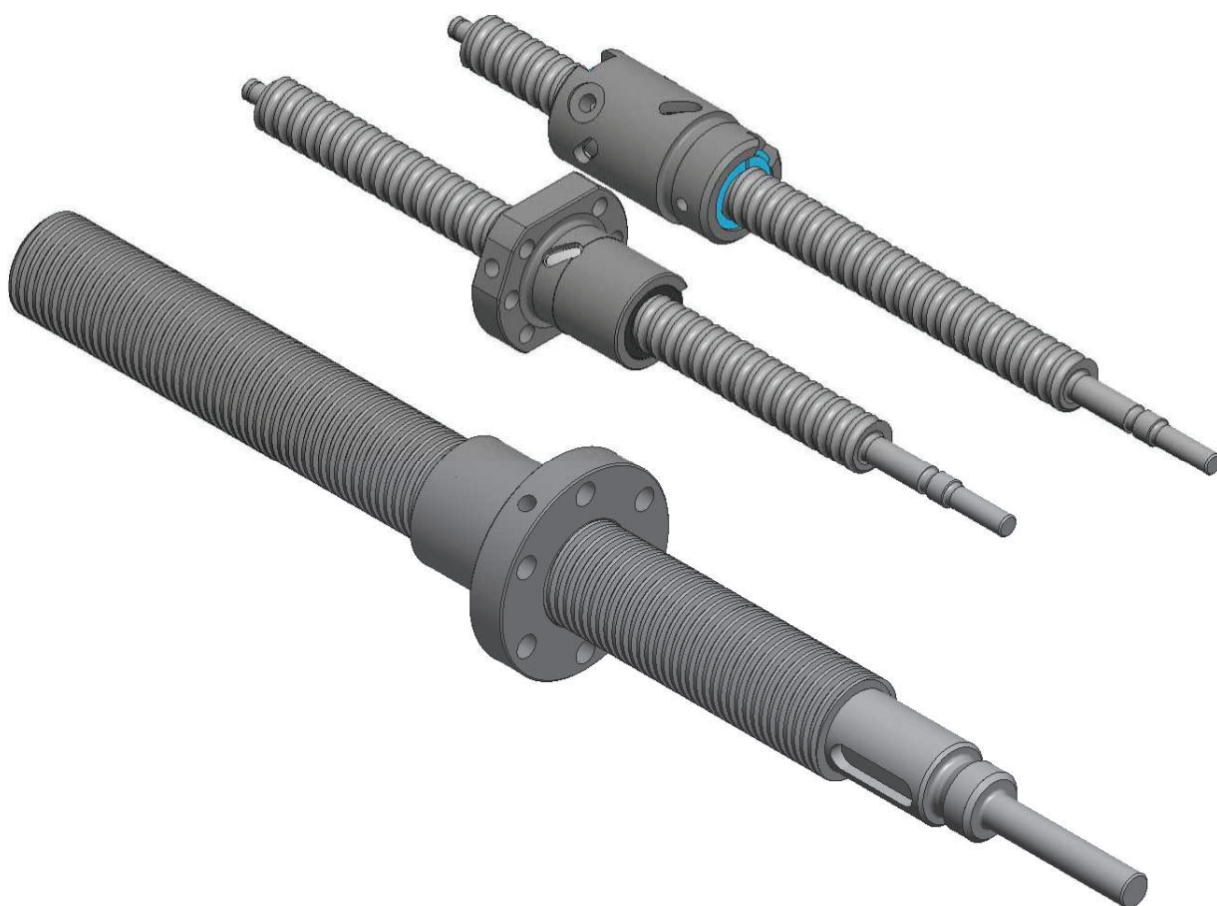


Assembly and maintenance instructions

Ball screws KGT Trapezoidal thread screws TGT



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1

Safety

This chapter serves as instruction and safety guidelines for all those planning to use and install a ball screw as a machine component, as well as for those carrying out the following work:

Machining ends,
Assembly,
Servicing,
Dismantling.



