Power chuck
ROTA NC plus 2, 2 Jaws

Assembly and Operating Manual

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

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Table of contents

1 General

1.1 About this manual

This manual contains important information for a safe and appropriate use of the product.

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

Before starting work, the personnel must have read and understood this operating manual. Prerequisite for safe working is the observance of all safety instructions in this manual.

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

In addition to these instructions, the documents listed under (☞ 1.3, Page 6) are applicable.

1.2 Presentation of Warning Labels

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

⚠ DANGER

Danger 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.

1.3 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 marked with an asterisk (*) can be downloaded on our homepage **schunk.com**

1.4 Sizes

This operating manual applies to the following sizes:

- ROTA NC plus 2
  185-52/2
  215-66/2
  260-86/2
  315-104/2

1.5 Warranty

The warranty period is 24 months after delivery date from factory or 500 000 cycles*, if it is used as intended, under the following conditions:

- Observe the applicable documents (☞ 1.3, Page 6)
- Observe the ambient conditions and operating conditions, (☞ 2.6, Page 9)
- Observe the specified maintenance and lubrication intervals, (☞ 7, Page 36)

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

* A cycle consists of a complete clamping process ("Open" and "Close").

1.6 Scope of delivery

1	**Power lathe chuck** in the version ordered
4	**Mounting screws**
4	**T-nuts with screws or 2 combi T-nuts**
1	**Operating manual**
1	**Assembly key (from size 260)**
1	**Eye bolt (from size 260)**

2 Basic safety notes

2.1 Intended use

This product is intended for clamping workpieces on machine tools and other suitable technical devices.

- The product may only be used within the scope of its technical data, (☞ 3, Page 18).
- The product is intended for industrial and industry-oriented use.
- Appropriate use of the product includes compliance with all instructions in this manual.
- 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”). (☞ 3, Page 18)

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. (☞ 3, Page 18)
- 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 Constructional changes

Implementation of structural changes

By conversions, changes, and reworking, e.g. additional threads, holes, or safety devices can impair the functioning or safety of the product or damage it.

- 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.

- Use only original spare parts or spares authorized by SCHUNK.

2.5 Chuck jaws

Requirements of the chuck jaws

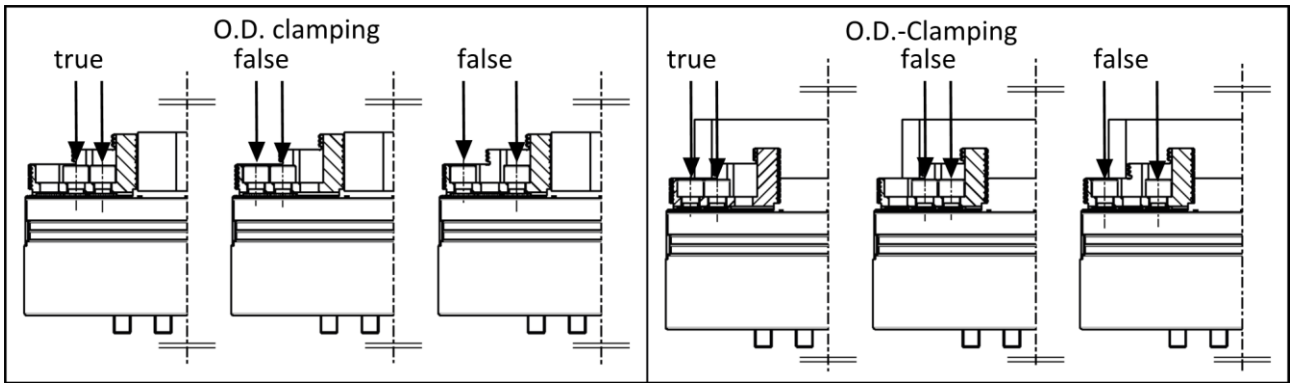
Stored energy can make the product unsafe and risk the danger of serious injuries and considerable material damage.

- Only change chuck jaws if no residual energy can be released.
- Do not use welded jaws.
- 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).
- If for constructional reasons the special chuck jaws are heavier than the top jaws assigned to the lathe chuck, greater centrifugal forces must be accounted for when defining the required clamping force and the recommended speed.
-

The maximum recommended speed may only be operated in conjunction with maximum actuating force and only with the lathe chuck in optimal, fully functioning condition.

- After a collision, the lathe chuck and the chuck jaws must be subjected to a crack test before being used again. Damaged parts must be replaced with original SCHUNK spare parts.
- Renew the chuck jaw mounting bolts if there are signs of wear or damage. Only use bolts with a quality of 12.9.
- The jaw mounting screws must be installed so that they counteract the tilting moments caused by the clamping force on the largest possible lever arm.

For correct mounting of jaws, the fixing screws must be set accordingly



Proper mounting of jaws

2.6 Environmental 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 to the product's life span.

- Make sure that the product is used only in the context of its defined application parameters, (☞ 3, Page 18).
- Make sure that the product is a sufficient size for the application.
- Only use high-quality cooling emulsions with anti-corrosive additives during processing.

Clamping force tester

Depending on the operating conditions, the function and clamping force must be checked after a certain period of operation (☞ 7.2, Page 37). Only use a calibrated clamping force tester for measuring during the clamping force test.

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

If the clamping force has dropped too much or if the base jaws and pistons no longer move properly, the chuck must be disassembled, cleaned, and relubricated (☞ 7, Page 36).

2.7 Personnel qualification

Inadequate qualifications of the personnel

If the personnel working with the product is not sufficiently qualified, the result may be serious injuries and significant property damage.

- All work may only be performed by qualified personnel.
- Before working with the product, the personnel must have read and understood the complete assembly and operating manual.
- Observe the national safety regulations and rules and general safety instructions.

The following personal qualifications are necessary for the various activities related to the product:

Trained electrician Due to their technical training, knowledge and experience, trained electricians are able to work on electrical systems, recognize and avoid possible dangers and know the relevant standards and regulations.

Qualified personnel Due to its technical training, knowledge and experience, qualified personnel is able to perform the delegated tasks, recognize and avoid possible dangers and knows the relevant standards and regulations.

Instructed person Instructed persons were instructed by the operator about the delegated tasks and possible dangers due to improper behaviour.

Service personnel of the manufacturer

Due to its technical training, knowledge and experience, service personnel of the manufacturer is able to perform the delegated tasks and to recognize and avoid possible dangers.

2.8 Personal protective equipment

Use of personal protective equipment

Personal protective equipment serves to protect staff against danger which may interfere with their health or safety at work.

