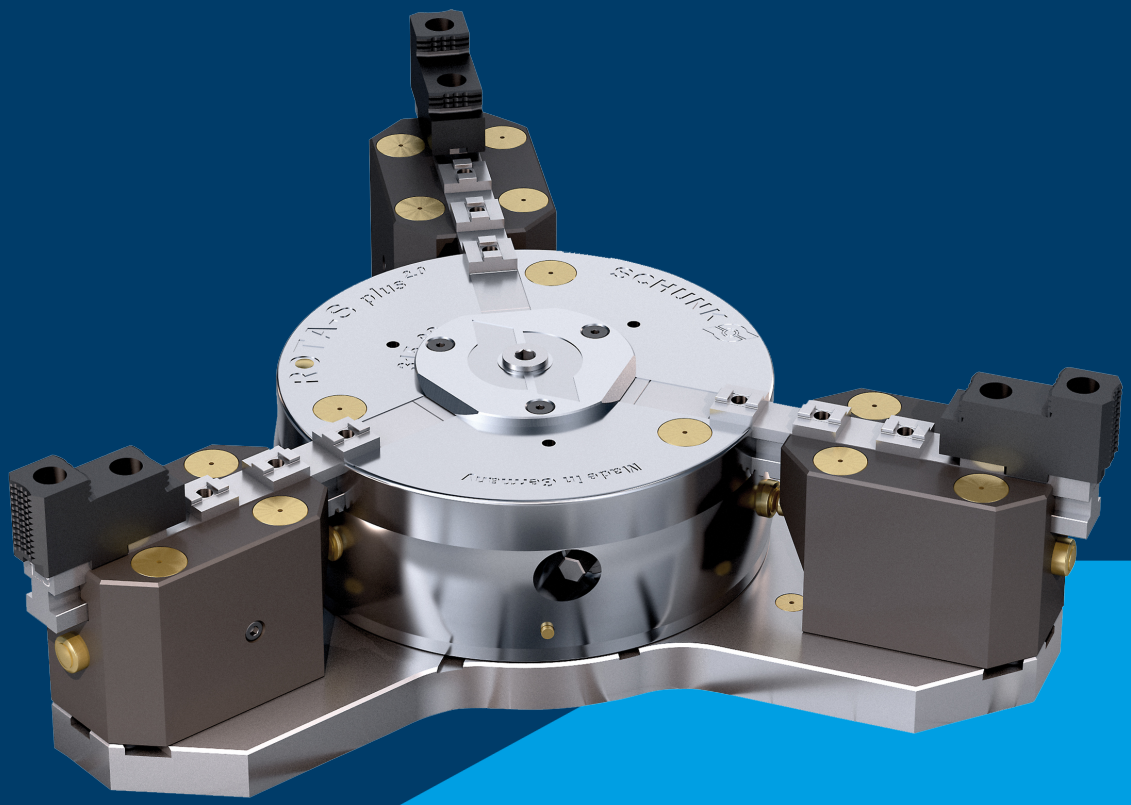

Manual Lathe Chucks
ROTA-S flex
Assembly and Operating Manual

Translation of Original Operating Manual

Hand in hand for tomorrow

Imprint

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

Document number: 0889139

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

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

Table of Contents

1 General

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

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.

CAUTION

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

Katalogdatenblatt des gekauften Produkts

Calculation of the jaw centrifugal forces
("Technology" chapter in the lathe chuck catalog)

The above mentioned documents can be downloaded at **www.de.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.

2.1 Intended use

The chuck is used to clamp workpieces on machine tools and other suitable technical facilities, paying particular attention to the technical data specified by the manufacturer. The technical data specified by the manufacturer must never be exceeded.

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"). ▸ 6.1 [🗋 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. ▸ 6.1 [🗋 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

This product may pose a danger to persons and property if, for example:

- It is not used as intended;
- It is not installed or maintained properly;
- The safety and installation instructions, local applicable safety and accident prevention regulations or the EC Machinery Directive are not observed.

⚠ 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.

⚠ DANGER

Possible risk of fatal injury to operating personnel due to loss of clamping force as a result of temperature changes between the clamping procedure and machining due to loss of workpiece!

- If the chuck jaws are expected to penetrate the workpiece during the clamping procedure and if a temperature change occurs between the clamping procedure and machining, it is imperative that the lathe chuck is re-tensioned before machining.
- The larger the clamping diameter, the difference in the linear expansion coefficient of the workpiece compared to steel and the temperature range, the greater the loss of clamping force.

⚠ DANGER

Possible risk of fatal injury to operating personnel due to loss of clamping force as a result of the time period between the clamping procedure and machining due to loss of workpiece!

- If the time between the clamping procedure and machining is longer than 8 hours, it is imperative to re-tension before machining.

⚠ 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.

⚠ WARNING

Risk of injury by catapulted brass cover caps (accessory) of the clamping bolt in case of rotation of the chuck.

The brass cover caps (accessory) of the clamping bolt must only be used for stationary use of the 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

Danger of damage due to incorrectly selected clamping position of the clamping jaws to the workpiece.

An incorrectly selected clamping position of the clamping jaws to the workpiece can result in damage to the base and top jaws.

- Make sure that the workpiece clamping is concentric.
- In the case of a chuck with a quick-change jaw system the top jaws must not protrude radially beyond the base jaws used.
  Exception: The supporting jaw variant 3 protrudes beyond the chuck base jaw due to the construction of the jaw. In this case, the T-nuts must always be inserted completely into the groove of the chuck base jaw.

⚠ 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.

CAUTION

Excessive lubrication may lead to functional defects (stiffness) when changing jaws or in the release mechanism.

- Disassemble the chuck and remove the excess grease.
- For lubrication observe the chapter maintenance.

2.4 Notes on safe operation

- Do not start the machine spindle until the workpiece is clamped and the spanner wrench has been removed from the chuck.
- Only operate the lathe chuck when all protective equipment has been fitted and is in full working order.
- Check the lathe chuck at least once per shift for externally visible damage and faults.

Functional test

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

- **Clamping force!** At max. torque, the clamping force specified for the chuck must be reached.
- **Indicator pin!** Never clamp or switch on the lathe when the indicator pin is protruding. (Golden pin on the chuck's shell).
- **Jaw lock!** The spindle can only be turned when all the chuck jaws have been fitted into the T-slot. This prevents the wedge bars from being brought into the working position without chuck jaws.

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.

⚠ WARNING

Vibrations caused by the processing can result a loss of clamping force. Risk of injury due drop out of the workpiece.

Manually operated chucks can lose clamping force because of vibration which is caused by the processing of the workpiece.

