Power chuck

ROTA NC plus 2 / ROTA NCF plus 2

Assembly and Operating Manual

Original operating manual

Hand in hand for tomorrow

Imprint

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

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Dear Customer,

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

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

Best regards,

Your SCHUNK team

Customer Management

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

Table of Contents

1 General

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

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

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

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

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

1.1 Warnings

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

⚠ DANGER

Dangers for persons!

Non-observance will inevitably cause irreversible injury or death.

⚠ WARNING

Dangers for persons!

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

⚠ CAUTION

Dangers for persons!

Non-observance can cause minor injuries.

NOTICE

Material damage!

Information about avoiding material damage.

⚠ WARNING

Warning about hand injuries

⚠ WARNING

Warning about hot surfaces

1.2 Applicable documents

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

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

2 Basic safety instructions

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

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

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

2.1 Intended use

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

The product is intended for industrial use.

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

- The maximum RPM of the chuck and the required clamping force must be determined by the user for the respective clamping task based on the applicable standards and technical specifications of the manufacturer.
  (See also "Calculations for clamping force and RPM" in the chapter "Technical data"). ▸ 6 [🗋 19]

2.2 Not intended use

A not intended use of the product is for example:

- It is used as a press, a punch, a toolholder, a load-handling device or as lifting equipment.
- the product is used for unintended machines or workpieces.
- the technical data is exceeded when using the product. ▸ 6 [🗋 19]
- if workpieces are not clamped properly, paying particular attention to the clamping forces specified by the manufacturer.
- if it is used in working environments that are not permissible.

- if the product is operated without a protective cover.

2.3 Notes on particular risks

⚠ DANGER

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

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

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

⚠ DANGER

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

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

⚠ DANGER

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

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

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

⚠ WARNING

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

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

⚠ CAUTION

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

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

⚠ CAUTION

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

- Do not reach between the jaws.
- Wear safety gloves.
- Observe the safety and accident prevention regulations during operation of the chuck, especially in connection with machining centers and other technical equipment.

⚠ CAUTION

Risk of burns due to workpieces with high temperatures.

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

⚠ CAUTION

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

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

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

⚠ CAUTION

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

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

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

2.4 Notes on safe operation

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

Functional test

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

Two important points are:

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

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

Speed of rotation

⚠ DANGER

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

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

Maintenance instructions

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

- For lubrication, we recommend our tried and tested special grease, LINOMAX plus. Unsuitable lubricants can have a negative impact on the functioning of the chuck (clamping force, coefficient of friction, wear characteristics).
  (For product information about LINOMAX plus, see the "Accessories" chapter of the SCHUNK lathe chuck catalog or contact SCHUNK.)
- Use a suitable high-pressure grease gun to ensure that you reach all the greasing areas.
- To ensure correct distribution of the grease, move the clamping piston to its end positions several times, lubricate again, and then check the clamping force.
- We recommend checking the clamping force using a clamping force tester before starting a new production run and between maintenance intervals. *Optimum safety can only be guaranteed through regular checks*.
- The clamping force should always be measured in the state of the lathe chuck as used for the current clamping situation. If top jaws with clamping steps are used, measuring must be performed in the same step as for the respective clamping task. In the event of high operating speeds, clamping force losses must be accounted for due to the centrifugal force acting on the chuck jaws. In this case the value of the operating clamping force should be measured dynamically.
- Move the clamping piston through to its end position several times after 500 clamping strokes, at the latest (This moves the lubricant back to the surfaces of the force transmission, so that the clamping force is retained for longer).

Safety notes for servicing

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

⚠ DANGER

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

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

Use of special chuck jaws

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

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

2.4.1 Substantial modifications

No substantial modifications may be made to the chuck.

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

2.5 Personnel qualification

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

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

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

2.6 Organizational measures

Obeying the rules

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

Monitoring the behavior of personnel

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

Danger signs

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

Faults

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

Spare parts

Only ever use original SCHUNK spare parts.

Environmental regulations

Comply with the applicable legal norms when disposing of waste.

2.7 Using personal protective equipment

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

3 Warranty

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

- Observe the applicable documents, ▸ 1.2 [🗋 6]
- Observe the ambient conditions and operating conditions
- Observe the maximum number of clamping cycles ▸ 6 [🗋 19]
- Observe the specified maintenance and lubrication intervals, ▸ 9 [🗋 39]

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

4 Torques per screw

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

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

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

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

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

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

5 Scope of delivery

- 1 **Power chuck**
- 3 **Mounting screws**
- 6 **T-nuts with screws or 3 combi T-nuts**
- 1 **Mounting wrench** (from size 260 and up)
- 1 **Eye bolt**from size 260 and up
- 1 **Operating manual**

6 Technical data

6.1 Chuck data

	ROTA NC plus 2				ROTA NCF plus 2			
Size	**185**	**215**	**260**	**315**	**185**	**215**	**260**	**315**
Max. actuating force [kN]	30	42	60	70	30	42	60	70
Max. clamping force [kN]	72	100	140	160	72	100	140	160
Max. speed [rpm]	5000	5000	4000	3500	6000	6000	4500	4000
Stroke per jaw [mm]	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Piston stroke [mm]	20	20	20	20	20	20	20	20
Chuck through bore [mm]	52	66	86	104	52	66	86	104
Weight [kg]	15.2	20.3	33.3	49	14.3	19.7	32	48.4
Centrifugal force of a base jaw M_{cGB} [kgm]	0.029	0.041	0.087	0.155	– 0.011*	– 0.03*	– 0.04*	– 0.094*
Max. jaw eccentricity of center of gravity in axial direction a_{max} [mm]	24	40	40	40	24	40	40	40
Operating temperature	15 – 60°C							

* with centrifugal force compensation taken into account

The specified maximum speed of rotation stated only applies when using the maximum clamping force and the SHB-type, hard, standard stepped jaws that go with the chuck.

The maximum permissible speed of rotation 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 rotation of the chuck.

Length of warranty	24 Months
Maximum clamping cycle number	500 000 Cycles

Tab.: Warranty and maximum clamping cycles

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

Chuck data for rapid chuck jaw quick change:

Caution! The maximum speed of rotation and the clamping force can deviate from the default values. These are engraved on the chuck body and indicated in a customer drawing.

6.2 Clamping force / speed diagrams

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

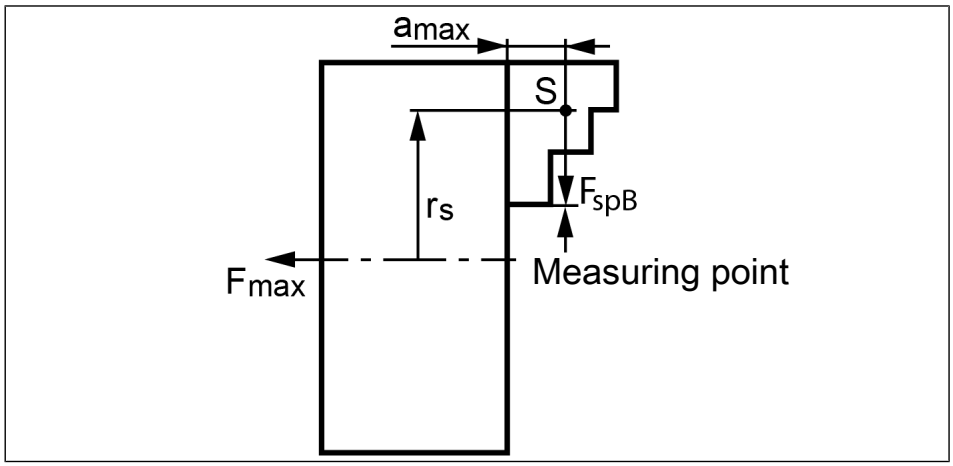
The chuck is in perfect condition and lubricated with SCHUNK LINOMAX special grease.

