Power Chuck
ROTA NCO
Operating Manual
Dear customer,

congratulations on choosing a SCHUNK product. By choosing SCHUNK, you have opted for the highest precision, top quality and best service.

You are going to increase the process reliability of your production and achieve best machining results – to the customer's complete satisfaction.

SCHUNK products are inspiring.

Our detailed assembly and operation manual will support you.

Do you have further questions? You may contact us at any time – even after purchase.

Kindest Regards

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<td>40</td>
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</tbody>
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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”. (or 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.

<table>
<thead>
<tr>
<th>![Danger Symbol]</th>
<th><strong>DANGER</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Danger for persons.</strong></td>
<td></td>
</tr>
<tr>
<td>Non-compliance will inevitably cause irreversible injury or death.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>![Warning Symbol]</th>
<th><strong>WARNING</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dangers for persons.</strong></td>
<td></td>
</tr>
<tr>
<td>Ignoring a safety note like this can lead to irreversible injury and even death.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>![Caution Symbol]</th>
<th><strong>CAUTION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dangers for persons.</strong></td>
<td></td>
</tr>
<tr>
<td>Non-observance can cause minor injuries.</td>
<td></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 above mentioned documents can be downloaded at www.de.schunk.com.
2 Basic safety notes

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 use original SCHUNK spare parts.

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, Page 18)

2.2 Not intended use

The product is not being used as intended if, for example,

- It is used as a press, a punch, a chuck, a load-handling device or as lifting equipment.
- It is used in working environments that are not permissible.
- Workpieces are not clamped properly, paying particular attention to the clamping forces specified by the manufacturer.
- People work on machines or technical equipment that do not comply with the EC Machinery Directive 2006/42/EC, in violation of the applicable safety regulations.
Basic safety notes

- The technical data for use of the product specified by the manufacturer are exceeded.

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 due to the workpiece falling down or being flung out in the event of a power failure!

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

- Due to the carried out and documented danger assessment and risk evaluation, the machine manufacturer and its operator have to ensure that appropriate measures have been taken in order to maintain the clamping force of the chuck until the machine's standstill, and to secure the workpiece correspondingly (e.g. via a crane or a suitable hoist).
- The machines and facilities must fulfill the minimum requirements of the EC Machinery Directive 2006/42/EC; specifically, they must have effective technical measures to protect against possible mechanical hazards.
DANGER

Possible risk of fatal injury to operating personnel if a jaw breaks or if the 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 chuck must never be exceeded.
- The chuck may only be used on machines and facilities that fulfill the minimum requirements of the EC Machinery Directive 2006/42/EC; 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 chuck and being dragged into the machine

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

- The machines and facilities must fulfill the minimum requirements of the EC Machinery Directive 2006/42/EC; specifically, they must have effective technical measures to protect against possible mechanical hazards.
- Always wear tight-fitting clothing and a hairnet when working on the machine and the chuck.

WARNING

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

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

<table>
<thead>
<tr>
<th>✋ CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danger of slipping and falling in case of dirty environment where the chuck is used (e.g. by cooling lubricants or oil).</td>
</tr>
<tr>
<td>• Make sure the work environment is clean before beginning assembly and installation tasks.</td>
</tr>
<tr>
<td>• Wear suitable safety shoes.</td>
</tr>
<tr>
<td>• Observe the safety and accident prevention regulations during operation of the chuck, especially in connection with machining centers and other technical equipment.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>✋ CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danger of limbs being crushed by opening and closing of the chuck jaws during manual loading and unloading or when replacing moving parts.</td>
</tr>
<tr>
<td>• Do not reach between the jaws.</td>
</tr>
<tr>
<td>• Wear safety gloves.</td>
</tr>
<tr>
<td>• Observe the safety and accident prevention regulations during operation of the chuck, especially in connection with machining centers and other technical equipment.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>✋ CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk of burns due to workpieces with high temperatures.</td>
</tr>
<tr>
<td>• Wear protective gloves when removing the workpieces.</td>
</tr>
<tr>
<td>• Automatic loading is preferred.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>✋ CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk of damages due to incorrect choice of clamping position for chuck jaws on workpiece.</td>
</tr>
<tr>
<td>If an incorrect clamping position is chosen for the chuck jaws on workpiece, the base and the top jaws may be damaged.</td>
</tr>
<tr>
<td>• The T-nuts combine the top jaws with the base jaws and they should never protrude over the base jaws in radial direction.</td>
</tr>
<tr>
<td>• The outer diameter of the screwed top jaws must not exceed the outer diameter of the chuck by more than 10%.</td>
</tr>
</tbody>
</table>
Basic safety notes