- Tighten the chuck regularly during processing to compensate the loss of clamping force due to vibration.

Maintenance instructions

The manual 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 lathe chuck 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 with the chuck in the same condition as it is used in for the current clamping application. If top jaws with clamping steps are used,

measuring must be performed in the same step as for the respective clamping task. In the event of high operating speeds, clamping force losses must be accounted for due to the centrifugal force acting on the chuck jaws. In this case the value of the operating clamping force should be measured dynamically.

- Move the lathe chuck through to its end position several times after 500 clamping strokes, at the latest. (This moves the lubricant back to the force transmission surfaces 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.

Immediately report any changes including operational behavior to the competent units/persons; if necessary, immediately shut down and secure the machine on which the lathe chuck is mounted. Do not start up the machine that the chuck is mounted on again until the malfunction has been eliminated.

⚠ 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.

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 special chuck jaws 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 bolts into the bore holes furthest apart.
- The maximum recommended speed may only be operated in conjunction with the maximum clamping force and only with the lathe chuck in optimum, fully functioning condition.
- If the chuck is involved in a collision, it must be subjected to a crack test before using it 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.

2.4.1 Constructional changes, attachments or modifications

Modifications and rework (additional threads or bore holes) or attaching fittings that are not offered as accessories by SCHUNK may be performed only with permission of SCHUNK. This also applies to the installation of safety devices.

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

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

Checking the behavior of personnel

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

Danger signs

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

Faults

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

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 ▸ 6.1 [🗋 19]
- Observe the specified maintenance and lubrication intervals, ▸ 9 [🗋 32]

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

5 Scope of delivery

Centering chuck (complete) **ROTA-S plus 2.0** or **ROTA-S plus**
1 **Console plate**
3 **Extensions of guideway**
1 **Set of long special base jaws**
1 **Set of short special base jaws**
1 **Cover plate**
2 **Centering bolts** Ø 32g6 / Ø 50g6
Screws and T-nuts for mounting on the machine table
1 **Allan key** (up to size 1200 only)
1 **Ratchet with adapter**
1 **Operating Manual ROTA-S flex**
1 **Operating Manual ROTA-S plus 2.0 or ROTA-S plus**

6 Technical data

6.1 Chuck data

(with long base jaws)

ROTA-S flex		550	700	1000	1200	1400
Max. torque	Nm	120	220	280	320	350
Stroke per jaw	mm	7	9.7	12	12	15
Recommended max. speed	min^{-1}	1000	800	500	500	400
Total gripping force max.	kN	100	180	230	270	270
Mass moment of inertia	kg m^2	1.6	7.078	25.03	57.89	125.28
Chuck through hole	mm	52	92	102	162	252
Weight with jaws	kg	65	150	360	490	830
Centrifugal torque of the long base jaws	$\mathbf{M}_{cGB}$ kgm	0.153	0.5448	1.8	2.66	5.59
Max. jaw center eccentricity in axial direction (with long base jaws)	$\mathbf{a}_{max}$ mm	For the ROTA-S flex chucks it's necessary to determine those data specific. Calculation examples are in the chapter "Technology" in the SCHUNK-lathe-chuck-catalog or in the chapter "Special jaws/Technology" in the SCHUNK-power-chuck-catalog. Those catalogs are also available as download at www.de.schunk.com.				

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

Length of warranty	24 Months
Maximum clamping cycle number	50 000 Cycles

Tab.: Warranty and maximum clamping cycles

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

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

The recommended speed is valid for ROTA-S flex with long base jaws and SCHUNK stepped block jaws, hard, type STF.
In this the base jaws are inserted flush with outer diameter of the chuck.

Jaw type	SFA 200	SFA 315	SFA 400	SFA 500	SFA 630
Weight / Set [kg]	2.0	5.6	13.5	13.5	40.0

The speed of rotation must be reduced for jaws with a higher weight!

Max. oscillating diameter – with base jaws type SFG

ROTA-S flex	550	700	1000	1200	1400
Oscillating diameter Ø [mm]	570	755	1000	1265	1400

The chuck is balanced at Q 6.3 at rated speed.

6.2 Clamping force / speed diagrams

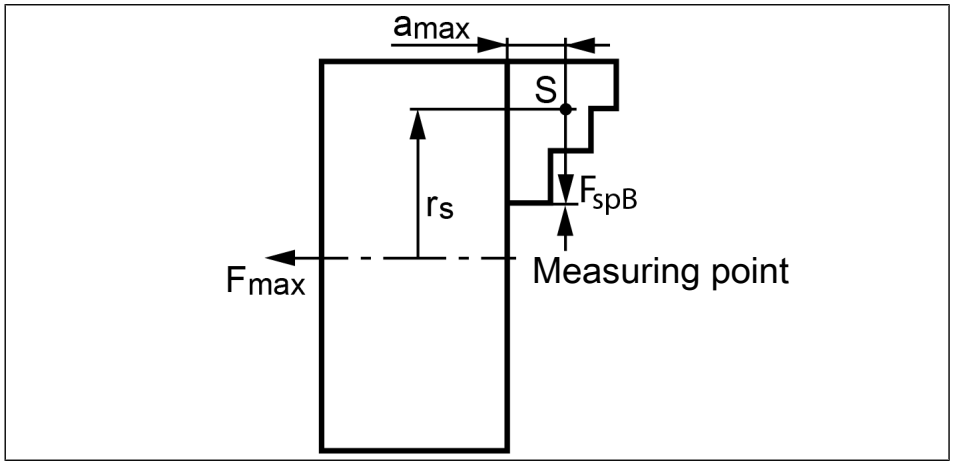
The diagrams relate to a 3-jaw chuck.
Clamping force/RPM curves have been calculated using long, hard base jaws and hard SHF and SFA standard jaws. During this the maximum actuating force was applied.

The diagrams showing short, hard base jaws and hard SHF and SFA standard jaws can be found in the ROTA-S plus or ROTA-S plus 2.0 operating manuals contained in the scope of delivery

The chucks were in perfect condition and lubricated with SCHUNK LINOMAX special grease.