Naturally, the following also apply

- Relevant accident prevention regulations
- Generally recognised safety rules
- EU Directives
- Other applicable standards
- Country-specific provisions

1.1 Importance of these operating instructions

The operating instructions are a part of the device and are:

- Always to be kept handy up until disposal of the device.
- Always to be forwarded with the device when it is sold or hired.

It is essential that you contact the manufacturer if something in the operating instructions is not clearly understandable.

Unavoidable residual risks for people and property are generated by this product. Therefore, every person working on this device who is involved with the transport, set-up, operation, maintenance and repair of the device must be instructed and must be aware of the possible risks. To do this, the operating instructions, in particular the safety guidelines, must be carefully read, understood and observed.

A lack of or insufficient familiarity with the operating instructions leads to the loss of any liability claims against the company Thomson Neff GmbH. It is therefore recommended that the operator has the employee instruction confirmed in writing.

1.2 Use in accordance with the intended purpose

The term ball screw is used to describe a drive element for the conversion of a rotary motion into an axial motion and vice versa.

A ball screw consists of a ball screw shaft, a ball screw nut featuring a ball return and the balls themselves.

The balls, which roll between the screw shaft and the nut, offer optimum levels of efficiency (up to 98%). As a result, ball screws, in contrast to trapezoidal thread screws, are not self-locking and therefore a braking or holding device must be provided in order to prevent inadvertent lowering during vertical installation.

Any other use of the device is not in accordance with the intended purpose.

Because ball screws can be used in very different fields of application, the responsibility for the specific use is transferred to the user on starting the respective application.

1.3 Operator obligations

In accordance with the EU Use of Work Equipment Directive 89/655/EEC Art. 6(1) and 7 as well as the EU Framework Directive 89/391/EEC Art. 1(1) and Art. 6(1), the operator is obligated to instruct the user and in particular to provide safety instruction to those who are to be commissioned with installation, operation, maintenance, repair or dismantling of a linear unit.

In addition, the operator is obligated in accordance with the EU Use of Work Equipment Directive 89/655/EEC Art. 4a to carry out the inspection of the machine prior to commissioning, after repairs and after the occurrence of faults.

1.4 Expert personnel

The ball screws have been constructed in accordance with state of the art technology and the recognised safety rules. In spite of this, hazards may be generated through their use. For this reason, the device may only be installed and operated by competent and trained personnel, and may only be used in accordance with its intended purpose.

Every person commissioned with the installation, operation, maintenance, repair or dismantling of a shaft lifting gear must have read and understood these instructions and in particular Chapter 1 "Safety".

1.5 Marking of residual risks and danger zones

Should, in spite of the constructionally safe use of the linear units, residual risks remain for people or property, the user must notify of these residual risks through signs or written rules of conduct.

1.6 Signs and labels

Keep markings, signs and labels completely legible - their observation is mandatory.
Replace damaged or illegible signs and labels.

1.7 Conversions and changes

Ball screws may not be modified either constructionally or in terms of safety without our written consent. Any unauthorised change excludes us from all liability.

The replacement of wear parts and spare parts may only be carried out after contacting our Service technicians, or if our Service technicians carry out the work themselves.

Safety and protective devices may never be dismantled or put out of operation.

When using special mounted parts, the manufacturer's installation specifications must be observed!

Naturally, the following also apply

- Relevant accident prevention regulations
- Generally recognised safety rules
- EU Directives
- Country-specific provisions

1.8 Warranty

The warranty terms and conditions are defined in the sales documentation. Any rights to warranty claims expire if:

- The device has not been used in accordance with the intended purpose
- The instructions in these operating instructions have not been observed
- The device has been modified without permission from the manufacturer
- The screws sealed with securing lacquer have been opened

The manufacturer can only be held liable when original spare parts are used in the case of maintenance and repair.

1.9 Safety guidelines in the operation instructions



This symbol indicates possible risks to people.
Observe the guidelines in order to avoid injuries.



This symbol indicates possible risks for the device.
Observe these guidelines in order to avoid damage to the device.



