = \sqrt[4]{\frac{I}{\pi}} \times \frac{64}{I}
\]

**Example:**
\[
I = \frac{45,000 \text{ N} \times 3 \times (1,320 \text{ mm} \times 2)^2}{\pi^2 \times 210,000 \text{ N/mm}^2} = 9.089611 \text{ mm}^4
\]
\[
d = \sqrt[4]{\frac{9.089611 \text{ mm}^4 \times 64}{453,965.22 \text{ mm}^4}} = 55.15 \text{ mm minimum core diameter}
\]

**Formula:**
\[
I = \frac{F \times v \times L^2}{\pi^2 \times E}
\]
\[
d = \sqrt[4]{\frac{I}{\pi}} \times \frac{64}{I}
\]

**Example:**
\[
I = \frac{45,000 \text{ N} \times 3 \times (1,320 \text{ mm})^2}{\pi^2 \times 210,000 \text{ N/mm}^2} = 2.3522411 \text{ mm}^4
\]
\[
d = \sqrt[4]{\frac{2.3522411 \text{ mm}^4 \times 64}{113,491.305 \text{ mm}^4}} = 38.99 \text{ mm minimum core diameter}
\]

**Formula:**
\[
I = \frac{F \times v \times (L \times 0.7)^2}{\pi^2 \times E}
\]
\[
d = \sqrt[4]{\frac{I}{\pi}} \times \frac{64}{I}
\]

**Example:**
\[
I = \frac{45,000 \text{ N} \times 3 \times (1,320 \text{ mm} \times 0.7)^2}{\pi^2 \times 210,000 \text{ N/mm}^2} = 1.1525922 \text{ mm}^4
\]
\[
d = \sqrt[4]{\frac{1.1525922 \text{ mm}^4 \times 64}{55,610.739 \text{ mm}^4}} = 32.62 \text{ mm minimum core diameter}
\]

---

**Table:**

<table>
<thead>
<tr>
<th>Screw Type</th>
<th>OSZ-2</th>
<th>Z-5</th>
<th>Z-10</th>
<th>Z-25</th>
<th>Z-35/50</th>
<th>Z-50/Tr50</th>
<th>Z-100</th>
<th>Z-150</th>
<th>Z-250</th>
<th>Z-350</th>
<th>Z-500</th>
<th>Z-750</th>
<th>Z-1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trapezoidal screw Tr</td>
<td>16x4</td>
<td>18x4</td>
<td>20x4</td>
<td>20x6</td>
<td>20x7</td>
<td>25x8</td>
<td>30x9</td>
<td>35x9</td>
<td>40x9</td>
<td>45x9</td>
<td>50x9</td>
<td>60x9</td>
<td>80x10</td>
</tr>
<tr>
<td>Core Ø in mm (minimum)</td>
<td>10.9</td>
<td>12.9</td>
<td>14.9</td>
<td>22.1</td>
<td>31.0</td>
<td>39.8</td>
<td>43.6</td>
<td>48.6</td>
<td>59.6</td>
<td>80.6</td>
<td>99.6</td>
<td>115.0</td>
<td>135.0</td>
</tr>
<tr>
<td>Ball screw KGT Ø mm</td>
<td>16</td>
<td>16</td>
<td>25</td>
<td>32</td>
<td>40</td>
<td>-</td>
<td>50</td>
<td>63</td>
<td>80</td>
<td>100</td>
<td>125</td>
<td>140</td>
<td>160</td>
</tr>
<tr>
<td>Core Ø in mm (minimum*)</td>
<td>12.9</td>
<td>12.9</td>
<td>21.5</td>
<td>27.3</td>
<td>34.1</td>
<td>-</td>
<td>43.6</td>
<td>51.8</td>
<td>67</td>
<td>87.4</td>
<td>107.8</td>
<td>117</td>
<td>132.8</td>
</tr>
</tbody>
</table>

*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

\[ n_{\text{zul}} = 0.8 \times n_{kr} \times f_{kr} \]

- \( n_{\text{zul}} \): 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.