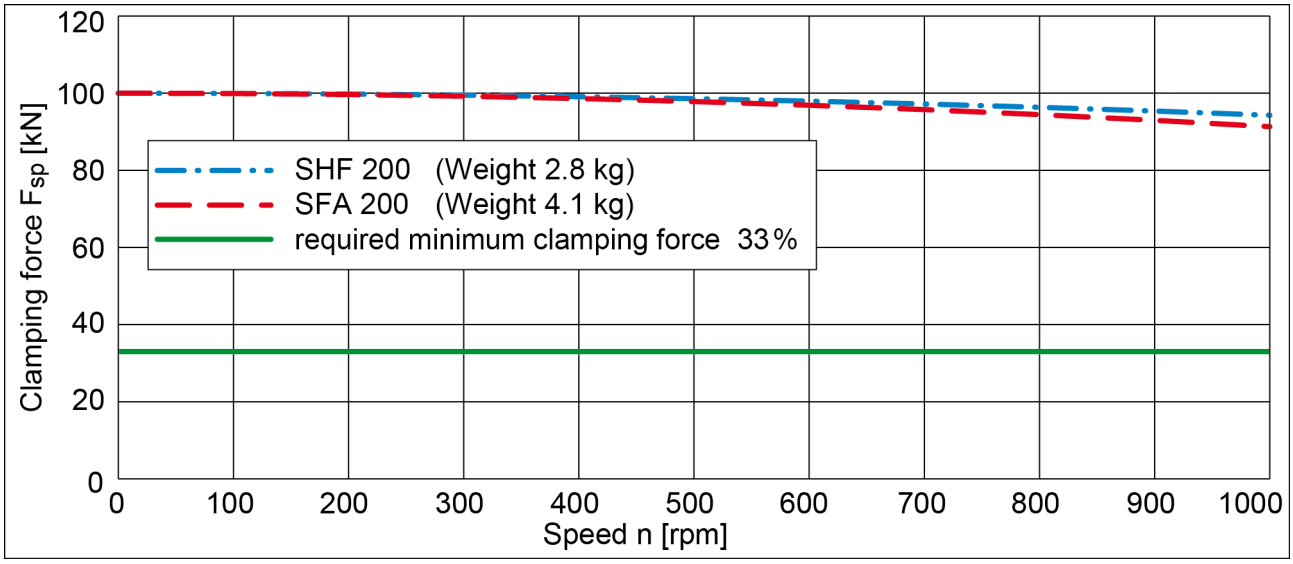
After modification of one or several of these prerequisites the diagram will no longer be valid.

Chuck setup for clamping force/RPM diagram

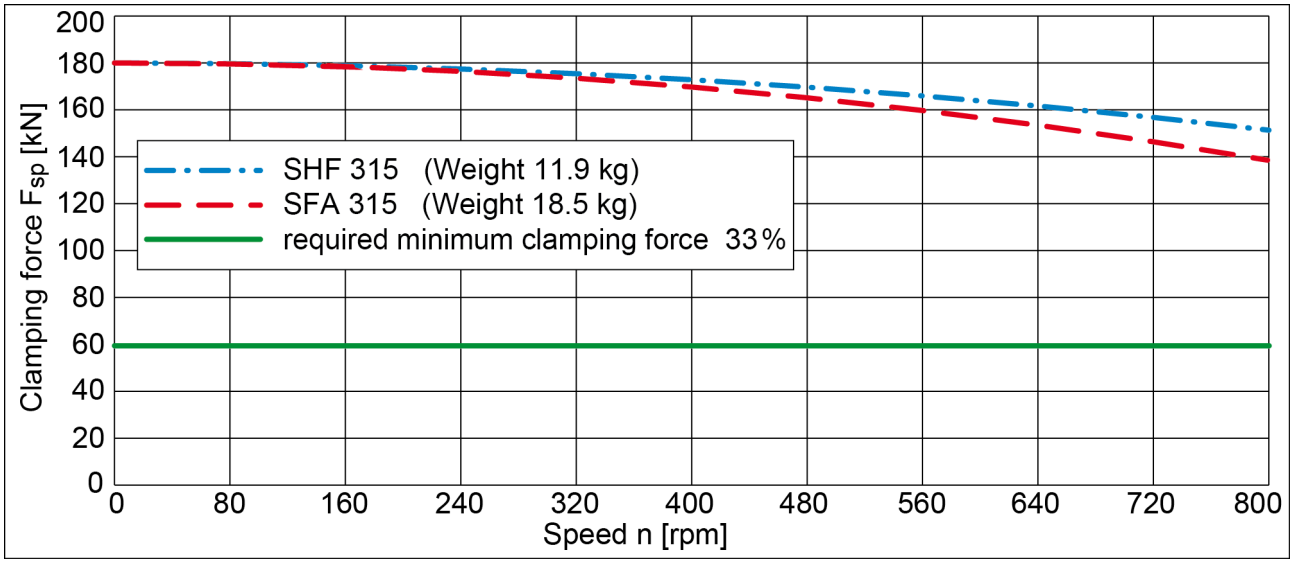


F / 3	Clamping force per jaw	S	Center of gravity
r_s	Center of gravity radius	a_{max}	Max. jaw center of gravity eccentricity in axial direction
F_{max}	Actuating force		

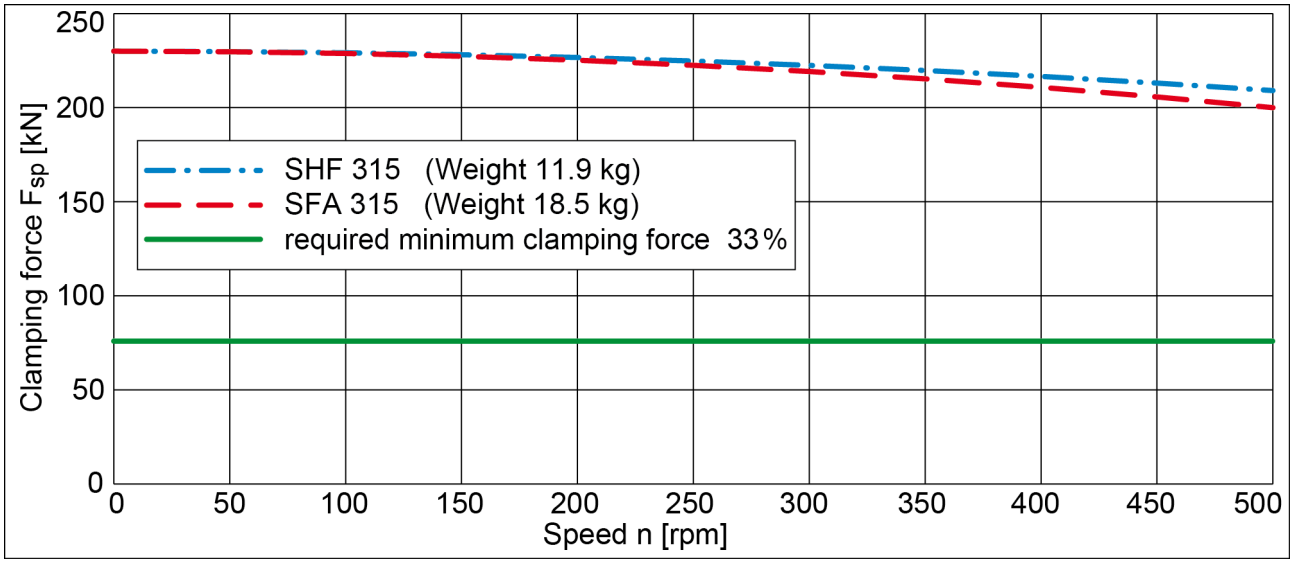
ROTA-S flex 550 (with long jaws)