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

Clamping force RPM graphs for rapid chuck jaw quick change:

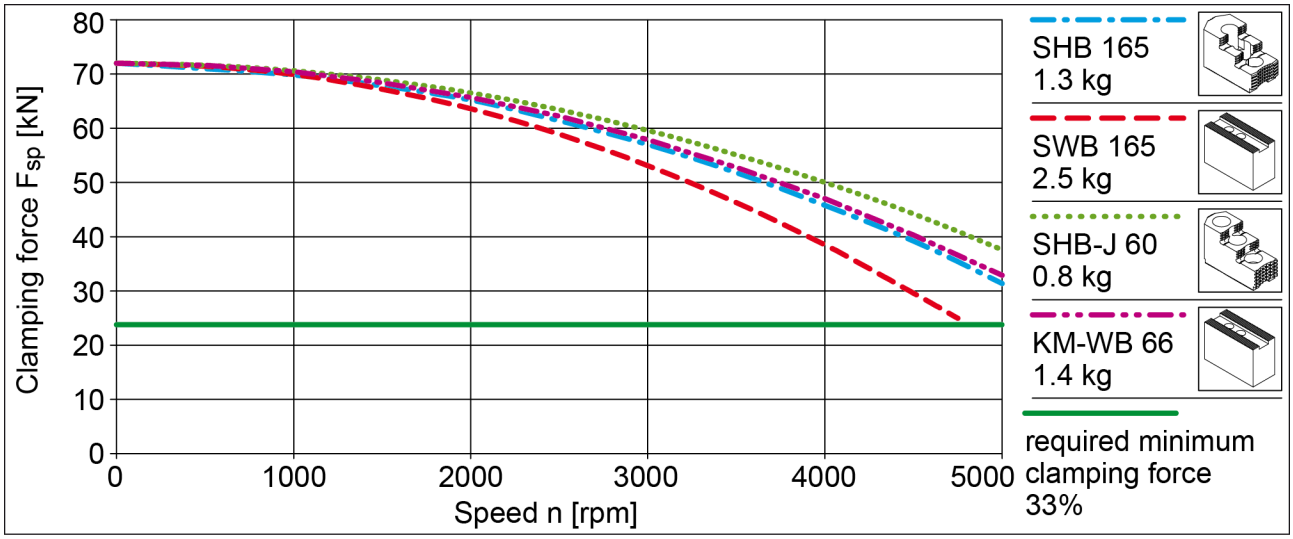
are determined separately and announced to the customer.

Chuck setup for clamping force/RPM graph

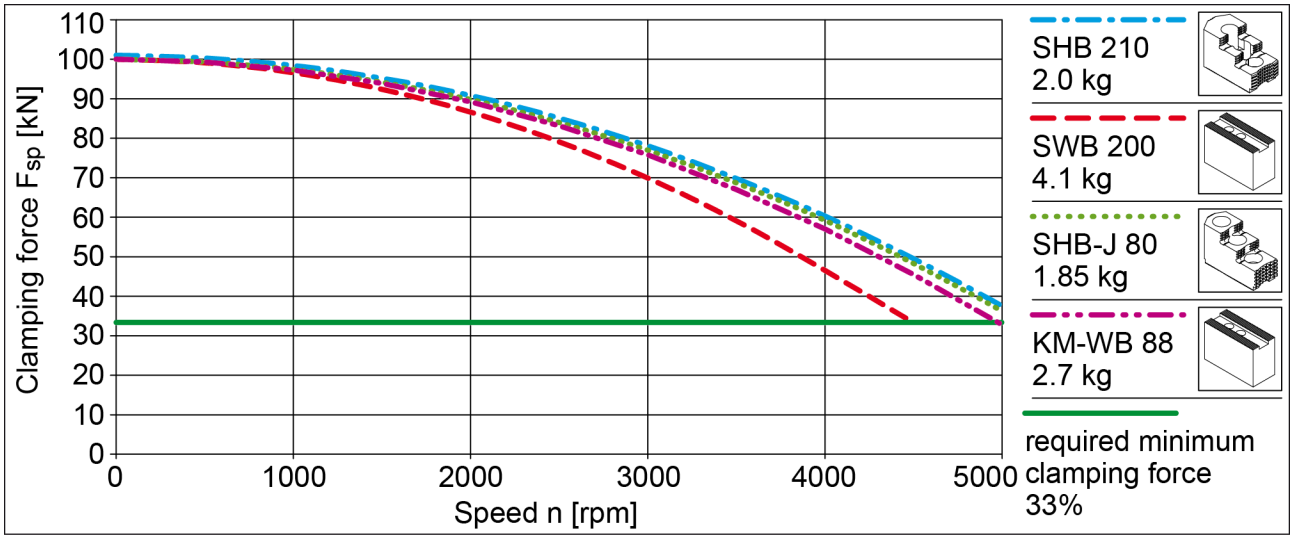


F/3	Clamping force per jaw	S	Center of gravity
r_s	Center of gravity radius	a_{max}	Max. jaw eccentricity of center of gravity in axial direction
F_{max}	Max. actuating force		

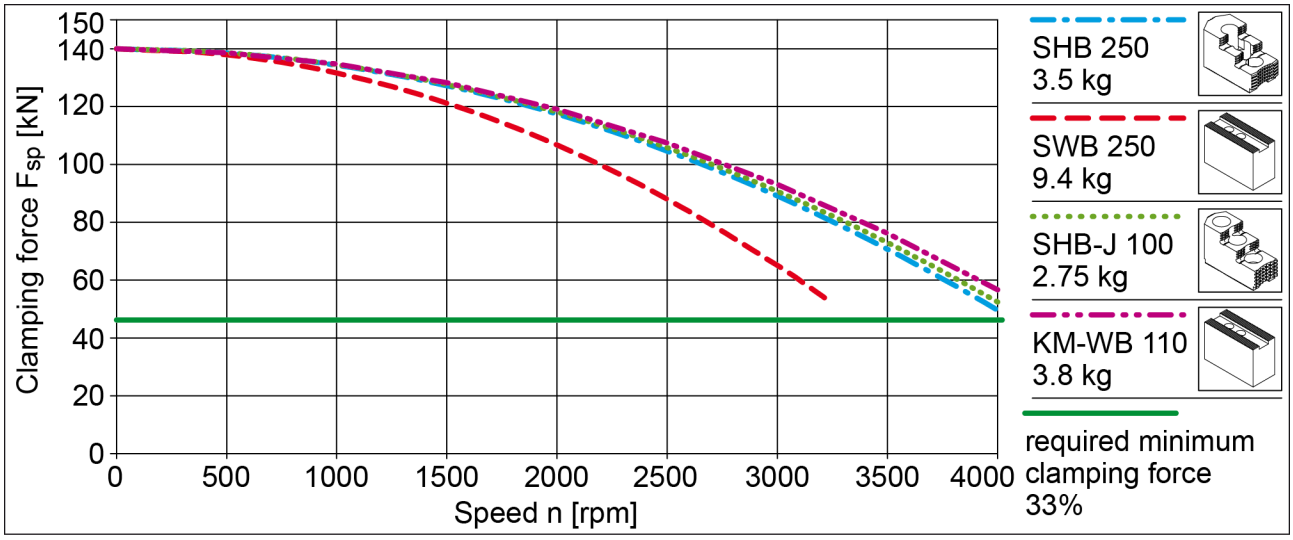
Clamping force RPM graph ROTA NC plus 185-52



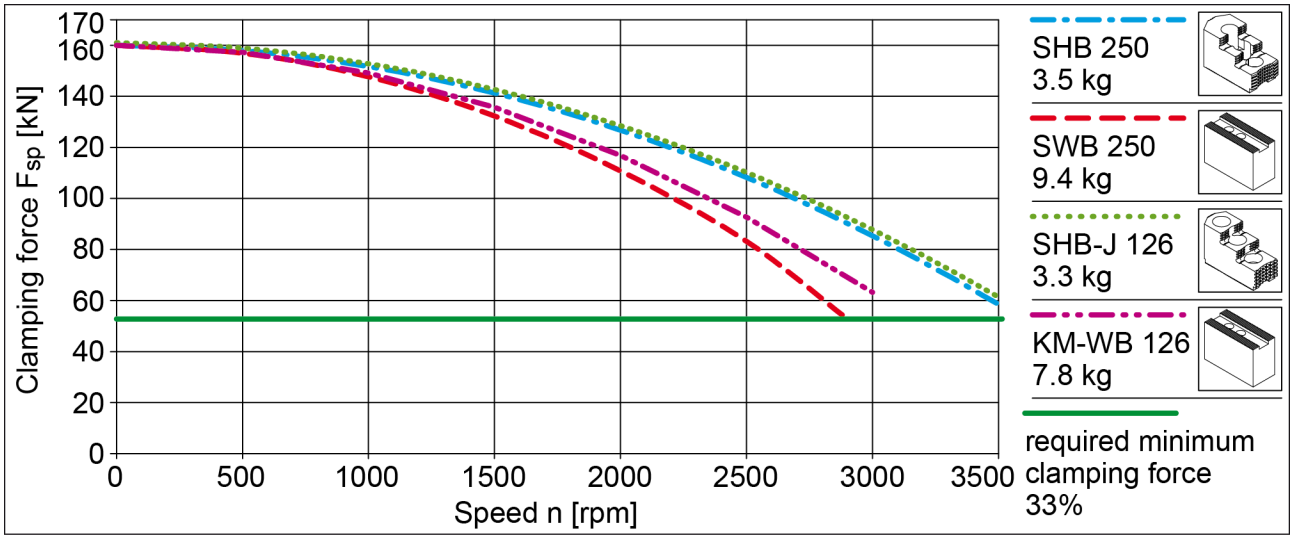
Clamping force RPM graph ROTA NC plus 215-66



