NOZAG
Transmission

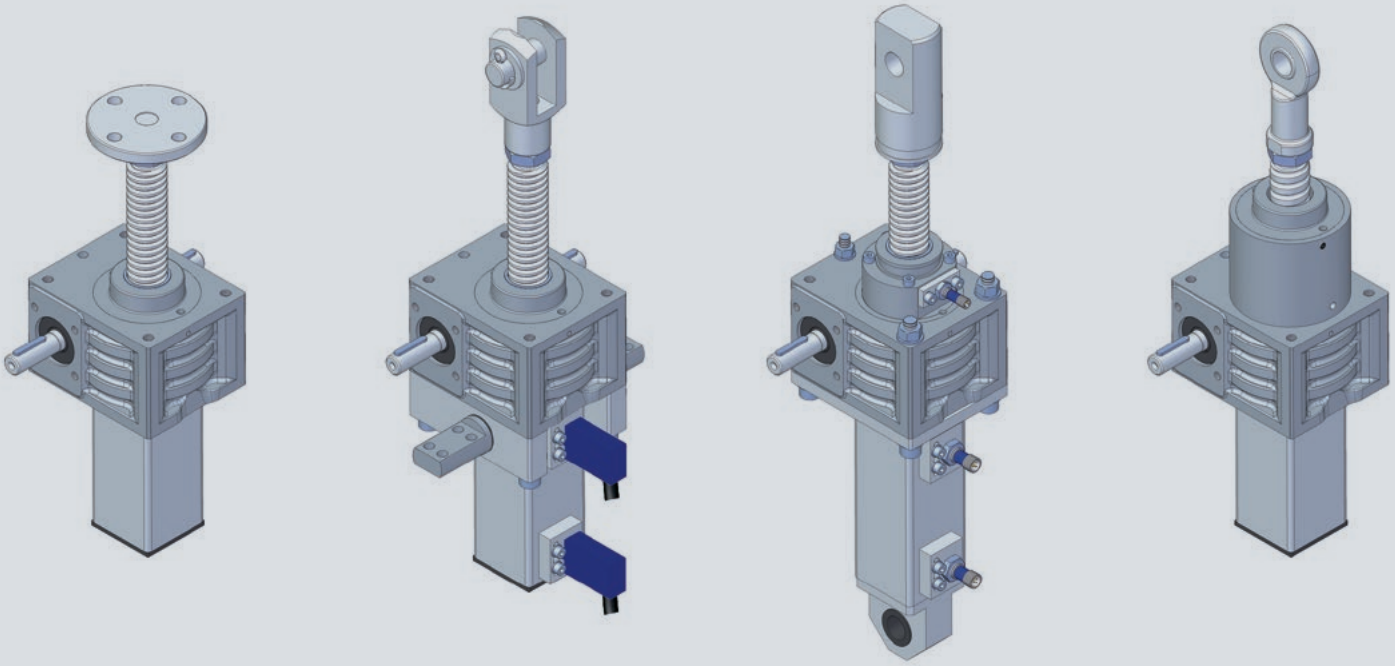
System Program

About us

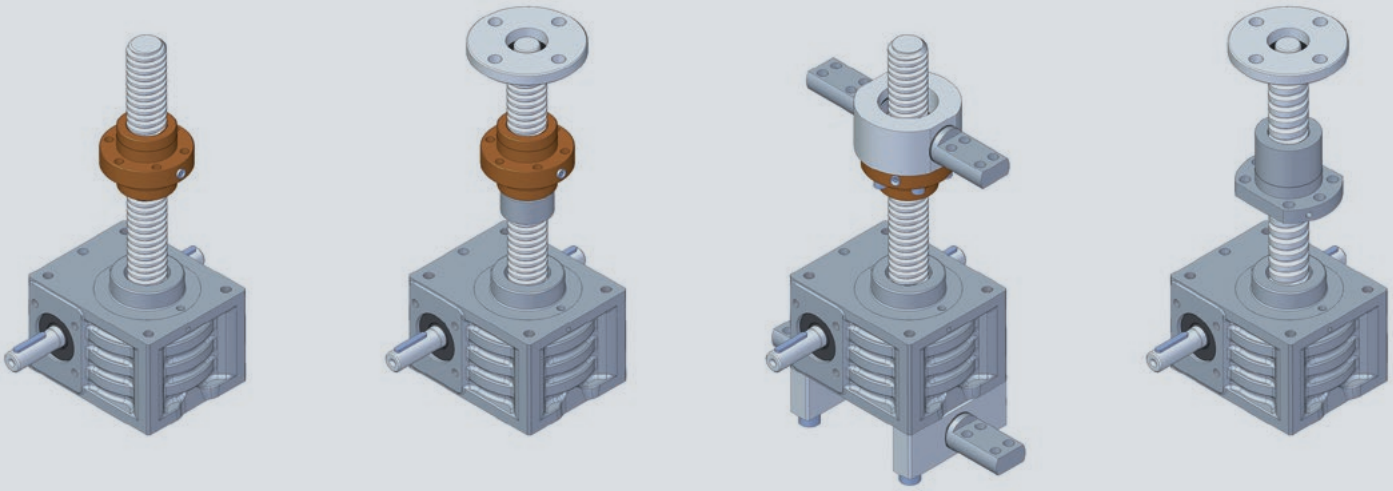
What counts is success – We help you achieve it
Today clear competitive advantages and opportunities depend on flexibility, speed, innovation and continuous improvement. We understand that time has become one of the most significant competitive factors. In clearly defined markets, we offer advanced solutions 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.

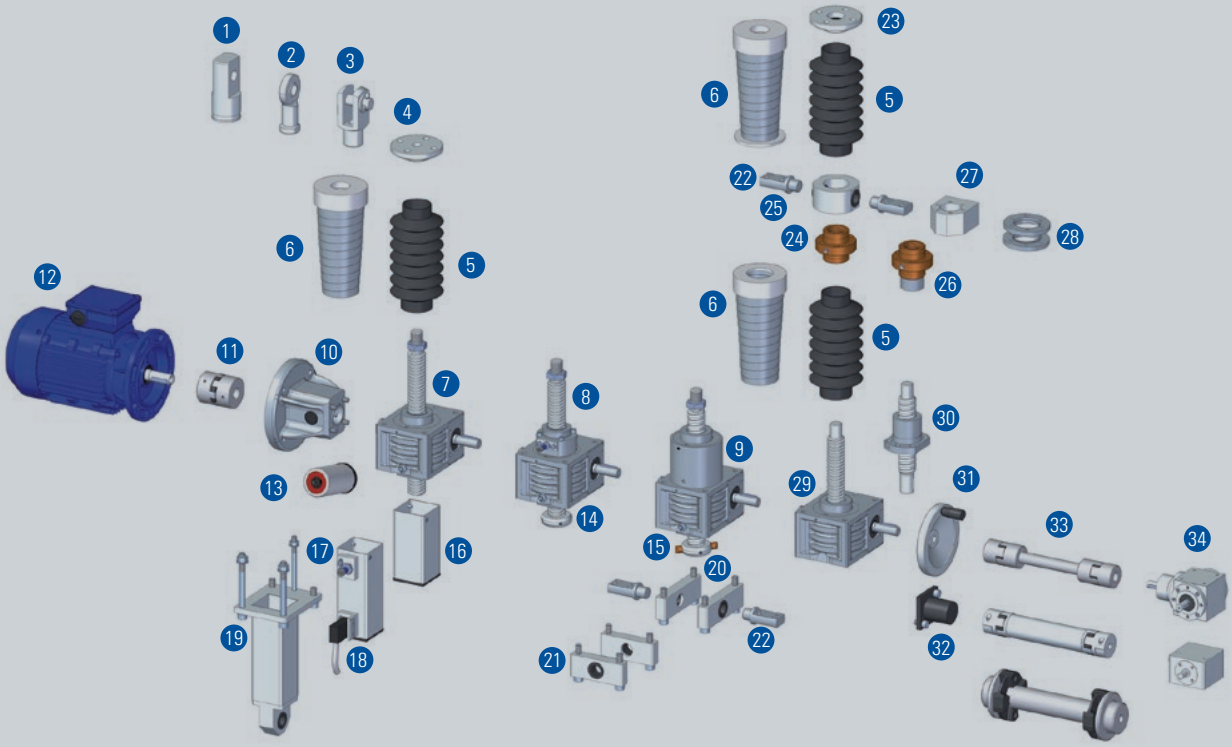
In-house manufacturing is supported by high-performance logistics; this going along with simple, direct and to-the-point communication with our partners. We respect and comply with all pertinent laws, especially those that protect the environment and the health and safety of our workers.

