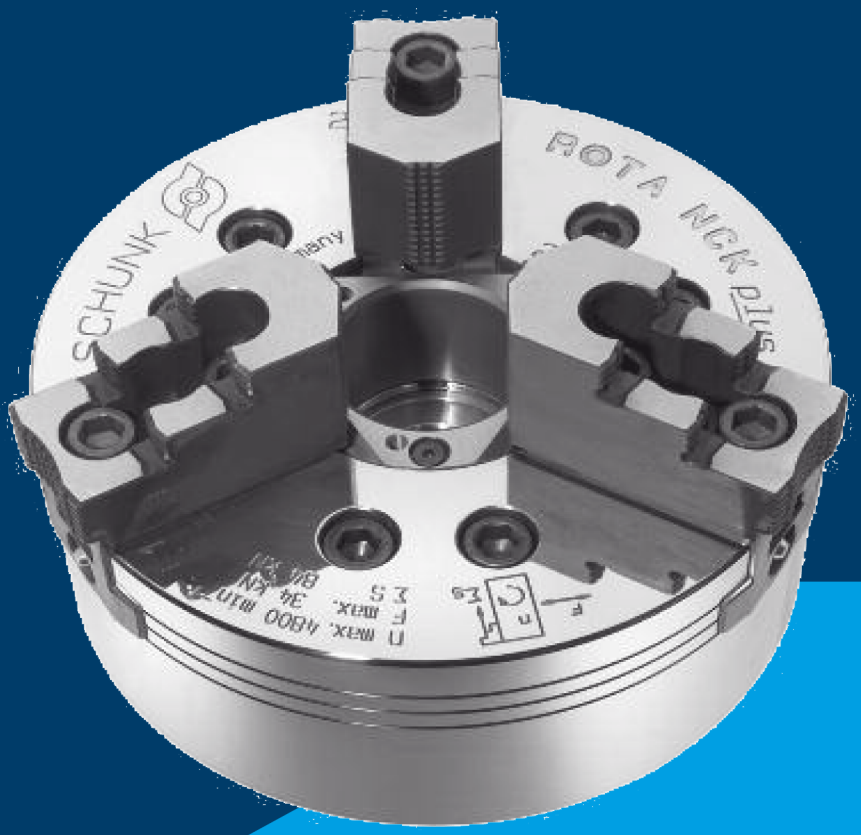
SCHUNK



Power Chuck
ROTA NCK plus
Assembly and operating manual

Translation of the original 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

This operating manual is an integral component of the product and contains important information on safe and proper assembly, commissioning, operation, care, maintenance and disposal. This manual must be stored in the immediate vicinity of the product where it is accessible to all users at all times.

Before using the product, read and comply with this manual, especially the chapter “Basic safety notes”.▸ 2 [🗋 7]

If the product is passed on to a third party, these instructions must also be passed on.

Illustrations in this manual are provided for basic understanding of the product and may differ from the actual product design.

We accept no liability for damage resulting from the failure to observe and comply with this operating manual.

1.1 Warnings

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.

NOTICE

Material damage!

Information about avoiding material damage.

⚠ WARNING

Warning about hand injuries

⚠ WARNING

Warning about hot surfaces

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**.

2 Basic safety instructions

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

Report any failures and damage immediately and repair without delay to keep the extent of the damage to a minimum and prevent compromising the safety of the product.
Only original SCHUNK spare parts may be used.

NOTE
We hereby confirm that the components comply with the relevant basic and proven safety principles of Annex A and C of ISO 13849-2, taking into account the requirements of the documentation. The parameters, limitations, ambient conditions, characteristic values, etc. for proper operation are defined in the operating manual.

2.1 Intended use

The product is suitable for clamping workpieces on milling or lathe machines and other suitable tooling machines.

The product is intended for industrial use.

Intended use also means that the user has read and understood this operating manual in its entirety, especially the chapter "Basic safety notes".

- 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"). ▸ 6 [🗋 19]

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. ▸ 6 [🗋 19]
- 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 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.

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.

⚠ WARNING

Risk of injury due to dropping the chuck during transport, installation or removal.

- Take special care in the danger zone when transporting, installing or removing the chuck.
- Note the relevant load securing regulations for working safely with cranes, ground conveyors, lifting gear and load-handling equipment.

⚠ 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 jaws.
- Wear safety 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

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

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

- The T-nuts combine the top jaws with the base jaws and they should never protude over the base jaws in radial direction.
- The outer diameter of the screwed top jaws must not exceed the outer diameter of the chuck by more than 10%.

⚠ 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.

2.4 Notes on safe operation

- The machine spindle may only be started up when clamping pressure has built up in the cylinder and clamping has followed in the permitted work area.
- Unclamping may only be possible when the machine spindle has come to a standstill.
- If the clamping energy fails, the workpiece must remain firmly clamped until the spindle is shut down and the workpiece is secured.
- The technical safety requirements in the respective operating instructions must be observed exactly.

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

Possible risk of fatal injury to operating personnel if the chuck's top speed is exceeded and a workpiece is released or parts fly off.

If the machine tool or technical equipment can reach a higher speed than the chuck's top speed, a reliable speed limiter must be installed and proof must be provided that the speed limiter is effective.

Maintenance instructions

The chuck'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 chuck (clamping force, coefficient of friction, wear characteristics).
  (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 piston to its end positions several times, lubricate again, and then check the clamping force.
- 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*.
- The clamping force should always be measured in the state of the lathe chuck as used for the current clamping situation. 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.
- Move the clamping piston 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, so that the clamping force is retained for longer).

Safety notes for servicing

Follow all the applicable legal standards for health and safety during servicing. Use suitable personal protective equipment, especially protective gloves, goggles, and safety boots – paying particular attention to the operating system and hazard assessment.

⚠ DANGER

Possible risk of fatal injury to operating personnel due to toolholder failure if the maintenance and servicing instructions for the toolholder are disregarded.

The servicing instructions specified by the manufacturer must be complied with to ensure safe operation of the chuck.
Work must be carried out by qualified specialist personnel with the relevant safety training.
Observe the maintenance instructions in this manual.

Use of special chuck jaws

When using special chuck jaws, please observe the following rules:

- 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).
- Do not use welded jaws.
- If for constructional reasons the chuck jaws in special design are heavier than the top jaws assigned to the clamping device, greater centrifugal forces must be accounted for when defining the required clamping force and the recommended speed.
- Screw the jaw mounting screws into the bore holes furthest apart.
- The maximum recommended speed may only be operated in conjunction with maximum actuating force and only with the chuck in optimal, fully functioning condition.
- If the chuck is involved in a collision, it must be subjected to a crack test before using it again. Replace damaged parts with original SCHUNK spare parts.
- Replace the chuck jaw mounting screws if there are signs of wear or damage. Only use screws with a quality of 12.9.

2.4.1 Substantial modifications

No substantial modifications may be made to the chuck.

If the operator carries out a substantial modification to the chuck, the product shall no longer conform to the EC Machinery Directive 2006/42/EC.

2.5 Personnel qualification

Assembly and disassembly, commissioning, operation and repair of the chuck may be performed only by qualified specialists who have been instructed with respect to safety.

All persons who are assigned to operate, maintain and repair our chuck must have access to the operating manual, especially the chapter "Fundamental safety instructions". We recommend that the operator create in-house safety operating instructions.

Persons in training may be assigned to machines and technical equipment in which a chuck is mounted only if they are under the constant guidance and supervision of qualified specialists.