- When working on and with the product, observe the occupational health and safety regulations and wear the required personal protective equipment.
- Observe the valid safety and accident prevention regulations.
- Wear protective gloves to guard against sharp edges and corners or rough surfaces.
- Wear heat-resistant protective gloves when handling hot surfaces.
- Wear protective gloves and safety goggles when handling hazardous substances.
- Wear close-fitting protective clothing and also wear long hair in a hairnet when dealing with moving components.

2.9 Notes on safe operation

Incorrect handling of the personnel

Incorrect handling and assembly may impair the product's safety and cause serious injuries and considerable material damage.

- Avoid any manner of working that may interfere with the function and operational safety of the product.
- Use the product as intended.
- Observe the safety notes and assembly instructions.
- Do not expose the product to any corrosive media. This does not apply to products that are designed for special environments.
- Eliminate any malfunction immediately.
- Observe the care and maintenance instructions.
- Observe the current safety, accident prevention and environmental protection regulations regarding the product's application field.

2.10 Transport

Handling during transport

Incorrect handling during transport may impair the product's safety and cause serious injuries and considerable material damage.

- When handling heavy weights, use lifting equipment to lift the product and transport it by appropriate means.
- Secure the product against falling during transportation and handling.
- Stand clear of suspended loads.

2.11 Malfunctions

Behavior in case of malfunctions

- Immediately remove the product from operation and report the malfunction to the responsible departments/persons.
- Order appropriately trained personnel to rectify the malfunction.
- Do not recommission the product until the malfunction has been rectified.
- Test the product after a malfunction to establish whether it still functions properly and no increased risks have arisen.

2.12 Disposal

Handling of disposal

The incorrect handling of disposal may impair the product's safety and cause serious injuries as well as considerable material and environmental harm.

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

2.13 Fundamental dangers

General

- Observe safety distances.
- Never deactivate safety devices.
- Before commissioning the product, take appropriate protective measures to secure the danger zone.
- Disconnect power sources before installation, modification, maintenance, or calibration. Ensure that no residual energy remains in the system.
- If the energy supply is connected, do not move any parts by hand.
- Do not reach into the open mechanism or movement area of the product during operation.

2.13.1 Protection during handling and assembly

Incorrect handling and assembly

Incorrect handling and assembly may impair the product's safety and cause serious injuries and considerable material damage.

- Have all work carried out by appropriately qualified personnel.
- For all work, secure the product against accidental operation.
- Observe the relevant accident prevention rules.
- Use suitable assembly and transport equipment and take precautions to prevent jamming and crushing.

Incorrect lifting of loads

Falling loads may cause serious injuries and even death.

- Stand clear of suspended loads and do not step into their swiveling range.
- Never move loads without supervision.
- Do not leave suspended loads unattended.

2.13.2 Protection during commissioning and operation

Falling or violently ejected components

Falling and violently ejected components can cause serious injuries and even death.

- Take appropriate protective measures to secure the danger zone.
- Never step into the danger zone during operation.

2.13.3 Protection against dangerous movements

Unexpected movements

Residual energy in the system may cause serious injuries while working with the product.

- Switch off the energy supply, ensure that no residual energy remains and secure against inadvertent reactivation.
- Never rely solely on the response of the monitoring function to avert danger. Until the installed monitors become effective, it must be assumed that the drive movement is faulty, with its action being dependent on the control unit and the current operating condition of the drive. Perform maintenance work, modifications, and attachments outside the danger zone defined by the movement range.
- To avoid accidents and/or material damage, human access to the movement range of the machine must be restricted. Limit/prevent accidental access for people in this area due through technical safety measures. The protective cover and protective fence must be rigid enough to withstand the maximum possible movement energy. EMERGENCY STOP switches must be easily and quickly accessible. Before starting up the machine or automated system, check that the EMERGENCY STOP system is working. Prevent operation of the machine if this protective equipment does not function correctly.

2.13.4 Notes on particular risks

⚠ DANGER

Risk of fatal injury from suspended loads!
Falling loads can cause serious injuries and even death.

- Stand clear of suspended loads and do not step within their swiveling range.
- Never move loads without supervision.
- Do not leave suspended loads unattended.
- Wear suitable protective equipment.

⚠ 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 automated 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.

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.

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 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 workpiece, the base and top jaws may become damaged.

- The T-nuts for connecting the top jaws to the base jaws must not protrude beyond the base jaws in the radial direction.
- The diameter of the workpiece may not be bigger than the chuck diameter.

⚠ 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.

3 Technical data

3.1 Chuck data

ROTA NC plus 2	185-52/2	215-66/2	260-86/2	315-104/2
Max. actuating force [kN] *	20	28	40	46
Max. clamping force [kN]	48	66	95	106
Max. speed [rpm]	4700	4200	3500	2800
Stroke per jaw [mm]	5.3	5.3	5.3	5.3
Piston stroke [mm]	20	20	20	20
Chuck bore [mm]	66	66	86	104
Weight [kg]	16	20.3	33	47
Centrifugal torque of base jaw [kgm] $\mathbf{M}_{cGB}$	0.13	0.13	0.28	0.51
Max. jaw eccentricity of center of gravity in axial direction a_{max} [mm]	40	40	40	40
Operating temperature	15 to 60 °C			

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

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

The maximum permissible RPM for the specific machining has to be defined by the user on the basis of the required clamping forces. This speed must not exceed the maximum speed of the chuck.

Ensure minimal weight for all jaws.
For unhardened top jaws or chuck jaws in special design, the permissible RPM according to VDI 3106 must be determined by means of calculation for the respective machining job. In this, however, the recommended maximum speed must not be exceeded. The calculated values must be checked by dynamic measurement. Function monitoring (piston movement and actuating pressure) must be performed in accordance with the guidelines of the Berufsgenossenschaft (employers' mutual insurance association).

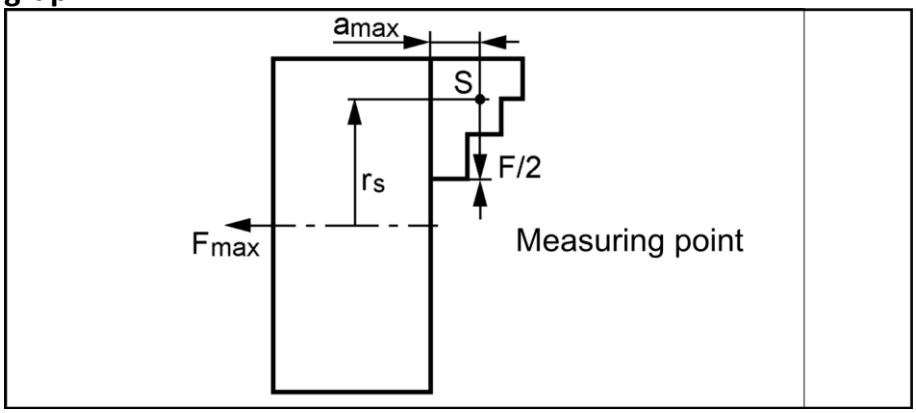
3.2 Clamping force / speed diagrams

Clamping force/RPM curves have been calculated using the corresponding standard top jaws (stepped jaws and monoblock jaws). In the determination process, the maximum actuating force was applied and the jaws were set flush with the outer diameter of the chuck.

