

Power Chuck

ROTA NCD

Assembly and operating manual

Imprint

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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.

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1 General

1.1 About this manual

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

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

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

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

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

1.1.1 Illustration of warnings

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



⚠ DANGER

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



⚠ WARNING

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



⚠ CAUTION

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

NOTICE

Information about avoiding material damage.

1.1.2 Applicable documents

- General Terms and Conditions *
- Calculation of the jaw centrifugal forces and jaw guidance load, in the "Technology" chapter of the lathe chuck catalog * and the "Calculating the clamping force and RPM" chapter
- Brief operating instructions if available
- Approval drawings

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

1.2 Warranty

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

- Observe the applicable documents, ▶ [1.1.2 \[6\]](#)
- Observance of the ambient conditions and operating conditions, ▶ [2.5 \[8\]](#)
- Observance of the specified maintenance and lubrication intervals ▶ [6.2 \[34\]](#)

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

- Power lathe chuck in the version ordered
- Mounting screws
- 3 Combi T-nuts (up to size 165)
- 6 T-nuts (from size 210)
- 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).

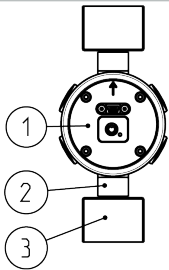
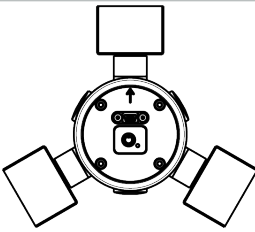
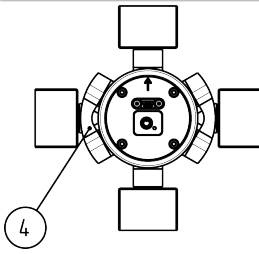
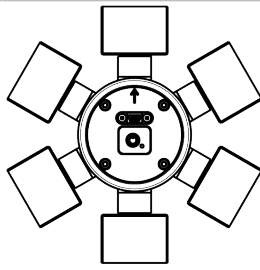
Maintenance instructions

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	Operating manual SCHUNK IFT Clamping force tester
			Attention Compensation must be activated, otherwise it may lead to inconsistent results.	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 as 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 NCD	132	165	185	215	255	315	400	500	630
Max. actuating force [kN]	25	35	45	50	70	90	120	120	120
Max. clamping force [kN]	45	70	90	110	160	180	240	240	240
Max. speed of rotation [rpm]	7500	7000	6000	6000	5000	4200	3200	2800	1800
Stroke/jaw [mm]	3	3.7	4.5	4.5	5.7	5.8	7.5	7.5	7.5
Piston stroke [mm]	14	17	20	20	25	25	33	33	33
Chuck bore [mm]	32	46	54	66	86	115	165	165	165
Centrifugal force of the base jaw M_{cGB} [kgm]	0.009	0.019	0.029	0.051	0.104	0.124	0.319	0.569	0.962
Max. jaw eccentricity of center of gravity in axial direction a_{max} [mm]	20	24	24	30	40	34	40	40	40

The recommended max. r.p.m. is only valid for max. operating force and the use of the suitable hard standard stepped jaws Type SHB.

When using unhardened top jaws or jaws in special design, make sure that their weight is as low as possible. 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.

3.2 Clamping force / speed diagrams

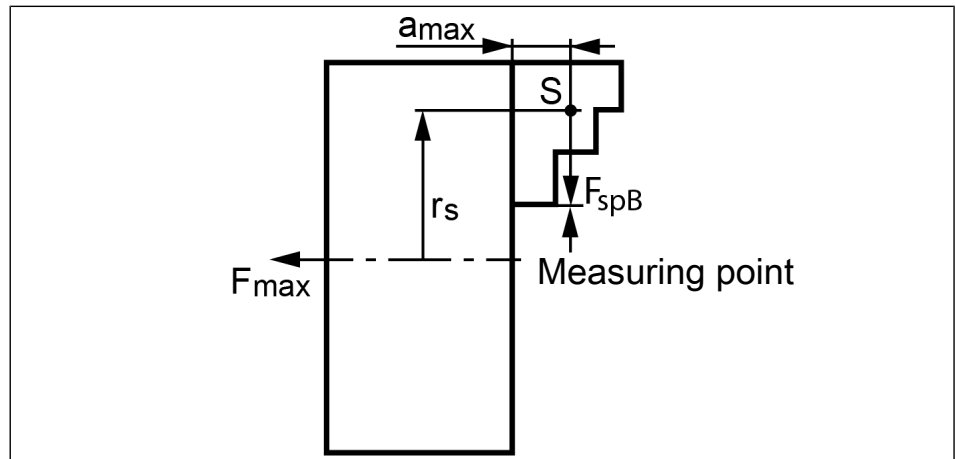
The diagrams refer to 3-jaw-chuck.

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 .