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

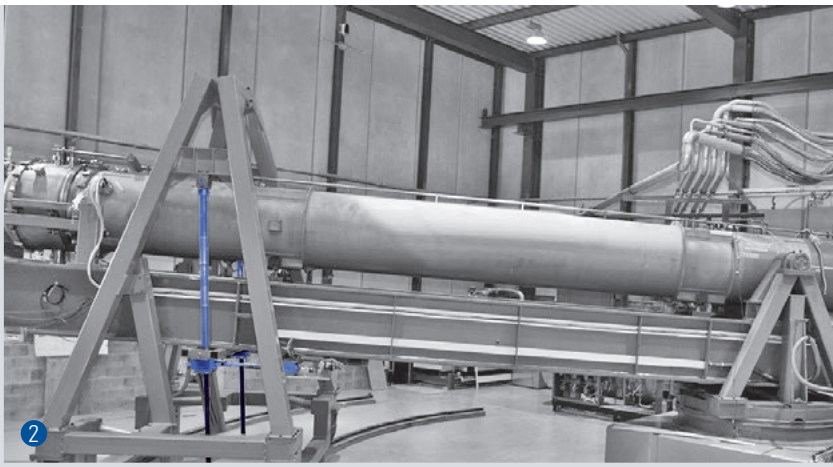
> Easy assembly with standardized individual components from the kit.
You save time

> 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



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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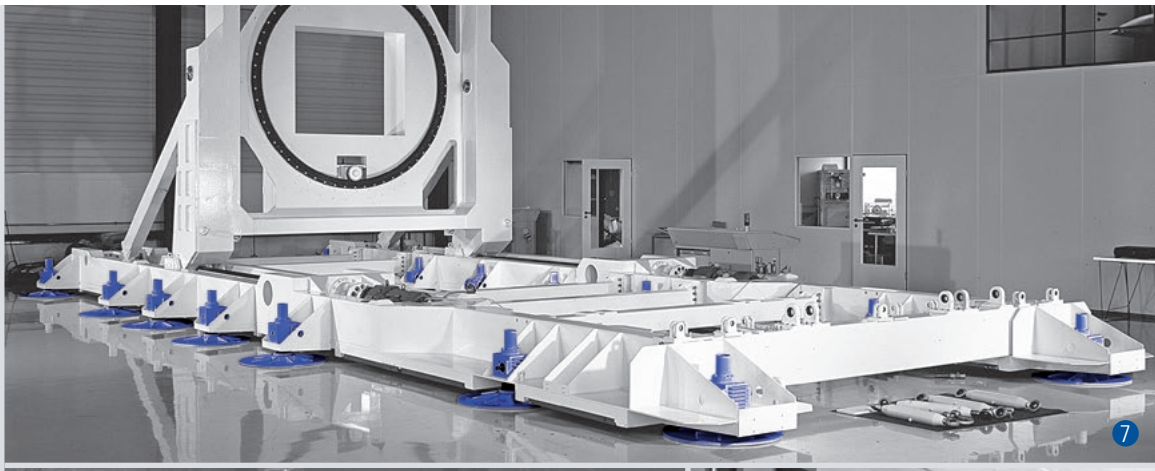
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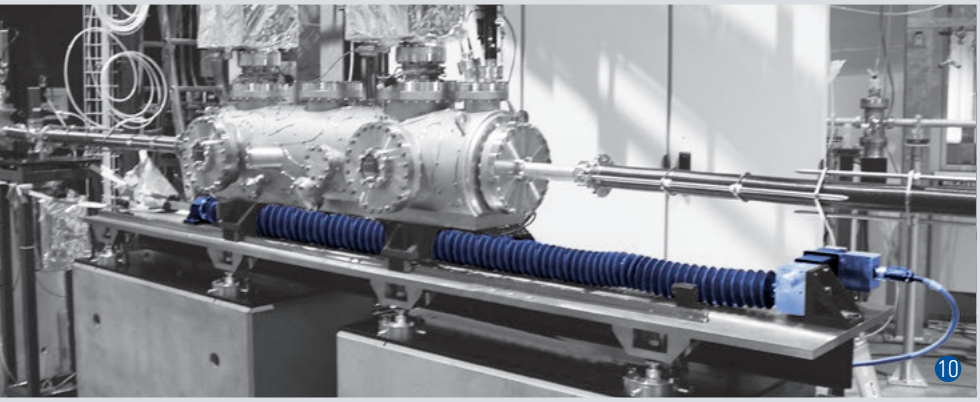
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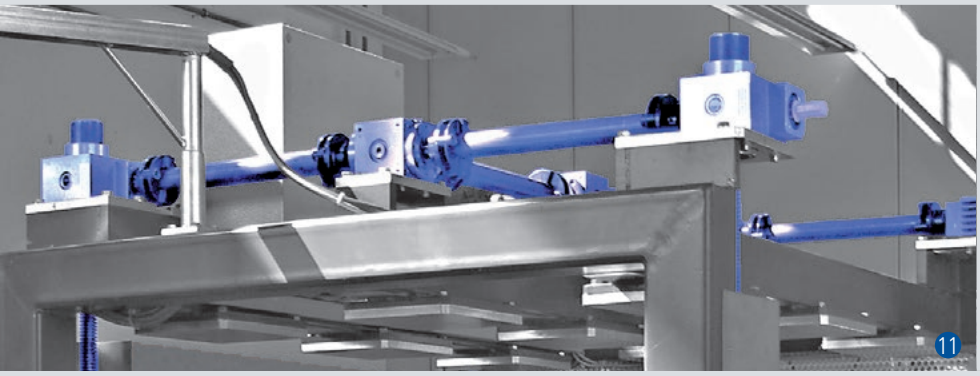
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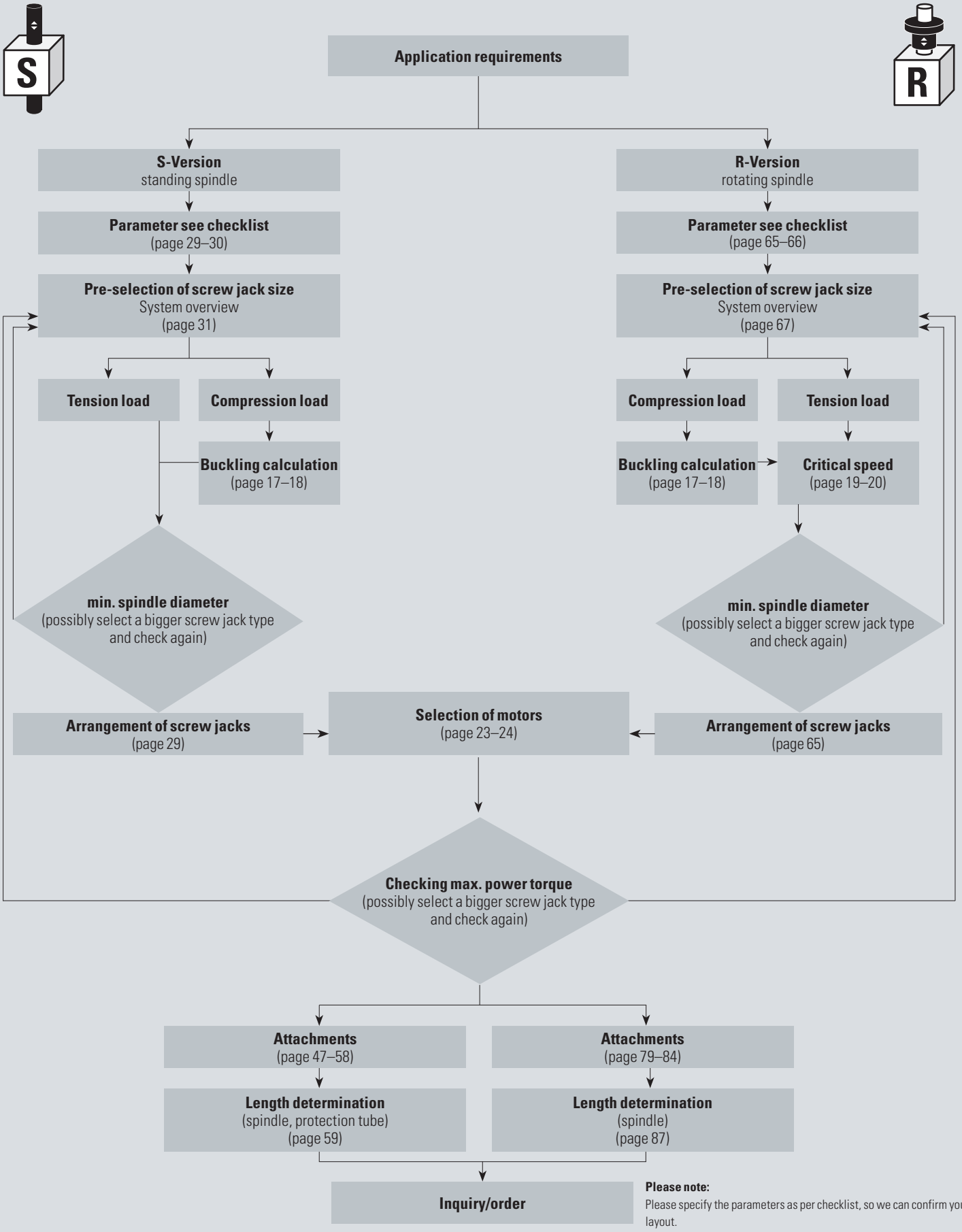
Selection of Screw Jack System and Arrangement



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

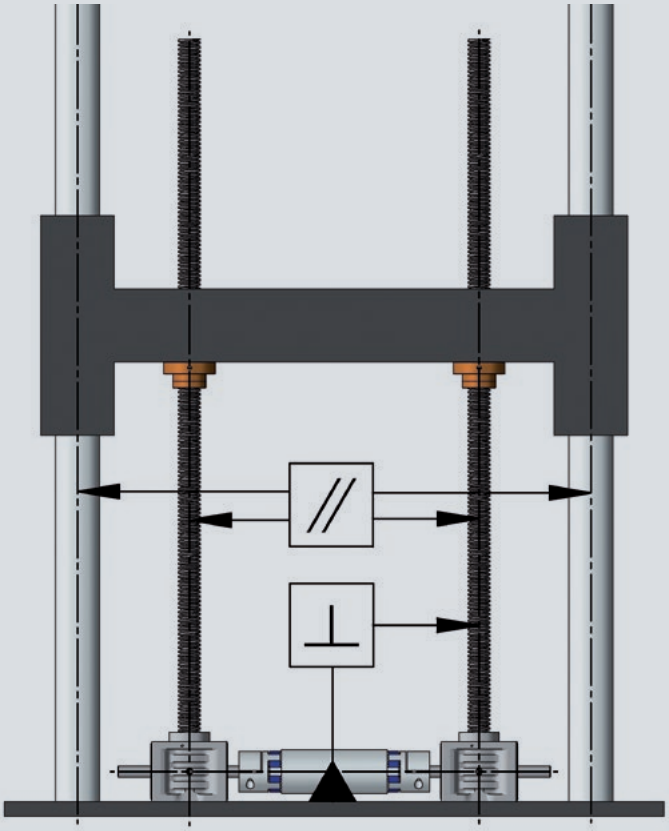
Possibilities of influencing the lifting speeds
Increasing
- Double-thread spindle (usually not an in-stock item): Doubling the speed (Caution: max. input drive torque, not self locking, brake required)
- Reinforced spindle for R-version (spindle of the next bigger gearbox): depending on the gearbox 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).