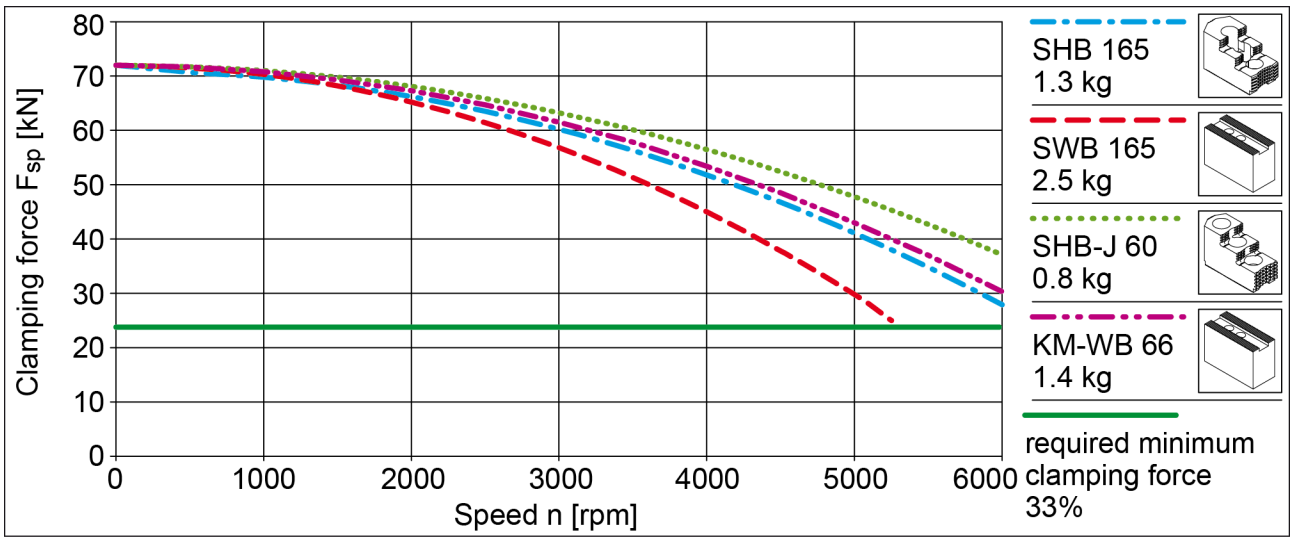
Clamping force RPM graph ROTA NC plus 260-86



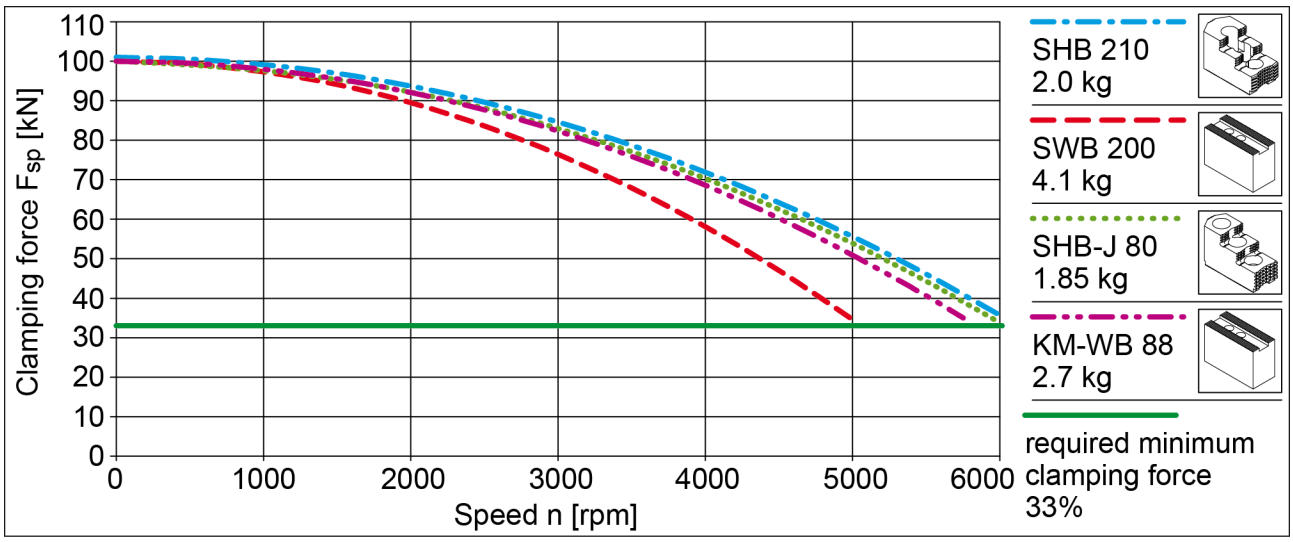
Clamping force RPM graph ROTA NC plus 315-104



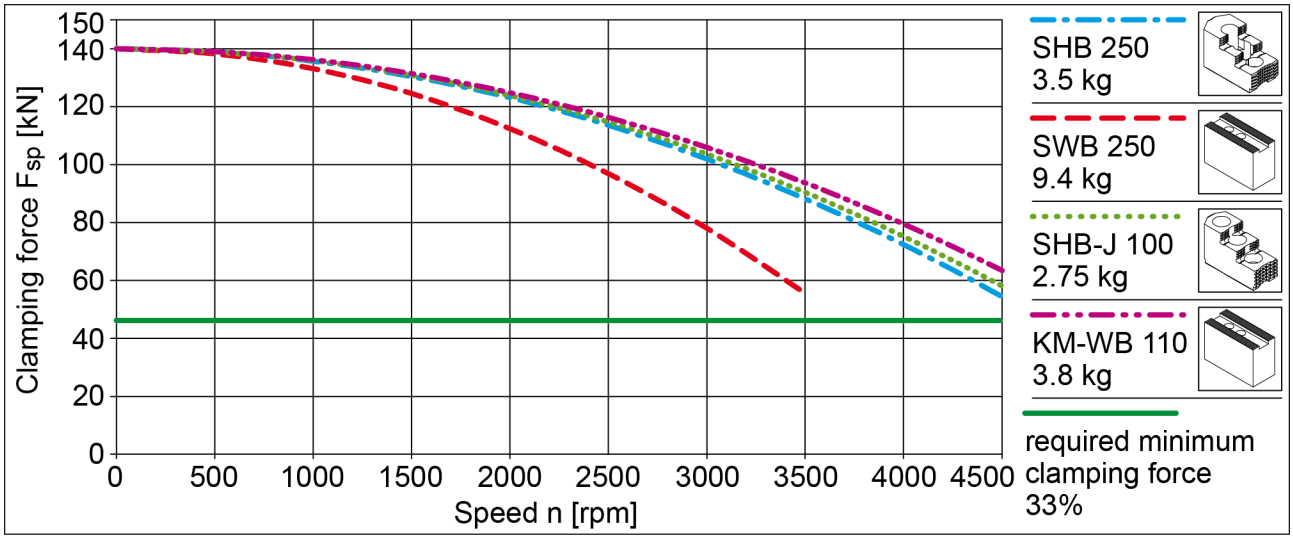
Clamping force RPM graph ROTA NC plus 185-52



