Manual Lathe Chucks
ROTA-S plus with jaw lock

Assembly and Operating Manual

Imprint

Technical changes:

We reserve the right to make technical improvements.

Document number: 0889004

Version: 04.00 |2/24/2021|en-US

Dear Customer

Dear Customer,

Thank you for putting your trust in 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. We look forward to your challenging questions. We will find a solution!

Best regards,

Your SCHUNK team

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

Table of Contents

1 About this Manual

This manual contains important information for the safe, correct use of the product.

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

Personnel must have read and understood this manual before beginning any work. The observance of all safety notes in this manual is the precondition for all safe working.

The illustrations in this manual are intended to provide a basic understanding and may deviate from the actual version.

Besides this manual, other documents which apply are those listed under (☞ 1.2, Page 6).

1.1 Illustration of safety notes

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

	**⚠ DANGER** **Danger to individuals!** Ignoring a safety note such as this will certainly lead to irreversible injury and even death.

	**⚠ WARNING** **Danger to individuals!** Ignoring a safety note such as this can lead to irreversible injury and even death.

	**⚠ CAUTION** **Danger to individuals!** Non-observance can cause minor injuries.

	***NOTICE*** **Material damage!** Information about avoiding material damage.

1.2 Applicable documents

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

The documents indicated with an asterisk (*) can be downloaded from **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 original SCHUNK spare parts may be used.

2.1 Appropriate use

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

- 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 speed and the necessary clamping force must be determined by the operator for each clamping task in accordance with the valid standards or technical specifications of the manufacturer.
  (Also see "Calculation for clamping force and speed of rotation" in chapter "Technical data".) (☞ 6, Page 17)

2.2 Inappropriate use

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

- it is used as a press, a punch, a toolholder, a load-handling device or as lifting equipment.
- the product is used with machines/systems or workpieces that are not designed to be used with it.
- the specified technical data for use of the product are exceeded. (☞ 6, Page 17)
- workpieces are not properly clamped, paying particular attention to the specified clamping forces.
- the product is used in working environments that are not permissible.
- the product is operated without protective equipment.

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 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

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.

⚠ 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 lathe chuck.
- Note the relevant load securing regulations for working safely with cranes, ground conveyors, lifting gear and load-handling equipment.

⚠ CAUTION

Risk of slipping or falling if the chuck's operational environment is not clean (e.g. contaminated with cooling lubricants or oil).

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

⚠ CAUTION

Risk of limbs being crushed when opening and closing the chuck jaws during manual loading or unloading or when exchanging moving parts.

- Do not reach between the chuck jaws.
- Wear protective gloves.
- Follow the safety and accident prevention regulations when operating the chuck, especially when working with machine tools and other technical equipment.

⚠ CAUTION

Risk of burns due to workpieces with high temperatures!

- Wear protective gloves when removing the workpieces.
- Automatic loading is preferred.

⚠ CAUTION

Risk of damage due to incorrect choice of clamping position for chuck jaws on workpiece.
If an incorrect clamping position is chosen for the chuck jaws on workpiece, the base and top jaws may break.

- Make sure that the workpiece is clamped concentrically.
- If the chuck has a quick-change jaw system, the top jaws must not protrude beyond the base jaws in the radial direction. **Exception:** The supporting jaw variant 3 protrudes beyond the chuck base jaw due to its design. In this case, the T-nuts always need to be completely inserted 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 RPM.
- Wear hearing protection.

NOTICE

If the lathe chuck is overlubricated, malfunctions (difficulty of movement) may occur when changing the jaws or release mechanism.

- Disassemble the chuck and remove excess grease.
- For lubrication, refer to the chapter "Maintenance".

2.4 Notes on safe operation

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

Functional test

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

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

Speed of rotation

⚠ DANGER

Possible risk of fatal injury to operating personnel if the chuck's top speed is exceeded and a workpiece is released or parts fly off.

If the machine tool or technical equipment can reach a higher speed than the chuck's top speed, a reliable speed limiter must be installed and proof must be provided that the speed limiter is effective.

⚠ WARNING

Vibrations caused by machining can lead to a loss of clamping force. Risk of injury due to loss of workpiece.

Manually actuated lathe chucks can lose clamping force due to the vibration caused by machining the workpiece.

- Regularly adjust the lathe chuck during machining to compensate for loss of clamping force caused by vibrations.

Maintenance instructions

The reliability and safety of the manual lathe chuck can only be guaranteed if the operator complies with the maintenance instructions from the manufacturer.

- For lubrication, we recommend our tried-and-tested special grease, LINOMAX. Unsuitable lubricants can have a negative impact on the functioning of the lathe chuck (clamping force, coefficient of friction, wear characteristics).
  (For product information about LINOMAX, see the "Accessories" chapter of the SCHUNK lathe chuck catalog or contact SCHUNK.)
- Use a suitable high-pressure grease gun to ensure that you reach all the greasing areas.
- To ensure correct distribution of the grease, move the lathe chuck to its end positions several times, lubricate again, and then check the clamping force.
- We recommend checking the clamping force using a gripping force tester before starting a new production run and between maintenance intervals. *Optimum safety can only be guaranteed through regular checks*.
- The clamping force should always be measured with the lathe chuck in the same condition as it is used in for the current clamping application. If top jaws with clamping steps are used, measuring must be performed in the same step as for the respective clamping task. In the event of high operating speeds, clamping force losses must be accounted for due to the centrifugal force acting on the chuck jaws. In this case the value of the operating clamping force should be measured dynamically.
- Move the lathe chuck through to its end position several times after 500 clamping strokes, at the latest. (This moves the lubricant back to the surfaces of the force transmission so that the clamping force is retained for longer).

Safety notes for servicing

Follow all the applicable legal standards for health and safety during servicing. Use suitable personal protective equipment, especially protective gloves, goggles, and safety boots - paying particular attention to the operating system and hazard assessment.

Immediately report any changes including operational behavior to the competent units/persons; if necessary, immediately shut down and secure the machine on which the lathe chuck is mounted. Do

not start up the machine that the chuck is mounted on again until the malfunction has been eliminated.

⚠ DANGER

Possible risk of fatal injury to operating personnel due to lathe chuck failure if the maintenance and servicing instructions for the lathe chuck are disregarded!
The servicing instructions specified by the manufacturer must be complied with to ensure safe operation of the lathe chuck.
Work must be carried out by qualified specialist personnel with the relevant safety training.

