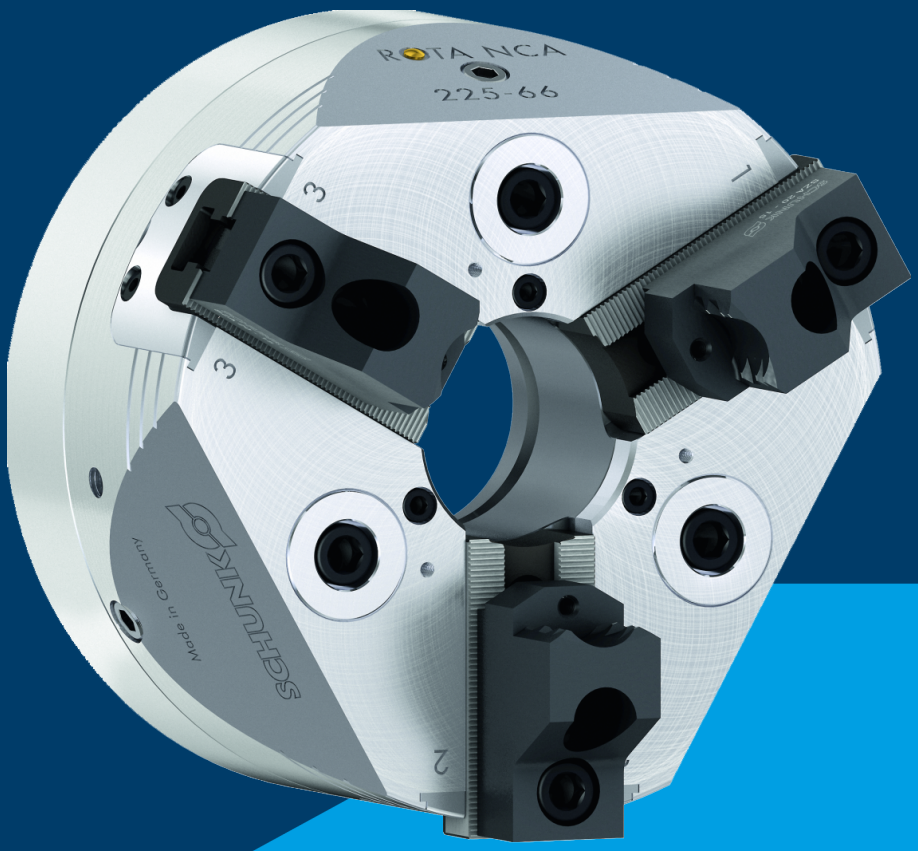


Power Lathe Chuck
ROTA NCA
Assembly and Operating Manual

Hand in hand for tomorrow

Imprint

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

Document number: 1155400

Version: 04.00 | 27/05/2025 | en

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
Tel. +49-7572-7614-1300
Fax +49-7572-7614-1039
cmm@de.schunk.com

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

Table of Contents

1 General

1.1 About this manual

This manual contains important information for 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
- Brief operating instructions if available
- Approval drawings

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

1.1.3 Sizes

This operating manual applies to the following sizes:

- ROTA NCA 160-32
- ROTA NCA 200-52
- ROTA NCA 225-66
- ROTA NCA 280-86
- ROTA NCA 330-104

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 ▸ 6.2 [🗋 34]

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 in the version ordered
3	Mounting screws
6	T-nuts with screws or 3 combination T-nuts
1	Assembly key (from size 280)
1	Eye bolt
1	Assembly and Operating Manual

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 or damage. 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).

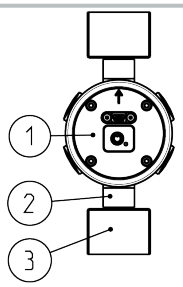
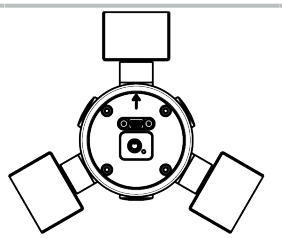
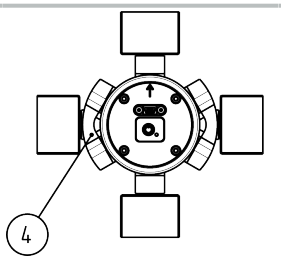
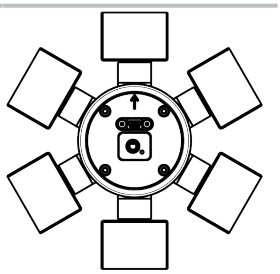
Maintenance instructions

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 NCA	160	200	225	280	330
Max. actuating force [kN] *	20	32	45	63	72
Max. clamping force [kN]	45	72	100	140	160
Max. speed [rpm]	5500	5000	5000	4000	3500
Stroke per jaw [mm]	4	5.3	5.3	5.3	5.3
Piston stroke [mm]	15	20	20	20	20
Chuck through bore [mm]	32	52	66	86	104
Weight [kg]	11.5	19.6	29	42	62.8
Centrifugal torque of base jaw [kgm] M_{cGB}	0.039	0.089	0.153	0.348	0.478
Operating temperature [°C]	15 to 60				

* For I.D. clamping, the maximum actuating force must be reduced by 30%.