2.6 Organizational measures

Obeying the rules

By means of suitable organizational measures and instructions, the operator must ensure that the relevant safety rules are obeyed by any persons asked to operate, maintain and repair the lathe chuck.

Monitoring the behavior of personnel

The operator must check that the personnel are behaving in a safety-conscious manner and are aware of the potential hazards at least from time to time.

Danger signs

The operator must ensure that the signs concerning safety and hazards on the machine where the lathe chuck is mounted are clearly legible and observed.

Faults

If a fault occurs on the lathe chuck and this fault endangers safety or if a problem is suspected due to production characteristics, the machine tool where the lathe chuck is mounted must be immediately stopped and remain shut down until the fault has been located and remedied. Only allow specialists to remedy malfunctions.

Spare parts

Only ever use original SCHUNK spare parts.

Environmental regulations

Comply with the applicable legal norms when disposing of waste.

2.7 Using personal protective equipment

When using this product, you must comply with the relevant health and safety at work rules and you must use the required personal safety equipment (minimum: category 2).

3 Warranty

If the product is used as intended, the warranty is valid for 24 months from the ex-works delivery date under the following conditions:

- Observe the applicable documents, ▸ 1.2 [🗋 6]
- Observe the ambient conditions and operating conditions
- Observe the maximum number of clamping cycles ▸ 6 [🗋 19]
- Observe the specified maintenance and lubrication intervals, ▸ 9 [🗋 37]

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

4 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)

Screw size	M6	M8	M10	M12	M14	M16	M20	M24
Max. admissible torque M_A (Nm)	16	30	50	70	130	150	220	450

Tightening torques for the protection sleeve mounting screws (screw quality 8.8)

Screw size	M3	M4	M5	M6
Tightening torques M_A (Nm)	1.3	3.0	5.5	9.0

5 Scope of Delivery

- 1 Power chuck
- 6 Fastening screws
- 6 T-nuts with screws or 3 Jaw-Nuts
- 1 Mounting wrench
- 1 Eye bolt from size 210 and up

6 Technical data

6.1 Chuck data

Size	165	210	250	315
Max. actuating force [kN]	22	34	44	56
Max. clamping force [kN]	57	84	111	145
Max. rotation speed [min-1]	6000 5500*	5000	4200	3300
Stroke per jaw [mm]	2,75	3,70	4,40	5,30
Piston stroke [mm]	12	16	19	23
Chuck through bore [mm]	45	52	75	91
Centrifugal force of the base jaw [kgm] M_{cGB}	0,029	0,056	0,095	0,171
Max. jaw eccentricity of center of gravity in axial direction [mm] a_{max}	24	40	40	40

* with 1/16" x 90° base jaw fine serration

NOTE

The speed indicated with »* « on the ROTA NCKplus 165 chuck applies to the jaw version serrated in inch sizes. For the jaw version serrated in metric sizes, the maximum speed is 6,000 rpm.

The recommended max. speed is only valid for max. operating force and the use of the suitable hard standard jaws.

⚠ WARNING

Danger of personal injury and property damage caused by flying parts in case of spiral fracture of soft top jaws!

Soft top jaws must be hardened in the area of the screw's counterbore.

Just deep hardened no surface hardening.

Ensure for all jaws the lowest possible weight. For soft top jaws or jaws in special design the permissible speed of the respective cutting task has to be calculated in accordance to VDI 3106, whereby the maximum standard value may not be exceeded. The calculated values have to be examined with a dynamic measurement. Control of function (piston movement and actuation pressure) has to be accomplished in accordance with the guidelines of the professional association.

More technical data is included in the catalog data sheet. Whichever is the latest version.

6.2 Clamping force / speed diagrams

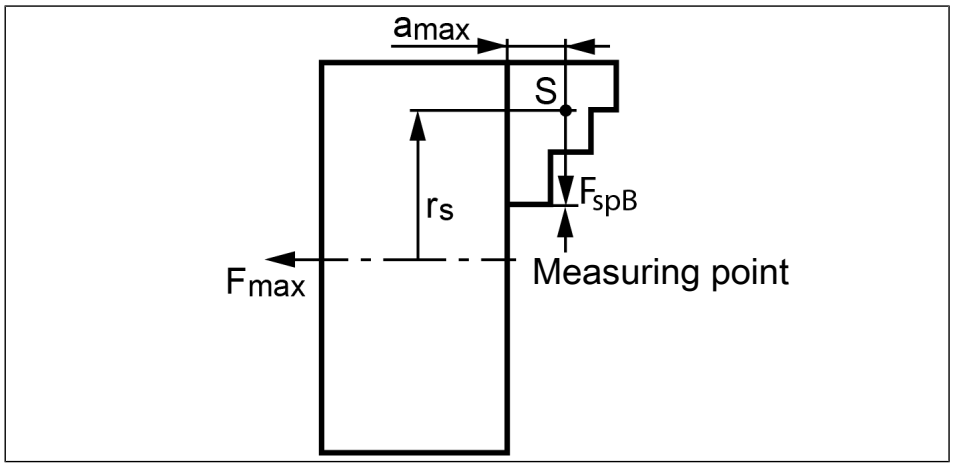
The diagrams refer to 3-jaw-chuck.

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 .

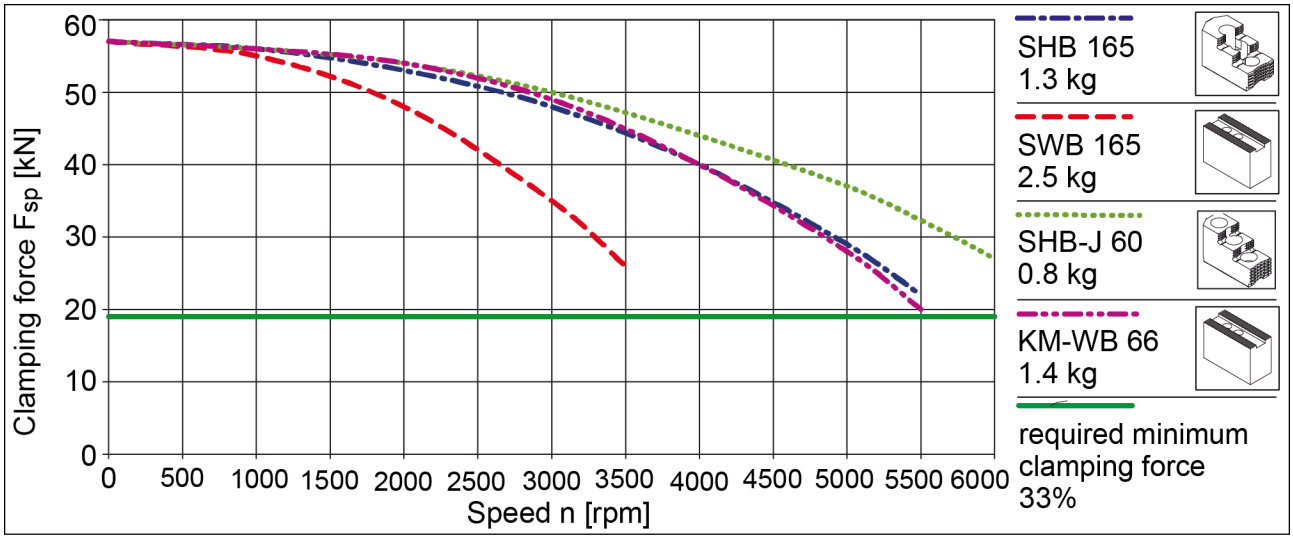
If one or more of these prerequisites is altered, the diagrams will no longer be valid.

