SCHUNK



Power lathe chuck
ROTA THW plus
Assembly and operating manual

Hand in hand for tomorrow

Imprint

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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

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

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1 General

1.1 About this manual

This manual contains important information for the safe, correct use of the product.

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

Personnel must have read and understood this manual before beginning any work. The observance of all safety notes in this manual is a prerequisite to ensure safe work processes.

The illustrations are intended to provide a basic understanding and may deviate from the actual version.

Besides this manual, other documents which apply are those listed under ▸ 1.1.2 [🗋 6]

1.1.1 Illustration of warnings

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



⚠ DANGER

Denotes a hazard with a high degree of risk that, if not avoided, will result in death or serious injury.



⚠ WARNING

Denotes a hazard with a medium degree of risk that, if not avoided, could result in death or serious injury.



⚠ CAUTION

Denotes a hazard with a low degree of risk that, if not avoided, could result in a minor or moderate injury.

NOTICE

Information about avoiding material damage.

1.1.2 Applicable documents

- General Terms and Conditions *
- Calculation of the jaw centrifugal forces and jaw guidance load, in the "Technology" chapter of the lathe chuck catalog * and the "Calculating the clamping force and RPM" chapter
- Chuck jaws assembly and operating manual (ID number 1593578) *
- Brief operating instructions if available
- Approval drawings

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

1.2 Warranty

The warranty for standard products is 24 months from the date of delivery from the factory, or 50,000 cycles* for manually operated clamping devices and 500,000 cycles* for power operated clamping devices. For special clamping devices, it is 12 months from the date of delivery from the factory, assuming appropriate use in accordance with the following conditions:

- Observe the applicable documents, ▸ 1.1.2 [🗋 6]
- Observance of the ambient conditions and operating conditions, ▸ 2.5 [🗋 8]
- Observance of the specified maintenance and lubrication intervals ▸ 6.3 [🗋 36]

Parts touching the workpiece and wearing parts are not part of the warranty.

* One cycle comprises one complete clamping procedure ("opening" and "closing")

1.3 Scope of delivery

1 **Power lathe chuck ROTA THW plus**
1 **Set of base jaws**
3 **Mounting screws**
1 **Jaw change key**
1 **Assembly and Operating Manual**
1 **Short operating manual**
1 **Mounting wrench** (from size 260)

2 Basic safety notes

Improper handling, assembly and maintenance of this product may result in risk to persons and equipment if this operating manual is not observed.

2.1 Appropriate use

- The product is used for clamping metal and plastic workpieces on machine tools.
- The product may only be used within the scope of its technical data.
- The product is intended for industrial and commercial use.
- Appropriate use of the product includes compliance with all instructions in this manual.
- The maximum speed and the necessary clamping force must be determined by the operator for each clamping task in accordance with the valid standards or technical specifications of the manufacturer (See also "Calculation for clamping force and speed of rotation" in the chapter "Technical data").
- Use suitable top jaws with a suitable interface.
- The interference circuit diameter of the workpiece must be smaller or at most equal to the outer diameter of the clamping device.
- The workpiece must not experience plastic deformation under clamping force (clamping pressures are permissible).

2.2 Inappropriate use

The product is not being used appropriately if:

- the product is used as a press, a punch, a toolholder, a load-handling device or as lifting equipment.
- the specified technical data for use of the product are exceeded.
- workpieces are not properly clamped, paying particular attention to the specified clamping forces.
- the top jaws are not mounted properly.
- the product is not being operated properly.
- the product is operated in the stroke end positions.
- the guideways are overloaded due to the chuck jaws being too high or the clamping point being selected too high.
- the product has been insufficiently maintained.
- the product is brought into contact with aggressive media, especially acids.
- the product is used in abrasive blasting processes, especially sandblasting.
- the product is operated in a potentially explosive area (EX area (ATEX directive)).

2.3 Structural changes

Implementation of structural changes

Modifications, changes or reworking, e.g. additional threads, holes, or safety devices, can damage the product or impair its functionality or safety.

- 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.

- Only use original spare parts and spares authorized by SCHUNK.

2.5 Ambient conditions 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 in the service life of the product.

- Make sure that the product is only used within its defined application parameters.
- Ensure that the product is of a sufficient size for the application.
- Ensure that maintenance and lubricating intervals are observed.
- Only use cooling emulsions with anti-corrosive additives when machining.

Depending on the operating conditions, the function and clamping force must be checked after a certain period of operation.

With the smallest possible actuation pressure on the clamping cylinder, the base jaws should move evenly. This method is not a substitute for measuring the clamping force.

If the clamping force has dropped too much or if the base jaws and/or the release mechanism no longer move properly, the clamping device must be disassembled, cleaned, and relubricated.

2.6 Material limitations

The product is made of steel alloys, elastomers, aluminum alloys and brass. In addition, Linomax plus grease, Branotect anti-rust oil and Renolit HLT2 are incorporated into the product as auxiliary and operating materials. The safety data sheet for LINOMAX plus can be found at **www.schunk.com**.

2.7 Chuck Jaws

Requirements of the chuck jaws

Rotational or if applicable, accumulated energy, can make the product unsafe and risk the danger of serious injuries and considerable material damage.

- Change chuck jaws at a standstill and without a clamped workpiece.
- Do not use welded jaws.
- Design the chuck jaws 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 the clamping point is at a greater distance from the housing, the operating pressure must be reduced.
- After a collision, the clamping device and the chuck jaws must be subjected to a crack detection test before being used again. Replace damaged parts with original SCHUNK spare parts.
- The chuck jaw mounting screws and if present, the T-nuts, must be replaced if there are **signs of wear**, **are damaged** or if the **recommended number of clamping cycles has been exceeded**. Only use screws of quality grade 12.9 in compliance with the specified tightening torques. For clamping devices with fine serration, the jaw mounting screws must be screwed into the holes closest to the clamping point.

2.8 Personnel qualifications

Inadequate qualification of personnel

Any work on the product by inadequately qualified personnel can lead to serious injuries and considerable material damage.

- All work must be performed by appropriately qualified personnel.
- Personnel must have read and understood the complete manual before beginning any work on the product.
- Observe country-specific accident prevention regulations and the general safety notes.

The following personnel qualifications are required for the various activities on the product:

Qualified electrician Qualified electricians have the professional training, knowledge, and experience to work on electrical systems, to recognize and avoid potential dangers, and know the relevant standards and regulations.

Specialist personnel Specialist personnel have the specialized training, knowledge, and experience to perform the tasks entrusted to them, to recognize and avoid potential dangers, and know the relevant standards and regulations.

Instructed person Instructed persons have been instructed by the operator regarding the tasks entrusted to them and the potential dangers of inappropriate behavior.

Manufacturer's service personnel The manufacturer's service personnel have the specialized training, knowledge, and experience to perform the work entrusted to them and to recognize and avoid potential dangers.

2.9 Personal protective equipment

Use of personal protective equipment

Personal protective equipment serves to protect staff in the event of a danger that may interfere with their health or safety at work.

2.10 Transport

Handling during transport

Incorrect handling during transport can make the product unsafe and risks the danger of serious injuries and considerable material damage.

- During transport and handling, secure the product to prevent it from falling.
- Use the transport thread on the clamping device.

2.11 Protection during handling and assembly

Incorrect handling and assembly

Incorrect handling and assembly can make the product unsafe and can risk the danger of serious injuries and considerable material damage.

- All work must only be performed by appropriately qualified personnel.
- Secure the system against accidental operation during all work.
- Use suitable assembly and transport equipment and take precautions to prevent jamming and crushing.

2.12 Protection during commissioning and operation

Falling or violently ejected components

Falling and ejected components can lead to serious injury or death.

- Take suitable protective measures to secure the danger zone.

2.13 Notes on safe operation

Incorrect manner of working by personnel

An incorrect manner of working can make the product unsafe and risks serious injuries and considerable material damage.

- Observe the safety notes and assembly instructions.
- Do not expose the product to any corrosive media. Products for special ambient conditions are excluded.
- Rectify malfunctions as soon as they occur.
- Observe the care and maintenance instructions.