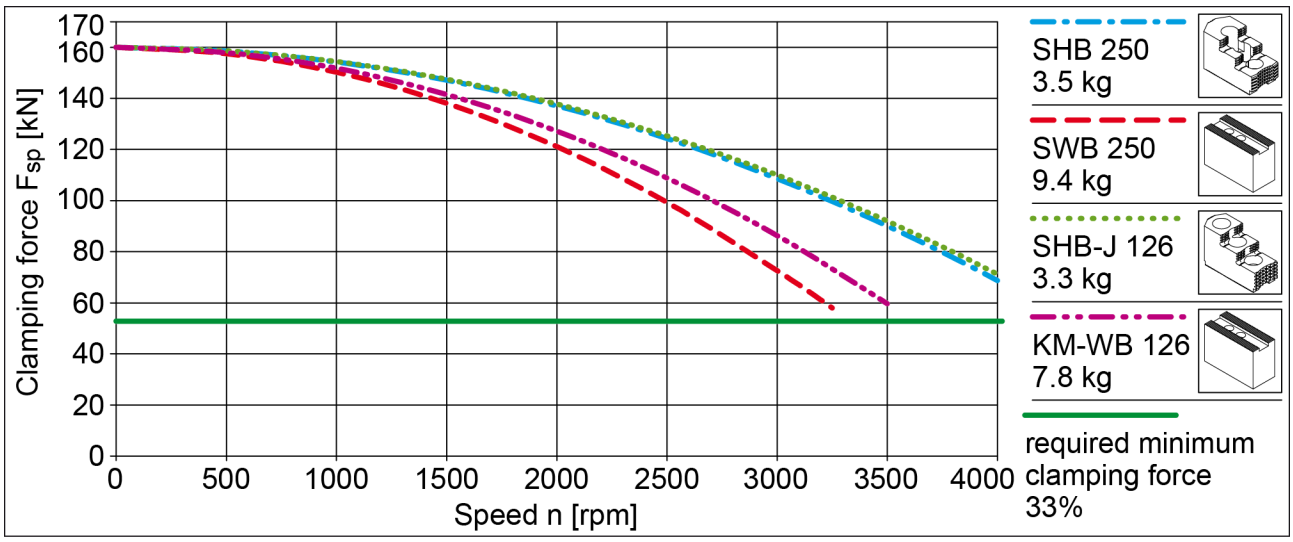
Clamping force RPM graph ROTA NCF plus 215-66



Clamping force RPM graph ROTA NCF plus 260-86



Clamping force RPM graph ROTA NCF plus 315-104



6.3 Calculations for clamping force and speed

Missing information or specifications can be requested from the manufacturer.

Legend

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

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

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

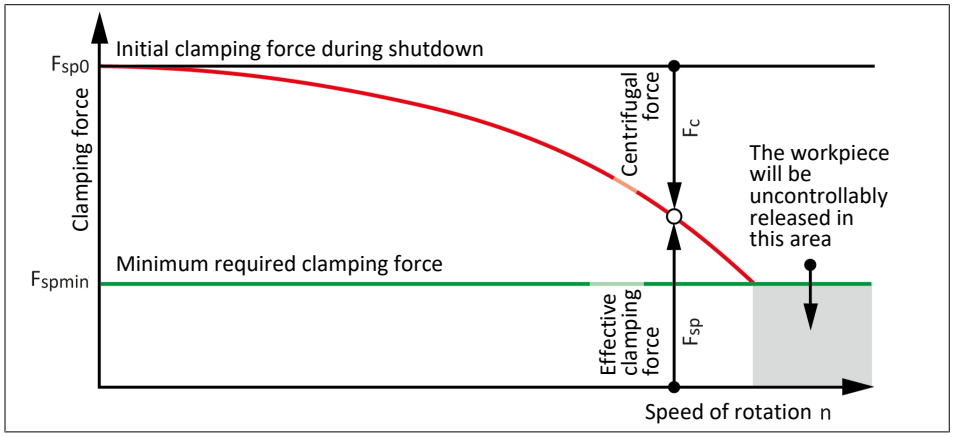
$$F_{sp} = F_{sp0} \mp F_c \text{ [N]}$$

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

⚠ DANGER

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

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



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

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

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

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

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

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

NOTICE

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

See also "Lathe chuck data" table ▶ 6.1 [🗋 19]

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

NOTICE

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

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

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

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

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

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

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

The following data is known for the machining job:

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

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

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

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

Initial clamping force during shutdown:

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

Calculation of total centrifugal force:

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

For two-part chuck jaws, the following applies:

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

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

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

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

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

Centrifugal torque for one jaw:

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

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

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

The total centrifugal force can now be calculated:

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

Initial clamping force during shutdown that was sought:

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

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

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

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

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

NOTICE

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

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

The following data is known from previous calculations:

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

NOTE:

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

Identifying the permissible RPM:

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

The calculated RPM n_{perm} = 1495 RPM is smaller than the maximum permissible RPM of the lathe chuck n_{max} = 3200 RPM (see "Lathe chuck data" table ▸ 6.1 [🗋 19]).

This calculated RPM may be used.

6.4 Grades of Accuracy

The radial and axial runout tolerance correspond to the technical delivery specifications for chucks according to DIN ISO 3442-3.

7 Attachment and disassembly of the chuck

The item numbers specified for the corresponding individual components relate to chapter drawings.▸ 12 [🗋 44]

7.1 Pre-assembly measures

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

⚠ CAUTION

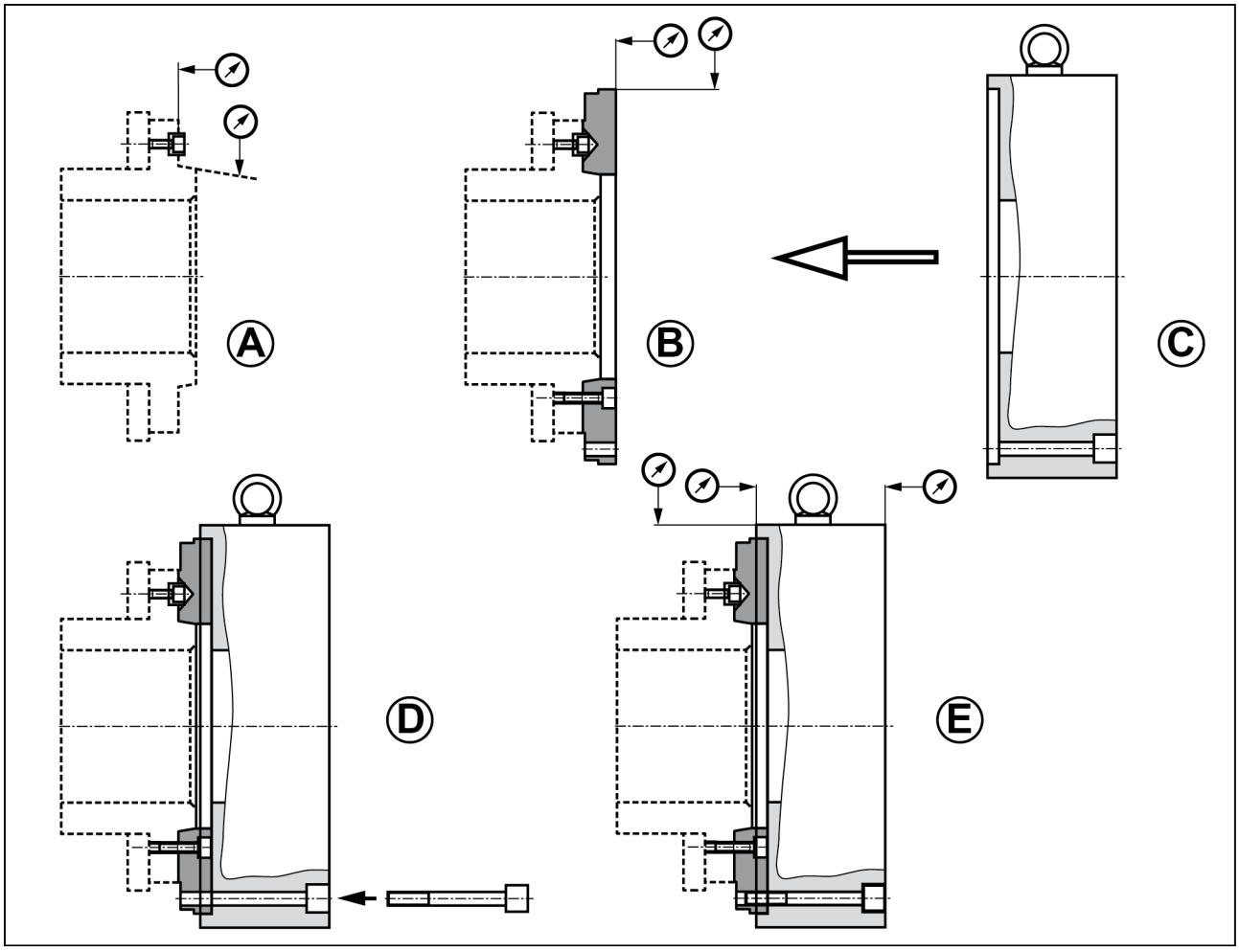
Danger of injury due to sharp edges and rough or slippery surfaces

Use personal protective gear, especially safety gloves.