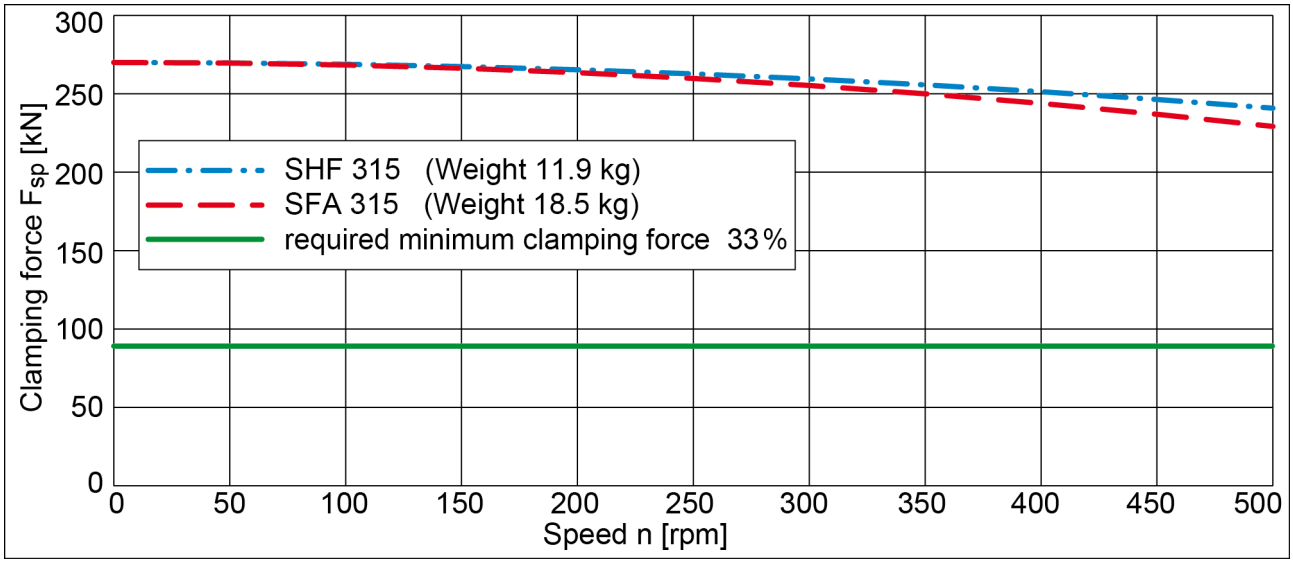
ROTA-S flex 700 (with long jaws)



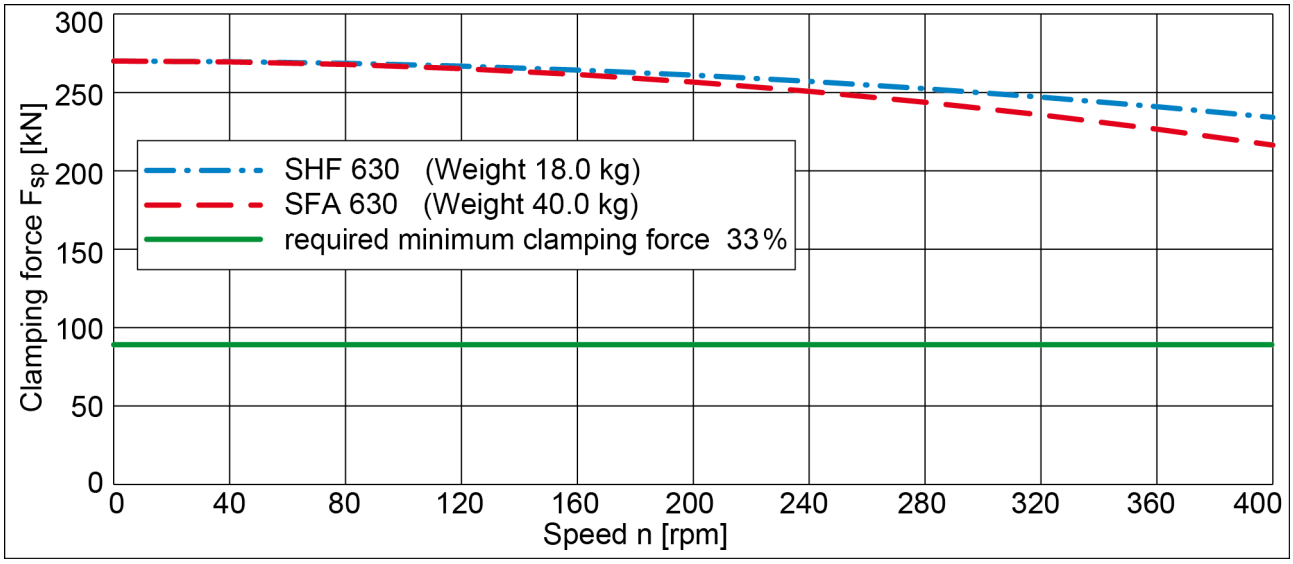
ROTA-S flex 1000 (with long jaws)



ROTA-S flex 1200 (with long jaws)



ROTA-S flex 1400 (with long jaws)



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 [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			

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}**.