- Observe the current safety, accident prevention, and environmental protection regulations for the application field of the product.
- The chuck may only be accelerated to speed or otherwise when a workpiece is correctly clamped. This means that the clamping force has been applied to the workpiece and the clamping has taken place within the permissible operating range.
- Unclamping may only occur once the machine spindle has come to a standstill.

Functionality check

After installation of the clamping device, its function must be checked prior to commissioning.

Two important points are:

- **Clamping force:** At max. actuation force/pressure/torque, the clamping force specified for the clamping device must be reached.
- **Stroke control:** The stroke of the clamping piston must have a margin of safety at the front and back end positions. The machine spindle must not start up until the clamping piston has passed through this safety margin.

With manual clamping devices, stroke control is carried out via the indicator pin. Clamping is only correct if the indicator pin is countersunk and clamping force is applied to the workpiece.

When determining the clamping force required to machine a workpiece, the centrifugal force acting on the chuck jaws must be taken into account (according to VDI 3106).

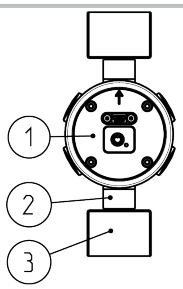
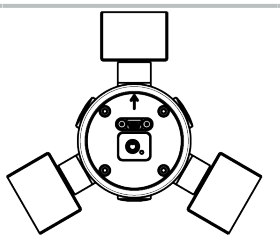
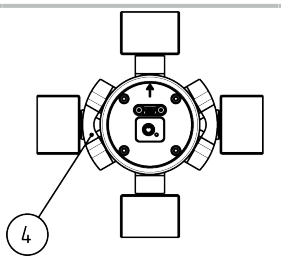
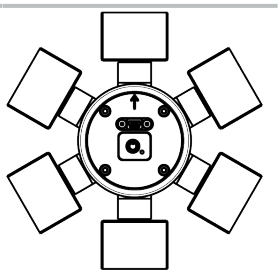
Maintenance instructions

The clamping device's reliability and safety can only be guaranteed if the operator complies with the manufacturer's maintenance instructions.

- For lubrication, we recommend our tried and tested special grease, LINOMAX plus. Unsuitable lubricants can have a negative impact on the functioning of the clamping device (clamping force, coefficient of friction, wear behavior). (For product information about LINOMAX plus, see the "Accessories" chapter of the SCHUNK lathe chuck catalog or contact SCHUNK.)
- Use a suitable high-pressure grease gun to ensure that you reach all the greasing areas.
- To ensure correct distribution of the grease, move the clamping device to its end positions several times, lubricate again, and then check the clamping force.
- Move the clamping device through to its end position several times after 500 clamping strokes, at the latest. This moves the lubricant back to the surfaces of the force transmission.
- Check the clamping device regularly for clamping force and jaw stroke.

Clamping force measurement

- Depending on the operating conditions, the function and clamping force must be checked after a certain period of operation . For this purpose, a calibrated clamping force meter (e.g. SCHUNK IFT) must be used. The loading conditions are shown below for the different chuck variants.

	2-jaw	3-jaw	4-jaw (compensating)	6-jaw (compensating)
				
Measuring device	SCHUNK IFT clamping force tester	SCHUNK IFT clamping force tester	SCHUNK IFT clamping force tester	SCHUNK IFT clamping force tester
Accessories	–	–	IFT MA4	–
Measuring points	0°/180°	0°/120°/240°	0° / 180° / 90° / 270° (IFT MA4)	0°/60°/120°/180°/ 240°/300°
Please note	Operating manual SCHUNK IFT Clamping force tester	Operating manual SCHUNK IFT Clamping force tester	Operating manual SCHUNK IFT Clamping force tester **Attention** Compensation must be activated, otherwise it may lead to inconsistent results.	Operating manual SCHUNK IFT Clamping force tester **Attention** Compensation must be activated, otherwise it may lead to inconsistent results.

① Measuring head
② Clamping insert
③ Chuck jaw
④ Bridge element (IFT MA4)

- If the clamping force has dropped too much or if the base jaws and piston no longer move properly, the chuck will have to be disassembled, cleaned and relubricated.
- The clamping force should always be measured with the clamping device in the same condition as it is used in for the current clamping application. If top jaws with clamping steps are used, measuring must be performed in the same step as for the respective clamping task. In the event of high operating speeds, clamping force losses must be accounted for due to the centrifugal force acting on the chuck jaws. In this case the value of the operating clamping force should be measured dynamically.
- We recommend checking the clamping force using a clamping force tester before starting a new production run and between maintenance intervals. "Optimum safety can only be guaranteed through regular checks".

2.14 Disposal

Handling of disposal

Incorrect handling of disposal can make the product unsafe and lead to risks of environmental harm.

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

2.15 Fundamental dangers

General

- Disconnect power sources before installation, modification or calibration. Ensure that no residual energy remains in the system.
- Do not reach into the open mechanism or movement area of the product during operation.

2.16 Protection against dangerous movements

Unexpected movements

If the system still retains residual energy, serious injuries can be caused while working on the product.

- Switch off the energy supply, ensure that no residual energy remains and secure against inadvertent reactivation.
- Never rely merely on the response of the monitoring function to avert danger. Assume that the drive movement is faulty as long is the installed monitors are not effective, since the effect depends on the control and the current operating state of the drive.
- To avoid accidents and/or material damage, human access to the movement range of the machine must be restricted.

2.17 Notes on particular risks



⚠ 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

This poses a risk of death or injury to the operating personnel and can result in serious damage to the machine.



⚠ DANGER

Possible risk of death for the operating personnel in case of insufficient clamping force due to ejection or falling of the workpiece!

Due to settling behavior, the clamping force may decrease over time.

- Re-clamping of the workpiece with manual or pneumatic clamping devices after 4 hours.
- The energy supply must be constantly applied to power-operated clamping devices during operation.
- Use clamping cylinders with energy conservation.



⚠ DANGER

Possible risk of death for operating personnel if the clamping device's top speed of rotation is exceeded and a workpiece is released or parts fly off.

If the machine tool or the technical equipment can reach a higher speed than the maximum speed of the clamping device, the speed must be limited for safety purposes!



⚠ DANGER

Possible risk of death for operating personnel if a jaw breaks or if the clamping device fails because the technical data has been exceeded and a workpiece is released or parts fly off!

- Never exceed the technical data specified by the manufacturer for using the clamping device.



⚠ DANGER

Possible risk of death for operating personnel from clothing or hair getting caught on the clamping device and being dragged into the machine!

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

- Always wear tight-fitting clothing and a hairnet when working on the machine and the lathe chuck.



⚠ WARNING

Possible risk of death for the operating personnel due to impact of the rotating clamping device!

- Keep a safe distance to the rotating clamping device!
- Do not reach into the rotating clamping device!



⚠ CAUTION

Risk of limbs being crushed when opening and closing the chuck jaws during manual loading or unloading or when exchanging moving parts.

- Do not reach between the chuck jaws.



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



⚠ CAUTION

There is a risk of limbs being crushed by moving parts during manual loading and unloading and the clamping procedure.

- Do not reach between the chuck jaws.
- Use loading devices.



⚠ CAUTION

Allergic reactions or irritation due to skin or eye contact with lubricants on the product.

- In case of foreseeable contact with lubricants on the product (e.g. when lubricating or cleaning)
- Wear protective equipment (protective gloves, protective goggles)

NOTICE

Risk of damage due to incorrect choice of clamping position for chuck jaws on workpiece.

If an incorrect clamping position is chosen for the chuck jaws on the workpiece, the base and top jaws may become damaged.

- Observe maximum positions of base and top jaws.
- The diameter of the workpiece must not be greater than the clamping device diameter.
- For clamping devices with fine serration, do not allow the T-nuts for connecting the top jaws to protrude beyond the base jaws in radial direction.
- The outer diameter of the screwed-on top jaws must not exceed the outer diameter of the clamping device by more than 10%.