The maximum RPM stated is only valid with the maximum clamping force and when using the hard standard chuck jaws that go with the chuck.

The maximum permissible RPM for the specific 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 determined by means of calculation for the respective machining job. In this, however, the recommended maximum speed must not be exceeded. The calculated values must be checked by dynamic measurement. Function monitoring (piston movement and actuating pressure) must be performed in accordance with the guidelines of the Berufsgenossenschaft (employers' mutual insurance association).

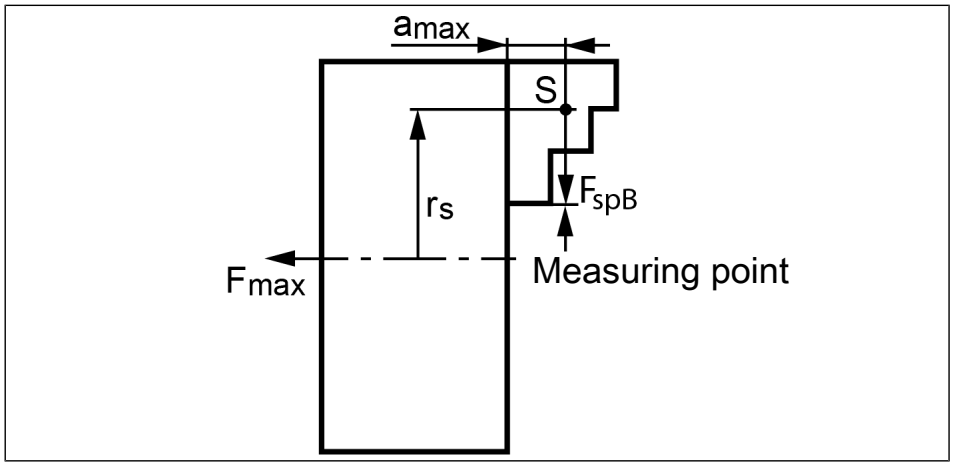
3.2 Clamping force-RPM diagrams

Clamping force/RPM curves have been calculated using the corresponding standard top jaws (stepped jaws and monoblock 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 .

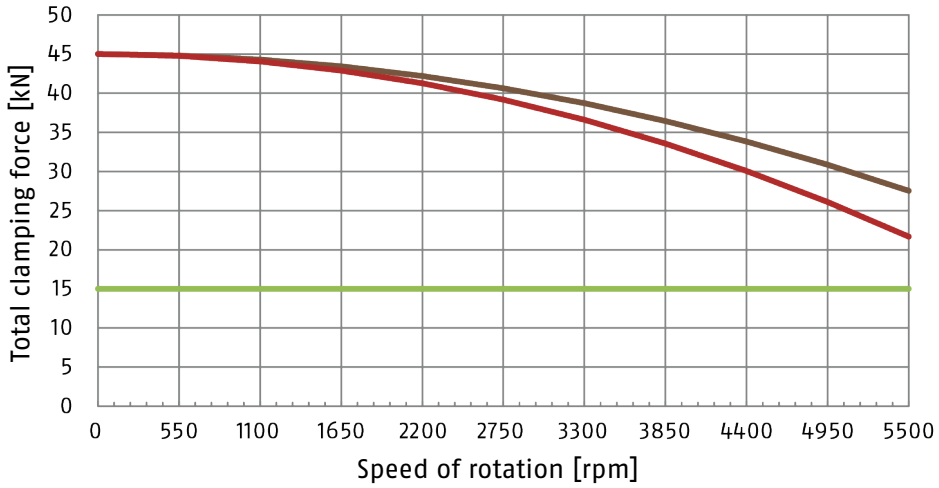
If one or more of these prerequisites is altered, the diagrams will no longer be valid.

Chuck setup for clamping force/RPM diagram



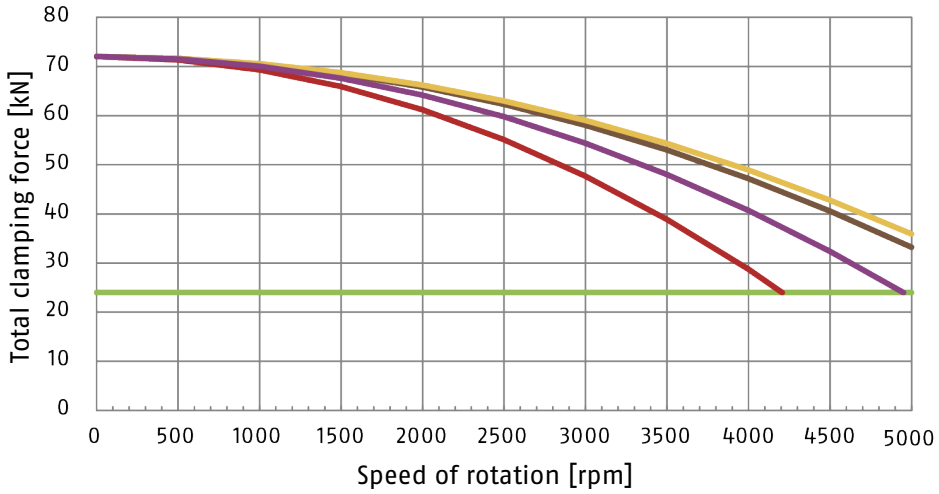
F_{spB}	Clamping force per jaw	S	Center of gravity
r_s	Center of gravity radius	a_{max}	Max. jaw center of gravity eccentricity in axial direction
F_{max}	Max. actuating force		