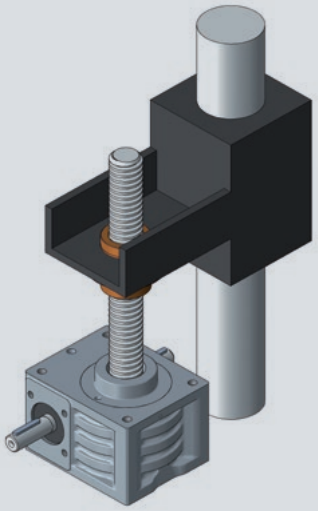
Parallelism and angularity
Attention must be paid to parallelism and angularity of the screw-on surfaces, gearboxes, nuts and guides with respect to one another. Also, exact alignment of the gearbox, pedestal bearings, connecting shafts and motors to one another.

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.



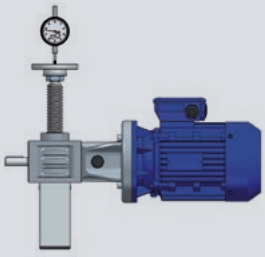
Lateral forces
Lateral forces acting on the spindle are to be absorbed by additional guides (1 N lateral force > 4 N more lifting force). Loads must be led externally as far it is possible.

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.

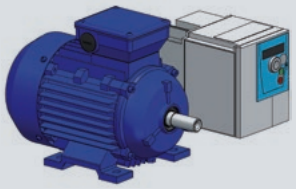
Accuracy
The repeat accuracy of the gearbox is up to 0.05 mm, when moving to the same position again under the same circumstances. This requires drive-side measures such as the use of a three-phase braking motor in conjunction with a frequency converter and rotary pulse transmitter or a servomotor with 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.

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	η = 0.99
Connecting shaft	η = 0.98
Bevel gear	η = 0.97

Critical buckling force of the lifting spindle

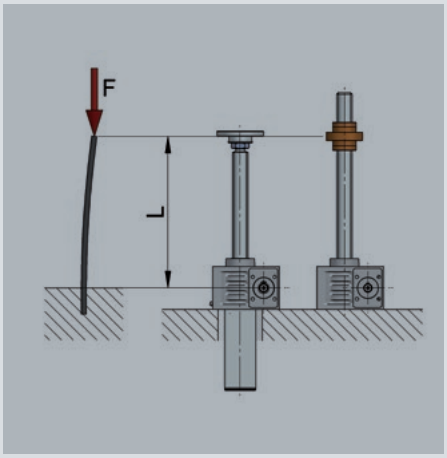
Explanation

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

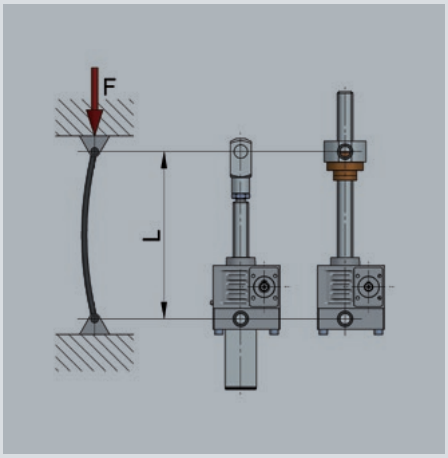
$$I = \frac{F \times s \times (L \times 2)^2}{\pi^2 \times E} \quad \text{then} \quad d = \sqrt[4]{\frac{I \times 64}{\pi}}$$

Example

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

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

Load case 2



Formula

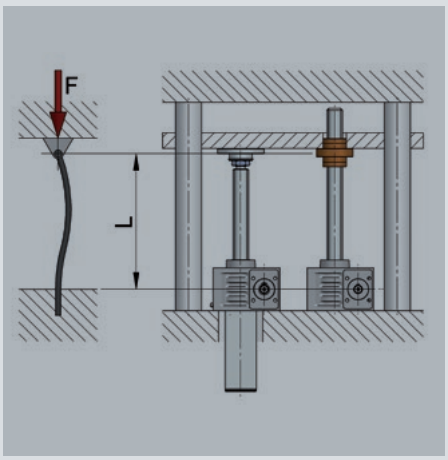
$$I = \frac{F \times s \times L^2}{\pi^2 \times E} \quad \text{then} \quad d = \sqrt[4]{\frac{I \times 64}{\pi}}$$

Example

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

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

Load case 3



Formula

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

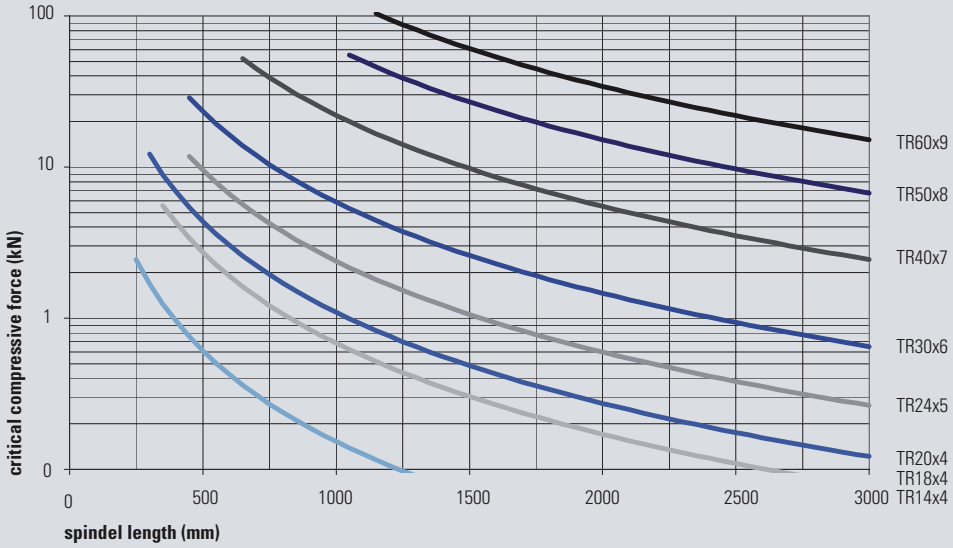
Example

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

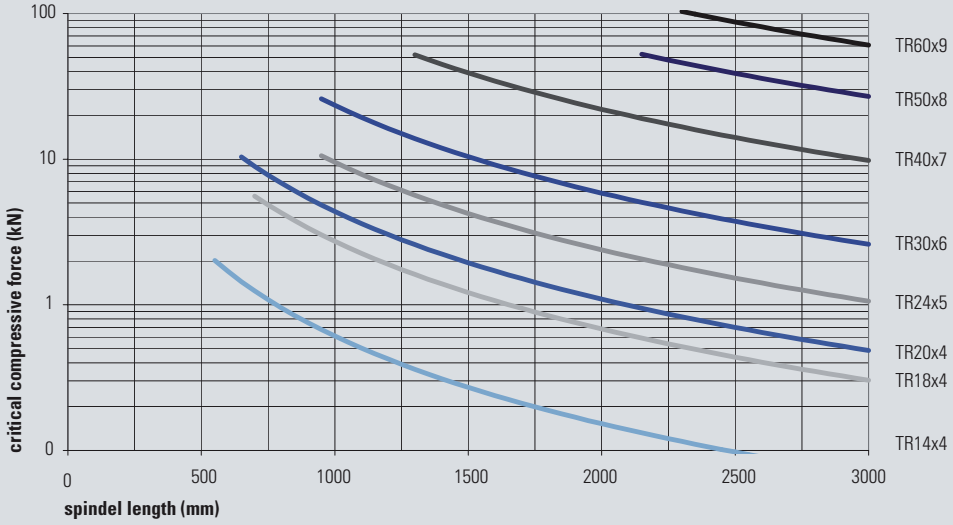
$$d = \sqrt[4]{\frac{9418.1\ mm^4 \times 64}{\pi^2 \times 210000 N/mm^2}} = 20.9\ mm \text{ minimum core diameter}$$
$$= \text{NSE25 (core-Ø = 23.0 mm)}$$

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.

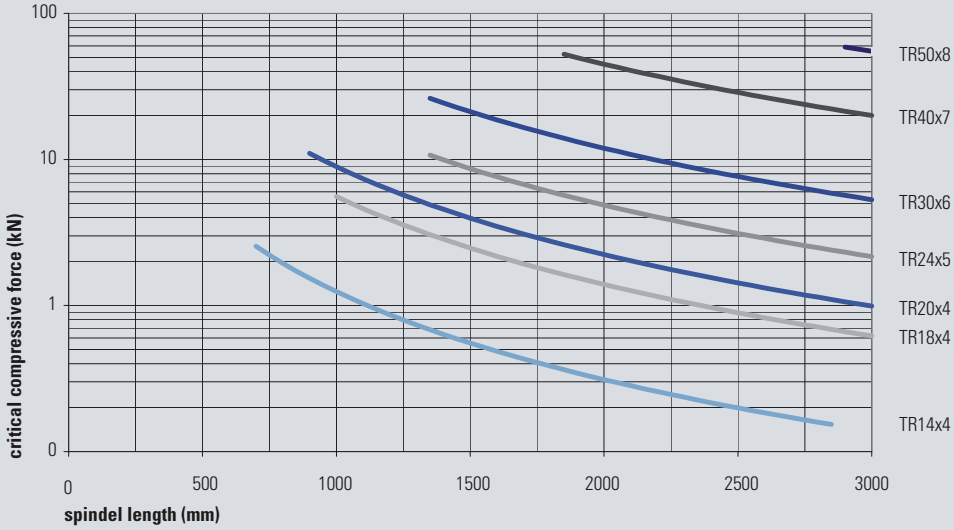
Load case 1



Load case 2



Load case 3



Bending critical speed of trapezoid thread spindle

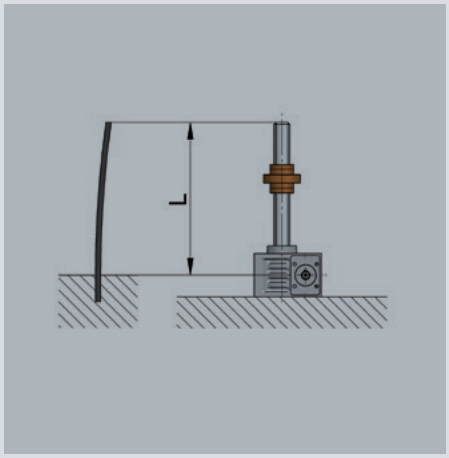
Explanation

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 x 6)
L_K = 2000 mm
s = 3
$ma1$ = 4.5 kg/m