This symbol indicates special information

- For optimum use
- To ease operation of the device

2 Product description

2.1 Configuration and function of the ball screws (KGT)

A ball screw consists of a ball screw shaft, a ball screw nut featuring a ball return and the balls themselves. The balls, which roll between the screw shaft and the nut, offer optimum levels of efficiency (up to 98%), and convert a rotary motion into an axial motion and vice versa.

2.2 Installation

The installation of ball screws requires expert knowledge and should therefore only be carried out by trained personnel. Ball screws can only adsorb axial forces. Radial or eccentric forces must be absorbed by external guides. Due to the low friction on a ball screw, alignment errors when turning manually are not usually palpable. Therefore, the appropriate measuring possibilities are required. In order to avoid damage of the KGT; limit switches and final dampers must be provided on the machine.

2.3 Designs

THOMSON NEFF provides ball screws in the following designs:

2.31 Ball screws with nuts in standard dimensions with standard ends.

2.32 Ball screws in accordance with customer drawings.

2.33 Shafts cut to length according to customer requirements, shaft ends, annealed if necessary, nuts of sleeves (the nuts are pre-finished mounted, and the sleeve keeps the balls within the nut track.).

2.34 Shafts cut to production length, nuts on sleeves.



Caution!

In order to avoid damage and contamination, the ball screws must remain in the protective film until they are installed.

3



Machining and installation

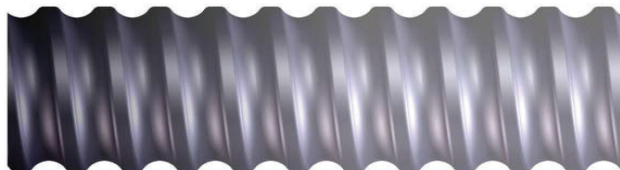
(For case 2.34)

- Cut the shaft to length (cutting disc or tungsten carbide tool), shaft hardness: 60±2 HRC.
- Annealing and processing of the shaft ends. Anneal at 650 ... 700°C (dark red) and leave to cool down in the fresh air.

**Caution!**

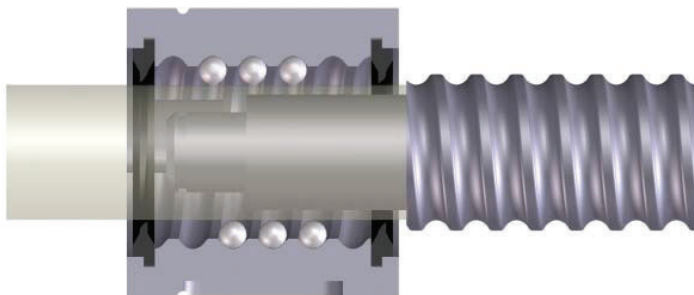
Cool the adjacent threads! (Fig. 1)

Fig.1



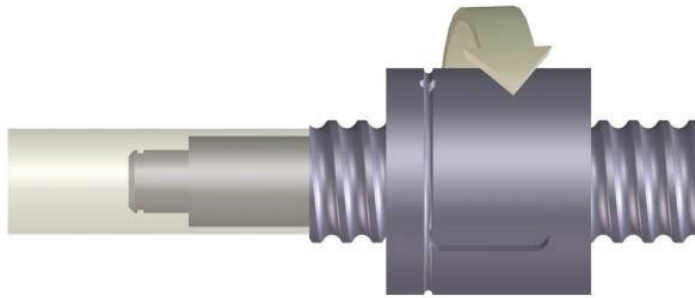
- Deburr the start of the ball screw thread. Clean the entire shaft.
- Remove one of the two axial guards on the

Fig.2



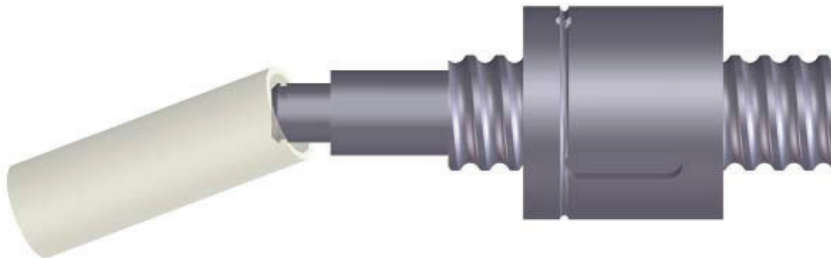
nut sleeve, and push this with the nut over the shaft end. Centre the sleeve and press it against the start of the thread. (Fig. 2)

