Power chucks
ROTA NCX

Assembly and Operating Manual

Imprint

Technical changes:

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

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Dear Customer,

thank you for trusting our products and our family-owned company, the leading technology supplier of robots and production machines.

Our team is always available to answer any questions on this product and other solutions. Ask us questions and challenge us. We will find a solution!

Best regards,

Your SCHUNK team

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1 General

1.1 About this manual

This manual contains important information for a safe and appropriate use of the product.

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

Before starting work, the personnel must have read and understood this operating manual. Prerequisite for safe working is the observance of all safety instructions in this manual.

Illustrations in this manual are provided for basic understanding and may differ from the actual product design.

In addition to these instructions, the documents listed under (☞ 1.1.2, Page 6) are applicable.

1.1.1 Presentation of Warning Labels

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

	**⚠ DANGER** **Danger for persons!** Non-observance will inevitably cause irreversible injury or death.

	**⚠ WARNING** **Dangers for persons!** Non-observance can lead to irreversible injury and even death.

	**⚠ CAUTION** **Dangers for persons!** Non-observance can cause minor injuries.

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

1.1.2 Applicable documents

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

The documents marked with an asterisk (*) can be downloaded on our homepage **schunk.com**

1.1.3 Sizes

This operating manual applies to the following sizes:

- ROTA NCX 165-53
- ROTA NCX 210-66
- ROTA NCX 260-81
- ROTA NCX 315-106

1.2 Warranty

The warranty period is 24 months after delivery date from factory or 500 000 cycles*, if it is used as intended, under the following conditions:

- Observe the applicable documents, (☞ 1.1.2, Page 6)
- Observe the ambient conditions and operating conditions, (☞ 2.6, Page 9)
- Observe the specified maintenance and lubrication intervals, (☞ 7, Page 36)

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

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

1.3 Scope of delivery

1	**Power chucks**
1	**Set of base jaws**
3	**Mounting screws**
1	**Jaw change key**
1	**Assembly key**
1	**Operating manual**

2 Basic safety notes

2.1 Intended use

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

- The product may only be used within the scope of its technical data, (☞ 3, Page 19).
- The product is intended for industrial and industry-oriented use.
- Appropriate use of the product includes compliance with all instructions in this manual.
- The maximum RPM of the chuck and the required clamping force must be determined by the user for the respective clamping task based on the applicable standards and technical specifications of the manufacturer.
  (See also “Calculations for clamping force and RPM” in the chapter “Technical data”). (☞ 3, Page 19)

2.2 Not intended use

A not intended use of the product is for example:

- It is used as a press, a punch, a toolholder, a load-handling device or as lifting equipment.
- the product is used for unintended machines or workpieces.
- the technical data is exceeded when using the product.
  (☞ 3, Page 19)
- if workpieces are not clamped properly, paying particular attention to the clamping forces specified by the manufacturer.
- if it is used in working environments that are not permissible.
- if the product is operated without a protective cover.

2.3 Constructional changes

Implementation of structural changes

By conversions, changes, and reworking, e.g. additional threads, holes, or safety devices can impair the functioning or safety of the product or damage it.

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

2.4 Spare parts

Use of unauthorized spare parts

Using unauthorized spare parts can endanger personnel and damage the product or cause it to malfunction.

- Use only original spare parts or spares authorized by SCHUNK.

2.5 Chuck jaws

Requirements of the chuck jaws

Stored energy can make the product unsafe and risk the danger of serious injuries and considerable material damage.

- Only replace chuck jaws if no residual energy can be released.
- Do not use welded jaws.
- The jaws should be designed as light and as low as possible. The clamping point must be as close as possible to the chuck face (clamping points at a greater distance lead to greater surface pressure in the jaw guidance and can significantly reduce the clamping force).
- If for constructional reasons the special chuck jaws are heavier than the top jaws assigned to the lathe chuck, greater centrifugal forces must be accounted for when defining the required clamping force and the recommended speed.
- The maximum recommended speed may only be operated in conjunction with maximum actuating force and only with the lathe chuck in optimal, fully functioning condition.
- After a collision, the lathe chuck and the chuck jaws must be subjected to a crack test before being used again. Damaged parts must be replaced with original SCHUNK spare parts.

- Screw the jaw mounting screws into the bore holes furthest apart.
- The jaw fastening screws must be replaced if they show any signs of wear or damage. Only use screws with a quality of 12.9.