3 Technical data

3.1 Chuck data

ROTA THW plus	165-43	185-52	215-66	260-81	315-104
Max. actuating force [kN]	30	36	46	65	90
Max. clamping force [kN]	45	64	82	115	160
Max. speed of rotation [RPM]	6000	5700	5400	4000	3600
Stroke per jaw [mm]	5.9	6.7	7.4	8.2	8.6
Piston stroke [mm]	20	23	25	28	28
Through hole [mm]	43	52	66	81	104
Weight [kg]	14	18	26	45	70
Operating temperature	15 – 60°C				
Centrifugal torque of the base jaw with fine serration M_{cGB} [kgm]	For the THW plus 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 at **www.schunk.com**.				

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.

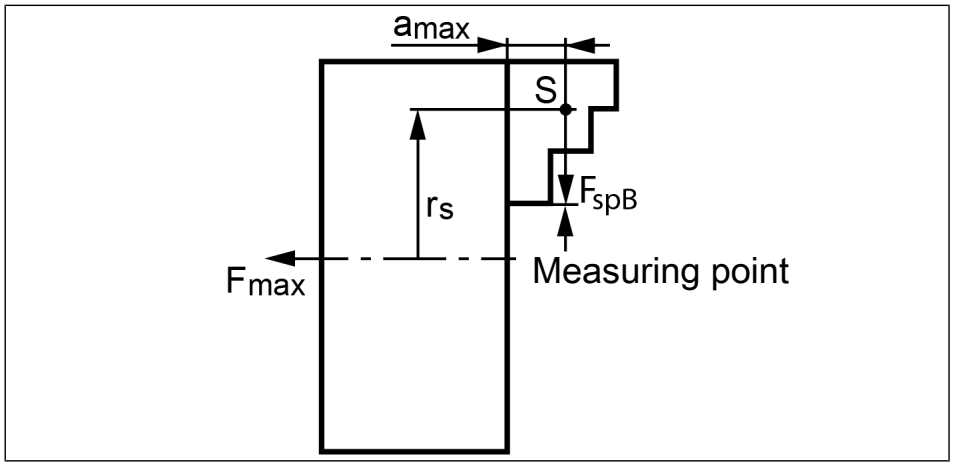
3.2 Clamping force / speed diagrams

Clamping force/RPM curves have been determined by using hard jaws. In the determination process, the maximum actuating force was applied and the jaws were set flush with the outer diameter of the chuck.

It is also assumed the chuck is in perfect condition and lubricated with SCHUNK LINOMAX plus special grease .

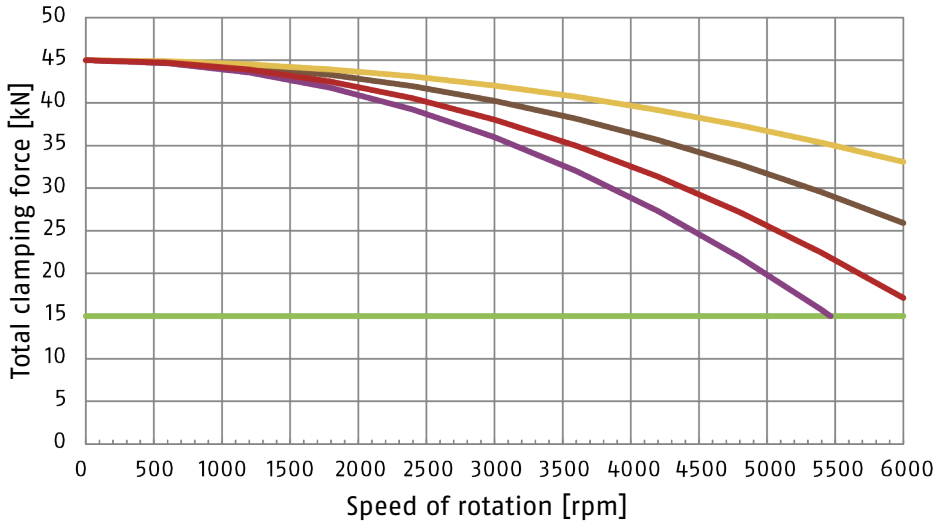
If one or more of these prerequisites is altered, the diagrams will no longer be valid.

Chuck setup for clamping force/RPM diagram



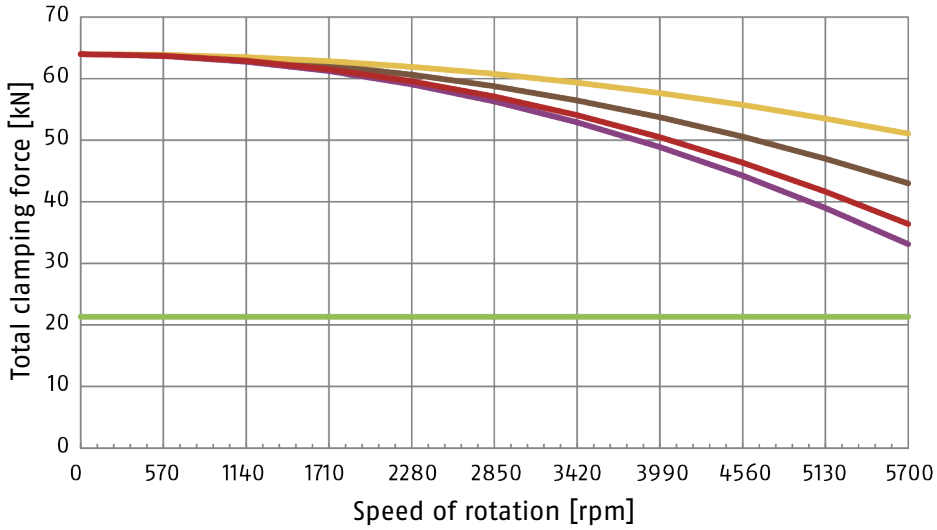
F_{spB}	Clamping force per jaw	S	Center of gravity
r_s	Center of gravity radius	a_{max}	Max. jaw center of gravity eccentricity in axial direction
F_{max}	Max. actuating force		

Clamping force / speed diagrams ROTA THW plus 165-43



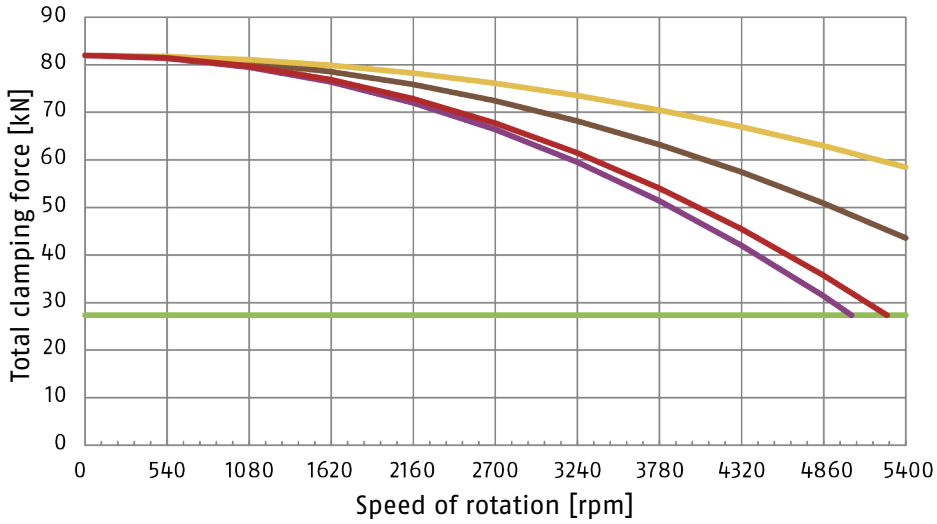
Colour	Jaw ID	Weight [kg]
	GST 140	0,7
	SHF 160	1,2
	UVB 160	1,5
	SFA 160	1,8
	Minimum required clamping force 33%	