Use of customized jaws

When using customized jaws, please observe the following rules:

- The chuck jaws should be designed to be as light and as low as possible. The clamping point must be as close as possible to the chuck face (clamping points at a greater distance lead to greater surface pressure in the jaw guidance and can significantly reduce the clamping force).
- Do not use welded jaws.
- If for constructional reasons the special chuck jaws are heavier than the top jaws assigned to the clamping device, greater centrifugal forces must be accounted for when defining the required clamping force and the recommended speed.
- Screw the jaw mounting screws into the bore holes furthest apart.
- The maximum recommended speed may only be operated in conjunction with the maximum clamping force and only with the lathe chuck in optimum, fully functioning condition.
- If the lathe chuck is involved in a collision, it must be subjected to a crack test before using it again. Damaged parts must be replaced with original SCHUNK spare parts.
- Renew the chuck jaw mounting screws if there are signs of wear or damage. Only use screws with a quality of 12.9.

2.4.1 Structural changes

Implementation of structural changes

Modifications, changes or reworking, e.g. additional threads, holes, or safety devices, can damage the product or impair its functionality or safety.

- Structural changes should only be made with the written approval of SCHUNK.

2.5 Personnel qualification

The lathe chuck must only be installed, removed, started up, operated and serviced by qualified specialist personnel with the relevant safety training.

All persons charged with operating, maintaining and servicing this lathe chuck must have access to the operating manual, especially the chapter "Basic safety instructions". We recommend that the operator draw up in-house safety operating instructions.

Trainees may work on machines and technical equipment in which a lathe chuck is installed provided that they are supervised at all times by qualified specialist personnel.

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 lathe chuck.

Monitoring 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 lathe chuck is mounted are clearly legible and are observed.

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

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 in the event of a danger that 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

If the product is used as intended, the warranty is valid for 60 months from the date of delivery from the production facility or 50 000 cycles* under the following conditions:

- Refer to the applicable documents, (☞ 1.2, Page 6)
- Observance of the ambient conditions and operating conditions.
- Observance of the specified maintenance and lubrication intervals (☞ 9, Page 35)

Parts touching the workpiece and wearing parts are not part of the warranty.

* One cycle comprises one complete clamping procedure ("opening" and "closing").

4 Screw tightening torques

Tightening torques for mounting screws for clamping the chuck (screw quality 10.9)

Screw size	M6	M8	M10	M12	M14	M16	M18	M20	M22	M24	M27	M30
Tightening torques M_A (Nm)	13	28	50	88	120	160	200	290	400	500	1050	1500

Tightening torques to mount top jaws onto the chuck (screw quality 12.9)

Screw for base jaws SFG / SFGK / SFG-V / SFGL / SFGX	M6	M8 x 1 fine thread	M10	M12 x 1.5 fine thread	-	M16 x 1.5 fine thread	M20	-	M24
maximum admissible torque in (Nm)	16	30	60	85	-	105	180	-	230

5 Scope of delivery

1 **Power lathe chuck (complete)**
either with cylindrical recess and mounting screws or with the corresponding flange and accessories for the machine 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 bolts

1 **Spanner wrench** without ejector

1 **Operating manual**

6 Technical data

6.1 Chuck data

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

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 special chuck jaws, the speed of rotation permitted for the cutting task must be calculated in accordance with VDI 3106 whereby the maximum recommended speed may 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.

Jaw type	STF 160	STF 200	STF 250	STF 315	STF 400	SFG 630 SHF 630	SFG 800 SHF 800*	SFG 1000 SHF 1000*
Weight / set [kg]	1.1	1.9	3.3	5.3	10.8	34.35	36.4	45.1

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

Max. oscillating circle – With type SFG base jaws

ROTA-S plus	160	200	250	315	400	500	630	800	1000
Oscillating circle Ø [mm]	221	270	326	403	511	594	820	891	1200

At the rated speed the chucks are balanced to Q 6.3

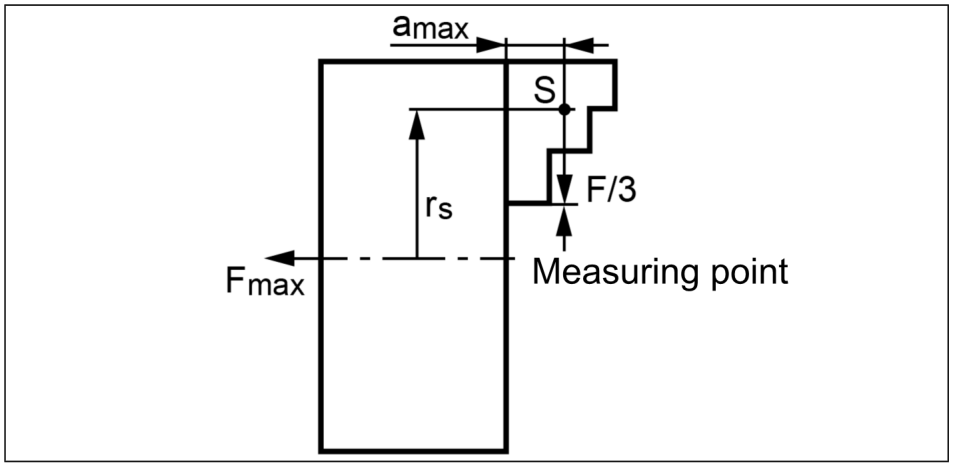
6.2 Clamping force RPM diagrams

Clamping force/RPM curves have been determined by using hard jaws. In the determination process, the maximum actuating force was applied and the jaws were set flush with the outer diameter of the chuck.

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

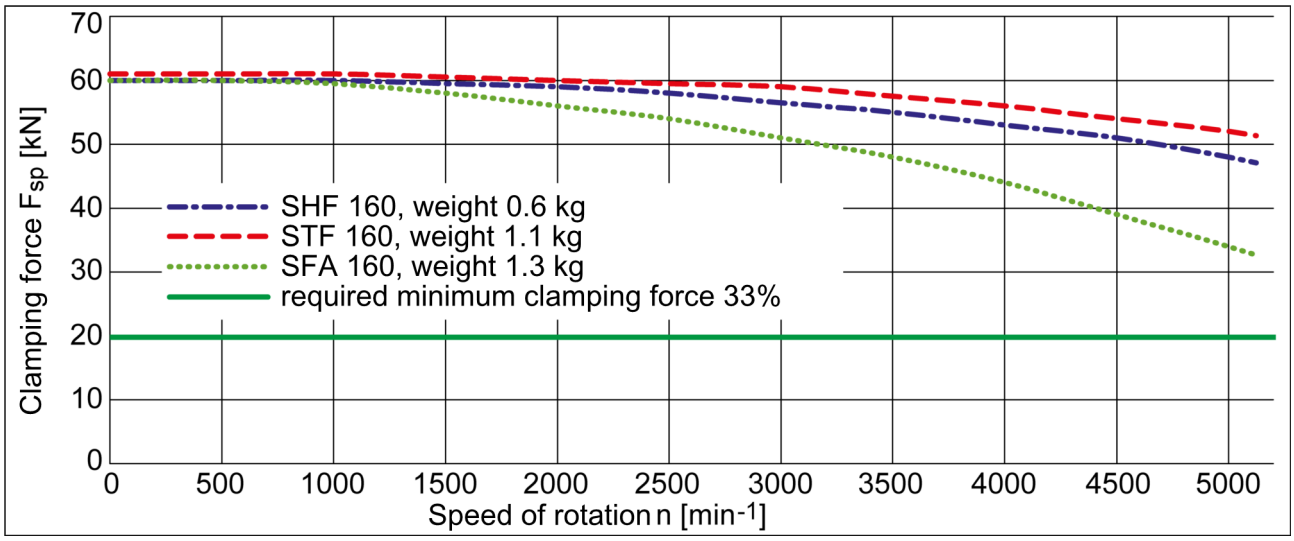
If one or more of these prerequisites is modified, the diagrams will no longer be valid.