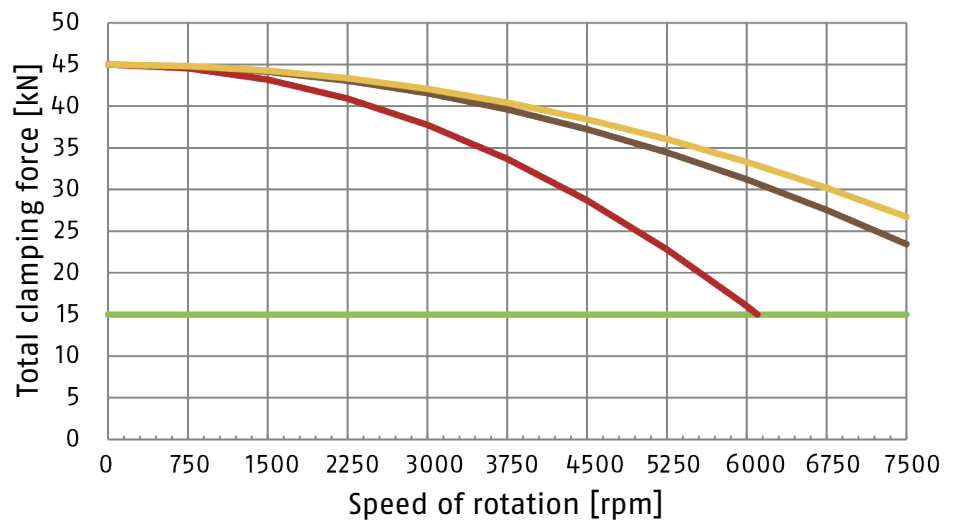
If one or more of these prerequisites is altered, the diagrams will no longer be valid.

Chuck setup for clamping force/RPM diagram



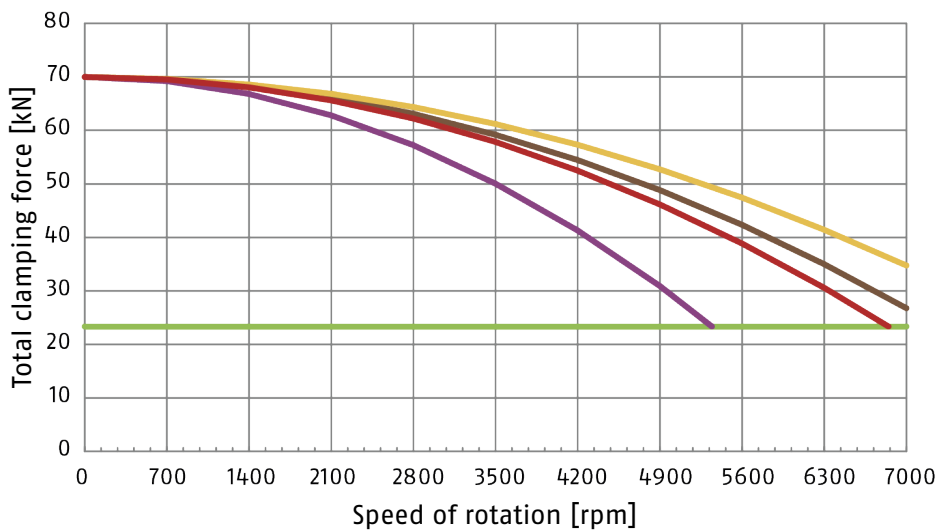
F_{spB}	Clamping force per jaw	S	Center of gravity
r_s	Center of gravity radius	a_{max}	Max. jaw center of gravity eccentricity in axial direction
F_{max}	Max. actuating force		

Clamping force / speed diagrams ROTA NCD 132-32



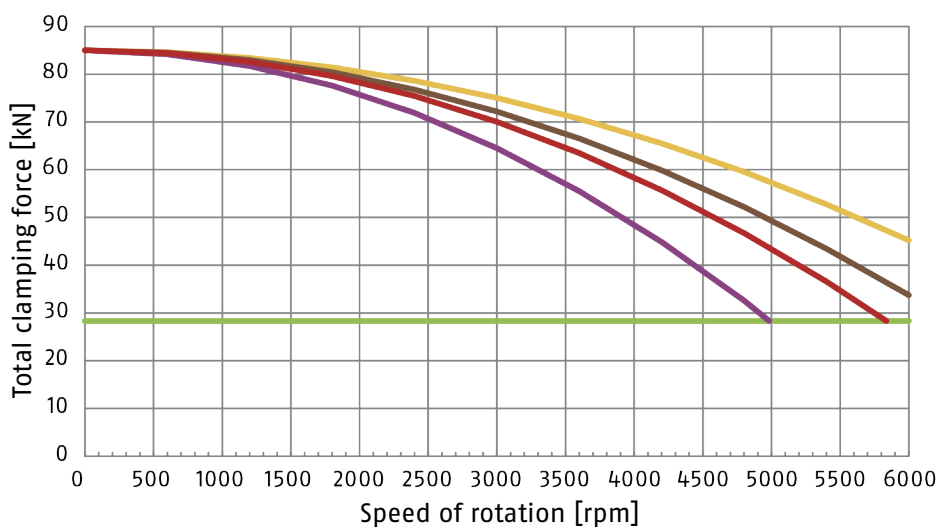
Colour	Jaw ID	Weight [kg]
	FR-AL 130	0.4
	SHB-FR 130	0.4
	SWB-FR 132	1.0
	Minimum required clamping force 33%	