Chuck setup for clamping force/RPM diagram

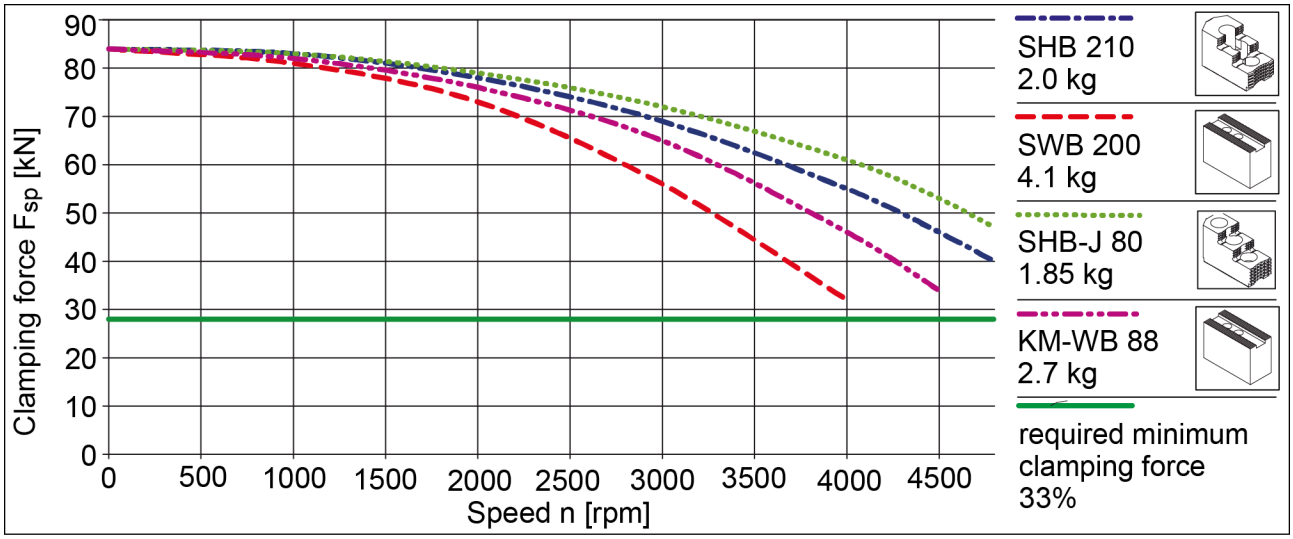


F_{spB}	Clamping force per jaw	S	Center of gravity
r_s	Center of gravity radius	a_{max}	Max. jaw center of gravity eccentricity in axial direction
F_{max}	Max. actuating force		

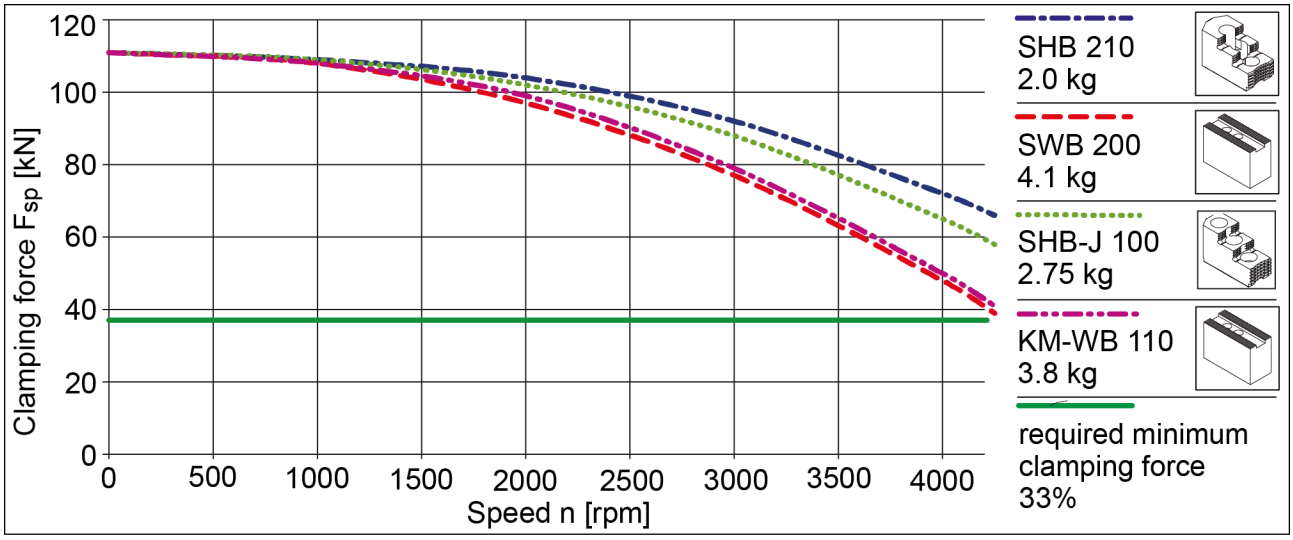
Clamping force / speed diagram ROTA NCKplus 165-45



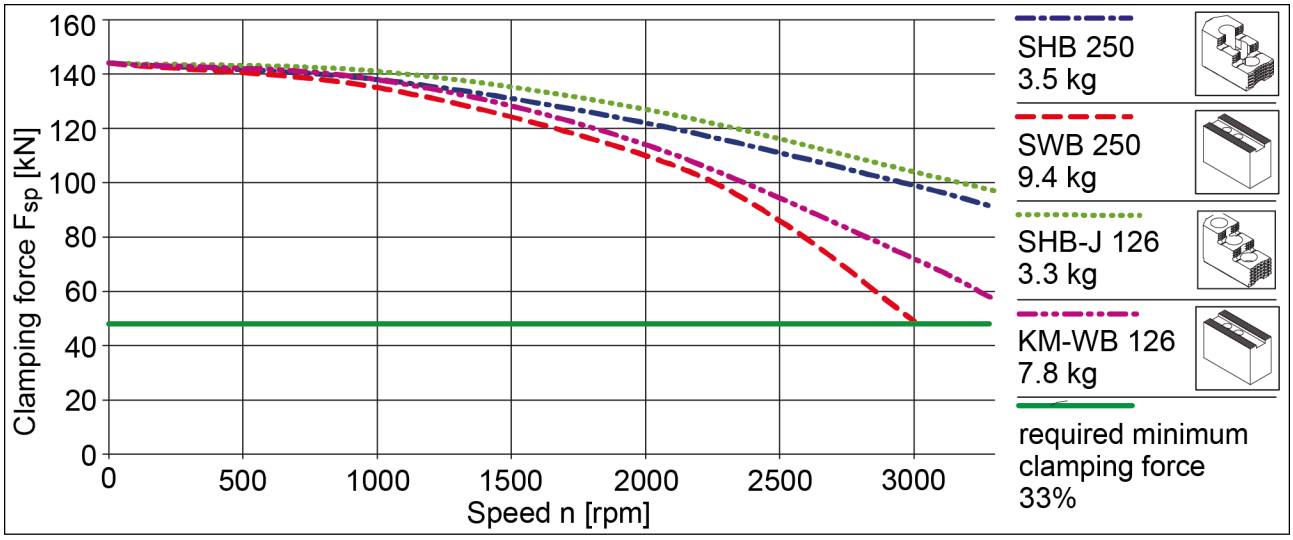
Clamping force / speed diagram ROTA NCKplus 210-52



Clamping force / speed diagram ROTA NCKplus 250-75



Clamping force / speed diagram ROTA NCKplus 315-91



6.3 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]

6.3.1 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}**.

