Manual Lathe Chucks
ROTA-S plus with jaw lock
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 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 (see 1.2, Page 6) are applicable.

1.1 Presentation of Warning Labels

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

<table>
<thead>
<tr>
<th></th>
<th><strong>DANGER</strong></th>
<th><strong>WARNING</strong></th>
<th><strong>CAUTION</strong></th>
<th><strong>NOTICE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>![Icon]</td>
<td>Danger for persons!</td>
<td>Dangers for persons!</td>
<td>Dangers for persons!</td>
<td>Material damage!</td>
</tr>
<tr>
<td></td>
<td>Non-observance will inevitably cause irreversible injury or death.</td>
<td>Non-observance can lead to irreversible injury and even death.</td>
<td>Non-observance can cause minor injuries.</td>
<td>Information about avoiding material damage.</td>
</tr>
</tbody>
</table>
1.2 Applicable documents

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

The documents marked with an asterisk (*) can be downloaded on our homepage 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 product is suitable for clamping workpieces on milling or lathe machines and other suitable tooling machines.

- The product may only be used within the scope of its technical data, (☞6, Page 17).
- 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”). (☞6, Page 17)

### 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, Page 17)
- 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.
### Basic safety instructions

#### WARNING

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

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

#### CAUTION

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

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

#### CAUTION

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

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

#### CAUTION

**Risk of burns due to workpieces with high temperatures.**

- Wear protective gloves when removing the workpieces.
- Automatic loading is preferred.
**Basic safety instructions**

---

### 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.

---

### NOTICE

**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

• 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

⚠️ 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 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
Basic safety instructions

machine to which the Power Chuck is fitted when the cause of the problem has been eliminated.

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Possible risk of fatal injury to operating personnel due to chuck failure if the servicing instructions for the chuck are disregarded!</strong></td>
</tr>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

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

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.

2.5 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 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.
3 Warranty

The warranty period is 60 months after delivery date from factory or 50,000 cycles*, if it is used as intended, under the following conditions:

- Observe the applicable documents, (☞ 1.2, Page 6)
- Observe the ambient conditions and operating conditions.
- Observe the specified maintenance and lubrication intervals, (☞ 9, Page 34)

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

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

4 Torque per screw

**Maximum admissible torque for fastening screws to mount the lathe chuck** (screw grade 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>M18</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>
<td>1500</td>
</tr>
</tbody>
</table>

**Maximum admissible torque per screw for mounting top jaws onto the lathe chuck** (screw grade 12.9)

<table>
<thead>
<tr>
<th>Screw size</th>
<th>M8</th>
<th>M10</th>
<th>M12</th>
<th>M16</th>
<th>M20</th>
<th>M24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tightening torque (Nm)</td>
<td>25</td>
<td>60</td>
<td>80</td>
<td>100</td>
<td>180</td>
<td>230</td>
</tr>
</tbody>
</table>

5 Scope of Delivery

1. **Power lathe chuck (complete)**
   either with cylindrical recess and mounting screws or with the corresponding flange and accessory parts for the spindle
   – DIN ISO 702-1 short taper A with mounting screws
   – DIN ISO 702-3 bayonet mount C with stud bolt and collar nut
   – DIN ISO 702-2 camlock mount S with camlock bolts and screws

