NOZAG Transmission

General/Basics

Summary – System Program

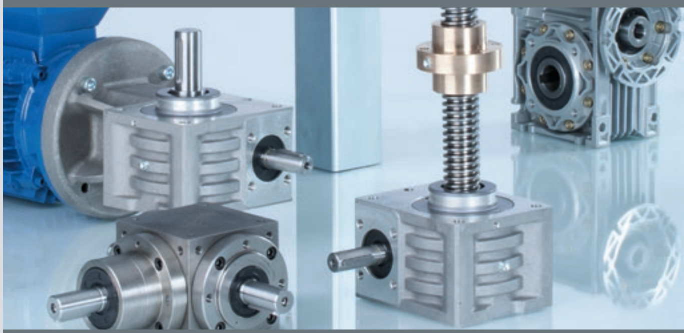
About us

What counts is success – We help you achieve it
Today clear competitive advantages and opportunities depend on flexibility, speed, innovation and continuous improvement. We understand that time has become one of the most significant competitive factors. In clearly defined markets, we offer advanced solutions that aim at optimum customer value. With internationally recognized quality, – our entire company is certified according to ISO 9001:2008 – high stock availability and maximum reliability, we aim at being a true partner for our customers. We are aware that a lasting partnership is built on mutual trust and understanding and will be further strengthened by absolute liability. Nozag employees commit themselves every day to win the confidence of clients and suppliers. Highly, above-average skilled employees and state-of-the art facilities are the basis for that.

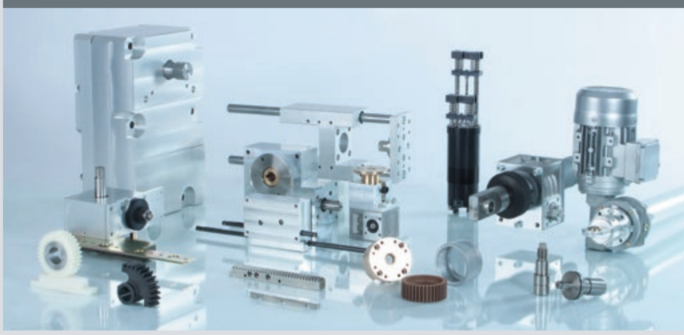
In-house manufacturing is supported by high-performance logistics; this going along with simple, direct and to-the-point communication with our partners. We respect and comply with all pertinent laws, especially those that protect the environment and the health and safety of our workers.

Standard Program Standard parts, further processing

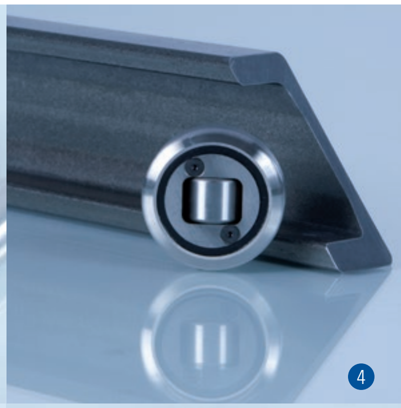
System Program Screwjack systems, standard gearboxes

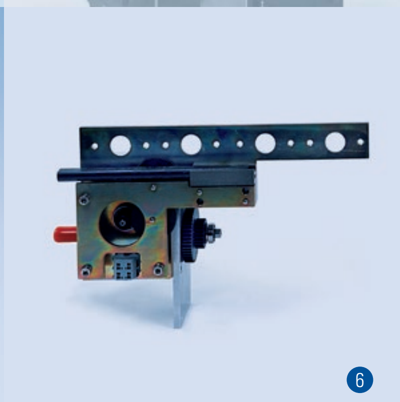


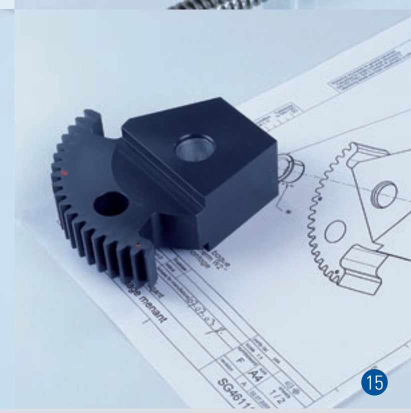
Toothed components, electromechanical and pneumatical drives



Product overview







System Program
1 Screw jacks
2 Bevel gearboxes
3 Connecting shafts
4 Linear drives
5 Gear, worm gear
6 Customer-specific construction group

Standard Program
7 Spur gears module 0.3 to 8
8 Bevel gears up to module 6
9 Worms and worm wheels
10 Standard racks
11 Trapezoid threaded screws, trapezoid threaded nuts
12 Chains and chain wheels
13 Couplings
14 Hardened precision steel shafts
15 Manufacturing according to drawing

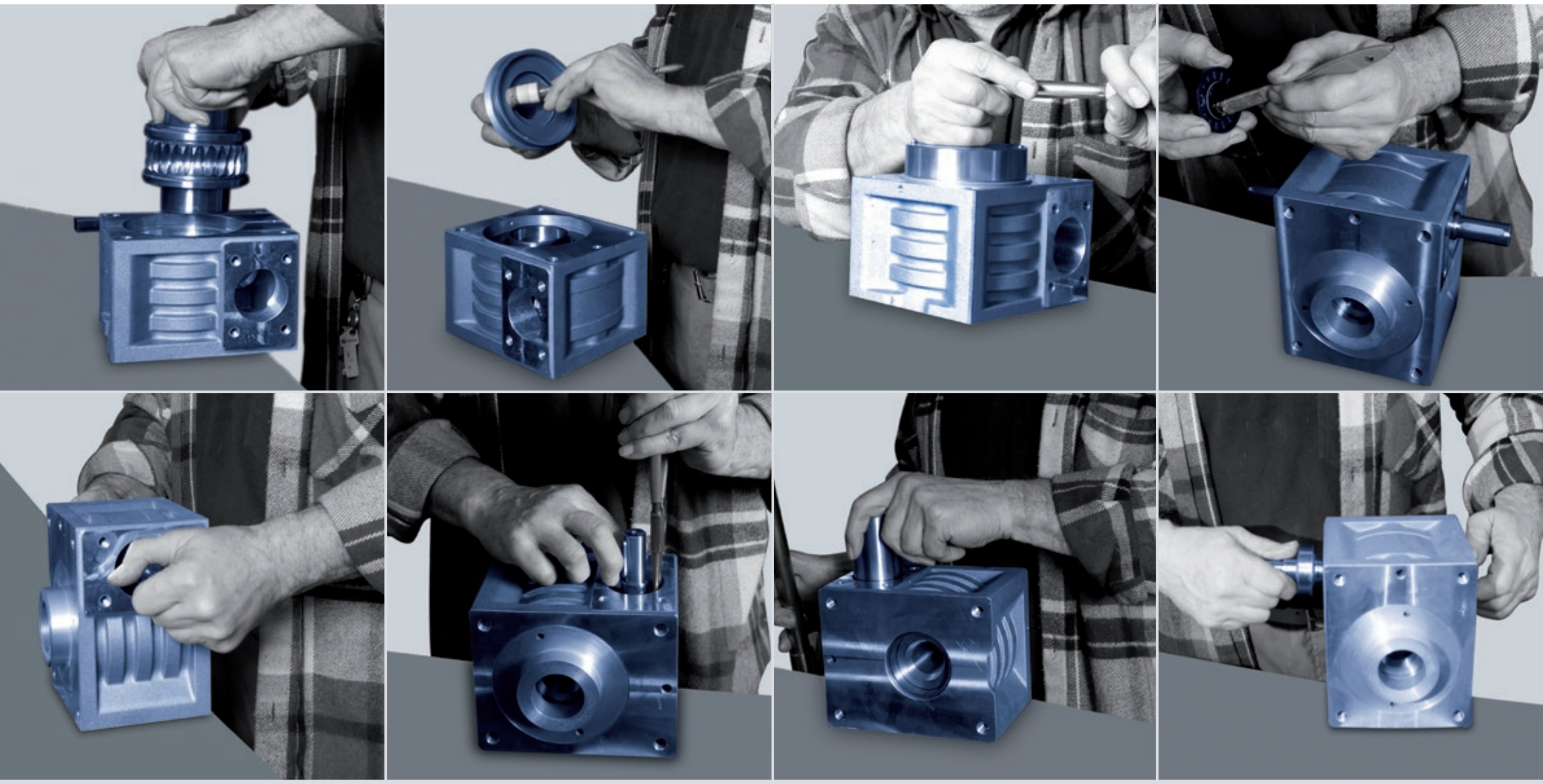
Contents Catalog systems

Screw jack

1. General/Basics Modular system / Layout procedure / Practical applications / Application requirements / Base values / Design/Calculation	5
2. Screw jacks, non-rotating Application examples / Checklist / Sizes/System overview / Sizes/Models / Attachments / Length determination / Section drawing	25
3. Screw jacks, rotating Application examples / Checklist / Sizes/System overview / Sizes/Models / Attachments / Length determination / Section drawing	61
4. Drive components Connecting shafts / Pedestal bearings / Clamp coupling / Flexible couplings / Bevel gear LMA / Bevel gear RM	89
5. Motor attachment Principles / Motor adapter / Motor adapter / Motors power rating/output / Brake motors power rating/output / Rotary pulse encoders / Spring-loaded brake	117
6. Maintenance Assembly and Operating Manu	134

Individual products and services

7. Customer specific assemblies/gearboxes / Individual gear components / Hardened and ground precision shafts h6	149
8. General terms and conditions	157



Screw jacks from our own production facility

To view the screw jack in all its facets as a standard machine element, that is a dream of many designers and machine builders.