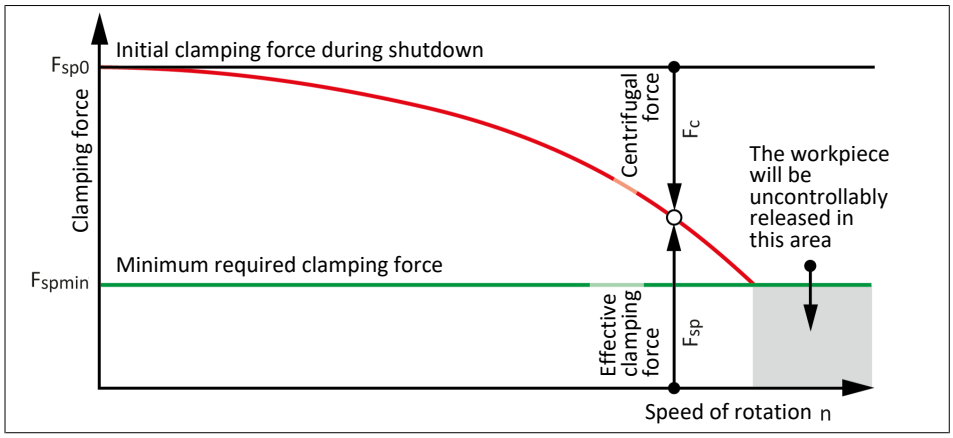
$$F_{sp} = F_{sp0} \mp F_c \text{ [N]}$$

(–) 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 ▶ 6.1 [🗋 19]

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"▸ 6.1 [🗋 19]. The centrifugal torque of the top jaws M_{cAB} is calculated as per:

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

6.3.2 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:

M_{cGB} = 0.319 kgm

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

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

Centrifugal torque for one jaw:

$M_c = 0.319 + 0.571 \Rightarrow$ **M_c = 0.89 kgm**

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

$\sum M_c = 3 \cdot M_c = 3 \cdot 0.889 \Rightarrow$ **$\sum M_c$ = 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:

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

6.3.3 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 ▶ 6.1 [🗋 19]).

This calculated RPM may be used.

6.4 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.

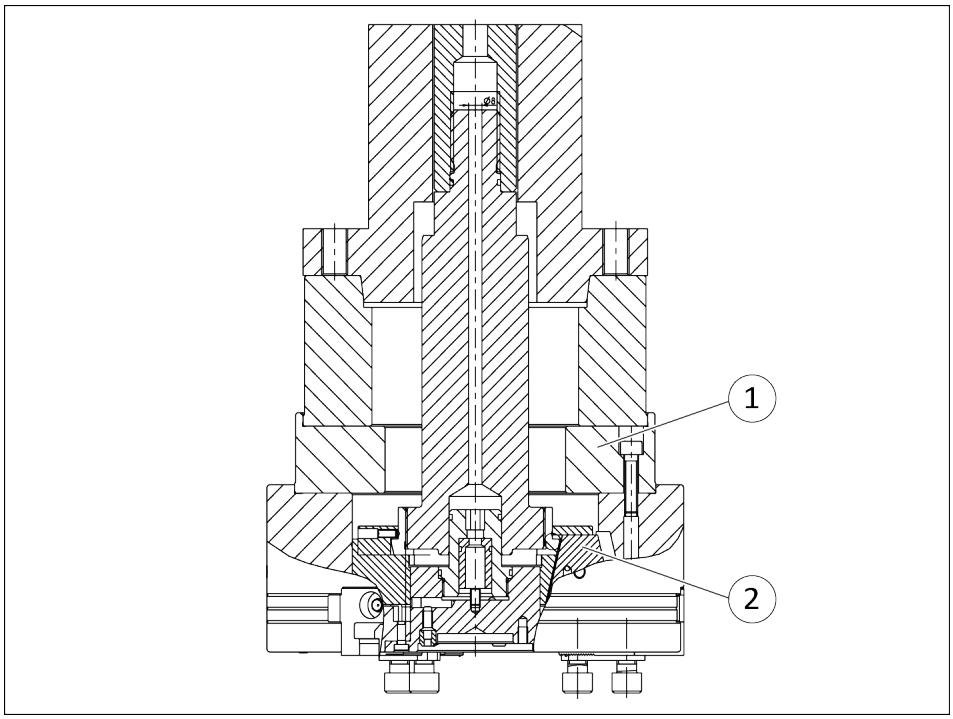
6.5 Permissible imbalance

Rotating clamping stations without pallets and workpieces correspond to 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 in particular to high speeds of rotation, asymmetrical workpieces or the use of lathe chucks that do not correspond to balancing grade 6.3, as well as uneven lubricant application. 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.

7 Mounting of the Chuck to the Machine Spindle

Note for a vertically suspended machine spindle

In the case of a vertically suspended machine spindle, it must be ensured that the piston (2) has a stop in the chuck flange (1). This prevents the chuck body of the clamping chuck from being pulled by the dead weight.from the piston (2) during the assembly / disassembly.



Mounting of the Chuck for a vertically suspended machine spindle

7.1 Inspection of the spindle nose for mounting the chuck flange

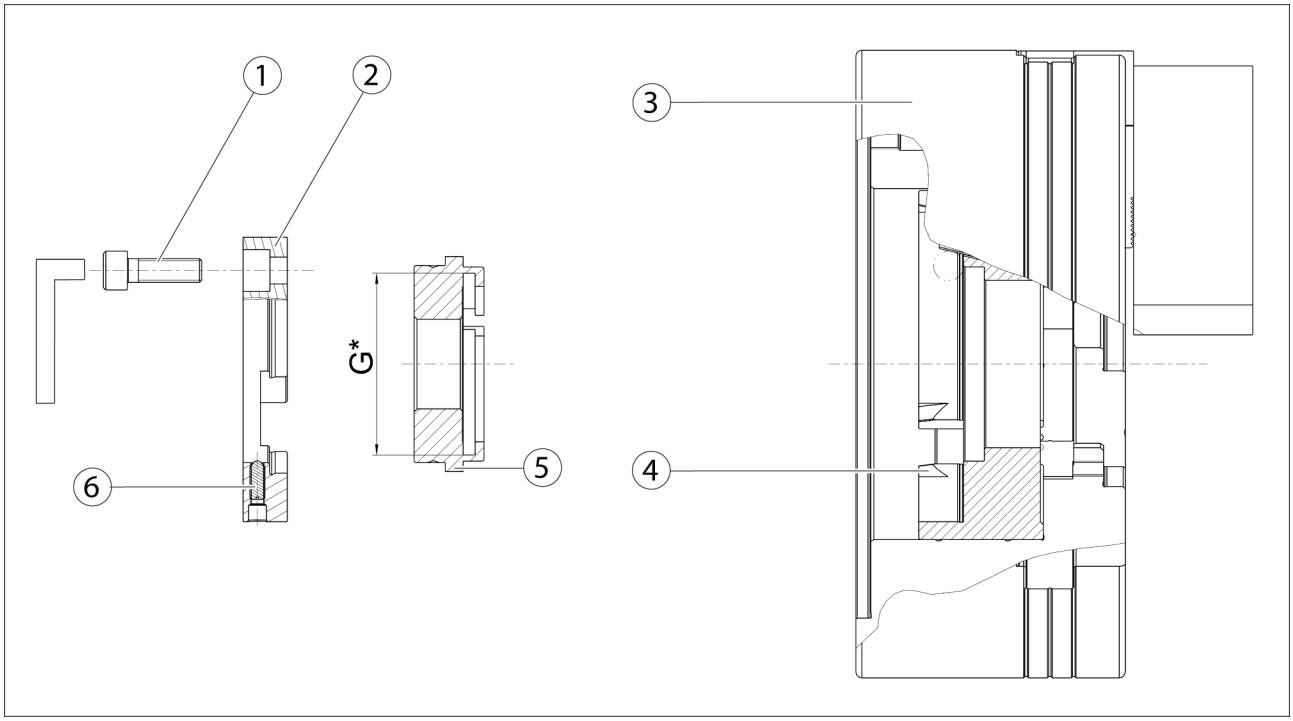
To achieve high true running of the chuck, the machine side must be aligned before mounting the flange. Therefore check the receiving surface at the spindle for concentricity and runout with a dial indicator.

maximum run-out error of 0.005 mm on the centring mount and a maximum run-out error of 0.005 mm on the contact surfaces must be ensured.Also, the end face of the spindle must be checked for evenness with a straightedge.