Check the delivery for completeness and for transport damage.

7.2 Inspection of the spindle nose

Checking the spindle nose for mounting the chuck flange.



Chuck assembly

The machine side has to be aligned prior to the flange being installed in order to achieve high true run-out accuracy for the chuck. To do this, check the contact surfaces on the spindle for axial and radial run-out accuracy using a dial indicator (see Fig. "Chuck assembly" - A▶ 7.2 [🗋 29]).

There should be a maximum concentricity error in the centering of the mount of 0.005 mm and a maximum axial run-out error in the contact surfaces of 0.005 mm. The flat surface of the spindle must also be checked for flatness using a straight edge.

Make sure that the surface area of the flat surface is deburred at the bore holes and is clean.

At regular intervals, check that the retainer ring (item 6) is seated firmly.

7.3 Mounting of the chuck

7.3.1 Mounting the chuck with a reduction or extension flange

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

- For mounting the chuck on the machine spindle with a short taper by means of a reduction or extension flange, a corresponding chuck flange is attached on the spindle nose.
- Before installing the chuck flange, remove any dirt or swarf from the machine spindle and from the centring mount and the contact surface of the flange.
- A chuck flange made by the user himself must be finished machining on the machine spindle and must be balanced before the chuck is mounted.
- After mounting, it must be ensured that the flange is fitted tightly on the entire surface.
- Next, the radial and axial run-out must be checked (see Fig. "Assembly of the chuck" - B ▶ 7.2 [🗋 29]).

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

⚠ WARNING

Risk of injury from falling of the unit during transport and assembly!

The use of a crane is necessary for assembling the lathe chuck. This can be fastened on the eye bolt provided (see Fig. Assembly of the Chuck quick-change or intermediate flange - C). The eye bolt is in all deliveries from chuck size 260 and up included.

Before commissioning the lathe chuck, the eye-bolt has to be removed.

- Push the chuck onto the intermediate flange. During this, it must be ensured that the through-holes for attaching the chuck coincide with the threaded holes of the flange (see Fig. "Assembly of the chuck" - D).
- Next, turn in the fastening screws and tighten them slightly. Check the chuck for radial and axial run-out (see figure "Assembly of the chuck" - E) and align with slight blows with a hammer on the outer diameter if necessary. Next, screw the chuck tightly onto the chuck flange by means of the fastening screws using a torque wrench. During this, pay attention to the specified maximum tightening torques (see chapter "Torque per screw" ▶ 4 [🗋 17]). Next, check the radial and axial run-out again as described in figure (see figure "Assembly of the chuck" - E).

7.3.2 Mounting the chuck by means of a direct mount

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

- Before mounting the chuck flange on the cylindrical recess of the chuck, dirt and swarf must be removed from the centering mount and contact surface of the flange.
- The flange must be slightly tightened on the chuck by means of the supplied screws and aligned towards the chuck body. The radial and axial run-out must be checked.
- Afterwards tighten the screws with the stated torque (see chapter "Torque per screw" ▶ 4 [🗋 17]).
- After mounting, it must be ensured that the flange is fitted tightly on the entire surface. Check radial and axial run-out.

After mounting the flange on the chuck, the chuck must be mounted on the machine spindle.

- Push the chuck onto the intermediate flange. During this, it must be ensured that the through-holes for attaching the chuck coincide with the threaded holes of the flange (see Fig. "Assembly of the chuck" - D).
- Then screw in the mounting screws and tighten slightly. Then check the chuck for radial and axial runout (see Fig. "Assembly of the chuck" - E). Tighten the mounting screws on the chuck flange with a torque wrench. When doing this,

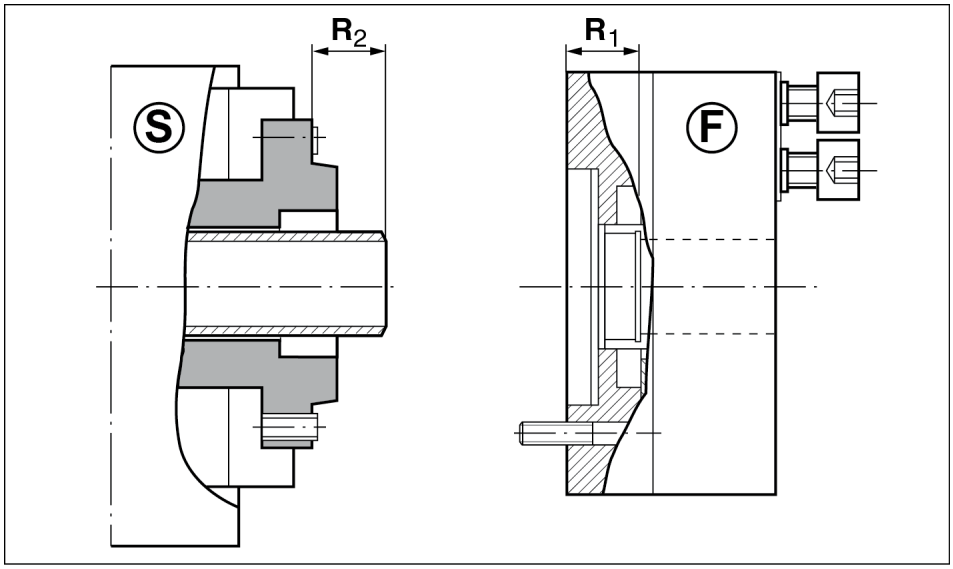
observe the specified maximum tightening torques (see chapter "Torque per screw" ▸ 4 [🗋 17]). Then check again for radial and axial runout (see Fig. "Assembly of the chuck" – E).

The obtainable radial and axial runout accuracies depend on the outer diameter of the chuck.
The radial and axial runout tolerance correspond to the technical delivery specifications for chucks according to DIN ISO 3442-3.

7.3.3 Mounting the ROTA NC plus / NCF plus chuck with a centering edge

Remove cylindrical screws of the top jaws together with the T-nuts (Item 46).

Move the draw tube to the frontmost position by actuating the clamping cylinder.



Attachment

S	Spindle head	**F**	Chuck

Cylinder piston in frontmost position
R1 = press chuck piston into frontmost position and measure with a depth gauge.
R2 = R1 – 0.5 mm (max. – 1 mm)

Chucks in sizes 185 and 215

- The entire chuck must be turned to the draw tube (rod).

Chucks in sizes 260 and 315

- Unscrew the cylindrical screws (Item 28) and pull out the center sleeve (Item 4).
- Unscrew screw (Item 30) completely from the chuck body (Item 1).
  NOTE: the same screws (Item 28) can be used to press off the center sleeve (Item 4) from the chuck body through the additional thread.
- Using lifting gear on the eye bolt, lift the chuck so that it is aligned with the center of the spindle in front of the spindle head.
- Use the included assembly key to screw on the turning draw nut (item 5) in the chuck to the stop.
- Push in the center sleeve (Item 4) and tighten with the cylindrical screws (Item 28).

Tighten the chuck mounting screws (item 30) alternately.

Check radial and axial runout on the control edge ▸ 7.2 [🗋 29].

Check the function and level of the actuating force.

Check the ease of movement and jaw stroke of the base jaws.

Mount the top jaws corresponding to the markings 1, 2 and 3 on the base jaws with T-nuts (Item 46) and screws.

Disassemble the spindle in reverse order.

NOTICE

During the change of the protection sleeve the chuck mechanism gets opened. Danger of damage of the chuck because of swarf and dirt.

Do not allow swarf and dirt to enter the chuck mechanism.
If no center sleeve is mounted in the chuck, do not actuate the chuck or move the chuck piston!