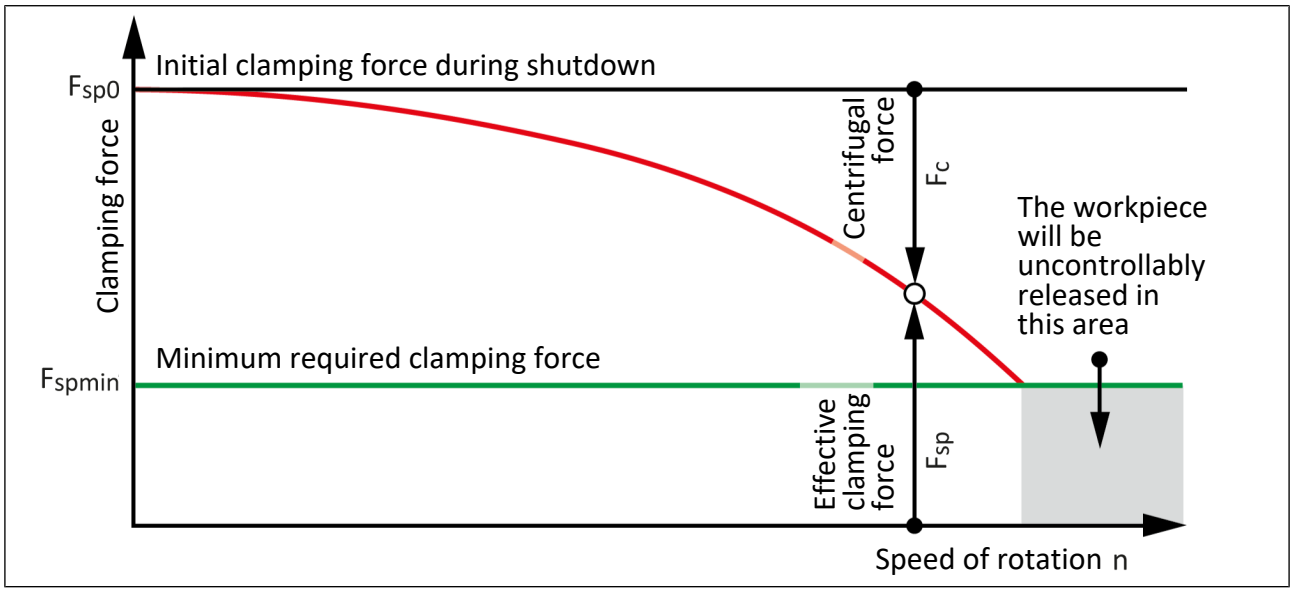
$$F_{sp} = F_{sp0} \mp F_c \text{ [N]}$$

(–) 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

CAUTION

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

See also "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.

CAUTION

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:

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

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.**

$$M_C = m_B \cdot r_S [kgm]$$

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:

$$M_C = M_{cGB} + M_{cAB} [kgm]$$

The centrifugal torque of the base jaws M_{cGB} can be found in the table "Chuck data"▶ 6.1 [🗋 19]. The centrifugal torque of the top jaws M_{cAB} is calculated as per:

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

6.3.2 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 rpm (application-specific)
- Mass of one (!) top jaw m_{AB} = 5.33 kg (application-specific)
- Center of gravity radius of top jaw r_{sAB} = 0.107 m (application-specific)
- Safety factor S_z = 1.5 (according to VDI 3106)
- Safety factor S_{sp} = 1.5 (according to VDI 3106)

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

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

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

Initial clamping force during shutdown:

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

Calculation of total centrifugal force:

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

For two-part chuck jaws, the following applies:

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

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 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 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:

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

CAUTION

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 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_{zul} = 1495 ^{rpm} is smaller than the maximum permissible RPM of the chuck n_{max} = 3200 ^{rpm} (see "Chuck data" table ▶ 6.1 [🗋 19]).

This calculated RPM may be used.

6.4 Grades of Accuracy

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

6.5 Permissible imbalance

Rotating clamping stations without pallets and workpieces correspond to balancing quality class 6.3 (according to DIN ISO 21940-11). Residual imbalance risks may arise due to insufficient rotation compensation being achieved (see DIN EN 1550 6.2 e). This applies in particular to high speeds of rotation, asymmetrical workpieces or the use of lathe chucks that do not correspond to balancing grade 6.3, as well as uneven lubricant application. In order to prevent damage resulting from these residual risks, the entire rotor is to be dynamically balanced in accordance with DIN ISO 21940-11.

7 Attachment of the entire manual chuck

The item numbers specified for the corresponding individual components relate to the chapter Drawings, ▶ 11 [🗋 35].

7.1 Handling prior to attachment

See the **ROTA-S plus** or **ROTA-S plus 2.0**Assembly and Operating Manual contained in the scope of delivery.

7.2 Preparing the chuck attachment

- Check the machine table and ready-machined intermediate flange for radial and axial runout. The permissible limit is 0.005 mm as per DIN 6386 and ISO 3089.
- The contact surface must be chamfered and clean. Rectify any damage of the machine table contact surfaces.

7.3 Assembly of the entire manual chuck

Insert the T-nuts (item 15) into the grooves provided in the machine table. Then lift the toolholder and supplied eye bolts onto the machine table. Align centrally with the centering pins (item 8) and radially with the location bolts (item 21) on the manual lathe chuck. Then fasten the chuck according to the specified torque using a torque wrench with the screws (item 14) and the T-nuts. To protect the counterbore holes against contamination, fit the caps (items 9, 10).

The radial and axial run-out accuracy to be reached depend on the diameter of the chuck.

The following table shows the attainable maximum radial and axial run-out tolerances.

Chuck size [mm]	Max. radial run-out tolerance [mm]	Max. axial run-out tolerance [mm]
550	0.02	0.03
700	0.03	0.04
1000	0.03	0.05
1200	0.03	0.05
1400	0.03	0.06

⚠ WARNING

Risk of injury from mounting screw brass caps (items 9 and 10) being flung out when chuck turns.

The mounting screw brass caps (items 9 and 10) must only be applied for stationary use of the chuck.

8 Function

The item numbers specified for the corresponding individual components relate to chapter drawings.▸ 11 [🗋 35]

The manual chuck can be operated in two different modes:

- With guideway extensions and long base jaws.
- Without guideway extensions and with short base jaws (corresponds to the basic manual chucks ROTA-S plus or ROTA-S plus 2.0)

8.1 Handling and jaw change

See also the **ROTA-S plus** or **ROTA-S plus 2.0** Assembly and Operating Manual.

When fitting the cover (item 4) to close the bore, ensure that the base jaws are mounted first. Then screw the cover (item 4) with the O-ring (item 18) onto the chuck face using the screws (item 11).

The base jaws must always move under the cover so as to keep the toolholder through bore sealed. However, the base jaws must only be moved inwards to the extent that the first tongue and groove of the base jaws does not move onto the cover (item 4) in the course of clamping.

If standard jaws are used on the toolholder, the cover (item 4) cannot be mounted.

With the ROTA-S flex 1000 size, ensure that the indicator pin is not covered by the cover when screwing on the cover (item 4) - observe recess in cover!

Fitting the guideway extensions

The guideway extensions are aligned with the baseplate using the feather keys (item 19) and screwed to the baseplate using the screws (item 12).

⚠ WARNING

Risk of injury (danger to life and limb) for the operating personnel and risk of considerable material damage if the guideway extensions (item 3) are not mounted correctly.