2.6 Environmental and operating conditions

Required ambient conditions and operating conditions

Incorrect ambient and operating conditions can make the product unsafe, leading to the risk of serious injuries, considerable material damage and/or a significant reduction to the product's life span.

- Make sure that the product is used only in the context of its defined application parameters, (☞ 3, Page 19).
- Make sure that the product is a sufficient size for the application.
- Only use high-quality cooling emulsions with anti-corrosive additives during processing.

Clamping force tester

Depending on the operating conditions, the function and clamping force must be checked after a certain period of operation (☞ 7.2, Page 37). Only use a calibrated clamping force tester for measuring during the clamping force test.

With the smallest possible actuating pressure (clamping cylinder), the base jaws should move evenly. This method only provides a limited indication and is not a substitute for measuring the clamping force.

If the clamping force has dropped too much or if the base jaws and pistons no longer move properly, the chuck must be disassembled, cleaned, and relubricated (☞ 7, Page 36).

2.7 Personnel qualification

Inadequate qualifications of the personnel

If the personnel working with the product is not sufficiently qualified, the result may be serious injuries and significant property damage.

- All work may only be performed by qualified personnel.
- Before working with the product, the personnel must have read and understood the complete assembly and operating manual.
- Observe the national safety regulations and rules and general safety instructions.

The following personal qualifications are necessary for the various activities related to the product:

Trained electrician	Due to their technical training, knowledge and experience, trained electricians are able to work on electrical systems, recognize and avoid possible dangers and know the relevant standards and regulations.
Qualified personnel	Due to its technical training, knowledge and experience, qualified personnel is able to perform the delegated tasks, recognize and avoid possible dangers and knows the relevant standards and regulations.
Instructed person	Instructed persons were instructed by the operator about the delegated tasks and possible dangers due to improper behaviour.
Service personnel of the manufacturer	Due to its technical training, knowledge and experience, service personnel of the manufacturer is able to perform the delegated tasks and to recognize and avoid possible dangers.

2.8 Personal protective equipment

Use of personal protective equipment

Personal protective equipment serves to protect staff against danger which may interfere with their health or safety at work.

- When working on and with the product, observe the occupational health and safety regulations and wear the required personal protective equipment.
- Observe the valid safety and accident prevention regulations.
- Wear protective gloves to guard against sharp edges and corners or rough surfaces.
- Wear heat-resistant protective gloves when handling hot surfaces.
- Wear protective gloves and safety goggles when handling hazardous substances.
- Wear close-fitting protective clothing and also wear long hair in a hairnet when dealing with moving components.

2.9 Notes on safe operation

Incorrect handling of the personnel

Incorrect handling and assembly may impair the product's safety and cause serious injuries and considerable material damage.

- Avoid any manner of working that may interfere with the function and operational safety of the product.
- Use the product as intended.
- Observe the safety notes and assembly instructions.
- Do not expose the product to any corrosive media. This does not apply to products that are designed for special environments.
- Eliminate any malfunction immediately.
- Observe the care and maintenance instructions.
- Observe the current safety, accident prevention and environmental protection regulations regarding the product's application field.

2.10 Transport

Handling during transport

Incorrect handling during transport may impair the product's safety and cause serious injuries and considerable material damage.

- When handling heavy weights, use lifting equipment to lift the product and transport it by appropriate means.
- Secure the product against falling during transportation and handling.
- Stand clear of suspended loads.

2.11 Malfunctions

Behavior in case of malfunctions

- Immediately remove the product from operation and report the malfunction to the responsible departments/persons.
- Order appropriately trained personnel to rectify the malfunction.
- Do not recommission the product until the malfunction has been rectified.
- Test the product after a malfunction to establish whether it still functions properly and no increased risks have arisen.

2.12 Disposal

Handling of disposal

The incorrect handling of disposal may impair the product's safety and cause serious injuries as well as considerable material and environmental harm.

- Follow local regulations on dispatching product components for recycling or proper disposal.

2.13 Fundamental dangers

General

- Observe safety distances.
- Never deactivate safety devices.
- Before commissioning the product, take appropriate protective measures to secure the danger zone.
- Disconnect power sources before installation, modification, maintenance, or calibration. Ensure that no residual energy remains in the system.
- If the energy supply is connected, do not move any parts by hand.
- Do not reach into the open mechanism or movement area of the product during operation.

2.13.1 Protection during handling and assembly

Incorrect handling and assembly

Incorrect handling and assembly may impair the product's safety and cause serious injuries and considerable material damage.