Clamping force/RPM graph for ROTA NCA 160-32



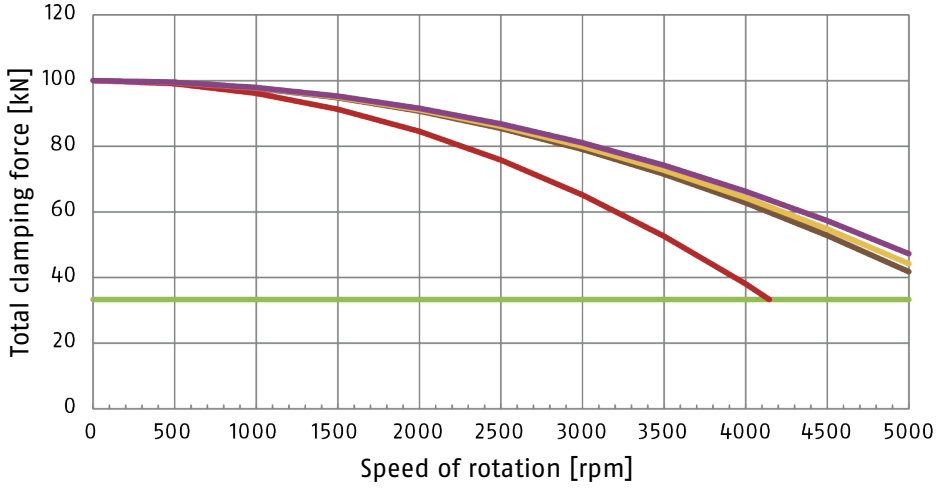
Color	Jaw ID	Weight [kg]
	SHB-FR 130	0.4
	SWB-FR 130	0.6
	minimum required clamping force 33%	

Clamping force/RPM graph for ROTA NCA 200-52



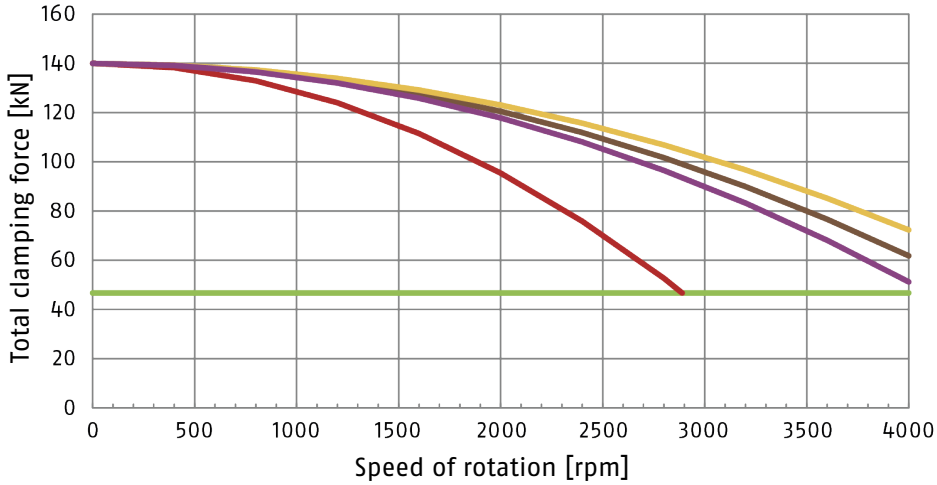
Color	Jaw ID	Weight [kg]
	SHB 165	1.3
	SWB 165	2.5
	SHB-J 60	0.8
	KM-WB 66	1.4
	minimum required clamping force 33%	