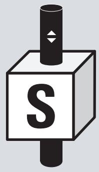
We have already accepted this challenge a few years ago and today, offer the market a comprehensive delivery program and product range of screw jacks and accessories. Even the very first series, attachments and accessories were conceived and developed with the thought of one day being able to make from them, a large modular kit for individual and operationally safe drive-technology solutions.

To put it succinctly: A lot should be moved with as little effort as possible, and in doing so, the investment, maintenance, repair and operating costs must stay within narrow limits. Screw jacks such as the ones developed, produced and sold by Nozag, solve drive-engineering tasks and problems in a comparably simple, and above all economical and cost-effective manner.

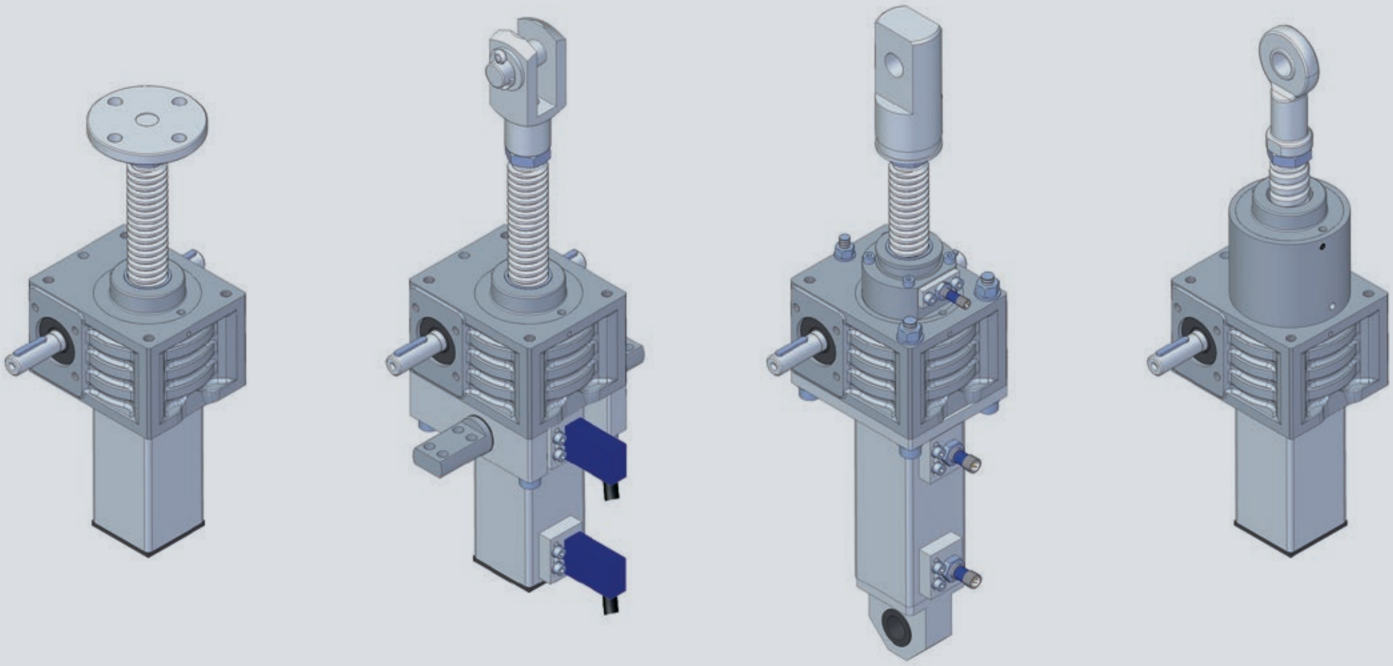
The customer thus receives, from a single responsible source, a complete, ready-to-install lifting/lowering/drawing/pushing system with defined interfaces. The possibilities of use are almost unlimited and as widespread as the supply program and product range. They range from the task analysis and the design calculation and manufacture, right up to the supply of the ready-to-install unit.

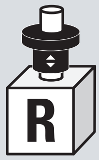
Nozag modular kit

Defined force up to 1000 kN
- Rational design through complete modular sets – through-and-through compatible
- Everything from a single source minimises the procurement effort
- Supply of pre-assembled units and assemblies including motors
- Short delivery times
- Modern design
- Same force forward/backwards
- Constant speed forward and back, corresponding to the rotational speed of the drive motor
- Adjustable stroke

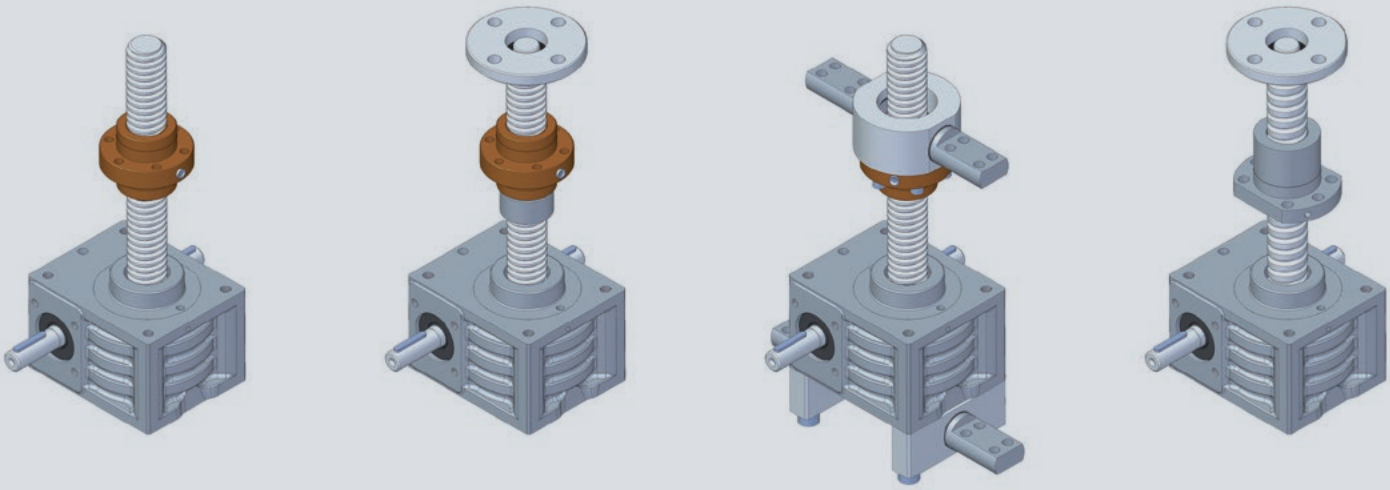


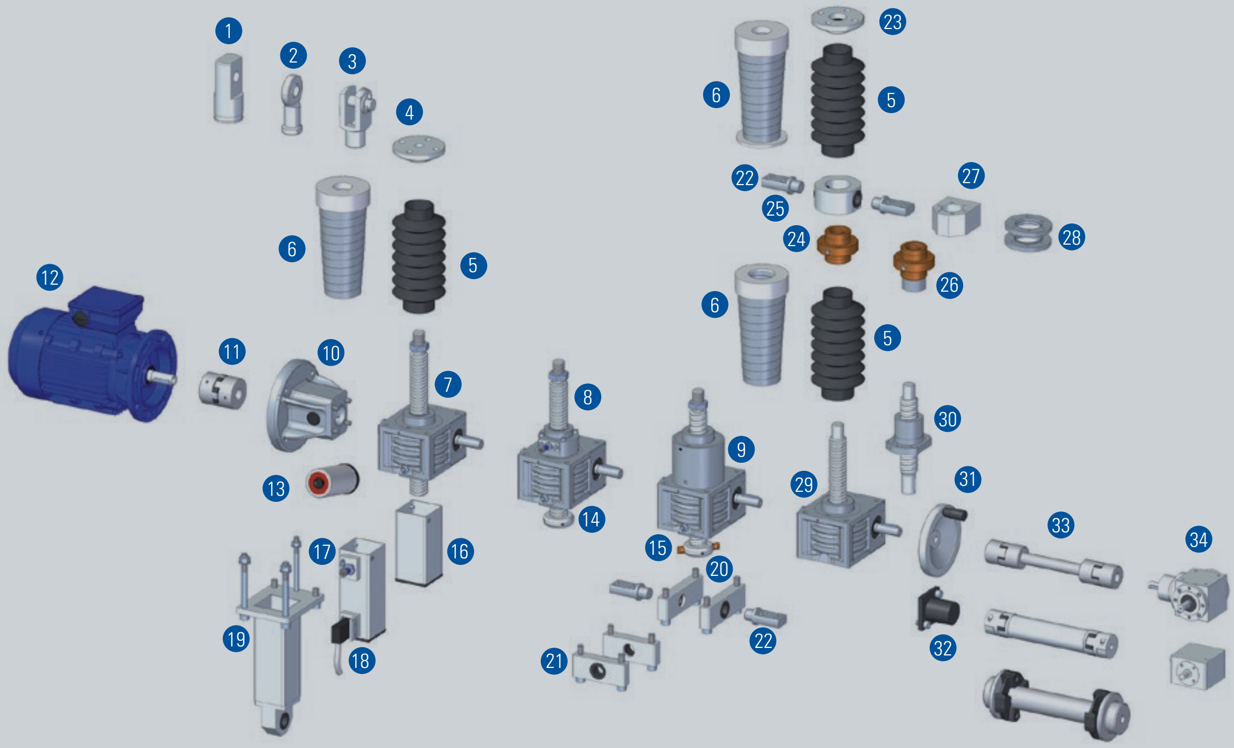
Non-rotating spindle
The worm wheel is provided with a female thread and converts the rotational movement into an axial movement of the spindle, when the latter is prevented from rotating (through its design or by means of an anti-rotation protection in the protection tube).