1. **Spanner wrench** without ejector

1. **Operating manual**
6 Technical data

6.1 Chuck data

<table>
<thead>
<tr>
<th>ROTA-S plus</th>
<th>160</th>
<th>200</th>
<th>250</th>
<th>315</th>
<th>400</th>
<th>500</th>
<th>630</th>
<th>800</th>
<th>1000</th>
<th>1200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chuck bore [mm]</td>
<td>42</td>
<td>52</td>
<td>62</td>
<td>92</td>
<td>102</td>
<td>162</td>
<td>252</td>
<td>252</td>
<td>402</td>
<td>on request</td>
</tr>
<tr>
<td>Max. enlargement of the chuck bore [mm]</td>
<td>45</td>
<td>55</td>
<td>70</td>
<td>101</td>
<td>130</td>
<td>180</td>
<td>270</td>
<td>270</td>
<td>412</td>
<td></td>
</tr>
<tr>
<td>Max. torque [Nm]</td>
<td>70</td>
<td>100</td>
<td>200</td>
<td>210</td>
<td>280</td>
<td>320</td>
<td>350</td>
<td>350</td>
<td>350</td>
<td></td>
</tr>
<tr>
<td>Max. clamping force [kN]</td>
<td>60</td>
<td>95</td>
<td>160</td>
<td>180</td>
<td>230</td>
<td>270</td>
<td>270</td>
<td>270</td>
<td>270</td>
<td></td>
</tr>
<tr>
<td>Max. speed [rpm]</td>
<td>5200</td>
<td>4600</td>
<td>4000</td>
<td>3200</td>
<td>2200</td>
<td>1500</td>
<td>1000</td>
<td>1000</td>
<td>900</td>
<td></td>
</tr>
<tr>
<td>Stroke per jaw [mm]</td>
<td>6.5</td>
<td>6.8</td>
<td>7.5</td>
<td>9.7</td>
<td>12.0</td>
<td>12.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td></td>
</tr>
<tr>
<td>Centrifugal force of the base jaw $M_{c\text{GB}}$ [kgm]</td>
<td>For the ROTA-S plus chuck, it is necessary to specifically determine this data.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. jaw eccentricity of center of gravity in axial direction $a_{\text{max}}$ [mm]</td>
<td>Examples of calculation can be found in the &quot;Chuck jaws in special design/technology&quot; chapter in our current chuck jaw catalog.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

For soft top jaws or chuck jaws in special design, the permissible speed of rotation according to VDI 3106 must be calculated for the machining job in question. The recommended maximum speed must not be exceeded. The calculated values must be checked by dynamic measurement. Functional monitoring must be performed according to the guidelines of the insurance association.

The recommended speed is valid for ROTA-S plus with SCHUNK stepped block jaws, hard, type STF.

For this, the base jaws are inserted flush with outer diameter of the chuck.

<table>
<thead>
<tr>
<th>Jaw type</th>
<th>STF 160</th>
<th>STF 200</th>
<th>STF 250</th>
<th>STF 315</th>
<th>STF 400</th>
<th>SFG 630</th>
<th>SHF 630</th>
<th>SFG 800</th>
<th>SHF 800*</th>
<th>SFG 1000</th>
<th>SHF 1000*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight / set [kg]</td>
<td>1.1</td>
<td>1.9</td>
<td>3.3</td>
<td>5.3</td>
<td>10.8</td>
<td>34.35</td>
<td>36.4</td>
<td>45.1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Delivery on request
The speed of rotation must be reduced for chuck jaws with a higher weight!
Technical data

Max. oscillating circle - With type SFG base jaws

<table>
<thead>
<tr>
<th>ROTA-S plus</th>
<th>160</th>
<th>200</th>
<th>250</th>
<th>315</th>
<th>400</th>
<th>500</th>
<th>630</th>
<th>800</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oscillating circle Ø [mm]</td>
<td>221</td>
<td>270</td>
<td>326</td>
<td>403</td>
<td>511</td>
<td>594</td>
<td>820</td>
<td>891</td>
<td>1200</td>
</tr>
</tbody>
</table>

At the rated speed the chucks are balanced to Q 6.3

6.2 Clamping force / speed diagrams

Clamping force/RPM curves have been calculated using hard jaws. The chucks were operated with the max. permissible force and the jaws were located exactly on line with the chuck O.D.

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

Should one or several of the above mentioned parameters be changed the diagrams are no longer valid.