Clamping force/RPM graph for ROTA NCA 225-66



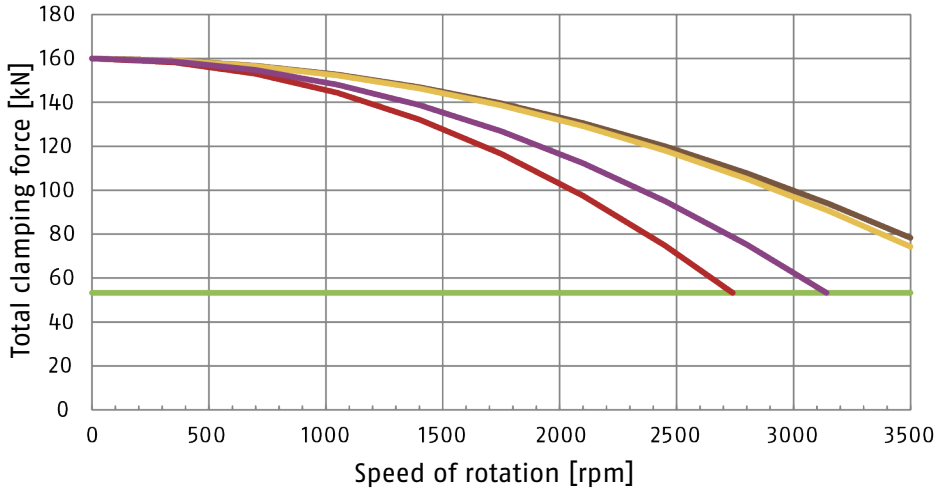
Color	Jaw ID	Weight [kg]
	SHB 210	2.0
	SWB 200	4.1
	SHB-J 80	1.85
	KM-WB 88	2.7
	minimum required clamping force 33%	

Clamping force/RPM graph for ROTA NCA 280-89



Color	Jaw ID	Weight [kg]
	SHB 250	3.5
	SWB 250	9.4
	SHB-J 100	2.8
	KM-WB 110	3.8
	minimum required clamping force 33%	

Clamping force/RPM graph for ROTA NCA 330-104



Color	Jaw ID	Weight [kg]
	SHB 250	3.5
	SWB 250	9.4
	SHB-J 126	5.15
	KM-WB 126	7.8
	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 of rotation [RPM]
F_{sp0}	Initial clamping force [N]	r_s	Center of gravity radius [mm]
F_{spz}	Cutting force [N]	r_{sAB}	Center of gravity radius of top jaw [mm]
m_{AB}	Mass of one top jaw [kg]	s_{sp}	Safety factor for clamping force
m_B	Mass of chuck jaw set [kg]	s_z	Safety factor for machining
M_c	Centrifugal torque [kgm]	Σ_s	Max. clamping force of lathe chuck [N]

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}**.

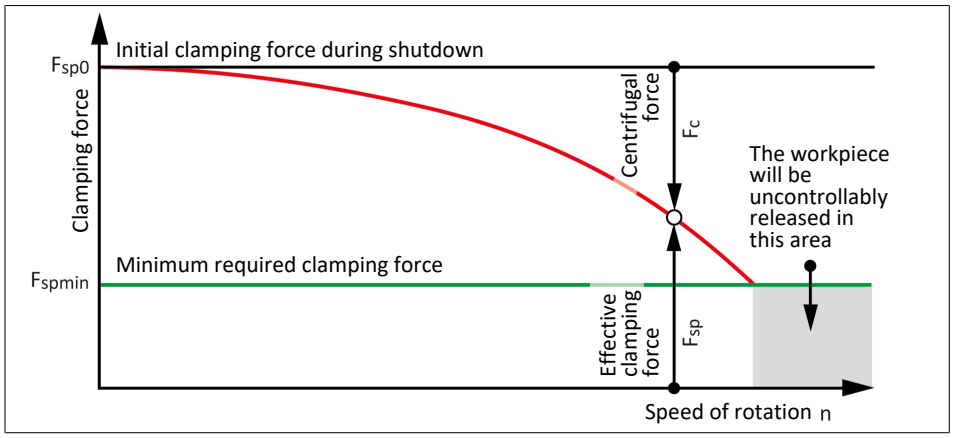
$$F_{sp} = F_{sp0} \mp F_c \text{ [N]}$$

(–) 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:

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**

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 NCA in ungreased state without T-nuts and 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 1550 6.2 e). 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 7/16"	M12 1/2"	M14	M16 5/8"	M18	M20 3/4"	M22 7/8"	M24 1"	M27	M30
Tightening torques 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	M4	M5	M6	M8
Tightening torques M_A (Nm)	3.2	7.5	13	28

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.