Clamping force / speed diagrams ROTA THW plus 185-52



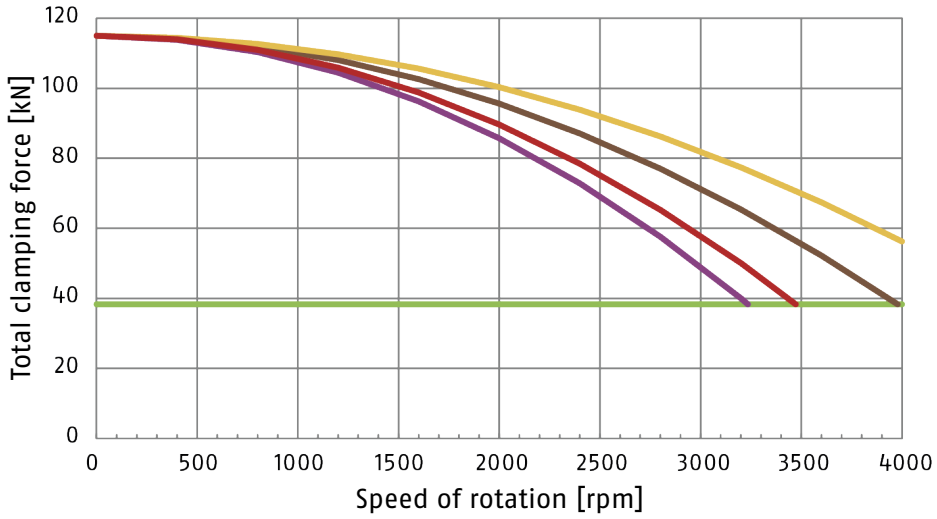
Colour	Jaw ID	Weight [kg]
	GST 140	0,7
	SHF 160	1,2
	UVB 160	1,5
	SFA 160	1,8
	Minimum required clamping force 33%	

Clamping force / speed diagrams ROTA THW plus 215-66



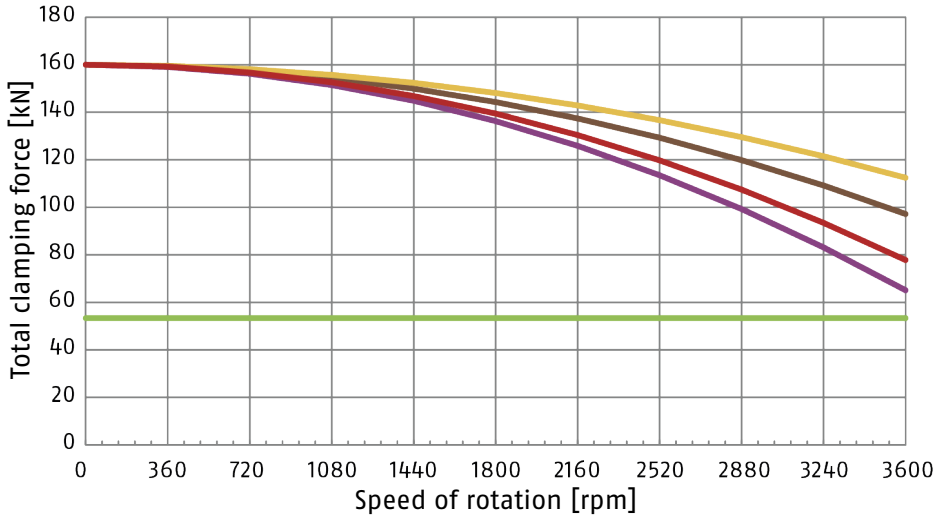
Colour	Jaw ID	Weight [kg]
	GST 201	1,6
	SHF 200	1,9
	UVB 200	2,7
	SFA 200	3,0
	Minimum required clamping force 33%	

Clamping force / speed diagrams ROTA THW plus 260-81



Colour	Jaw ID	Weight [kg]
	GST 251	2,8
	SHF 250	5,0
	UVB 250	4,8
	SFA 250	6,8
	Minimum required clamping force 33%	

Clamping force / speed diagrams ROTA THW plus 315-104



Colour	Jaw ID	Weight [kg]
	GST 315	3,5
	SHF 250	5,0
	UVB 315	7,6
	SFA 250	6,8
	Minimum required clamping force 33%	

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 [rpm]
F_{sp0}	Initial clamping force [N]	r_s	Center of gravity radius [m]
F_{spz}	Cutting force [N]	r_{sAB}	Center of gravity radius of top jaw [m]
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 force torque [Kgm]	Σ_s	Max. clamping force of chuck [N]

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}**.

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

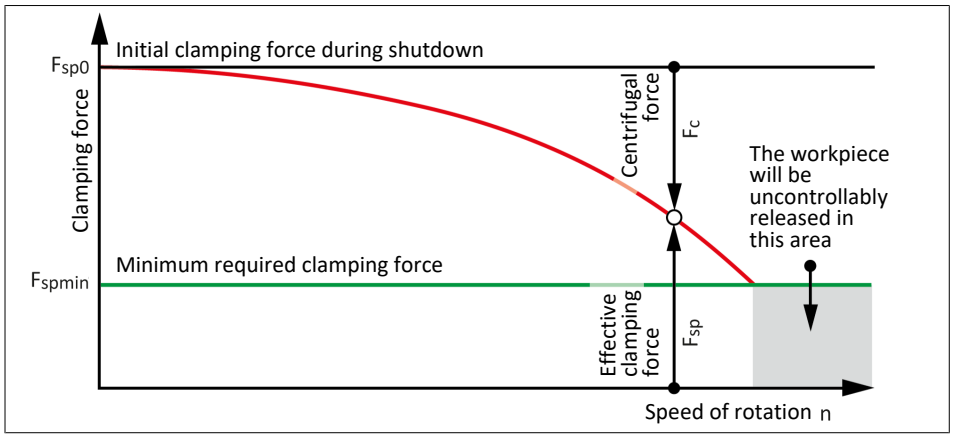
(–) for gripping from the outside inwards
(+) for gripping from the inside outwards



⚠ 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

NOTICE

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.

NOTICE

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:

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

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

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

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 $\mathbf{M_{cGB}}$** and the **centrifugal torque of the top jaws $\mathbf{M_{cAB}}$** 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:

$$F_C = \sum M_C \cdot (\frac{\pi \cdot n}{30})^2$$

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:

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

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:

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

NOTICE

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

The ROTA THW plus in ungreased state without top 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 ISO 21940-11). This applies particularly to high RPM, asymmetrical workpieces or the use of various top jaws, as well as uneven lubrication. In order to prevent damage resulting from these residual risks, the entire rotor must be dynamically balanced in accordance with DIN ISO 21940-11.

4 Mounting

4.1 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
Admissible torque M_A (Nm)	16	32	60	120	150	180	230

4.2 Mounting in general

4.2.1 Pre-assembly measures

Carefully lift the product (e.g. using suitable lifting gear) from the packaging.



⚠ 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.

Check the delivery for completeness and for transport damage.

In order to achieve high run-out accuracy of the chuck, the machine side must be aligned before mounting the chuck. To do this, check the mounting surfaces for radial and axial run-out using a dial indicator.

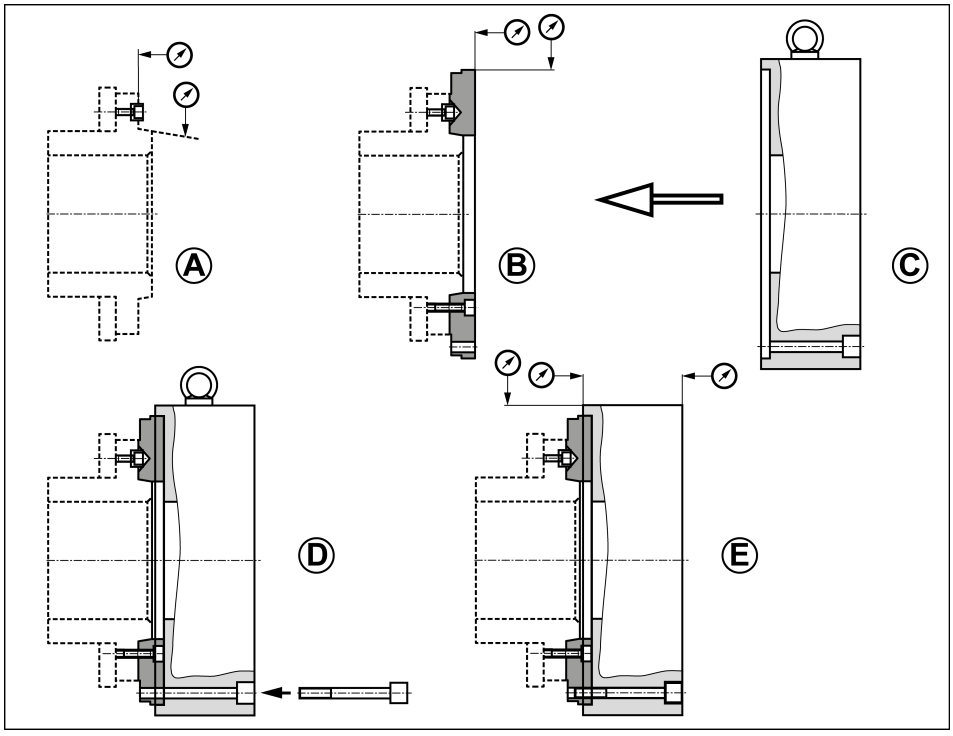
A maximum concentricity error of 0.01 mm should be ensured for the centring of the mount and a maximum axial run-out error of 0.01 mm for the contact surfaces. In addition, the flat surface must be checked for evenness using a straight edge (flat surface deburred and clean at the bore holes).