It must also be ensured that the surface of the end face is chamfered and clean at the bores.

7.2 Threading of drawnut

1. By loosening the six fastening screws, you can take the drawing sleeve blank, which only has one bore in its original condition, out of the chuck.
2. During this, pay attention to the spring clamping element, which protects the drawing sleeve against turning. The spring clamping element is inserted into the drawing piston and presses against the drawing sleeve.
3. Cut the same thread into the drawing sleeve as on the drawing tube.
4. Next, the drawing sleeve can be inserted back into the chuck.
5. Retighten the chuck drawing sleeve using the six screws.



1	Screws	4	ROTA-NCK 165: the spring clamping element is inte grated directly within the chuck piston
2	Ring	5	Draw nut (blank)
3	Chuck	6	Spring clamping element
*	G will be achieved by boring the blank draw nut.		

NOTICE

Tighten the mounting bolt accroding to the specified torque ▸ 4 [🗋 17]. If tightening torque is insufficient or too strong, bolts might brake.
Use only attached bolts.

NOTICE

In order to achieve the full stroke of the chuck the draw nut needs to have sufficient play in the spindle. The ROTA NCKplus 315-A6 will only achieve its full stroke if the draw nut blank is shortened by 4 mm.

7.3 Mounting

7.3.1 Mounting the chuck with a reduction or extension flange

If the chuck is screwed on with an intermediate flange, the following points must be observed:

For mounting the chuck on the machine spindle with a short taper by means of a reduction or extension flange, a corresponding chuck flange is attached on the spindle nose.

1. Before installing the chuck flange, remove any dirt or swarf from the machine spindle and from the centring mount and the contact surface of the flange.
2. A chuck flange made by the user himself must be finished machining on the machine spindle and must be balanced before the chuck is mounted.
3. After mounting, it must be ensured that the flange is fitted tightly on the entire surface.
4. Next, the radial and axial run-out must be checked as in ▸ 7.1 [🗋 27]. During this, proceed as described in figure B

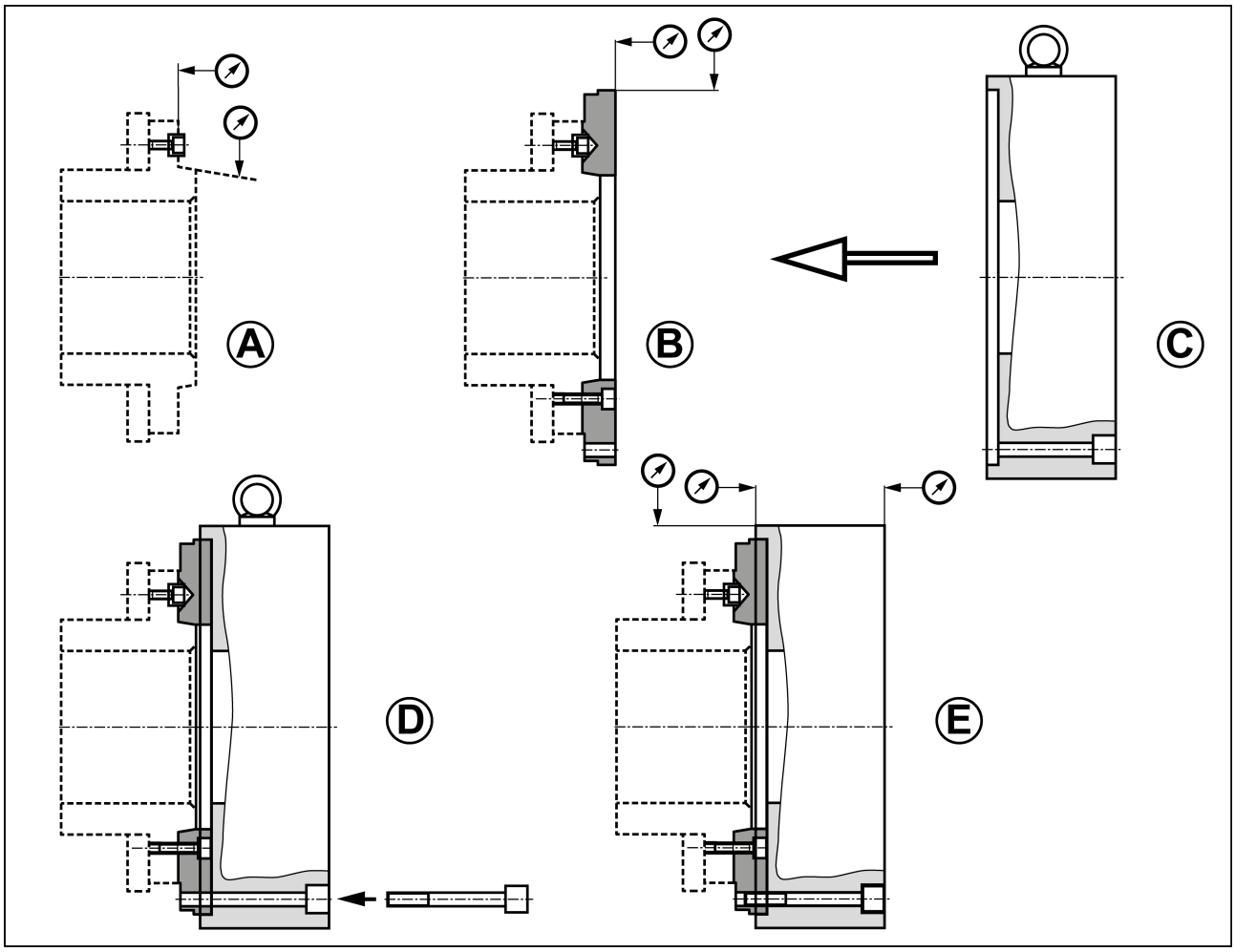
The chuck is mounted after the flange has been aligned. During this, it must be ensured that any contaminations on the flange and on the chuck contact surfaces are removed.

NOTICE

When mounting or removing the chuck, lift the chuck with a crane by using an eyebolt (Illustr. B). Be sure to remove the eye bolt from the chuck, before you start working or after you have mounted the chuck onto the machine. The eye bolt is in all deliveries from chuck size 210 and up included.

1. Push the chuck onto the intermediate flange. During this, it must be ensured that the through-holes for attaching the chuck coincide with the threaded holes of the flange (figure D).
2. Next, turn in the fastening screws and tighten them slightly.

3. Check the chuck for radial and axial run-out (figure E) and align with slight blows with a hammer on the outer diameter if necessary.
4. Next, screw the chuck tightly onto the chuck flange by means of the fastening screws using a torque wrench.
   During this, pay attention to the specified maximum tightening torques ▸ 4 [🗋 17].
5. Next, check the radial and axial run-out again.