Chuck set-up for clamping force / speed diagram

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

Clamping force RPM diagram, ROTA-S plus 160-42

Clamping force RPM diagram, ROTA-S plus 200-52

Clamping force RPM diagram, ROTA-S plus 250-62
Technical data

Clamping force RPM diagram, ROTA-S plus 315-92

Clamping force RPM diagram, ROTA-S plus 400-102

Clamping force RPM diagram, ROTA-S plus 500-162
Clamping force RPM diagram, ROTA-S plus 630-252

Clamping force RPM diagram, ROTA-S plus 800-252

Clamping force RPM diagram, ROTA-S plus 1000-402
### 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>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$F_c$</td>
<td>Total centrifugal force [N]</td>
<td>$M_{cAB}$</td>
<td>Centrifugal torque of top jaws [Nm]</td>
</tr>
<tr>
<td>$F_{sp}$</td>
<td>Effective clamping force [N]</td>
<td>$M_{cGB}$</td>
<td>Centrifugal torque of base jaws [Nm]</td>
</tr>
<tr>
<td>$F_{spmin}$</td>
<td>Minimum required clamping force [N]</td>
<td>$n$</td>
<td>Speed [rpm]</td>
</tr>
<tr>
<td>$F_{sp0}$</td>
<td>Initial clamping force [N]</td>
<td>$r_s$</td>
<td>Center of gravity radius [mm]</td>
</tr>
<tr>
<td>$F_{spz}$</td>
<td>Cutting force [N]</td>
<td>$r_{sAB}$</td>
<td>Center of gravity radius of top jaw [mm]</td>
</tr>
<tr>
<td>$m_{AB}$</td>
<td>Mass of one top jaw [kg]</td>
<td>$s_{sp}$</td>
<td>Safety factor for clamping force</td>
</tr>
<tr>
<td>$m_B$</td>
<td>Mass of chuck jaw set [kg]</td>
<td>$s_z$</td>
<td>Safety factor for machining</td>
</tr>
<tr>
<td>$M_c$</td>
<td>Centrifugal force torque [Nm]</td>
<td>$\Sigma_s$</td>
<td>Max. clamping force of chuck [N]</td>
</tr>
<tr>
<td>$\text{kgm} \times 9.81 = \text{Nm}$</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 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.
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: $S_z \geq 1.5$.

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

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

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

(+) 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 (☞6.1, Page 17)

From the above formula it is evident that the sum of the effective clamping force $F_{sp}$ and the total centrifugal force $F_c$ is multiplied by the safety factor for the clamping force $S_{sp}$. According to VDI 3106, the following also applies here: $S_{sp} \geq 1.5$.

The total centrifugal force $F_c$ is dependent on both the sum of the masses of all jaws and on the center of gravity radius and the rpm.

**NOTICE**

For safety reasons, in accordance with DIN EN 1550, the centrifugal force may be a maximum of 67% of the initial clamping force.
The formula for the calculation of the total centrifugal force $F_c$ is:

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

For this, $n$ is the given speed of rotation in RPM. The product $m_B \cdot r_s$ is referred to as the centrifugal 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" (see 6.1, Page 17). 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 $F_{spz} = 3000 \text{ N}$ (application-specific)
- max. speed of rotation $n_{\text{max}} = 3200 \text{ rpm}$ ("Chuck data" table)
- RPM $n = 1200 \text{ rpm}$ (application-specific)
- Mass of one (!) top jaw $m_{AB} = 5.33 \text{ kg}$ (application-specific)
- Center of gravity radius of top jaw $r_{sAB} = 0.107 \text{ m}$ (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:
\[ F_c = \sum M_c \cdot (\frac{\pi \cdot n}{30})^2 \]

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:
\[ M_{cGB} = 0.319 \text{ kgm} \]

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:
\[ F_c = \sum M_c \cdot (\frac{\pi \cdot n}{30})^2 = 2.668 \cdot (\frac{\pi \cdot 1200}{30})^2 \Rightarrow F_c = 42131 \text{ N} \]