Radial and axial run-out tolerances of the chuck:

Chuck size [mm]	Max. Radial run-out tolerance [mm]	Max. Axial run-out tolerance [mm]
≤ 315	0.02	0.02
≤ 400	0.03	0.03
≤ 800	0.04	0.04
≤ 1200	0.05	0.05
≤ 1600	0.06	0.06

4.2.2 Chuck assembly options

If the interface of the machine spindle and chuck is identical, assembly is carried out without assembly preparation. If the interface of the machine spindle deviates from the interface of the chuck, a connecting flange must be installed before assembly.



Chuck assembly

- Direct assembly of the chuck to the machine spindle
- Assembly of the chuck with connecting flange
  - Direkt flange (insert ring)
  - Reduction flange
  - Expansion flange

NOTICE

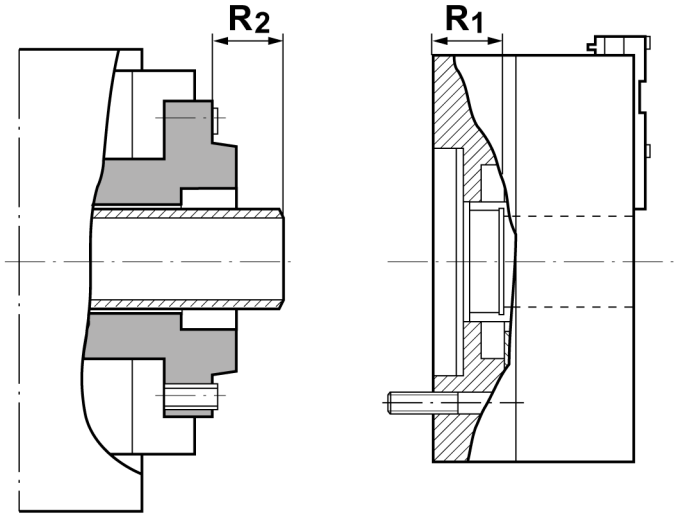
When mounting with the connecting flange, never allow the outer rim of the chuck body to make contact. The flange must support on the entire surface.

NOTICE

Use a crane to install the chuck. Fasten the chuck to the eye bolt provided for this purpose (see Fig. "Chuck assembly" – C) The eye bolt must be removed prior to commissioning.

4.3 Mounting of the Chuck to the Machine Spindle

- 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.

Chucks in sizes 165, 185 and 215

- Offset the base jaws so that they do not project over the outer edge of the chuck.
- The entire chuck has to be rotated on the draw tube (rod).
- Insert and **slightly tighten** the mounting screws.
- Check the chuck for radial and axial run-out and, if necessary, align it at the outer diameter with gentle taps using a plastic hammer (See "Chuck assembly" Fig. - E and the table of the attainable maximum radial and axial run-out tolerances).
- Then tighten the fastening screws alternately with a torque wrench. Observe the specified maximum tightening torques ▸ 4.1 [🗋 26].
- Check radial and axial run-out again.
- Check the actuating force is functioning and is sufficiently large.
- Move the cylinder into the front position. Unlock the wedge bars with the jaw change key supplied and insert or offset the base jaws into the chuck's jaw guidance as shown on markings 1, 2 or 3.
- Check that the base jaw and jaw stroke can easily move.

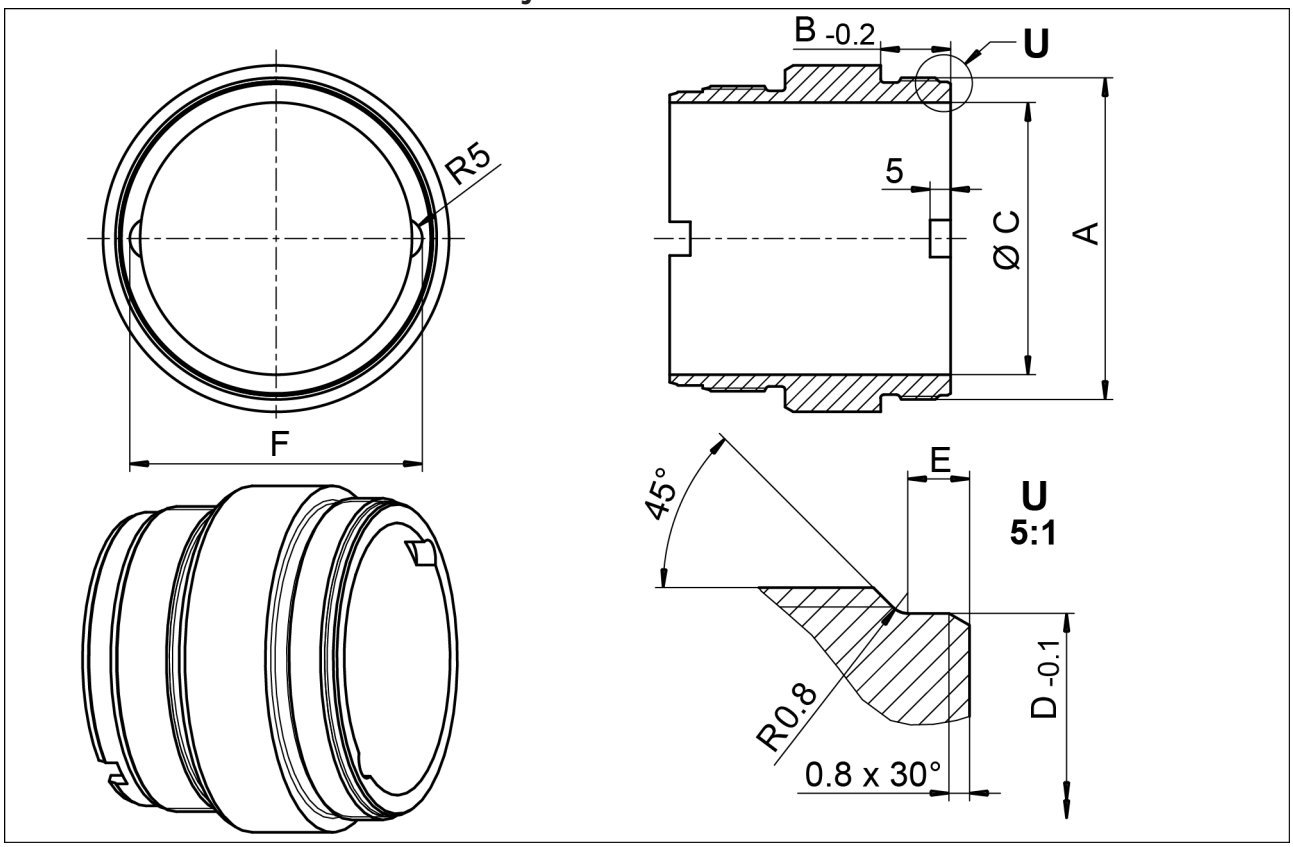
Chucks in sizes 260 and 315

- Offset the base jaws to the outermost marking (▸ 5.3 [🗋 34]).
- Remove the screws (item 43) and use the threaded extraction hole to push off the protection sleeve (item 4) away from the chuck body (item 1), and then pull it out completely.
- Lift the chuck to in front of the spindle lug using an eye bolt flush to the center of the spindle.
- Screw the rotating center sleeve (item 18) onto the draw tube using the enclosed assembly tool as far as this will go.
- Check the chuck for radial and axial run-out and, if necessary, align it at the outer diameter with gentle taps using a plastic hammer (See "Chuck assembly" Fig. - E and the table of the attainable maximum radial and axial run-out tolerances).
- Then tighten the fastening screws alternately with a torque wrench. Observe the specified maximum tightening torques ▸ 4.1 [🗋 26].
- Check radial and axial run-out again.
- Check the actuating force is functioning and is sufficient.
- Insert and fasten the protection sleeve (item 4) in the chuck body with the screws (item 43).