2.4 Notes on safe operation

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

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

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

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

**Speed**

<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>

**Maintenance instructions**

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

- For lubrication, we recommend our tried and tested special grease, LINO MAX. Unsuitable lubricants can have a negative impact on the functioning of the chuck (clamping force, coefficient of friction, wear characteristics). (For product information about LINO MAX, see the "Accessories" chapter of the SCHUNK lathe chuck catalog or contact SCHUNK).

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

- To ensure correct distribution of the grease, move the clamping piston to its end positions several times, lubricate again, and then check the clamping force.

- We recommend checking the clamping force using a clamping force tester before starting a new production run and between maintenance intervals. "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.
The operating clamping force must in this case be determined by means of 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.

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible risk of fatal injury to operating personnel due to chuck failure if the servicing instructions for the chuck are disregarded!</td>
</tr>
<tr>
<td>The servicing instructions specified by the manufacturer must be complied with to ensure safe operation of the chuck.</td>
</tr>
<tr>
<td>Work must be carried out by qualified specialist personnel with the relevant safety training.</td>
</tr>
</tbody>
</table>

**Use of special chuck jaws**

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

- The chuck jaws should be designed to be as light and as low as possible. The clamping point must be as close as possible to the chuck face (clamping points at a greater distance lead to greater surface pressure in the jaw guidance and can significantly reduce the clamping force).

- Do not use welded jaws.

- If for constructional reasons the chuck jaws in special design are heavier than the top jaws assigned to the clamping device, greater centrifugal forces must be accounted for when defining the required clamping force and the recommended speed.

- Screw the jaw mounting screws into the bore holes furthest apart.
Basic safety notes

- The maximum recommended speed may only be operated in conjunction with maximum actuating force and only with the chuck in optimal, fully functioning condition.
- If the chuck is involved in a collision, it must be subjected to a crack test before using it again. Replace damaged parts with original SCHUNK spare parts.
- Replace the chuck jaw mounting screws if there are signs of wear or damage. Only use screws with a quality of 12.9.

2.4.1 Substantial modifications

No substantial modifications may be made to the chuck.

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

2.5 Personnel qualification

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

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

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

2.6 Organizational measures

*Obeying the rules*

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 date of delivery from the production facility under the following conditions:

- Observe the applicable documents (☞ 1.2, Page 6)
- Observe the environmental and operating conditions.
- Observation of the maximum clamping cycles (☞ 6, Page 18)
- Observe the mandatory maintenance and lubrication intervals (☞ 9, Page 34)

Parts touching the work piece and wearing parts are not part of the warranty.
4 Torque per screw

Tightening torques for mounting screws for clamping the chuck
(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>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>

Tightening torques to mount 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>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>

Tightening torques to mount the protection sleeve
(screw quality 8.8)

<table>
<thead>
<tr>
<th>Screw size</th>
<th>M5</th>
<th>M6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admissible torque $M_A$ (Nm)</td>
<td>5.5</td>
<td>9</td>
</tr>
</tbody>
</table>

5 Scope of delivery

1. **Power Chuck incl. fastening screws**
   - base jaws with fine serration incl. T-nuts with screws
   - base jaws with tenon and slot incl. jaw fixing screws