Rotating spindle
The spindle has a fixed connection to the worm wheel and rotates with it. The nut therefore screws itself up and down.





The modular, flexible and innovative screw jack kit in a wide performance range from 2 to 1000kN makes perfect drive solutions from low-cost standard components. Through the new gearbox series N, the kit not only includes the use of high-quality materials, innovative coatings and high-performance components, but is also subject to the highest standards of functionality, quality and design.

Your construction will be simpler and cost effective

> Easy assembly with standardized individual components from the kit. You save time
> less specific designs, because of a wide range of options to choose from

Complete drive systems – all from one source

> Whether motor, position measuring system, position switches or special requirements – you have one partner

1 Swivel bearing head
2 Ball joint head
3 Fork head
4 Mounting flange
5 Bellows
6 Spiral spring cover
7 Screw jacks, non-rotating
8 Screw jacks, non-rotating with safety trap nut
9 Screw jacks, non-rotating with ball screw
10 Motor adapter
11 Flexible coupling
12 Motor/brake motor
13 Lubricant dispenser
14 Unscrew protection
15 Anti rotation lock
16 Protection tube
17 Limit switch inductive
18 Limit switch mechanical
19 Support tube
20 Suspension adapter long
21 Suspension adapter short
22 Suspension bolt
23 Flange bearing
24 Flange nut/Duplex nut
25 Suspension adapter for flange nut
26 Safety trap nut
27 Carrier flange
28 Calotte disks
29 Screw jack, rotating
30 Ball screw flange nut
31 Hand wheel
32 Protection cap
33 Connecting shafts
34 Bevel gearboxes

Analysis and Definitions

Do come to us with your concerns and wishes. We would be happy to discuss this situation with you and consider the problem. After the analysis, we will define the objectives that have to be reached in terms of content, scope and time.

Feasibility study

Design
1. Tensile or compressive load
2. Buckling
3. Lifting speed
4. Critical bending speeds
5. Duty cycle

Ambient conditions
1. Chemicals, aggressive media
3. Corrosion
4. Temperatures, humidity
5. Dirty environment
6. Swarf

Safety aspects
1. SUVA-, TÜV-specifications (Machinery Directive)
2. Laws
3. Personal protection
4. Expensive plants/machines

Draft

1. Quotation
2. Technical drawing
3. Purchase order

Test/implementation

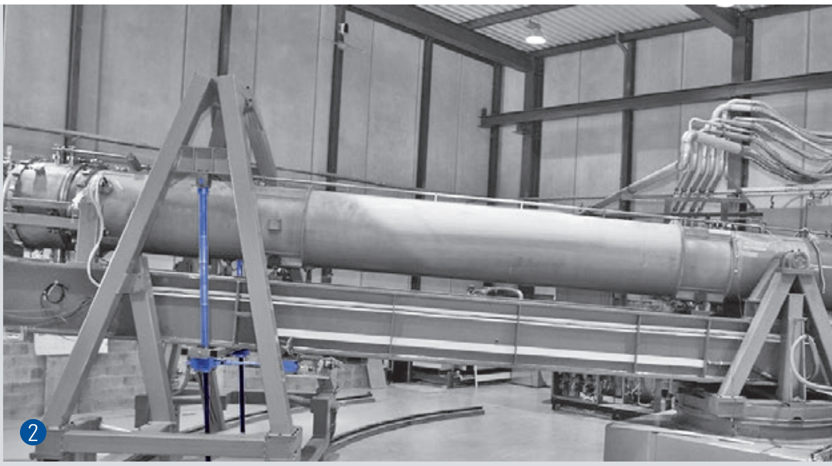
1. Delivery
2. Assembly and installation
3. Commissioning

Screw jacks as linear movement drives, are appliable wherever controllable, raising, lowering, pushing, pressing, tilting, swivelling and similar movement sequences involving positioning, with millimetre accuracy, are to be carried out, in a constantly variable (i.e. stepless) manner, i.e. where rotational movements have to be converted into linear movements. Here, it is insignificant whether the linear movements take place horizontally, vertically, for pushing or pulling. Trouble-free functioning is guaranteed in all installation positions.

The advantages of the screw jacks with trapezoidal thread spindles and nuts as compared to other systems are, for example, in the self-locking feature, given from the design, when the drive is at standstill, and the minimal maintenance complexity. Screw jacks are closed drive concepts, in a compact construction, robust, impact-damping and silent.

Our planned procedures result in achieving the goal
Regardless of the type of challenge that you are confronting; it is always worthwhile to place an inquiry with us. Your goal is a mere four steps away.


1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4


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Practical applications

1 Packaging
Correct height setting for filling

2 Research
Exact positioning of the measuring instrument for sunlight

3 Sunshade
Opening and closing the sunshade

4 Silo cover
Controlled closing and opening of the cover

5 Textile industry
Reliable positioning despite vibrations

6 Solar tracker
Fine-positioning of solar panels

7 Space Travel
Exact levelling, due to individually controllable lifting jacks

8 Lifting carriage
Manual positioning of pipes

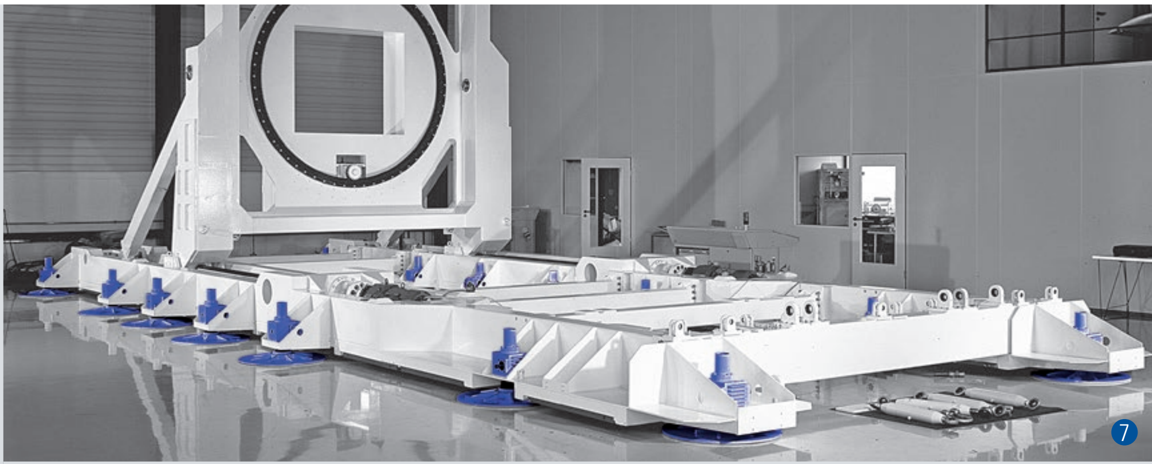
9 Garage lift
Space-saving solution through lifting one of the vehicles

10 Vacuum chamber
Positioning and adjusting the chamber

11 Production machine
One motor drives four lifting jacks, mechanically synchronised

12 Silo
Construction and lifting help for large silo construction

6



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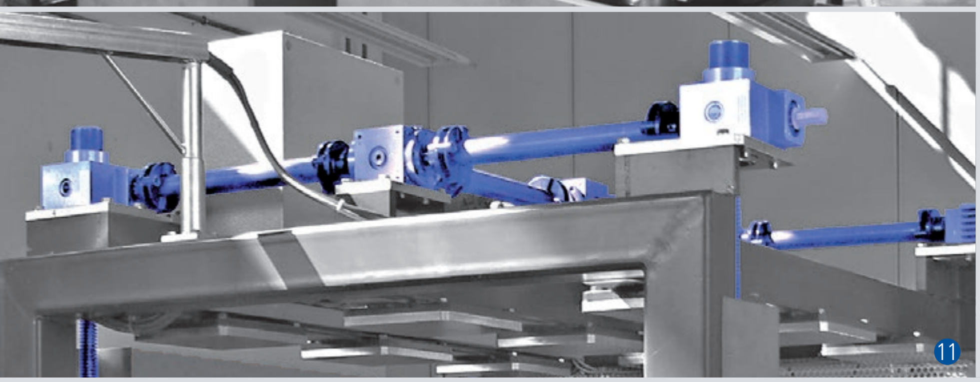