- Move the cylinder to the front position. Unlock the wedge bars with the jaw change key supplied and insert or offset the base jaws into the chuck's jaw guidance as shown on markings 1, 2 or 3.
- Check that the base jaw and jaw stroke can easily move.

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

At regular intervals, check that the retainer ring (item 17) is seated firmly.



ROTA THW plus Size	A Thread	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	O-ring [mm]
165-43	M54 x 1.5	15.0	43	50.8	2.8	47	50.47 x 2.62
185-52	M64 x 1.5	15.0	52	62.0	2.4	58	60 x 2
215-66	M78 x 1.5	17.0	66	76.0	2.4	70	76 x 2
260-81	M90 x 2.0	20.3	81	87.0	2.4	84	86 x 2
315-104	M115 x 2.0	22.5	104	110.0	3.2	107	110 x 3

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 plus into the lubricating nipple every 3 strokes. For optimum 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.

4.4 Disassembling and assembling the chuck

The lathe chuck may only be disassembled once it has been uninstalled (see Mounting the chuck, chapter ▸ 4.3 [🗋 28]) .

- You can leave the base jaws (item 2) in the chuck. Move them to the outermost permissible position. To do this, push the chuck piston (item 3) to its front end position.
- Remove the screws (item 43) and use the threaded extraction hole to push off the protection sleeve (item 4) away from the chuck body (item 1), and then pull it out completely.
- Remove the screws (item 42/44) from the mount (item 7).
- Mark the position of the mount (item 7) in relation to the chuck body (item 1).
- Undo the screws (item 40/41) several thread turns and hammer gently on the screw heads using a rubber mallet. This allows the mount (item 7) to be released from the centering for the chuck body (item 1). Remove the screws and take off the mount.
- Remove the safety bolt (item 14) with compression spring (item 35) and spring bolt (item 13).
- Use a suitable tool to push out and remove the jaw-change bolt (item 8) with the balls (item 37) through the bore hole for the safety bolt. Check the seal (item 33) for damage and wear, and replace it if necessary.
  NOTE: The bearing mechanism may cause metallic noise.
- Pull the chuck piston (item 3) together with the three wedge bars (item 9) out of the chuck body (item 1). The individual wedge bars (item 9) are identified in position in the chuck body (item 1) in accordance with the numbering on the perimeter. The piston has a point marking at the radial front side on the piston wedge hook. This is assigned to base jaw guide **1** during assembly.
- Push the base jaws (item 2) out of the chuck body (item 1).
- Check the seal (item 31) in the chuck piston (item 3) for the protection sleeve (item 4) and the seal (item 32) for the draw tube for damage and wear, and replace it if necessary.
- A wedge bar (item 9) consists of nine parts in total. Spring tension pre-loads the pressure bolt (item 12) and the pressure pieces (item 16). Remove the wedge bar (item 9) using the appropriate safety measures and using safety goggles.

- With its slot for the jaw-change bolt (item 8), the eccentric bolt (item 10) is joined to the wedge bar (item 9) in extension of the groove. This is the position for operation and assembly of the chuck. For disassembly, the eccentric bolt (item 10) has to be turned clockwise by approx. 15° using a suitable tool.
- Push out the eccentric bolt (item 10) from the diagonal pull side of the wedge bar (item 9) up to approx. 6 mm. The thrust bolt (item 12) then becomes visible. The displacement force is reduced through slight pressure on the serration.
- Secure the pressure bolt (item 12) against flying off and then completely remove the eccentric bolt (item 10) out of the wedge bar (item 9).
- Take the angle with plunger pin (item 15) and pressure piece (item 16) with compression spring (item 34) off the wedge bar.
- The pin (item 11) is securely glued into the eccentric bolt (item 10).

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

Only original SCHUNK spare parts may be used.

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

Before installation, lubricate parts well with LINO MAX plus special grease paste.



⚠ CAUTION

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

- Wear protective gloves.

5 Function and handling

The item numbers specified for the corresponding individual components relate to the chapter Drawings, ▶ 9 [🗋 40].

5.1 Function of the chuck

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

5.2 Handling the chuck and the base jaws

The clamping and opening path of the chuck jaws is prescribed 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 manually.



⚠ CAUTION

There is a risk of crushing during manual loading due to the large jaw stroke.

We recommend automatic loading.

If manual loading is used, set up the jaw position so that there is no risk of injury when inserting the parts. The maximum opening gap must be less than 4 mm when the workpiece is in contact with one of the jaws.

For each jaw guidance, a jaw-change bolt (item 8) with hexagon socket (which can be turned using the jaw change key (item 90)) is arranged on the chuck perimeter. Turning the jaw-change bolt moves the serration for the wedge bar (item 9) axially against spring pressure out of the serration for the base jaw (item 2). 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.

Der Ausklinkschlüssel wird verriegelt, solange keine Spannbacken in den Funktionsbereich gebracht wurden! Der Funktionsbereich bedeutet, dass die Grundbacke im Eingriff der Verzahnung des Winkels ist.

NOTICE

The chuck piston (item 3) must not be moved so long as the jaw change key (item 90) is located in one of the jaw-change bolts (item 8) for the chuck.
Risk of damage to the chuck.

NOTICE

The mechanical system of the chuck is opened when the protection sleeve (item 4) is changed. No chips may penetrate into the mechanical system of the chuck. If no protection sleeve is installed in the chuck, then the chuck must not be actuated and the chuck piston (item 3) must not be moved!
Risk of damage to the chuck.



⚠ CAUTION

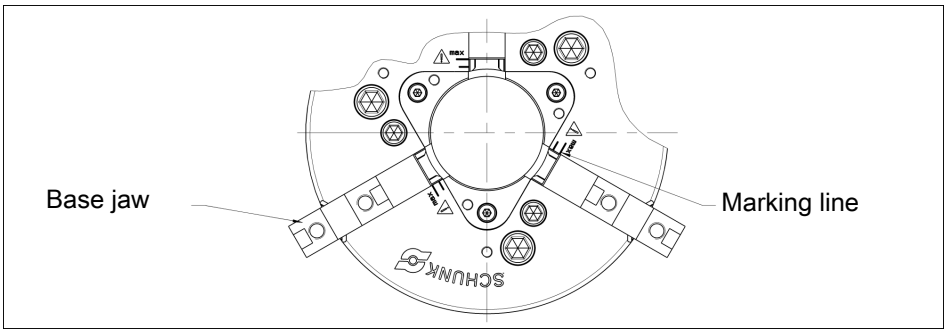
Risk of crushing due to mechanical system of the chuck being open when the protection sleeve is being changed.

Do not reach into the open mechanical system of the chuck!
Wear protective gloves.

5.3 Base jaw position

A marking line between the jaw guides is milled on the face side of the chuck. 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.



5.4 Change or supplement of jaws

Jaws for highest repeatability must be bored and ground in the chuck under clamping pressure.

- When boring and grinding it is important that the boring ring or the boring bolts are clamped **by the top jaws** – and not by the base jaws. Keep base and top jaws screwed together for later tasks.
- Keep the base jaws and top jaws screwed in place for recurring work. Tighten the jaw mounting screws to the specified torque ▸ 4.1 [🗋 26].

Tighten the jaw mounting screws with a torque wrench.