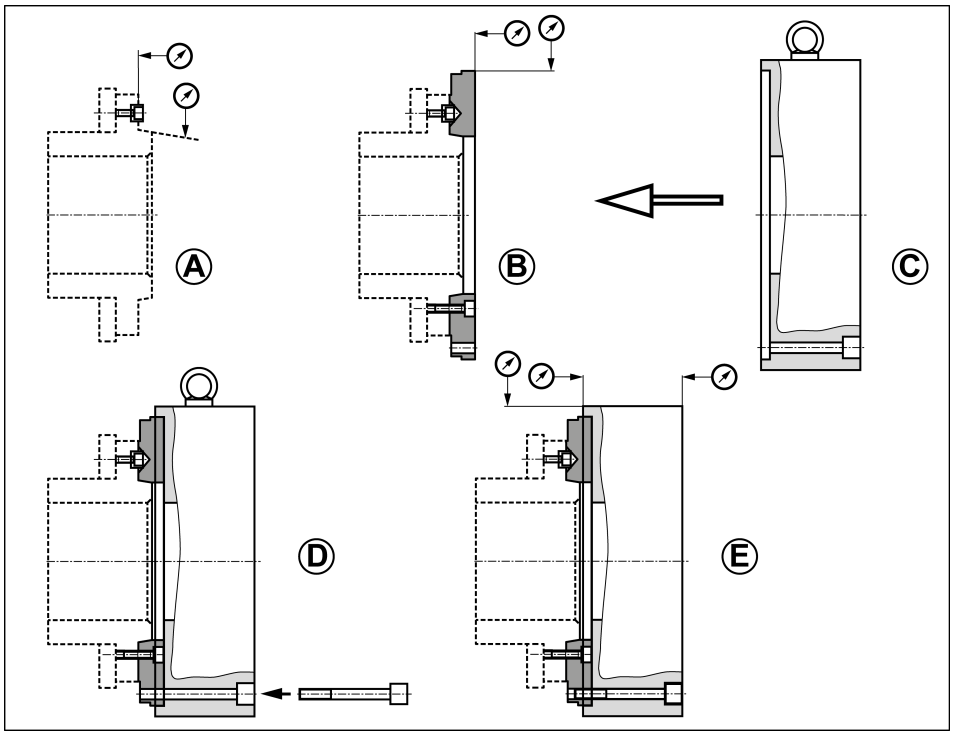
A maximum concentricity error of 0.01 mm should be ensured for the centring of the mount and a maximum axial run-out error of 0.01 mm for the contact surfaces. In addition, the flat surface must be checked for evenness using a straight edge (flat surface deburred and clean at the bore holes).

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 Chuck assembly

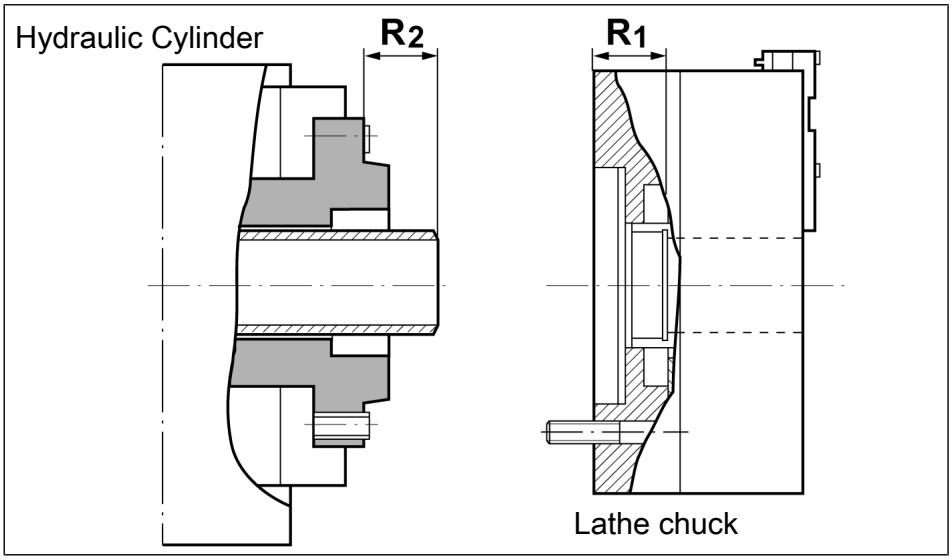
NOTE
If the mount of the machine spindle and the lathe chuck are identical, chuck assembly takes place without assembly preparation.
If the mount of the machine spindle deviates from the mount of the lathe chuck, a connecting flange must be affixed before the chuck is assembled.

NOTICE

Use a crane to install the chuck. The chuck can be fastened to the eye bolt provided (see Fig. "Chuck assembly" - C).
The eye bolt must be removed prior to starting up.
The eye bolt is included in the scope of delivery.

Chuck assembly

1. Remove the cylindrical screws (item 27) for the top jaws together with the T-nuts (item 26).
2. Move the draw tube to the frontmost position.
   Piston in foremost position R1 = press chuck piston in foremost position
   and measure with depth gauge R2 = R1 – 0.1 mm (max. – 0.3 mm)
   It must be ensured that the piston can be brought into the foremost (jaw change) position. To do this, ensure that the dimensions for the attachment are complied with.



3. Push the chuck piston (item 3) to the frontmost position (chuck open).
4. Lift the lathe chuck flush to the center of the spindle.
5. Screw the rotating center sleeve (item 6) in the chuck onto the draw tube using the enclosed assembly key as far as this will go. Chuck without rotatable center sleeve must be bolted onto the draw tube/pull rod.