Illustr. 3 – Mounting the chuck

⚠ WARNING

Risk of injury by falling down of the chuck when assembling with reduction and extension flange on vertically hanging spindle.

- Do not remove the mounting plate before screwing in the mounting screws of the chuck.

7.3.2 Mounting the chuck by means of a direct mount

When mounting the chuck by means of a direct mount with a through screw connection, the flange is first attached to the chuck and subsequently mounted on the spindle.Observe the following:Observe the following: Observe the following:

1. Before mounting the chuck flange on the cylindrical recess of the chuck, dirt and swarf must be removed from the centring mount and contact surface of the flange.
2. The flange must be slightly tightened on the chuck by means of the supplied screws and aligned towards the chuck body.
3. Next, the screws must be tightened with the specified torque ▶ 4 [🗋 17].
4. After mounting, it must be ensured that the flange is fitted tightly on the entire surface. Check radial and axial run-out.

After mounting the flange on the chuck, the chuck must be mounted on the machine spindle.During this, the following points must be observed: During this, the following points must be observed:

1. Push the chuck onto the intermediate flange. During this, it must be ensured that the through-holes for attaching the chuck coincide with the threaded holes of the flange (figure D).
2. Next, turn in the fastening screws and tighten them slightly.
3. Next, check the chuck for radial and axial run-out as described in figure E and then tighten the chuck on the chuck flange using the fastening screws and a torque wrench. During this, pay attention to the specified maximum tightening torques ▶ 4 [🗋 17].
4. Next, check the radial and axial run-out as described in figure E.

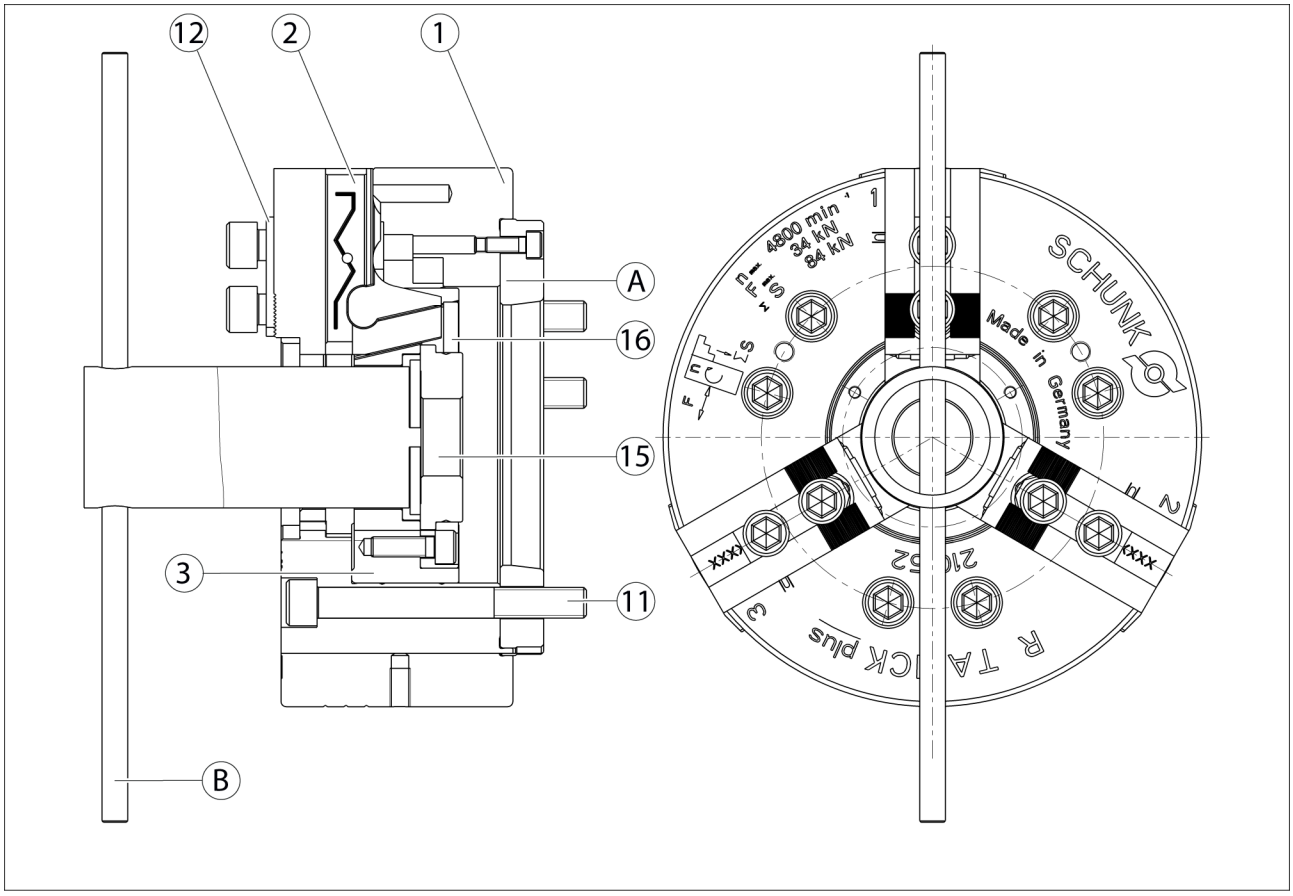
The target radial and axial run-out accuracies depend on the outer diameter of the chuck.The following table shows the maximum attainable radial and axial run-out tolerances: The following table shows the maximum attainable radial and axial run-out tolerances:

Chuck size [mm]	max. radial run-out error [mm]	max. axial run-out error [mm]
160	0,01	0,01
200	0,02	
250		
315	0,03	0,02

Chuck size [mm]	max. radial run-out error [mm]	max. axial run-out error [mm]
400		
500	0,05	0,04
630		
800	0,06	0,05
1000		

7.3.3 Mounting the ROTA NCKplus Chuck with straight recess mount

1. Remove the chuck from the packaging and check for damage and completeness.
2. Loosen the cap head screws on the top jaws. Remove the top jaws complete with the T-nuts (12).
3. Unscrew the cap head screws (10) and draw out the protection sleeve (4).



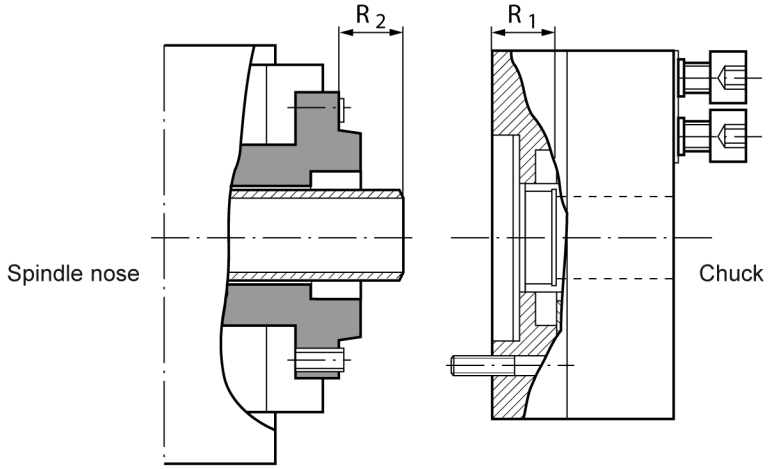
1	Chuck body	15	Draw nut
2	Base jaw	16	Retainer ring
3	Piston	A	Flange
11	Screws	B	Mounting wrench

12 T-nut

NOTE

The protection sleeve (4) can be pressed off the chuck body by using the additional threads with the same screws (10).