Fig.3



- Screw the nut in its entire length onto the shaft. (Fig. 3)

Fig. 4



- Remove the sleeve. Secure the nut against running of the shaft (using a rubber ring or an axial sleeve guard. (Fig. 4)
- Dismantle by following these instructions backwards.



**In order to install or position the ball screw, use an appropriate lifting device, if necessary with several support points.
Observe the applicable work safety provisions for dealing with suspended loads.**

- Install the ball screw.
Permitted alignment error: $<0.05 \text{ mm/m}$. Turn the nut unit as close to the shaft bearing as possible and align it there, screw it down and pin it if necessary. The ball screw may not adsorb radial loads!
- If necessary, connect to the centralized lubrication system - the flange nut directly, and the cylinder nut via the necessary housing.

4 Cover

Contamination occurring installation should be removed using petroleum, oil or benzine. Cold cleaners and paint solvents are not permitted. During operation, ball screws must be protected against dust, chips etc., even if they are already equipped with wipers. Possible protective measures are:

- Bellows (only permitted for vertical installation without an additional guide).
- Helical spring cover.
- Telescopic tubes or sleeves (high axial space requirements).

Our range of offers also includes completely protected systems ready for installation:

- THOMSON NEFF KOKON - ball screw with self-closing cover band return.

5 Wiper



Installation of the rubber or plastic wiper with lug for ball screws

Caution: Assemble the wiper so that the Mod. No. XXXX remains visible.



After assembling the nut onto the screw shaft, screw the nut back until the flat face on the nut wiper bore and the start of the shaft run align.

Insert the wiper into the nut bore so that the lug in the nut recess projects, and check the fit in the nut before applying it to the deburred screw shaft.

Carefully turn the nut with wiper until the wiper engages in the shaft thread. Continue to screw the nut with wiper onto the thread.

6 Storage and transport

Ball screws are high-precision devices. Strong impacts can damage the accurate mechanism on the devices and have a negative influence on its function. In order to avoid damage during storage and transport, the ball screws should remain in the protective film until installation or processing, as well as being:

- Protected against damage and strong vibrations
- Protected against sliding
- Stored in sufficiently large crates

The components must be protected against:

- Contamination
- Corrosion
- Water
- Aggressive atmospheres

7 Lubrication

7.1 Recommendation

The correct lubrication of ball screws is not only a prerequisite for the achievement of the theoretical lifetime, but also has an influence on smooth running properties, heat generation during operation and on the idling torque.

