Manual chuck
ROTA-S flex
Assembly and Operating Manual
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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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, Page 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.

- **NOTICE**
  - Material damage!
  - Information about avoiding material damage.
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 risk 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, 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. (☞6.1, 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 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.

<table>
<thead>
<tr>
<th><strong>DANGER</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>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</strong></td>
</tr>
<tr>
<td>- The technical data specified by the manufacturer for using the lathe chuck must never be exceeded.</td>
</tr>
<tr>
<td>- 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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>DANGER</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Possible risk of fatal injury to operating personnel from clothing or hair being caught on the lathe chuck and being dragged into the machine</strong></td>
</tr>
<tr>
<td>Loose clothing or long hair may become caught on projecting parts of the lathe chuck and be drawn into the machine.</td>
</tr>
<tr>
<td>- 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.</td>
</tr>
<tr>
<td>- Always wear tight-fitting clothing and a hairnet when working on the machine and the lathe chuck.</td>
</tr>
</tbody>
</table>
**DANGER**

Risk to life and limb of the operating personnel in case of not completely clamped workpiece and not removed Allan key

Risk to life and limb of the operating personnel and significant damage of the machine due to the possibility of parts flying off.

- The machine spindle should only be started when the workpiece is clamped and the Allan key is removed from the chuck.
- Unclamping may only be possible when the machine spindle has come to a standstill.

**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.
Basic safety instructions

**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**

Hazard from vibration due to imbalanced rotating parts and noise generation.
Physical and mental strains due to imbalanced workpieces and noise during the machining process on the clamped and rotating workpiece.

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

### 2.4 Notes on safe operation

- The machine spindle should only be started when the workpiece is clamped and the Allan key is removed from the chuck.
- Only operate the chuck when all protective equipment has been fitted and is in full working order.
- Check the manual chuck at least once per shift for externally visible damage and faults.
### Functional test
After installation of the chuck, its function must be checked prior to start-up.

- **Clamping force** The max. clamping force specified for the clamping device must be reached at max. torque.
- **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

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>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.</strong></td>
</tr>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vibrations caused by the processing can result a loss of clamping force. Risk of injury due drop out of the workpiece.</strong></td>
</tr>
<tr>
<td>Manually operated chucks can lose clamping force because of vibration which is caused by the processing of the workpiece.</td>
</tr>
<tr>
<td>• Tighten the chuck regularly during processing to compensate the loss of clamping force due to vibration.</td>
</tr>
</tbody>
</table>

### Maintenance instructions
The power 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 special grease, LINOMAX. Unsuitable lubricants can have a negative impact on the chuck (clamping force, coefficient of friction, wear characteristics). (For product information about LINOMAX, see the "Accessories" section of the current SCHUNK lathe chuck catalog or contact SCHUNK).

• Use a suitable high-pressure grease gun to ensure that you reach all the greasing areas.

• For good distribution of the grease, move the 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. “Only regular checks can guarantee optimal safety”.

• The clamping force should always be measured in the state of the chuck as used for the current clamping situation. If top jaws with clamping steps are used, measuring must be performed in the same step as for the respective clamping task. In the event of high operating speeds, clamping force losses must be accounted for due to the centrifugal force acting on the chuck jaws. In this case, the value of the operating clamping force has to be determined by a dynamic measurement.

• Move the clamping piston through to its end position several times after 500 clamping strokes, at the latest. (This moves the lubricant back to the surfaces of the force transmission. This means that the clamping force is retained for longer).

Safety notes for servicing

Follow all the applicable legal norms 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.

Report any alterations including alterations in operational behaviour to the responsible place/persons immediately, if necessary bring the machine to which the Power Chuck is mounted to an immediate standstill and secure it. Only restart the machine to which the Power Chuck is fitted when the cause of the problem has been eliminated.
Possible risk of fatal injury to operating personnel due to chuck failure if the servicing instructions for the chuck 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 designed jaws
When using special designed jaws the following rules must be observed:

- The jaws should be designed as light and as low as possible. The clamping point must be as close as possible to the chuck face (clamping points at a greater distance lead to greater surface pressure in the jaw guidance and can significantly reduce the clamping force).
- Do not use welded jaws.
- If for constructional reasons the chuck jaws in special design are heavier than the top jaws assigned to the clamping device, greater centrifugal forces must be accounted for when defining the required clamping force and the recommended speed.
- Screw the jaw mounting screws into the bore holes furthest apart.
- The maximum recommended speed may only be operated in conjunction with maximum actuating force and only with the chuck in optimal, fully functioning condition.
- If the clamping device is involved in a collision, it must be subjected to a crack test before using it again. Damaged parts must be replaced by original SCHUNK spare parts.
- The jaw fastening screws must be replaced if they show any signs of wear or damage. Only use screws 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 60 months from the ex-works delivery date under the following conditions:

- Observe the applicable documents, (☞1.2, Page 6)
- Observe the ambient conditions and operating conditions
- Observe the maximum number of clamping cycles (☞6.1, Page 18)
- Observe the specified maintenance and lubrication intervals, (☞9, Page 30)

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)

<table>
<thead>
<tr>
<th>Screw size</th>
<th>M6</th>
<th>M8</th>
<th>M10</th>
<th>M12</th>
<th>M14</th>
<th>M16</th>
<th>M20</th>
<th>M22</th>
<th>M24</th>
<th>M27</th>
<th>M30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admissible torque $M_A$ (Nm)</td>
<td>13</td>
<td>28</td>
<td>50</td>
<td>88</td>
<td>120</td>
<td>160</td>
<td>200</td>
<td>290</td>
<td>400</td>
<td>500</td>
<td>1050</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Screw size</th>
<th>M6</th>
<th>M8</th>
<th>M10</th>
<th>M12</th>
<th>M14</th>
<th>M16</th>
<th>M20</th>
<th>M24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. admissible torque $M_A$ (Nm)</td>
<td>16</td>
<td>30</td>
<td>50</td>
<td>70</td>
<td>130</td>
<td>150</td>
<td>220</td>
<td>450</td>
</tr>
</tbody>
</table>

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 $\varnothing 32g6 / \varnothing 50g6$
   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)

<table>
<thead>
<tr>
<th>ROTA-S flex</th>
<th>550</th>
<th>700</th>
<th>1000</th>
<th>1200</th>
<th>1400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. torque</td>
<td>Nm</td>
<td>120</td>
<td>220</td>
<td>280</td>
<td>320</td>
</tr>
<tr>
<td>Stroke per jaw</td>
<td>mm</td>
<td>7</td>
<td>9.7</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Recommended max. speed</td>
<td>min⁻¹</td>
<td>1000</td>
<td>800</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Total gripping force max.</td>
<td>kN</td>
<td>100</td>
<td>180</td>
<td>230</td>
<td>270</td>
</tr>
<tr>
<td>Mass moment of inertia</td>
<td>kg m²</td>
<td>1.6</td>
<td>7.078</td>
<td>25.03</td>
<td>57.89</td>
</tr>
<tr>
<td>Chuck through hole</td>
<td>mm</td>
<td>52</td>
<td>92</td>
<td>102</td>
<td>162</td>
</tr>
<tr>
<td>Weight with jaws</td>
<td>kg</td>
<td>65</td>
<td>150</td>
<td>360</td>
<td>490</td>
</tr>
<tr>
<td>Centrifugal torque of the long base jaws</td>
<td>M&lt;sub&gt;cGB&lt;/sub&gt; kgm</td>
<td>0.153</td>
<td>0.5448</td>
<td>1.8</td>
<td>2.66</td>
</tr>
</tbody>
</table>

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.

**Warranty and maximum clamping cycles**

<table>
<thead>
<tr>
<th>Length of warranty</th>
<th>60 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum clamping cycle number</td>
<td>50 000 Cycles</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Jaw type</th>
<th>SFA 200</th>
<th>SFA 315</th>
<th>SFA 400</th>
<th>SFA 500</th>
<th>SFA 630</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight / Set [kg]</td>
<td>2.0</td>
<td>5.6</td>
<td>13.5</td>
<td>13.5</td>
<td>40.0</td>
</tr>
</tbody>
</table>

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

**Max. oscillating diameter – with base jaws type SFG**

<table>
<thead>
<tr>
<th>ROTA-S flex</th>
<th>550</th>
<th>700</th>
<th>1000</th>
<th>1200</th>
<th>1400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oscillating diameter Ø [mm]</td>
<td>570</td>
<td>755</td>
<td>1000</td>
<td>1265</td>
<td>1400</td>
</tr>
</tbody>
</table>

The chuck is balanced at Q 6.3 at rated speed.

### 6.2 Clamping force / speed diagrams

The diagrams refer to 3-jaw-chuck. Clamping force-/RPM curves were determined using long, hard base jaws and hard SHF and SFA standard jaws. During this the max. actuating force was applied.

