SCHUNK

Power chuck
ROTA THW / THWB
Assembly and Operating Manual

Translation of Original Operating Manual

Hand in hand for tomorrow

Imprint

Technical changes:
We reserve the right to make alterations for the purpose of technical improvement.

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Dear Customer,

Thank you for trusting our products and our family-owned company, the leading technology supplier of robots and production machines.

Our team is always available to answer any questions on this product and other solutions. Ask us questions and challenge us. We will find a solution!

Best regards,

Your SCHUNK team

Customer Management
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Please read the operating manual in full and keep it close to the product.

Table of Contents

1 General

1.1 About this manual

This manual contains important information for a safe and appropriate use of the product.

This manual is an integral part of the product and must be kept accessible for the personnel at all times.

Before starting work, the personnel must have read and understood this operating manual. Prerequisite for safe working is the observance of all safety instructions in this manual.

In addition to these instructions, the documents listed under ▸ 1.1.2 [🗋 6] are applicable.

NOTE: The illustrations in this manual are intended to provide a basic understanding and may deviate from the actual version.

1.1.1 Presentation of Warning Labels

To make risks clear, the following signal words and symbols are used for safety notes.

⚠ DANGER

Dangers for persons!

Non-observance will inevitably cause irreversible injury or death.

⚠ WARNING

Dangers for persons!

Non-observance can lead to irreversible injury and even death.

⚠ CAUTION

Dangers for persons!

Non-observance can cause minor injuries.

CAUTION

Material damage!

Information about avoiding material damage.

1.1.2 Applicable documents

- General terms of business *
- Catalog data sheet of the purchased product *
- Calculation of the jaw centrifugal forces, "Technology" chapter in the lathe chuck catalog *

The documents labeled with an asterisk (*) can be downloaded from **schunk.com**.

1.1.3 Sizes

This operating manual applies to the following sizes:

- ROTA THW
  400; 500; 630; 800; 1000
- ROTA THWB
  210; 265; 315; 400; 500; 630

1.2 Warranty

If the product is used as intended, the warranty is valid for 24 months from the date of delivery from the production facility or 500 000 cycles* under the following conditions:

- Observe the applicable documents, ▶ 1.1.2 [🗋 6]
- Observe the ambient conditions and operating conditions, ▶ 2.6 [🗋 8]
- Observe the specified maintenance and lubrication intervals, ▶ 7 [🗋 34]

Parts touching the workpiece and wear parts are not included in the warranty.

* A cycle consists of a complete clamping process ("Open" and "Close").

1.3 Scope of delivery

1 **Power chuck** incl. Fastening screws
- Base jaws with screws
- Jaw change wrench

1 **Eye bolt**

1 **Operating manual**

2 Basic safety notes

2.1 Intended use

This product is intended for clamping workpieces on machine tools and other suitable technical devices.

- The product may only be used within the scope of its technical data, ▸ 3 [🗋 17].
- The product is intended for industrial and industry-oriented use.
- Appropriate use of the product includes compliance with all instructions in this manual.
- The maximum RPM of the chuck and the required clamping force must be determined by the user for the respective clamping task based on the applicable standards and technical specifications of the manufacturer.
  (See also "Calculations for clamping force and RPM" in the chapter "Technical data"). ▸ 3 [🗋 17]

2.2 Not intended use

A not intended use of the product is for example:

- It is used as a press, a punch, a toolholder, a load-handling device or as lifting equipment.
- the product is used for unintended machines or workpieces.
- the technical data is exceeded when using the product. ▸ 3 [🗋 17]
- if workpieces are not clamped properly, paying particular attention to the clamping forces specified by the manufacturer.
- if it is used in working environments that are not permissible.
- if the product is operated without a protective cover.

2.3 Constructional changes

Implementation of structural changes

By conversions, changes, and reworking, e.g. additional threads, holes, or safety devices can impair the functioning or safety of the product or damage it.

- Structural changes should only be made with the written approval of SCHUNK.

2.4 Spare parts

Use of unauthorized spare parts

Using unauthorized spare parts can endanger personnel and damage the product or cause it to malfunction.

- Use only original spare parts or spares authorized by SCHUNK.

2.5 Chuck jaws

Requirements of the chuck jaws

Stored energy can make the product unsafe and poses the danger of serious injuries and considerable material damage.

- Only change chuck jaws if no residual energy can be released.
- Do not use welded jaws.
- The chuck jaws should be designed to be as light and as low as possible. The clamping point must be as close as possible to the chuck face (clamping points at a greater distance lead to greater surface pressure in the jaw guidance and can significantly reduce the clamping force).
- If for constructional reasons the special chuck jaws are heavier than the top jaws assigned to the lathe chuck, greater centrifugal forces must be accounted for when defining the required clamping force and the recommended speed.
- The maximum recommended speed may only be operated in conjunction with maximum actuating force and only with the lathe chuck in optimum, fully functioning condition.
- After a collision, the lathe chuck and the chuck jaws must be subjected to a crack test before being used again. Damaged parts must be replaced with original SCHUNK spare parts.
- Renew the chuck jaw mounting screws if there are signs of wear or damage. Only use screws with a quality of 12.9.
- Screw the jaw mounting screws into the bore holes furthest apart.

2.6 Environmental and operating conditions

Required ambient conditions and operating conditions

Incorrect ambient and operating conditions can make the product unsafe, leading to the risk of serious injuries, considerable material damage and/or a significant reduction to the product's life span.

- Make sure that the product is used only in the context of its defined application parameters, ▶ 3 [🗋 17].
- Make sure that the product is a sufficient size for the application.
- Only use high-quality cooling emulsions with anti-corrosive additives during processing.
- Lubricating intervals must be adhered to ▶ 7.2 [🗋 35].

2.7 Personnel qualification

Inadequate qualifications of the personnel

If the personnel working with the product is not sufficiently qualified, the result may be serious injuries and significant property damage.

- All work may only be performed by qualified personnel.
- Before working with the product, the personnel must have read and understood the complete assembly and operating manual.
- Observe the national safety regulations and rules and general safety instructions.

The following personal qualifications are necessary for the various activities related to the product:

Trained electrician	Due to their technical training, knowledge and experience, trained electricians are able to work on electrical systems, recognize and avoid possible dangers and know the relevant standards and regulations.
Qualified personnel	Due to its technical training, knowledge and experience, qualified personnel is able to perform the delegated tasks, recognize and avoid possible dangers and knows the relevant standards and regulations.
Instructed person	Instructed persons were instructed by the operator about the delegated tasks and possible dangers due to improper behaviour.
Service personnel of the manufacturer	Due to its technical training, knowledge and experience, service personnel of the manufacturer is able to perform the delegated tasks and to recognize and avoid possible dangers.

2.8 Personal protective equipment

Use of personal protective equipment

Personal protective equipment serves to protect staff against danger which may interfere with their health or safety at work.

- When working on and with the product, observe the occupational health and safety regulations and wear the required personal protective equipment.
- Observe the valid safety and accident prevention regulations.
- Wear protective gloves to guard against sharp edges and corners or rough surfaces.
- Wear heat-resistant protective gloves when handling hot surfaces.
- Wear protective gloves and safety goggles when handling hazardous substances.
- Wear close-fitting protective clothing and also wear long hair in a hairnet when dealing with moving components.

2.9 Notes on safe operation

Incorrect handling of the personnel

Incorrect handling and assembly may impair the product's safety and cause serious injuries and considerable material damage.

- Avoid any manner of working that may interfere with the function and operational safety of the product.
- Use the product as intended.
- Observe the safety notes and assembly instructions.
- Do not expose the product to any corrosive media. This does not apply to products that are designed for special environments.
- Eliminate any malfunction immediately.
- Observe the care and maintenance instructions.
- Observe the current safety, accident prevention and environmental protection regulations regarding the product's application field.

2.10 Transport

Handling during transport

Incorrect handling during transport may impair the product's safety and cause serious injuries and considerable material damage.

- When handling heavy weights, use lifting equipment to lift the product and transport it by appropriate means.
- Secure the product against falling during transportation and handling.
- Stand clear of suspended loads.

2.11 Malfunctions

Behavior in case of malfunctions

- Immediately remove the product from operation and report the malfunction to the responsible departments/persons.
- Order appropriately trained personnel to rectify the malfunction.
- Do not recommission the product until the malfunction has been rectified.
- Test the product after a malfunction to establish whether it still functions properly and no increased risks have arisen.

2.12 Disposal

Handling of disposal

The incorrect handling of disposal may impair the product's safety and cause serious injuries as well as considerable material and environmental harm.

- Follow local regulations on dispatching product components for recycling or proper disposal.

2.13 Fundamental dangers

General

- Observe safety distances.
- Never deactivate safety devices.
- Before commissioning the product, take appropriate protective measures to secure the danger zone.
- Disconnect power sources before installation, modification, maintenance, or calibration. Ensure that no residual energy remains in the system.
- If the energy supply is connected, do not move any parts by hand.
- Do not reach into the open mechanism or movement area of the product during operation.

2.13.1 Protection during handling and assembly

Incorrect handling and assembly

Incorrect handling and assembly may impair the product's safety and cause serious injuries and considerable material damage.

- Have all work carried out by appropriately qualified personnel.
- For all work, secure the product against accidental operation.
- Observe the relevant accident prevention rules.
- Use suitable assembly and transport equipment and take precautions to prevent jamming and crushing.

Incorrect lifting of loads

Falling loads may cause serious injuries and even death.

- Stand clear of suspended loads and do not step into their swiveling range.
- Never move loads without supervision.
- Do not leave suspended loads unattended.

2.13.2 Protection during commissioning and operation

Falling or violently ejected components

Falling and violently ejected components can cause serious injuries and even death.

- Take appropriate protective measures to secure the danger zone.
- Never step into the danger zone during operation.

2.13.3 Protection against dangerous movements

Unexpected movements

Residual energy in the system may cause serious injuries while working with the product.