Clamping force / speed diagrams ROTA NCD 165-46



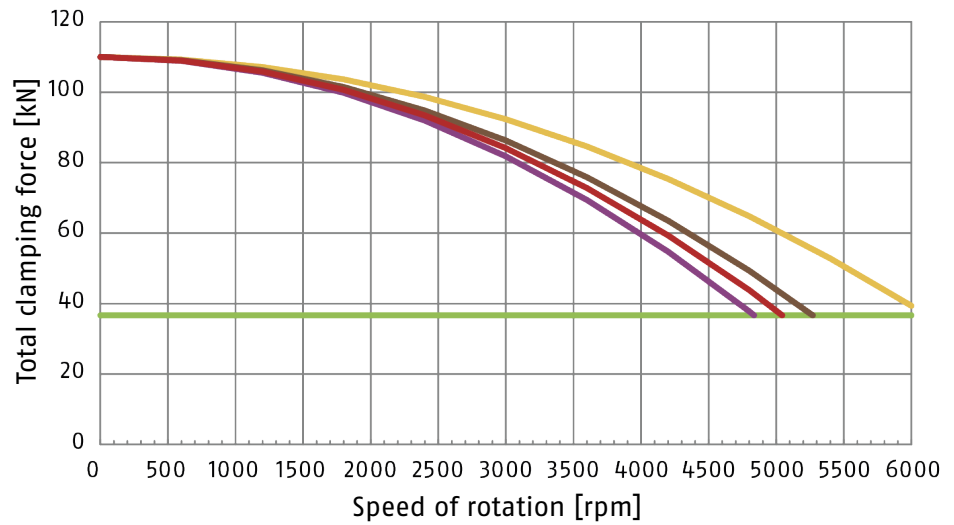
Colour	Jaw ID	Weight [kg]
	SHB-J 60	0.8
	SHB 130	0.7
	KM-WB 66	1.4
	SWB-FR 161	1.8
	Minimum required clamping force 33%	

Clamping force / speed diagrams ROTA NCD 185-54



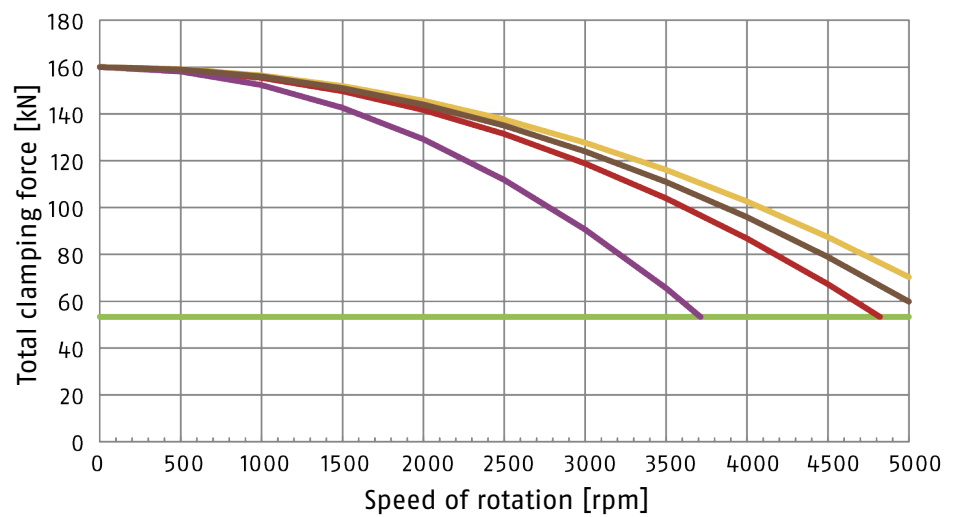
Colour	Jaw ID	Weight [kg]
	SHB 175	1.2
	SHB-J 60	0.8
	KM-WB 66	1.4
	SWB 160	3.1
	Minimum required clamping force 33%	

Clamping force / speed diagrams ROTA NCD 215-66



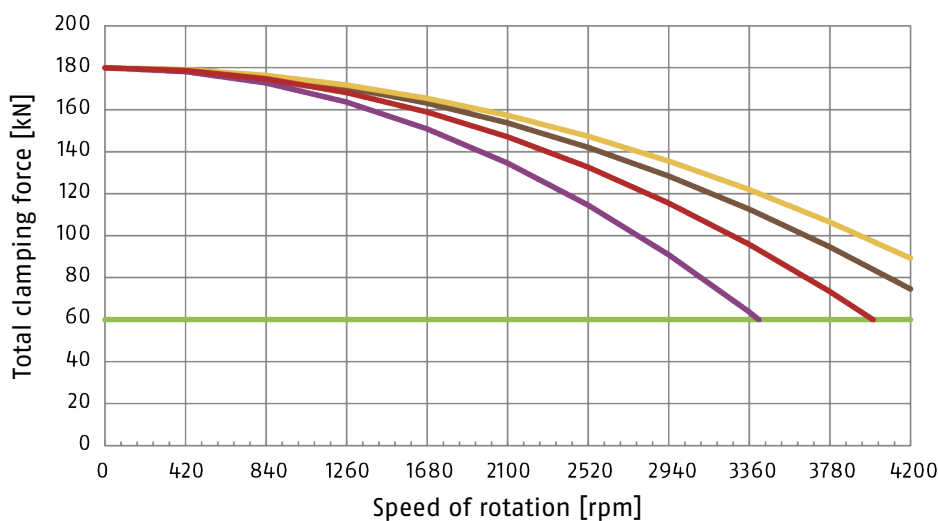
Colour	Jaw ID	Weight [kg]
	SHB 210	2.0
	SHB-J 80	1.9
	KM-WB 88	2.7
	SWB 200	4.1
	Minimum required clamping force 33%	