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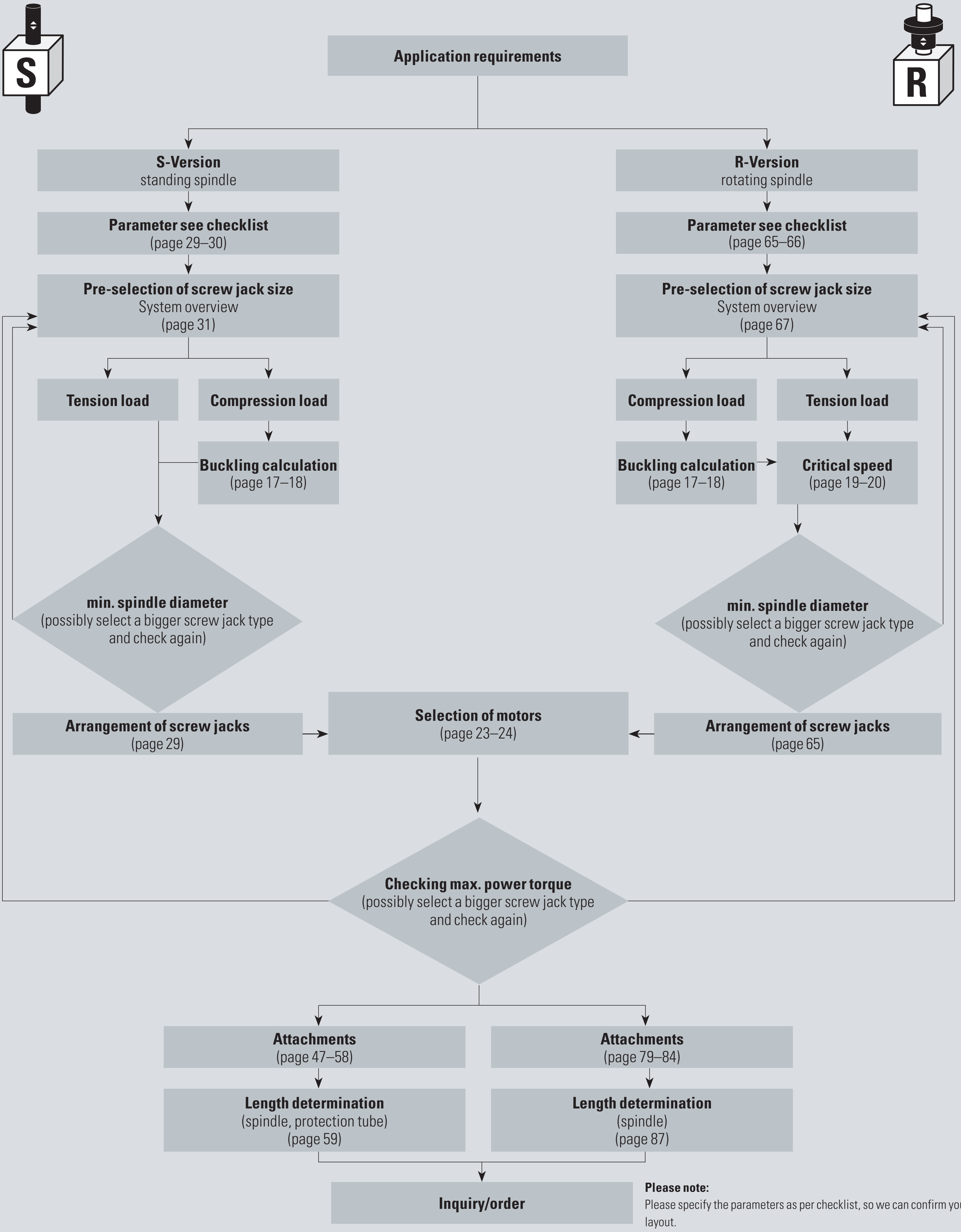
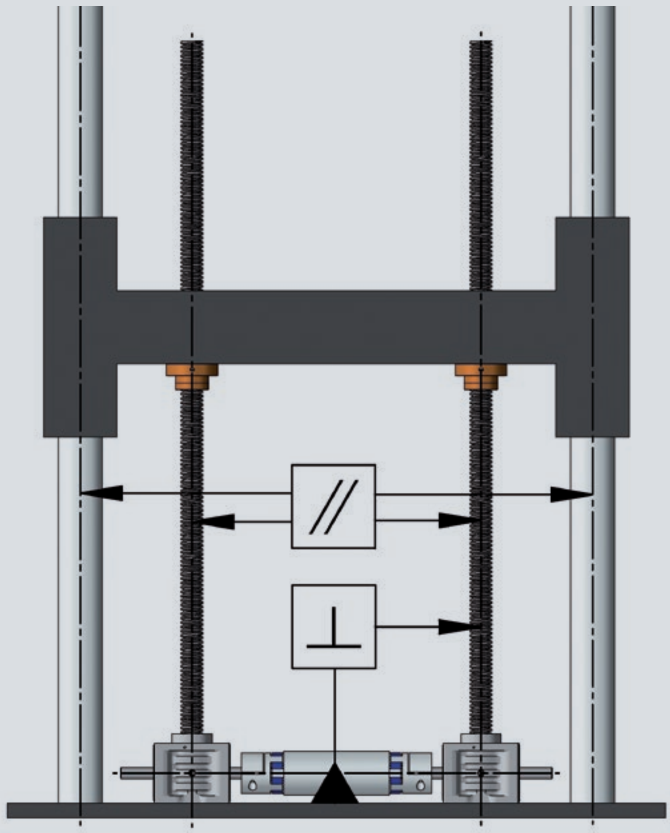
Selection of Screw Jack System and Arrangement



Please note:
Please specify the parameters as per checklist, so we can confirm your layout.

Construction and layout
The selection or the dimensioning is determined by the customer, since we are not familiar with the construction conditions like the place of application and the type of operation. If desired, we can be of help for the selection and design of the layout, and can generate assembly drawings and calculations for you on the basis of your rating parameters, as suggestions. The gearboxes are conceived in accordance with the load and duty cycle shown in the catalogue, for industrial purposes. We request you to check with us for any requirements over and above these. We generally supply subject to our current terms and conditions of supply.



Lifting speed
Normal version N:
1 mm stroke per drive shaft revolution
(exception NSE2-N with 0.8 mm)
gives, at 1500 min^{-1} > 25 mm/s
or 20 mm/s
respectively

Slow version L:
0.25 mm stroke per drive shaft revolution
(exception NSE2-L with 0.2 mm)
gives, at 1500 min^{-1} > 6.25 mm/s
or 5.00 mm/s
respectively

Possibilities of influencing the lifting speeds
Increasing
- Double-thread spindle (usually not an in-stock item): Doubling the speed (Caution: max. input drive torque, not self locking, brake required)
- Reinforced spindle for R-version (spindle of the next bigger gearbox): depending on the gearbox size, somewhat greater pitch/lifting speed
- Ball screw spindle: different pitches available
- Frequency converter: The motor rotation speed can be increased to more than 1400.

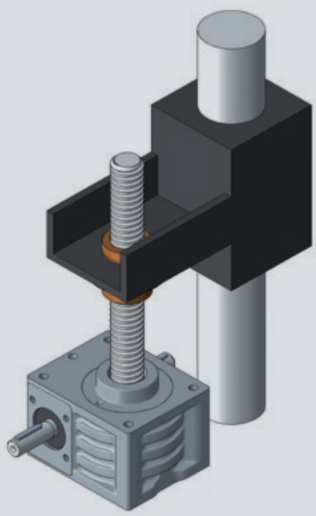
Reduction
> Motors with a higher number of poles/smaller rotation speed (6-, 8-pole)
> Frequency converter (Attention: in case of prolonged operation below 25 Hz, sufficient cooling of the motor must be ensured, e.g.: external fan)
> Geared motor (Attention: maximum input drive torque)
> Bevel gearbox with reduction (only possible with some arrangements)

Temperature and duty cycle
Screw jacks are basically not suitable for continuous operation. In borderline cases, choose a larger gearbox or contact us.
The operating temperature may not exceed 80°C (higher upon request).

Parallelism and angularity
Attention must be paid to parallelism and angularity of the screw-on surfaces, gearboxes, nuts and guides with respect to one another. Also, exact alignment of the gearbox, pedestal bearings, connecting shafts and motors to one another.

If lifting jacks are used in machine building, there are hardly ever any problems, since the surfaces are machined. However, in plant construction, with steel structures, there are very frequently errors in the geometry of the welding construction despite meticulous working. Geometric errors can also occur owing to the interplay between different components. Here, the following must be remembered: The parallelism of the spindles to one another and to the guides must be guaranteed, otherwise, the system can get stuck during operation. Also, the fastening surfaces of the gearbox must be exactly at right angles to the guides, otherwise jamming can occur. This results in faster wear and/or destruction. Basically, mounting surfaces for the nuts must also be at an angle. To save time and costs in this respect, the compensating nuts can be used. Another possibility of balancing out certain inaccuracies in the design is the use of Cardan adapters.

Guides
The play of the guide bushing in the gearbox neck is toleranced between 0.2 and 0.6 mm depending on the size. This is a secondary support and does not replace a guidance system for absorbing lateral forces.



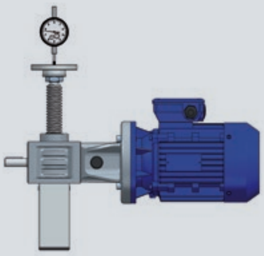
Lateral forces
Lateral forces acting on the spindle are to be absorbed by additional guides (1 N lateral force > 4 N more lifting force). Loads must be led externally as far it is possible.