The guideway extensions (item 3) must be screwed to the bracket (item 2) using the feather keys (item 19) and **all** the mounting screws (item 12).

To protect the counterbore holes against contamination, fit the caps (item 10). Then push in the base jaws (item 6, 7).
See also the **ROTA-S plus** or **ROTA-S plus 2.0** Assembly and Operating Manual.

⚠ WARNING

Risk of injury from mounting screw brass caps (items 9 and 10) being flung out when chuck turns.

The mounting screw brass caps (items 9 and 10) must only be applied for stationary use of the chuck.

8.2 Important notes on the ROTA-S plus or ROTA-S plus 2.0 manual chuck

See the **ROTA-S plus** or **ROTA-S plus 2.0**Assembly and Operating Manual contained in the scope of delivery.

8.3 Checking the ROTA-S plus or ROTA-S plus 2.0 manual chuck

See the **ROTA-S plus** or **ROTA-S plus 2.0**Assembly and Operating Manual contained in the scope of delivery.

9 Maintenance

The item numbers specified for the corresponding individual components relate to the chapter Drawings, ▸ 11 [🗋 35].

A high bearing load capacity with secure workpiece clamping can only be guaranteed by lubricating regularly with a high-performance lubricant. For this reason, we recommend that the chuck is cleaned regularly and lubricated using LINOMAX plus special grease. The chuck will have to be disassembled and cleaned at regular intervals according to its application.

⚠ CAUTION

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

- Wear protective gloves.

9.1 Disassembling and assembling the chuck

Remove the base jaws from the chuck as described in chapter "Handling and jaw change" ▸ 8.1 [🗋 30]

Unscrew the screws (item 33) and remove the guideway extension (item 4). Screw out the screws (item 33) and undo the ROTA-S flex from the baseplate (item 3), taking it off to the front.

For further disassembly and assembly of the chuck, see the **ROTA-S plus** or **ROTA-S plus 2.0** Assembly and Operating Manual.

⚠ WARNING

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

During transport and when installing or detaching the manual chuck, ensure it does not fall off.

9.2 Jaw change

Clean and lubricate jaws if there is no film of grease.

9.3 At least once a month

Lubricate the chuck at the two lubrication nipples (item 37) on the circumference of the chuck body (item 1) using a manual press. Use LINOMAX plus by SCHUNK as lubricant.

The chuck must be in fully the open position (jaw change position) so that all the important areas are covered with grease by the lubrication system.

- The functional surfaces of the wedge bars (items 5 and 6) and the drive ring (item 7) are reached via the lubrication nipple opposite jaw 1. The second greasing area supplies grease to the spindle bearings and the spindle thread.
- After lubricating, open and close the chuck 2 – 3 times without a workpiece to evenly distribute the grease across all the functional surfaces.
- Clean the guideway extensions and apply LINOMAX with a brush.

9.4 In the case of decreasing clamping force or after approx. 200 operating hours

If the clamping force decreases, the inside of the chuck is contaminated or the coolant has washed out or decomposed the grease.

In this case, disassemble the chuck, carefully clean all parts with degreasing agent and check for wear and damage.

Replace damaged parts with original SCHUNK spare parts only!

Before installation, lubricate all individual components with LINOMAX special grease.

This cleaning procedure should be performed about every 200 operating hours, depending on the extent of stress on the chuck.

10 Spare parts ROTA-S flex

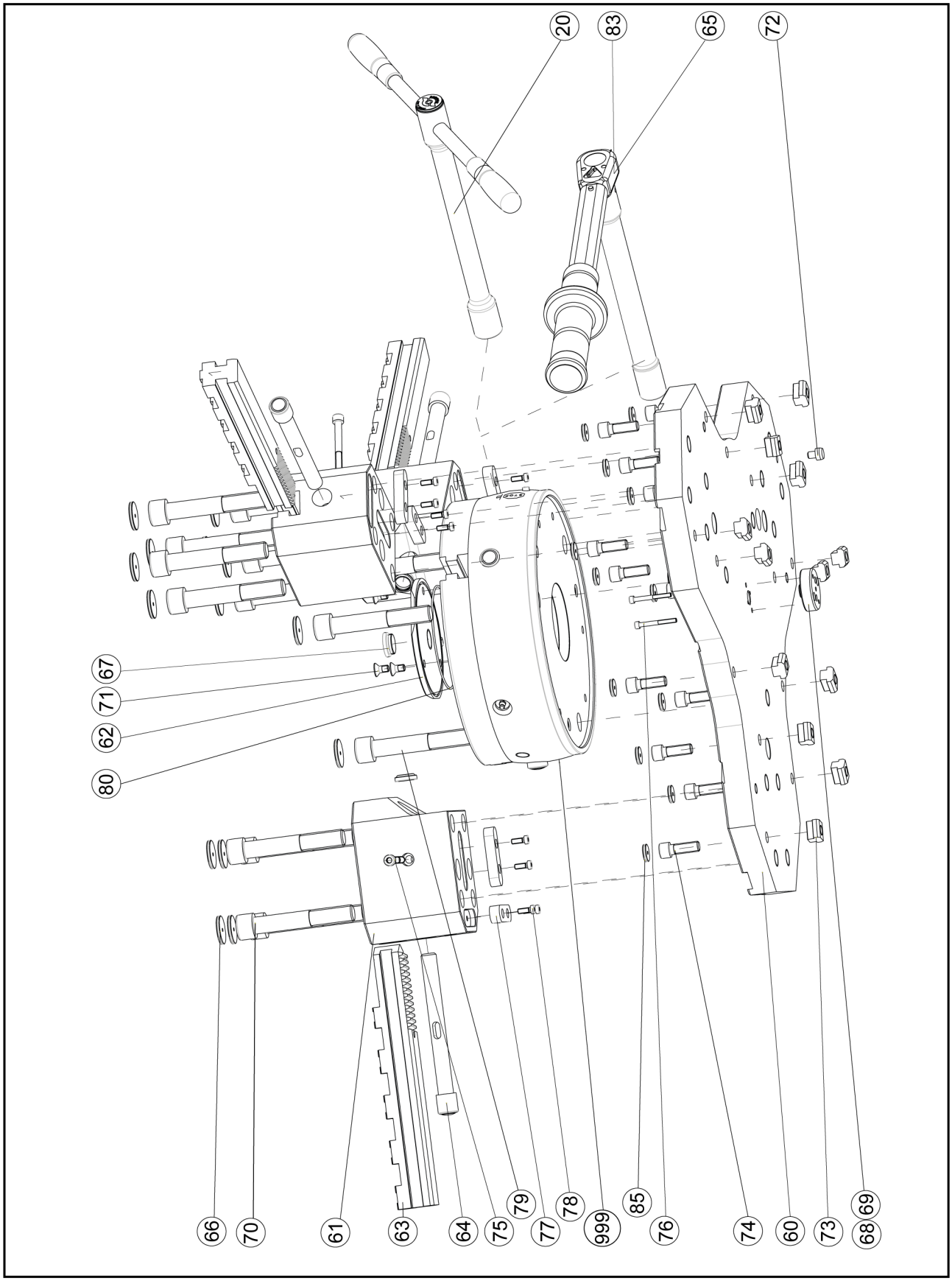
When ordering spare parts, it is imperative to specify the type, size and above all the manufacturing no of the chuck.