Clamping force / speed diagrams ROTA NCD 255-86



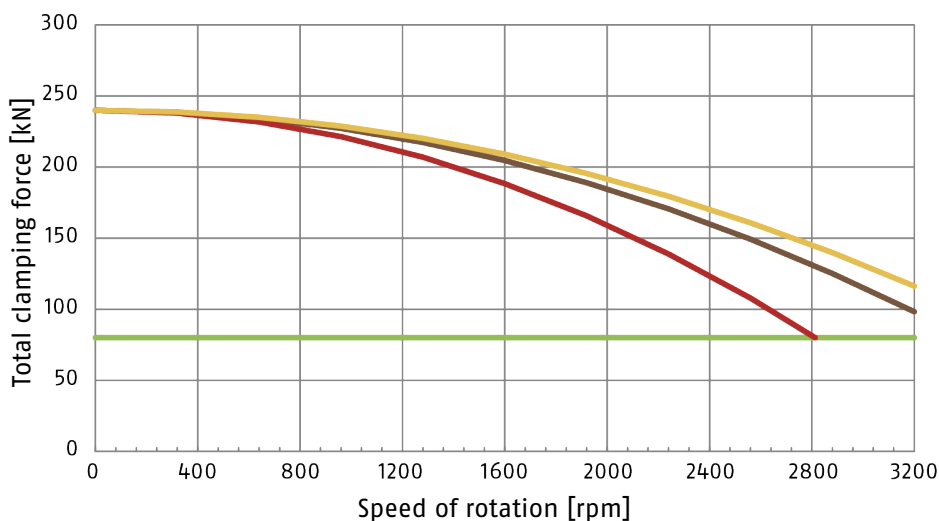
Colour	Jaw ID	Weight [kg]
	SHB-J 100	2.8
	KM-WB 110	3.8
	SHB 250	3.5
	SWB 250	9.4
	Minimum required clamping force 33%	








Clamping force / speed diagrams ROTA NCD 315-115



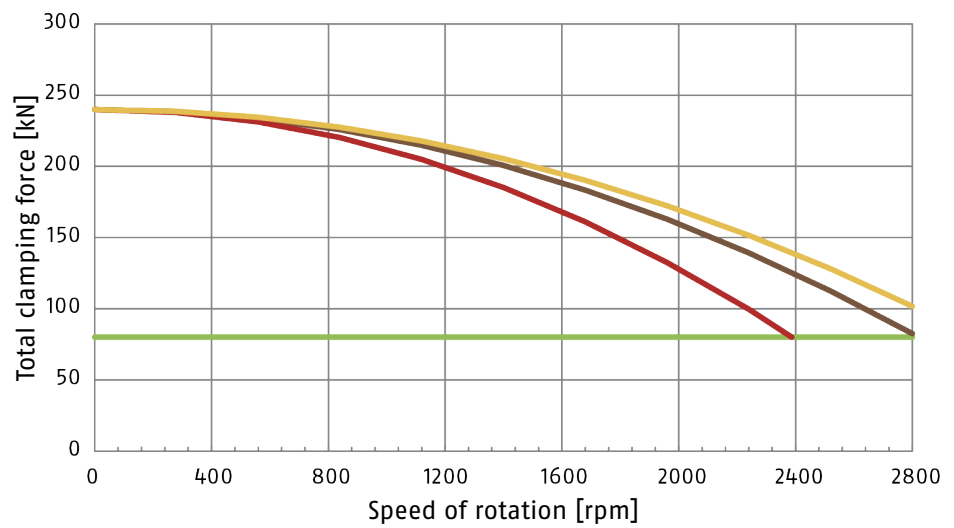
Colour	Jaw ID	Weight [kg]
	 SHB-J 122	3.3
	 SHB 315	4.6
	 KM-WB 126	7.8
	 SWB 250	9.4
	Minimum required clamping force 33%	








Clamping force / speed diagrams ROTA NCD 400-165



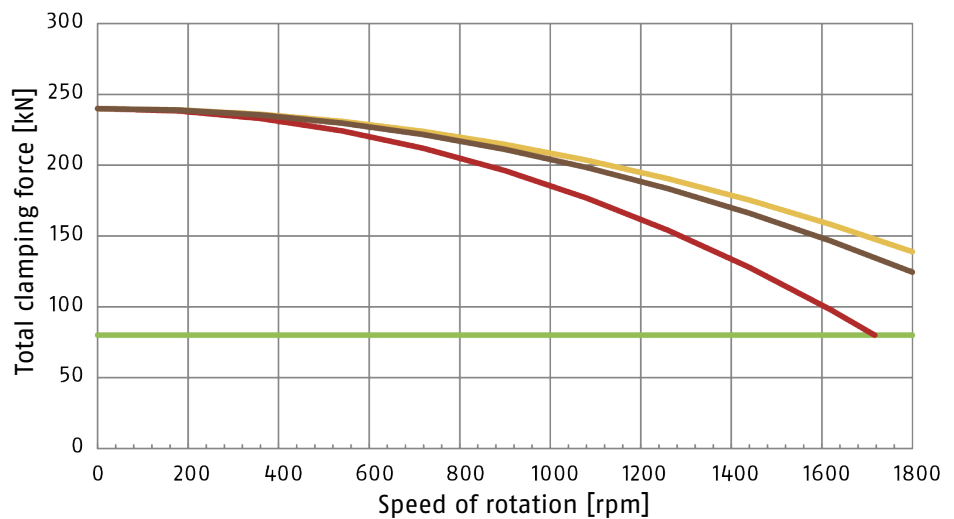
Colour	Jaw ID	Weight [kg]
	 SWB-AL 400	6.4
	 SHB 400	8.0
	 SWB 400	18.3
	Minimum required clamping force 33%	








Clamping force / speed diagrams ROTA NCD 500-165



Colour	Jaw ID	Weight [kg]
	 SWB-AL 400	6.4
	 SHB 400	8.0
	 SWB 400	18.3
	Minimum required clamping force 33%	