- Switch off the energy supply, ensure that no residual energy remains and secure against inadvertent reactivation.
- Never rely solely on the response of the monitoring function to avert danger. Until the installed monitors become effective, it must be assumed that the drive movement is faulty, with its action being dependent on the control unit and the current operating condition of the drive. Perform maintenance work, modifications, and attachments outside the danger zone defined by the movement range.
- To avoid accidents and/or material damage, human access to the movement range of the machine must be restricted. Limit/prevent accidental access for people in this area due through technical safety measures. The protective cover and protective fence must be rigid enough to withstand the maximum possible movement energy. EMERGENCY STOP switches must be easily and quickly accessible. Before starting up the machine or automated system, check that the EMERGENCY STOP system is working. Prevent operation of the machine if this protective equipment does not function correctly.

2.13.4 Notes on particular risks

⚠ DANGER

Risk of fatal injury from suspended loads!

Falling loads are sure to cause serious injuries and even death.

- Use suitable lifting equipment.
- Secure the product to prevent it from falling.
- Stand clear of suspended loads and do not step within their swiveling range.
- Only move loads when supervised and do not leave unattended.
- Wear suitable protective equipment.

⚠ DANGER

Risk of fatal injury to operating personnel due to the workpiece falling down or being flung out in the event of a power failure.

In the event of a power failure, the lathe chuck's clamping force may fail immediately and the workpiece may be released in an uncontrolled manner. This poses a risk of death or injury to the operating personnel and can result in serious damage to the system.

- The machine manufacturer and the operator of the machine must carry out and document a hazard assessment and risk analysis to ensure that suitable measures are taken to maintain the lathe chuck's clamping force until the machine comes to a standstill and the workpiece can be secured (e.g. using a crane or suitable lifting equipment).
- The machines and equipment must fulfill the minimum requirements of the EC Machinery Directive; specifically, they must have effective technical measures to protect against potential mechanical hazards.
- Perform regular maintenance.

⚠ DANGER

Possible risk of fatal injury to operating personnel if a jaw breaks or if the lathe chuck fails because the technical data have been exceeded and a workpiece is released or parts fly off

- The technical data specified by the manufacturer for using the lathe chuck must never be exceeded.
- The lathe chuck may only be used on machines and facilities that fulfill the minimum requirements of the EC Machinery Directive; specifically, they must have effective technical measures to protect against possible mechanical hazards.

⚠ DANGER

Possible risk of fatal injury to operating personnel from clothing or hair being caught on the lathe chuck and being dragged into the machine

Loose clothing or long hair may become caught on projecting parts of the lathe chuck and be drawn into the machine.

- The machines and equipment must fulfill the minimum requirements of the EC Machinery Directive; specifically, they must have effective technical measures to protect against potential mechanical hazards.
- Always wear tight-fitting clothing and a hairnet when working on the machine and the lathe chuck.

⚠ CAUTION

Danger of slipping and falling in case of dirty environment where the chuck is used (e.g. by cooling lubricants or oil).

- Ensure that the working environment is clean before starting assembly and installation work.
- Wear suitable safety shoes.
- Follow the safety and accident-prevention regulations when operating the chuck, especially when working with machine tools and other technical equipment.

⚠ CAUTION

Danger of limbs being crushed by opening and closing of the chuck jaws during manual loading and unloading or when replacing moving parts.

- Do not reach between the chuck jaws.
- Automatic loading is preferred.
- If manual loading is used, adjust the jaw position so that the opening gap between the jaw and the workpiece is less than 4 mm.
- Wear protective gloves.
- Observe the safety and accident prevention regulations during operation of the chuck, especially in connection with machining centers and other technical equipment.

⚠ CAUTION

Risk of burns due to workpieces with high temperatures.

- Wear protective gloves when removing the workpieces.
- Automatic loading is preferred.

⚠ CAUTION

Danger of damage due to incorrectly selected clamping position of the clamping jaws to the workpiece.

An incorrectly selected clamping position of the clamping jaws to the workpiece can result in damage to the base and top jaws.

- Make sure that the workpiece clamping is concentric.
- In the case of a chuck with a quick-change jaw system the top jaws must not protrude radially beyond the base jaws used.
  Exception: The supporting jaw variant 3 protrudes beyond the chuck base jaw due to the construction of the jaw. In this case, the T-nuts must always be inserted completely into the groove of the chuck base jaw.

⚠ CAUTION

Hazard from vibration due to imbalanced rotating parts and noise generation.

Physical and mental strains due to imbalanced workpieces and noise during the machining process on the clamped and rotating workpiece.

- Ensure the chuck's axial and concentric runout.
- Check options for remedying imbalances on special top jaws and workpieces.
- Reduce the speed.
- Wear hearing protection.

3 Technical data

3.1 Chuck data

ROTA THW	400	500	630	800 – 1000
Max. actuating force [kN]	133	133	133	On request
Max. clamping force [kN]	240	240	240	
Max. rotation speed [min-1]	3500	2200	1700	
Stroke per jaw [mm]	6.5	9	9.8	
Piston stroke [mm]	23	30	34	
Through hole [mm]	120	128	160	
Operating temperature	15°C – 60°C			
Centrifugal torque of the base jaw $\mathbf{M}_{cGB}$ [kgm]	For the NCX chuck, it is necessary to specifically determine this data. Examples of calculation can be found in the "Technology" chapter of the SCHUNK lathe chuck catalog and in the "Chuck jaws in special design/technology" chapter of the SCHUNK chuck jaws catalog. These catalogs can be downloaded from schunk.com .			
Max. jaw eccentricity of center of gravity in axial direction $\mathbf{a}_{max}$ [mm]				

ROTA THWB	210	265	315	400	500	630
Max. actuating force [kN]	50	73	100	133	133	133
Max. clamping force [kN]	90	132	180	240	240	240
Max. rotation speed [min-1]	3000	3000	2800	2450	1600	240
Stroke per jaw [mm]	5.7	6.5	6.5	6.5	9	6.5
Piston stroke [mm]	20	23	23	23	30	34
Through hole [mm]	52	71	86	120	128	160
Operating temperature	15°C – 60°C					
Centrifugal torque of the base jaw$\mathbf{M}_{cGB}$ [kgm]	For the NCX chuck, it is necessary to specifically determine this data. Examples of calculation can be found in the "Technology" chapter of the SCHUNK lathe chuck catalog and in the "Chuck jaws in special design/technology" chapter of the SCHUNK chuck jaws catalog. These catalogs can be downloaded from schunk.com .					
Max. jaw eccentricity of center of gravity in axial direction $\mathbf{a}_{max}$ [mm]						

The maximum permissible speed for special machining has to be defined by the user on the basis of the required clamping forces. This speed must not exceed the maximum speed of the chuck.

Ensure minimal weight for all jaws.
For unhardened top jaws or chuck jaws in special design, the permissible RPM according to VDI 3106 must be calculated for the respective machining job. Whereby the recommended maximum speed must not be exceeded. The values calculated must be checked by means of dynamic measurement using a clamping force tester.

3.2 Clamping force / speed diagrams

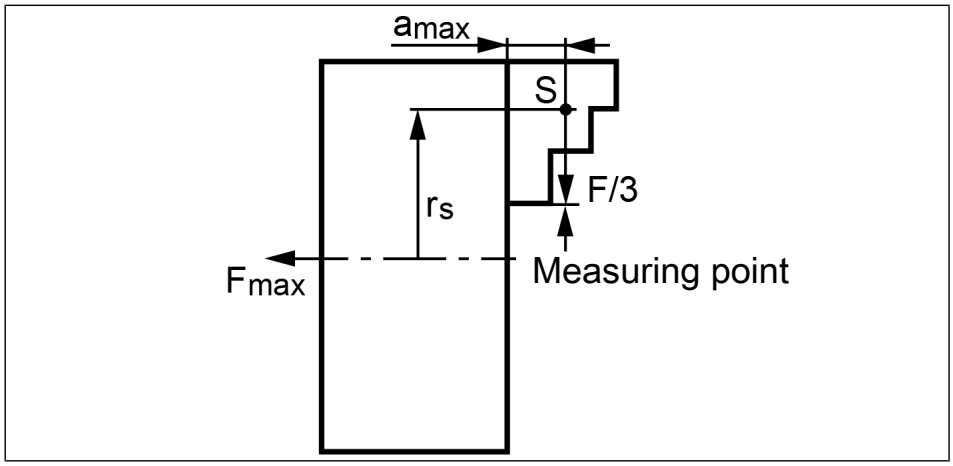
The diagrams refer to 3-jaw-chuck.

Clamping force/speed curves were determined with hard standard stepped jaws SHB, SWB and SWB-AL. The maximum actuating force was introduced and the jaws were placed flush with the base jaw outer edge.

The chuck is in perfect condition and lubricated with SCHUNK LINO MAX special grease.