Load case 1



Formula

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

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

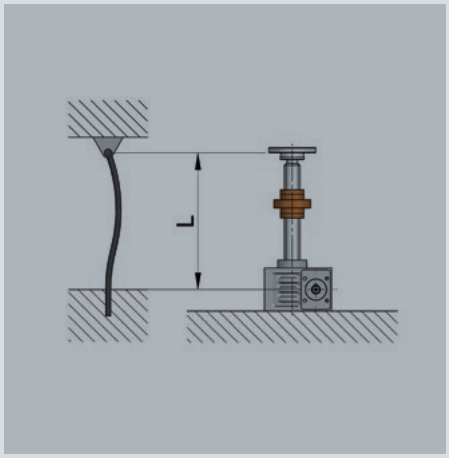
Example

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

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

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

Load case 3



Formula

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

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

Example:

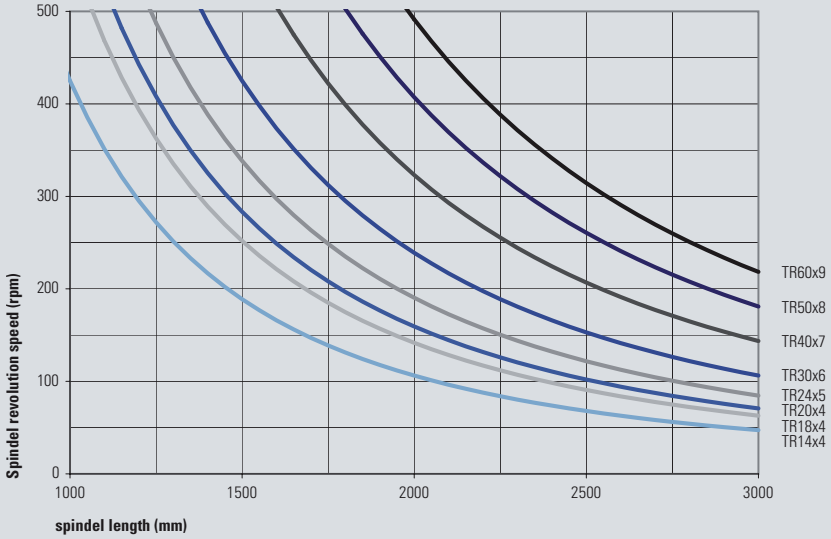
$$I = \frac{\pi \times 27.00^4}{64} = 26087\ mm^4 \qquad m = \frac{2000mm}{1000} \times 4.5\ kg/m = 9\ kg$$

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

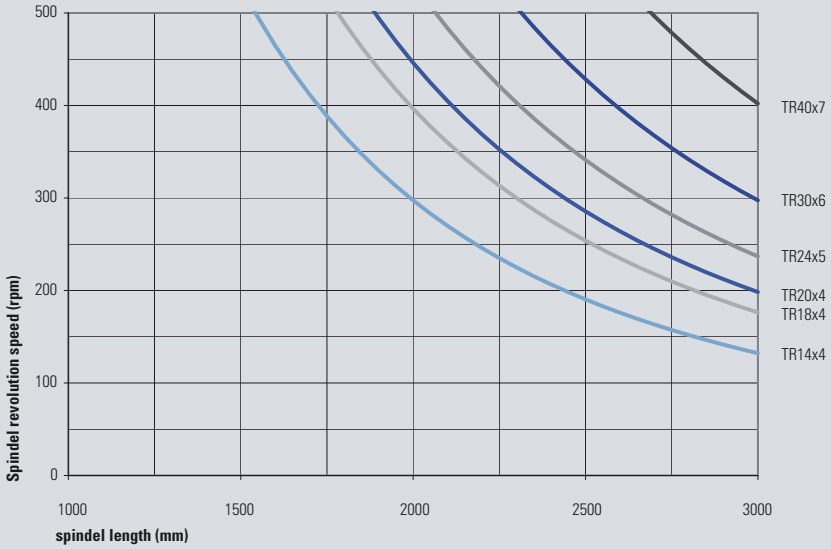
Case 3 according to Euler: $n_{k3} = 420 \times \sqrt{\frac{32.9}{9}} = 803\ min^{-1}$

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.

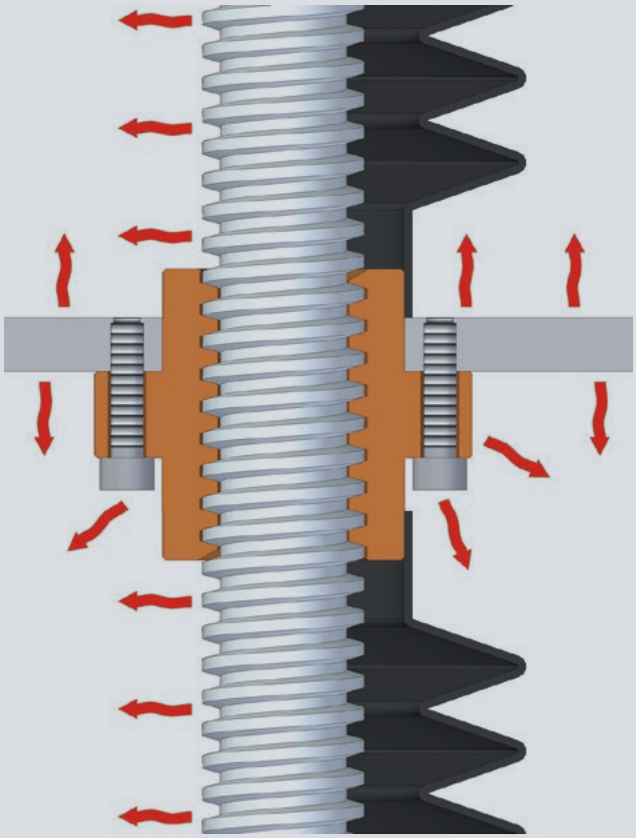
In the case of screwjacks with a non-rotating spindle, the gearbox power loss and the spindle power loss are generated in the gearbox and emitted outwards through the gearbox housing. In the case of the rotating spindle, the gearbox power loss originates in the gearbox and is dissipated through the gearbox 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.

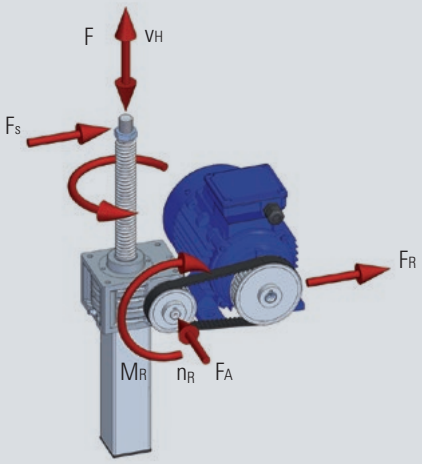
In the case of gearboxes with non-rotating spindles, the bellows are not a problem, since the heat is mostly emitted from the housing.

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.

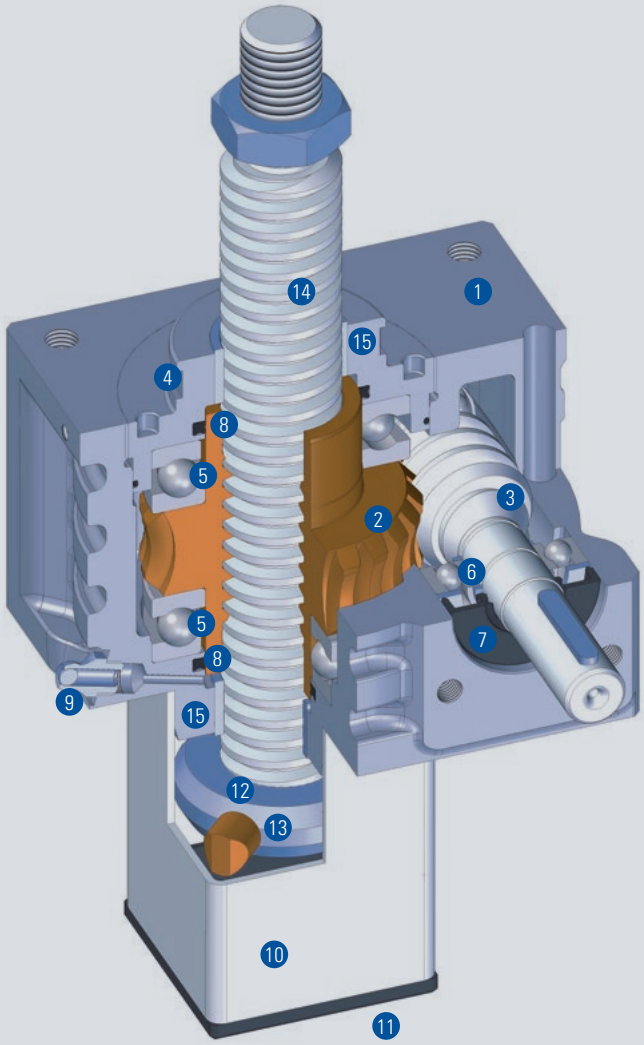
maximum radial loading of the input drive shaft FR [N]