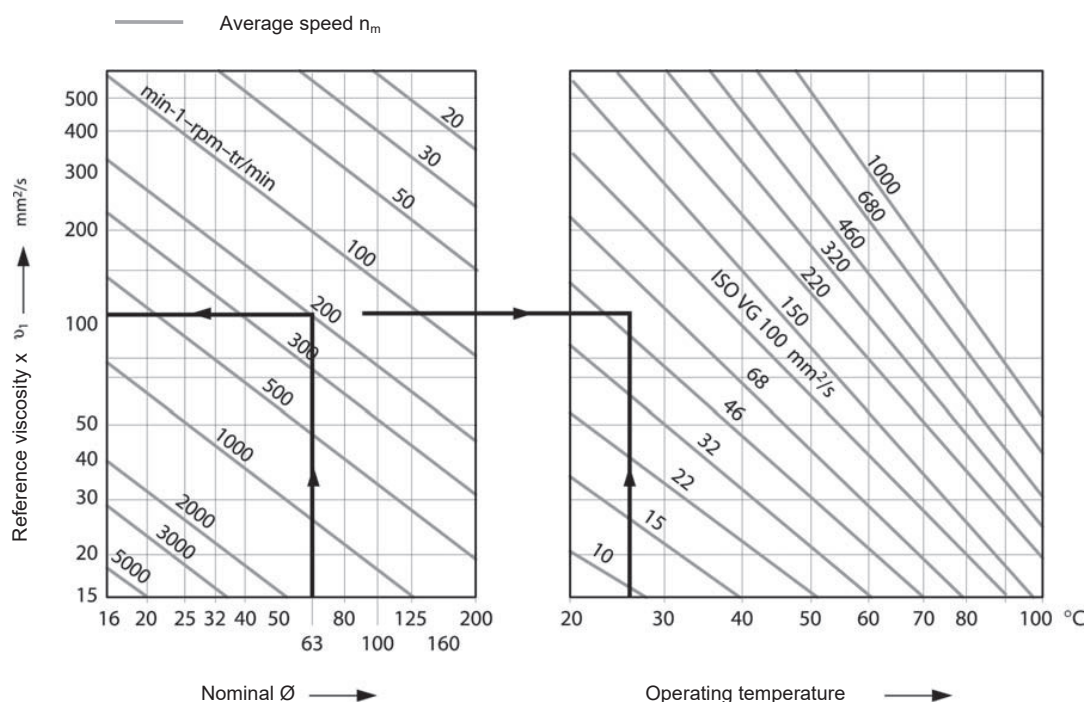
In principle, the types of oil and grease used for rolling bearings are suitable for this purpose. Unless the customer has specified otherwise, the function acceptance process is performed at Thomson Neff using an oil in accordance with ISO VG100.

Oil lubrication

Generally speaking, CL oils are used in this context for increasing corrosion protection and durability. Alloyed CLP oils with EP additives can also be used. The appropriate level of viscosity depends on the circumferential speed (in other words, diameter and speed) and the ambient or expected operating temperature. The amount of oil required per ball revolution lies somewhere between 0.3 and 0.5 cm³/h, depending on the speed. Only 1/10 of this amount is needed if liquid grease is used. For oil bath lubrication, it is enough for the oil level to reach half way up the lowest lying ball if the mounting position is horizontal. Use the diagram below to determine the viscosity level.

Example: KGT63 x 10
 Average speed $n_m = 200$ rpm
 Operating temperature $t = 25^\circ\text{C}$

For a nominal diameter of 63 mm and $n_m = 200$ rpm the left part of the diagram shows a viscosity v_1 of 110 mm²/s. When this value is transferred to the diagram on the right, the point of intersection at a temperature of 25°C lies between ISO VG46 and ISO VG68. In order to ensure there is an adequate lubricating film during all operating states, the higher value should be selected in each case. This would be ISO VG68 in the current case, although even higher levels may be required for longer running times where fatigue may be an issue. The appropriate oils with this viscosity class can be selected from the table of lubricants shown below.



Grease lubrication

Grease can also be used to lubricate ball screws. This approach allows longer intervals between each lubrication.

Given that a small amount of grease escapes from the nut and remains on the shaft with each stroke of the ball screw, even when the wipers are working as well as they can, the amount of grease available reduces during operation. This limits the length of time the ball screw can be used without being regreased. The expected service life L₁₀ can only be achieved if the grease lost is replaced by means of a centralized lubrication system or a lubrication schedule tailored to the application in question.

Manual regreasing can achieve an average of around 700 extra service hours. This figure can vary considerably, however, depending on the machine design and the conditions under which it is used.

Lubricating greases are divided into NLGI classes based on their penetration level in accordance with DIN 51818. Under normal conditions (operating temperatures between -20°C and +120°C), waterproof greases from class K2K-20 in accordance with DIN 51825 should be used for ball screws. Greases from class K1K-20 (very high speeds) or KP2K-20 (very high loads or low speeds) can be used for special applications. Greases which do not share the same saponification basis should not be mixed. The manufacturer must be consulted if operating temperatures are going to be higher or lower than the values specified. When deciding how much grease to use, look to fill about half of the space available. In order to avoid the ball screws heating up unnecessarily as a result of excess grease, machine designs should ensure that waste or superfluous grease is able to escape.