- Have all work carried out by appropriately qualified personnel.
- For all work, secure the product against accidental operation.
- Observe the relevant accident prevention rules.
- Use suitable assembly and transport equipment and take precautions to prevent jamming and crushing.

Incorrect lifting of loads

Falling loads may cause serious injuries and even death.

- Stand clear of suspended loads and do not step into their swiveling range.
- Never move loads without supervision.
- Do not leave suspended loads unattended.

2.13.2 Protection during commissioning and operation

Falling or violently ejected components

Falling and violently ejected components can cause serious injuries and even death.

- Take appropriate protective measures to secure the danger zone.
- Never step into the danger zone during operation.

2.13.3 Protection against dangerous movements

Unexpected movements

Residual energy in the system may cause serious injuries while working with the product.

- Switch off the energy supply, ensure that no residual energy remains and secure against inadvertent reactivation.
- Never rely solely on the response of the monitoring function to avert danger. Until the installed monitors become effective, it must be assumed that the drive movement is faulty, with its action being dependent on the control unit and the current operating condition of the drive. Perform maintenance work, modifications, and attachments outside the danger zone defined by the movement range.
- To avoid accidents and/or material damage, human access to the movement range of the machine must be restricted. Limit/prevent accidental access for people in this area due through technical safety measures. The protective cover and protective fence must be rigid enough to withstand the maximum possible movement energy. EMERGENCY STOP switches must be easily and quickly accessible. Before starting up the machine or automated system, check that the EMERGENCY STOP system is working. Prevent operation of the machine if this protective equipment does not function correctly.

2.13.4 Notes on particular risks

⚠ DANGER

Risk of fatal injury from suspended loads!
Falling loads can cause serious injuries and even death.

- Stand clear of suspended loads and do not step within their swiveling range.
- Never move loads without supervision.
- Do not leave suspended loads unattended.
- Wear suitable protective equipment.

⚠ DANGER

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 lathe 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 automated system.

- The machine manufacturer and the operator of the machine must carry out and document a hazard assessment and risk analysis to ensure that suitable measures are taken to maintain the lathe chuck's clamping force until the machine comes to a standstill and the workpiece can be secured (e.g. using a crane or suitable lifting equipment).
- 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.

DANGER

Possible risk of fatal injury to operating personnel if a jaw breaks or if the lathe chuck fails because the technical data have been exceeded and a workpiece is released or parts fly off

- The technical data specified by the manufacturer for using the lathe chuck must never be exceeded.
- The lathe chuck may only be used on machines and facilities that fulfill the minimum requirements of the EC Machinery Directive; specifically, they must have effective technical measures to protect against possible mechanical hazards.

DANGER

Possible risk of fatal injury to operating personnel from clothing or hair being caught on the lathe chuck and being dragged into the machine

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

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

CAUTION

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

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

⚠ CAUTION

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

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

⚠ CAUTION

Risk of burns due to workpieces with high temperatures.

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

⚠ CAUTION

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.

⚠ CAUTION

Hazard from vibration due to imbalanced rotating parts and noise generation.

Physical and mental strains due to imbalanced workpieces and noise during the machining process on the clamped and rotating workpiece.

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

3 Technical data

3.1 Chuck data

ROTA NCX	165-53	210-66	260-81	315-106
Max. actuating force [kN]	33	45	68	88
Max. clamping force [kN]	50	80	128	155
Max. rotation speed [min-1]	6000	5000	4500	3500
Stroke per jaw [mm]	3	4.2	5	6.3
Piston stroke [mm]	13	18	21	25
Through hole [mm]	53	66	81	106
Operating temperature	+ 15 °C to + 60 °C			
Centrifugal torque of the base jaw with fine serration **M_{cGB}** [kgm]	For the NCX chuck, it is necessary to specifically determine this data. Examples of calculation can be found in the "Technology" chapter of the SCHUNK lathe chuck catalog and in the "Chuck jaws in special design/technology" chapter of the SCHUNK chuck jaws catalog. These catalogs can be downloaded from schunk.com.			
Weight with base jaws [kg]	165-53	210-66	260-81	315-106
DIN ISO 702-4-No. 5 DIN ISO 702-1-A5	10.30 kg 11.50 kg			
DIN ISO 702-4-No. 6 DIN ISO 702-1-A6		18.10 kg 21.70 kg		
DIN ISO 702-4-No. 8 DIN ISO 702-1-A6 DIN ISO 702-1-A8			37.80 kg 41.20 kg 39.20 kg	
DIN ISO 702-4-No. 11 DIN ISO 702-1-A6 DIN ISO 702-1-A8 DIN ISO 702-1-A11				58.70 kg 72.70 kg 72.50 kg 66.10 kg