Chuck setup for clamping force/RPM diagram

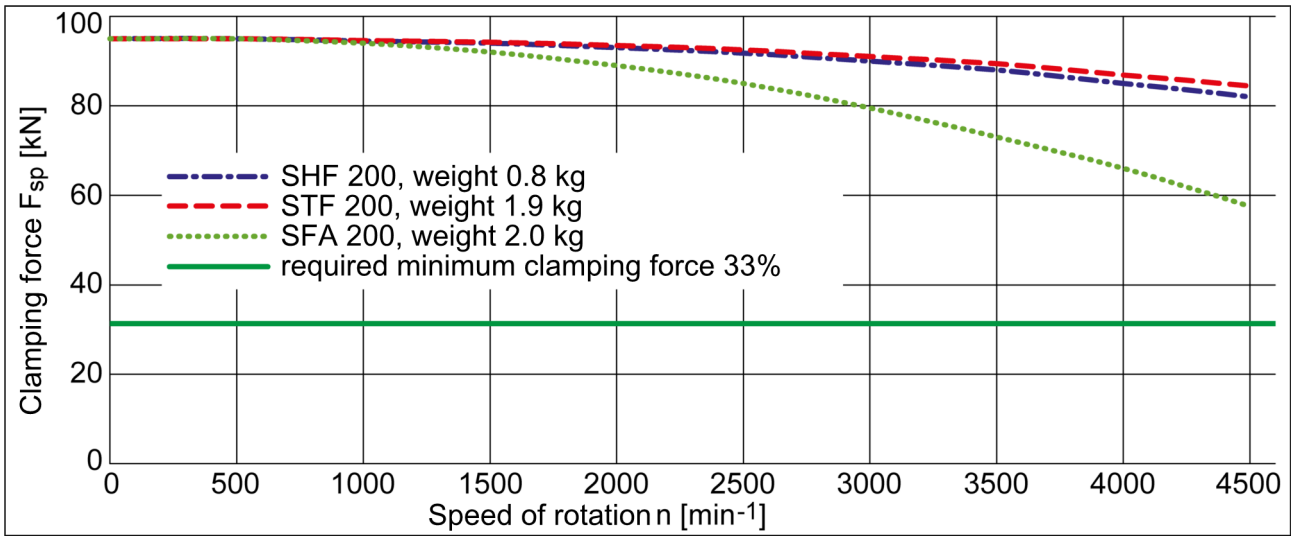


F/3	Clamping force per jaw	S	Center of gravity
r_s	Center of gravity radius	a_{max}	Max. jaw eccentricity of center of gravity in axial direction
F_{max}	Max. actuating force		

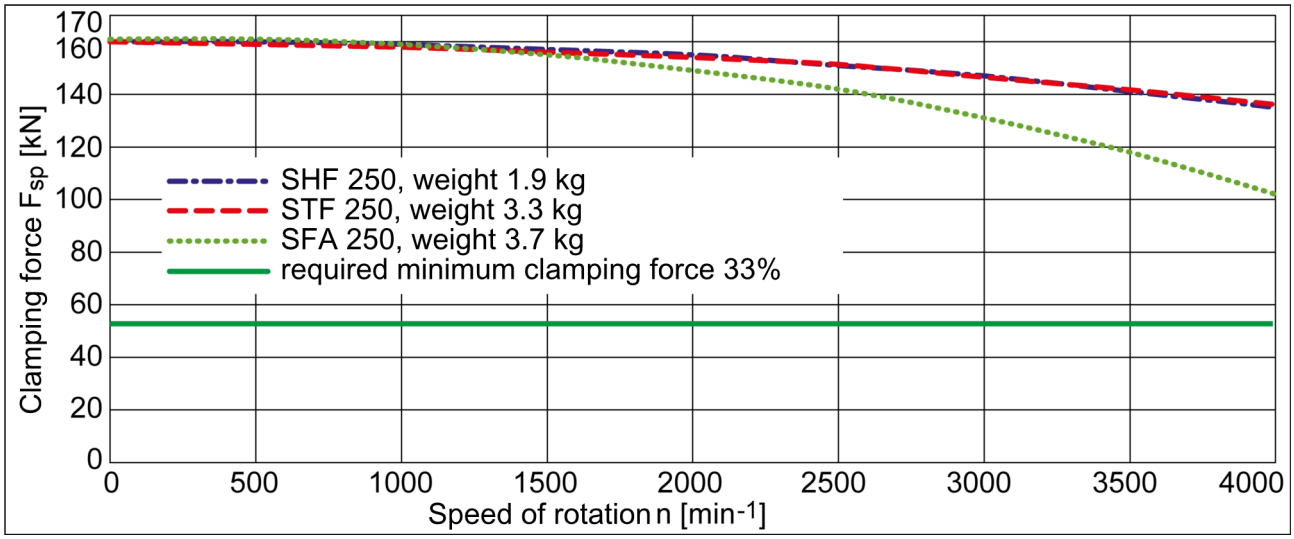
Clamping force RPM diagram, ROTA-S plus 160-42