6 Maintenance

6.1 Lubrication



⚠ WARNING

Risk of injury through contact with lubricants!

Skin or eye contact with lubricants can cause irritation and allergic reactions.

- Avoid skin or eye contact with lubricants.
- Wear safety goggles and protective gloves.

To maintain the safe functioning and high quality of the chuck, it must be lubricated regularly at all lubrication points. For optimum grease distribution, the chuck must be lubricated in the lubricating position (▸ 6.2 [🗋 35]).

Depending on the operating conditions, the function and clamping force must be checked after a certain period of operation (▸ 6.3 [🗋 36]). Only perform the clamping force test with a calibrated clamping force tester (SCHUNK IFT). If the chuck is used over several clamping cycles in the short stroke range (< 50% clamping stroke), it is recommended to perform a empty stroke regularly to maintain the clamping force at a consistently high level.

Lubricate the chuck evenly in order to avoid large imbalances.

6.2 Lubricating position

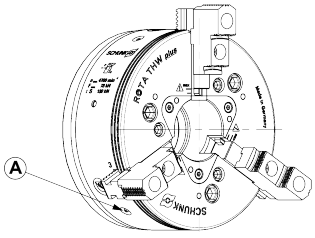


Fig. 1: Lubricating points

The following procedure should be followed to ensure optimum distribution of the lubricant:

- Open the chuck and move it to the outer end position.
- Lubricate the chuck at the 3 grease nipples (**A** / item 39) with LINOMAX plus.
- Perform several empty strokes over the entire travel range of the chuck.

The following number of grease gun strokes must be applied to the chuck at each of the 3 lubrication points:

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

6.3 Maintenance and lubrication plan



⚠ WARNING

Risk of injury from flying parts ifthe jaw mounting screws break!

If the maximum allowable number of clamping cycles is exceeded, the jaw mounting screws may break.

- The jaw mounting screws must be replaced after no more than 15,000 clamping cycles.
- The jaw mounting screws must be inspected for damage at specified maintenance intervals and replaced if necessary.

The specified intervals are guide values and must be adjusted by the operator depending on the ambient and operating conditions and the frequency of use of the clamping device used. To determine a suitable lubrication interval for the respective application, regular clamping force tests must be carried out. If only 80% of the maximum clamping force is reached, the clamping device must be lubricated. In accordance with VDI 3106, it must be ensured that sufficient clamping force is available for the application.

Maintenance task	Interval
Lubricate	Every 24 operating hours
Check clamping force	To be determined by the operator
Replacing the jaw mounting screws	After 15,000 clamping cycles
Complete cleaning / disassembly	Annually / after 2500 operating hours

7 Storage

When storing the product for a longer period of time, observe the following points:

- Clean the product and lubricate it lightly.
- Store the product in a suitable transport container.
- Only store the product in dry rooms.
- Protect the product from major temperature fluctuations.

NOTE: Before recommissioning, clean the product and all attachments, check for damage, functionality and leaks.

8 Chuck mounts and parts list

8.1 Chuck mounts

ROTA THW plus Size	Chuck mount	ID
165-43	Z 140	0800600
	A5	0800601
	A6	0800602
185-52	Z 140	0800610
	Z 170	0800611
	A5	0800612
	A6	0800613
215-66	Z 170	0800620
	A6	0800621
	A8	0800622
260-81	Z 170	0800630
	Z 220	0800631
	A6	0800632
	A8	0800633
315-104	Z 220	0800640
	A8	0800641
	A11	0800642

8.2 Parts list

When ordering spare parts, it is essential to specify the type, size and, above all, the serial number of the chuck. **Seals, sealing elements, screw connections, springs, bearings, screws and wiper strips as well as parts that come into contact with the workpiece are not covered by the warranty.**

ROTA THW plus

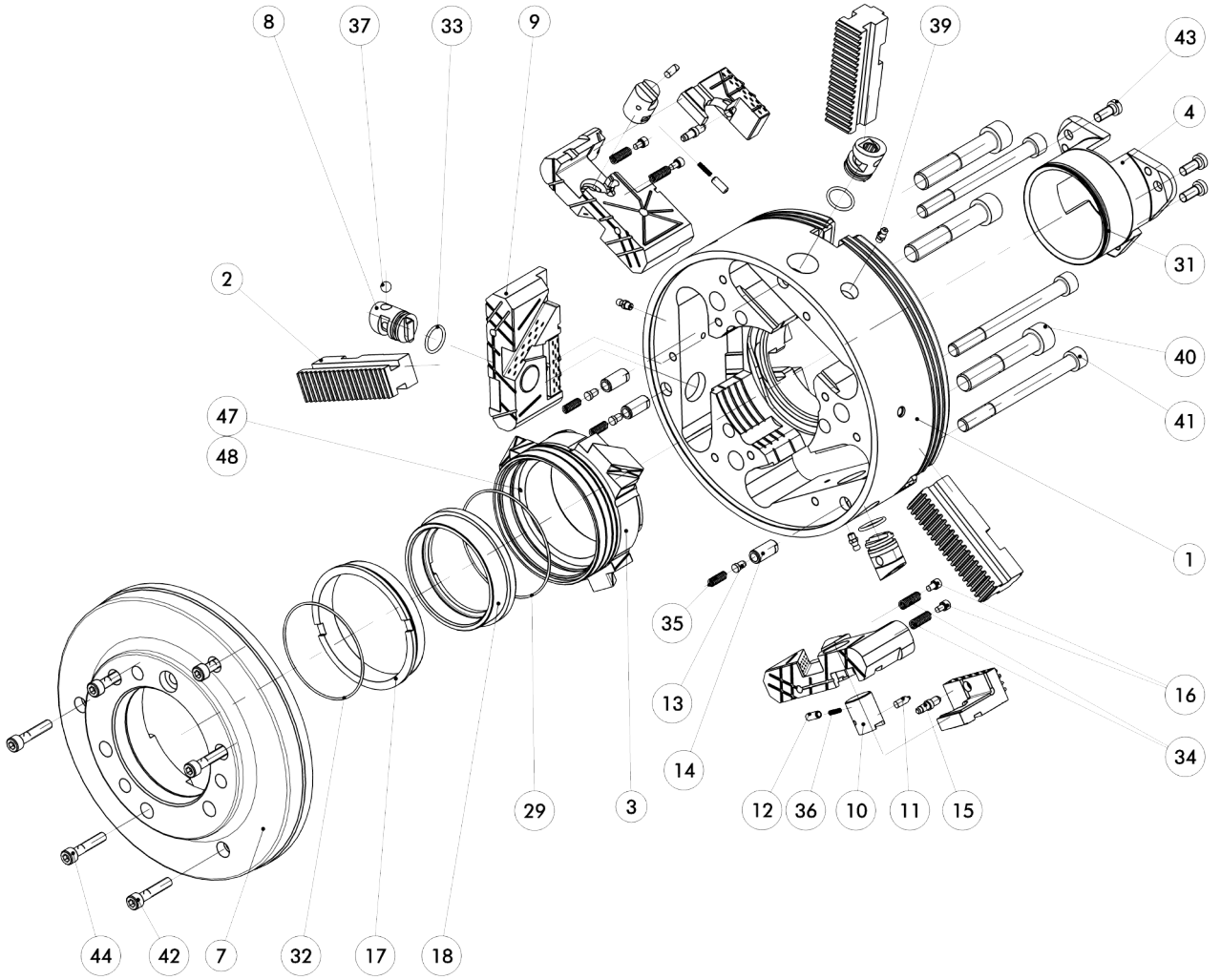
Item	Designation	Quantity	Note
1	Chuck body	1	
2	Base jaws	3	
3	Piston	1	
4	Standard protection sleeve	1	
7	Mount	1	
8	Jaw-change bolt	3	
9	Complete wedge bar	3	
10	Eccentric bolt	3	
11	Pin	3	
12	Thrust bolt	3	
13	Spring bolt	3	