The maximum permissible speed for special machining has to be defined by the user on the basis of the required clamping forces. This speed must not exceed the maximum speed of the chuck. Ensure minimal weight for all jaws.
For unhardened top jaws or chuck jaws in special design, the permissible RPM according to VDI 3106 must be calculated for the respective machining job. Whereby the recommended maximum speed must not be exceeded. The values calculated must be checked by means of dynamic measurement using a clamping force tester.

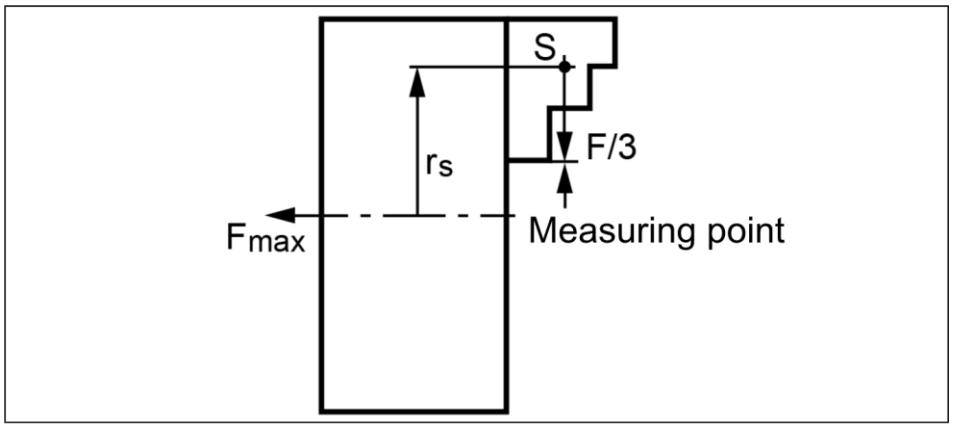
3.2 Clamping force / speed diagrams

Clamping force/RPM curves have been calculated using the corresponding standard top jaws (stepped jaws and monoblock jaws). For this, 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 plus special grease.

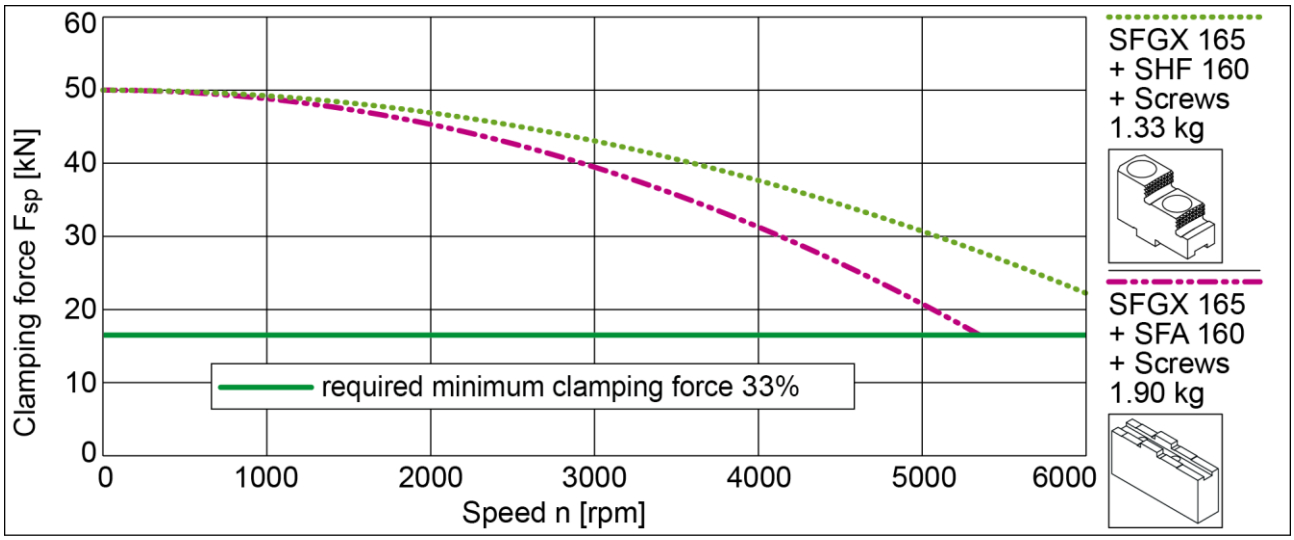
If one or more of these prerequisites is modified, the graphs will no longer be valid.