Clamping force /speed diagrams ROTA NCD 630-165



Colour	Jaw ID	Weight [kg]
	 SWB-AL 400	6.4
	 SHB 400	8.0
	 SWB 400	18.3
	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

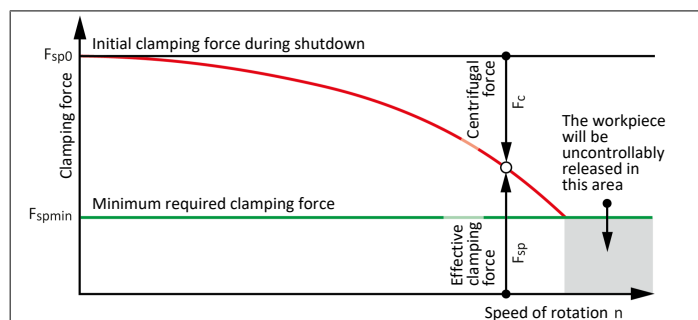
(+) for gripping from the inside outwards



⚠ 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:

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

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

$$M_c = m_B \cdot r_s \text{ [kgm]}$$

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

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

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

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

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

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

The following data is known for the machining job:

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

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

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

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

Initial clamping force during shutdown:

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

Calculation of total centrifugal force:

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

For two-part chuck jaws, the following applies:

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

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

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

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

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

Centrifugal torque for one jaw:

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

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

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

The total centrifugal force can now be calculated:

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

Initial clamping force during shutdown that was sought:

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

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:

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

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 $F_{sp0} = 17723 \text{ N}$
- Machining force for machining job $F_{spz} 3000 \text{ N}$ (application-specific)
- Total centrifugal torque of all jaws $\sum M_c = 2,668 \text{ kgm}$
- 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:

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

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

This calculated RPM may be used.

3.4 Grades of Accuracy

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

3.5 Permissible imbalance DIN ISO 21940-11

The ROTA NCD 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 speeds, asymmetrical workpieces or the use of various top jaws, as well as uneven application of lubricants. In order to prevent damage resulting from these residual risks, the entire rotor is to be dynamically balanced in accordance with DIN ISO 21940-11.

4 Function

The item numbers specified for the corresponding individual components relate to the chapter Drawings, ▶ 9 [📄 37].

4.1 Function and handling

Wedgebar chucks are actuated by rotating cylinders with or without through holes. The axial draw- or pressure forces are deviated into a radial jaw clamping force via the helical angle of traction between the piston and the wedgebar and via the toothed angle between the wedgebar and the base jaws.

The clamp and unclamping stroke of the jaws is determined by the cylinder. Moving or changing the base jaws with top jaws bolted to them must be carried out in unclamped position. For safety reasons the base jaws are still interlocked when the chuck piston is in this position. The base jaws are unlocked mechanically.

4.2 Change or supplement of jaws

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

- When boring and grinding it is important that the boring ring or the boring bolts are clamped by the top jaws – and not by the base jaws. Keep base and top jaws screwed together for later tasks. Always secure the jaw fixing screws with the torque specified (see chapter "Torque per screw" ▶ 5.1 [📄 28]).

NOTICE

Never carry out this work by using an extension rod or by applying blows from a hammer!

5 Mounting

5.1 Torques per screw

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

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

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

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

5.2 Mounting in general

5.2.1 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.

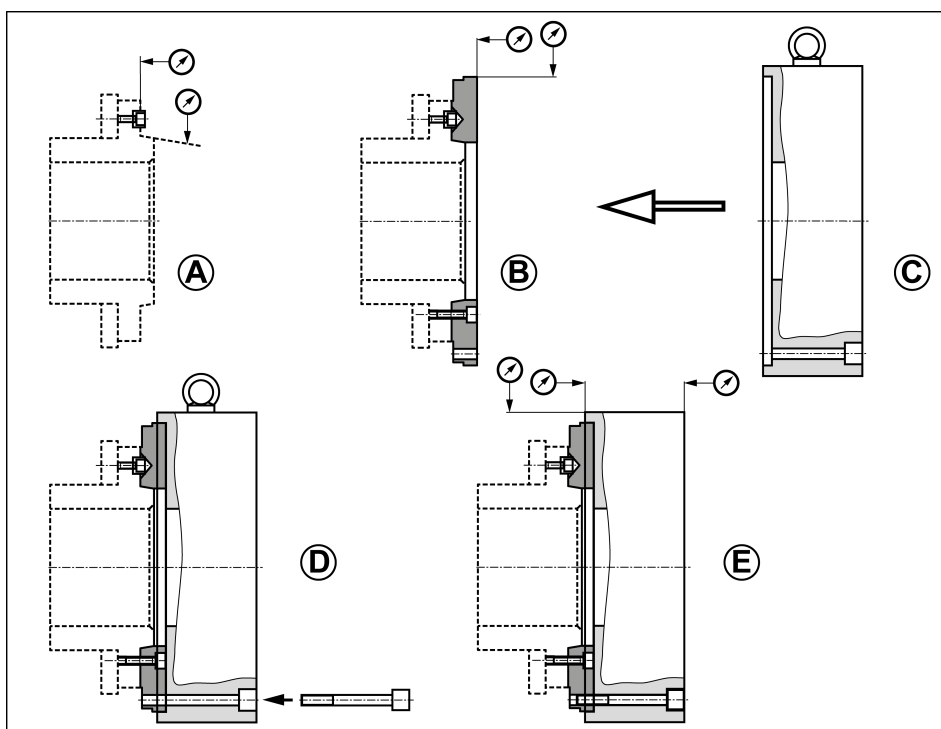
A maximum concentricity error of 0.01 mm should be ensured for the centring of the mount and a maximum axial run-out error of 0.01 mm for the contact surfaces. In addition, the flat surface must be checked for evenness using a straight edge (flat surface deburred and clean at the bore holes).