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 \( n_{\text{perm}} \) 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:
\[ n_{zul} = \frac{30}{\pi} \cdot \sqrt{\frac{F_{sp0} - (F_{spz} \cdot S_2)}{\sum M_c}} \text{ [min}^{-1}] \]

**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 \( F_{sp0} = 17723 \) N
- Machining force for machining job \( F_{spz} = 3000 \) N (application-specific)
- Total centrifugal torque of all jaws \( \Sigma M_c = 2.668 \) 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:

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

The calculated RPM \( n_{zul} = 1495 \) rpm is smaller than the maximum permissible RPM of the chuck \( n_{max} = 3200 \) rpm (see "Chuck data" table (\( \sigma 6.1, \text{Page 17} \)).

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 manual chuck

The item numbers specified for the corresponding individual components relate to chapter drawings. ([12, Page 40])

7.1 Handling prior to attachment

Before mounting on the lathe, remove the base jaws from the chuck, then re-install the base jaws and turn the spindle several times as far as it will go to the right and left.

• Use the spanner wrench to turn the spindle (item 8) as far as possible to the left.
• Press the cartridge (item 19) under the first jaw (item 4). The base jaw is now free to move.
• Remove the base jaw.
• Slide the base jaw into the chuck again, until the jaw safety lock (plunger pin, item 25) locks into place.
• Proceed in this way for all three base jaws.

The numbered jaws must be inserted into the correspondingly numbered guides (jaw 1 in guide 1, etc.).

Finally, turn the spindle a few times as far as it will go to the right and left.

7.2 Preparing the chuck attachment

• Check the spindle nose or the ready-machined intermediate flange for radial and axial run-out. The permissible limit is 0.005 mm in accordance with DIN 6386 and ISO 3089.
• The contact surface must be chamfered and clean at the bore holes. Rectify any damage of the spindle nose supporting surfaces. For the flange spindle, check the contact surface with a straight edge.

NOTICE

When mounting with the intermediate flange, never allow the outer rim of the chuck body to make contact. The flange must support on the entire surface.

ROTA-S plus chucks are supplied with various short taper mounts. For the type C bayonet mounting, for the type S Camlock mounting and with the intermediate flange for type A short taper. (Our technical sales would be glad to answer any questions you may have.)
7.3 Mounting of the Manual Chuck

Before putting on the chuck on the spindle nose, carefully clean the centering and contact surfaces of both parts and rub in some oil. While the chuck is lightly pressed on, there should be noticeable play in the taper and at most 0.02 mm play between the flat surfaces (feeler gauge).

**NOTICE**

Danger of damage to the cartridge (item 19) when setting down the chuck on the cartridge, e.g., for cleaning or maintenance. Never set the chuck down on the cartridge (item 19)!
8 Function

The item numbers specified for the corresponding individual components relate to chapter drawings. (☞ 12, Page 40)

8.1 Handling and jaw change

⚠️ WARNING

If the indicator pin protrudes, the entire serration of the wedge bars (items 5 and 6) no longer engages into the base jaws. The base jaws are not sufficiently engaged by the wedge bars. Risk of injury from jaws and workpiece being flung out.

- If the indicator pin protrudes, do not clamp the chuck and do not start up.

- Once the spindle (item 8) has reached the stop, press the cartridge (item 19) under the base jaw. The corresponding jaw is released and can now be adjusted or exchanged.

⚠️ NOTICE

If the cartridge (item 19) is stuck or does not move easily, it must be removed and cleaned (see Section "Disassembling and assembling the chuck"). Never apply force (e.g. with a hammer, etc.) to loosen the cartridge, since this could damage the plunger pin (item 24), which in turn could impair the safety mechanism.

ATTENTION: Do not disassemble the cartridge!

Oil the cleaned cartridge, do not grease with chuck grease!

The numbered chuck jaws must be inserted into the correspondingly numbered guides of the chuck body (jaw no. 1 in guide 1, etc.).