1. **Eye bolt** (DIN 580) from size 260 and up
6 Technical data

6.1 Chuck data

<table>
<thead>
<tr>
<th>ROTA NCR</th>
<th>165</th>
<th>200</th>
<th>250</th>
<th>315</th>
<th>400</th>
<th>500</th>
<th>630</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. actuating force [kN]</td>
<td>30</td>
<td>42</td>
<td>62</td>
<td>90</td>
<td>120</td>
<td>140</td>
<td>140</td>
</tr>
<tr>
<td>Max. clamping force [kN]</td>
<td>72</td>
<td>95</td>
<td>150</td>
<td>190</td>
<td>270</td>
<td>330</td>
<td>330</td>
</tr>
<tr>
<td>Max. rotation speed [min⁻¹]</td>
<td>6000</td>
<td>5000</td>
<td>4500</td>
<td>3600</td>
<td>2500</td>
<td>2000</td>
<td>1600</td>
</tr>
<tr>
<td>Stroke per jaw [mm]</td>
<td>6.4</td>
<td>9.0</td>
<td>10.0</td>
<td>13.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>Piston stroke [mm]</td>
<td>24</td>
<td>27</td>
<td>30</td>
<td>40</td>
<td>45</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>Centrifugal torque of base jaw</td>
<td>0.025</td>
<td>0.043</td>
<td>0.099</td>
<td>0.161</td>
<td>0.431</td>
<td>0.674</td>
<td>1.085</td>
</tr>
<tr>
<td>fine serration ( M_{cGB} ) [kgm]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centrifugal torque of base jaw Tongue and groove ( M_{cGB} ) [kgm]</td>
<td>0.030</td>
<td>0.056</td>
<td>0.137</td>
<td>0.241</td>
<td>0.571</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Max. jaw eccentricity of center of gravity in axial direction ( a_{max} ) [mm]</td>
<td>30</td>
<td>30</td>
<td>40</td>
<td>32</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>

The recommended max. r.p.m. is only valid for max. operating force and the use of the suitable hard standard stepped jaws Type SHB.

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.

6.2 Clamping force / speed diagrams

The diagrams refer to 3-jaw-chuck.

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 LINO MAX 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>
<th>S</th>
<th>Center of gravity</th>
</tr>
</thead>
<tbody>
<tr>
<td>r_s</td>
<td>Center of gravity radius</td>
<td>a_max</td>
<td>Max. jaw eccentricity of center of gravity in axial direction</td>
</tr>
<tr>
<td>F_{max}</td>
<td>Max. actuating force [kN]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Clamping force / speed diagram ROTA NCO 165**

- **SHB 200**: 1.3 kg
- **SWB 160**: 2.5 kg
- **SWB-AL 160**: 1.2 kg

required minimum clamping force 33%
Technical data

Clamping force / speed diagram ROTA NCO 400

Clamping force / speed diagram ROTA NCO 500

Clamping force / speed diagrams ROTA NCO 630
6.3 Calculations for clamping force and speed

Missing information or specifications can be requested from the manufacturer!

<table>
<thead>
<tr>
<th>Legend</th>
</tr>
</thead>
<tbody>
<tr>
<td>F&lt;sub&gt;c&lt;/sub&gt;</td>
</tr>
<tr>
<td>F&lt;sub&gt;sp&lt;/sub&gt;</td>
</tr>
<tr>
<td>F&lt;sub&gt;spmin&lt;/sub&gt;</td>
</tr>
<tr>
<td>n</td>
</tr>
<tr>
<td>F&lt;sub&gt;sp0&lt;/sub&gt;</td>
</tr>
<tr>
<td>r&lt;sub&gt;s&lt;/sub&gt;</td>
</tr>
<tr>
<td>F&lt;sub&gt;spz&lt;/sub&gt;</td>
</tr>
<tr>
<td>r&lt;sub&gt;sAB&lt;/sub&gt;</td>
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<tr>
<td>m&lt;sub&gt;AB&lt;/sub&gt;</td>
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<td>s&lt;sub&gt;sp&lt;/sub&gt;</td>
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<td>Σ&lt;sub&gt;s&lt;/sub&gt;</td>
</tr>
</tbody>
</table>

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

The initial clamping force F<sub>sp0</sub> 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 rpm, 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<sub>sp0</sub> and the total centrifugal force F<sub>c</sub> is the effective clamping force F<sub>sp</sub>.