**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.

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.

\[
\text{Screw speed} = \frac{\text{Input drive speed}}{l_{\text{gearbox}}}
\]
Determining the drive torque \([M_G]\) of a single screw jack

### Explanatory notes:
- **\(M_0\)**: necessary drive torque \([\text{Nm}]\) for a screw jack
- **\(F\)**: Lifting load \((\text{dynamic})\) \([\text{kN}]\)
- **\(\eta_{\text{gearbox}}\)**: Efficiency of the gearbox
- **\(\eta_{\text{screw}}\)**: Efficiency of the screw
- **\(P\)**: Screw pitch \([\text{mm}]\)
- **\(i\)**: Drive ratio of the screw jack
- **\(M_i\)**: Idling torque \([\text{Nm}]\)
- **\(P_m\)**: Motor drive power

### Formula:
1. **Drive torque:**
   \[
   M_0 = \frac{F \cdot P}{2 \cdot \pi \cdot \eta_{\text{gearbox}} \cdot \eta_{\text{screw}} \cdot i} + M_i
   \]
2. **Motor power:**
   \[
   P_m[\text{kW}] = \frac{M_0 \cdot n}{9550}
   \]
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).

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

<table>
<thead>
<tr>
<th>(i)</th>
<th>(\text{rpm})</th>
<th>(\text{GSZ-2})</th>
<th>(\text{Z-5})</th>
<th>(\text{Z-10})</th>
<th>(\text{Z-25})</th>
<th>(\text{Z-35})</th>
<th>(\text{Z-50})</th>
<th>(\text{Z-100})</th>
<th>(\text{Z-150})</th>
<th>(\text{Z-250})</th>
<th>(\text{Z-350})</th>
<th>(\text{Z-500})</th>
<th>(\text{Z-750})</th>
<th>(\text{Z-1000})</th>
</tr>
</thead>
<tbody>
<tr>
<td>(N)</td>
<td>3000</td>
<td>0.87</td>
<td>0.81</td>
<td>0.83</td>
<td>0.87</td>
<td>0.87</td>
<td>0.87</td>
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<td>0.87</td>
<td>0.87</td>
</tr>
<tr>
<td>(N)</td>
<td>1500</td>
<td>0.87</td>
<td>0.82</td>
<td>0.84</td>
<td>0.87</td>
<td>0.87</td>
<td>0.87</td>
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<td>0.87</td>
<td>0.87</td>
<td>0.87</td>
<td>0.87</td>
</tr>
<tr>
<td>(N)</td>
<td>1000</td>
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<td>0.82</td>
<td>0.86</td>
<td>0.87</td>
<td>0.87</td>
<td>0.87</td>
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<td>0.87</td>
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<td>0.87</td>
</tr>
<tr>
<td>(N)</td>
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<td>0.84</td>
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<td>0.85</td>
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<td>0.85</td>
<td>0.85</td>
</tr>
<tr>
<td>(N)</td>
<td>500</td>
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<td>0.82</td>
<td>0.84</td>
<td>0.83</td>
<td>0.85</td>
<td>0.85</td>
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<td>0.85</td>
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</tr>
<tr>
<td>(N)</td>
<td>100</td>
<td>0.74</td>
<td>0.77</td>
<td>0.79</td>
<td>0.78</td>
<td>0.78</td>
<td>0.78</td>
<td>0.78</td>
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<td>0.78</td>
<td>0.78</td>
<td>0.78</td>
<td>0.78</td>
</tr>
<tr>
<td>(L)</td>
<td>3000</td>
<td>0.78</td>
<td>0.74</td>
<td>0.78</td>
<td>0.76</td>
<td>0.76</td>
<td>0.76</td>
<td>0.76</td>
<td>0.76</td>
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<td>0.76</td>
<td>0.76</td>
<td>0.76</td>
<td>0.76</td>
</tr>
<tr>
<td>(L)</td>
<td>1500</td>
<td>0.77</td>
<td>0.70</td>
<td>0.74</td>
<td>0.72</td>
<td>0.64</td>
<td>0.66</td>
<td>0.67</td>
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<tr>
<td>(L)</td>
<td>1000</td>
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<td>0.72</td>
<td>0.70</td>
<td>0.64</td>
<td>0.66</td>
<td>0.65</td>
<td>0.66</td>
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<td>0.66</td>
</tr>
<tr>
<td>(L)</td>
<td>750</td>
<td>0.74</td>
<td>0.65</td>
<td>0.70</td>
<td>0.68</td>
<td>0.64</td>
<td>0.66</td>
<td>0.65</td>
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<tr>
<td>(L)</td>
<td>500</td>
<td>0.71</td>
<td>0.62</td>
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<td>0.63</td>
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<td>0.65</td>
<td>0.63</td>
<td>0.63</td>
<td>0.63</td>
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</tr>
<tr>
<td>(L)</td>
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<td>0.53</td>
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<td>0.57</td>
<td>0.53</td>
<td>0.65</td>
<td>0.67</td>
<td>0.61</td>
<td>0.68</td>
<td>0.66</td>
</tr>
</tbody>
</table>