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

The chucks were in good condition and greased with special SCHUNK grease LINO MAX.

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

**Chuck set-up for clamping force / speed diagram**

<table>
<thead>
<tr>
<th>F / 3</th>
<th>Clamping force per jaw</th>
<th>S</th>
<th>Center of gravity</th>
</tr>
</thead>
<tbody>
<tr>
<td>r_s</td>
<td>Center of gravity radius [mm]</td>
<td>a_max</td>
<td>Max. jaw eccentricity of center of gravity in axial direction</td>
</tr>
<tr>
<td>F_max</td>
<td>Actuating force</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Technical data

**ROTA-S flex 1200** (with long jaws)

![Graph showing clamping force vs. speed for ROTA-S flex 1200](image)

**ROTA-S flex 1400** (with long jaws)

![Graph showing clamping force vs. speed for ROTA-S flex 1400](image)

### 6.3 Calculations for clamping force and speed

Missing information or specifications can be requested from the manufacturer.

<table>
<thead>
<tr>
<th>Legend</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( F_c )</td>
<td>Total centrifugal force ([\text{N}])</td>
</tr>
<tr>
<td>( F_{sp} )</td>
<td>Effective clamping force ([\text{N}])</td>
</tr>
<tr>
<td>( F_{sp\text{min}} )</td>
<td>Minimum required clamping force ([\text{N}])</td>
</tr>
<tr>
<td>( F_{sp0} )</td>
<td>Initial clamping force ([\text{N}])</td>
</tr>
<tr>
<td>( m_{AB} )</td>
<td>Mass of one top jaw ([\text{kg}])</td>
</tr>
<tr>
<td>( m_B )</td>
<td>Mass of chuck jaw set ([\text{kg}])</td>
</tr>
<tr>
<td>( M_c )</td>
<td>Centrifugal force torque ([\text{Nm}])</td>
</tr>
<tr>
<td>( M_{CAB} )</td>
<td>Centrifugal torque of top jaws ([\text{Nm}])</td>
</tr>
<tr>
<td>( M_{CGB} )</td>
<td>Centrifugal torque of base jaws ([\text{Nm}])</td>
</tr>
<tr>
<td>( n )</td>
<td>Speed ([\text{rpm}])</td>
</tr>
<tr>
<td>( r_s )</td>
<td>Center of gravity radius ([\text{mm}])</td>
</tr>
<tr>
<td>( r_{s_{AB}} )</td>
<td>Center of gravity radius of top jaw ([\text{mm}])</td>
</tr>
<tr>
<td>( s_{sp} )</td>
<td>Safety factor for clamping force</td>
</tr>
<tr>
<td>( s_z )</td>
<td>Safety factor for machining</td>
</tr>
<tr>
<td>( \Sigma_s )</td>
<td>Max. clamping force of chuck ([\text{N}])</td>
</tr>
</tbody>
</table>

\[ \text{kgm} \times 9.81 = \text{Nm} \]
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 $F_{sp}$.

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

(−) 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 $F_{sp\text{min}}$. 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 $\Sigma S$ engraved on the chuck.

See also "Chuck data" table (ϕ 6.1, 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" (§ 6.1, Page 18). The centrifugal torque of the top jaws $M_{cAB}$ is calculated as per:

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

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:

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

Initial clamping force during shutdown:

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

Calculation of total centrifugal force:

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

For two-part chuck jaws, the following applies:

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

Centrifugal torque of base jaw and top jaw specified in "Chuck data" table:

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

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

$$M_{cAB} = m_{AB} \cdot r_{sAB} = 5.33 \cdot 0.107 \Rightarrow M_{cAB} = 0.57 \text{ kgm}$$
Centrifugal torque for one jaw:
\[
M_c = 0.319 + 0.571 \Rightarrow M_c = 0.89 \text{ kgm}
\]
The chuck has 3 jaws, the total centrifugal torque is:
\[
\sum M_c = 3 \cdot M_c = 3 \cdot 0.889 \Rightarrow \sum M_c = 2.667 \text{ kgm}
\]
The total centrifugal force can now be calculated:
\[
F_c = \sum M_c \cdot \left(\frac{\pi \cdot n}{30}\right)^2 = 2.668 \cdot \left(\frac{\pi \cdot 1200}{30}\right)^2 \Rightarrow F_c = 42131 \text{ N}
\]
Initial clamping force during shutdown that was sought:
\[
F_{sp0} = S_{sp} \cdot (F_{sp} + F_c) = 1.5 \cdot (4500 + 42131) \Rightarrow F_{sp0} = 69947 \text{ N}
\]