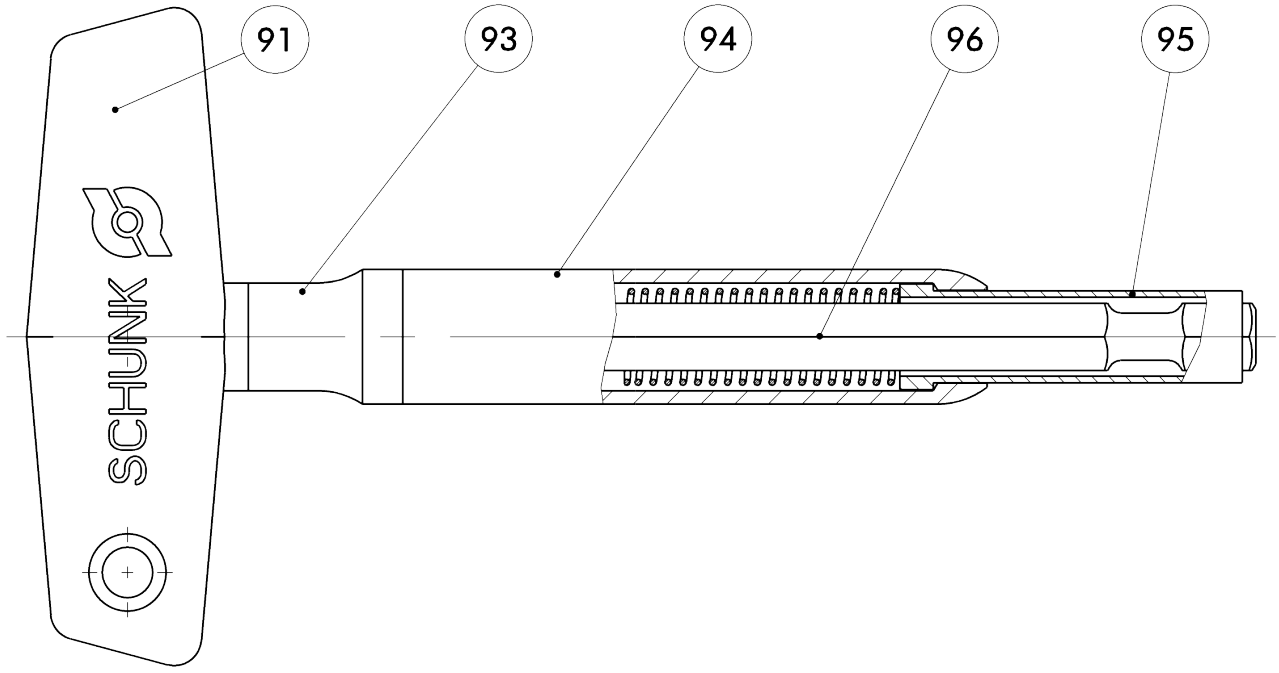
Item	Designation	Quantity	Note
14	Safety bolt	3	
15	Plunger pin	3	
16	Pressure piece	6	
17	Retainer ring	1	260 / 315
18	Center sleeve	1	260 / 315
19	Assembly tool	1	260 / 315
20	Lever for assembly tool	1	260 / 315
29	Center sleeve seal	1	260 / 315
31	Piston seal	1	
32	Adapter seal	1	
33	Jaw-change bolt seal	3	
34	Compression spring for pressure piece	6	
35	Compression spring for safety bolt	3	
36	Compression spring for thrust bolt	3	
37	Steel ball for jaw-change bolt	3	
39	Tapered lubricating nipple	3	
40	Mounting screws	3	
41	Mounting screws	3	
42	Mounting screws	3	185 / 215 / 315
	Mounting screws	6	260
43	Mounting screws	3	
44	Mounting screws	3	260
	Mounting screws	6	165 / 185 / 215 / 315
47	Compression spring for grid	2	260 / 315
48	Steel ball for grid	2	260 / 315
60	Eye bolt	1	260 / 315
90	Jaw change key	1	

Jaw change key (item 90)

Item	Designation	Quantity	Note
91	Cross handle	1	
93	Holding piece	1	
94	Spring sleeve	1	
95	Pressure sleeve	1	
96	Compression spring	1	

9 Drawings


8
37
33
9
39
43
4
2
31
40
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41
48
1
35
16
13
34
14
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36
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SCHUNK

10 Manufacturer certificate

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

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 proper 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.
- **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)

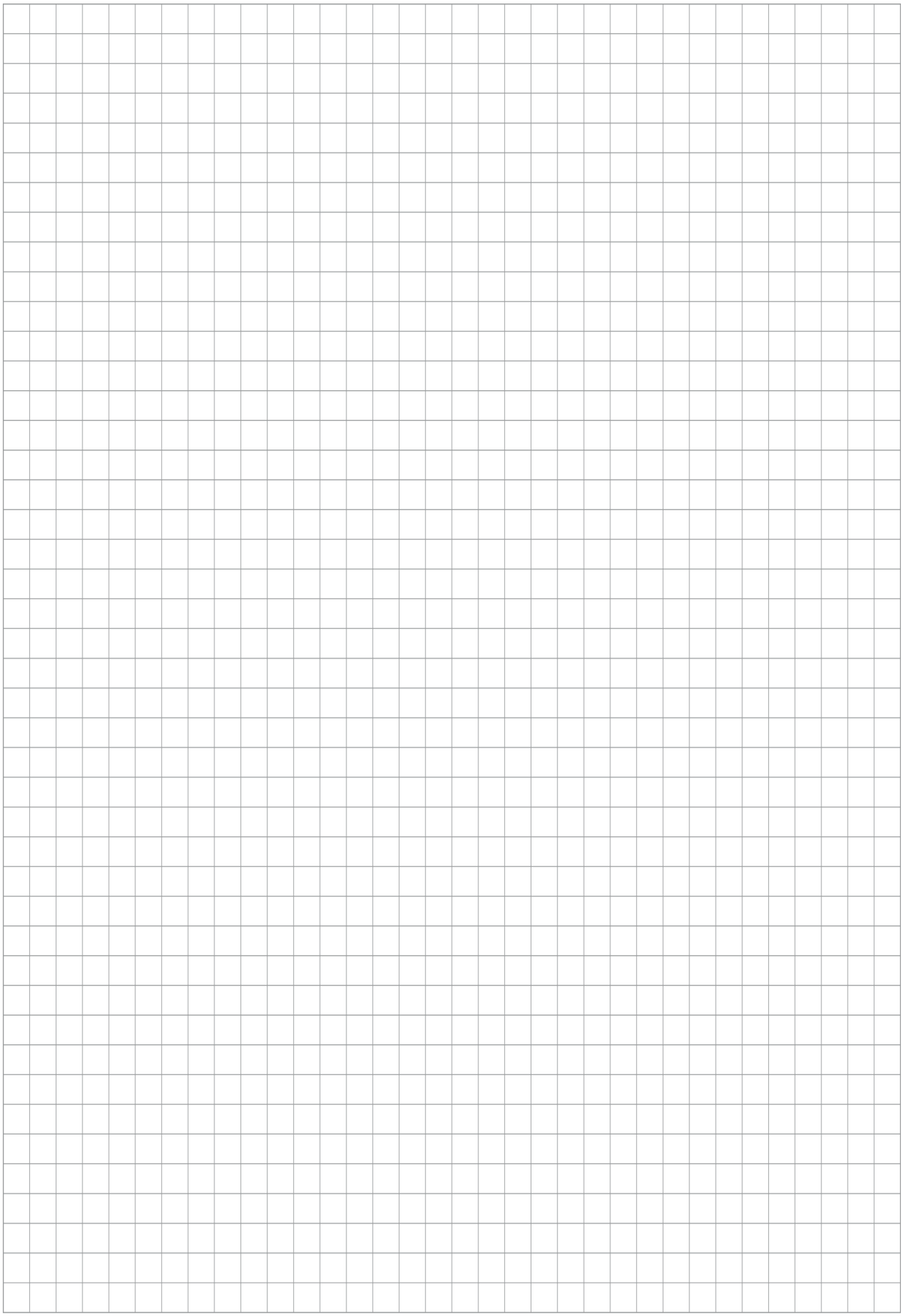
Mengen, 02nd of August 2023

i.V. Philipp Schräder

p.p. Philipp Schräder
Head of Development standard products

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