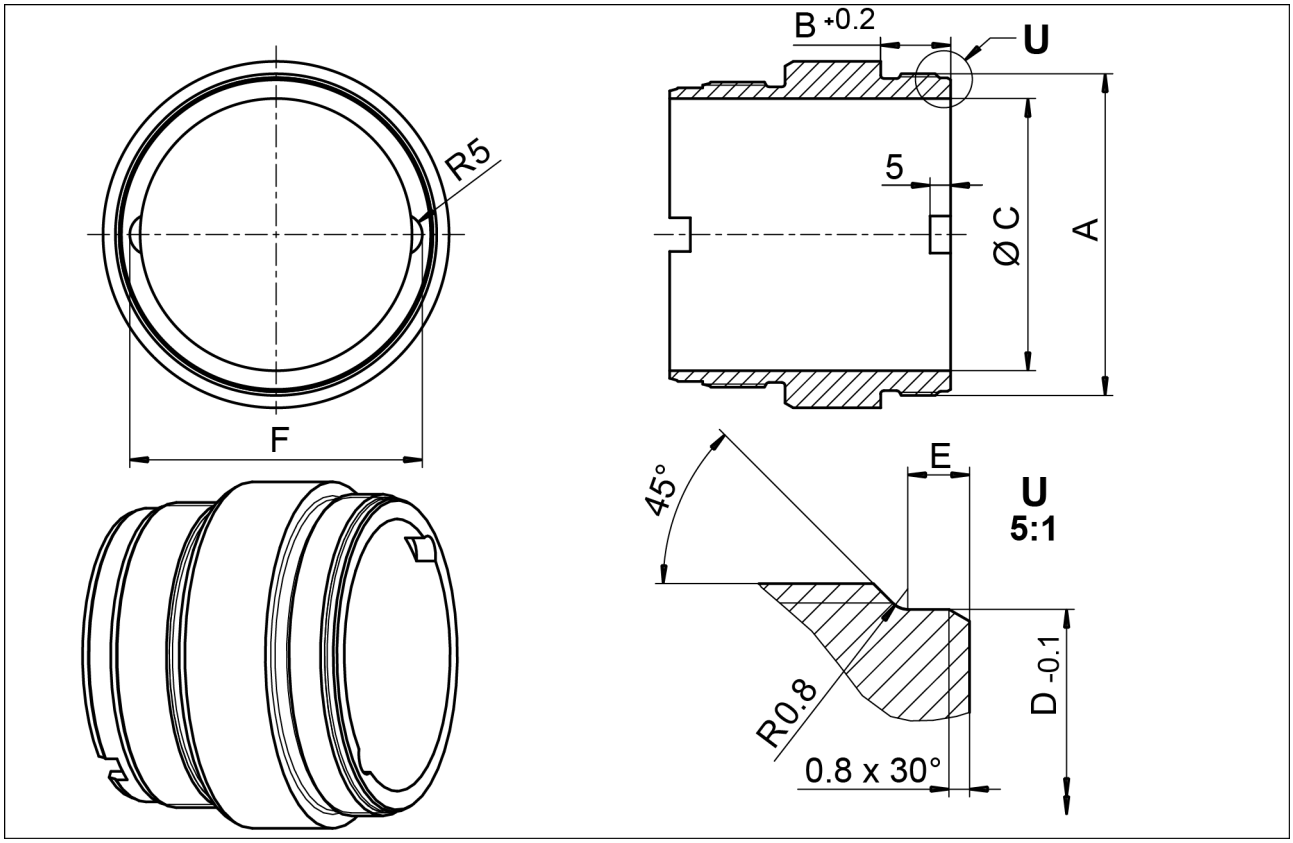
Check the mounting ring (item 5) at regular intervals to ensure it is seated firmly.

⚠ CAUTION

When the chuck mechanism is open there is a danger of limbs being crushed.

Do not reach into the open chuck mechanism!

Adapter for extension of the draw tube to the chuck



Adapter

ROTA	A	B	C	D	E	F	O-ring
NC plus 2 / NCF plus 2 185-52	M67 x 1.5	15.0	52	65	2.4	58	66 x 2
NC plus / NCF plus 315-104	M74 x 1.5	15.0	66	72	2.4	70	72 x 2
NC plus 2 / NCF plus 2 260-86	M94 x 1.5	21.5	86	91	2.4	89	93 x 2
NC plus / NCF plus 315-104	M115 x 2.0	22.7	104	110	3.2	107	110 x 3

8 Function and handling

The item numbers specified for the corresponding individual components relate to chapter drawings.▶ 12 [🗋 44]

8.1 Function and handling

The wedge-hook chuck is actuated by means of a rotating solid or through-hole cylinder. The axial pulling and pushing forces are deflected via the wedge hook angle in the piston and the base jaws to the radial jaw clamping force.

The clamping and opening path of the clamping jaws is defined by the clamping cylinder. The serration of the base jaws can be used to hold standard jaws as well as special jaws for workpieces with difficult shapes. The top jaws are moved or changed in open clamping position.

⚠ CAUTION

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

We recommend automatic loading.

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

8.2 Jaw Change or supplement of jaws

Chuck jaws for maximum clamping repeat accuracy must be turned or ground in the chuck under clamping pressure. The clamping force for machining the top jaws must correspond to approximately 67% (2/3) of the maximum clamping force for the respective chuck (according to DIN ISO 3442-3).

When turning or grinding, ensure that the jaw turning ring or turning pin is clamped **by the top jaws** and not by the base jaws. Tighten the jaw fastening screws (screw quality 12.9) with the prescribed torque (see Chapter "Screw tightening torques" ▶ 4 [🗋 17].

Tighten the mounting screws of the top jaws with a torque wrench. Never tighten the Allen key with an extension pipe or by hitting it with a hammer.

Tool-free rapid quick change (see Fig. 2):

I: Cartridge quick change

II: Spring-loaded pressure piece

III, IV: Set-screw with soft washer

V: Chuck jaws

The chuck jaws can be mounted and removed manually without any tools. Position the chuck jaws as in Fig. 1 and then slide into the hook until the chuck jaws noticeably engage. The quick change shown is only suitable for O.D. clampings.

The spring-loaded pressure piece (II) can be finely adjusted. To do this, slightly loosen the set-screw (III) and adjust the spring-loaded pressure piece. Then tighten the set-screw (III).