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

(\(\mp\)) for gripping from the outside in
(\(\pm\)) for gripping from the inside out

⚠️ 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<sub>spmin</sub>. 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 $F_{spZ}$ with the safety factor $S_z$. This factor takes into account uncertainties in the calculation of the clamping force. According to VDI 3106, the following is valid: $S_z \geq 1.5$.

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

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 in

(+) for gripping from the inside out

**NOTICE**

This calculated force must not be larger than the maximum clamping force $\Sigma S$ engraved on the chuck.

See also the table “Chuck data” (☞ 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 both on 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:

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

$n$ is the given speed in r.p.m. The product $m_B \cdot r_s$ is described as the centrifugal force torque $M_c$.

$M_c = m_B \cdot r_s [kgm]$

In case of chucks 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 base jaws $M_{cGB}$ and the centrifugal torque of top jaws $M_{cAB}$ need to be added:

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

The centrifugal torque of the base jaws $M_{cGB}$ is taken from the table “Chuck data” (Page 18); the centrifugal torque of the top jaws $M_{cAB}$ is calculated as follows:

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

6.3.2 Calculation example: Required initial clamping force $F_{sp0}$ for a given rpm $n$

The following data is known for the machining job:

- gripping from the outside in (application-specific)
- machining force $F_{spz} = 3000 \text{ N}$ (application-specific)
- max. speed $n_{\text{max}} = 3200 \text{ min}^{-1}$ (“Chuck data” table)
- rpm $n = 1200 \text{ min}^{-1}$ (application specific)
- Mass of one (!) top jaw $m_{AB} = 5.33 \text{ kg}$ (application specific)
- Center of gravity radius of the top jaw $r_{sAB} = 0.107 \text{ m}$ (application-specific)
- Safety factor $S_z = 1.5$ (as per VDI 3106)
- Safety factor $S_{sp} = 1.5$ (as per 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 determined using the specific machining force:

$$F_{sp} = F_{sp2} \cdot S_z = 3000 \cdot 1.5 \Rightarrow F_{sp} = 4500 \text{ N}$$

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 is valid:

$$M_c = M_{CBG} + M_{CAB}$$

The centrifugal torques of the base jaw and the top jaw are taken from the table “Chuck data”:

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

For centrifugal torque of the top jaw, the following is valid:

$$M_{CAB} = m_{AB} \cdot r_{SAB} = 5.33 \cdot 0.107 \Rightarrow M_{CAB} = 0.57 \text{ kgm}$$

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 was:

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

### 6.3.3 Calculation example: permissible RPM for a given effective clamping force

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

$$n_{zul} = \frac{30}{\pi} \cdot \sqrt{\frac{F_{sp0} - (F_{sp2} \cdot S_z)}{\sum M_c}} \text{ [min}^{-1}]$$

**NOTICE**

The calculated permissible RPM may not exceed the maximum RPM inscribed on the chuck for safety reasons!
Calculation example: permissible RPM for a given effective clamping force

The following data is known from previous calculations:

- Initial clamping force when not rotating $F_{sp0} = 17723$ N
- Machining force for machining job $F_{spz} = 3000$ N (application-specific)
- Total centrifugal force of all jaws $\sum M_c = 2.668$ kgm
- Safety factor $S_z = 1.5$ (as per VDI 3106)
- Safety factor $S_{sp} = 1.5$ (as per VDI 3106)

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

Identifying the permissible RPM:

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

The calculated RPM $n_{zul} = 1495 \text{ min}^{-1}$, is smaller than the maximum permissible RPM of the chuck $n_{\text{max}} = 3200 \text{ min}^{-1}$, (see table “Chuck data” (Φ 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 3442-3.