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

**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 \(F_{sp0} = 17723 \text{ N}\)
- Machining force for machining job \(F_{spz} = 3000 \text{ N} \) (application-specific)
- Total centrifugal torque of all jaws \(\sum M_c = 2.667 \text{ kgm}\)
- Safety factor \(S_z = 1.5 \) (according to VDI 3106)
- Safety factor \(S_{sp} = 1.5 \) (according to VDI 3106)

**NOTE:**

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

\[ n_{zul} = \frac{30}{\pi} \cdot \sqrt{\frac{F_{sp0} - (F_{spz} \cdot S_2)}{\sum M_C}} = \frac{30}{\pi} \cdot \sqrt{\frac{69947 - (3000 \cdot 1.5)}{2.668}} \Rightarrow n_{zul} = 1495 \text{ min}^{-1} \]

The calculated RPM \( n_{zul} = 1495 \text{ rpm} \) is smaller than the maximum permissible RPM of the chuck \( n_{\text{max}} = 3200 \text{ rpm} \) (see "Chuck data" table (☞6.1, Page 18)).

This calculated RPM may be used.

### 6.4 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.

### 6.5 Permissible imbalance

The permissible imbalance for lathe chucks is quality class G 6.3 as per DIN ISO 1940-1.
7 Attachment of the entire manual chuck

The item numbers specified for the corresponding individual components relate to chapter drawings. (☞ 11, Page 33)

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 bolts (item 8) and radially with the location bolts (item 21). Align the chuck and then attach using the screws (item 14) and the T-nuts. To protect the counterbore holes against contamination, fit the caps (items 9, 10).

**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, Page 33)

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 chapter drawings. (☞ 11, Page 33)

A high bearing load capacity with a secure workpiece clamping can only be guaranteed with regular lubrication using a high-performance lubricant. For this reason, we recommend regularly cleaning the chuck and lubrication using LINO MAX special grease. The chuck will have to be disassembled and cleaned at regular intervals according to its application.

⚠️ CAUTION

Allergic reactions due to grease in contact with skin!
Wear 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, Page 28)

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 LINO MAX by SCHUNK as grease.

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 (item 5 and 6) and the drive ring (item 7) are reached via the lubrication nipple opposite jaw 1. The second greasing area provides the spindle bearings and the spindle thread with grease.
- 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 LINO MAX 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 parts with LINO MAX special grease. This cleaning procedure should be performed approx. every 200 operating hours, depending on the extent of strain 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.

<table>
<thead>
<tr>
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<th>Designation</th>
<th>Quantity</th>
</tr>
</thead>
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<td>999</td>
<td>ROTA-S plus 2.0 or ROTA-S plus centering chuck (complete)</td>
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<tr>
<td>60</td>
<td>Base plate</td>
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</tr>
<tr>
<td>61</td>
<td>Guideway extension</td>
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<td>62</td>
<td>Cover</td>
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<td>64</td>
<td>Pressure bolt</td>
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<td>63</td>
<td>Long base jaw</td>
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<tr>
<td>40</td>
<td>Short base jaw</td>
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<td>Cover (bore cover)</td>
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<td>Cover (bore cover)</td>
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<td>65/83</td>
<td>Ratchet with adapter</td>
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</table>
11 Assembly drawing

ROTA-S flex
12 Spare parts ROTA-S plus 2.0

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.

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<tr>
<td>3</td>
<td>Drive ring</td>
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<td>Base jaw</td>
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<td>6</td>
<td>Wedge bar</td>
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<td>7</td>
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<td>8</td>
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<td>Spindle nut</td>
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<td>Bearing seat</td>
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<td>11</td>
<td>Wiper (starting for size 200)</td>
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<td>31</td>
<td>Compression spring for pressure bolt</td>
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<td>Compression spring for locking slide</td>
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<td>Spring-loaded pressure piece</td>
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<td>Flat lens head screw (starting from size 200)</td>
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13 Assembly drawing

ROTA-S plus 2.0
14 Spare parts ROTA-S plus

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.

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<th>Item</th>
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<td>1</td>
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<td>Cover</td>
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<td>Drive ring</td>
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<td>4</td>
<td>Base jaws</td>
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<td>Wedge bar with thread</td>
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<td>7</td>
<td>Sliding block</td>
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<td>Lubrication nipple for chuck body</td>
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15 Assembly drawing

ROTA-S plus