Chuck setup for clamping force/RPM diagram

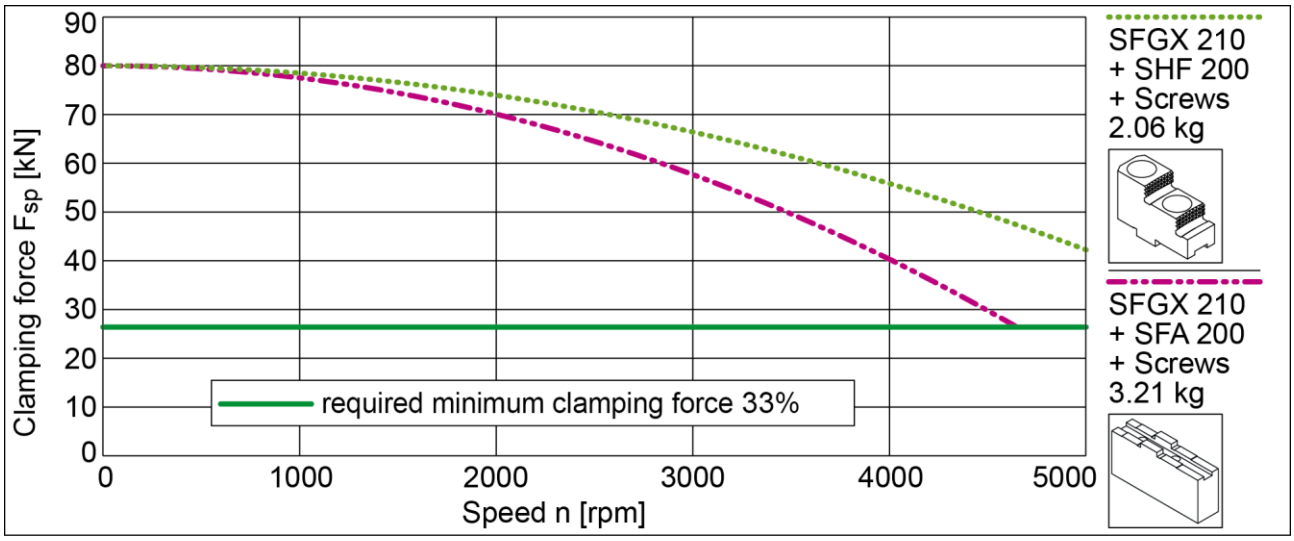


F/3	Clamping force per jaw	F_{max}	Max. actuating force
r_s	Center of gravity radius	S	Center of gravity

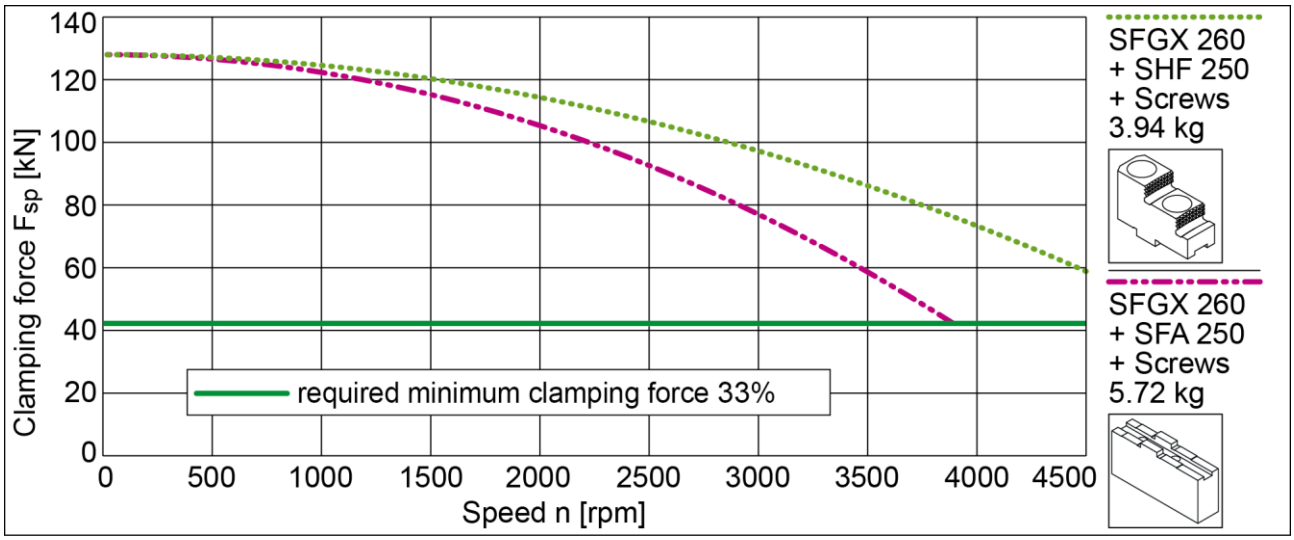
Clamping force/RPM graph for ROTA NCX 165-53