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

5.2.2 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

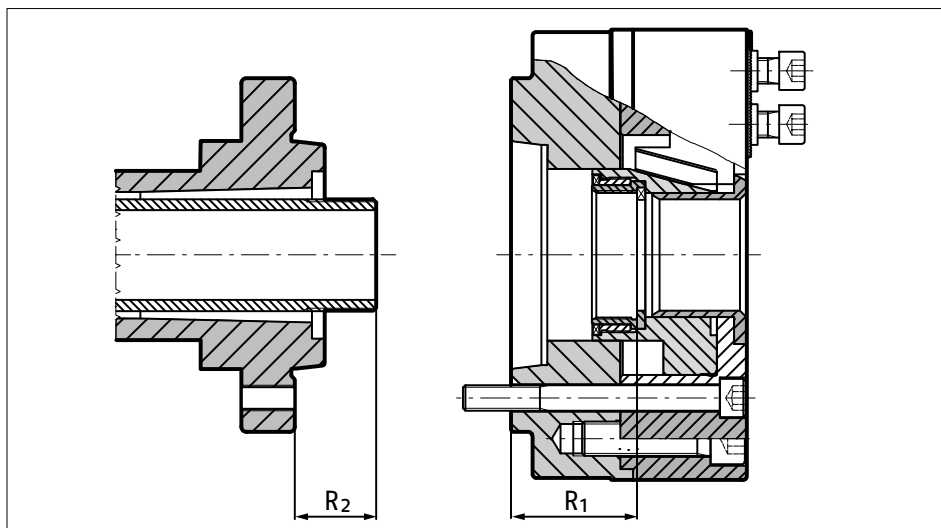
Use a crane to install the chuck. Fasten the chuck to the eye bolt provided for this purpose (see Fig. "Chuck assembly" – C) The eye bolt must be removed prior to commissioning.

5.3 Mounting of the Chuck to the Machine Spindle

The item numbers specified for the corresponding individual components relate to the chapter Drawings, ▶ 9 [📄 37].

1. Loosen the cap head screws on the top jaws and remove them completely with the T-nuts (Item 15).
2. Push the chuck piston into its foremost position (see illustration).
3. Push the chuck piston (Item 3) into its foremost position.
4. 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.
5. Use the mounting key supplied, screw the rotatable threaded bushing in the chuck (Item 8) firmly on the draw bar.
6. **Only for ROTA NCD 132 / 165 / 185 / 215:** The chuck has to be aligned to the middle of the spindle. Lift it in front of the spindle nose and screw it manually until it contacts the stop of the draw bar.
7. Secure the chuck fixing screws crosswise (Item 16 or 17).
8. Check the concentricity and face runout at the control rim.
9. Check the function and the size of the operating force.
10. Check that the base jaws run smoothly and that the jaw stroke is correct.
11. Mount the top jaws firmly on the base jaws with the T-nuts and screws (Item 15) according to the markings 1, 2 and 3.

Dismounting of the spindle is carried out in reverse order. Regularly control if the retainer ring (Item 9) fits tightly.



Cylinder piston in the 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)

Lubricate before commissioning the chuck

Before commissioning, move the chuck in the open position. Press three strokes SCHUNK special grease LINOMAX plus into each of the grease nipples using a high-pressure grease gun. To achieve the optimal grease distribution and the maximum clamping force, close and open the chuck several times over the entire clamping stroke. Check the clamping force and, if necessary, repeat the lubrication process.

5.4 Disassembly and assembly of the Chuck

NOTICE

Only disassemble the chuck in unmounted condition (see chapter: mounting the chuck ▶ 5.3 [30]).

- Move the piston (Item 3) to the front. Mark the distance of the basic jaw ends (Item 2) to the chuck body extent (Item 1).
- Remove the screws (Item 18).
- Unthighten the screws (Item 16 or Item 17) a little bit and hit them slightly with a rubber mallet onto the screw heads. The mounting (Item 7) will loosen from the centering of the chuck body (Item 1). Loosen the screws (Item 16 or Item 17) and remove the mounting. (Mark the position of the chuck cover on the chuck body).
- Pull the piston (Item 3), together with the wedge bar, (Item 5) out of the chuck body.

- Remove the base jaws (Item 2) out of the guidance and take out the seals (Item 33).
- Screw out the screws (Item 19) and take out the guiding bushing (Item 4). Take out the O-ring (Item 31).
- **For ROTA-NCD 255 – 630 the following applies:**
Unscrew the retainer ring (Item 9) out of the piston (Item 3) and draw out the draw nut (Item 8). Remove the ball (Item 24) and spring (Item 27) out of the piston.
- Remove the bar's sealing (Item 32) from the piston (Item 3).

NOTICE

The jaw guidings on the chuck body are numbered from 1 to 3. When mounting the base jaws it is important that the number of notches on the base jaws are identical to the numbering on the jaw guide. Also pay attention that the base jaws are mounted in its original position.

For assembly of the piston please make sure that the marking at the angled wedge hook of the piston can be allocated to jaw guidance 1.

- Clean all parts of dirt and grease and check for damage.
Before mounting, grease well with lubricant LINOMAX plus.