For improved handling, an M10 thread is located at the front of type SFG 800 and SFG 1000 base jaws. Changing the base jaws can be done with mounted, heavy top jaws using an M10 eye bolt and appropriate lifting equipment. This simplifies the jaw change especially with a horizontal application of the chuck.

- Adjust exchanged jaws until the desired clamping diameter has been reached. The jaw safety locks (item 10) must snap in.

For all the wedge bar teeth (items 5 and 6) to be supportive, the base jaws in the guides must always be inserted at least up to the marking line on the chuck body (item 1) (see Fig. "Jaw change").
All jaws have to be at the same marking line. An additional actuating lock prevents the spindle from being turned to the right without chuck jaws.

**NOTICE**

If force is used to continue turning, the chuck will be damaged and the jaw lock function will no longer be active. Do not forcefully turn the spindle further!

Only after all the chuck jaws have been inserted into the guide will the jaw lock be unlocked. Then the wedge bars can be shifted into working position. (Turn spindle to the right!)

**Sluggish jaws**

If sluggish jaws do not snap in properly, slightly offset one jaw (by gently knocking e.g.) and carefully turn the spanner wrench to the right until the serration engages. Then turn the spindle back and offset other sluggish jaws as well.

In the event of noticeable resistance (jaw not engaged), do not turn further forcefully. Slightly move the base jaw until it engages.

The base jaws fit into the chuck in both directions. They can be turned around.

If you turn the spindle to the right, the indicator pin will protrude from the chuck body (gold-colored pin).

**WARNING**

If the indicator pin protrudes, the entire serration of the wedge bars (items 5 and 6) no longer engages into the base jaws. The base jaws are not sufficiently engaged by the wedge bars. Risk of injury from jaws and workpiece being flung out.

- If the indicator pin protrudes, do not clamp the chuck and do not start up.
8.2 Important notes

When working with a very short opening stroke or large series, lubrication grease may be pressed out between the loaded surfaces of the chuck gear. In this case efficiency will decrease!

Following a number of clampings, activate the chuck several times without a workpiece inserted at full stroke so that the grease can be distributed evenly again on the sliding areas on the inside of the chuck. The chuck will then attain its full clamping force again.

- Never remove the base jaws without actuating the cartridge (item 19).
- Regularly adjust the lathe chuck during operations to compensate for loss of clamping force caused by vibrations.
- Following a longer period of shutdown (more than 8 hours), always re-tension the clamped chuck in order to compensate for the spindle settling and the resulting loss of clamping force.
- When gripping the spanner wrench, do not tighten with an extension pipe or by using hammer blows! Only grip using the flange-mounted chuck!
- Do not flange-mount the chuck against the edge of the chuck body!
- Do not grip the base jaws outside of the marking lines (8.1, Page 29)!
- Do not use force (e.g. hammer blows) to move jaws that are difficult to move! Clean the guides and jaws.
- Subsequently delivered hard top jaws (type SHF) or unsplit, hard jaws (type STF) must be ground in the chuck for run-out accuracy.
- For precise clamping, do not remove the ground top jaws from the base jaws. This will result in loss of true-running accuracy. Use a different set of jaws when changing the jaws.
- When re-equipping from cylindrical mounting to short-taper flange, the lid (item 2) must be removed if the centering lid is used.
8.3 Control of the chuck

The ROTA-S plus manual chuck can only be checked in flange-mounted condition. The round and planar surfaces in the rear chuck body area must run true. The jaws must be just as easy to move after attachment as it was before ([§9.1, Page 34]).

If the jaws are more difficult to move than before attachment, the chuck body has been incorrectly attached. The chuck may have become twisted.

8.4 Control of true-running

(on delivery of ROTA-S plus with STF/SHF hard jaws ground on the chuck)

To check the radial and axial run-out accuracy, hardened and ground test pins or test disks are clamped (see Fig. "True running check"). The torque (Md) at the key when gripping the test pins and test disks are provided in the table.