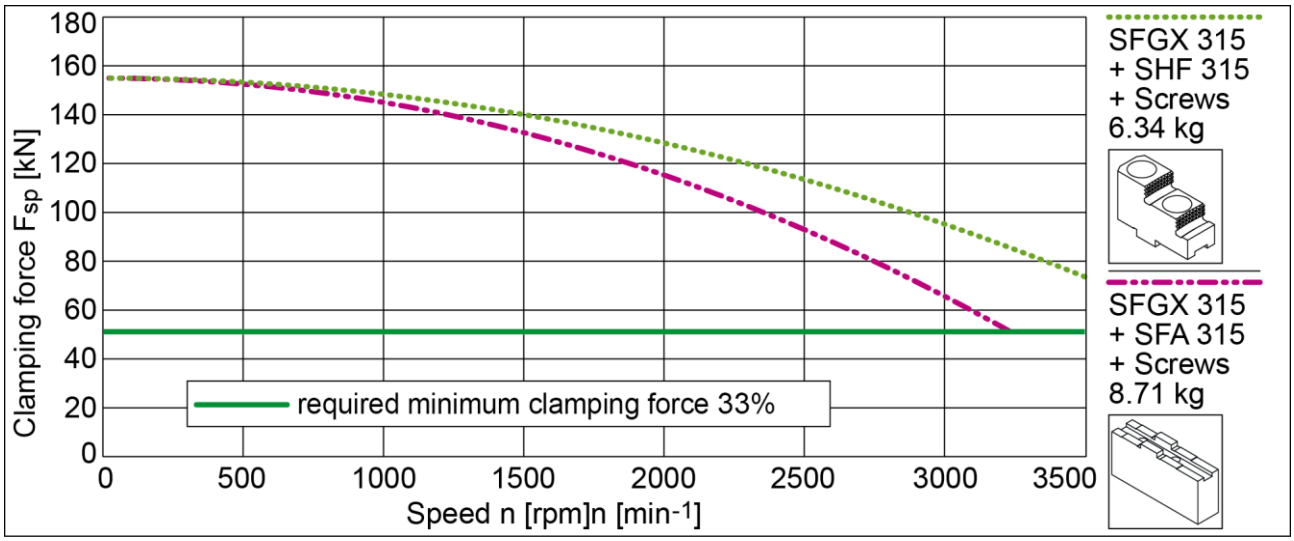
Clamping force/RPM graph for ROTA NCX 210-66



Clamping force/RPM graph for ROTA NCX 260-81



Clamping force/RPM graph for ROTA NCX 315-106



3.3 Calculations for clamping force and speed

Missing information or specifications can be requested from the manufacturer.

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

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

The **initial clamping force F_{sp0}** is the total force impacting radially on the workpiece via the jaws due to actuation of the lathe chuck during shutdown. Under the influence of rotation, the jaw mass generates an additional centrifugal force. The centrifugal force reduces or increases the initial clamping force depending on whether gripping is from the outside inwards or from the inside outwards.
The sum of the initial clamping force F_{sp0} and the **total centrifugal force F_c** is **the effective clamping force F_{sp}**.