### 6.5 Permissible imbalance

The permissible imbalance for lathe chucks is quality class G 6.3 as per DIN ISO 1940-1.
7 Mounting

7.1 Pre-assembly measures

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

**CAUTION**

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

Use personal protective gear, especially safety gloves.

Check the delivery for completeness and for transport damage.

7.2 Mounting of the Power Chuck

- Remove top jaws with fasten screws as well as T-nuts (if available).
- For actuation of the clamping cylinder, please remove the drawbar to its front position.
- Disassemble the central feeding insert.
- Move the chuck piston into the front position.
- Basically the chuck can be attached in two positions (horizontally or vertically), depending on the position of the machine spindle.
7.3 Horizontal attachment

Lift the chuck by means of an assembly belt or with a ring bolt aligned to the spindle centre in front of the spindle nose.

- **ROTA NCO 165:**
  Screw the chuck on to the spindle by turning it on its axis until it stops. Turn the chuck back towards the left until the through bolts are in alignment with the threads or the driving hole is in alignment with the driving keys in the spindle for the first time.

- **ROTA NCO 210 - 630:**
  Screw the central fastening screw with a hexagon wrench into the draw bar or into the drawing tube adapter, until it contacts the stop.

7.4 Vertical attachment

- **ROTA NCO 165:**
  Screw the chuck on to the spindle by turning it on its axis until it stops. Turn the chuck back towards the left until the through bolts are in alignment with the threads or the driving hole is in alignment with the driving keys in the spindle for the first time.

- **ROTA NCO 210 - 630:**
  Put the chuck upside-down onto the assembly device. Turn the spindle with the assembly device onto the spindle. Afterwards turn the chuck back until the fastening bores and the threads of the spindle flang are aligned. Screw in the central fastening screw with a hexagon wrench into the draw bar or into the drawing tube adapter.

- Assemble the central feeding insert.
- Secure the chuck fixing screws crosswise.
- Check the concentricity and face runout at the control rim.
- Check the function and the size of the operating force.
- Check that the base jaws run smoothly and that the jaw stroke is correct.
- Mount the top jaws firmly on the base jaws with the T-nuts and screws according to the markings 1, 2 and 3.

**Dismounting of the spindle is carried out in reverse order.**
8 Function

The item numbers specified for the corresponding individual components relate to chapter drawings. ([¶] 12, Page 38)

8.1 Function and handling

Wedge hook chuck are actuated by rotating cylinders with or without through holes. The axial draw- or pressure forces are deviated into a radial jaw clamping force via the helical angle of traction between the piston and the base jaws.

The clamp and unclamping stroke of the jaws is determined by the cylinder. Moving or changing the base jaws with top jaws bolted to them must be carried out in unclamped position. For safety reasons the base jaws are still interlocked when the chuck piston is in this position. The base jaws are unlocked mechanically.

8.2 Change or supplement of jaws

Jaws for highest repeatability must be bored and ground in the chuck under clamping pressure.

- When boring and grinding it is important that the boring ring or the boring bolts are clamped by the top jaws – and not by the base jaws. Keep base and top jaws screwed together for later tasks.

- Keep the base jaws and top jaws screwed in place for recurring work. Tighten the jaw mounting screws to the specified torque.

Tighten the jaw mounting screws with a torque wrench. On no account tighten the screws with an extension pipe or with hammer blows.

8.3 Disassembly of chucks for complete cleaning or in case of damage

The item numbers specified for the corresponding individual components relate to chapter drawings. ([¶] 12, Page 38)

Please consider the tightening torques of all screws at every assembly and disassembly work! (see chapter 4!)

For disassembly, please remove the chuck from the machine and then disassemble it. Otherwise it can’t be disassembled.
• Remove the top jaws (if existing), T-nuts and fastening screws from the base jaws.

• Screw screws (item 73) out of the chuck and take out media insert (item 24). Set screw (item 28) can be taken out (insert without media lead-through only). O-rings (items 86 and 88) can be removed from the insert.

• Turn chuck on its back. Remove screws (item 78) and take out mounting (item 7). O-ring (item 68) can be taken out.