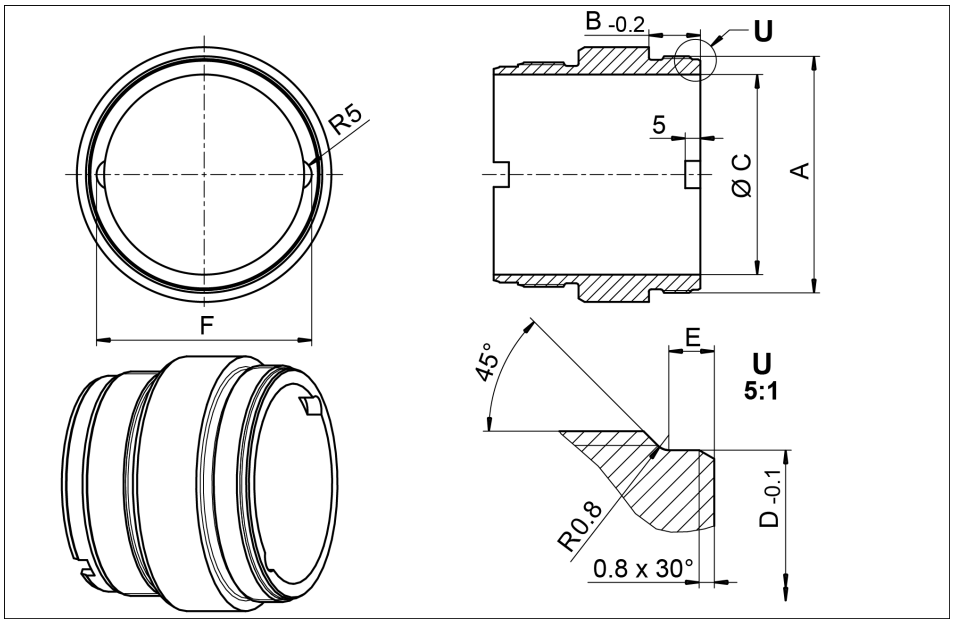
6. Insert and slightly tighten the mounting screws (item 10).
7. Check the chuck for concentricity and axial run-out accuracy (see Fig. "Chuck assembly" – E) and, if necessary, align at the outer diameter with gentle taps using a hammer.
8. Tighten the fastening screws (item 10) with a torque wrench, ▸ 4.1 [🗋 26].
9. Check the chuck again for concentricity and axial run-out accuracy (see Fig. "Chuck assembly" – E). The "Concentricity and axial run-out tolerances" table shows the concentricities and axial run-out accuracies to be achieved.
10. Check the actuating force is functioning and is sufficient.
11. Check the jaw stroke of the base jaws. (Item 2) Fasten the top jaws marked 1, 2 and 3 to the base jaws using T-nuts (item 27) and screws (item 26).

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

4.4 Connection thread draw tube

The chuck and draw tube are connected via a thread. The following requirements must be met on the draw tube side. If they cannot be attached directly to the draw tube, an adapter must be used.

Size	A	B	C	D	E	F	O-ring
NCA 160-32	M38 x 1.5	15	32	36	2.4	28	38 x 1.5
NCA 200-53	M67 x 1.5	15	52	65	2.4	58	66 x 2
NCA 225-66	M74 x 1.5	14.5	66	72	2.4	70	72 x 2
NCA 280-86	M94 x 1.5	20	86	91	2.4	89	93 x 2
NCA 330-104	M115 x 2	22.5	104	110	3.2	107	110 x 3



5 Function

5.1 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!

5.2 Functional testing

Functional test

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

Two important points are:

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

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

Speed of rotation

⚠ DANGER

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

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

5.3 Replacement or renewal of jaws

For maximum clamping repeat accuracy, the chuck jaws must be turned or ground in the lathe chuck under clamping pressure.

NOTICE

When turning or grinding, ensure that the turning ring or turning pin is clamped by the top jaws and not by the base jaws.

Tighten the jaw mounting screws (screw grade 12.9) to the specified torque ▸ 4.1 [🗋 26].

NOTICE

Tighten the mounting screws of the top jaws with a torque wrench.

NOTICE

Make sure that the workpiece is clamped halfway up the base jaw stroke.

The workpiece must not be clamped at the end of the base jaw stroke. This can lead to the workpiece becoming loose.

⚠ WARNING

Risk of personal injury and property damage due to parts flying off in the event of a screw breakage on unhardened top jaws!

Soft standard top jaws must be hardened in the countersink region.

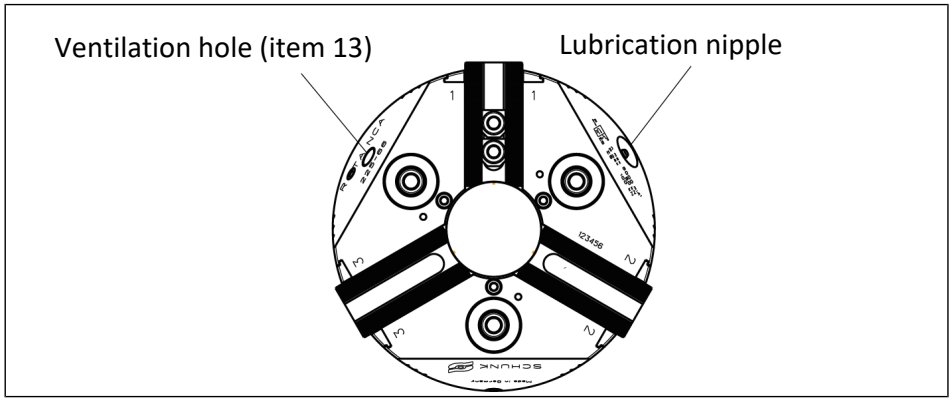
They should only be depth-hardened, not surface-hardened.