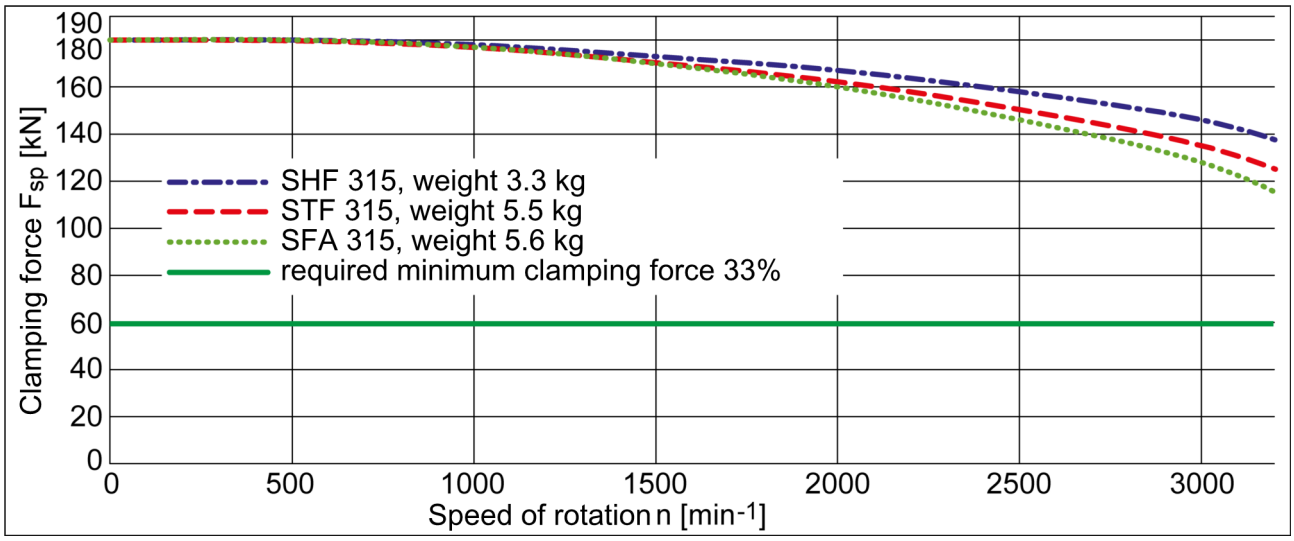
Clamping force RPM diagram, ROTA-S plus 200-52



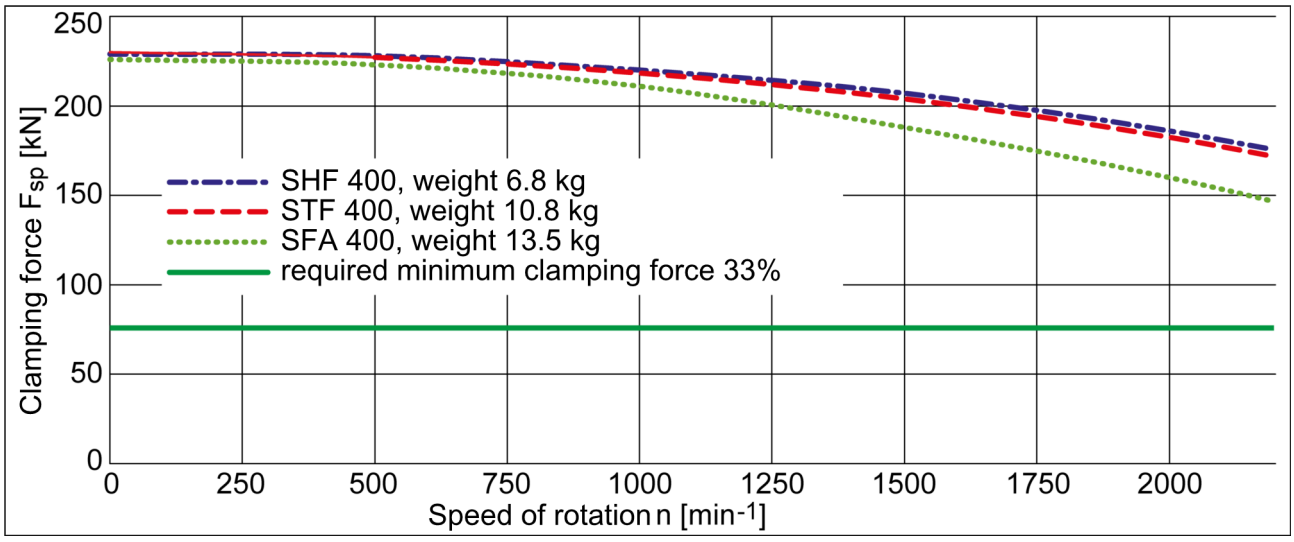
Clamping force RPM diagram, ROTA-S plus 250-62



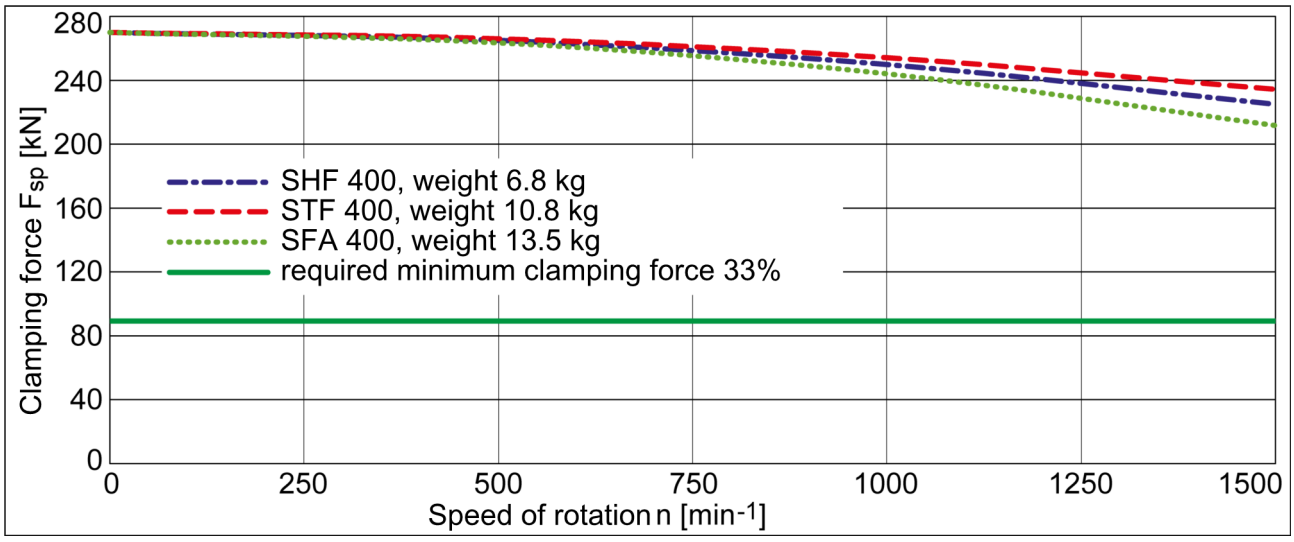
Clamping force RPM diagram, ROTA-S plus 315-92