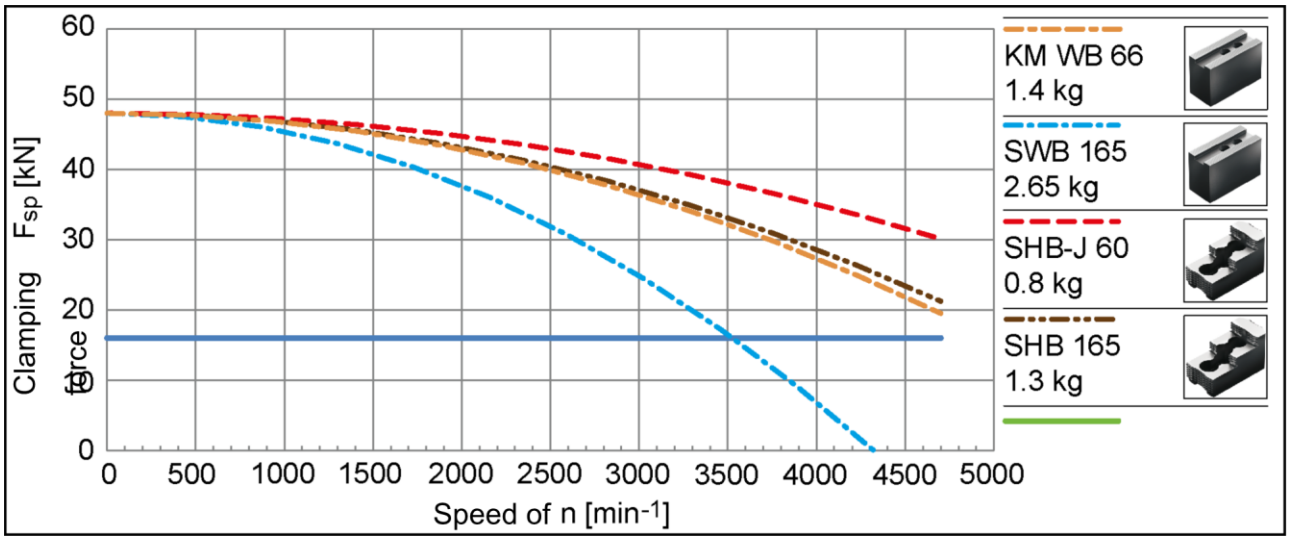
The chuck is in perfect condition and lubricated with SCHUNK LINOMAX plus special grease.

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

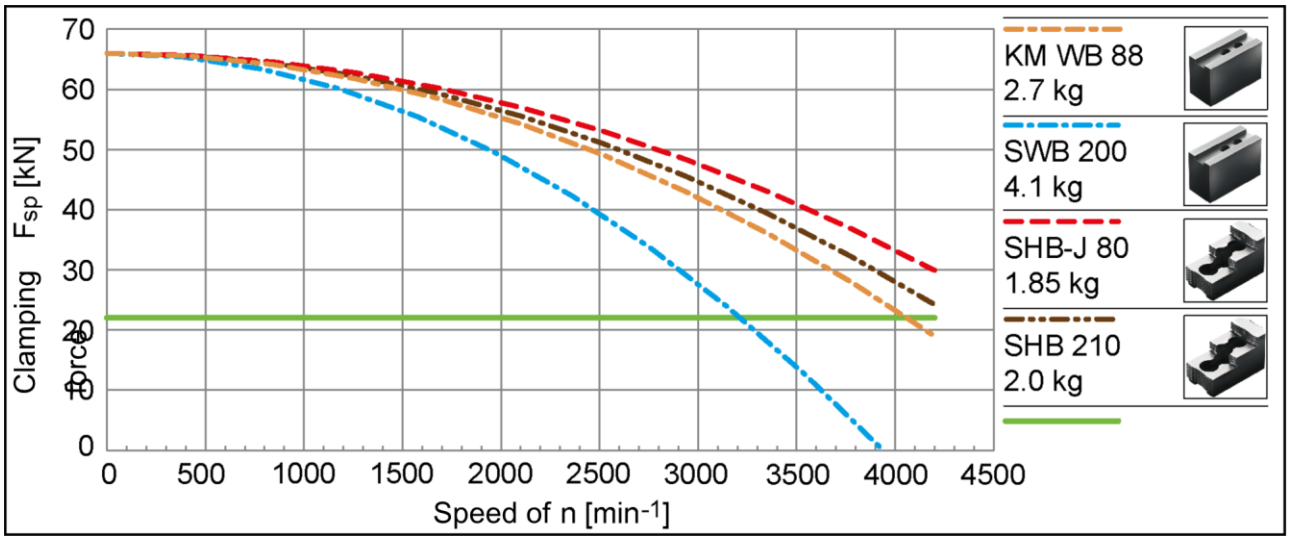
Chuck setup for clamping force/RPM graph



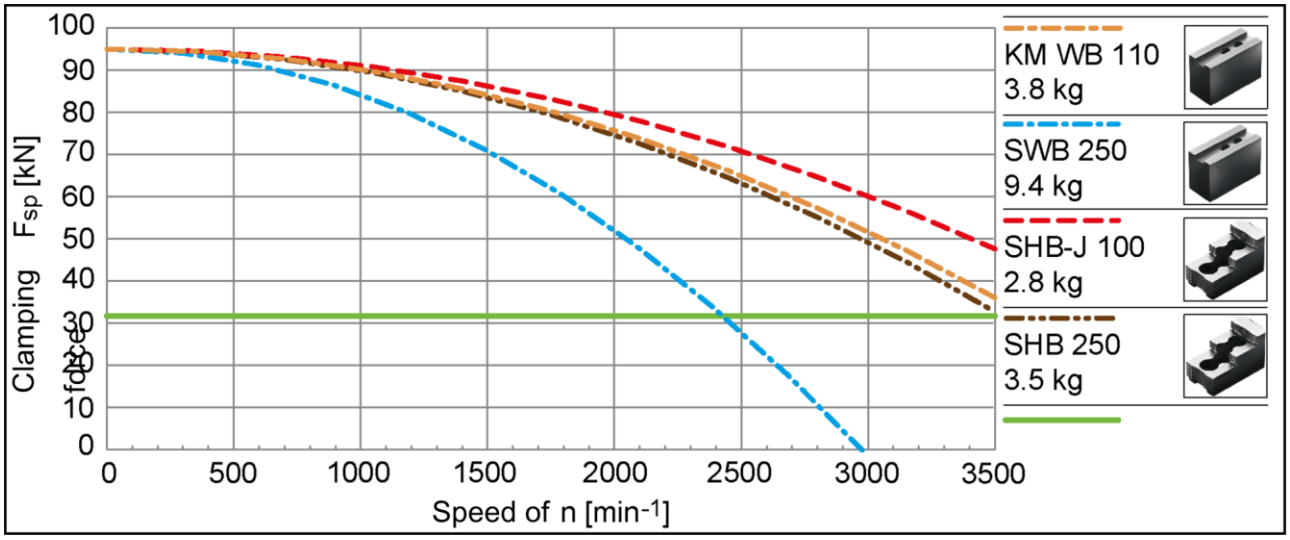
Clamping force RPM graph, ROTA NC plus 2 185-52/2