Anti-rotation lock
In the case of non-rotating version S, the spindle is loosely screwed into the gearbox (worm wheel). Because the spindle would also rotate owing to the friction in the worm wheel, it must be locked against rotation. This can be achieved by the spindle linkage to your construction (e.g. external guide) or by means of an anti-rotation lock in the protection tube.

Fastening
A plane-machined base surface is required. The fastening screws are designed for the static nominal load of the gearbox for tension and compression. Additional impact loads etc. must be taken into account. The screw-in depth must be maintained. For the main load direction, the fastening screws should be mounted for «Pressure». In case of unknown factors like impact and vibration, we recommend an additional securing of the lifting jack by means of beams and threaded rods. This will secure the maximum load for tension and compression.

Safety distance
The safety distance between the movable and the fixed components must not be underrun, otherwise, there is a danger of jamming. A lifting system must never come to a mecanical stop.

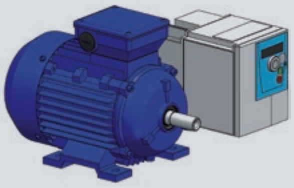
Accuracy
The repeat accuracy of the gearbox is up to 0.05 mm, when moving to the same position again under the same circumstances. This requires drive-side measures such as the use of a three-phase braking motor in conjunction with a frequency converter and rotary pulse transmitter or a servomotor with resolver, etc.
The pitch accuracy is ± 0.2 mm over a spindle length of 300 mm in the case of trapezoidal spindles, and with ball screw spindles, 0.05 mm over 300 mm spindle length. With alternating loads, the axial play can be up to 0.4 mm in the case of trapezoid threads and 0.08 mm in the case of ball screws.



Direction of Rotation and Movement
Note the direction of rotation of the system and indicate it in the drawing or select one of our standard arrangements (page 20). In the case of T-bevel gear drives with a through-drive shaft, the direction of rotation can be changed by simply inversing the gearbox

Self-locking/overrun
Screw jacks with a single-start trapezoid thread spindle are self-locking to a limited extent and that too, not always reliably in case of impact loads or vibrations (brake recommended).
The overrun, after switching off the motor, is different depending on the application. To reduce the overrun to a minimum, we recommend using a braking motor. In case of double-thread spindles or ball screws, a braking motor is necessary, as these are not self locking.

Drive
For uniform starting and braking ramps, we recommend the use of a frequency converter. This increases the life of the system and the starting noises are minimised.



Trial operation
To ensure safe working, a test run at no-load and under load in real-time operation is required. It is necessary to run the trials at your premises, to achieve an impeccable geometry through exact assembly, as well as to eliminate influences that could disturb the working.

Spare Parts
For protection from production downtimes, in case of a long duty cycle or a high load, we recommend stocking a gearbox set (incl. threaded spindles and accessories) either with you or your customer.

Stage construction
We supply lifting jack systems according to the current stage building specifications.

Land-, air and water vehicles
Our machine elements, used in all vehicles that run on land or water or in the air, are generally exempted from the product liability. Individual agreements can be drawn up with us.

Ambient conditions
If your ambient conditions are not similar to those of a normal industrial workshop, please specify accordingly (checklist for non-rotating, page 29; checklist for rotating, page 65).

Operation
The loads, rotation speeds, duty cycles and operating conditions assumed for the screw jacks and attached elements may not be exceeded – not even for a short time – (even a one-off excess can result in permanent damage). Good spindle lubrication ensures optimum operating and wear conditions.

Maintenance
In screw jack systems, good, permanent lubrication between the spindle and the spindle nut (worm wheel) is essential. They must be kept free of grease residues. After a short operating time, all the fastening screws should be tightened. At intervals that are laid down according to the prevailing operating conditions, the wear of the spindle nut (safety trap nut) should be checked on the basis of the thread play. If the thread play is more than 1/4th the thread pitch, the spindle nut (worm wheel) should be replaced.

For ensuring reliable lubrication of the spindle or in case of prolonged duty cycles of the gearbox, we recommend an automatic grease dispenser.

The gearboxes are lubricated for life under standard conditions, no grease nipples available for future use.

Lubrication of screw jacks type NSE
Lubrication is done with grease, option oil. The gearboxes are lubricated for life under standard conditions.

Lubricants for spindles:
Klüber: Microlube GBU Y 131
Other lubricants provided upon request.

CAD-files
To support you in your design, you can download our components in the form of CAD files from our homepage www.nozag.ch.

Data sheets
For every screw jack, a summary is available under the product data sheets in the downloads section at www.nozag.ch.

Screw Jacks «Gold» – For Extreme Environmental and Operational Conditions

The shiny casing, mounting flange and cover indicate the highest degree of corrosion resistance. In simple terms, the conventional aluminum components as well as the external parts have been replaced by components made of the aluminum bronze material CuAl10Fe5Ni5. All the spindles and shafts as well as the internal elements are manufactured from stainless steel or synthetic material (seals).

- High corrosion stability combined with a high degree of wearing resistance and cavitation protection through CuAl10Fe5Ni5
- Resistance against mechanical damages due to an oxide protection film (basically Al203) that immediately forms on the material surface
- Excellent performance in applications with gases, fluids and solid materials

The CuAl10Fe5Ni5 material
- features high scaling resistance (up to 800°)
- has a lower degree of corrosion resistance to strongly acidic media with high oxidation potential (such as nitric acid) as well as alkaline materials, because these will dissolve the oxide coating and prevent its formation.
- has a lower tendency to selective corrosion (dealumination)

Areas of Application
Screw jacks of this design may be used for instance in industrial applications in the vicinity of saline water or sulfuric oxide, in slightly oxidizing and weak alkaline areas, in brackish water, in organic acids (acetate) and in reducing as well as slightly oxidizing mineral acids (diluted hydrochloric, hydrofluoric or phosphoric acid), in environments containing sulfuric acid at room temperature or at elevated temperatures.

1.6 Base values

General/Basics

TR-spindle, single-thread
Efficiency

TR	P	η lubricated	Core-Ø	Flanks-Ø
14	4	0.50	9.5	12.0
18	4	0.42	13.5	16.0
20	4	0.40	15.5	18.0
24	5	0.41	18.5	21.5
30	6	0.40	23.0	27.0
40	7	0.36	32.0	36.5
50	8	0.34	43.0	46.0
60	9	0.32	50.0	55.5
80	16	0.40	62.0	72.0
100	16	0.34	84.0	92.0
120	16	0.30	104.0	112.0
140	20	0.31	118.0	130.0
160	20	0.28	138.0	150.0

The efficiency of trapezoid thread spindles is far lower as compared to ball screw spindles because of the sliding friction. However, the trapezoidal screw is technically simpler and less expensive. Any securing, for example by a brake, should be examined individually, owing to the limited self-locking of trapezoidal screws.

TR-spindle, double-thread
Efficiency

TR	P	η lubricated	Core-Ø	Flanks-Ø
14	8	0.71	9.5	12.0
18	8	0.63	13.5	16.0
20	8	0.60	15.5	18.0
24	10	0.61	18.5	21.5
30	12	0.60	23.0	27.0
40	14	0.56	32.0	36.5
50	16	0.53	43.0	46.0
60	18	0.51	50.0	55.5
80	32	0.60	62.0	72.0
100	32	0.53	84.0	92.0
120	32	0.48	104.0	112.0
140	40	0.50	118.0	130.0
160	40	0.46	138.0	150.0

In the case of ball screw spindles, an efficiency of < = 0.9 can be reckoned with. Here, a brake must always be provided.

Efficiency

Size	N	L
2	0.76	0.45
5	0.84	0.62
10	0.86	0.69
25	0.87	0.69
50	0.89	0.74
100	0.85	0.65
150	0.84	0.67
250	0.86	0.72
350	0.87	0.70
500	0.84	0.62
750	–	–
1000	–	–

No-load torque

Size	N	L
2	0.21	0.11
5	0.10	0.08
10	0.26	0.16
25	0.36	0.26
50	0.76	0.54
100	1.68	1.02
150	1.90	1.20
250	2.64	1.94
350	3.24	2.20
500	3.96	2.84
750	–	–
1000	–	–

Efficiency of drive components
Coupling $\eta = 0.99$
Connecting shaft $\eta = 0.98$
Bevel gear $\eta = 0.97$

Critical buckling force of the lifting spindle

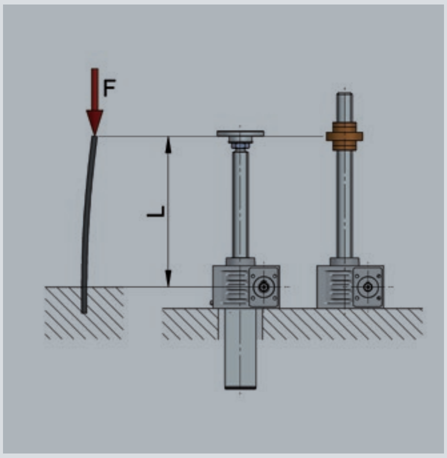
Explanation

I = moment of area of the 2nd degree in mm^4
F = max. 1 load/gearbox in N
L = free spindle length in mm
E = modulus of elasticity for steel (210000 N/mm^2)
s = safetyfactor (normally 3)
d = minimum core diameter of the spindle