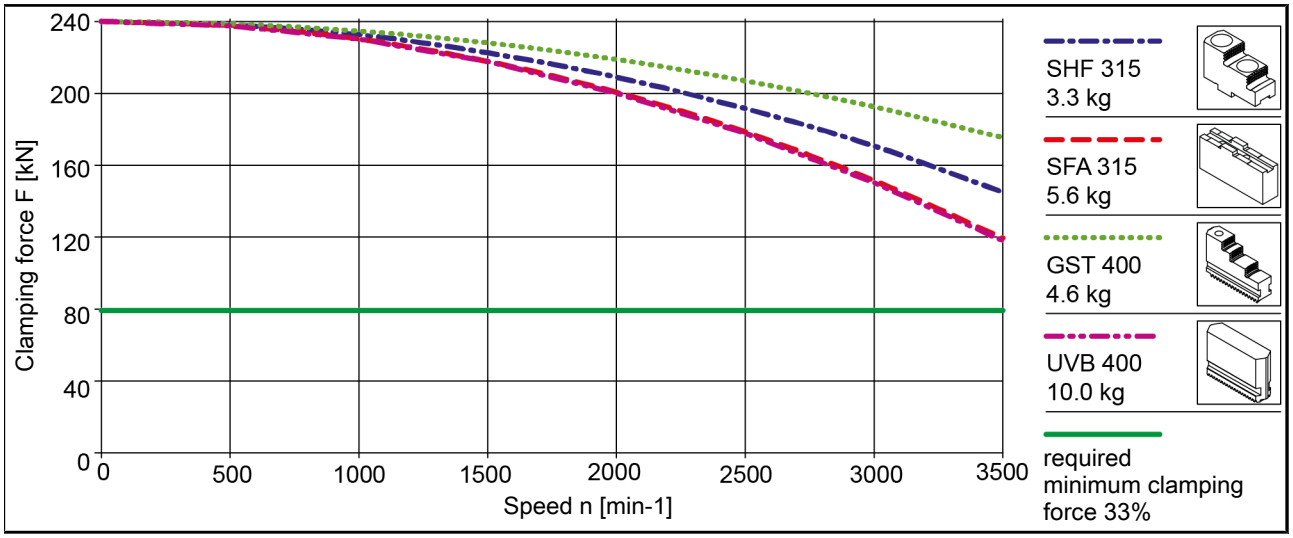
Should one or several of the above mentioned parameters be changed the diagrams are no longer valid.

Chuck set-up for clamping force / speed diagram

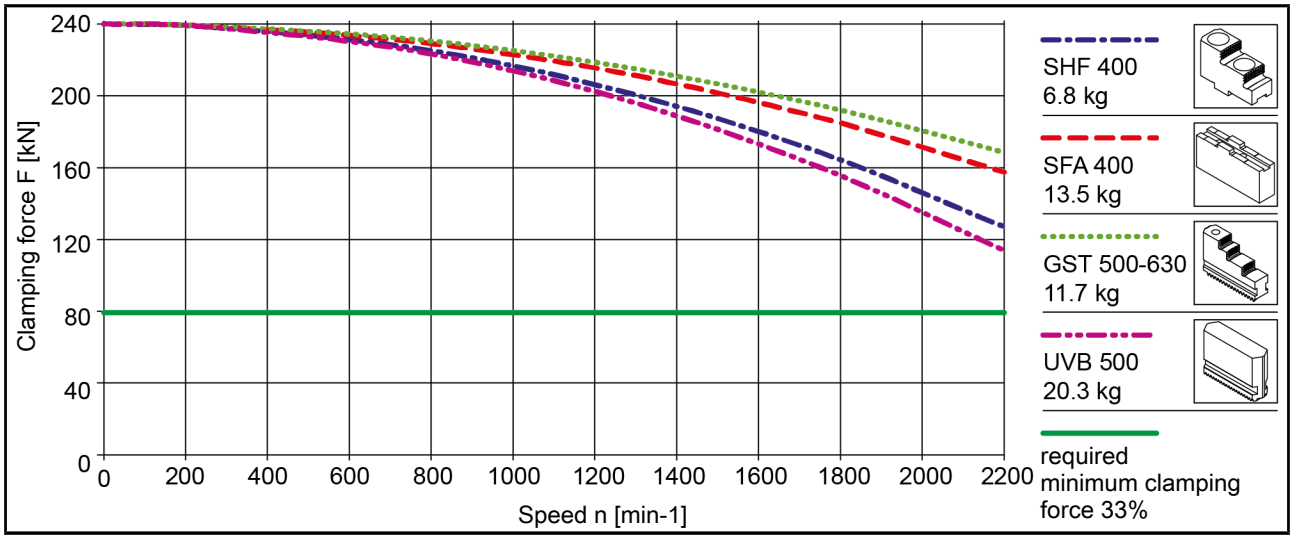


F/3	Clamping force per jaw	S	Center of gravity
r_s	Center of gravity radius	a_{max}	Max. jaw eccentricity of center of gravity in axial direction
F_{max}	Max. actuating force		

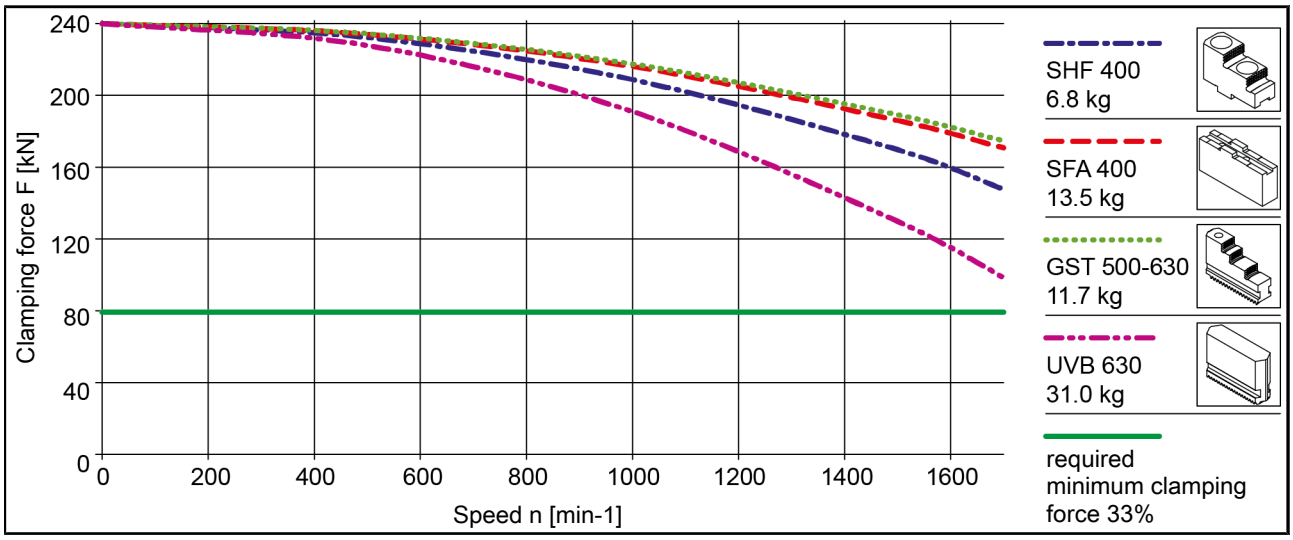
Clamping force / speed diagrams ROTA THW 400-120



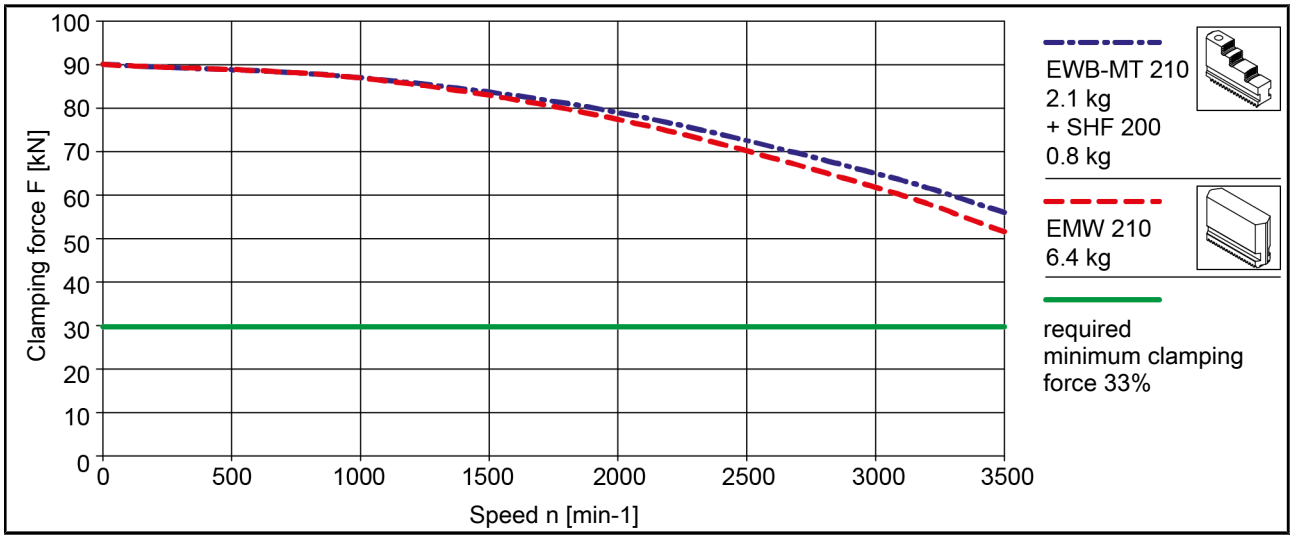
Clamping force / speed diagrams ROTA THW 500-128



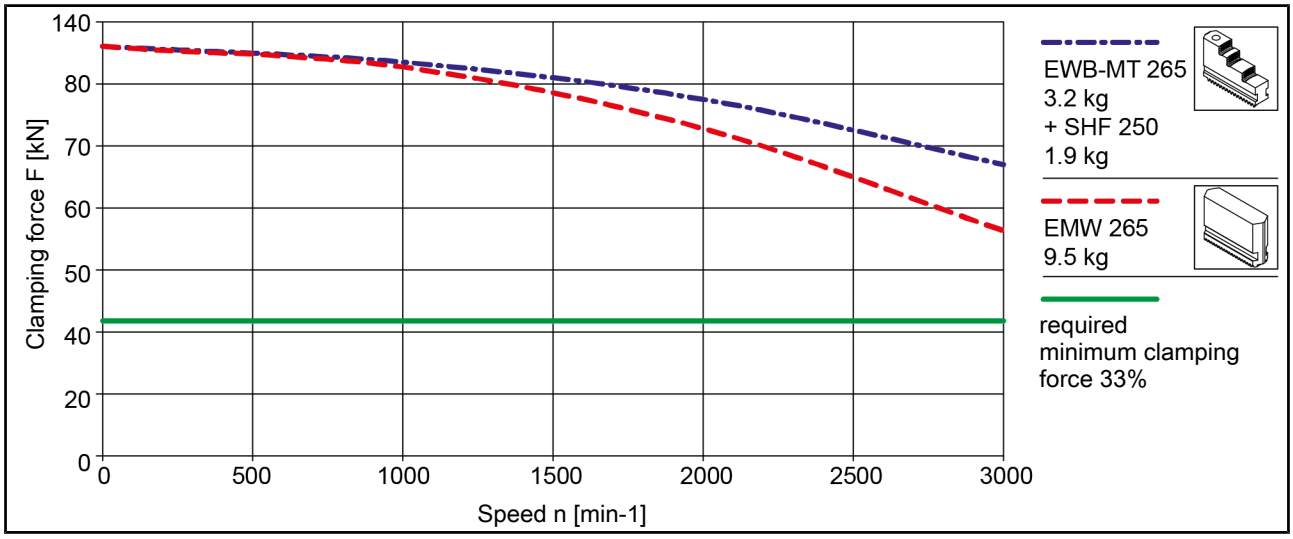
Clamping force / speed diagrams ROTA THW 630-160