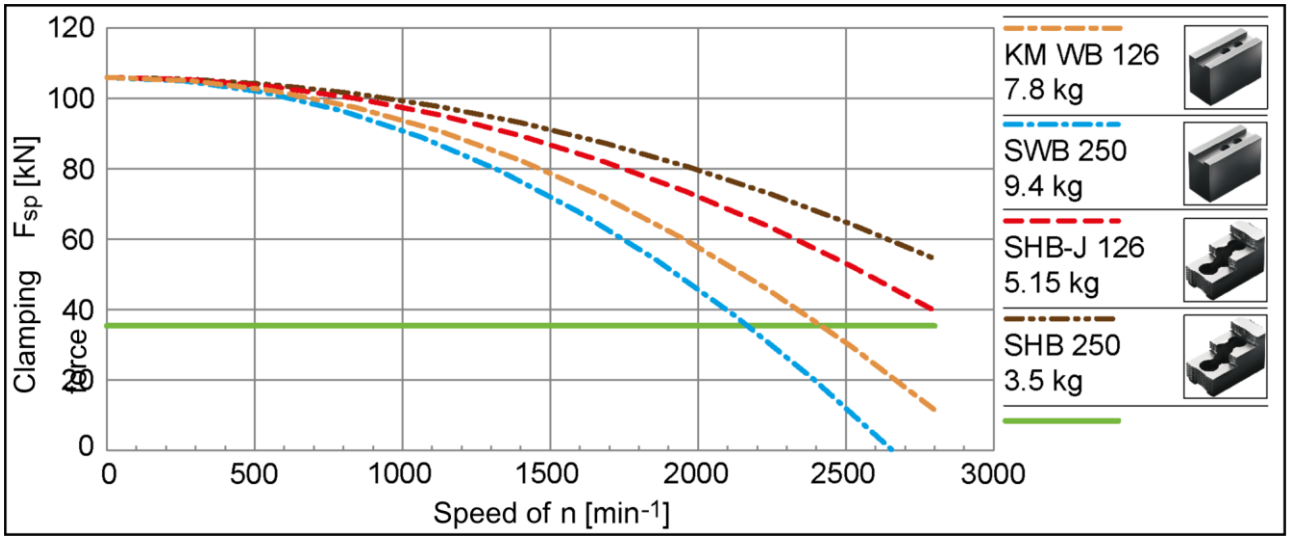
Clamping force RPM graph ROTA NC plus 2 216-66/2



Clamping force RPM graph ROTA NC plus 2 260-86/2



Clamping force RPM graph ROTA NC plus 2 315-104/2



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 [Nm]
F_{sp}	Effective clamping force [N]	M_{cGB}	Centrifugal torque of base jaws [Nm]
F_{spmin}	Minimum required clamping force [N]	n	Speed [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 force torque [Nm]	Σ_s	Max. clamping force of chuck [N]
kgm × 9.81 = Nm			

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}**.

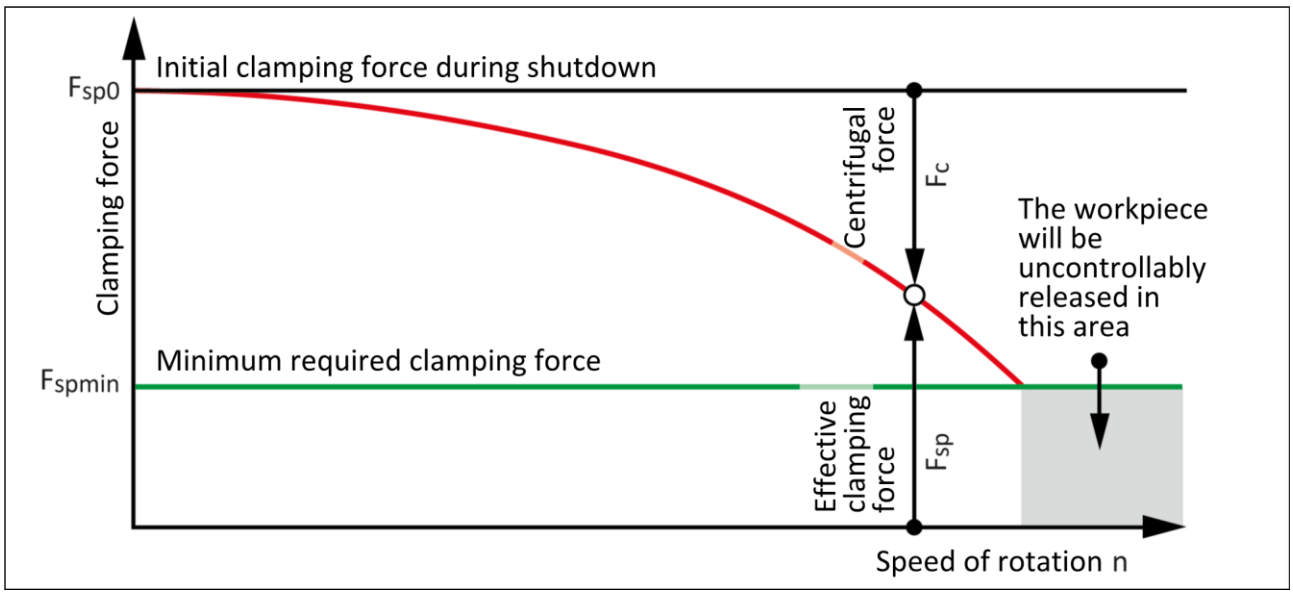
$$F_{sp} = F_{sp0} \mp F_c \text{ [N]}$$

(–) 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 chuck.
See also "Chuck data" table (☞ 3.1, Page 18)