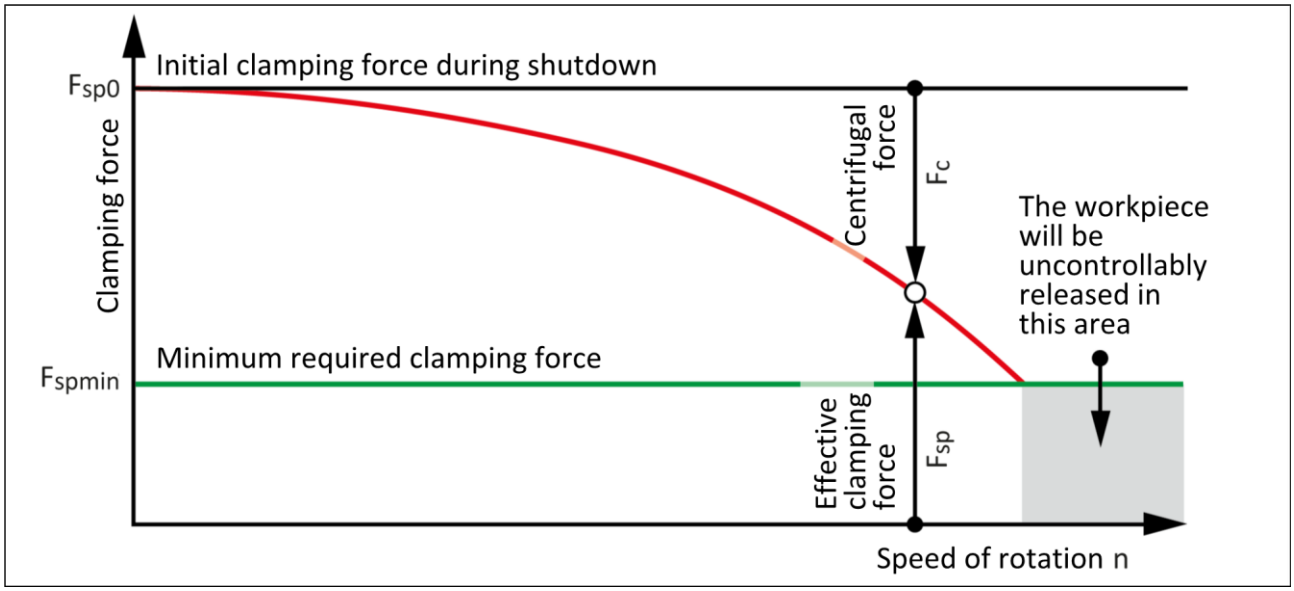
$$F_{sp} = F_{sp0} \mp F_c \text{ [N]}$$

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

DANGER

Risk to life and limb of the operating personnel and significant property damage when the RPM limit is exceeded! With gripping from the outside inwards, and with increasing RPM, the effective clamping force is reduced by the magnitude of the increasing centrifugal force (the forces are opposed). When the RPM limit is exceeded, the clamping force drops below the required minimum clamping force F_{spmin}. Consequently, the workpiece is released spontaneously.

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



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

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

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

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

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

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

CAUTION

This calculated force must not be larger than the maximum clamping force ΣS engraved on the chuck.
See also "Chuck data" table (☞ 3.1, Page 19)

From the above formula it is evident that the sum of the effective clamping force F_{sp} and the total centrifugal force F_c is multiplied by the **safety factor for the clamping force S_{sp}**. According to VDI 3106, the following also applies here: **$S_{sp} \geq 1.5$.**
The **total centrifugal force F_c** is dependent on both the sum of the masses of all jaws and on the center of gravity radius and the rpm.

CAUTION

For safety reasons, in accordance with DIN EN 1550, the centrifugal force may be a maximum of 67% of the initial clamping force.

The formula for the calculation of the total centrifugal force F_c is:

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

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

$$M_C = m_B \cdot r_S \text{ [kgm]}$$

In case of toolholders with split chuck jaws, i.e., with base jaws and top jaws, for which the base jaws change their radial position only by the stroke amount, the **centrifugal torque of the base jaws M_{cGB}** and the **centrifugal torque of the top jaws M_{cAB}** need to be added:

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

The centrifugal torque of the base jaws M_{cGB} can be found in the table "Chuck data"(☞ 3.1, Page 19). The centrifugal torque of the top jaws M_{cAB} is calculated as per:

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

3.3.2 Calculation example: required initial clamping force for a given speed

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

The following data is known for the machining job:

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

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

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

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

Initial clamping force during shutdown:

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

Calculation of total centrifugal force:

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

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:

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

3.3.3 Calculation of the permissible speed in case of a given initial clamping force

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

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

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

CAUTION

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

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

The following data is known from previous calculations:

- Initial clamping force during shutdown F_{sp0} = 17723 N
- Machining force for machining job F_{spz} 3000 N (application-specific)
- Total centrifugal torque of all jaws $\sum M_c$ = 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 (☞ 3.1, Page 19)).