Only use SCHUNK original spares when replacing damaged parts.

Mounting of the chuck follows in reverse order.

6 Maintenance

6.1 Lubrication

To maintain the safe function and high quality of the power chuck it is important to lubricate it regularly at the grease nipples (item 23).

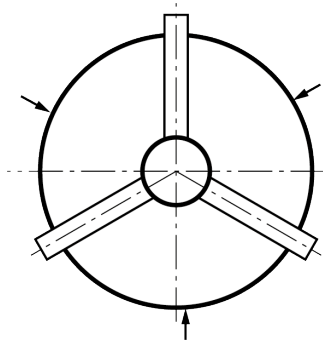


Fig. 1: Lubricating points

In order to assure a constant distribution of grease, the base jaws have to be moved into the closed position for outside clamping. The power chuck can be greased then and after-wards the base jaws may be moved into the open position again. Repeat this procedure once again. The next step will be to move the piston several times into its end position.

NOTICE

All jaws should be greased / lubricated evenly in order to avoid untrue-running.

Operating Conditions

Depending on operating conditions, check the function and the clamping force after a certain time of operation (see ▶ 6.2 [34]). Perform the clamping force test only by using a calibrated clamping force tester (SCHUNK IFT).

Technical Condition

The base jaws must move evenly at the smallest possible operating pressure (cylinder). This method is only to some extent 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.

Use original SCHUNK spare parts only when exchanging damaged parts.

6.2 Maintenance and lubrication plan

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

Maintenance task	Strain	Interval
Lubricate	normal / coolant utilization	Daily / every 16 hours*
	high / coolant utilization	1x per shift / every 8 hours*
Check clamping force		To be determined by the operator
Complete cleaning / disassembly	depending on soiling	as required / after 1200 hours

* Depending on which event occurs earlier.

6.3 Changing the stepped jaws

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



⚠ 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.

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.

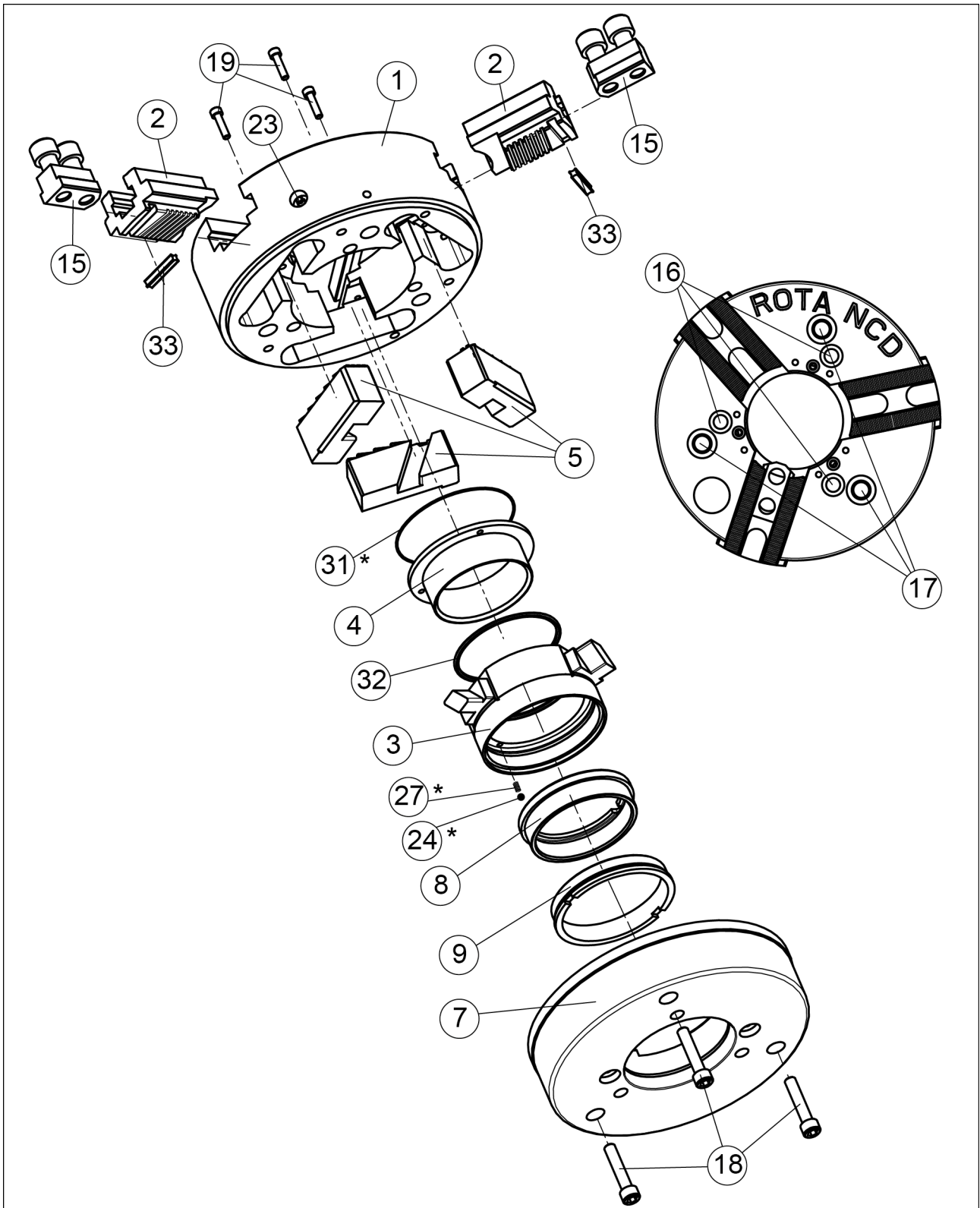
NOTE: Before recommissioning, clean the product and all attachments, check for damage, functionality and leaks.