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 force 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 "Chuck data"(☞ 3.1, Page 18). 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 speed 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. speed of rotation n_{max} = 3200 ^{rpm} ("Chuck data" table)
- RPM n = 1200 min^{-1} (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:

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

Centrifugal torque of base jaw and top jaw specified in "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 2 jaws, the total centrifugal torque is:

$\sum M_c = 2 \cdot M_c = 2 \cdot 0.889 \Rightarrow \sum M_c = 1.778\ kgm$

The total centrifugal force can now be calculated:

$$F_c = \sum M_c \cdot \left(\frac{\pi \cdot n}{30}\right)^2 = 1.778 \cdot \left(\frac{\pi \cdot 1200}{30}\right)^2 \Rightarrow F_c = 28077\ N$$

Initial clamping force during shutdown that was sought:

$F_{sp0} = S_{sp} \cdot (F_{sp} + F_c) = 1.5 \cdot (4500 + 28077) \Rightarrow F_{sp0} = 32577\ N$

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

Calculation of the permissible speed 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

The calculated permissible RPM may not exceed the maximum RPM inscribed on the chuck for safety reasons!

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 $\sum M_c$ = 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:

$$n_{zul} = \frac{30}{\pi} \cdot \sqrt{\frac{F_{sp0} - (F_{spz} \cdot S_z)}{\sum M_c}} = \frac{30}{\pi} \cdot \sqrt{\frac{32577 - (3000 \cdot 1.5)}{1.778}} \Rightarrow n_{zul} = 1655 \; min^{-1}$$

The calculated RPM n_{zul} = 1655 min^{-1}, is smaller than the maximum permissible RPM of the chuck n_{max} = 3200 min^{-1} (see "Chuck data" table (☞ 3.1, Page 18)).

This calculated RPM may be used.

3.4 Grades of Accuracy

Tolerances for run-out accuracy and axial run-out accuracy correspond to the Technical Supply Terms for lathe chucks as per DIN ISO 3089.

3.5 Permissible imbalance

The ROTA NC2 plus 2, 2 jaws in ungreased state without T-nuts and top jaws corresponds to the balancing quality class 6.3 (according to DIN ISO 21940-11). Residual imbalance risks may arise due to insufficient rotation compensation being achieved (see DIN EN 1550 6.2 e). This applies particularly to high RPM, asymmetrical workpieces or the use of various top jaws, as well as uneven lubrication. In order to prevent damage resulting from these residual risks, the entire rotor must be dynamically balanced in accordance with DIN ISO 21940-11.

4 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 Mounting

5.1 Installing and connecting

⚠ 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.

1 Checking the spindle nose for mounting the chuck flange (☞ 5.2, Page 28)

2 Chuck assembly

⇨ Chuck assembly with cylindrical recess (☞ 5.3.1, Page 30) or

⇨ Assembly of the chuck with reduction or extension flange (☞ 5.3.2, Page 30) or

3 Performing a functional check (☞ 6.2, Page 33)

5.2 Inspection of the spindle nose for mounting the chuck flange

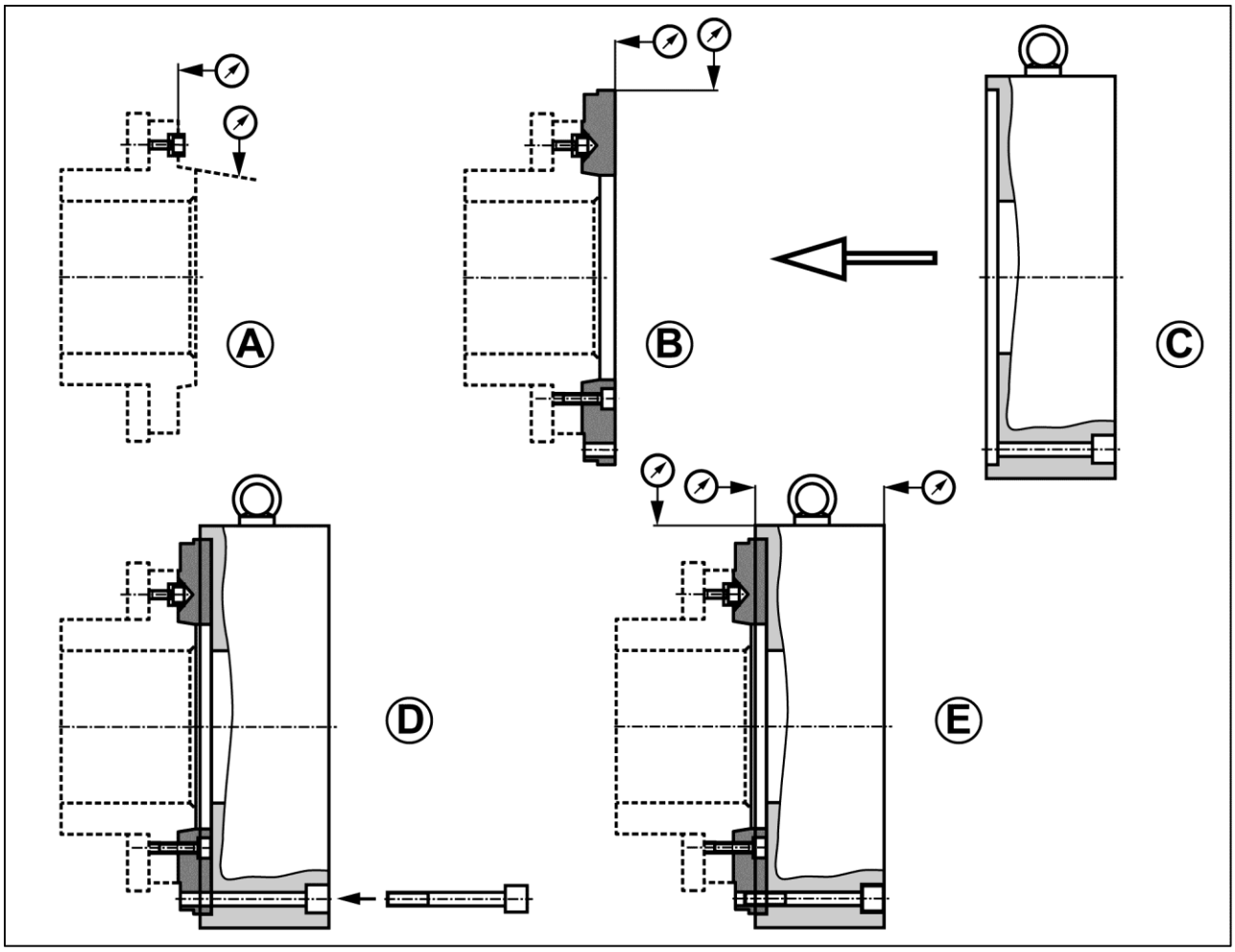
The machine side must be aligned prior to the flange being installed in order to achieve high run-out accuracy of the chuck. To do this, check the contact surfaces on the spindle for axial and concentric run-out using a dial indicator (see Fig. "Chuck assembly" - (☞ 5.3, Page 29)).