If the permissible radial and axial run-out error (see table) is exceeded, check the following points:

- Applied wrench torque (Md)
- Correct mounting of the chuck
- Test pins and test disks deviate from the factory specification
Table of the maximum permissible radial and axial run-out error for the ROTA-S plus chuck with STF or SHF jaws

<table>
<thead>
<tr>
<th>ROTA-S plus</th>
<th>160</th>
<th>200</th>
<th>250</th>
<th>315</th>
<th>400</th>
<th>500</th>
<th>630</th>
<th>800</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jaw type</td>
<td>STF-160</td>
<td>STF-200</td>
<td>STF-250</td>
<td>STF-315</td>
<td>STF-400</td>
<td>STF-400</td>
<td>--</td>
<td>on request (special stepped jaws)</td>
<td>on request (special stepped jaws)</td>
</tr>
<tr>
<td></td>
<td>SHF-160</td>
<td>SHF-200</td>
<td>SHF-250</td>
<td>SHF-315</td>
<td>SHF-400</td>
<td>SHF-400</td>
<td>SHF-630</td>
<td>on request (special stepped jaws)</td>
<td>on request (special stepped jaws)</td>
</tr>
<tr>
<td>Md [Nm]</td>
<td>40</td>
<td>70</td>
<td>80</td>
<td>80</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>L [mm]</td>
<td>60</td>
<td>80</td>
<td>80</td>
<td>120</td>
<td>120</td>
<td>160</td>
<td>160</td>
<td>160</td>
<td>160</td>
</tr>
<tr>
<td>d (STF) [mm]</td>
<td>Ø 34</td>
<td>Ø 41</td>
<td>Ø 41</td>
<td>Ø 55</td>
<td>Ø 119</td>
<td>Ø 119</td>
<td>Ø 120</td>
<td>Ø 120</td>
<td>Ø 120</td>
</tr>
<tr>
<td>d (SHF) [mm]</td>
<td>Ø 34</td>
<td>Ø 41</td>
<td>Ø 41</td>
<td>Ø 55</td>
<td>Ø 119</td>
<td>Ø 119</td>
<td>Ø 120</td>
<td>Ø 120</td>
<td>Ø 120</td>
</tr>
<tr>
<td>$T_{R1}\text{ max [mm]}$</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
<td>0.04</td>
<td>0.04</td>
<td>0.05</td>
<td>0.05</td>
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<td>0.05</td>
</tr>
<tr>
<td>D (STF) [mm]</td>
<td>Ø 140</td>
<td>Ø 160</td>
<td>Ø 210</td>
<td>Ø 243</td>
<td>Ø 313</td>
<td>Ø 313</td>
<td>Ø 243</td>
<td>Ø 243</td>
<td>Ø 243</td>
</tr>
<tr>
<td>D (SHF) [mm]</td>
<td>Ø 140</td>
<td>Ø 140</td>
<td>Ø 210</td>
<td>Ø 243</td>
<td>Ø 234</td>
<td>Ø 234</td>
<td>Ø 243</td>
<td>Ø 243</td>
<td>Ø 243</td>
</tr>
<tr>
<td>W [mm]</td>
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<td>25</td>
<td>25</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>$T_{P1}\text{ max [mm]}$</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
</tr>
</tbody>
</table>

True running check
9 Maintenance

The item numbers specified for the corresponding individual components relate to chapter drawings. \( \text{[ref 12, Page 40]} \)

A high bearing load capacity with a secure workpiece clamping device can only be guaranteed with regular lubrication using a high-performance lubricant. For this reason, it is recommended to regularly clean the chuck and lubricate it using LINOMAX special grease.

----

**CAUTION**

Allergic reactions due to grease in contact with skin!

Wear gloves.

The chuck will have to be disassembled and cleaned at regular intervals according to its application.

9.1 Disassembling and assembling the chuck

Disassembly

When replacing spare parts or cleaning, the chuck will have to be disassembled.

- First remove the manual chuck from the lathe.