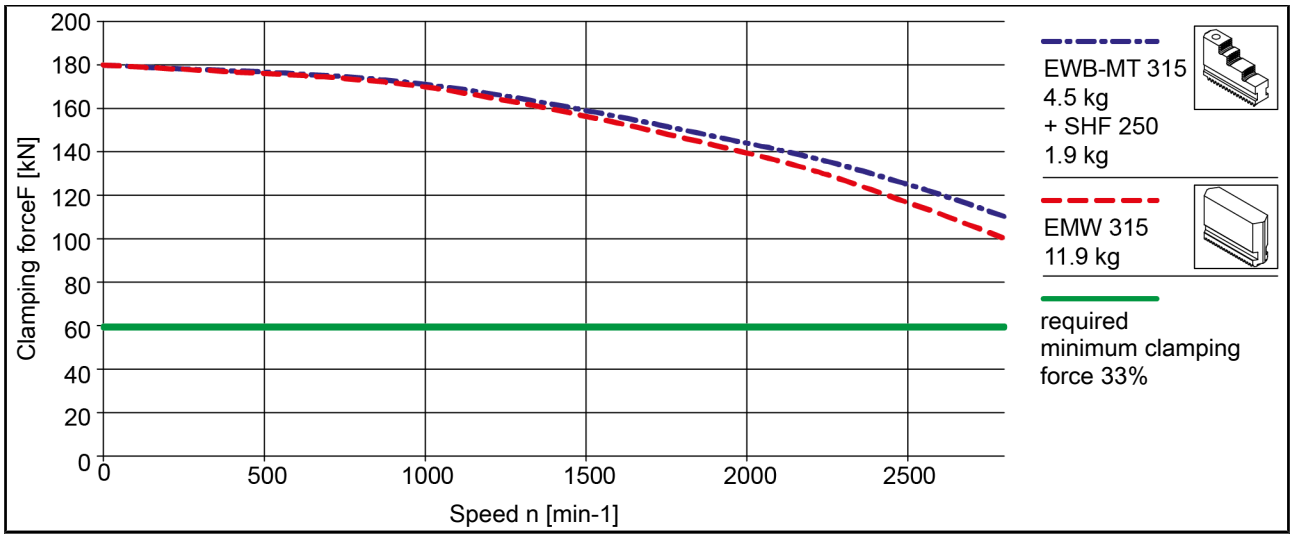
Clamping force / speed diagrams ROTA THWB 210-52



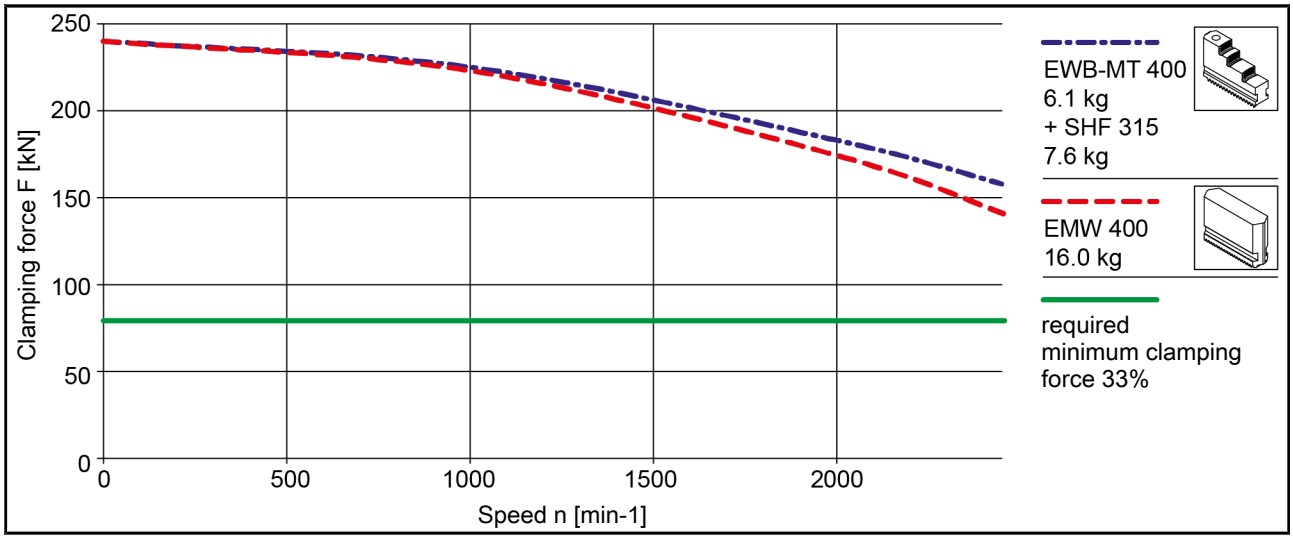
Clamping force / speed diagrams ROTA THWB 265-71



Clamping force / speed diagrams ROTA THWB 315-86



Clamping force / speed diagrams ROTA THWB 400-120



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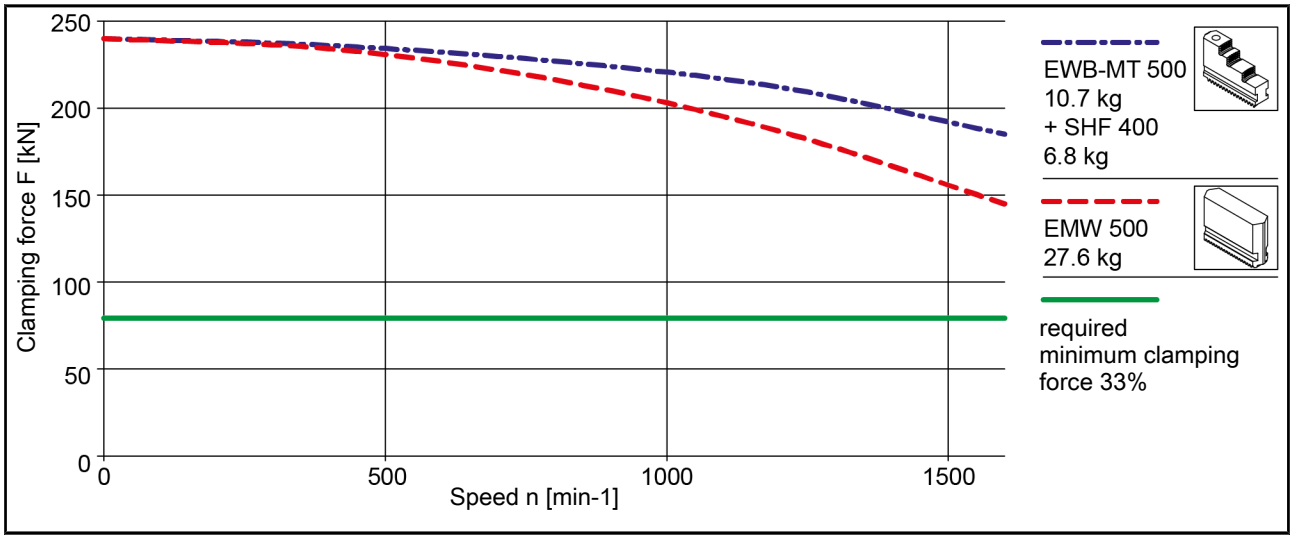
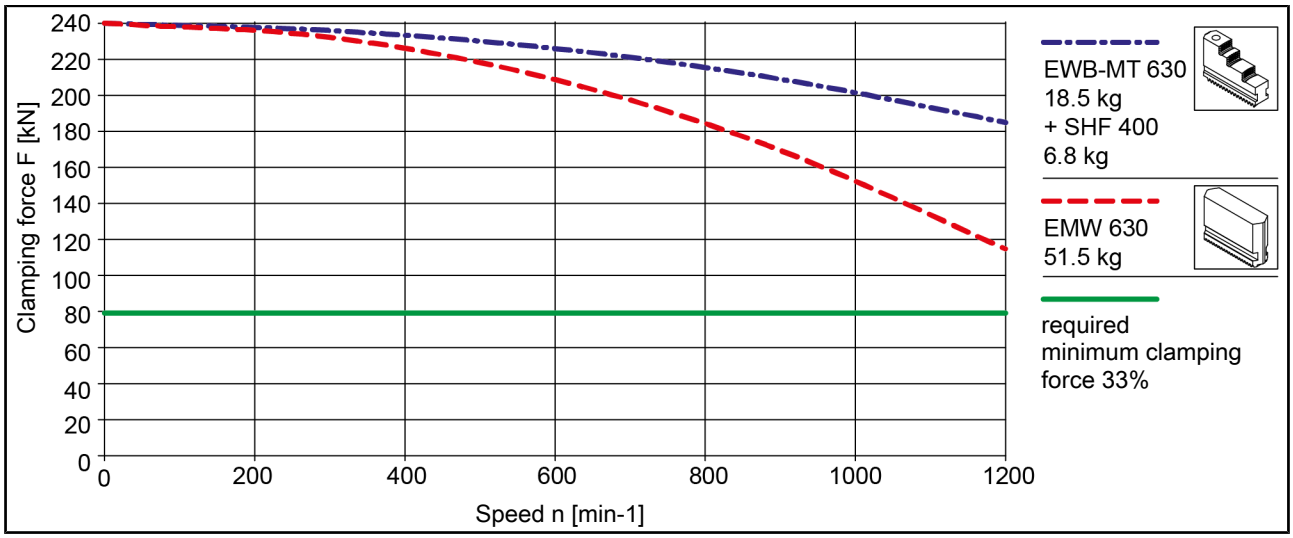


Clamping force / speed diagrams ROTA THWB 630-160



3.3 Calculations for clamping force and speed

Missing information or specifications can be requested from the manufacturer.