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.

5.3 Assembly of the chuck on the machine

The item numbers specified for the corresponding individual components relate to chapter drawings.(☞ 9, Page 40)



Chuck assembly

The radial and axial run-out accuracy to be reached depend on the diameter of the chuck. The table shows the attainable maximum radial and axial run-out tolerances:

Chuck size [mm]	Max. concentricity error [mm]	Max. axial run-out error [mm]
185-52	0.020	0.01
215-66	0.025	0.01
260-86	0.030	0.01
315-104	0.030	0.015

5.3.1 Chuck assembly with cylindrical recess

- Completely remove the mounting screws (item 30).
- Actuate the hydraulic cylinder and move the draw tube to its foremost position (see Fig. "piston position").

Using a crane on an assembly belt or eye bolt, raise the chuck in front of the spindle lug until it is flush with the center of the spindle.

- By rotating the draw tube, pull the chuck onto the spindle.
- Tighten the chuck mounting screws (item 30) alternately.
- Check radial and axial runout at the checking edge (see "Chuck assembly" Fig. - A (☞ 5.3, Page 29)).
- Check the actuating force is functioning and is sufficient.
- Ensure smooth operation.
- In accordance with identification 1 and 2, secure the top jaws to the base jaws with screws.

The parts are disassembled in the same way but in the reverse order.

Cylinder piston in foremost position
R1 = Push the chuck piston to its foremost position and measure with a depth gauge
R2 = R1 – 0.5 mm (max. – 1 mm)

5.3.2 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:

To mount the chuck with a reducing or extension flange on the machine spindle with a short taper, a corresponding chuck flange must be fastened to the spindle nose.

- Before assembly of the chuck flange, remove any dirt or chips from the machine spindle and from the centering mount and contact surface of the flange.

- A chuck flange produced by the user must be fully machined on the machine spindle and balanced before assembly of the chuck.
- After assembly, ensure that the flange is in contact with the entire surface.
- Then check radial and axial run-out. (See "Chuck assembly" Fig. - B and the table of the attainable maximum radial and axial run-out tolerances (☞ 5.3, Page 29)).

After the flange has been aligned, the chuck is assembled.
Remove any contaminants on the flange and the chuck contact surfaces.

- Using a crane on an assembly belt or eye bolt, raise the chuck in front of the spindle lug until it is flush with the center of the spindle (see "Chuck assembly" Fig. - C (☞ 5.3, Page 29)). The eye bolt is included in the scope of delivery from size 250.

The eye bolt must be removed after the chuck has been assembled and prior to starting up the chuck.

- If necessary, turn the adapter on the chuck.
- Push the chuck onto the intermediate flange. Ensure that the through-bores for fastening the chuck line up with the threaded holes of the flange (see "Chuck assembly" Fig. - D (☞ 5.3, Page 29)).
- Insert and **slightly tighten** the mounting screws.
- Check the chuck for radial and axial run-out accuracy and, if necessary, align at the outer diameter with gentle taps using a hammer. (See "Chuck assembly" Fig. - E and the table of the attainable maximum radial and run-out tolerances (☞ 5.3, Page 29)).
- Then tighten the mounting screws with a torque wrench. Observe the specified maximum tightening torques (see "Screw tightening torques" chapter (☞ 4, Page 27)).
- Check radial and axial run-out again.

5.4 Exchanging and turning the top jaws

When changing the top jaws, the serration must be cleaned. Tighten the screws with the specified torque (see "Screw torques" chapter (☞ 4, Page 27)).

⚠ WARNING

Risk of personal injury and property damage due to parts flying off in the event of a screw breakage on unhardened top jaws!
Soft standard top jaws must be hardened in the countersink region.
They should only be depth-hardened, not surface-hardened.

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 turning ring or turning pin is clamped **by the top jaws** and not by the base jaws.
Tighten jaw mounting screws (screw quality 12.9) to specified torque (see "Screw torques" chapter"). (☞ 4, Page 27)

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.

6 Function

6.1 Function and handling

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

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

⚠ WARNING

Clamping further above the chuck surface results in lower clamping force.
If the workpiece is released in an uncontrolled manner, there is a risk of personal injury and damage to the system.

- Refer to the "Technical data" chapter!

6.2 Functional testing

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

Two important points are:

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

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

Speed of rotation

DANGER

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

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

6.3 Replacement or renewal of jaws

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

NOTICE

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

Tighten the jaw mounting screws (screw grade 12.9) to the specified torque (☞ 4, Page 27).

NOTICE

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!

NOTICE

Make sure that the workpiece is clamped halfway up the base jaw stroke.
The workpiece must not be clamped at the end of the base jaw stroke. This can lead to the workpiece becoming loose.

⚠ WARNING

Risk of personal injury and property damage due to parts flying off in the event of a screw breakage on unhardened top jaws!
Soft standard top jaws must be hardened in the countersink region.
They should only be depth-hardened, not surface-hardened.

Changing the top jaws

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

7 Maintenance

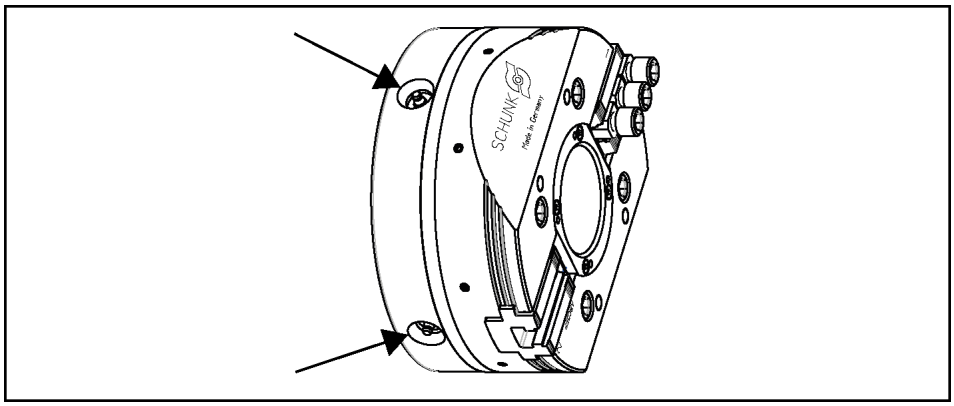
7.1 Lubrication

To maintain the safe function and high quality of the chuck, it must be regularly lubricated at the lubrication nipples (item 33) (☞ 9, Page 40).