Base de conception

F = 19000 N/gearbox
L = 836 mm
s = 3

Load case 1



Formula

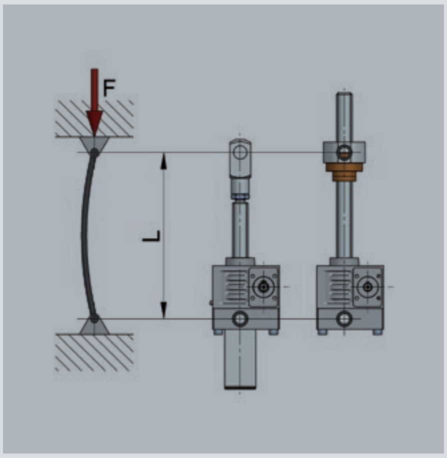
$$I = \frac{F \times s \times (L \times 2)^2}{\pi^2 \times E} \quad \text{then} \quad d = \sqrt[4]{\frac{I \times 64}{\pi}}$$

Example

$$I = \frac{19000 \times 3 \times (836\,mm \times 2)^2}{\pi^2 \times 210000 N/mm^2} = \frac{15.9348^{10}\,mm^4}{2072616.9} = 76882.7\,mm^4$$

$$d = \sqrt[4]{\frac{19000 \times 3 \times (836\,mm \times 2)^2}{\pi^2 \times 210000 N/mm^2}}$$
= 35.3 mm minimum core diameter
= NSE100 (core-Ø = 50.0 mm)

Load case 2



Formula

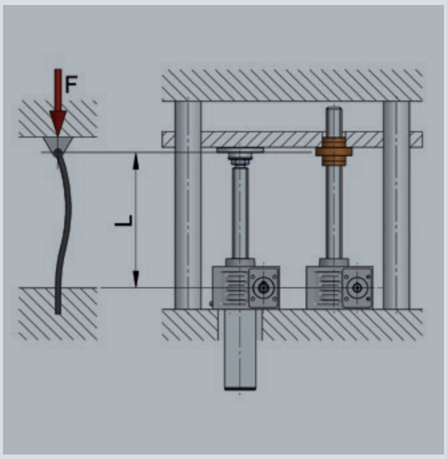
$$I = \frac{F \times s \times L^2}{\pi^2 \times E} \quad \text{then} \quad d = \sqrt[4]{\frac{I \times 64}{\pi}}$$

Example

$$I = \frac{19000 \times 3 \times 836\,mm^2}{\pi^2 \times 210000 N/mm^2} = \frac{3.98371^{10}\,mm^4}{2072616.9} = 19220.7\,mm^4$$

$$d = \sqrt[4]{\frac{19220.7\,mm^4 \times 64}{\pi}}$$
= 25.0 mm minimum core diameter
= NSE50 (core-Ø = 32.0 mm)

Load case 3



Formula

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

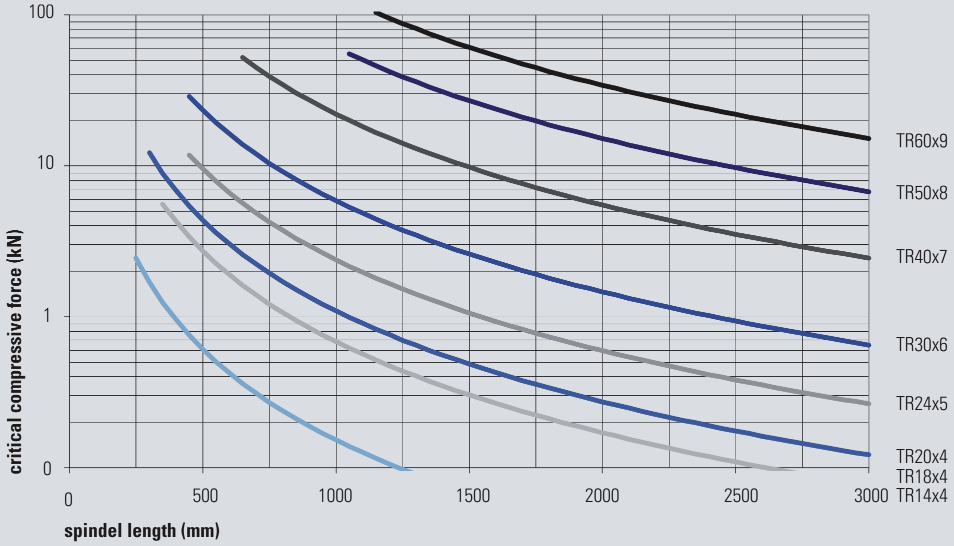
Example

$$I = \frac{19000N \times 3 \times (836\,mm \times 0.7)^2}{\pi^2 \times 210000 N/mm^2} = \frac{1.9520^{10}\,mm^4}{2072616.9} = 9418.1\,mm^4$$

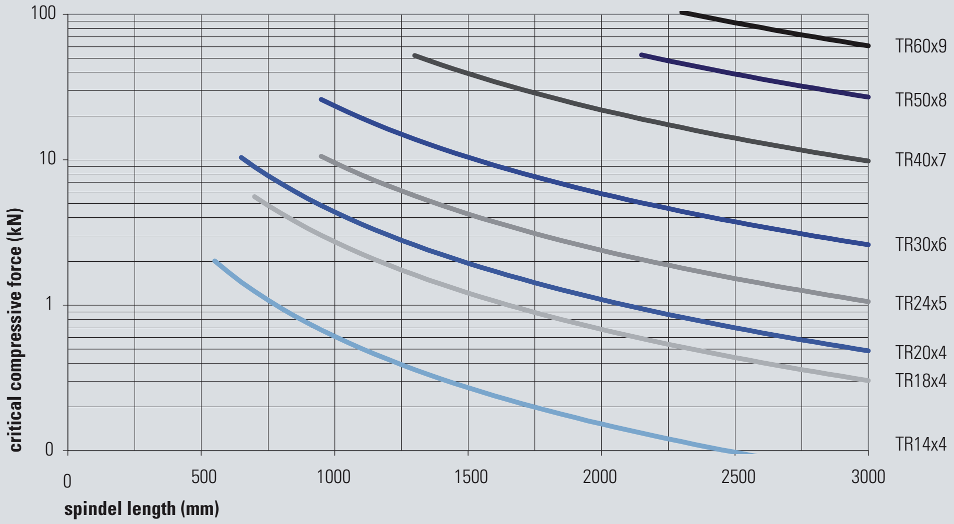
$$d = \sqrt[4]{\frac{9418.1\,mm^4 \times 64}{\pi^2 \times 210000 N/mm^2}}$$
= 20.9 mm minimum core diameter
= NSE25 (core-Ø = 23.0 mm)

In the diagram below (calculated with safety 1) with the corresponding load case (1/2/3), determine the point of intersection of buckling force F and the free spindle length L. The point of intersection must be below the line of demarcation of the selected spindle diameter. If this is not the case, a larger spindle or the next larger gearbox should be selected.

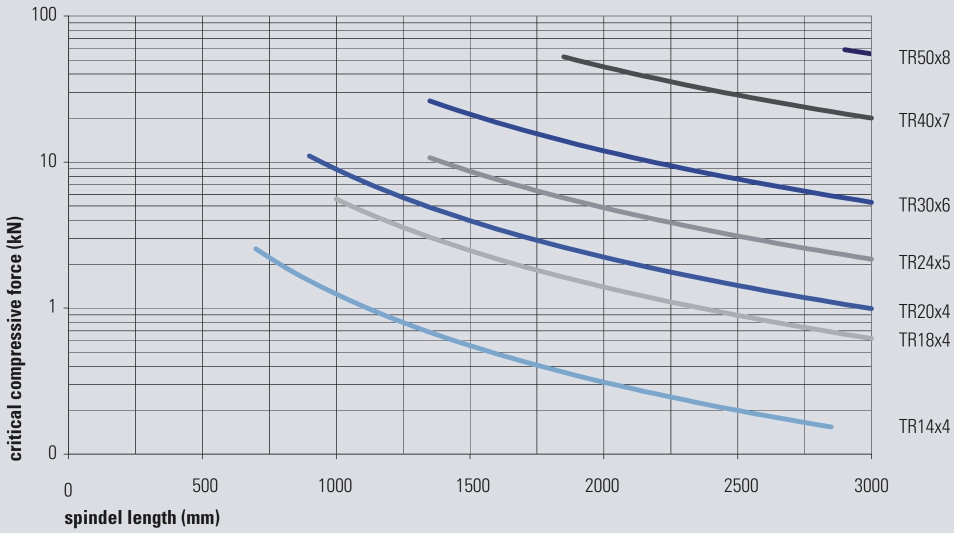
Load case 1



Load case 2



Load case 3



Bending critical speed of trapezoid thread spindle

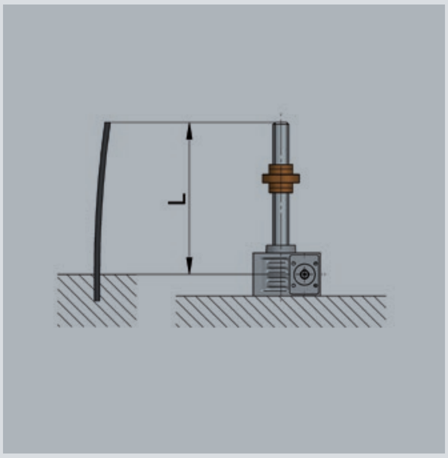
Explanation

C_P = Spring constant
I = Second moment of area (mm^4)
L_K = Free spindle length (mm)
E = Modulus of elasticity (N/mm^2)
d_F = Flank diameter of the spindle (mm)
m_{a1} = Weight of the spindle (kg/m)
s = Safetyfactor (normally 3)
n_K = Crit. rotation speed (min^{-1})