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
999	ROTA-S plus 2.0 or ROTA-S plus centering chuck (complete)	1
60	Base plate	1
61	Guideway extension	3
62	Cover	1
64	Pressure bolt	3
63	Long base jaw	3
40	Short base jaw	3
68/69	Centering pin	2
66	Cover (bore cover)	15
85	Cover (bore cover)	13
71	Countersunk screws	3
70	Cylindrical screws	15
75	Cylindrical screws	3
74	Cylindrical screws	13
73	Nut for T-slot	13
78	Cylindrical screws	12
76	Cylindrical screws	2
80	O-ring	1
77	Feather keys	6
72	Mounting bolts	1
79	Wiper	3
67	Locking screw	1
20	Spanner wrench	1
65/83	Ratchet with adapter	1

11 Assembly drawing

ROTA-S flex



12 Spare parts ROTA-S plus 2.0

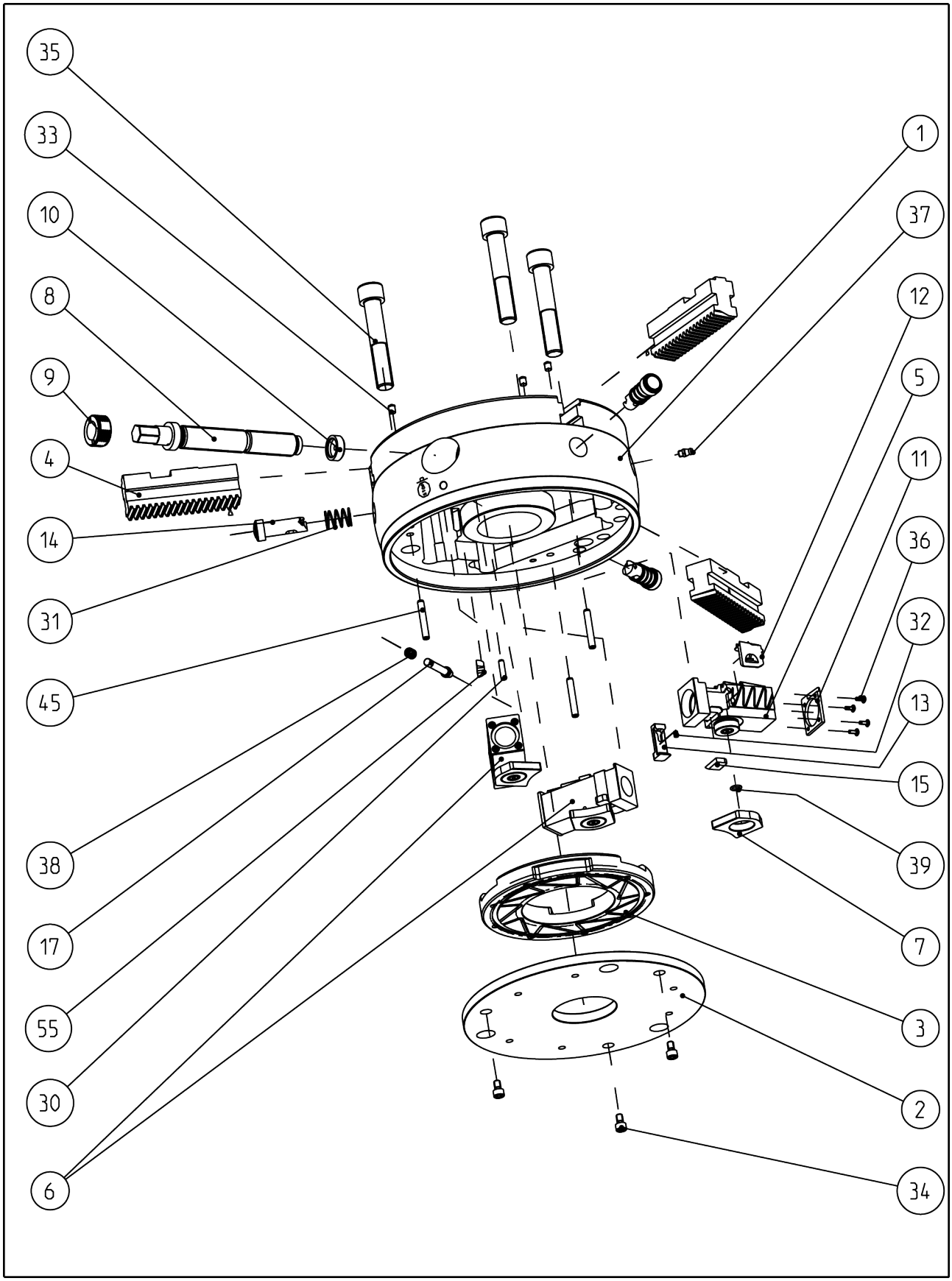
When providing spare parts, it is not possible to state the type, size, and, above all, the manufacturing no. of the chuck.

Seals, sealing elements, fittings, springs, bearings, screws, wiper bars and parts that come into contact with the workpiece are not covered by the warranty.