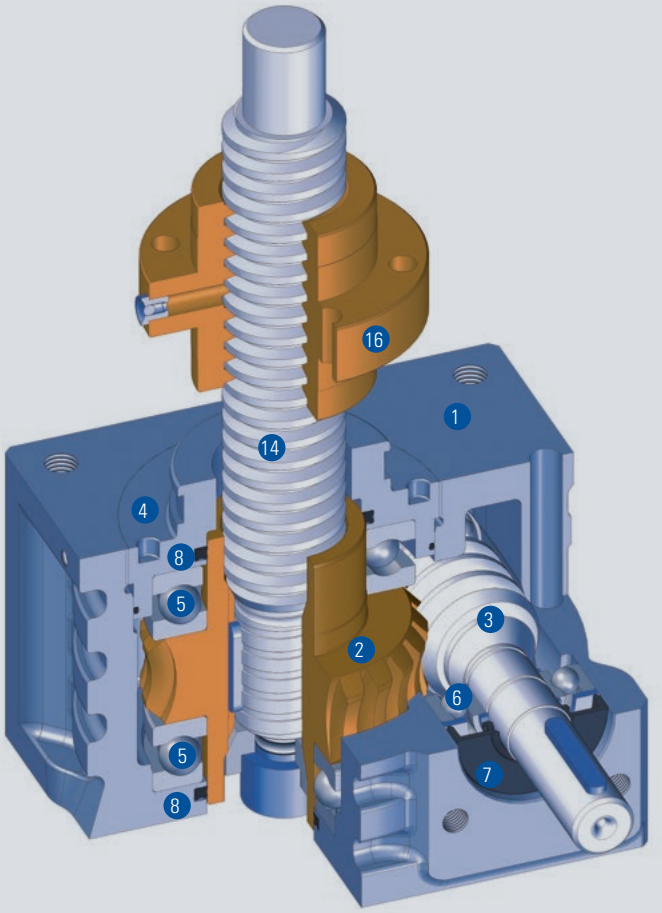
	F_R (N)
NSE2	18
NSE5	110
NSE10	215
NSE25	300
NSE50	520
NSE100	800

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

Non-rotating spindle NSE...-S...
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 NSE...-R...
The spindle has a fixed connection to the worm wheel and rotates with it. The nut therefore screws itself up and down.





1 Housing
2 Worm wheel
3 Worm
4 Bearing cover
5 Axial grooved ball bearing
6 Grooved ball bearing
7 Oilseal
8 X-ring/O-ring
9 Lubrication nipple for spindle
10 Protection tube
11 End cover
12 Unscrewing protection
13 Anti-rotation lock
14 Spindle
15 Spindle guide
16 Duplex nut

This manual is applicable to all screw jacks of the NSE series in the standard versions manufactured by Nozag in the sizes 2, 5, 10, 25, 50 and 100, as well as for special types, in consultation with Nozag.

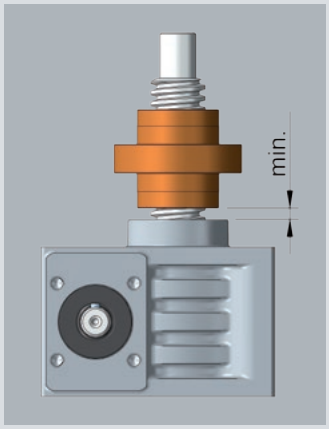
6.4.1 General Design Measures

The load bearing capacity of the drives and system components varies widely according to the installation situation and the operating duration. The limits specified in the data sheets must not be exceeded under any circumstances.

Screw jacks are basically not suitable for continuous operation under load. The maximum operating duration depends on the load being moved and must not exceed the limit values according to the ED-diagram on the relevant data sheets.

The duration of operation can be significantly increased by using a ball screw spindle instead of the trapezoid thread spindle. Particular attention must be paid to the evenness, as well as the parallelity and angularity of the mounting face of the gearbox, nut and guides with respect to one another.

Lateral forces must be absorbed by additional guides.
The play between the spindle and the integrated guide bushings is between 0.2 and 0.6 mm depending on the size. This is only a secondary support and does not replace a guiding system.



As a minimum distance of the movable parts to the fixed parts in the direction of lifting, we recommend in the case of trapezoid spindles, the thread pitch times one, and in the case of ball threaded spindles, the thread pitch times two. This distance must not fall below this limit.

A screw jack must never hit a mechanical stop, since the forces that then occur could reach a multiple of the rated load. All warranties as well all liabilities of Nozag shall be rendered null and void in such a case.

There are various moving parts freely accessible on a screw jack, such as the nut, spindle and shaft ends, which can mean great personal danger while in operation. The systems integrator is responsible for ensuring protection against accidental contact in the course of operation.

The protective cap SK from Nozag can be used for the free end of the driving shaft as protection from accidental contact.

In general, the construction instructions and design procedures listed in our catalogue should be followed.

6.4.2 Operating Temperatures

The temperature behaviour is dependent on the ambient temperature and on self-heating during operation under load. The self-heating can be reduced through favourable construction measures for fast dissipation of heat.

The jack can quickly become hot during operation under load. Therefore, in such a case, sufficient contact protection should be provided. Please note the following temperature ranges and the corresponding notes:

-40°C to -20°C	**low temperature** The standard seals and greases can all be used up to -40°C. However, the breakaway torque and the wear both increase significantly. In general, at low temperatures, all the components should be dimensioned for greater safety. Please contact our technical department.
-20°C to +60°C	**normal temperature** The highest heating is normally to be observed at the worm shaft and at the trapezoid threaded nut and it should never go out of this temperature range. The range limits may not be used as the normal operating points.
+60°C to +160°C	**high temperature** In case of ambient or operating temperatures in this range, only jacks equipped with high-temperature grease and FPM seals may be used. Please contact our technical department.

6.4.3 Measures to be Taken in Case of Increased Risk

The trapezoid threaded nut is subject to continuous wear owing to the existing friction. The wear of the trapezoid thread in the worm wheel or in the nut must be checked at suitable intervals depending on the duty cycle.

As soon as the axial distance between the trapezoid thread nut and the spindle is more than 20% of the thread pitch, the gearbox or the worm wheel (S-Version) or the nut (R-Version) must be replaced.

The wear can be checked with a safety trap nut and by monitoring it.

Essentially, a screw jack in the R-Version should not be subjected to tensile loads, since the trapezoid thread spindle is subject to a cyclical bending stress and can break without any warning. If this type of installation cannot be avoided, then, under increased safety requirements (such as in stage construction, suspended loads, …) the load must without fail be secured by an external trapping device.

Upon request Nozag shall provide suitable solutions for this.

The screw jacks of the NSE serve to convert a rotational movement into a linear one, in order to then carry out controlled and regulated pushing and pulling movements. In addition, they can be used in all installation positions in general mechanical engineering, under normal ambient conditions, in compliance with the operating limits and always in consideration of all the technical data, in accordance with the applicable data sheets.

In case of use with suspended loads, special additional measures must be taken in order to ensure sufficient protection for persons and property at all times.

Other uses, or any use over and above those described a proper usage, shall be considered as improper and can result in dangerous situations.

Adjustments may be necessary in case of special requirements, such as those existing, for example in the food industry, or where extreme ambient conditions prevail. In such cases, it is necessary to clarify all specific details with Nozag.

A screw jack may only be brought into operation when it is ensured that the machine or plant, in which it has been installed, conforms to the EU Machinery Directive's regulations and to corresponding national standards and specifications.

Screw jacks in ATEX design are special versions and should be discussed with Nozag.

6.6.1 Guide Values for Screw Tightening Torques

Information based on VDI 2230, edition 2003: Maximum permissible tightening torques for hexagon socket screws ISO4762 and screws with similar head strength and head bearing surface, of the strength class 8.8 at 90% exploitation of the elastic limit R_{el}. / 0.2%-yield point $R_{p0.2}$. The table shows the permissible maximum values and does not contain any further safety factors. It assumes a knowledge of the relevant directives and design criteria.

Maximum tightening torques (Nm) for strength class 8.8 and a total coefficient of friction of $\mu_{ges} = 0.12$:

Thread size	Tightening torque M_A
M4	3
M5	6
M6	10
M8	25
M10	48
M12	84
M16	206

Dealing with the guide values

Friction μ_{ges}

The friction coefficient shows scatter, since it is depending upon many factors, such as the material pairing, the surface quality (roughness depth) and the surface treatment. If the total friction is less, a smaller tightening torque should be selected. The main cause of fractures is an overestimation of total friction factors.

Strength class

The strength class refers only to the screw and is determined according to ISO 898/1.

Tightening torque M_A

These are guide values and do not substitute a recalculation according to VDI2230. In case of additional tensile forces acting centrally or eccentrically, as well as statically or dynamically on the screws, the tightening torques and/or loading forces should be reduced to such an extent that the maximum permissible load on the screws is not exceeded.

Screw-in depth

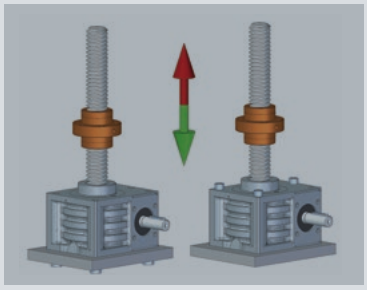
These guide values assume a screw-in depth of 1.4 x nominal diameter (of the screws) in the aluminium housing.

6.6.2 Housing

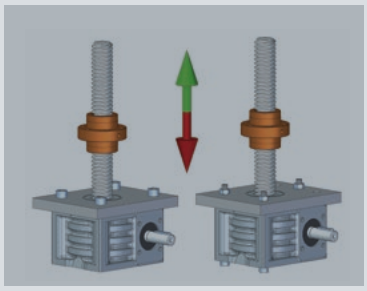
Should the specified screw-in depths not be exploited for fastening the housing or the prescribed tightening torques not be complied with, the certainty of the screws getting pulled out under tractional stress is reduced. If the screws are stressed to more than 50% of the rated tensile load, the screw connection must be recalculated according to VDI2230. A decision can thus be made whether the existing safety is adequate in the relevant application.