Changing the top jaws

When changing the top jaws, the serration has to be cleaned and lightly greased with SCHUNK LINOMAX plus special grease.

6 Maintenance

6.1 Lubrication



Greasing areas

To maintain the safe function and high quality of the lathe chuck, it has to be regularly lubricated at the lubrication nipples in the chuck body.

The chuck must be lubricated in the open position.

Select the position with the chuck set up horizontally when lubricating so that the lubricating nipple and the ventilation hole are at 60° to the horizontal.

When lubricating a vertical or hanging chuck, the upper ventilation hole must be opened.

When lubricating, press the grease gun until grease is pushed out on the 120° offset upper ventilation hole.

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

⚠ CAUTION

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

- Wear protective gloves.

Operating conditions

Depending on the operating conditions, the function and clamping force must be checked after a specific period of operation (▸ 6.2 [🗋 34]). Only use a calibrated clamping force tester for the clamping force test (SCHUNK IFT).

Technical condition

With the smallest possible actuating pressure (clamping cylinder), the base jaws should move evenly. This method only provides a limited indication and is not a substitute for measuring the clamping force. If the clamping force has dropped too much or if the base jaws and piston no longer move properly, the chuck has to be disassembled, cleaned, and relubricated.

Only use genuine SCHUNK spare parts when replacing damaged parts.

6.2 Maintenance intervals

Lubricating the greasing areas:

Lubrication interval	Demands
every 30 days or after 50,000 clamping cycles	normal / use of coolant
every 10 days or after 15,000 clamping cycles	high / use of coolant
after one year or after 250,000 clamping cycles	Full cleaning with disassembly of chuck depending on type of contamination and quantity

6.3 Disassembling and assembling the chuck

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

The chuck can only be disassembled once it has been removed, ▸ 4 [🗋 26].

1. Remove the screws (item 10).
2. Remove screws (item 27), T-nuts (item 26) and top jaws.
3. Unscrew screws (item 11).
4. Mark the position of the mount (item 7) in relation to the chuck body (item 1).
5. Undo the screws (item 14) several thread turns and hammer gently on the screw heads using a rubber mallet. In so doing, the chuck must be in a horizontal position. This allows the mount (item 7) to be released from the centering for the chuck body (item 1). Remove screws (item 14), the pin (item 29) and sealing rings (item 15, 16, 18 & 23).
6. Pull piston (item 3) out of the chuck body (item 1) or lever out with an aluminum arbor using light knocks on the surface of the chuck. Remove sealing ring (item 17).
7. Remove bolts (item 12) and remove center sleeve (item 4) to the rear from the chuck body (item 1). Remove sealing ring (item 19 & 21).
8. Remove the screws (item 28).
9. Slide the base jaws (item 2) over the cover (item 5) to the chuck center. Lift the seal (item 20) out of the groove above the base jaw (item 2) and remove the axial cover (item 5) upwards out of the chuck body (item 1). Remove seal (item 22).

10. Lift seal (item 20) as before over the base jaw (item 2) and remove the base jaw (item 2) outwards out of the chuck body.
11. The sleeves (items 6 & 8) may not be removed.
12. Remove the screws (item 13).

Degrease and clean all parts and check them for damage. Before assembly, grease well with LINOMAX plus.

Only use genuine SCHUNK spare parts when replacing damaged parts.

1. When inserting the base jaw (item 2), make sure that the base jaw is not pushed too far inwards. In doing so, the seal (item 20) may become damaged.
2. When introducing the cover (item 5), make sure that the seal (item 22) is not damaged.

The chuck is assembled in the same way, but in reverse order. The following must be considered here!

NOTICE

When assembling the base jaws, make sure that the numbers on the base jaws match the numbers on the jaw guides.

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 Seal kit and part lists

8.1 Sealing Kit List

Sealing kit*	ID
ROTA NCA 160	1352529
ROTA NCA 220	1352530
ROTA NCA 225	1352531
ROTA NCA 280	1352532
ROTA NCA 330	1352533

* For included items, see note **X** in the Parts List chapter below. Seals are wearing parts and are recommended to be replaced during maintenance. The sealing kit can only be ordered as a complete kit.