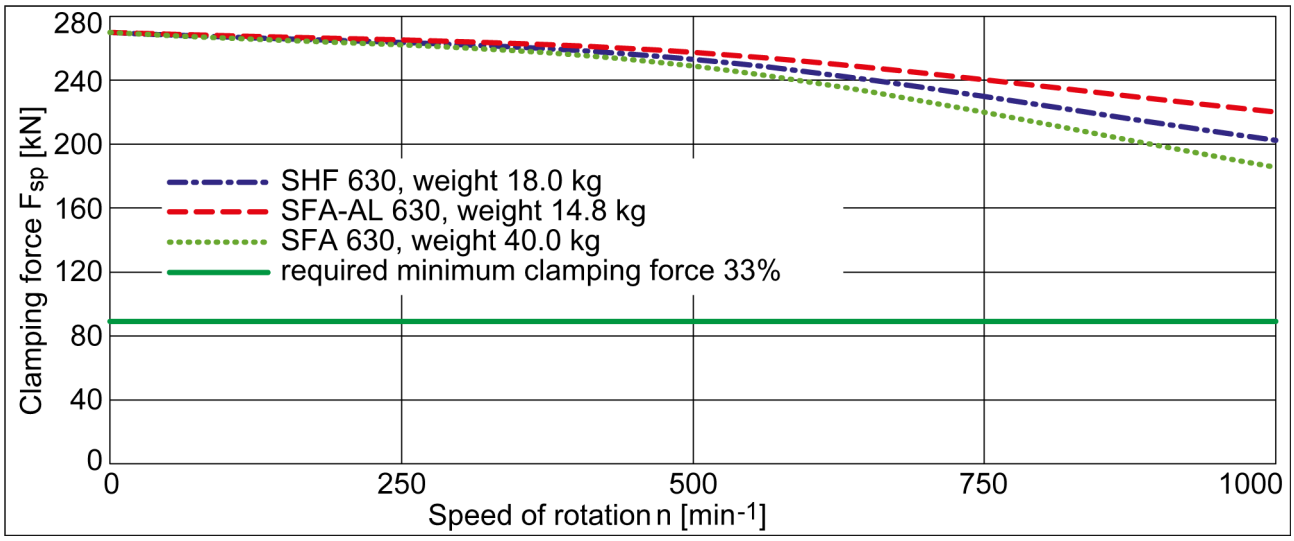
Clamping force RPM diagram, ROTA-S plus 400-102



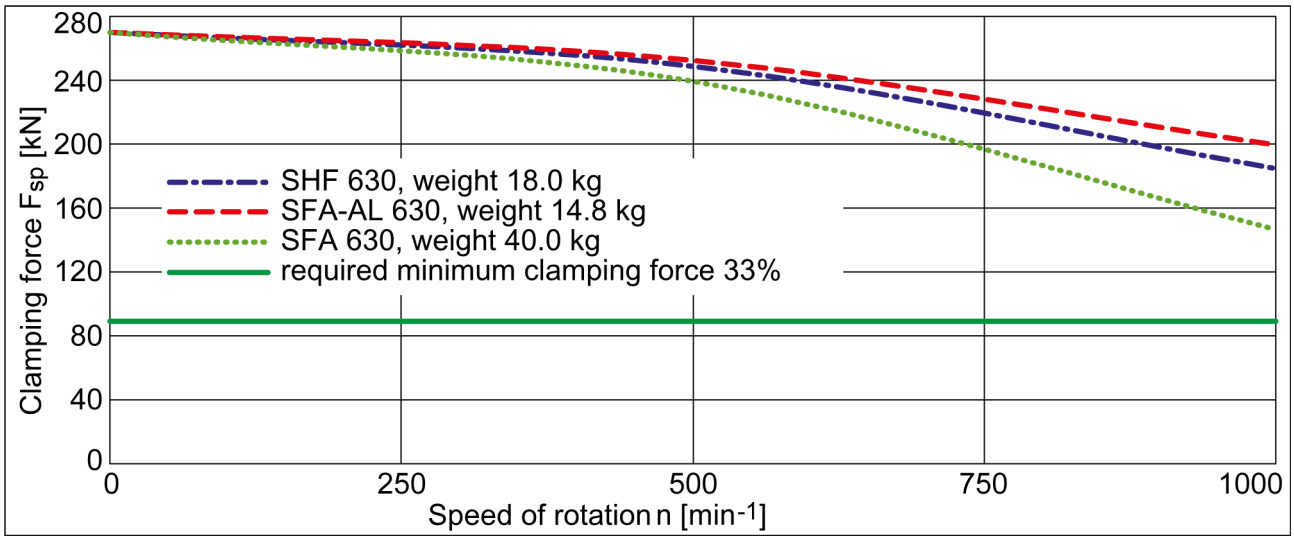
Clamping force RPM diagram, ROTA-S plus 500-162



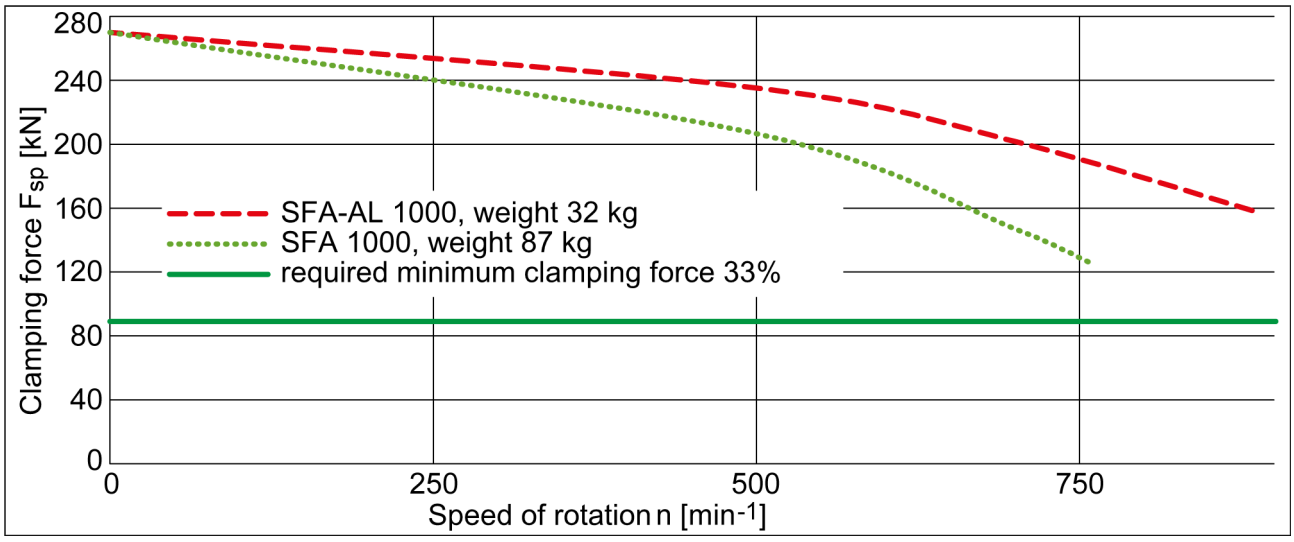
Clamping force RPM diagram, ROTA-S plus 630-252