Base de conception

d_F = 27.00 mm (TR 30 × 6)
L_K = 2000 mm
s = 3
ma1 = 4.5 kg/m

Load case 1



Formula

$I = \frac{\pi \times d_F^4}{64}$ then $m = \frac{L_K}{1000} \times ma1$ then $C_P = \frac{48 \times E \times I}{L_k^3}$

$n_k = 150 \times \sqrt{\frac{C_P}{m}}$

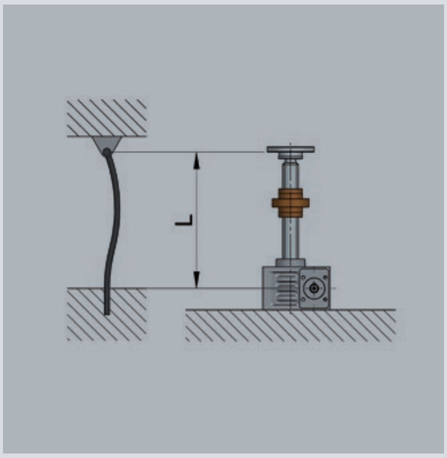
Example

$I = \frac{\pi \times 27.00^4}{64} = 26087\ mm^4$ $m = \frac{2000mm}{1000}$ x 4.5 kg/m = 9 kg

$C_P = \frac{48 \times 210000 \times 26087}{2000^3} = 32.9$

Case 1 according to Euler: $n_{k1} = 150 \times \sqrt{\frac{32.9}{9}} = 287\ min^{-1}$

Load case 3



Formula

$I = \frac{\pi \times d_F^4}{64}$ then $m = \frac{L_K}{1000} \times Weight/m$ then $C_P = \frac{48 \times E \times I}{L_k^3}$

$n_k = 420 \times \sqrt{\frac{C_P}{m}}$

Example:

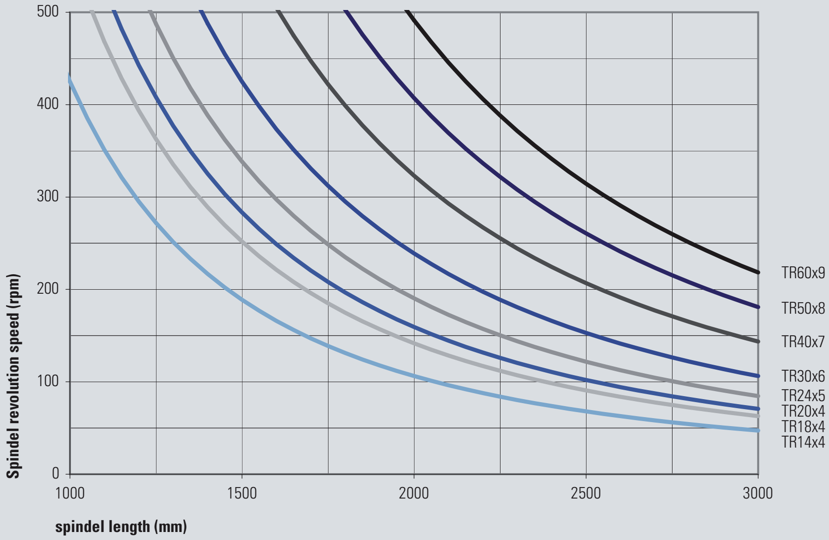
$I = \frac{\pi \times 27.00^4}{64} = 26087\ mm^4$ $m = \frac{2000mm}{1000}$ x 4.5 kg/m = 9 kg

$C_P = \frac{48 \times 210000 \times 26087}{2000^3} = 32.9$

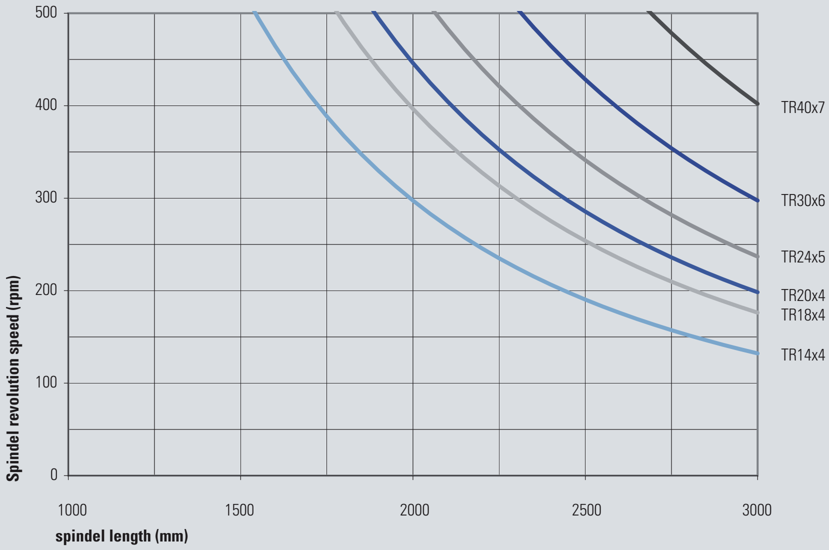
Case 3 according to Euler: $n_{k3} = 420 \times \sqrt{\frac{32.9}{9}} = 803\ min^{-1}$

In the diagram below (calculated with safety 1) with the corresponding load case (1/2/3), determine the point of intersection of the spindle rotation speed and the free spindle length L. The point of intersection must be below the line of demarcation of the selected spindle diameter. If this is not the case, a larger spindle or the next larger gearbox should be selected.

Load case 1



Load case 3



Heat balance

In the case of screw jacks with trapezoidal thread spindles, only a small part of the drive power is converted into lifting force.

There are losses in the worm drive and at the trapezoidal thread, which have to be dissipated in the form of heat.

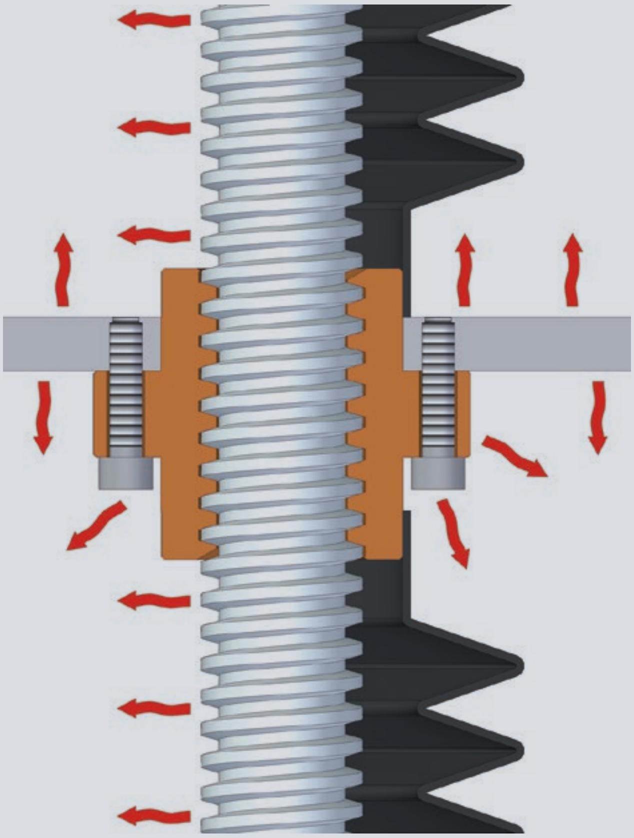
In the case of screwjacks with a non-rotating spindle, the gearbox power loss and the spindle power loss are generated in the gearbox and emitted outwards through the gearbox housing. In the case of the rotating spindle, the gearbox power loss originates in the gearbox and is dissipated through the gearbox housing; the spindle power loss originates between the spindle and the nut and must be dissipated via the surface of the nut, the spindle and the support plate.

When bellows are used with rotating spindles, particular attention must be paid to the heat balance. Experience has shown that only about 50% of the generated heat can dissipated with the bellows. Therefore, the possible duty cycle is reduced by 50% as compared to an identical design without bellows.

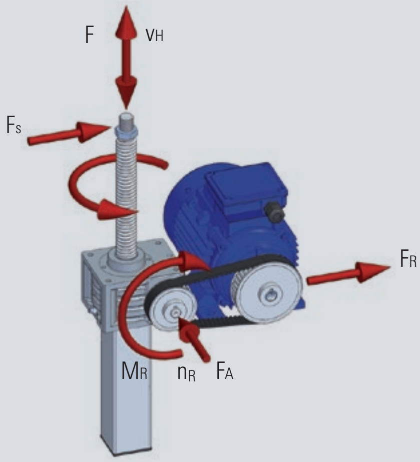
In the case of gearboxes with non-rotating spindles, the bellows are not a problem, since the heat is mostly emitted from the housing.

Influence of the ambient temperature
If the ambient temperature is higher than 20°C, the load must be reduced, since the higher heat level cannot be emitted. For every 10 °C higher ambient temperature, the load must be reduced by approx. 15–20 %.