Legend			
F_c	Total centrifugal force [N]	M_{cAB}	Centrifugal torque of top jaws [Kgm]
F_{sp}	Effective clamping force [N]	M_{cGB}	Centrifugal torque of base jaws [Kgm]
F_{spmin}	minimum required clamping force [N]	n	Speed of rotation [RPM]
F_{sp0}	Initial clamping force [N]	r_s	Center of gravity radius [mm]
F_{spz}	Cutting force [N]	r_{sAB}	Center of gravity radius of top jaw [mm]
m_{AB}	Mass of one top jaw [kg]	s_{sp}	Safety factor for clamping force
m_B	Mass of chuck jaw set [kg]	s_z	Safety factor for machining
M_c	Centrifugal torque [kgm]	Σ_s	Max. clamping force of lathe chuck [N]
kgm × 9.81 = Nm			

3.3.1 Calculation of the required clamping force in case of a given rpm

The initial clamping force F_{sp0} is the total force impacting radially on the workpiece via the jaws due to actuation of the lathe chuck during shutdown. Under the influence of rotation, the jaw mass generates an additional centrifugal force. The centrifugal force reduces or increases the initial clamping force depending on whether gripping is from the outside inwards or from the inside outwards.
The sum of the initial clamping force F_{sp0} and the **total centrifugal force F_c** is **the effective clamping force F_{sp}**.

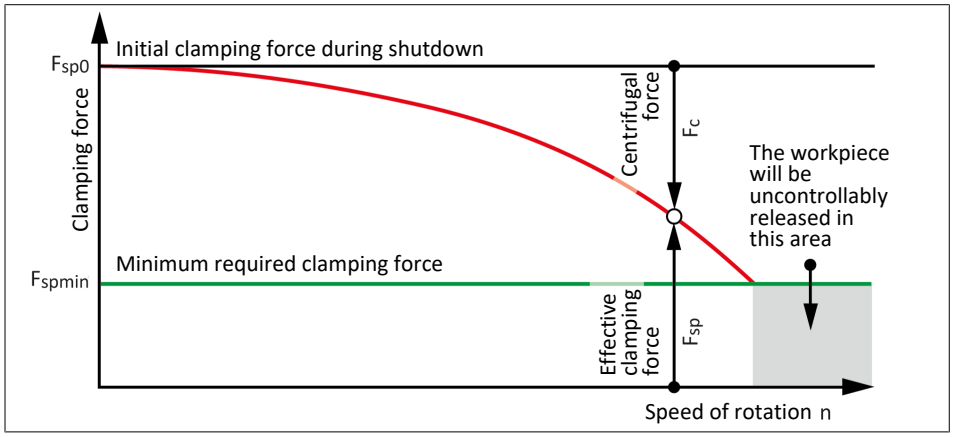
$$F_{sp} = F_{sp0} \mp F_c \text{ [N]}$$

(–) for gripping from the outside inwards
(+) for gripping from the inside outwards

⚠ DANGER

Risk to life and limb of the operating personnel and significant property damage when the RPM limit is exceeded! With gripping from the outside inwards, and with increasing RPM, the effective clamping force is reduced by the magnitude of the increasing centrifugal force (the forces are opposed). When the RPM limit is exceeded, the clamping force drops below the required minimum clamping force F_{spmin}. Consequently, the workpiece is released spontaneously.

- Do not exceed the calculated RPM.
- Do not fall below the necessary minimum clamping force.



Reduction in effective clamping force by the magnitude of the total centrifugal force, for gripping from the outside inwards.

The required effective clamping force for machining F_{sp} is calculated from the product of the **machining force F_{spZ}** and the **safety factor S_z**. This factor takes into account uncertainties in the calculation of the machining force. According to VDI 3106: **$S_z \geq 1.5$.**

$$F_{sp} = F_{spz} \cdot S_Z \text{ [N]}$$

From this we can derive the calculation of the initial clamping force during shutdown:

$$F_{sp0} = S_{sp} \cdot (F_{sp} \pm F_C) \text{ [N]}$$

(+) for gripping from the outside inwards
(–) for gripping from the inside outwards

CAUTION

This calculated force must not be larger than the maximum clamping force ΣS engraved on the lathe chuck.

See also "Lathe chuck data" table ▶ 3.1 [🗋 17]

From the above formula it is evident that the sum of the effective clamping force F_{sp} and the total centrifugal force F_c is multiplied by the **safety factor for the clamping force S_{sp}**. According to VDI 3106, the following also applies here: **$S_{sp} \geq 1.5$.**
The **total centrifugal force F_c** is dependent on both the sum of the masses of all jaws and on the center of gravity radius and the rpm.

CAUTION

For safety reasons, in accordance with DIN EN 1550, the centrifugal force may be a maximum of 67% of the initial clamping force.

The formula for the calculation of the total centrifugal force F_c is:

$$F_C = \sum(m_B \cdot r_s) \cdot \left(\frac{\pi \cdot n}{30}\right)^2 = \sum M_C \cdot \left(\frac{\pi \cdot n}{30}\right)^2 \text{ [N]}$$

For this, **n is the given speed of rotation** in RPM. The product **$m_B \cdot r_s$ is referred to as the centrifugal torque M_c.**

$$M_C = m_B \cdot r_S \text{ [kgm]}$$

In case of toolholders with split chuck jaws, i.e., with base jaws and top jaws, for which the base jaws change their radial position only by the stroke amount, the **centrifugal torque of the base jaws M_{cGB}** and the **centrifugal torque of the top jaws M_{cAB}** need to be added:

$$M_C = M_{cGB} + M_{cAB} \text{ [kgm]}$$

The centrifugal torque of the base jaws M_{cGB} can be found in the table "Lathe chuck data"▸ 3.1 [🗋 17]. The centrifugal torque of the top jaws M_{cAB} is calculated as per:

$$M_{cAB} = m_{AB} \cdot r_{sAB} \text{ [kgm]}$$

3.3.2 Calculation example: required initial clamping force for a given speed

Required initial clamping force F_{sp0} for a given RPM n

The following data is known for the machining job:

- Gripping from the outside in (application-specific)
- Machining force F_{spz} = 3000 N (application-specific)
- max. RPM n_{max} = 3200 RPM ("Lathe chuck data" table)
- RPM n = 1200 RPM (application-specific)
- Mass of one (!) top jaw m_{AB} = 5.33 kg (application-specific)
- Center of gravity radius of top jaw r_{sAB} = 0.107 m (application-specific)
- Safety factor S_z = 1.5 (according to VDI 3106)
- Safety factor S_{sp} = 1.5 (according to VDI 3106)

Note: Masses of the jaw mounting screws and T-nuts are not taken into account.

First the required effective clamping force F_{sp} is calculated using the machining force stated:

$$F_{sp} = F_{spz} \cdot S_z = 3000 \cdot 1.5 \Rightarrow \mathbf{F_{sp} = 4500\ N}$$

Initial clamping force during shutdown:

$$F_{sp0} = S_{sp} \cdot (F_{sp} + F_c)$$

Calculation of total centrifugal force:

$$F_c = \sum M_c \cdot \left(\frac{\pi \cdot n}{30}\right)^2$$

For two-part chuck jaws, the following applies:

$$M_c = M_{cGB} + M_{cAB}$$

Take the centrifugal torque of the base jaw and top jaw specified from the "Lathe chuck data" table:

$$\mathbf{M_{cGB} = 0.319\ kgm}$$

For the centrifugal torque of the top jaw, the following applies:

$$M_{cAB} = m_{AB} \cdot r_{sAB} = 5.33 \cdot 0.107 \Rightarrow \mathbf{M_{cAB} = 0.57\ kgm}$$

Centrifugal torque for one jaw:

$M_C = 0.319 + 0.571 \Rightarrow \mathbf{M_c = 0.89\ kgm}$

The chuck has 3 jaws, the total centrifugal torque is:

$\sum M_C = 3 \cdot M_C = 3 \cdot 0.889 \Rightarrow \mathbf{\sum M_c = 2.667\ kgm}$

The total centrifugal force can now be calculated:

$F_C = \sum M_C \cdot (\frac{\pi \cdot n}{30})^2 = 2.668 \cdot (\frac{\pi \cdot 1200}{30})^2 \Rightarrow \mathbf{F_c = 42131\ N}$

Initial clamping force during shutdown that was sought:

$F_{sp0} = S_{sp} \cdot (F_{sp} + F_C) = 1.5 \cdot (4500 + 42131) \Rightarrow \mathbf{F_{sp0} = 69947\ N}$

3.3.3 Calculation of the permissible speed in case of a given initial clamping force

Calculation of the permissible RPM n_{perm} in case of a given initial clamping force F_{sp0}

The following formula can be used to calculate the permissible RPM for a given initial clamping force during shutdown:

$$n_{zul} = \frac{30}{\pi} \cdot \sqrt{\frac{F_{sp0} - (F_{spz} \cdot S_z)}{\sum M_C}}\ [min^{-1}]$$

CAUTION

For safety reasons, the calculated permissible RPM may not exceed the maximum RPM inscribed on the lathe chuck!