1. Push the tension rod into its foremost position.
2. Push the chuck piston (3) into its foremost position.



Cylinder piston in foremost position

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

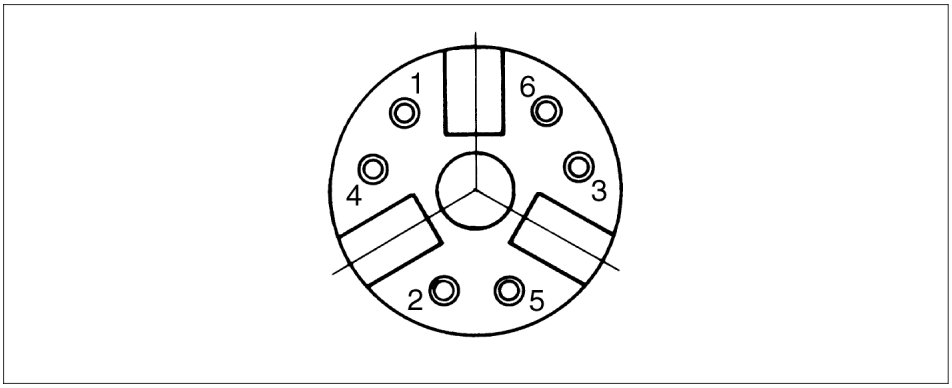
R2 = R1 – 0.5 mm (max. – 1 mm)

1. Use an assembly belt or a lifting eye bolt to hold the chuck in alignment with the centre of the spindle in front of the spindle nose.
2. Using the supplied mounting key, screw the rotatable threaded bushing in the chuck (Pos.
3. Secure the chuck fixing screws (11) crosswise.
4. Put the protection sleeve (4) and secure firmly with the cap head screws (10).
5. Check the concentricity and face runout at the control rim ▶ 7.1 [🗋 27].
6. Check the function and the size of the operating force.
7. Check that the base jaws run smoothly and that the jaw stroke is correct.
8. Mount the top jaws firmly on the base jaws with the T-nuts (12) and screws according to the markings 1, 2 and 3.

Dismounting of the spindle is carried out in reverse order.

NOTE

When changing the protection sleeve, the chuck mechanics opens, preventing the in gress of chips into this mechanics. If no protection sleeve should be mounted onto the chuck, the chuck shouldn't be actuated, or the chuck piston shouldn't move! Never grasp into the uncovered chuck mechanics!



Bolt tightening steps.

8 Function

The item numbers specified for the corresponding individual components relate to chapter drawings.▶ 11 [🗋 40]

8.1 Function and handling

Wedge-hook chucks are actuated using rotating closed-center or open-center hydraulic cylinders or via a static hydraulic cylinder. The axial tensile and pressure forces are converted to the radial jaw clamping force by the wedge hook angle in the piston and base jaws.

The clamping and opening path of the chuck jaws is determined by the hydraulic cylinder. The fine serration of the base jaws can be used to mount standard jaws as well as special jaws for complicated workpiece shapes. The top jaws are moved or changed in the open clamping position.

⚠ WARNING

Clamping further above the chuck surface results in lower clamping force.

If the workpiece is released in an uncontrolled manner, there is a risk of personal injury and damage to the system.

- Refer to the "Technical data" chapter!

8.2 Replacement or renewal of jaws

Clamping jaws for maximum clamping repeat accuracy have to be bored out or ground out in the clamping chuck under clamping pressure.

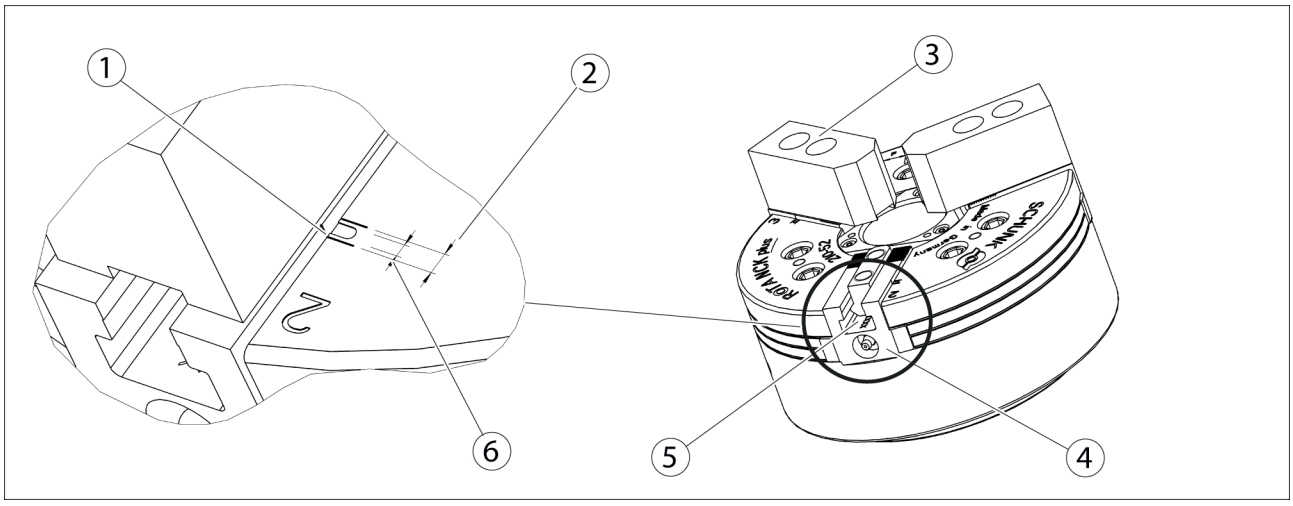
NOTE

During boring or grinding out, be sure that the turning ring or the turning pins from the top jaws are clamped and not those from the base jaws.

Tighten the jaw mounting screws (screw grade 12.9) with the specified torque ▶ 4 [🗋 17].

NOTE

- Tighten the jaw fastening screws with a dynamometric key. Never carry out this work by using an extension rod or by applying hammer blows.



Check the base line mark of master jaw is within the range of the whole stroke.

NOTICE

Make sure that the workpiece is clamped in half of the base jaw throw.

Avoid clamping the workpiece at the end. It might cause the dissloving of the workpiece.

8.3 Disassembly and assembly of the Chuck

NOTE

The power chuck may only be dis assembled in unmounted con dition. Mounting of the chuck to the machine spindle.

1. Loosen screws (10) and remove the protection sleeve (4).
2. Pull the piston (3) out out of the chuck body (1).
3. Push the base jaws (2) inwardly out of the base jaw guide.

NOTE

When assembling the base jaws, ensure that the number on the base jaw is identical to the numbering on the jaw guide.

Clean all parts of dirt and grease and check for damage. Before mounting, grease well with lubricant LINO MAX.

Only use SCHUNK original spares when replacing damaged parts.