In order to avoid a tensile load of the screws, the bearing surface must be arranged as follows, depending on the load:

Main load: Pressure from top > support below



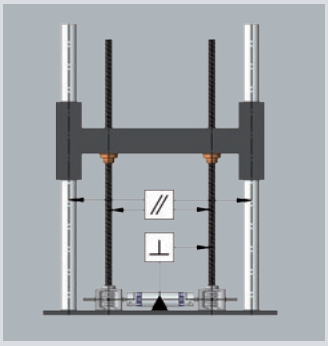
main load: tension upwards > support above



The 4 threaded holes or the 3 through holes in the housing can be used for fastening.

6.6.3 Spindle

While assembling the spindle and fastening the spindle end, care must always be taken, first, that the spindle is in alignment with the nut, second, that the housing is at right angles to the resting surface of the housing and third, that it is parallel to any guideway that may be present. This must be ensured during the entire operation, so that the jack does not have to absorb lateral forces in any situation.



In the R-version, the spindle can be installed in the housing from both sides. Thus, depending on the loading direction, the load can be ideally transmitted into the housing and not into the bearing cover.

In the R-version, the central screw or nut for spindle fastening must be installed with a suitable thread adhesive (e.g. Loctite 243) and the correct torque. Otherwise, in case of tensile loading, there is a danger that the spindle might be pulled out of the housing!

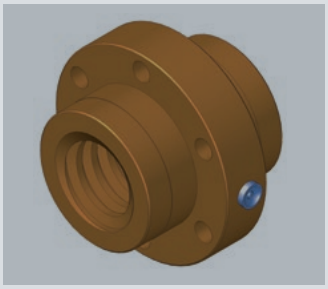
In this context, the instructions of the thread adhesive manufacturer must be followed without fail.

Tightening torques (Nm) for spindle central screw or nut in the R-version:

NSE2	NSE5	NSE10	NSE25	NSE50	NSE100
2	5	10	15	50	100
nut	screw	screw	screw	screw	screw
M6	M8×20	M10×30	M14×40	M20×50	M42×3
4-6	9-14	19-30	55-90	150-240	550-990

6.6.4 Nut

The nut must be mounted concentrically with the spindle, and the bearing surface must be at right angles to the spindle axis, so that uniform resting in all thred turns is ensured. The calotte disks NSE...-KS can be used for compensating angle errors up to ±3°.

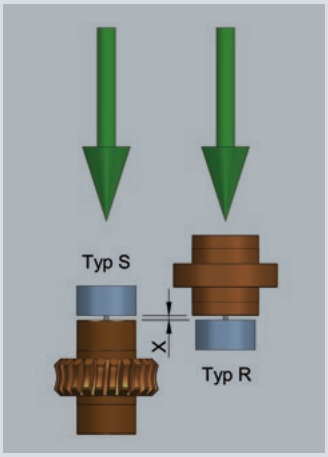


Lateral loads and alignment errors should be avoided, since they can have a very negative effect on the life of the support nut.

In order not to subject the screws to tensile loads as far as possible, the load must always be supported against the nut flange. Should this not be possible, the threaded joint must be designed in accordance with VDI2230 and constructed accordingly.

6.6.5 Safety trap nut

The gap X between the nut and the safety trap nut corresponds to half the trapezoid thread pitch (= tooth thickness) in the new state. The wear of the nut causes a corresponding reduction of the gap, which can be monitored.



The safety trap nut works in one direction only and therefore, attention must be paid to the correct arrangement!
R-Version: viewed in the direction of the load after the nut
S-Version: viewed in the direction of the load, before the nut

6.6.6 Ball Screw KGT

The same points as described in 6.6.3 and 6.6.4 have to be followed.

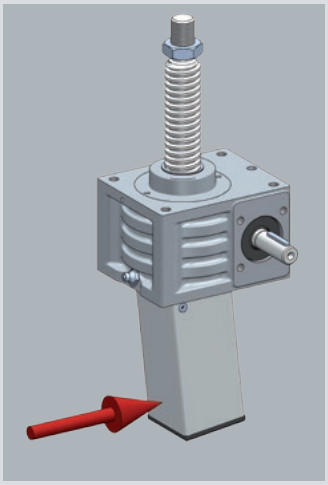
The delivery is always in the form of an assembled spindle/nut unit and it must not be taken apart under any circumstance, otherwise the balls will fall out.

If dismantling is necessary, in the R-version, the nut can be removed by using a mounting sleeve. The sleeve is used like an extension of the spindle and prevents the balls from falling out.

Ball screws are not self-locking, which is why a braking motor or a spring-loaded brake FDB is necessary. A ball screw in the S-version is generally assembled with an unscrewing protection AS by default.

6.6.7 Protection Tube

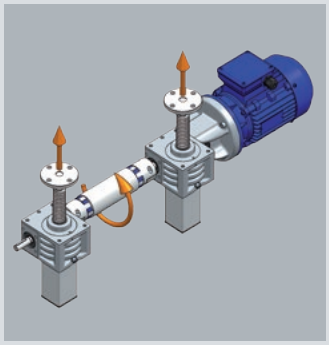
The protection tube cannot absorb any lateral force in the standard version. The same applies during transportation: the jack must not be supported at the protection tube end.



6.6.8 Lubrication

Screw jacks are supplied in an operationally ready state and are lubricated for life under standard conditions.

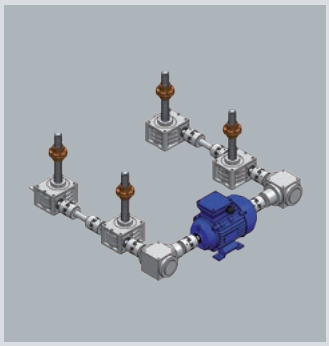
Nozag provides the spindles in the S-version pre-greased ready for use, with a protection tube. Without a protection tube, or in the case of the R-version, the spindles are delivered without grease owing to the danger of soiling.



Before the first trial run, the ungreased spindles must be cleaned and generously lubricated over theire entire length with a grease that adheres well.For a long life, use the greases that are suggested by Nozag.

6.6.9 Direction of Rotation and Movement

Before a motor trial run, a check should first be carried out as to whether all the coupled screw jacks have the same direction of movement. When using bevel gearboxes, the direction of movement of the screw jacks can be changed, simply by turning the bevel gear (however, this only applies to the D-version with 3 shafts).



6.6.10 Levelling and Trial Run

In the case of coupled screw jacks, the individual gearboxes can be levelled with the help of couplings or connecting shafts. The levelling is done under load by loosening and turning the coupling or the shaft through 120°. For continuous (stepless) variable height settings, a clamping hub coupling KNK or a connecting shaft VW can be used.

Screw jacks equipped with ball screws or multi-start trapezoid thread spindles are not self-locking and must therefore be secured during assembly.

During the trial run, the assembly quality can be indirectly checked by a continuous measurement of the motor current drawn. If an increased drawn current is determined, the fastening screws should be loosened and a new trial run initiated. Non-uniform force requirements and wear tracks on the spindle indicate the presence of alignment errors.

Before and after the trial run, all the screwed joints must be checked and tightened correctly.

6.7.1 Screw Jack

The jack must never hit against a mechanical stop (such as an unscrewing protection, end stop, …), since the forces hereby generated could reach a multiple of the rated load. Any damage caused by the violation of the latter rule shall not be covered by warranty obligations or render the manufacturer to be liable in any way whatsoever.

We recommend the following safety distances between the movable and the fixed parts:

Trapezoid thread spindle:	Safety distance = 1 x spindle pitch
Ball screw:	Safety distance = 2 x spindle pitch

During operation, the named safety distance must be ensured through customer-side measures or by using our limit switches ESM / ESI.

For uniform starting and braking ramps, we recommend the use of a frequency transformer. This prolongs the life of the system and minimises the starting noises.

The positioning accuracy mainly depends on the type of drive used. In case of more stringent requirements, a three-phase servomotor with frequency transformer and rotary pulse transmitter or a servomotor with resolver etc. can be used.

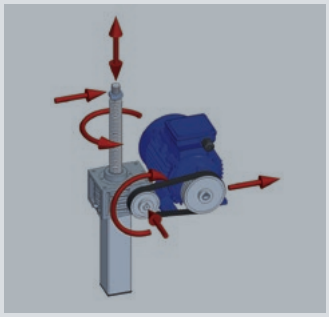
6.7.2 Rotational Speeds

The maximum rotational speed advised in the data sheet may not be exceeded.When R-gearboxes (with rotating spindles) are used, the bending-critical rotational speed of the spindle must be taken into consideration.

Long, thin spindles can squeak despite complying with the bending-critical rotational speed. Therefore, your calculations should include a sufficient safety factor.

6.7.3 Maximum Forces / Torques

The power usage of the machine in operation must not exceed the limit data specified in the catalogue (not even temporarily). Permanent damage may result, even if the limits are exceeded just once.



Regarding the maximum drive torque, it should be remembered that the starting torque is approx. 50% above the operating torque.

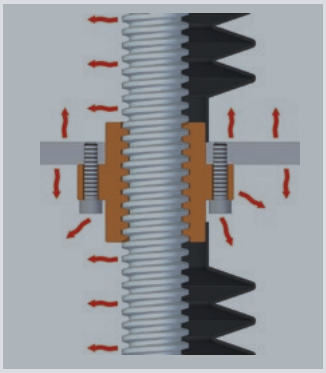
Depending on the motor type, the short-circuit torque can be a multiple of the rated torque!

Where several gearboxes are coupled to one another, if one gearbox is blocked, the full energy of the motor can act on that gearbox!