### Efficiencies of the screws \(\eta_{\text{screw}}\)

- **Tr screw, single-pitch**
  - \(16x4\): 0.453
  - \(18x4\): 0.420
  - \(20x4\): 0.391
- **Tr screw, double-pitch**
  - \(10x4\): 0.563
  - \(12x4\): 0.563
- **Ball screw**
  - \(0.9\)

### Idling torques \(M_i\) of screw jacks \([\text{Nm}]\) (without screw, at \(20\text{°C}\) – significantly higher at low temperatures)

<table>
<thead>
<tr>
<th>(Z)</th>
<th>(\text{N})</th>
<th>(\text{L})</th>
</tr>
</thead>
<tbody>
<tr>
<td>(N)</td>
<td>0.08</td>
<td>0.10</td>
</tr>
<tr>
<td>(L)</td>
<td>0.06</td>
<td>0.08</td>
</tr>
</tbody>
</table>

These are indicative values for calculation. Series production models may vary!
## 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 \( M_i \) [Nm]**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>3000</td>
<td>1.2</td>
<td>4.0</td>
<td>11.0</td>
<td>17.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>N</td>
<td>1500</td>
<td>1.4</td>
<td>4.7</td>
<td>13.5</td>
<td>18.0</td>
<td>19.8</td>
<td>31.5</td>
<td>31.5</td>
<td>53.4</td>
<td>75.1</td>
<td>152</td>
<td>265</td>
<td>408</td>
<td>480</td>
<td>680</td>
</tr>
<tr>
<td>N</td>
<td>1000</td>
<td>1.5</td>
<td>5.6</td>
<td>14.0</td>
<td>22.0</td>
<td>20.8</td>
<td>36.8</td>
<td>36.8</td>
<td>60.8</td>
<td>77.1</td>
<td>152</td>
<td>265</td>
<td>408</td>
<td>480</td>
<td>680</td>
</tr>
<tr>
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<td>500</td>
<td>1.6</td>
<td>6.1</td>
<td>16.7</td>
<td>28.0</td>
<td>24.8</td>
<td>46.5</td>
<td>46.5</td>
<td>75.3</td>
<td>95.0</td>
<td>160</td>
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<td>500</td>
<td>640</td>
<td>960</td>
</tr>
<tr>
<td>L</td>
<td>3000</td>
<td>0.5</td>
<td>1.4</td>
<td>5.7</td>
<td>8.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>L</td>
<td>1500</td>
<td>0.5</td>
<td>1.5</td>
<td>7.5</td>
<td>10.0</td>
<td>9</td>
<td>10.4</td>
<td>10.4</td>
<td>13.5</td>
<td>20.7</td>
<td>41.4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>L</td>
<td>1000</td>
<td>0.5</td>
<td>1.8</td>
<td>8.7</td>
<td>11.0</td>
<td>9.7</td>
<td>14.9</td>
<td>14.9</td>
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<td>170</td>
<td>210</td>
<td>450</td>
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<tr>
<td>L</td>
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<td>0.6</td>
<td>2.2</td>
<td>10.7</td>
<td>14.0</td>
<td>11.1</td>
<td>19.2</td>
<td>19.2</td>
<td>18.9</td>
<td>29.4</td>
<td>63.5</td>
<td>112</td>
<td>220</td>
<td>240</td>
<td>580</td>
</tr>
</tbody>
</table>

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]**

<table>
<thead>
<tr>
<th></th>
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<th></th>
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<tbody>
<tr>
<td>9</td>
<td>39</td>
<td>57</td>
<td>108</td>
<td>130</td>
<td>260</td>
<td>260</td>
<td>540</td>
<td>540</td>
<td>540</td>
<td>770</td>
<td>1800</td>
<td>1940</td>
<td>4570</td>
</tr>
</tbody>
</table>

The maximum torques given are applicable for the following scenarios:

- Under normal operating conditions, i.e. with the appropriate lubrication, cooling, and protection against dust.
- The maximum input power is not exceeded.
- The maximum speed is not exceeded.
- The maximum radial and axial load is not exceeded.
- The maximum temperature rise is not exceeded.
- The maximum permissible shaft deflection is not exceeded.
- The maximum permissible bearing deflection is not exceeded.
- The maximum permissible bearing load is not exceeded.
- The maximum permissible shaft load is not exceeded.
- The maximum permissible shaft deflection is not exceeded.
- The maximum permissible bearing deflection is not exceeded.
- The maximum permissible bearing load is not exceeded.
- The maximum permissible shaft load is not exceeded.
- The maximum permissible shaft deflection is not exceeded.
- The maximum permissible bearing deflection is not exceeded.
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- The maximum permissible shaft deflection is not exceeded.
- The maximum permissible bearing deflection is not exceeded.
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- The maximum permissible shaft deflection is not exceeded.
- The maximum permissible bearing deflection is not exceeded.
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- The maximum permissible shaft deflection is not exceeded.
- The maximum permissible bearing deflection is not exceeded.
- The maximum permissible bearing load is not exceeded.
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- The maximum permissible shaft deflection is not exceeded.
- The maximum permissible bearing deflection is not exceeded.
- The maximum permissible bearing load is not exceeded.
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- The maximum permissible shaft deflection is not exceeded.
- The maximum permissible bearing deflection is not exceeded.
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- The maximum permissible shaft deflection is not exceeded.
- The maximum permissible bearing deflection is not exceeded.
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- The maximum permissible shaft deflection is not exceeded.
- The maximum permissible bearing deflection is not exceeded.
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- The maximum permissible bearing deflection is not exceeded.
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- The maximum permissible bearing deflection is not exceeded.
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- The maximum permissible shaft deflection is not exceeded.
- The maximum permissible bearing deflection is not exceeded.
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- The maximum permissible bearing deflection is not exceeded.
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- The maximum permissible bearing deflection is not exceeded.
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- The maximum permissible bearing deflection is not exceeded.
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- The maximum permissible bearing load is not exceeded.
- The maximum permissible shaft load is not exceeded.
- The maximum permissible shaft deflection is not exceeded.
- The maximum permissible bearing deflection is not exceeded.
- The maximum permissible bearing load is not exceeded.
- The maximum permissible shaft load is not exceeded.
- The maximum permissible shaft deflection is not exceeded.
- The maximum permissible bearing deflection is not exceeded.
- The maximum permissible bearing load is not exceeded.
- The maximum permissible shaft load is not exceeded.
Drive torque for screw jacks - approximate calculation

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.

\[ M_R = M_G \times 2.4 \]
\[ M_R = M_G \times 2.1 \]
\[ M_R = M_G \times 3.1 \]
\[ M_R = M_G \times 3.6 \]
\[ M_R = M_G \times 4.9 \]
\[ M_R = M_G \times 7.1 \]
\[ M_R = M_G \times 4.8 \]

\[ M_R = M_G \times 3.5 \]
\[ M_R = M_G \times 3.6 \]

MR - Overall drive torque for the entire system.
MG - Drive torque for an single gearbox
MA - Starting torque max. 1.5 x MR

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

\[ M_R = M_G \times 4.9 = 5.97 \, \text{Nm} \times 4.9 = 29.25 \, \text{Nm} \]
\[ \times \text{safety factor} \, 1.4 = 40.95 \, \text{Nm} \]

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 ($\eta = 0.95$) and bevel gearboxes ($\eta = 0.9$).

**Formula for the gearbox:**

$$M_G = \frac{F \cdot P}{2 \cdot \pi \cdot \eta_{\text{gearbox}} \cdot \eta_{\text{screw}} \cdot i} + M_L \ [Nm]$$

**Efficiencies:**

- Connecting shafts: $\eta = 0.95$
- Bevel gearbox: $\eta = 0.90$

**Example:**

1) $$M_0 = \frac{12 \ kN \cdot 6 \ mm}{2 \cdot \pi \cdot 0.87 \cdot 0.391 \cdot 6} + 0.36 \ Nm = 5.97 \ Nm$$

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

3) $$5.97 \ Nm + 6.28 \ Nm = 12.25 \ Nm$$

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

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

6) $$12.25 \ Nm + 14.33 \ Nm/0.9 = 29.53 \ Nm$$

7) $$29.53 \ Nm \cdot 1.4 = 41.34 \ Nm$$

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)
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.