• For chucks with central oil lubrication, remove gauge cartridges from the chuck.

• Loosen and remove all screws item 75 in the chuck. Carefully turn chuck on its face side.

• **NCO 165 – 400:**
  The lid (item 2) can now be taken out of the chuck. The wiper ledges and the flange head screws (items 66 and 67) can be removed from the chuck lid.

• **NCO 500 – 630:**
  The ledges of the jaw guiding (items 69 and 70) can be taken out of the chuck. The wiper ledges and the flange head screws (items 66 and 67) can be removed from the ledges.

• Individually remove base jaws (item 3) from the remaining chucks. Remove piston (item 4) from the chuck. Loosen set screw (item 89) and remove nut (item 9). Remove screw (item 8) and pressure pieces (item 56) from the remaining pistons. The O-rings (items 87 and 72) can be removed from the components.

**WARNING! In case of base jaw breakage, the bolts and set screws (item 19) must be exchanged.**

The jaw guidings on the chuck body are numbered from 1 – 3. When mounting the base jaws, it must be ensured that the number of groovings on the base jaws is identical with the numbering of the jaw guidings and that the base jaws are remounted in the same position they were in before their removal. When mounting the piston, it must be ensured that wedge hook 1 is assigned to jaw guiding 1.
• Remove set screws (items 47, 48 and 59) and lubricating nipples (item 55) from the chuck body (item 1) and remove lid (item 2).

• **NCO 210 – 400:**
  Remove cylindrical pins (item 19) from the chuck body.

• **NCO 500 – 630:**
  Remove set screws (item 19) from the base jaw (item 3).

Degrease and clean all parts and check them for damage or wear. Before installation, lubricate parts well with LINO MAX special grease.

**Only use original SCHUNK spare parts when exchanging damaged parts.**

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

---

**DANGER**

Danger to life and limb of the user by tearing of the chuck of the spindle when using chuck mounting screws quality 8.8.

If chuck mounting screws of the quality 8.8 get used it can lead to danger for life and limb of the user and to vastly damage of the unit.

• Only use screws of the quality 10.9 even if they are flat headed screws.

Chuck mounting screws of the quality 10.9 can be ordered as spare parts from SCHUNK.

### 8.4 Assembly of various energy inserts

*(Accessories - have to be ordered separately)*

Our standard chucks are equipped with a central energy insert (no energy feed through!).

The chuck can be modified with various energy feed throughs at a later date.

**Please consider the detailed list of necessary components.**

(see spare parts list in chapter 11).
**Modification – Central lubrication**

- Insert modification central lubrication
- Pull back screw
- Supply by customer
- 54 Gauge cartridges

**Modification – Air control**

- Insert modification air control
- Pull back screw
- Supply by customer
Modification – Coolant

Insert modification coolant

Pull back screw

Supply by customer

Nozzle insert
9 Maintenance

9.1 Lubrication

To maintain the safe function and high quality of the power chuck it is important to lubricate it regularly at the grease nipples (Item 55).

In order to assure a constant distribution of grease, the base jaws have to be moved into the open position for outside clamping. The power chuck can be greased then and afterwards the base jaws may be moved into the closed position again. Repeat this procedure once again.

The next step will be to move the piston several times into its end position.

Operating Conditions
Depending on operating conditions, check the function and the clamping force after a certain number of operating circles (see 9.2, Page 34). The clamping force can be measured by using a Grip Force Tester (SCHUNK SGT 270).

All 3 jaws should be greased / lubricated evenly in order to avoid untrue-running.

Technical condition: The base jaws must move evenly at the smallest possible actuating pressure (clamping cylinder). This method is only to some extent expressive and cannot replace clamping force measurement.

If the clamping force has dropped down too low, or if the base jaws and piston cannot be freely moved any more, the chuck has to be disassembled, cleaned and lubricate again.

Only use SCHUNK original spares when replacing damaged parts.