6.7.4 Measures for Minimimising Noise

The motor is usually the biggest source of noise. With a uniform acceleration ramp, starting and braking noises can be minimised.
The gearbox and motor should not be mounted on resonant bodies.

6.7.5 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 as heat. In the case of the version with the non-rotating spindle, the gearbox power loss and the spindle power loss occur in the gearbox and are dissipated 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 the heat can only dissipate about 50% due to 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 dissipated via the housing. If the ambient temperature is higher than 20°C, the load must be reduced, since the higher heat level cannot be dissipated. For every 10 °C increase in ambient temperature above 20 °C, the load must be reduced by approx. 15–20 %.

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

6.7.6 Electrical Connection

Regarding the electrical connections of the drive motor, attention must be paid to the following specifications and directives:

2004/108/EG	EMC Directive
2006/95/EG	Low-voltage Directive

The electrical installation work must only be carried out by a technician who is qualified according to the situational requirements. Attention must be paid to the local laws and to the specialists recommendations.

The electrical connections must be done in accordance with the specifications on the rating plate with regard to the frequency, voltage, current and connections. Connections must be made in such a way that a continuous, safe electrical contact is maintained. A secure protective conductor connection should be set up.

Before electrical commissioning, any possible impact against any hard mechanical stop must be ruled out.
Very high forces and torques can be generated by impacting against hard mechanical stops, which could result in enormous damage and have a very adverse impact on safety.

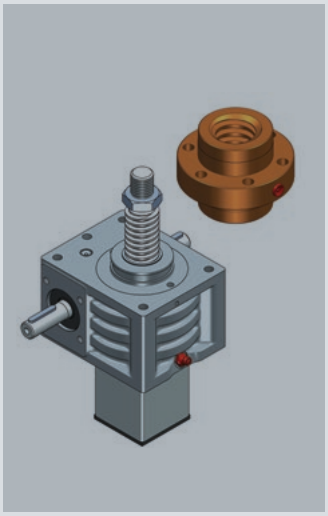
The drive motor must be protected from overload through suitable measures.

At the time of electrical initiation, the first thing to be checked is the direction of rotation.

There must not be any foreign bodies, dirt or moisture in the connection box. Cable ducts that are not required should be closed tightly.

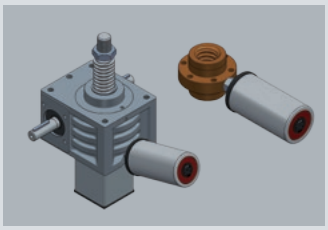
6.8.1 Lubrication

The worm gearboxes are lubricated for life under standard conditions. The lubrication consumption is concentrated above all, on the trapezoidal screw. It should be re-lubricated regularly, depending on the duty cycle. Since the lubrication requirement of a trapezoidal screw depends on very many factors, no general guidevalues can be specified for the required lubrication intervals. We recommend that the user starts with a weekly interval; a weekly inspection of the spindle should then be carried out. The lubrication intervals can thus be individually matched to the prevailing conditions.



During dry running, the nut is subjected to intense wear and can, in addition, become extremely hot very quickly.

Ball screws KGT should be re-lubricated after every 300 hours of effective operating time. A guideline value of 1 ml per cm spindle diameter can be taken for the grease quantity.



After about 5 years, the grease loses its lubricating properties. Dust and dirt increases this effect. Therefore in the case of long-life systems, a complete cleaning and re-greasing is necessary after 5 years. If the spindle is dirty, it must be cleaned and regreased to avoid excessive wear and damage.

Recomended grease Blasolube 306
(other lubricants on request)

Grease amount per gearbox

NSE2	20 cm^3	NSE25	100 cm^3
NSE5	25 cm^3	NSE50	420 cm^3
NSE10	40 cm^3	NSE100	800 cm^3

Our lubricant dispenser SSG can be used for automatic lubrication. The lubricant dispenser is screwed on in place of the grease nipple and continuously supplies grease to the lubrication point. The dispensing duration can be set continuously variable from 1 to 12 months and the grease quantity varies according to the SSG-size between 0.08 – 8.3 ml/day.

6.8.2 Checking Wear

The trapezoid thread in the worm wheel or in the nut is subject to continuous wear owing to the existing friction, which depends on many factors and cannot be predicted. We recommend that at the beginning, the axial play should be checked after just a few hours of effective deployment. Thereafter, the inspection interval can be gradually adjusted depending on the results.

As soon as the axial play in the trapezoid thread nut corresponds to more than 20 % of the thread pitch, the gearbox respectivly the worm wheel (S-Version) or the nut (R-Version) must be replaced.

The wear can be checked with a safety trap nut and by monitoring it. For simplified monitoring, Nozag offers, upon request, mechanical (manual buttons) and electrical (inductive sensor) aids.

Except for standard machine elements that are commonly available commercially, Nozag original spare parts must be used. Warranty entitlements as well as liability commitments shall be rendered null and void if third-party, imitation or non-approved components are used instead.

In order to prevent unwanted production downtimes, during long duty cycles or high loads, it is recommended to keep a complete gearbox (incl. threaded spindle, nut, …) on standby. New seals must always be used for repair.

Repair work is usually most economically achieved by completely replacing of the jack.

6.10.1 Bellows

The ZD-dimension must not be underrun and the AZ-dimension must not be exceeded. These dimensions can be viewed in our main catalogue.

It must be remembered that the bellows may not touch the spindle, otherwise, there is a danger of the bellows getting destroyed.

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

Our support rings STR can be used to prevent contact between the spindle and bellows in case of longer strokes or horizontal installation.

The maximum duty cycle of a jack with rotating spindle (R-Version) is reduced by about 50% owing to the heat-insulating action of a bellows.

6.10.2 Spiral Spring

The spiral spring is subject to a great deal of tension and is tied up with a securing wire. This securing wire may only be opened with extreme care, once the spiral spring has been pushed onto the spindle and the movable part of the machine has been compressed to such an extent, that both ends of the spiral spring are almost in contact.

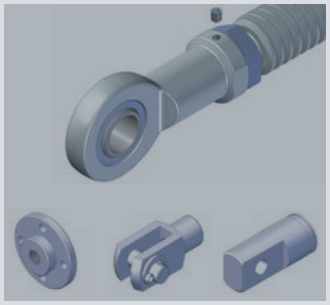
Centring flanges should be provided for positioning the two ends of the spiral spring, which permit the rotational movements of the springs. The spring must be able to move freely and must not be fastened under any circumstances.
In case of vertical deployment of the spiral spring, the large diameter should be at the top, so that, as far as possible, no foreign bodies (e.g. chips) can enter the coil openings.

In case of a horizontal installation of the spiral spring, for the same reason, the large diameter should be in the area where the chips are most prevalent.
Regular maintenance is necessary. Depending upon the degree of contamination, the spiral spring should be cleaned daily or weekly and then coated with a light film of oil. We recommend the Longlife Spray Oil W44T, which you can also obtain from us.

Spiral springs must preferably be used in oil-containing environments. If fine particles or dust are generated (especially in case of grinding dust), spiral springs are not suitable. For these cases, the use of bellows is recommended.

6.10.3 Spindle End Attachments: BF, GK, KGK and SLK

Fastening flanges, fork heads, ball joints and pivot bearing heads for the S-gearbox are screwed onto the spindle ends. After setting the position, these attachments should be fixed by means of a lock nut, stud screw and a suitable thread adhesive (e.g. Loctite 243). The securing must be done carefully and checked.



The fixations are not tightened at the time of delivery.
This gives the user the possibility for exact positioning.

When tightening the lock nut and the stud screw, the following maximum tightening torques in Nm should be maintained:

	NSE2	NSE5	NSE10	NSE25	NSE50	NSE100
Locking nut	6 Nm (M8)	20 Nm (M12)	45 Nm (M14)	140 Nm (M20)	440 Nm (M30)	700 Nm (M42x2)
Stud screw	1 Nm (M3)	2.5 Nm (M4)	5 Nm (M5)	5 Nm (M5)	8 Nm (M6)	20 Nm (M8)

Owing to the low efficiency of a trapezoidal spindle and the ratio of the gearboxes, the twisting torque reaches a multiple of the motor torque.
With enhanced safety requirements, a positive anti-rotation lock is recommended as being indispensable.

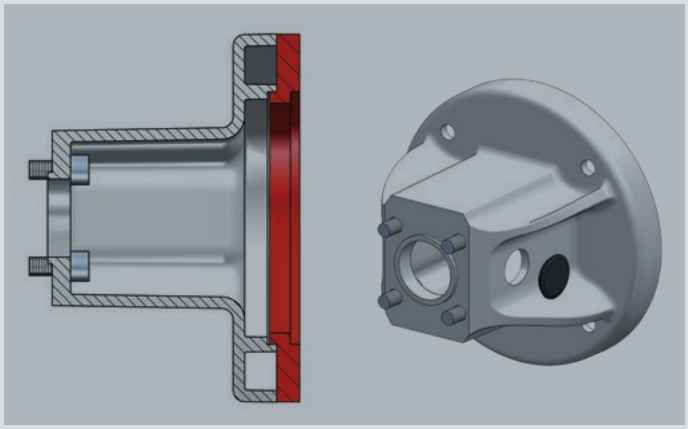
6.10.4 Flange Bearing FL

When assembling the flange bearing at the spindle end, care must be taken that it aligns with the gearbox/spindle/nut, otherwise, the spindle is subject to a cyclical bending stress and can break without previous warning.

The flange bearing is not suitable for absorbing radial forces.
At the time of assembly, it must be ensured that there is enough axial play, so that the spindle can expand freely when it heats up.

6.10.5 Motor Adapter MOA

Check the length of the fastening screws for the motor. The motor can get damaged if excessively long screws are used!
The coupling can be checked through the viewing hole and fixed.