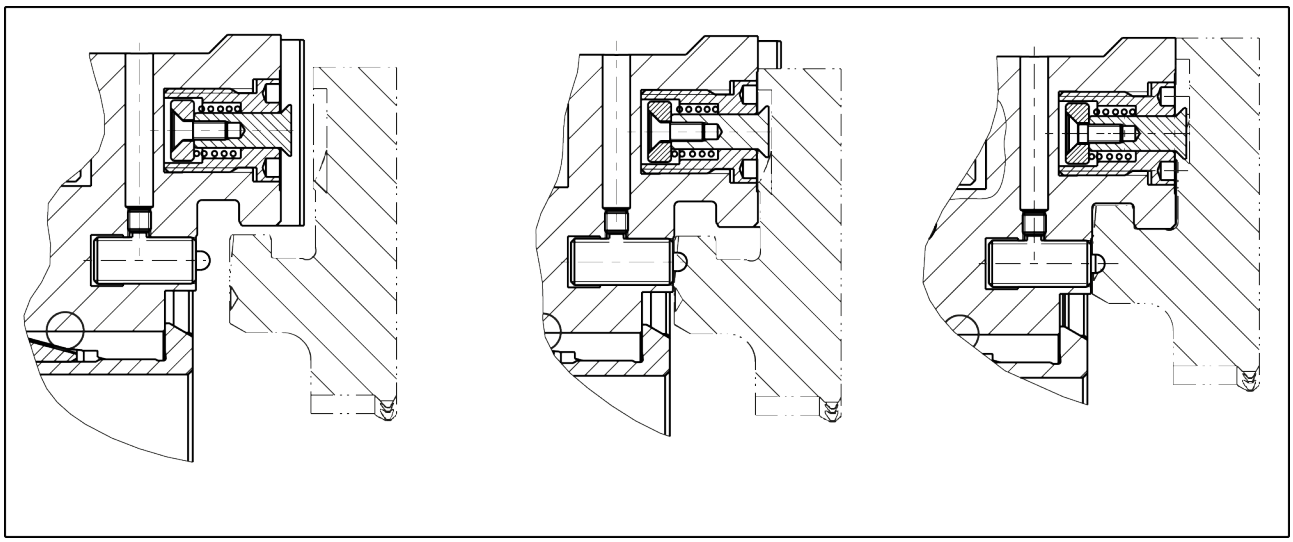


Figure 1

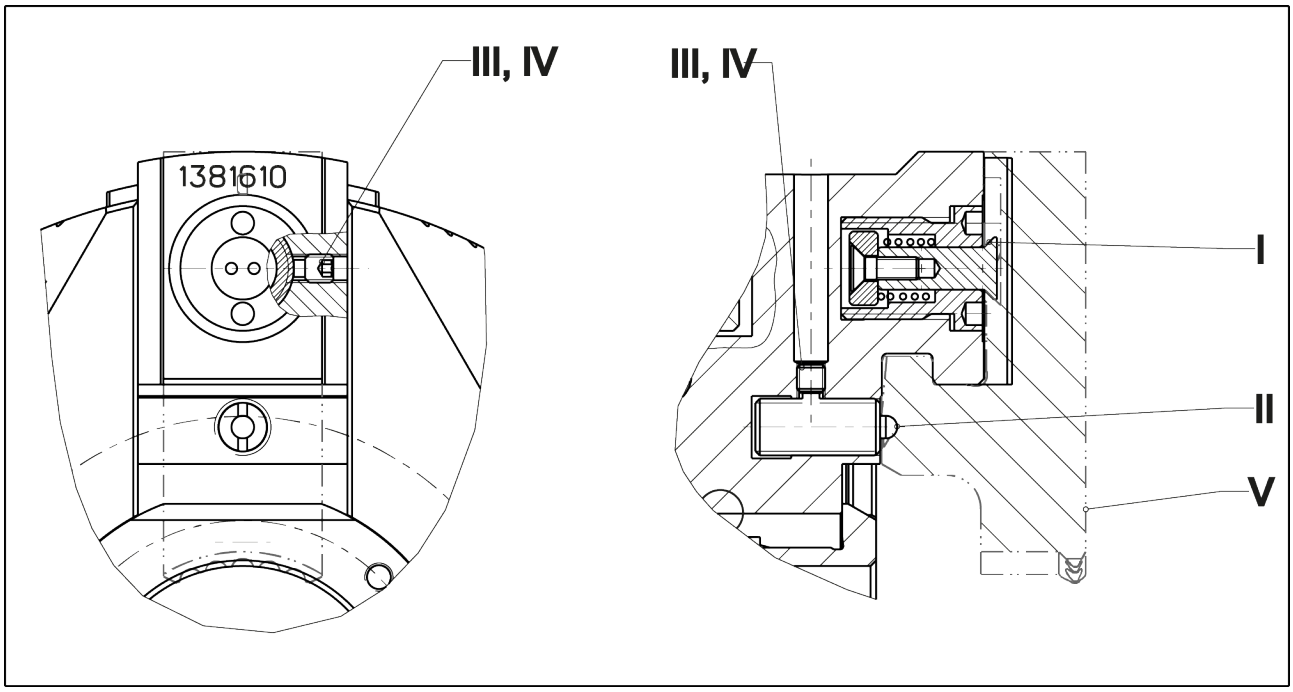


Figure 2

Rapid quick change with cartridge pin (See Fig. 3):

I: Cartridge quick change

III, IV: Set-screw with soft washer

V: Chuck jaws

The chuck jaw (V) can be changed if the pin of the cartridge (I) is depressed with a punch or screwdriver. The quick change is suitable for O.D. and I.D. clamping.

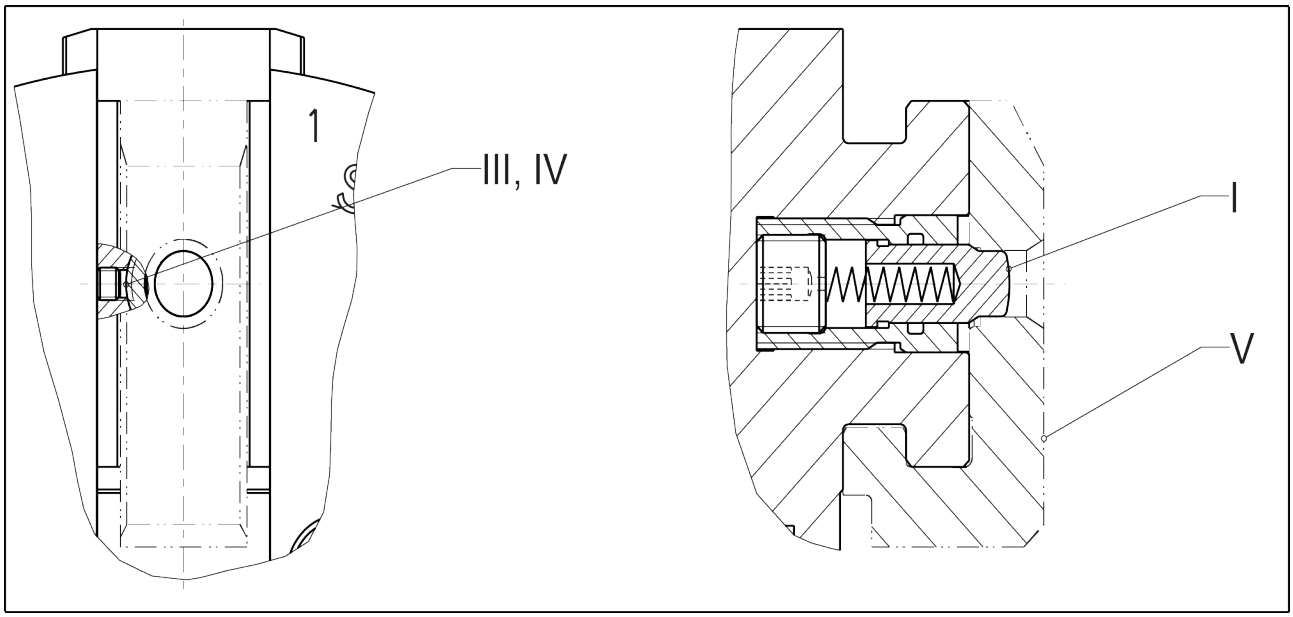


Figure 3

8.3 Disassembly and assembly of the Chuck

To disassemble the chuck, it must be removed.

▸ 7.3 [🗋 30]

- Remove the screws (Item 28) and use the press-off threads to press off the center sleeve (Item 4) from the chuck body (Item 1) and then remove it entirely.
- Mark the position of the mount (Item 7) to the chuck body (Item 1).
- Loosen the screws (Item 29) a few turns and tap the screw heads lightly with a rubber hammer. This releases the mount (Item 7) from the centering device of the chuck body (Item 1). Remove the screws and the mount.
- Remove the levers (Item 10) from the chuck body (Item 1) (ROTA NCF plus 2 only).
- Remove the locking pins (Item 11) from the chuck body (Item 1) (ROTA NC plus 2 only).
- Remove the piston (Item 3) from the chuck body (Item 1).
- Push the base jaws (Item 2) with the seal (Item 39) inward out of the base jaw guide.

Degrease and clean all parts and check for damage and wear.

Replace damaged parts only with original SCHUNK replacement parts.

Prior to assembly, replace all seals and thoroughly grease all parts with LINO MAX special grease. The sealing kit is available from SCHUNK.

⚠ CAUTION

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

- Wear protective gloves.

Assemble the chuck in reverse order.

During assembly, special care must be taken that the numbers of the base jaws are identical to the numbers of the corresponding jaw guide. The seal (Item 39) of the base jaw must not be damaged during assembly.

A compensating weight (ROTA NCF plus 2 only – Item 9) contains a total of 4 check valves.

For the correct setting of the valves, screw in the set screw (Item 13, 16) until flush.