8.2 Parts Lists

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.**

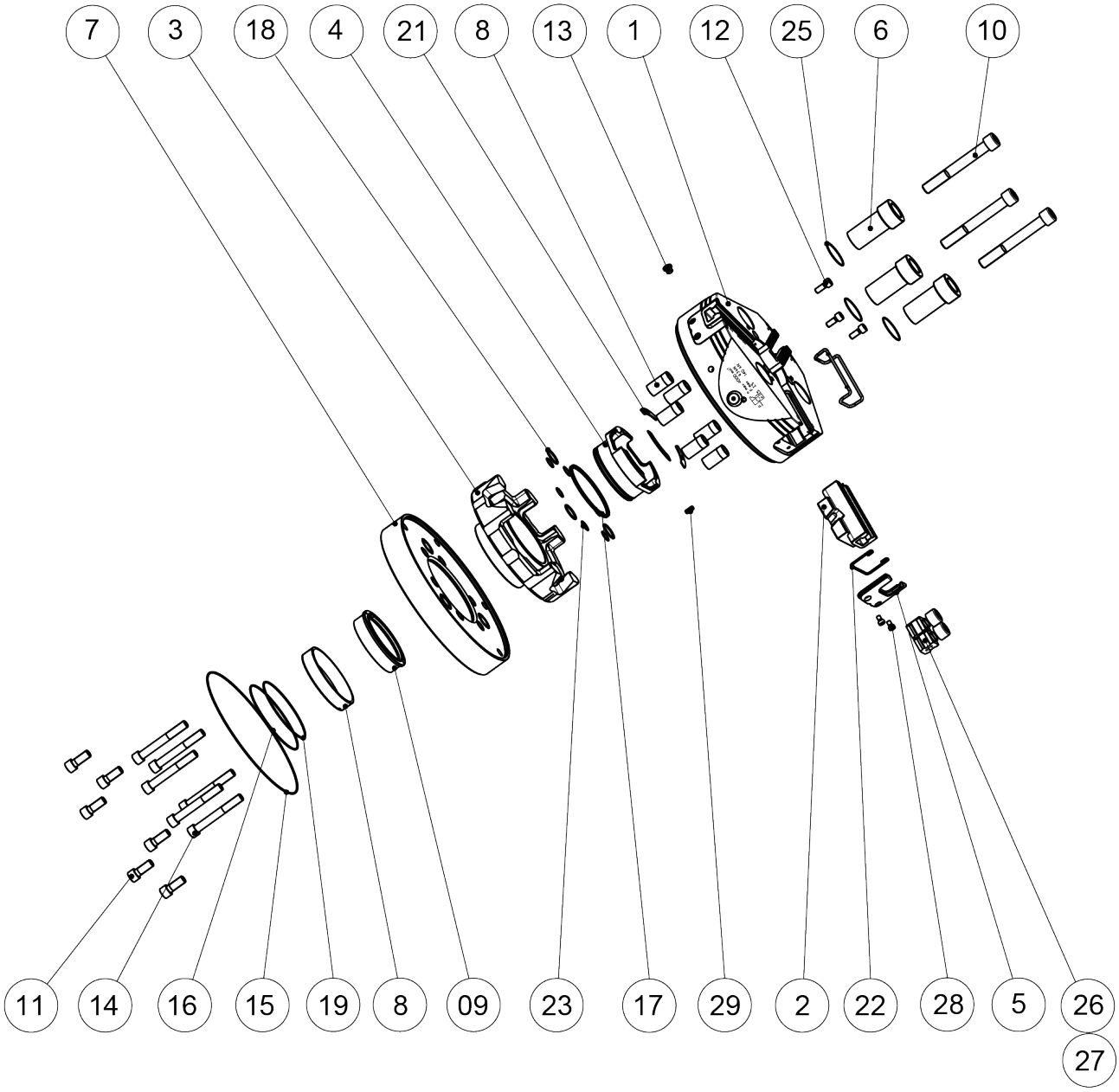
Item	Description	Quantity	Note
1	Chuck body	1	
2	Base jaw	3	
3	Piston	1	
4	Protection sleeve	1	
5	Cover	3	
6	Sleeve	3	*
7	Mount	1	
8	Sleeve	6	* 200 / 225 / 280 / 330
	Retainer ring	1	280 / 330
9	Center sleeve	1	280 / 330
10	Screw 10.9	3	
11	Screw 10.9	6	
12	Screw 10.9	3	
13	Locking screw	2	**X**
14	Screw 10.9	6	200 / 225 / 280 / 330
15	O-ring	1	**X**
16	O-ring	1	**X**
17	O-ring	1	**X**

Item	Description	Quantity	Note
18	O-ring	3	**X**
19	X-ring	1	**X**
20	Seal	3	**X**
21	Flat gasket	3	**X** / 160 / 225 / 280 / 330
	Seal	3	**X** / 200
22	Seal	3	**X** / 160 / 225 / 280 / 330
	Flat gasket	3	**X** / 200
23	O-ring	6	**X** / 200 / 225 / 280 / 330
24	Eye bolt	1	
25	O-ring	3	* 160 / 200 / 225 / 280
26	T-nut	3	160 / 200 / 225
	T-nut	6	280 / 330
28	Screw	6	
29	Dowel pin	1	
31	O-ring	1	280 / 330
35	Lubrication nipple	1	

Parts list key			
X	included in the sealing kit	225	for size 225
150	for size 150	280	for size 280
200	for size 200	330	for size 330

* positions are fixed and cannot be removed.

9 Drawing



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

Signature: see original declaration

p.p. Philipp Schräder
Head of Development standard products

Signature: see original declaration

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

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