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



Clamping force RPM diagram, ROTA-S plus 1000-402



6.3 Calculating the clamping force and RPM

Missing information or specifications can be requested from the manufacturer.

Legend			
F_c	Total centrifugal force [N]	M_{cAB}	Centrifugal torque of top jaws [Nm]
F_{sp}	Effective clamping force [N]	M_{cGB}	Centrifugal torque of base jaws [Nm]
F_{spmin}	Minimum required clamping force [N]	n	Speed of rotation [RPM]
F_{sp0}	Initial clamping force [N]	r_s	Center of gravity radius [mm]
F_{spz}	Cutting force [N]	r_{sAB}	Center of gravity radius of top jaw [mm]
m_{AB}	Mass of one top jaw [kg]	S_{sp}	Safety factor for clamping force
m_B	Mass of chuck jaw set [kg]	S_z	Safety factor for machining
M_c	Centrifugal force torque [Nm]	Σ_s	Max. clamping force of chuck [N]
kgm × 9.81 = Nm			

6.3.1 Calculation of the required clamping force at a specified speed of rotation

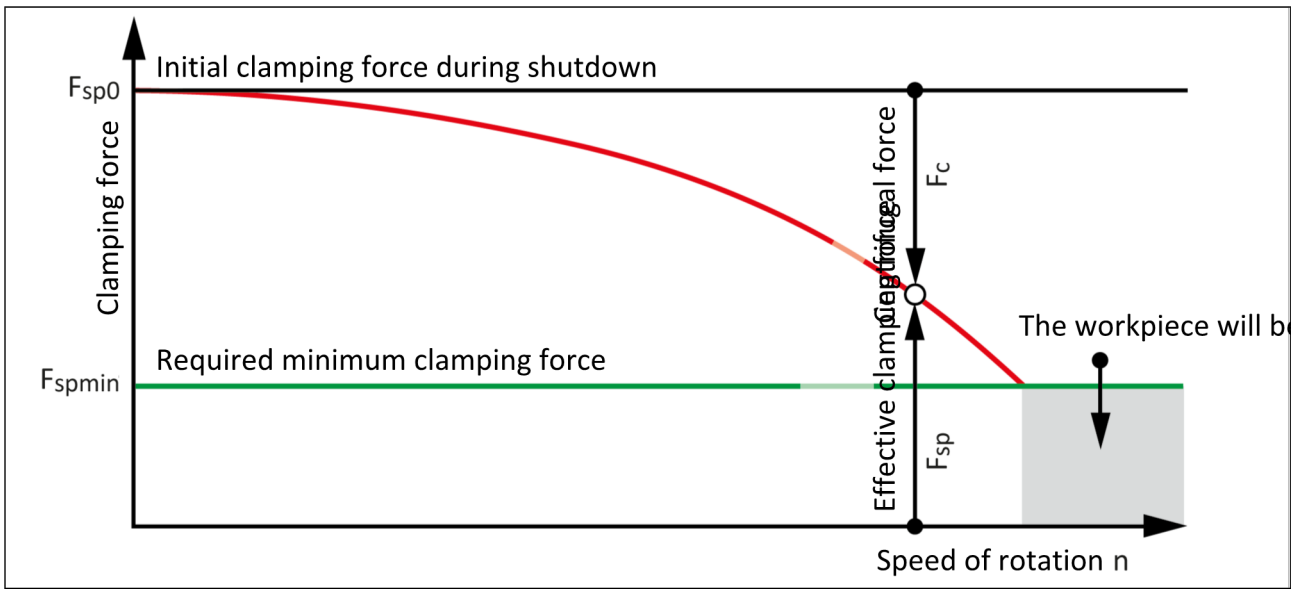
The **initial clamping force F_{sp0}** is the total force impacting radially on the workpiece via the jaws due to actuation of the lathe chuck during shutdown. Under the influence of rotation, the jaw mass generates an additional centrifugal force. The centrifugal force reduces or increases the initial clamping force depending on whether clamping 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}**.

$F_{sp} = F_{sp0} \mp F_c$ [N]
(–) for clamping from the outside inwards
(+) for clamping from the inside outwards

⚠ DANGER

Risk to life and limb of the operating personnel and significant property damage when a certain RPM limit is exceeded!
When clamping from the outside in, as the RPM increases, the effective clamping force decreases by the amount by which the centrifugal force increases (the forces are opposed). When the RPM limit is exceeded, the clamping force drops below the required minimum clamping force F_{spmin}. Consequently, the workpiece is released spontaneously.

- Do not exceed the calculated RPM.
- Do not fall below the necessary minimum clamping force.



Reduction in effective clamping force by the magnitude of the total centrifugal force, for clamping from the outside inwards.

The required effective clamping force for machining F_{sp} is calculated from the product of the **machining force F_{spZ}** and the **safety factor S_z**. This factor takes into account uncertainties in the calculation of the machining force. According to VDI 3106: **$S_z \geq 1.5$.**

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

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

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

(+) for clamping from the outside inwards
(–) for clamping from the inside outwards

	***NOTICE***
	This calculated force must not be larger than the maximum clamping force ΣS engraved on the chuck. See also "Chuck data" table (☞ 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:

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

For this, **n is the given speed of rotation** in ^{RPM}. The product $\mathbf{m_B \cdot r_S}$ **is referred to as the centrifugal force torque $\mathbf{M_C}$.**

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

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

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

The centrifugal torque of the base jaws M_{cGB} can be found in the table "Chuck data"(☞ 6.1, Page 17). The centrifugal torque of the top jaws M_{cAB} is calculated as per:

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

6.3.2 Calculation example: required initial clamping force for a given RPM

Required initial clamping force F_{sp0} for a given RPM n

The following data is known for the machining job:

- Clamping from the outside in (application-specific)
- Machining force F_{spz} = 3000 N (application-specific)
- max. RPM n_{max} = 3200 ^{RPM} ("Chuck data" table)
- RPM n = 1200 min^{-1} (application-specific)
- Mass of one (!) top jaw m_{AB} = 5.33 kg (application-specific)
- Center of gravity radius of top jaw r_{sAB} = 0.107 m (application-specific)
- Safety factor S_z = 1.5 (according to VDI 3106)
- Safety factor S_{sp} = 1.5 (according to VDI 3106)

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

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

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

Initial clamping force during shutdown:

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

Calculation of total centrifugal force:

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

For two-part chuck jaws, the following applies:

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

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

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

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

$M_{cAB} = m_{AB} \cdot r_{sAB} = 5.33 \cdot 0.107 \Rightarrow \mathbf{M_{cAB} = 0.57\ kgm}$

Centrifugal torque for one jaw:

$M_c = 0.319 + 0.571 \Rightarrow \mathbf{M_c = 0.89\ kgm}$

The chuck has 3 jaws, the total centrifugal torque is:

$\sum M_c = 3 \cdot M_c = 3 \cdot 0.889 \Rightarrow \mathbf{\sum M_c = 2.667\ kgm}$

The total centrifugal force can now be calculated:

$$F_c = \sum M_c \cdot \left(\frac{\pi \cdot n}{30}\right)^2 = 2.668 \cdot \left(\frac{\pi \cdot 1200}{30}\right)^2 \Rightarrow \mathbf{F_c = 42131\ N}$$

Initial clamping force during shutdown that was sought:

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

6.3.3 Calculation of the permissible RPM in case of a given initial clamping force

Calculation of the permissible RPM n_{perm} in case of a given initial clamping force F_{sp0}

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

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

NOTICE

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

Example of calculation: Permissible RPM for a given effective clamping force

The following data is known from previous calculations:

- Initial clamping force during shutdown F_{sp0} = 17723 N
- Machining force for machining job F_{spz} 3000 N (application-specific)
- Total centrifugal torque of all jaws $\sum M_c$ = 2,668 kgm
- Safety factor S_z = 1.5 (according to VDI 3106)
- Safety factor S_{sp} = 1.5 (according to VDI 3106)

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

Identifying the permissible RPM:

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

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

This calculated RPM may be used.

6.4 Accuracy classes

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 Permitted imbalance

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

7 Attachment of the manual lathe chuck

The item numbers specified for the corresponding individual components relate to the drawing in chapter "Drawings" (☞ 12, Page 41).

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 as per 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 Assembly of the manual lathe 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 the drawing in chapter "Drawings" (☞ 12, Page 41).

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 chapter "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

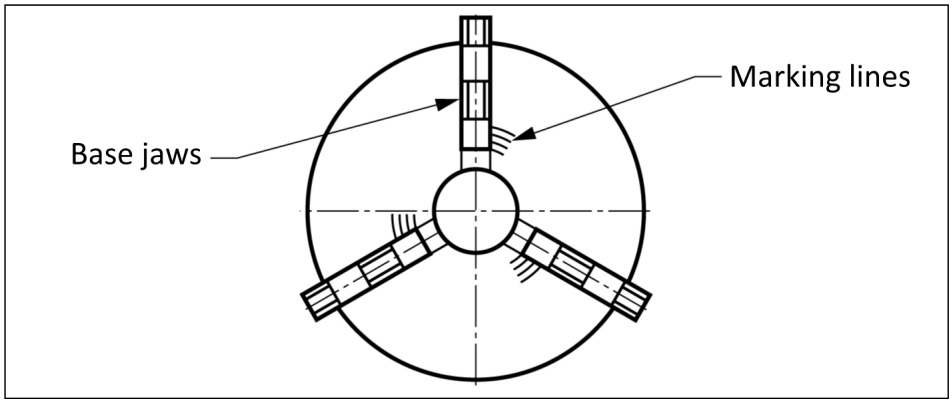
If force is used to continue turning, the chuck will be damaged and the jaw lock function will no longer be active.
Do not forcefully turn the spindle further!

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 for example) 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 operation to compensate for the loss of clamping force caused by vibrations.
- Following a longer period of shutdown (more than 8 hours), always re-tension the clamped lathe 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 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 30)!
- 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 run-out 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 Checking the chuck

The ROTA-S plus manual lathe chuck can only be checked in flange-mounted condition. The round and flat surfaces in the rear chuck body area must run true.
The jaws must be just as easy to move after attachment as they were before (☞ 9.1, Page 35).

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 True running check

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

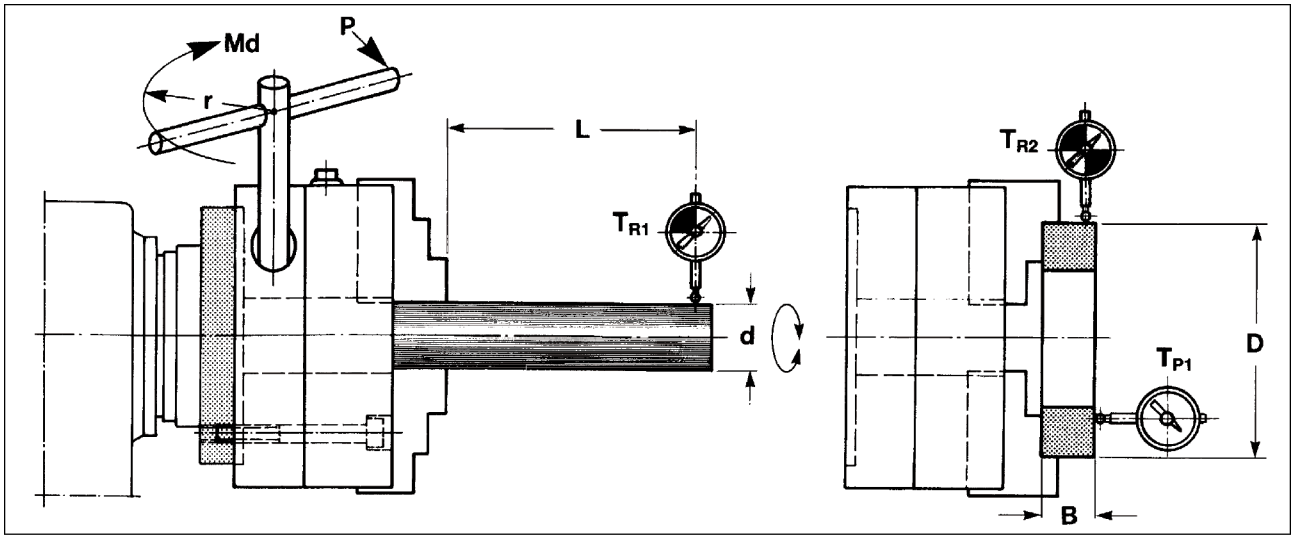
To check the radial and axial run-out accuracy, hardened and ground test pins or test disks are clamped (see Fig. "True running check"). The torques (Md) at the key when gripping the test pins and test disks are provided in the table.