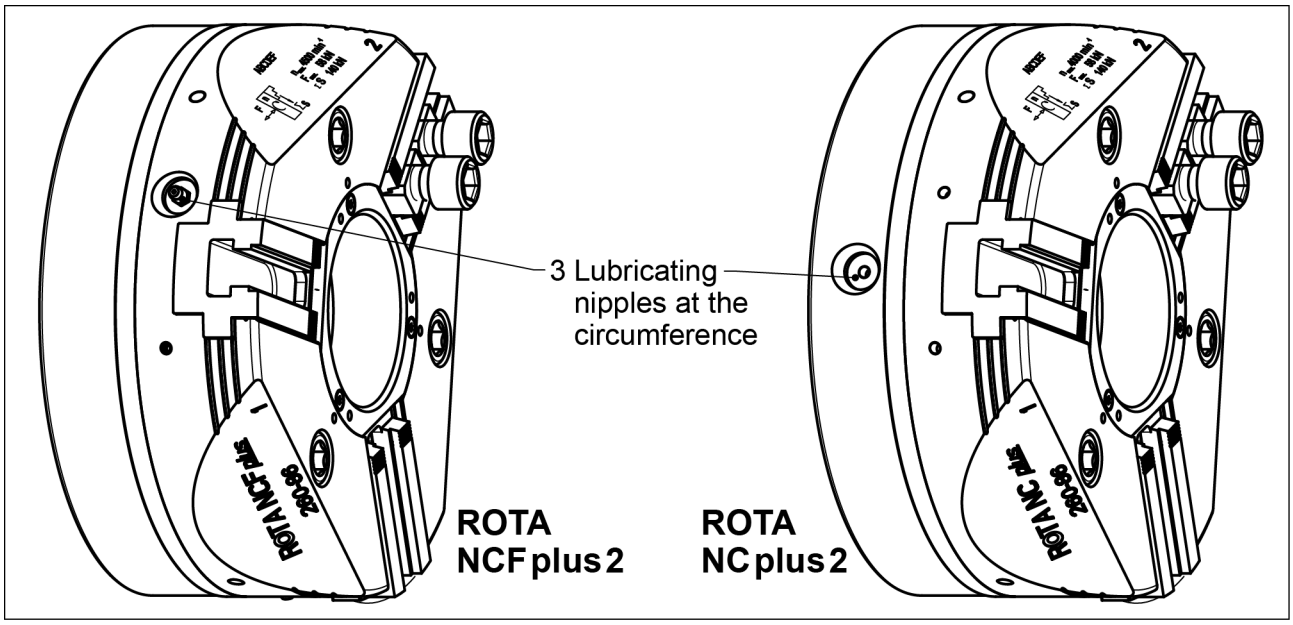
In the case of the NCF plus 2-215 and NCF plus 2-260, screw in the set screw (Item 13) to the stop and then unscrew one revolution.

9 Maintenance

9.1 Lubrication

To maintain the safe operation and high quality of the chuck, it must be regularly lubricated at the lubrication nipples with LINO MAX.

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



Lubrication

Operating conditions

Depending on the operating conditions, the function and clamping force must be checked after a specific period of operation (see "Maintenance intervals" chapter ▸ 9.2 [🗋 40]). Only use a calibrated clamping force tester for measuring in the clamping force test (SCHUNK SGT 270).

Technical condition

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

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

Only use original SCHUNK spare parts when replacing damaged parts.

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

⚠ CAUTION

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

- Wear protective gloves.

9.2 Maintenance intervals

Lubrication of the grease areas:

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

9.3 Changing the top jaws

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

10 Disposal

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

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

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

11 Spare parts

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

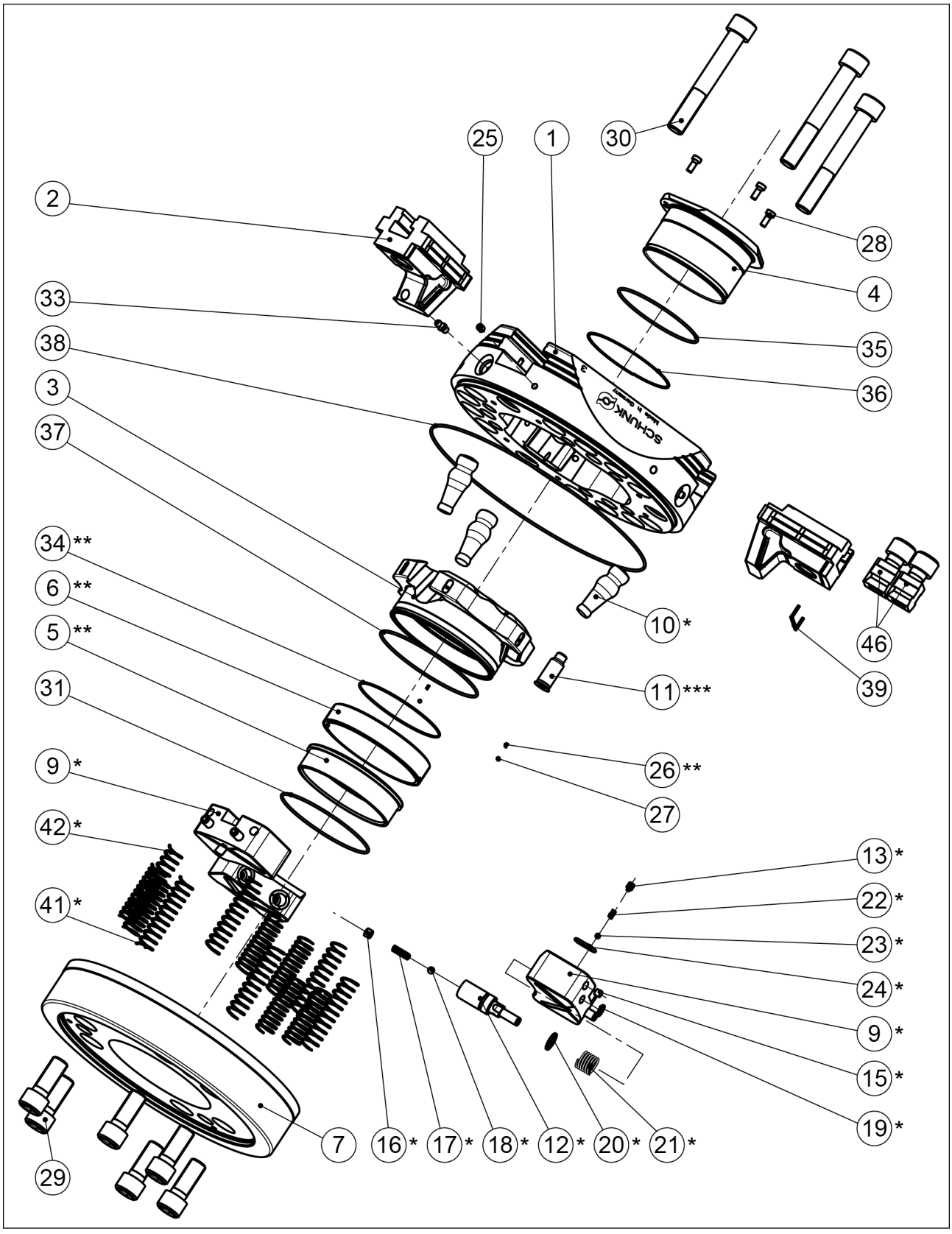
Seals, sealing elements, screw connections, springs, bearings, screws and wiper bars plus parts coming into contact with the workpiece are not covered by the warranty.

Item	Designation	Quantity
1	Chuck body	1
2	Base jaws	3
3	Piston	1
4	Center sleeve	1
5	Draw nut **	1
6	Mounting ring **	1
7	Mount	1
9	Compensating weight *	3
10	Lever *	3
11	Locking pin	3
12	Valve piston	6
13	Set screw *	6
15	Set screw *	6
16	Set screw *	6
17	Compression spring *	6
18	Steel ball *	6
19	Seal *	6
20	Seal *	6
21	Compression spring *	6
22	Compression spring *	6
23	Steel ball *	6
24	Seal *	6
25	Set screw *	3
25	Set screw ***	6
26	Compression spring **	2
27	Steel ball **	2
28	Screws	3
29	Screws	6
30	Screws	3
31	O-ring	1

Item	Designation	Quantity
33	Conical lubrication nipple	3
35	O-ring	1
36	Support ring	1
37	O-ring	1
38	O-ring	1
39	Seal	3
41	Compression spring *	6
42	Compression spring *	6
43	Lever for assembly key	1
44	Eye bolt **	1
45	Assembly key **	1
46	T-nuts (1/16" x 90°)	6
46	T-nuts (1.5 x 60°)	3

* only for NCF plus 2 ** only for chuck size 260 – 315 *** only for NC plus 2

12 Drawing



* Only for NCF plus 2 ** Only for chuck sizes 260 – 315 *** Only for NC plus 2

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Wir drucken nachhaltig I *We print sustainable*

04-2023 02.00 | ROTA NC plus 2 / ROTA NCF plus 2 | Power chuck | en | 0889127-en

Manufacturer certificate

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

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

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

Harmonized standards applied:

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

Other related technical standards and specifications:

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

Mengen, 25. Apr. 2023

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

i.V. Alexander Koch

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

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