9.2 Maintenance intervals

Lubrication of the grease areas:

<table>
<thead>
<tr>
<th>Lubrication interval</th>
<th>Strain</th>
</tr>
</thead>
<tbody>
<tr>
<td>every 25 hours</td>
<td>normal / coolant utilization</td>
</tr>
<tr>
<td>every 8 hours</td>
<td>high / coolant utilization</td>
</tr>
<tr>
<td>after 1200 hours or as needed</td>
<td>Total cleaning with disassembly of the chuck, depending on type and degree of contamination</td>
</tr>
</tbody>
</table>
9.3 Central oil lubrication

This chapter applies for chuck type ROTA NCO with modification "Central oil lubrication" only.

According to the case of application, the chuck has to be lubricated regularly. The lubrication oil VG220 DIN 51519 is filled into one bore of the chuck center. (see chapter "Period of maintenance" (\(\sim \) 9.2, Page 34)). Generally 3-6 impulses (3 sec.) per hour with a pressure of 10 to 30 bar are released from the pump to the chuck. The 3 gauge cartridges assure an even distribution of the oil inside the chuck.

Oil volume of the gauge cartridge:

<table>
<thead>
<tr>
<th>ROTA NCO 165</th>
<th>ROTA NCO 210</th>
<th>ROTA NCO 260</th>
<th>ROTA NCO 315</th>
<th>ROTA NCO 400</th>
<th>ROTA NCO 500</th>
<th>ROTA NCO 630</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3 ccm</td>
<td>0.3 ccm</td>
<td>0.3 ccm</td>
<td>0.6 ccm</td>
<td>0.6 ccm</td>
<td>0.6 ccm</td>
<td>0.6 ccm</td>
</tr>
</tbody>
</table>

9.4 Changing the top jaws

When changing the top jaws the serration must be cleaned and greased with SCHUNK special grease LINO MAX.