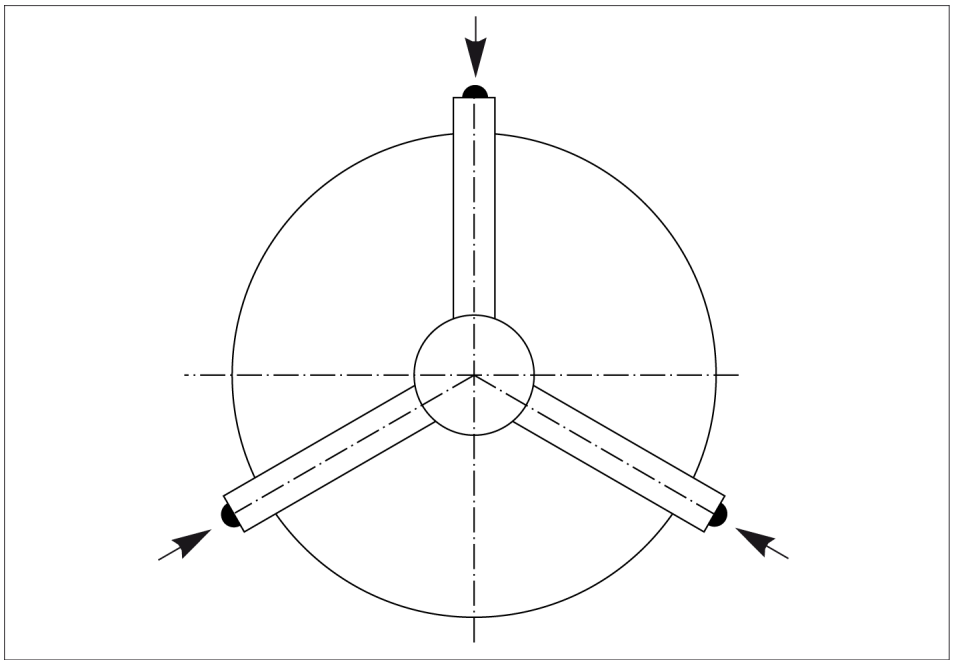
Mounting of the chuck follows in reverse order.

9 Maintenance

9.1 Lubrication

To maintain the safe function and high quality of the power chuck it is important to lubricate it regularly at the grease nipples of the base jaws.

For optimum grease distribution, the clamping piston must travel the entire clamping stroke several times after lubrication.



Operating Conditions

Depending on operating conditions, check the function and the clamping force after a certain time of operation ▶ 9.3 [🗋 38]. Clamping force can be measured by using a Grip Force Tester (SCHUNK SGT 270).

Technical Condition

The base jaws must move evenly at the smallest possible operating pressure (cylinder). This method is only to some extend expressive and cannot replace clamping force measurement.

If clamping force has dropped too low, or if base jaws and piston cannot be moved perfectly, it is necessary to disassemble the chuck to clean it and to relubricate it.

Only use SCHUNK original spares when replacing damaged parts.

9.2 Changing the top jaws

When changing the top jaws the serration must be cleaned and greased with SCHUNK special grease LINO MAX.

⚠ WARNING

Danger of personal injury and property damage caused by flying parts in case of spiral fracture of soft top jaws!

Soft top jaws must be hardened in the area of the screw's counterbore.

Just deep hardened no surface hardening.

9.3 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

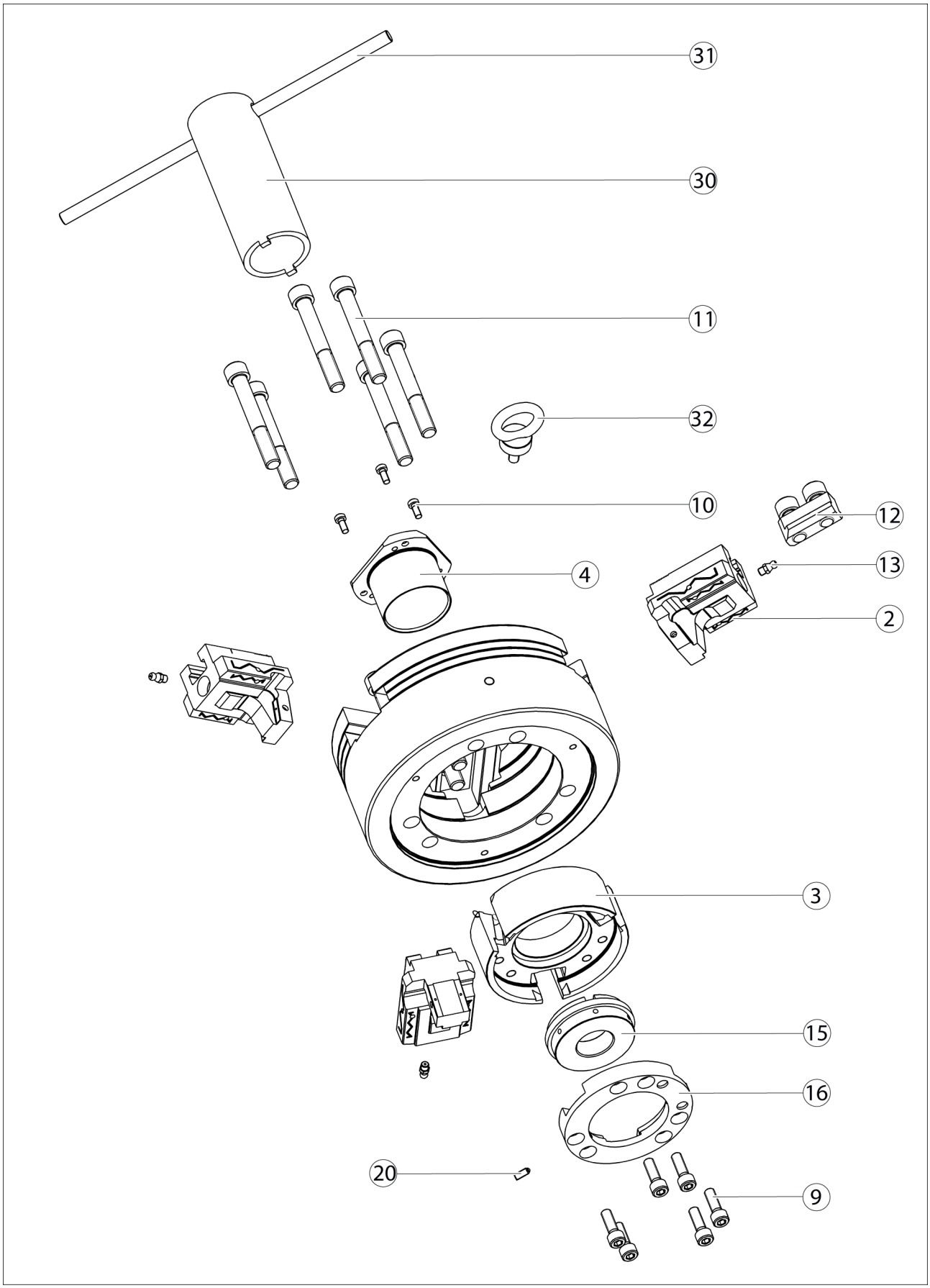
10 Disposal

After decommissioning, place the chuck in a position that enables any liquids in the chuck to drain out.

- Collect the escaping liquids and dispose of them properly in line with the statutory provisions.
- Remove any identifiable plastic or aluminum parts installed in or on the chuck and dispose of them properly in line with the statutory provisions.
- Dispose of the chuck's metal parts as scrap metal.

Alternatively, you can return the chuck to SCHUNK for proper disposal.

11 Assembly drawing



12 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	Designation	Quantity
1	Chuck body	1
2	Base jaws	3
3	Piston	1
4	Protection sleeve	1
9	Screws	3
10	Screws	3
11	Screws	6
12	T-nut	3
13	Grease nipple	3
15	draw nut	1
16	Retainer ring	1
20	Spring clamping element	1
30	Mounting wrench	1
31	Locking bolt	1
32	Eye bolt	1

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02.00 | ROTA NCK plus | Power Chuck | en | 0889048-en

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

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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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