If you have any additional questions concerning lubrication, please contact our engineering consultants.

Calculation for determining volume when regreasing (using grease)

$$V_{RL} = \frac{d_0 \times P_h \times D_w \times i^{0.7}}{1250}$$

V_{RL}	=	Regreasing volume [g]
d_0	=	Nominal diameter of shaft [mm]
P_h	=	Lead [mm]
D_w	=	Ball diameter [mm]
i	=	Number of revolutions in nut

When lubricating a dummy nut, multiply the volume calculated by 2.5.

7.2 Guidelines on greasing and installation

If the ball screw is not released in delivery condition, lubricant must be applied to the nut via the lubrication bore prior to commissioning. Both during initial lubrication and relubrication of the ball screw nuts via the lubrication bore, please note that the lubrication grease will distribute itself sluggishly and unevenly in the nut, making it hard to fill the nut completely to the calculated value. For this reason it is recommended that the nut is filled in several partial steps, and is moved at intervals briefly along the shaft to improve distribution of the grease in the threads. It is usually sufficient to continue to turn (at least the length of the nut). When filling, observe the collars of grease forming at both nut ends.

During the assembly of a pre-greased ball screw nut onto the associated ball screw shaft, please also note that a certain lubrication grease loss occurs outside the traverse path (on the shaft end). If the amount of grease lost is large, it is therefore advisable to refill a certain quantity of grease via the lubrication bore of the mounted ball screw nut, in order to guarantee sufficient filling once more.

7.3 Explanation

All figures stated are only reference values, and are based in part on experience values. It is therefore essential to check the ball screw regularly and to observe indications for insufficient lubrication, such as a dry shaft or a high quantity of grease loss. Please also observe the guidelines in the catalogue.

7.4 Operating temperature

The permitted operating temperature range for ball screws lies between -30°C and +80°C, temporarily, +110°C is also permitted. The prerequisite is always the correct lubrication.

At temperatures of below -20°C, the torque can increase to 10 times the value.

8 Trapezoidal thread screws TGT

8.1 Installation

Trapezoidal thread screws must be carefully aligned on installation – if the appropriate measuring equipment is not available, the lead screw must be moved once by hand along the entire length before the drive is fitted.

Uneven force requirements and/or running traces on the external diameter of the shaft indicate errors in the alignment between shaft axis and guide. In this case, first loosen the relevant mounting screws and then operate the lead screw once again by hand.

If the force requirement is now uniform, the corresponding elements must be aligned, otherwise the alignment error must be determined by loosening further mounting screws.

8.2 Cover

Trapezoidal thread screws are by nature less sensitive to contamination than ball screws, above all at lower speeds (e.g. manual operation).

However, motion drives, in particular those using plastic nuts, also require protective measures similar to those for ball screws.

8.3 Lubrication

- Oil lubrication

Is only used on trapezoidal thread screws in special cases.

- Grease lubrication

This is the usual lubrication for trapezoidal thread screws. The lubrication intervals depend on the operating conditions; it is recommended that the shaft is cleaned before being greased, especially if high performance lubricating systems are being used.

Grease grades: roller bearing greases without a solid lubricant constituent.

8.4 Operating temperature

Depends on the type of nut used, the lubrication conditions and the specifications set.

We ask you to contact us when operating at temperatures of over 100°C (with plastic nuts, at over 70°C).

8.5 Wear

May be tested by hand; the nut must be replaced if the axial play of a single thread lead screw is greater than 1/4 of the lead.

9 Service proposal

We conduct expert maintenance work on ball screws at short notice, both at our location and at the customer's site.

This offer also applies for other brands.

Any necessary replacement deliveries are possible at short notice through our standard range of products.

Should you have any queries, please contact:

Thomson Neff GmbH

Service

Nürtinger Straße 70

D-72649 Wolfschlugen

or by tel. 07022 504376

or by Email: service.wolfschlugen@thomsonlinear.com



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