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.

---

### Loading definitions:

- **F**: Lifting load tensile and/or compressive
- **Fₛ**: Lateral loads on the screw
- **Vₛ**: Lifting speed of the screw
  (or nut if the R version)
- **Fₐ**: Axial load on the input shaft
- **Mᵣ**: Input torque
- **ⁿᵣ**: Input speed

### Maximum forces / torques

#### Maximum lateral force \( Fₛ \) [N] (only static)

<table>
<thead>
<tr>
<th>( Z )</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>25</th>
<th>50</th>
<th>100</th>
<th>150</th>
<th>250</th>
<th>350</th>
<th>500</th>
<th>750</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>600</td>
<td>180</td>
<td>200</td>
<td>240</td>
<td>250</td>
<td>280</td>
<td>320</td>
<td>380</td>
<td>420</td>
<td>500</td>
<td>600</td>
<td>900</td>
</tr>
<tr>
<td>200</td>
<td>1200</td>
<td>360</td>
<td>400</td>
<td>480</td>
<td>500</td>
<td>560</td>
<td>640</td>
<td>760</td>
<td>840</td>
<td>1000</td>
<td>1200</td>
<td>1800</td>
</tr>
</tbody>
</table>

#### Extended screw length in mm

<table>
<thead>
<tr>
<th>( Z )</th>
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<th>10</th>
<th>15</th>
<th>25</th>
<th>50</th>
<th>100</th>
<th>150</th>
<th>250</th>
<th>350</th>
<th>500</th>
<th>750</th>
<th>1000</th>
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<td>5000</td>
<td>6000</td>
<td>7500</td>
<td>9000</td>
<td>12000</td>
<td>15000</td>
<td>18000</td>
<td>25000</td>
<td>30000</td>
<td>40000</td>
</tr>
</tbody>
</table>

#### Maximum radial load on the input shaft \( Fᵣ \) [N]

<table>
<thead>
<tr>
<th>( Z )</th>
<th>Z-5</th>
<th>Z-10</th>
<th>Z-25</th>
<th>Z-35</th>
<th>Z-50</th>
<th>Z-100</th>
<th>Z-150</th>
<th>Z-250</th>
<th>Z-350</th>
<th>Z-500</th>
<th>Z-750</th>
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<td>1100</td>
<td>1400</td>
<td>2600</td>
<td>3000</td>
<td>3400</td>
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</table>
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:

\[
\begin{align*}
250 & \quad \text{Stroke} \\
180 & \quad \text{Basic length} \\
44 & \quad \text{Bellows} \\
45 & \quad \text{Limit switch + rotation protection} \\
\hline
\end{align*}
\]

\[= 519 \text{ mm}
\]

Protective tube length SRO:

\[
\begin{align*}
250 & \quad \text{Stroke} \\
53 & \quad \text{Basic length} \\
72 & \quad \text{Limit switch + Rotation protection} \\
\hline
\end{align*}
\]

\[= 375 \text{ mm}
\]

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:

\[
\begin{align*}
250 & \quad \text{Stroke} \\
139 & \quad \text{Basic length} \\
60 & \quad \text{Bellows gearbox side} \\
55 & \quad \text{2nd bellows} \\
50 & \quad \text{Duplex nut} \\
\hline
\end{align*}
\]

\[= 554 \text{ mm}
\]

See Section 4 for the length calculation for connecting shafts.
### Length calculation – screw, translating version S

(The length calculation is identical for Z and GSZ)

<table>
<thead>
<tr>
<th>GSZ-2 to Z-150:</th>
<th>GSZ-2</th>
<th>Z-5</th>
<th>Z-10</th>
<th>Z-25</th>
<th>Z-35</th>
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<th>Z-50/Tr50</th>
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<td>ZD+5</td>
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<td>ZD+31</td>
<td>ZD+28</td>
<td>ZD+46</td>
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<td>ZD+63</td>
<td>ZD+81</td>
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<td>ZD+11</td>
<td>ZD+3</td>
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### Z-250 to Z-1000:

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<td>Limit switch ES(1)</td>
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</table>

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 bells 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)

### GSZ-2 to Z-150:

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<td>ES III and pivot bearing plate KAR</td>
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### Z-250 to Z-1000:

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<td>35</td>
<td>125x80</td>
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</table>

### CAUTION: minimum stroke with limit switch ES:

1. Basic length of the protective tube without a cap.
   The cap height is 5 mm.
2. If a shorter stroke than specified 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)

### GSZ-2 to Z-150:

- minimum stroke with limit switch ES: 53
- minimum stroke with ES and lubrication strip SL: 123

### Z-250 to Z-1000:

- minimum stroke with limit switch ES: 47
- minimum stroke with ES and lubrication strip SL: 117
Length Calculation – screw, rotating version R
(The length calculation is identical for Z and GSZ)

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<td>40x05 172</td>
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<td>50x20 307</td>
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<tr>
<td>KGT basic length without journal(3)</td>
<td>25x05 352</td>
<td>32x05 259</td>
<td>40x05 262</td>
<td>48x05 278</td>
<td>50x50 427</td>
<td>63x50 505</td>
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<td>KGT basic length increased screw with journal(3)</td>
<td>16x05 88</td>
<td>16x10 96</td>
<td>25x05 112</td>
<td>25x10 132</td>
<td>25x15 134</td>
<td>25x20 152</td>
<td>25x25 154</td>
<td>25x30 154</td>
</tr>
<tr>
<td>KGT basic length without journal(3)</td>
<td>16x05 108</td>
<td>16x10 116</td>
<td>25x05 132</td>
<td>25x10 134</td>
<td>25x15 134</td>
<td>25x20 152</td>
<td>25x25 154</td>
<td>25x30 154</td>
</tr>
<tr>
<td>PM + safety nut SIFA</td>
<td>14x05 35</td>
<td>16x05 45</td>
<td>25x05 50</td>
<td>46x05 70</td>
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<td>66</td>
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<tr>
<td>Duplex nut DM</td>
<td>45</td>
<td>45</td>
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<td>50</td>
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<tr>
<td>Self-aligning nut PM</td>
<td>78</td>
<td>83</td>
<td>95</td>
<td>129</td>
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<td>Self-aligning nut DDM</td>
<td>53</td>
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<tr>
<td>DM + safety nut SIFA</td>
<td>70</td>
<td>70</td>
<td>85</td>
<td>133</td>
<td>133</td>
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<td>PM + safety nut SIFA</td>
<td>123</td>
<td>128</td>
<td>158</td>
<td>212</td>
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<td>298</td>
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<tr>
<td>1. Bellows(3)</td>
<td>ZD-10</td>
<td>ZD-12</td>
<td>ZD-12</td>
<td>ZD-10</td>
<td>ZD-12</td>
<td>ZD-12</td>
<td>ZD-22</td>
<td>ZD-22</td>
</tr>
<tr>
<td>2. Bellows(3)</td>
<td>ZD-10</td>
<td>ZD-10</td>
<td>ZD-14</td>
<td>ZD-15</td>
<td>ZD-15</td>
<td>ZD-20</td>
<td>ZD-20</td>
<td>ZD-30</td>
</tr>
<tr>
<td>ZAR screw face and 1st bellows(3)</td>
<td>ZD+23</td>
<td>ZD+21</td>
<td>ZD+15</td>
<td>ZD+31</td>
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<td>-</td>
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<td>-</td>
</tr>
<tr>
<td>KGT flange nut KGF</td>
<td>add the respective nut length</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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Z-250 to Z-1000:

<table>
<thead>
<tr>
<th>Z-250</th>
<th>Z-350</th>
<th>Z-500</th>
<th>Z-750</th>
<th>Z-1000</th>
</tr>
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<tbody>
<tr>
<td>Ir basic length without journal</td>
<td>265</td>
<td>288</td>
<td>356</td>
<td>417</td>
</tr>
<tr>
<td>Ir basic length with journal (= standard for opposed bearing plate GLP)</td>
<td>340</td>
<td>388</td>
<td>486</td>
<td>537</td>
</tr>
<tr>
<td>KGT basic length with journal(3)</td>
<td>365</td>
<td>408</td>
<td>486</td>
<td>592</td>
</tr>
<tr>
<td>KGT basic length increased screw with journal(3)</td>
<td>80x10 340</td>
<td>100x20 428</td>
<td>125x25 506</td>
<td>140x25 557</td>
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<tr>
<td>KGT basic length without journal(3)</td>
<td>80x20 380</td>
<td>100x40 508</td>
<td>125x40 566</td>
<td>140x40 617</td>
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<td>KGT basic length increased screw with journal(3)</td>
<td>80x40 460</td>
<td>100x60 588</td>
<td>125x60 646</td>
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</tr>
<tr>
<td>KGT basic length without journal(3)</td>
<td>80x60 540</td>
<td>100x80 668</td>
<td>125x80 726</td>
<td>140x80 777</td>
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<tr>
<td>Duplex nut DM</td>
<td>140</td>
<td>160</td>
<td>180</td>
<td>220</td>
</tr>
<tr>
<td>Self-aligning nut PM</td>
<td>224</td>
<td>275</td>
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<td>-</td>
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<tr>
<td>DM + safety nut SIFA</td>
<td>250</td>
<td>370</td>
<td>303</td>
<td>365</td>
</tr>
<tr>
<td>PM + safety nut SIFA</td>
<td>369</td>
<td>455</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1. Bellows(3)</td>
<td>ZD-22</td>
<td>ZD-22</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2. Bellows(3)</td>
<td>ZD-40</td>
<td>ZD-40</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>KGT flange nut KGF</td>
<td>add the respective nut length</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

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

<table>
<thead>
<tr>
<th>Gearbox type</th>
<th>Size</th>
<th>Version</th>
<th>Drive ratio</th>
<th>Screw version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z</td>
<td>2</td>
<td>S</td>
<td>N</td>
<td>Tr</td>
</tr>
<tr>
<td>GSZ</td>
<td>5</td>
<td>N</td>
<td>L</td>
<td>Tr/SIFA</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25</td>
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<tr>
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</tr>
<tr>
<td></td>
<td>100</td>
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<tr>
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<td>150</td>
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<tr>
<td></td>
<td>500</td>
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<tr>
<td></td>
<td>750</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Screw Ø / pitch</th>
<th>Number of screw starts, material</th>
<th>Stroke</th>
<th>List of accessories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tr</td>
<td>1804</td>
<td>H + stroke in mm</td>
<td>List of accessories (in any sequence) see Section 4</td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Tr/SIFA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1605</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1610</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Tr**: Trapezoidal screw (not stated = Tr)
- **Tr/SIFA**: Tr with safety nut SIFA
- **OP**: OP
- **EL**: EL
- **ELV**: ELV
- **ELD**: ELD
- **NO**: NO
- **KGT**: KGT
- **Ball screw**

*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

The separate lubrication system is essential for high performance.

Screw lubrication during operation provides optimum grease distribution.

The same INNOVATION is also available for the ball screw version (KGT).

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

**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.

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

**Gearbox lubrication**

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 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](http://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.

**ZIMM Instruction Manual** in other languages and for special products are available on request or by downloading from [www.zimm.at](http://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:

<table>
<thead>
<tr>
<th>Component Type</th>
<th>Temperature Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard screw jacks</td>
<td>-25°C to +80°C [-40°C to +100°C]</td>
</tr>
<tr>
<td>High temperature screw jacks</td>
<td>up to 160°C, or 200°C</td>
</tr>
<tr>
<td>Round bellows</td>
<td>-32°C to +70°C (max. +85°C)</td>
</tr>
<tr>
<td>Polygonal bellows</td>
<td>-15°C to +70°C (no exposure to direct sunlight)</td>
</tr>
<tr>
<td>Limit switch</td>
<td>-30°C to +85°C</td>
</tr>
<tr>
<td>Rotary pulse encoder DiG</td>
<td>-40°C to +80°C</td>
</tr>
<tr>
<td>Motors</td>
<td>above 40°C reduced power, e.g. factor 0.8 at 60°C</td>
</tr>
<tr>
<td>Connecting shafts VWZ+KUZ-KK</td>
<td>0°C to +70°C, reduced from -20°C to +100°C (max. +120°C)</td>
</tr>
<tr>
<td>Couplings KUZ</td>
<td>-20°C to +70°C, reduced from -40°C to +100°C</td>
</tr>
<tr>
<td>Bevel gearboxes</td>
<td>-10°C to +90°C</td>
</tr>
<tr>
<td>Ball screws KGT</td>
<td>-20°C to +80°C</td>
</tr>
</tbody>
</table>

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.