Air holes must be made by the customer, depending on the speed.



Maximum Forces/torques



For selecting a suitable screw jack, please check the information on the following technical information pages, since various influences and assumptions can only be estimated according to experienced values. In case of doubt, please contact our engineering department.

Load definitions

F – Lifting load tension and/or compression
F_S – Lateral load of the spindle
v_H – Movement speed of the spindle (or nut in case of the rotating version)
F_A – Axial loading of the input drive shaft
F_R – Radial loading of the input drive shaft
M_R – Input drive shaft torque
n_R – Input drive rotational speed

Lateral forces on the lifting spindle

The maximum permissible lateral forces can be seen from the table below. Basically, lateral forces should be absorbed by means of guides. The guide bushing in the gearbox has only a secondary guiding function. The maximum lateral forces that actually act must be below the values in the table. Caution: only statically permissible

Maximum lateral force FS [N] (static)

	deployed spindle length in mm														
	100	200	300	400	500	600	700	800	900	1000	1200	1500	2000	2500	3000
NSE2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
NSE5	360	160	100	70	55	45	38	32	28	25	20	18	12	–	–
NSE10	600	280	180	130	100	80	70	60	50	47	40	30	20	15	–
NSE25	900	470	300	240	180	150	130	110	100	90	70	60	45	35	30
NSE50	3000	2000	1300	900	700	600	500	420	380	330	280	230	160	130	100
NSE100	5000	4000	3000	2300	1800	1500	1300	1100	950	850	700	600	400	350	250
NSE150	5500	5000	3900	2800	2300	1800	1500	1300	1200	1000	850	750	500	400	350
NSE250	9000	9000	6500	4900	3800	3000	2500	2200	2000	1900	1450	1250	900	760	660
NSE350	15000	13000	12000	10000	8800	7000	6000	5500	4800	4300	3500	3000	2000	1600	1400
NSE500	29000	29000	29000	29000	29000	24000	20000	17000	15000	14000	12000	9000	7000	5600	4900
NSE650	34800	34800	34800	34800	34800	28800	24000	20400	18000	16800	14400	10800	8400	6720	5880
NSE750	46000	46000	39000	36000	32000	30000	25000	29000	25000	23500	20000	17000	12000	10000	8000

Max. drive torque

The values given below must not be exceeded. In case of several gearboxes one after another, the drive shaft torque is higher. In case of more than six gearboxes in series, please contact our engineering department.

– Please note that the starting torque is about 1.5 times the operating torque
– Limit values are mechanical
– Thermal factors must be taken into account, depending on the duty cycle

	M_R SN/RN 1500 min^{-1}	M_R SL/RL 1500 min^{-1}
NSE2	2.50	0.80
NSE5	5.60	2.00
NSE10	10.50	4.20
NSE25	22.50	7.80
NSE50	51.00	18.00
NSE100	60.20	20.20

	M_R SN/RN 1500 min^{-1}	M_R SL/RL 1500 min^{-1}
NSE150	67.3	17.3
NSE250	118.4	23.5
NSE350	187.0	40.2
NSE500	204.3	42.8
NSE650	268.3	62.8
NSE750	415.0	83.0

Radial loading of the drive shaft

When using chain drives or belt drives, the radial forces FR given below may not be exceeded.

maximum radial loading of the input drive shaft FR [N]

	F_R (N)
NSE2	18
NSE5	110
NSE10	215
NSE25	300
NSE50	520
NSE100	800

	F_R (N)
NSE150	810
NSE250	1420
NSE350	2100
NSE500	3780
NSE650	4536
NSE750	–

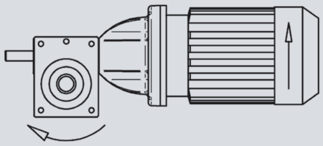
Drive torque of a lifting jack

Explanations

M_{Ge}	Drive torque [Nm] for one gearbox
F	Lifting load (dynamic) [kN]
η_{Ge}	Efficiency of the lift drive (without spindle)
η_{Sp}	Efficiency of the spindlel
P_{Sp}	Spindle pitch [mm]
i	Ratio of the lifting jack
M_L	no-load torque [Nm]
P_{Ge}	Drive rating
P_1	Drive rating, motor, effective
η_{Ku}	Efficiency of the coupling
n_{Ku}	Number of couplings
n	Motor rpm

Base de conception

NSE25-RN with F = 16 kN



η_{Ge} = 0.87
η_{Sp} = 0.40
η_{Ku} = 0.99
n_{Ku} = 1
n = 1400 min^{-1}

Drive torque

$$M_{Ge} = \frac{F\,(kN) \times P_{Sp}\,(mm)}{2 \times \pi \times \eta_{Ge} \times \eta_{Sp} \times i} + M_L\,(Nm)$$

Base de conception

$$M_{Ge} = \frac{16 \times 6}{2 \times \pi \times 0.87 \times 0.40 \times 6} + 0.36 = 7.67\ Nm$$

Motor output

$$P_{Ge} = \frac{M_{Ge}\,(Nm) \times n\,(min^{-1})}{9550}$$

$$P_1 = \frac{P_{Ge}}{(\eta_{Ku})^{n_{Ku}}}$$

$$P_{Ge} = \frac{7.67 \times 1400}{9550} = 1.12\ kW$$

$$P_{1eff} = \frac{1.12}{(0.99)^1} = 1.13\ kW$$

We recommend that you multiply the calculated value by a safetyfactor of 1.3 to 1.5 (in the case of small systems, up to 2).

1.13 x 1.5 = 1.7 > Motor with 2.2 kW

In the case of gearboxes with single-start trapezoid thread spindles, a simplified form of calculation can also be used, which is given on the respective catalogue gearbox page (non-rotating version Chapter 2/rotating version Chapter 3) or in the product data sheets.

Base values for calculation (Summary from page 16)

TR Spindle pitch (P)

TR	P
14	4
18	4
20	4
30	6
40	7
60	9

Efficiency

Size	N	L
2	0.76	0.45
5	0.84	0.62
10	0.86	0.69
25	0.87	0.69
50	0.89	0.74
100	0.85	0.65

No-load torque

Size	N	L
2	0.21	0.11
5	0.10	0.08
10	0.26	0.16
25	0.36	0.26
50	0.76	0.54
100	1.68	1.02

Drive torque of a lifting system

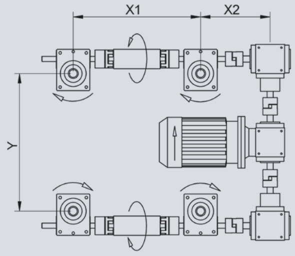
Explanations

M_{Ge}	Drive torque [Nm] for one gearbox
F	Lifting load (dynamic) [kN]
η_{Ge}	Efficiency of the lift drive (without spindle)
η_{Sp}	Efficiency of the spindlel
P_{Sp}	Spindle pitch [mm]
i	Ratio of the lifting jack
M_L	no-load torque [Nm]
P_{Ge}	Drive rating
P_1	Drive rating, motor, effective
η_{Ku}	Efficiency of the coupling
n_{Ku}	Number of couplings
η_{Ke}	Efficiency of the bevel gearbox
n_{Ke}	Number of bevel gearboxes
η_V	Efficiency of the connecting shaft
n_V	Number of connecting shafts
n_{NSE}	Number of screw jacks

Base de conception

NSE25-RN with F = 14 kN

η_{Ge} = 0.87
η_{Sp} = 0.40
η_{Ku} = 0.99
n_{Ku} = 4
η_{Ke} = 0.97
n_{Ke} = 3
η_V = 0.98
n_V = 2
n_{NSE} = 4
n = 1400 min^{-1}



Drive torque

$$M_{Ge} = \frac{F\,(kN) \times P_{Sp}\,(mm)}{2 \times \pi \times \eta_{Ge} \times \eta_{Sp} \times i} + M_L\,(Nm)$$

Base de conception

$$M_{Ge} = \frac{14 \times 6}{2 \times \pi \times 0.87 \times 0.40 \times 6} + 0.36 = 6.76\ Nm$$

Motor output

$$P_{Ge} = n_{NSE} \times \frac{6 M_{Ge}\,(N_m) \times n\,(min^{-1})}{9550}$$

$$P_1 = \frac{P_1}{(\eta_{Ku})^{n_{Ku}} \times (\eta_{Ke})^{n_{Ke}} \times (\eta_V)^{n_V}}$$

$$P_{Ge} = 4 \times \frac{6.76 \times 1400}{9550} = 3.96\ kW$$

$$P_1 = \frac{3.96}{(0.99)^4 \times (0.97)^3 \times (0.98)^2} = 4.70\ kW$$

We recommend that you multiply the calculated value by a safetyfactor of 1.3 to 1.5 (in the case of small systems, up to 2).

4.70 x 1.5 = 7.06 > Motor with 7.5 kW

Base values for calculation (Summary from page 16)

TR Spindle pitch (P)

TR	P
14	4
18	4
20	4
30	6
40	7
60	9

Efficiency

Size	N	L
2	0.76	0.45
5	0.84	0.62
10	0.86	0.69
25	0.87	0.69
50	0.89	0.74
100	0.85	0.65

No-load torque

Size	N	L
2	0.21	0.11
5	0.10	0.08
10	0.26	0.16
25	0.36	0.26
50	0.76	0.54
100	1.68	1.02

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