The chuck must be lubricated without a workpiece and in the completely closed base jaw position.

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

Chuck Size	185	215	260	315
Number of grease press strokes	6	8	12	20



Operating conditions

Depending on the operating conditions, the function and clamping force must be checked after a specific period of operation (see "Maintenance intervals" (☞ 7.2, Page 37)). Only use a calibrated clamping force tester for measuring in the clamping force test (SCHUNK GFT-X).

Technical condition

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

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

Only use genuine SCHUNK spare parts when replacing damaged parts.

7.2 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

7.3 Disassembly and assembly of the Chuck

The item numbers specified for the corresponding individual components relate to chapter drawings.(☞ 9, Page 40)

The lathe chuck must only be disassembled once it has been uninstalled.
(See chapter "Mounting the chuck to the machine" (☞ 5, Page 28).)

- Remove the screws (item 28) and use the threaded extraction hole to push off the protection sleeve (item 4) away from the chuck body (item 1), and then pull it out completely.
- Mark the position of the mount (item 7) in relation to the chuck body (item 1).
- Undo the screws (item 29) several thread turns and hammer gently on the screw heads using a rubber mallet. This allows the mount (item 7) to be released from the centering for the chuck body (item 1). Remove the screws and take off the mount.
- Remove the locking bolts (item 11) from the chuck body (item 1).
- Pull the piston (item 3) out of the chuck body (item 1). For sizes 260 and 315, the retaining ring can be removed by turning it counterclockwise (item 5) and pulling the center sleeve (item 6) with the balls (item 27) and the spring (item 26).
- Push the base jaws (item 2) with the seal (item 39) inwards out of the base jaw guide.

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

Only use genuine SCHUNK spare parts when replacing damaged parts.

Before assembly, grease well with LINOMAX plus special grease paste.

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

During assembly, the following must be observed in particular:

- The piston has a point marking on the front side. This is assigned to base jaw guide 1 during assembly.

8 Spare parts

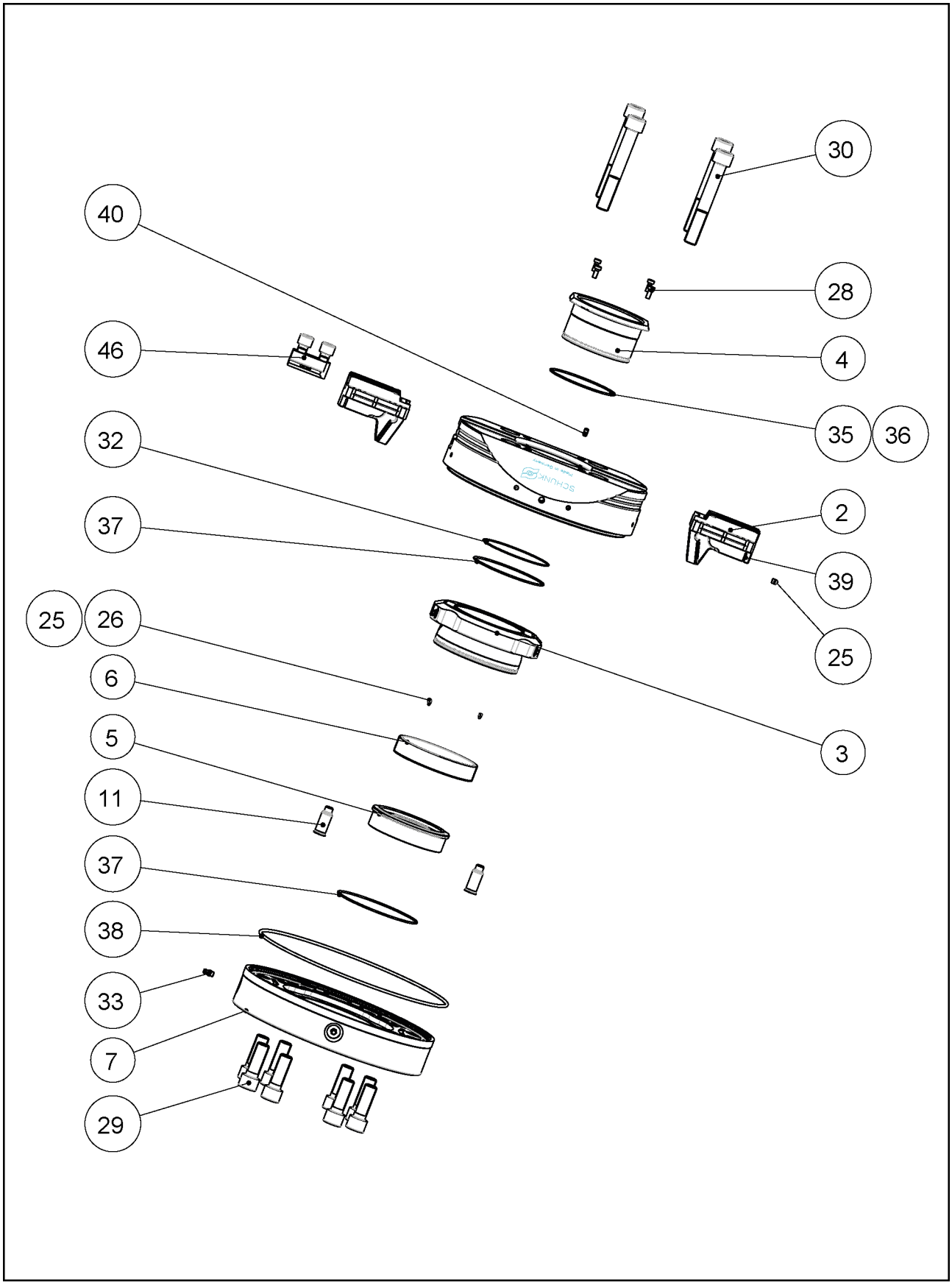
When ordering spare parts, it is imperative to specify the type, size and above all the serial no. of the chuck.

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	2
3	Piston	1
4	Protection sleeve	1
5	Center sleeve *	1
6	Retainer ring *	1
7	Mount	1
11	Safety bolt	2
25	Set-screw	8
26	Spring *	2
27	Sphere *	2
28	Screw	4
29	Screw	8
30	Screw	4
31	O-ring	1
33	Lubrication nipple	4
35	O-ring	1
36	Support ring	1
37	O-ring	1
38	O-ring	1
39	Sealing ring	1
40	Emblem	1
46	T-nut	4/2

* = from size 260

9 Drawing



10 Translation of the original declaration of incorporation

in terms of the Directive 2006/42/EG, Annex II, Part 1.B of the European Parliament and of the Council on machinery.