Item	Designation	Quantity	
		3-jaw	2-jaw
1	Chuck body	1	1
2	Cover	1	1
3	Drive ring	1	1
4	Base jaw	3	1
5	Wedge bar with thread	1	1
6	Wedge bar	2	1
7	Sliding block	3	2
8	Spindle	1	1
9	Spindle nut	1	1
10	Seat of bearing	1	1
11	Wiper (starting for size 200)	3	2
12	Slide	3	2
13	Locking slide	3	2
14	Pressure bolt	3	2
15	Traverse slide	3	2
17	Indicator pin	1	1
30	Cylindrical pin	1	1
31	Compression spring for pressure bolt	3	2
32	Compression spring for locking slide	3	2
34	Cylindrical screw	3	4
35	Cylindrical screw	3	4
36	Flat lens head screw (starting from size 200)	12	8
37	Lubrication nipples	2	2
38	Compression spring for indicator pin	1	1
39	O-ring	3	2
45	Cylindrical pin	3	2
50	Eye bolt (starting from size 250)	1	1
55	Insert	3	2
99	Assembly key	1	1

13 Assembly drawing

ROTA-S plus 2.0



14 Spare parts ROTA-S plus

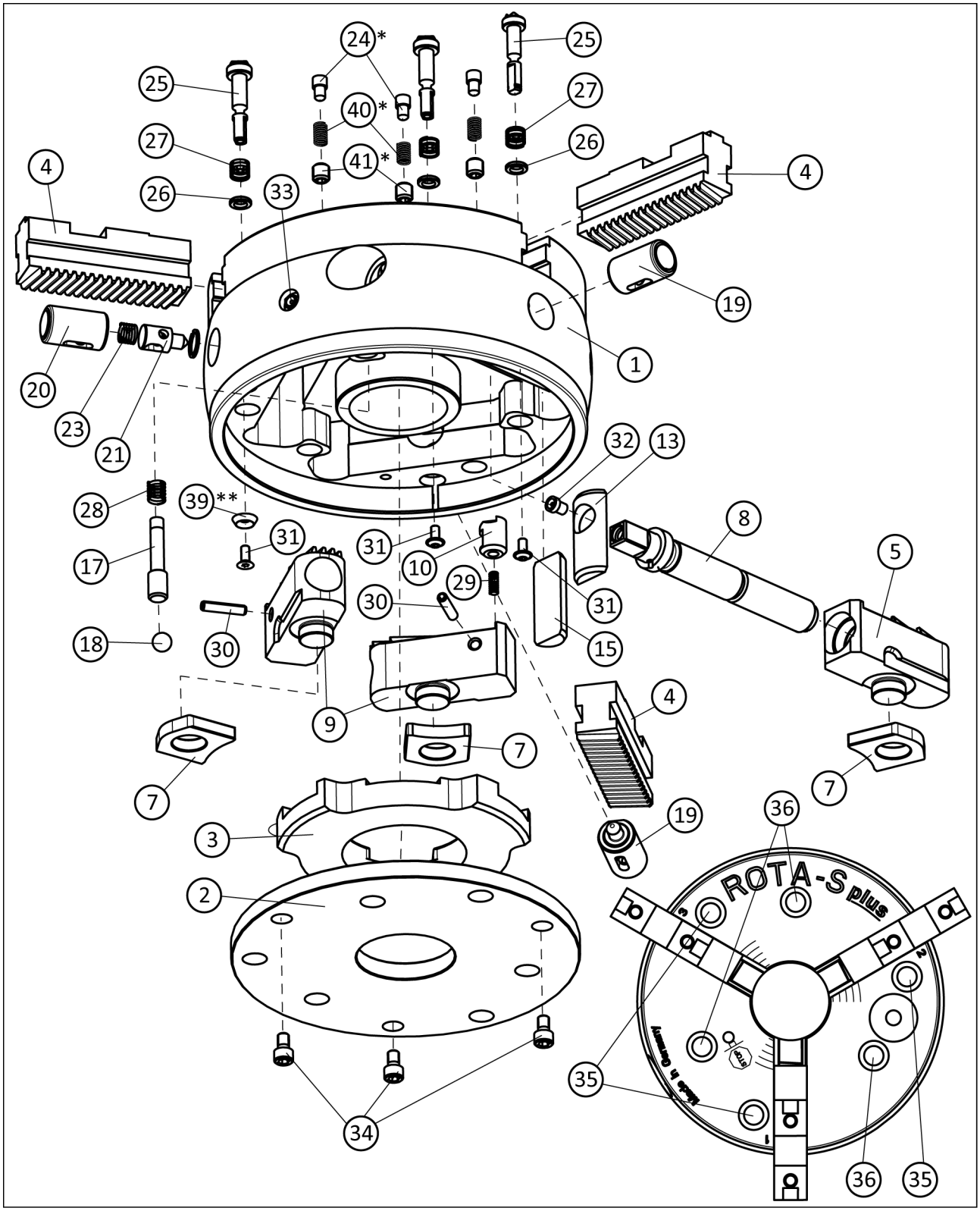
When providing spare parts, it is not possible to state the type, size, and, above all, the manufacturing no. of the chuck.

Seals, sealing elements, fittings, springs, bearings, screws, wiper bars and parts that come into contact with the workpiece are not covered by the warranty.

Item	Designation
1	Chuck body
2	Cover
3	Drive ring
4	Base jaw
5	Wedge bar with thread
7	Sliding block
8	Spindle
9	Wedge bar without thread
10	Safety bolt
13	Seat of bearing with bore hole
15	Seat of bearing
17	Indicator pin
18	Ball
19	Cartridge
24	2nd plunger pin
25	Plunger pin
26	Washer
27	Compression spring for plunger pin
28	Compression spring for indicator pin
29	Compression spring for safety bolt
30	Clamping sleeve
31	Screw for plunger pin
32	Lubrication nipple for spindle
33	Lubrication nipple for chuck body
34	Screw DIN EN ISO 4762 (cover)
35	Screw DIN EN ISO 4762
39	Safety disk (from size ROTA-S plus 500)
40	Compression spring
41	Set-screw

15 Assembly drawing

ROTA-S plus



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Manufacturer certificate

Manufacturer / Distributor:	Heinz-Dieter SCHUNK GmbH & Co. Spanntechnik KG. Lothringer Str. 23 D-88512 Mengen
Product:	**Lathe chucks**
Description:	**ROTA**
Type designation:	M-flex 2+2, S-flex, SPK, ROTA-G, ROTA-S, Vario-M

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

- a **risk assessment** has been carried out in accordance with ISO 12100:2010.
- an **operating manual** for the assembly instructions has been created in accordance with the contents of the Machinery Directive 2006/42/EC Annex I No. 1.7.4.2. and the contents of the provisions of Annex VI of the Machinery Directive 2006/42/EC.
- the relevant basic and proven safety principles of the Annexes of **ISO 13849-2:2012**, taking into account the requirements of the documentation have been observed for the component. The parameters, limitations, ambient conditions, characteristic values, etc. for proper operation are defined in the operating manual.
- an $MTTF_D$ value of 150 years can be estimated for mechanical components using the informative procedure in Table C.1 of ISO 13849-1:2015.
- 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.

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 702-2:2010-04** Machine tools – Connecting dimensions of spindle noses and lathe chucks – Part 2: front short-taper mount with camlock mounting
- **ISO 702-3:2010-04** Machine tools – Connecting dimensions of spindle noses and lathe chucks – Part 3: front short-taper mount with bayonet mounting
- **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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