Example of calculation: Permissible RPM for a given effective clamping force

The following data is known from previous calculations:

- Initial clamping force during shutdown F_{sp0} = 17723 N
- Machining force for machining job F_{spz} 3000 N (application-specific)
- Total centrifugal torque of all jaws ΣM_c = 2,668 kgm
- Safety factor S_z = 1.5 (according to VDI 3106)
- Safety factor S_{sp} = 1.5 (according to VDI 3106)

NOTE:

Masses of the jaw mounting screws and T-nuts are not taken into account.

Identifying the permissible RPM:

$$n_{zul} = \frac{30}{\pi} \cdot \sqrt{\frac{F_{sp0} - (F_{spz} \cdot S_z)}{\sum M_C}} = \frac{30}{\pi} \cdot \sqrt{\frac{69947 - (3000 \cdot 1.5)}{2.668}} \Rightarrow \mathbf{n_{zul} = 1495\ min^{-1}}$$

The calculated RPM n_{perm} = 1495 RPM is smaller than the maximum permissible RPM of the lathe chuck n_{max} = 3200 RPM (see "Lathe chuck data" table ▶ 3.1 [🗋 17]).

This calculated RPM may be used.

3.4 Grades of Accuracy

Tolerances for radial and axial run-out accuracy correspond to the Technical Supply Terms for lathe chucks as per DIN ISO 3442-3.

3.5 Permissible imbalance DIN ISO 21940-11

The ROTA THW / THWB in ungreased state without chuck jaws corresponds to the balancing quality class 6.3 (according to DIN ISO 21940-11). Residual imbalance risks may arise due to insufficient rotation compensation being achieved (see DIN EN 1550 6.2 e). This applies particularly to high speeds, asymmetrical workpieces or the use of various chuck jaws, as well as uneven application of lubricants. In order to prevent damage resulting from these residual risks, the entire rotor is to be dynamically balanced in accordance with DIN ISO 21940-11.

3.6 Torques per screw

Tightening torques for mounting screws used to clamp the chuck on lathes or other suitable technical equipment (screw quality 10.9)

Screw size	M6	M8	M10	M12	M14	M16	M18	M20	M22	M24	M27	M30
Admissible torque M_A (Nm)	13	28	50	88	120	160	200	290	400	500	1050	1500

Tightening torques for mounting screws used to attach top jaws onto the chuck (screw quality 12.9)

Screws for base jaws GB / GBK / GBK-V / GBKL	M6	M8	M10	M12	-	M16	M20	-	M24
max. admissible torque in (Nm)	16	25	60	80	-	100	180	-	230

4 Function

4.1 Function of the chuck

The type THW quick-change power chucks are actuated using a rotating solid or open-center hydraulic cylinder. The axial tensile or pressure forces are converted to the radial jaw clamping force via wedge bars positioned tangentially to the chuck body.

4.2 Functional testing

Functional test

After installation of the chuck, its function must be checked prior to start-up.

Two important points are:

- **Clamping Force!** The clamping force of the chuck must be achieved at max. operating force/pressure.
- **Stroke control!** The stroke of the clamping piston must allow a safety zone at the front and rear end position. The machine spindle may only be started when the clamping piston has passed through the safety zone. Only limit switches that meet the requirements for safety limit switches specified in DIN EN 60204-1 may be used.

When determining the necessary clamping force to machine a workpiece, take the centrifugal force acting on the chuck jaws into account (according to VDI 3106).
If the chuck jaws are changed, adjust the stroke control to the new situation.

Speed of rotation

⚠ DANGER

Risk of fatal injury to operating personnel if the top speed is exceeded, resulting in workpiece loss and parts flying off!

- A reliable speed limiter must be installed in the machine tool or technical equipment and proof must be provided that the speed limiter is effective!

4.3 Handling the chuck and the base jaws

The clamping and opening path of the chuck jaws is determined by the clamping cylinder. The base jaws with screwed-on top jaws are moved or changed in the open clamping position. For safety reasons, the serration for the base jaws is still engaged in this chuck piston position. The base jaws are unlocked mechanically.

⚠ CAUTION

Danger of limbs being crushed by opening and closing of the chuck jaws during manual loading and unloading or when replacing moving parts.

- Do not reach between the chuck jaws.
- Automatic loading is preferred.
- If manual loading is used, adjust the jaw position so that the opening gap between the jaw and the workpiece is less than 4 mm.
- Wear protective gloves.
- Observe the safety and accident prevention regulations during operation of the chuck, especially in connection with machining centers and other technical equipment.

For each jaw guidance, a jaw change bolt with hexagon socket (which can be turned using the jaw change key) is arranged on the chuck perimeter. Turning the jaw change bolt moves the serration for the wedge bar axially against the spring pressure and out of the serration for the base jaw. In this position, the base jaws can be moved or changed radially inwards or outwards. It is not possible to pull out the jaw change key in this position.

CAUTION

The chuck piston (item 3) must not be moved as long as the chuck key (item 14) is located in one of the jaw-change bolts (item 8) for the chuck.
Risk of damage to the chuck.

4.4 Base jaw position

A marking line between the jaw guides is milled on the face side of the chuck (see drawing▸ 9 [🗋 39]). This marking line is the positioning aid for the base jaws or top jaws. The outermost base jaw or monoblock position is reached when the front face of the base jaw or the unsplit top jaw agrees with the marking line in the jaw change position (chuck open).

It is vital that this jaw position is adhered to so that all teeth are engaged for the force transmission from the wedge bars to the base jaws or top jaws.

4.5 Exchanging and turning the top jaws

When changing the top jaws, the serration must be cleaned.

Chuck jaws for maximum clamping repeat accuracy must be turned or ground in the chuck under clamping pressure.

- When turning or grinding, ensure that the turning ring or turning pin is clamped **by the top jaws** and not by the base jaws.
- Keep the base jaws and top jaws screwed in place for recurring work. Tighten the jaw mounting screws to the specified torque ▸ 3.6 [🗋 26].

Tighten the jaw mounting screws with a torque wrench. Never tighten the screws with an extension pipe or with hammer blows.

5 Transport

⚠ DANGER

Risk of fatal injury from suspended loads!

Falling loads are sure to cause serious injuries and even death.

- Use suitable lifting equipment.
- Secure the product to prevent it from falling.
- Stand clear of suspended loads and do not step within their swiveling range.
- Only move loads when supervised and do not leave unattended.
- Wear suitable protective equipment.

⚠ CAUTION

Risk of injury due to sharp edges and rough or slippery surfaces

Wear personal protective equipment, particularly protective gloves.

An eye bolt is included in the scope of delivery for transporting chucks over a certain size. These chucks are only allowed to be transported on this eye bolt.

- Screw the eye bolt into the thread provided.

6 Mounting

6.1 Installing and connecting

⚠ WARNING

Risk of injury due to unexpected movements!

If the power supply is switched on or residual energy remains in the system, components can move unexpectedly and cause serious injuries.

- Before starting any work on the product: Switch off the power supply and secure against restarting.
- Make sure, that no residual energy remains in the system.

⚠ CAUTION

Danger of injury due to sharp edges and rough or slippery surfaces

- Wear personal protective equipment, particularly protective gloves.

1. Preparing the mount ▸ 6.2 [🗋 31]
2. Chuck assembly ▸ 6.2 [🗋 31]
3. Performing a functional check ▸ 4.2 [🗋 27]

6.2 Mounting the chuck onto the machine spindle

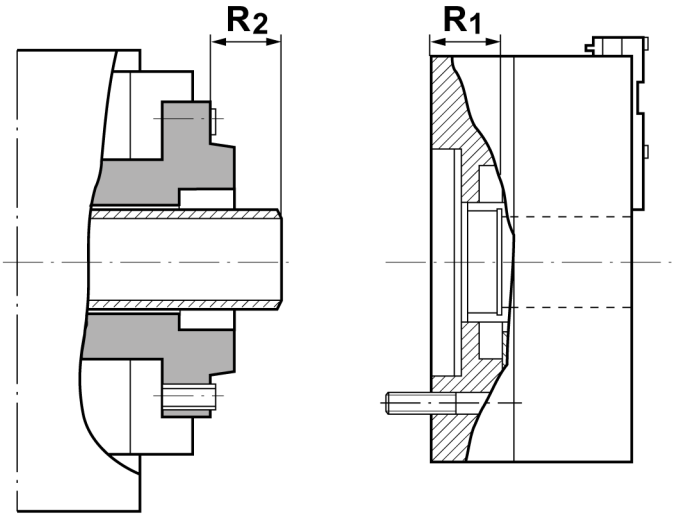
The item numbers specified for the corresponding individual components relate to the chapter Drawings, ▸ 9 [🗋 39].

Checking the chuck mounting

- Check the machine spindle nose and ready-machined intermediate flange for radial and axial run-out. The permissible limit is 0.005 mm in accordance with DIN 6386 and ISO 3089.
- The contact surface must be chamfered and clean at the bore holes.

Mounting the ROTA THW chuck

- Remove the chuck from its packaging and check for damage/ completeness. ▸ 5 [🗋 30]
- Unlock the base jaws and remove them from the chuck.
- Move the draw tube to its foremost position by actuating the clamping cylinder.



Piston in foremost position

R1 = Push the chuck piston to its foremost position and measure with a depth gauge

R2 = R1 + 0.3 mm (max. + 0.5 mm)

You have to ensure that the piston can be moved to the foremost (jaw change) position. To do this, ensure that the dimensions for the attachment are complied with.