Manufacturer/ Distributor	H.-D. SCHUNK GmbH & Co. Spanntechnik KG Lothringer Str. 23 D-88512 Mengen

We hereby declare that on the date of the declaration the following partly completed machine complied with all basic safety and health regulations found in the directive 2006/42/EC of the European Parliament and of the Council on machinery. The declaration is rendered invalid if modifications are made to the product.

Product designation:	Power chuck
Type designation:	ROTA NC plus 2 185-52/2, 215-66/2, 260-86/2, 315-104/2
ID number:	1344272, 1348228, 1316839, 1348229, 1316843, 1348230, 1316845, 1331433

The partly completed machine may not be put into operation until conformity of the machine into which the partly completed machine is to be installed with the provisions of the Machinery Directive (2006/42/EC) is confirmed.

Applied harmonized standards, especially:

EN 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 work holding chucks

Other related technical standards and specifications:

DIN ISO 702-1:2010-04	Machine tools - Connecting dimensions of spindle noses and work holding chucks - Part 1: Conical connection
DIN ISO 702-2:2010-04	Machine tools - Connecting dimensions of spindle noses and work holding chucks - Part 2: Conical connection
DIN ISO 702-3:2010-04	Machine tools - Connecting dimensions of spindle noses and work holding chucks - Part 3: Bayonet connection
DIN ISO 702-4:2010-04	Machine tools - Connecting dimensions of spindle noses and work holding chucks - Part 4: cylindrical assembly
DIN ISO 3442-2:2010-08	Machine tools - Dimensions and geometric tests for self-centring chucks with two-piece jaws - Part 2: Power-operated chucks with tongue and groove type jaws
VDI 106:2004-04	Determination of permissible speed (rpm) of lathe chucks (jaw chucks)

The manufacturer agrees to forward on demand the relevant technical documentation for the partly completed machinery in electronic form to national authorities.

The relevant technical documentation according to Annex VII, Part B, belonging to the partly completed machinery, has been created.

Person authorized to compile the technical documentation:
Philipp Schräder, Address: see manufacturer's address

Signature: see original declaration

Mengen, June 2018 p.p. Philipp Schräder; Head of Engineering Design

11 Appendix on Declaration of Incorporation, as per 2006/42/EC, Annex II, No. 1 B

1. Description of the basic safety and health protection requirements, as per 2006/42/EC, Annex I, that apply to and are fulfilled for the scope of the partly completed machinery:

Product designation	Power chuck
Type designation	ROTA NC plus 2 185-52/2, 215-66/2, 260-86/2, 315-104/2
ID number	1344272, 1348228, 1316839, 1348229, 1316843, 1348230, 1316845, 1331433

		To be provided by the System Integrator for the overall machine ⇓	Fulfilled for the scope of the partly completed machine ⇓	Not relevant ⇓
1.1	**Essential Requirements**			
1.1.1	Definitions		X	
1.1.2	Principles of safety integration		X	
1.1.3	Materials and products		X	
1.1.4	Lighting			X
1.1.5	Design of machinery to facilitate its handling		X	
1.1.6	Ergonomics			X
1.1.7	Operating positions			X
1.1.8	Seating			X
1.2	**Control Systems**			
1.2.1	Safety and reliability of control systems			X
1.2.2	Control devices			X
1.2.3	Starting			X
1.2.4	Stopping			X
1.2.4.1	Normal stop			X
1.2.4.2	Operational stop			X
1.2.4.3	Emergency stop			X
1.2.4.4	Assembly of machinery			X
1.2.5	Selection of control or operating modes			X
1.2.6	Failure of the power supply			X
1.3	**Protection against mechanical hazards**			
1.3.1	Risk of loss of stability		X	
1.3.2	Risk of break-up during operation		X	
1.3.3	Risks due to falling or ejected objects			X
1.3.4	Risks due to surfaces, edges or angles		X	
1.3.5	Risks related to combined machinery			X
1.3.6	Risks related to variations in operating conditions		X	
1.3.7	Risks related to moving parts		X	
1.3.8	Choice of protection against risks arising from moving parts			X
1.3.8.1	Moving transmission parts			X
1.3.8.2	Moving parts involved in the process			X
1.3.9	Risks of uncontrolled movements			X
1.4	**Required characteristics of guards and protective devices**			
1.4.1	General requirements			X
1.4.2	Special requirements for guards			X

1.4.2.1	Fixed guards			X
1.4.2.2	Interlocking movable guards			X
1.4.2.3	Adjustable guards restricting access			X
1.4.3	Special requirements for protective devices			X
1.5	**Risks due to other hazards**			
1.5.1	Electricity supply			X
1.5.2	Static electricity			X
1.5.3	Energy supply other than electricity			X
1.5.4	Errors of fitting		X	
1.5.5	Extreme temperatures		X	
1.45.6	Fire			X
1.5.7	Explosion			X
1.5.8	Noise		X	
1.5.9	Vibrations		X	
1.5.10	Radiation	X		
1.5.11	External radiation	X		
1.5.12	Laser radiation	X		
1.5.13	Emissions of hazardous materials and substances			X
1.5.14	Risk of being trapped in a machine			X
1.5.15	Risk of slipping, tripping or falling			X
1.5.16	Lightning			X
1.6	**Maintenance**			
1.6.1	Machinery maintenance		X	
1.6.2	Access to operating positions and servicing points		X	
1.6.3	Isolation of energy sources			X
1.6.4	Operator intervention			X
1.6.5	Cleaning of internal parts			X
1.7	**Information**			
1.7.1	Information and warnings on the machinery		X	
1.7.1.1	Information and information devices		X	
1.7.1.2	Warning devices			X
1.7.2	Warning of residual risks		X	
1.7.3	Marking of machinery	X		
1.7.4	Instructions	X		
1.7.4.1	General principles for the drafting of instructions		X	
1.7.4.2	Contents of the instructions	X		
1.7.4.3	Sales literature		X	
	The classification from Annex 1 is to be supplemented from here forward.			
2	Supplementary essential health and safety requirements for certain categories of machinery			X
2.1	Foodstuffs machinery and machinery for cosmetics or pharmaceutical products			X
2.2	Portable hand-held and/or guided machinery			X
2.2.1	Portable fixing and other impact machinery			X
2.3	Machinery for working wood and material with similar physical characteristics			X
3	Supplementary essential health and safety requirements to offset hazards due to the mobility of machinery			X
4	Supplementary essential health and safety requirements to offset hazards due to lifting operations			X
5	Supplementary essential health and safety requirements for machinery intended for underground work			X
6	Supplementary essential health and safety requirements for machinery presenting particular hazards due to the lifting of persons			X