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>NCO 165 – 400</th>
<th>Item</th>
<th>NCO 500 – 630</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chuck body</td>
<td>1</td>
<td>Chuck body</td>
</tr>
<tr>
<td>2</td>
<td>Cover</td>
<td>2</td>
<td>Cover</td>
</tr>
<tr>
<td>3</td>
<td>Base jaws</td>
<td>3</td>
<td>Base jaws</td>
</tr>
<tr>
<td>4</td>
<td>Piston</td>
<td>4</td>
<td>Piston</td>
</tr>
<tr>
<td>7</td>
<td>Mount</td>
<td>7</td>
<td>Mount</td>
</tr>
<tr>
<td>8</td>
<td>Screw</td>
<td>8</td>
<td>Screw</td>
</tr>
<tr>
<td>9*</td>
<td>Nut</td>
<td>9</td>
<td>Nut</td>
</tr>
<tr>
<td>16</td>
<td>T-nut</td>
<td>16</td>
<td>T-nut</td>
</tr>
<tr>
<td>18</td>
<td>Pin</td>
<td>18</td>
<td>Pin</td>
</tr>
<tr>
<td>19*</td>
<td>Set screw/Bolt</td>
<td>19</td>
<td>Set screw/Bolt</td>
</tr>
<tr>
<td>24</td>
<td>Insert 01</td>
<td>37</td>
<td>Insert 01</td>
</tr>
<tr>
<td>28</td>
<td>Set screw DIN EN ISO 4026</td>
<td>47</td>
<td>set screw DIN EN ISO 4026 (Polyamide coated)</td>
</tr>
<tr>
<td>47</td>
<td>Set screw DIN EN ISO 4026 (Polyamide coated)</td>
<td>48</td>
<td>O-ring</td>
</tr>
<tr>
<td>48</td>
<td>Set screw DIN EN ISO 4026 (Polyamide coated)</td>
<td>51</td>
<td>Screw DIN 7984 - 10.9 (pitch circle)</td>
</tr>
<tr>
<td>51</td>
<td>Screw DIN 7984 - 10.9 (pitch circle)</td>
<td>55</td>
<td>Tapered lubricating nipple</td>
</tr>
<tr>
<td>52</td>
<td>Screw DIN 7984 - 10.9 (pitch circle)</td>
<td>57</td>
<td>Expander</td>
</tr>
<tr>
<td>55</td>
<td>Tapered lubricating nipple</td>
<td>58</td>
<td>Expander</td>
</tr>
<tr>
<td>56*</td>
<td>Pressure piece</td>
<td>60</td>
<td>Pressure spring</td>
</tr>
<tr>
<td>59</td>
<td>Set screw DIN EN ISO 4026 (Polyamide coated)</td>
<td>61</td>
<td>Ball</td>
</tr>
<tr>
<td>66</td>
<td>Oval-head screw</td>
<td>66</td>
<td>Oval-head screw</td>
</tr>
<tr>
<td>67</td>
<td>Wiper</td>
<td>67</td>
<td>Wiper</td>
</tr>
<tr>
<td>68</td>
<td>O-ring DIN 3771</td>
<td>68</td>
<td>O-ring / O-ring DIN 3771</td>
</tr>
<tr>
<td>69</td>
<td>Gasket, right side (NCO 500)</td>
<td>69</td>
<td>Gasket, right side (NCO 500)</td>
</tr>
<tr>
<td>Item</td>
<td>NCO 165 – 400</td>
<td>Item</td>
<td>NCO 500 – 630</td>
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</tr>
<tr>
<td>70</td>
<td>Gasket, left side (NCO 500)</td>
<td>70</td>
<td>Gasket, left side (NCO 500)</td>
</tr>
<tr>
<td>72*</td>
<td>O-ring DIN 3771</td>
<td>72</td>
<td>O-ring DIN 3771</td>
</tr>
<tr>
<td>73</td>
<td>Countersunk screw DIN 7991 – 10.9</td>
<td>74</td>
<td>Screw</td>
</tr>
<tr>
<td>75</td>
<td>Screw DIN EN ISO 4762 - 10.9</td>
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<td>Screw</td>
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<td>Screw</td>
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<td>O-ring DIN 3771</td>
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<td>86</td>
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<td>88</td>
<td>O-ring DIN 3771</td>
<td>88</td>
<td>O-ring DIN 3771</td>
</tr>
<tr>
<td>89</td>
<td>Set screw DIN EN ISO 4027</td>
<td>89</td>
<td>Set screw DIN EN ISO 4027</td>
</tr>
<tr>
<td></td>
<td>** Modifications (chapter 8.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Plug</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>O-ring DIN 3771</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Internal valve components</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Scuring ring DIN 472</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>Gauge cartridge</td>
<td>54</td>
<td></td>
</tr>
</tbody>
</table>

** Not use for ROTA NCO 165
Assembly drawings

ROTA NCO 165 – 400

* At modification oil central lubrication

** Not use for NCO 165, Item 8 is screwed with Item 4

*** 2 x for NCO 165
13 Translation of original EC declaration of incorporation


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

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

Product designation: Power Chucks without through hole
ID number: ROTA NCO 165; 210; 260; 315; 400; 500; 630; 800; 1000
ID number: 0856000; 0856001; 0856002; 0856003; 0856010; 0856011; 0856012; 0856013; 0856014; 0856015; 0856020; 0856021; 0856022; 0856023; 0856024; 0856025; 0856030; 0856032; 0856033; 0856034; 0856036; 0856037; 0856040; 0856041; 0856042; 0856043; 0856050; 0856051; 0856060; 0856070; 0856080; 0856081; 0856016; 0856017; 0856018; 0856026; 0856027; 0856028; 0856038

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

Applied harmonized standards, especially:
DIN EN ISO 12100:2010 Safety of machinery - General principles for design - Risk assessment and risk reduction

Other related technical standards and specifications:
VDI 3106:2004-04 Determination of permissible speed (rpm) of lathe chucks (jaw chucks

The manufacturer agrees to forward on demand the special technical documents for the incomplete machine to state offices.

The special technical documents according to Annex VII, Part B, belonging to the incomplete machine have been created.

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

Mengen, January 2015

p.p. Alexander Koch; Director for Development / Design