- Move the chuck piston (item 3) to its foremost position.
- Raise the chuck on the eye bolt in front of the spindle lug using an assembly belt until it is flush with the center of the spindle. ▸ 5 [🗋 30]
- Screw the rotating threaded bush (item 15) in the chuck onto the draw tube using the enclosed assembly key as far as this will go.
- Tighten the chuck fastening screws (item 17) alternately.
- Check radial and axial runout at the checking edge.
- Check the actuating force is functioning and is sufficient.
- Move the cylinder into the front position. Unlock the wedge bar (item 14) and insert the base jaws into the chuck's jaw guidance as shown on markings 1, 2 or 3.
- Check the jaw stroke of the base jaws and that these can move easily.

The spindle is disassembled in the same way but in the reverse order.

Lubricating before commissioning the lathe chuck

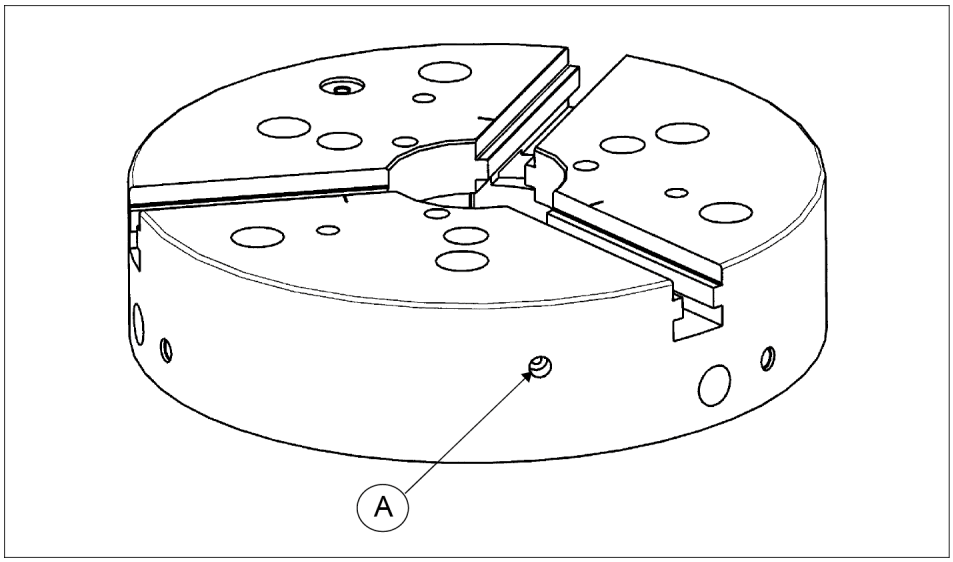
Before commissioning, move the chuck into the open position. Using a high-pressure grease press, press SCHUNK special grease LINOMAX into the lubricating nipple every 3 strokes. For optimal grease distribution and to achieve the maximum clamping force, close and open the chuck multiple times over the entire clamping stroke. Check the clamping force and if necessary repeat the lubrication procedure.

At regular intervals, check that the retainer ring is seated firmly.

7 Maintenance

7.1 Lubrication

To maintain the safe function and high quality of the chuck, it has to be regularly lubricated.



Move the chuck into the open position. Lubricate the chuck at the three lubrication nipples (**A**) using a high-pressure grease gun with two to six strokes (depending on the chuck side) of SCHUNK LINOMAX special grease at each nipple.

For optimum grease distribution, the clamping piston must travel the entire clamping stroke several times after lubrication. Check clamping force, repeat procedure, if necessary.

Chuck Size	165	185	215	260	315	400	500	630	800
Number of strokes	2	2	4	4	4	6	6	6	6

Lubricate all three segments evenly in order to avoid imbalances.

(For product information about LINOMAX, see the "Accessories" chapter of the SCHUNK lathe chuck catalog or contact SCHUNK.)

⚠ CAUTION

Allergic reactions if lubricating grease comes into contact with the skin.

- Wear protective gloves.

7.2 Maintenance intervals

Lubrication of the grease areas:

Lubrication interval	Strain
every 25 hours	normal / coolant utilization
every 8 hours	high / coolant utilization
after 1200 hours or as needed	Total cleaning with disassembly of the chuck, depending on type and degree of contamination

7.3 Technical condition

With the smallest possible actuating pressure (hydraulic cylinder), the base jaws should move evenly. This method only provides a limited indication and is not a substitute for measuring the clamping force.

If the clamping force has dropped too far or if the base jaws and clamping piston no longer move properly, the chuck has to be disassembled, cleaned and relubricated.

7.4 Disassembly and assembly of the chuck

The item numbers specified for the corresponding individual components relate to the chapter Drawings, ▸ 9 [🗋 39].

The chuck can only be disassembled once it has been removed. ▸ 6.2 [🗋 31]

- Unscrew the screws (item 18) from the mount (item 7) for sizes 400 and 500.
- Undo the screws (item 20) several thread turns and hammer gently on the screw heads using a rubber mallet. The mount (item 7) is thus released from the centering for the chuck body (item 1). Unscrew the screws (item 20) and remove the mount (mark position of the chuck cover to chuck body).
- Remove the safety bolts (item 9) with compression springs (item 29) and balls (item 23) from the chuck body.
- Remove the jaw-change bolts (item 8) with balls (item 23) and unscrew the chuck piston (item 3).
- Remove wedge bar (item 5) with angle (item 6), eccentric bolt (item 10) and torsion spring (item 28). The jaw guides on the chuck body are numbered consecutively from 1 – 3. When installing the piston, make sure that the point marking on the piston wedge hook is assigned to jaw guidance 1.

- Loosen screws (item 19) and remove guide bushing (item 4). Check the angular position of the milled-out portions when mounting the guide bushing. This can be done with a base jaw.
- Degrease and clean all parts and check them for damage. Lubricate thoroughly with LINOMAX grease before installation.

Clean all individual components and check them for damage and wear.

Only original SCHUNK spare parts may be used.

The chuck is assembled in the same way, but in reverse order.

Before installation, lubricate parts well with LINOMAX special grease paste.

⚠ CAUTION

Allergic reactions if lubricating grease comes into contact with the skin.

- Wear protective gloves.

8 Chuck mounts and Spare parts

8.1 Chuck mounts

SCHUNK type	Chuck mount	Id. No.
ROTA THW 165-37 R	Z 140	800 000
	A5	800 001
	A6	800 002
	Z 170	800 010
ROTA THW 215-52 R ROTA THW 250-65 R	A 6	800 011
	A 8	800 012
	Z 170	800 020
	Z 220	800 021
ROTA THW 265-71 R	A 6	800 022
	A 8	800 023
	Z 170	800 030
	Z 220	800 031
ROTA THW 315-86 R	A 6	800 032
	A 8	800 033
	Z 220	800 040
	Z 300	800 041
ROTA THW 400-120 R	A 8	800 042
	A 11	800 043
	Z 300	800 050
	Z 380	800 051
	A 11	800 052
	A 15	800 053
	Z 380	800 060
THW 500-128 R THW 630-160 R	A 11	800 061
	A 15	800 062
	Z 520	800 070