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

ROTA-S plus	160	200	250	315	400	500	630	800	1000
Jaw type	STF-160	STF-200	STF-250	STF-315	STF-400	STF-400	--	on request (special stepped jaws)	on request (special stepped jaws)
	SHF-160	SHF-200	SHF-250	SHF-315	SHF-400	SHF-400	SHF-630		
Md [Nm]	40	70	80	90	100	100	100		
L [mm]	60	80	80	120	120	160	160		
d (STF) [mm]	Ø 34	Ø 41	Ø 50	Ø 63	Ø 103	Ø 103	--		
d (SHF) [mm]	Ø 34	Ø 41	Ø 41	Ø 55	Ø 119	Ø 119	Ø 120		
T_{R1} max [mm]	0.03	0.03	0.03	0.04	0.04	0.05	0.05		
D (STF) [mm]	Ø 140	Ø 160	Ø 210	Ø 243	Ø 313	Ø 313	--		
D (SHF) [mm]	Ø 140	Ø 140	Ø 210	Ø 243	Ø 234	Ø 234	Ø 243		
W [mm]	20	25	25	35	35	35	50		
T_{P1} max [mm]	0.02	0.02	0.02	0.03	0.03	0.03	0.03		



True running check

9 Maintenance

The item numbers specified for the corresponding individual components relate to the drawing in chapter "Drawings" (☞ 12, Page 41).

A high load bearing 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 if lubricating grease comes into contact with the skin.
Wear protective 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 lathe chuck from the lathe.

Note for the corresponding mountings:

- For direct mounting in accordance with DIN ISO 702-1:
  Evenly loosen the mounting screws (item 36) and remove the chuck from the spindle.
- For direct mounting in accordance with DIN ISO 702-3 (bayonet):
  Loosen flanged nut, twist the bayonet disk and take the chuck out of the spindle.
- For direct mounting in accordance 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 lathe chuck during transport, installation or removal
During transport and when installing or detaching the manual lathe chuck, ensure it does not fall off.

- Remove the jaws from the guideways (see chapter "Handling and jaw changes" (☞ 8.1, Page 30))
- 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.
- Using the spanner wrench, turn the spindle (item 8) 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).

NOTICE

The cartridges (item 19) are safety equipment and may never be disassembled!
If the cartridge (item 19) is stuck or does not move easily, never use force to loosen it! Clean and oil the cartridges (do not lubricate with chuck grease!).

- 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!

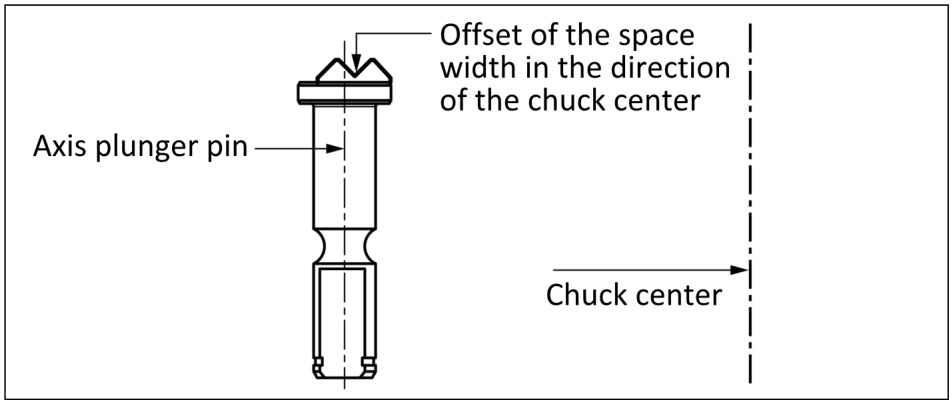
Before assembly, grease all individual components (except for the cartridges) using LINOMAX.

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

- 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 tension.

- 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 about 200 operating hours

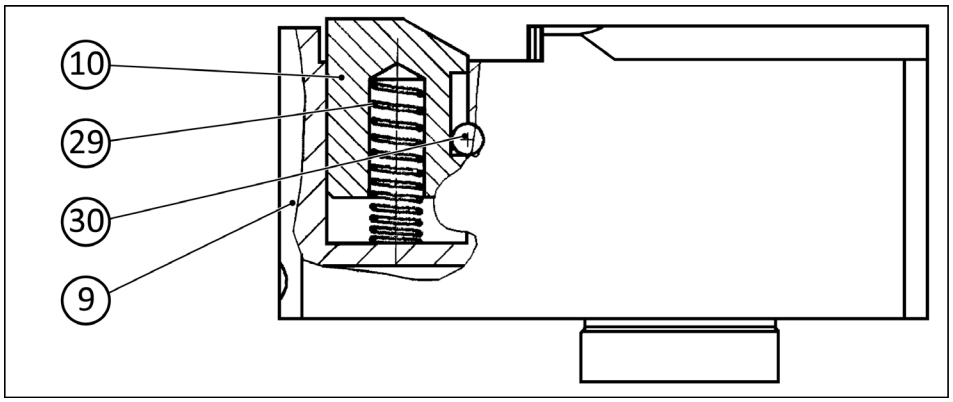
If the clamping force decreases, the inside of the chuck is contaminated or the coolant has washed out or decomposed the grease.

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 imperative to state the type, size, and, above all, the manufacturing no. of the chuck.

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

Item	Designation
1	Chuck body
2	Cover
3	Drive ring
4	Base jaws
5	Wedge bar with thread
7	Sliding block
8	Spindle
9	Wedge bar without thread
10	Safety bolt
13	Seat of bearing with bore hole
15	Seat of bearing
17	Indicator pin
18	Ball
19	Cartridge
24	2nd plunger pin
25	Plunger pin
26	Washer
27	Compression spring for plunger pin
28	Compression spring for indicator pin
29	Compression spring for safety bolt
30	Clamping sleeve
31	Screw for plunger pin
32	Lubrication nipple for spindle
33	Lubrication nipple for chuck body
34	Screw DIN EN ISO 4762 (cover)
35	Screw DIN EN ISO 4762
39	Safety disk (from size ROTA-S plus 400)
40	Compression spring
41	Set-screw

12 Assembly drawing