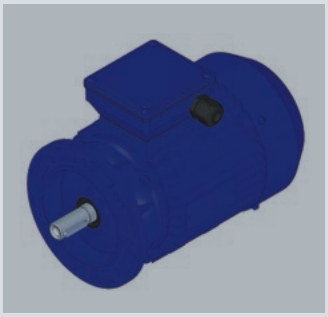


In the following motor-gearbox combinations, with Nozag standard couplings, an additional motor adaptor ring MOAR is necessary:

NSE10 - IEC80
NSE25 - IEC90
NSE50 - IEC100 - IEC112

The motor adapter ring can be dispensed with when using a rotary encoder DIG.

6.10.6 Three-phase Motor



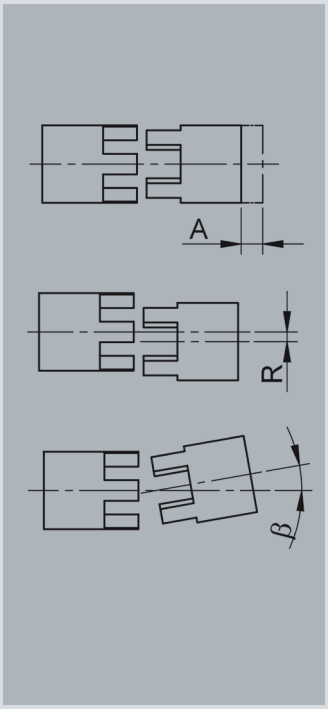
The motors normally have a terminal board with 6 terminals and an earth lead terminal in the terminal box. By shifting the connecting link, the stator winding can be connected in star or delta formation.
The star/delta starting process is not suitable for lifting jack systems, since the full torque is required right from the start.

Basically, we recommend the use of 4-pole motors with a maximum rotational speed of 1400 rpm. Higher rotational speeds are only possible with the expressed permission of Nozag.

The maximum motor torque can reach a multiple of the rated torque for a short time. If required, this must be limited using a frequency converter.

When operating with a frequency converter, it must be remembered that for prolonged operation below 25 Hz, an external fan is required for sufficient cooling of the motor. The separate documentation for the motor must be followed without fail.

6.10.7 Coupling / Connecting Shaft

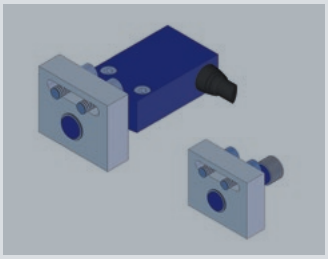


Beware of the axial alignment of the shafts being connected. Despite a certain elasticity of the coupling or the connecting shaft, the deviations should to be kept to a minimum. The maximum errors allowed can be seen in our catalogue. The standard couplings 035 to 190, as well as the connecting shafts LJ and GX must be pushed onto a shaft end with feather keys and thereafter, secured against axial displacement by tightening the threaded pin over the feather key.
The clamping hub coupling KNK and the connecting shaft VW can be radially mounted through the partitioned clamping hubs and the feather key can be omitted. The clamping screws are not allowed to be replaced by a different quality, and for securing torque transmission, must be tightened according to the following table:

Tightening torques (Nm) for clamping bolts:

	KNK02	KNK06	KNK15	KNK30	KNK45	KNK80
VW28	VW35	VW50	VW60	VW76	VW90	VW120
4	8	15	35	70	120	290

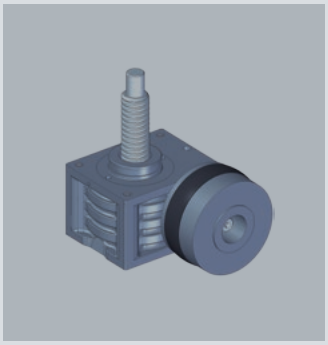
6.10.8 Limit Switch: ESM, ESI



The working of the controller in conjunction with the limit switches must be so designed that a mechanical stop is completely avoided. Test the limit switch function before the motor trial run. If the after-running of the motor does not ensure a complete stillstand, a braking motor should be used. This can especially take place in the case of multi-start threaded spindles and ball screws.

The protection tube has a wall thickness of only 2 mm,depending on the gearbox size. Therefore, the M5-fastening screws may be tightened with a maximum of 2Nm, so that the thread in the tube is not destroyed. In no case should screws longer than those supplied be used, since screws reaching too far into the protection tube could collide with the unscrewing protection.

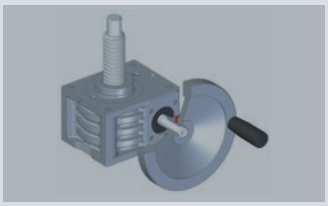
6.10.9 Spring-loaded Brake FDB



When re-lubricating the spindle, the friction surface of the spring-loaded brake must be protected from dirt without fail. Under no circumstances may oil or grease reach the friction pad. Small amounts of dirt can adversely affect the working of the brake.

The maximum permissible limiting temperature of the spring-loaded brake is 145°C. When using a spring-loaded brake or a braking motor in combination with a frequency converter, activate the brake separately. The separate documentation for the spring-loaded brake must be followed without fail.

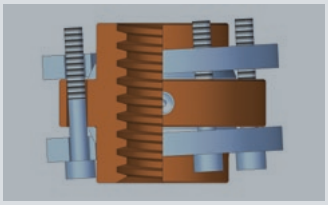
6.10.10 Handwheel HR



The handwheel is pushed onto the shaft with a feather key, at least to the extent that it is flush with the shaft end, and must be secured with a stud screw over the feather key or with a cross-hole and pin.

If a handwheel is combined with a motor, no handle must be screwed in because of the imbalance. During motor operation, the handwheel must under no circumstances be accessible.

6.10.11 Calotte disks KS for Duplex Nuts DMN

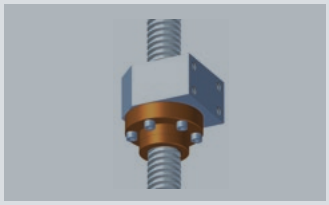


If the joint surface for the nuts is not at right angles to the spindle axis, the calotte disks KS can be used to compensate an error of up to ±3° on the fastening surface.

When tightening the screws, care must be taken that the two large disks are parallel to one another, in order to avoid excessive tilting torque of the screw heads.

The calotte disks are not suitable if the angle can change during operation.Parallelism errors of spindles to one another and to guides cannot be compensated.

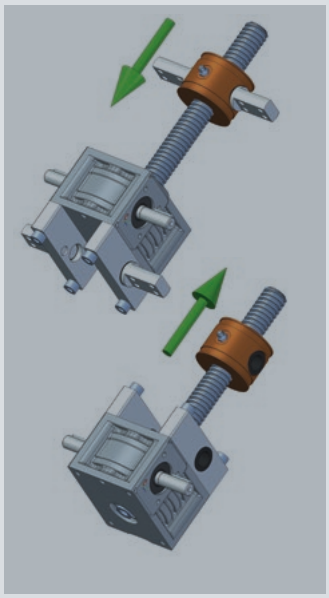
6.10.12 Carrier Flange TRMFL



The carrier flange serves for an eccentric fastening of a load, where by this load must have its own stable linear guide, so that solely an axial force acts on the nut and the carrier flange.

The torques that occur must be absolutely absorbed by an external guide, since the fastening screws could get overloaded with an additional tilting torque and the nut would be subject to significant wear.

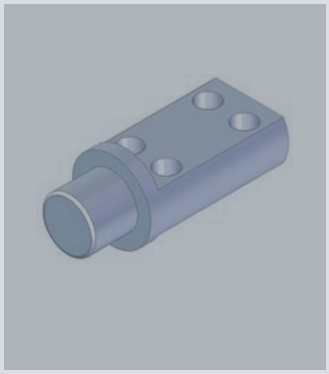
6.10.13 Cardan Adapter for Gearbox KAL, KAK and cardan Nut KM



The swivelling axis should preferably be arranged parallel to the drive axis, so that no additional torque acts on the spindles owing to the motor weight. Particular attention must be given in case of non-horizontally placed spindle axis, long strokes and large motors, otherwise, increased wear at the nut and the spindle will have to be expected. The pivot bearing bushings are maintenance-free and need not be lubricated. However, a one-off lubrication at the time of assembly improves the running-in characteristics as well as the friction coefficient. For the shaft, a tolerance zone h9 and a surface roughness of Ra=0.8 is recommended.

The cardan adapter must always be mounted in such a way that the fastening screws are not stressed in the main load direction. If this is not possible, the load that occurs may not exceed 50% of the rated load. Otherwise, calculations for the screwed joint will have to be carried out again with the conditions applicable in the respective application, in accordance with VDI2230.

6.10.14 Cardan Pin KB



The interface for the cardan pin must be made as rigid as possible, so that the pin cannot give way under load and the pins, always to be used in pairs, must be arranged coaxially, otherwise, a uniform positioning in the bearing bushes is not ensured, which results in excessive wear.The pins should be fastened in such a way that there is only a minimal play to the bearing bushes on the face side.

Above all, in combination of cardan pins with cardan adapter plates at the gearbox, a rigid positioning construction for the cardan pins is important. The pins must also remain coaxial (± 0.3°) under load, since otherwise, the fastening screws of the cardan adapter plates do no longer provide the same safety under the additional forces that occur.

The screw joint of the cardan pins must be designed with particular care and recalculated according to VDI2230. The resting contact surfaces should be so designed that shearing forces are avoided as far as possible.

6.10.15 Support Tube STR

With a support tube, large additional forces can act on the gearbox and the spindle, and therefore, for a swivel bearing solution, whenever possible, the cardan adapter should be preferred!

A horizontal arrangement is the least favourable, since almost the entire dead weight has to be absorbed by the short spindle guide in the gearbox. Therefore, the following maximum stroke lengths in mm apply:

NSE2	NSE5	NSE10	NSE25	NSE50	NSE100
100	200	250	400	500	600

The kink length calculation must be carried out without fail despite the already restricted stroke lengths. If the load is a pressure load, the maximum stroke length can be even shorter.