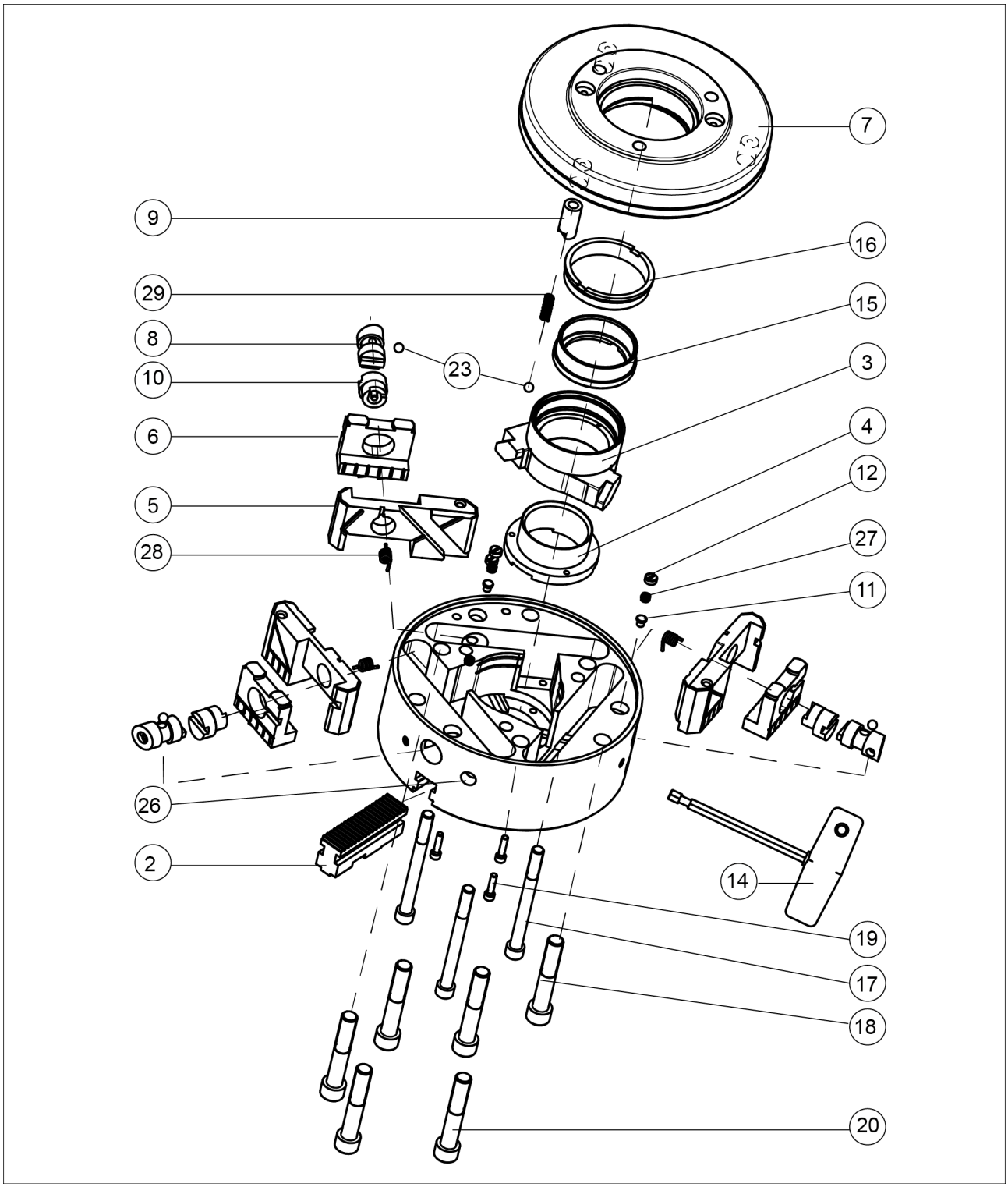
8.2 Spare parts

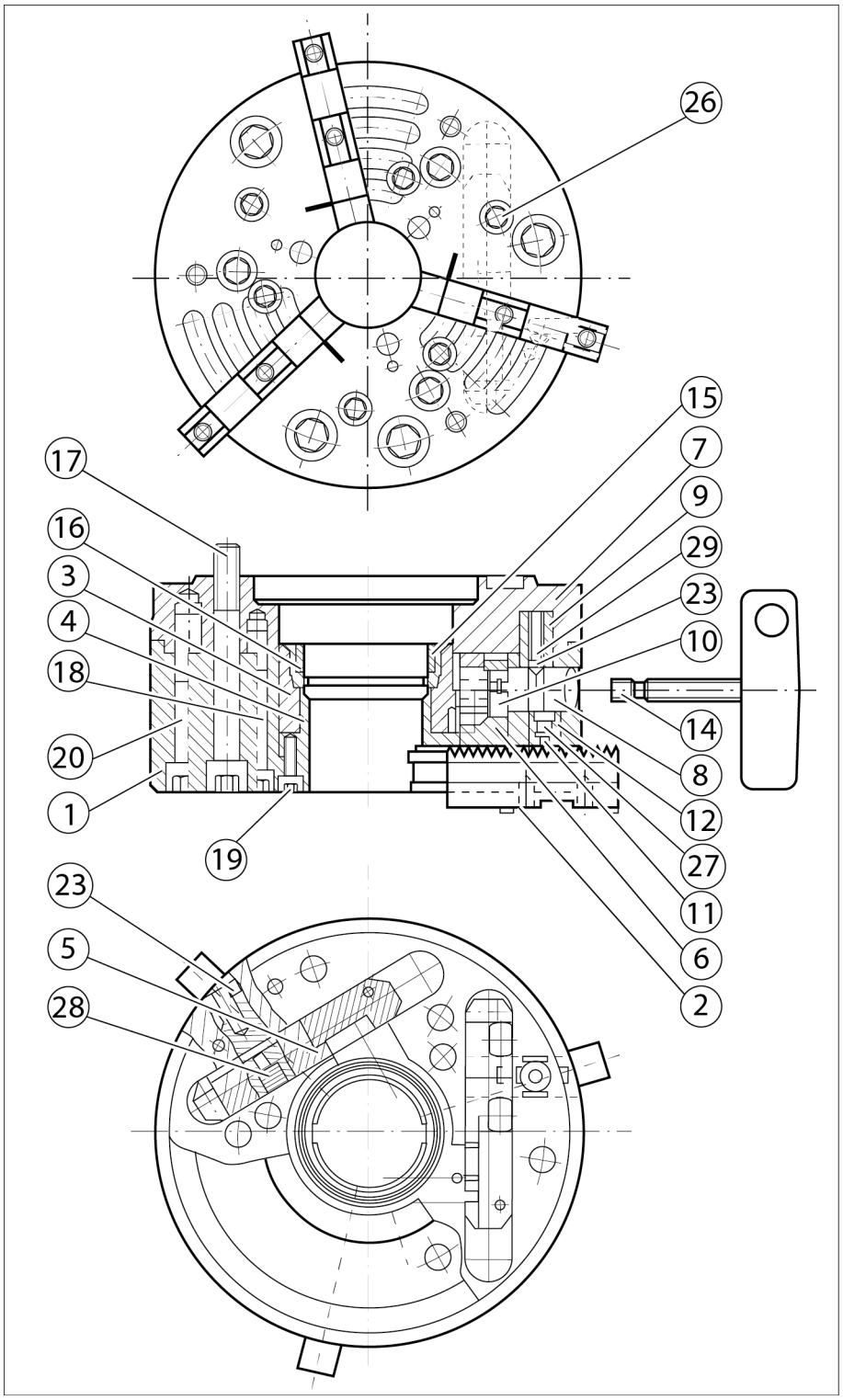
When ordering spare parts, it is imperative to specify the type, size and above all the manufacturing no of the chuck.

Seals, sealing elements, screw connections, springs, bearings, screws and wiper bars plus parts coming into contact with the workpiece are not covered by the warranty.

Item	Description
1	Chuck body
2	Base jaw
3	Piston
4	Guide bushing
5	Wedge bar
6	Angle
7	Back plate
8	Cam bolt
9	Keeper bush
10	Excenter bolt
11	Jaw stop pin
12	Threaded pin
14	Special hex, socket key
15	Draw bush
16	Retainer ring
17	Cylindrical screw
18	Cylindrical screw DIN EN ISO 4762 • 10.9
19	Cylindrical screw DIN EN ISO 4762 • 10.9
20	Cylindrical screw DIN EN ISO 4762 • 10.9
23	Steel ball
26	Grease nipple
27	Jaw stop pin Compressing spring
28	Leg spring
29	Keeper bush Compressing spring

9 Drawings




26
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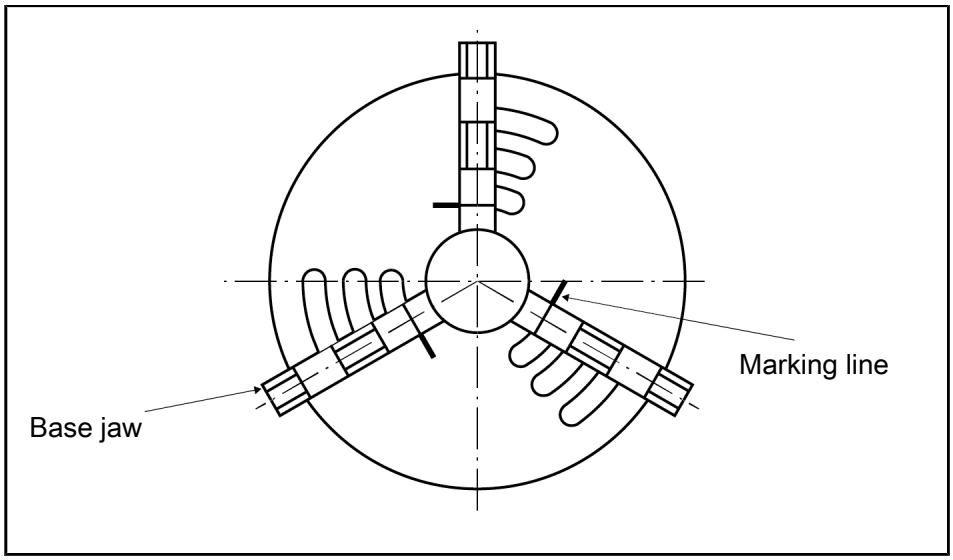
Marking line
Base jaw

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Spanntechnik KG

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Manufacturer certificate

Manufacturer / Distributor:	Heinz-Dieter SCHUNK GmbH & Co. Spanntechnik KG. Lothringer Str. 23 D-88512 Mengen
Product:	**Lathe chuck**
Description:	**ROTA**
Type designation:	2B, NCA, NCD, NCE, NC, NCF, NCK, NCO, NCR, NCS, NCX, TH, THW

Heinz-Dieter SCHUNK GmbH & Co. Spanntechnik KG certifies that the above-mentioned products, when used as intended and in compliance with the operating manual and the warnings on the product, are safe according to the national regulations and:

- a **risk assessment** has been carried out in accordance with ISO 12100:2010.
- an **operating manual** for the assembly instructions has been created in accordance with the contents of the Machinery Directive 2006/42/EC Annex I No. 1.7.4.2. and the contents of the provisions of Annex VI of the Machinery Directive 2006/42/EC.
- the relevant basic and proven safety principles of the Annexes of **ISO 13849-2:2012**, taking into account the requirements of the documentation have been observed for the component. The parameters, limitations, ambient conditions, characteristic values, etc. for correct operation are defined in the operating manual.
- an $MTTF_D$ value of 150 years can be estimated for mechanical components using the informative procedure in Table C.1 of ISO 13849-1:2015.
- the **fault exclusion** against the fault "Unexpected release without pending release signal".
- the **fault exclusion** against the fault "Breakage during operation" in compliance with the parameters, limitations, ambient conditions, characteristic values and maintenance intervals, etc., specified in the operating manual.
- that internal bore diameters in the **pipe or control lines** are at least 2 mm for pneumatic clamping systems and at least 3 mm for hydraulic clamping systems

Harmonized standards applied:

- **ISO 12100:2010** Safety of machinery - General principles for design - Risk assessment and risk reduction
- **EN 1550:1997+A1:2008** Machine-tools safety – Safety requirements for the design and construction of lathe chucks for the workpiece mount

Other related technical standards and specifications:

- **ISO 702-1:2010-04** Machine tools – Connecting dimensions of spindle noses and lathe chucks – Part 1: front short-taper mount with screws
- **ISO 702-4:2010-04** Machine tools – Connecting dimensions of spindle noses and lathe chucks – Part 4: cylindrical mount
- **VDI 3106:2004-04:** Determination of permissible RPM of lathe chucks (jaw chucks)

Mengen, 25. Apr. 2023

i. V. Philipp Schräder

p.p. Philipp Schräder / Head of Development standard products

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p.p. Alexander Koch / Head of Engineering Design special products

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