8 Parts list

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

Item	Designation	Quantity	Note
1	Chuck body	1	
2	Base jaw	3	
3	Piston	1	
4	Guiding bushing	1	
5	Wedge bar	3	
7	Mounting	1	
8	Sleeve	1	255 / 315 / 400 / 500 / 630
9	Retainer ring	1	255 / 315 / 400 / 500 / 630
15	Slot nut	3	132 / 165
	Slot nut	6	185 / 215 / 255 / 315 / 400 / 500 / 630
16	Screw 10.9	3	132 / 165 / 185 / 215 / 255 / 315
	Screw 10.9	6	400 / 500 / 630
17	Screw 10.9	3	132 / 165 / 185 / 215 / 255 / 315
	Screw 10.9	6	400 / 500 / 630
18	Screw 10.9	3	132 / 165 / 185 / 215 / 255 / 315 / 400 / 630
	Screw 10.9	6	500
19	Screw 10.9	3	165 / 185 / 215 / 255 / 315 / 400 / 500 / 630
	Countersunk screw 10.9	6	132
20	Screw 10.9	3	215 / 630
21	Screw 10.9	3	315
23	Lubrication nipple	3	
24	Spring pressure piece	2	255 / 315 / 400 / 500 / 630
31	O-ring	1	132 / 255 / 315 / 400 / 500 / 630
32	Bar seal kit	1	
33	X-ring	1	
34	X-ring	1	165 / 185
	X-ring	2	215
50	Eye bolt	1	215 / 255 / 315 / 400 / 630
61	Eye bolt	1	185

9 Assembly drawing



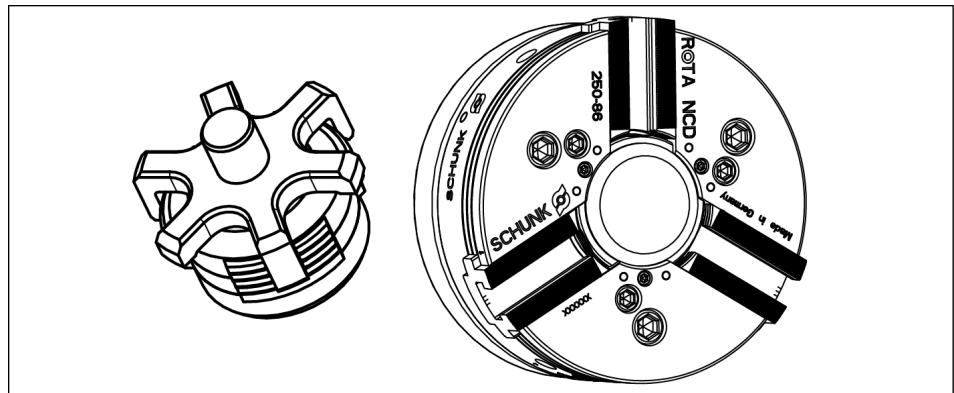
*only for ROTA NCD 250-600

10 Accessories

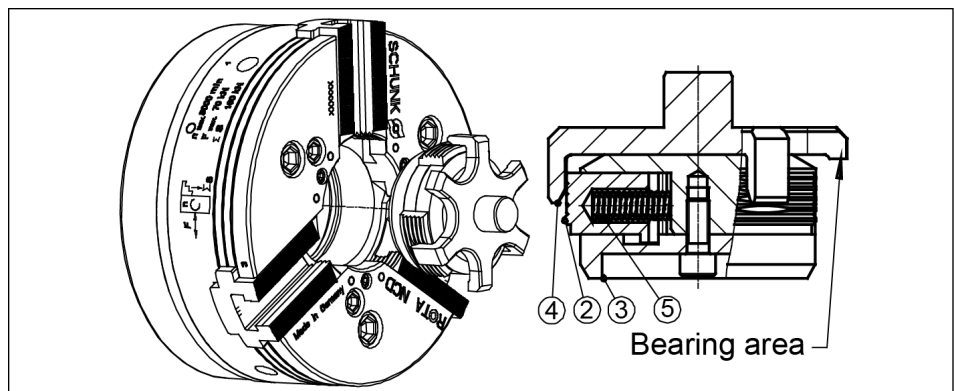
10.1 Center plug

NOTE:

The center plug is an accessory and has to be ordered separately.



Assembly of the center plug onto the power chuck



While the center plug is inserted, the piston of the power chuck must be located in "open position". Top jaws and T-nuts should not be mounted onto the base jaws.

- Put the center plug with assembly claw (Item 4 – Auxiliary equipment for assembly) into the bore of the power chuck. When the center plug is inserted, please make sure that the inserts (Item 2) are positioned in the guide surface of the base jaws.
- The center plug must be inserted deep enough so that the claw (Item 4) with the 3 bearing areas are contacting the face of the power chuck.
- After this, please close the power chuck so that the base jaws with the serration at the face are clamping the inserts (Item 2).
- When the base jaws "bite" into the inserts (Item 2), the assembly claw (Item 4) can be removed.

Disassembly of the center plug from the power chuck is done in reverse order.



CAUTION

The disk is spring-loaded.

11 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

Signature: see original declaration

p.p. Philipp Schröder
Head of Development standard products

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



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