Note for the corresponding mountings:

- For the direct mounting in acc. with DIN ISO 702-1:
  - Evenly loosen the mounting screws (item 36) and remove the chuck from the spindle.
- For the direct mounting in acc. with DIN ISO 702-3 (bayonet):
  - Loosen flanged nut, twist the bayonet disk and take the chuck out of the spindle.
- For the direct mounting in acc. with DIN ISO 702-2 (Camlock):
  - Unlock the Camlock bolts and take the chuck out of the spindle.
- For mounting with an intermediate flange (DIN ISO 702-1):
  - Evenly loosen the mounting screws (item 35 and 36) and loosen the chuck of the intermediate flange.

---

**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.
• Remove the jaws from the guideways (see chapter "Handling and jaw changes" ( муж 8.1, Page 29))

• Place the chuck on its front, undo the screws (item 34) and remove the cover (item 2).

• Carefully remove the drive ring (item 3) (Attention: spring tension!), the ball (item 18), the sliding blocks (item 7) and the threadless wedge bars (item 9) from the chuck.

• Turn the spindle (item 8) using the spanner wrench to the right until the threaded wedge bar (item 5) is just before the back stop. »Do not advance to the back stop !!«

• Remove the seat of bearing (item 15) at the front of the spindle (item 8).

• Remove the spindle (item 8) and the screwed-in wedge bar (item 5) with the seat of bearing (item 13) diagonally upwards out of the chuck body.

• Unscrew the wedge bar (item 5) from the spindle (item 8) and remove the seat of bearing (item 13).

• For sizes 160, 200, 250 and 315, remove the screw (item 31). For sizes 400, 500 and 630, remove the screw (item 31) and the safety disk (item 39).

• Take out the indicator pin (item 17) and the corresponding compression spring (item 28).

• Disassemble the threadless wedge bar (item 9): Remove clamping pins (item 30). Disassemble the compression springs (item 29) and the bolt (item 10) from the wedge bar (item 9).

• From size ROTA-S plus 250:
  Disassemble the set-screws (item 41) from the chuck body and remove the compression springs (item 40) and the second plunger pin (item 24).

  Clean all parts carefully with degreasing agent and check for wear and damage.

  Replace damaged parts with original SCHUNK spare parts only.
Before assembly, grease all individual components (except for the cartridges) using LINOMAX.

Assembly

The chuck is assembled in the reverse order. Observe the following when doing this:

- **Do not forget any parts! Even small components are essential for safety!**
- Assemble all cartridges. Reassemble plunger pins with washers, springs and safety rings (exception: ROTA-S plus 250).

Assembly of the plunger pins for ROTA-S plus 250:
The teeth of the locking pins are in an eccentric position. The space width must be mounted in the direction of the chuck center.

![Plunger pin for ROTA-S plus 250](image)

- Before inserting the drive ring (item 3) mount the indicator pin (item 17) with compression spring and ball in the chuck body (item 1). In doing so, insert the ball fully into the bore hole and hold the indicator pin steady on the chuck's front side using a suitable tool.

**CAUTION**

**Risk of injury due to the ball flying out.**
The ball is under spring pressure.
- Wear protective goggles.

9.2 At least once a month

- Use a grease gun to lubricate the spindle (item 8) via the lubrication nipples (item 32) in the square profile of the spindle (item 8).
- Lubricate the wedge bar mechanics with grease (LINOMAX) with a manual press at the 3 grease nipples (item 33) on the
circumference of the chuck body. (Before greasing, turn the base jaws all the way to the inside without a workpiece!)

To avoid an imbalance in the chuck, lubricate as evenly as possible!

After lubricating, open and close the chuck 2 – 3 times fully without a workpiece to evenly distribute the grease well to all greasing areas.

**Lubricate all 3 (2) segments evenly in order to avoid large imbalances.**

### 9.3 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 SCHUNK LINOMAX special grease.

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

**Wedge bar with jaw lock**

### 9.4 Jaw change

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

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

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

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

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

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

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