This calculated RPM may be used.

3.4 Grades of Accuracy

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

3.5 Permissible imbalance DIN ISO 21940-11

The ROTA NCX in ungreased state without chuck jaws corresponds to the 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, asymmetrical workpieces or the use of various chuck jaws, as well as uneven application of lubricants. 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.

4 Torques per screw

Tightening torques for mounting screws used to clamp the chuck on lathes or other suitable technical equipment (screw quality 10.9)

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

Tightening torques for the fastening screws of the quick-change jaw system (bolt quality 12.9)

Screw size	M8	M10	M12	M16	M20	M24
Tightening torque (Nm)	25	60	80	100	180	230

5 Assembly

5.1 Installing and connecting

⚠ WARNING

Risk of injury due to unexpected movements!
If the power supply is switched on or residual energy remains in the system, components can move unexpectedly and cause serious injuries.

- Before starting any work on the product: Switch off the power supply and secure against restarting.
- Ensure that no residual energy remains in the system.

⚠ CAUTION

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

- Wear personal protective equipment, particularly protective gloves.

1 Checking the chuck mount (☞ 5.3, Page 30)
2 Finish turning the center sleeve blank (☞ 5.2, Page 29)
3 Chuck assembly (☞ 5, Page 29)
4 Performing a functional check (☞ 6.5, Page 34)

5.2 Finish turning the center sleeve blank

Detach the retainer ring (item 10) and remove the center sleeve blank (item 11), which is shipped with a only a single bore hole, from the piston (item 3). Cut the appropriate draw tube thread into the center sleeve blank (item 11). Then reinsert the center sleeve (item 11) into the piston (item 3) and screw in the retainer ring (item 10).

Maximum internal thread for center sleeve blanks:

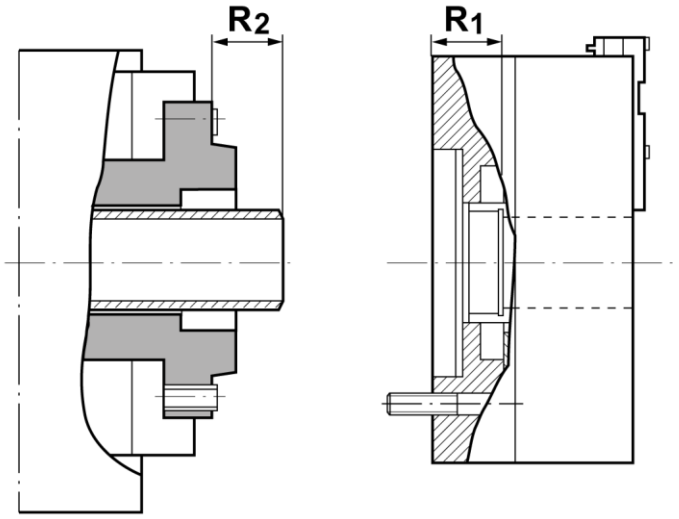
Chuck size	ROTA NCX 165	ROTA NCX 210	ROTA NCX 260	ROTA NCX 315
Max. thread	M60 x 2	M75 x 2	M90 x 2	M115 x 2

5.3 Checking the chuck mounting

- Check the machine spindle head or the ready-machined intermediate flange for radial and axial run-out. The permissible limit is 0.005 mm as per DIN 6386-1.
- The contact surface must be chamfered and clean at the bores.

5.4 Mounting the lathe chuck onto the machine spindle

- Move the draw tube to its foremost position by actuating the hydraulic cylinder (see Fig. "Piston position").



Piston position

Piston in foremost position
R1 = Push the chuck piston to its foremost position and measure with a depth gauge
R2 = R1 – 0.1 mm (max. – 0.3 mm)

You have to ensure that the piston can be moved to the foremost (jaw change) position. To do this, ensure that the dimensions for the attachment are complied with.

- Move the chuck piston (item 3) to its foremost position.
- Offset the base jaws to the outermost marking (see chapter "Drawings" (☞ 9, Page 42)).
- Remove the screws (item 24) and use the threaded extraction hole to push off the center sleeve (item 4) away from the chuck body (item 1), and then pull it out completely.
- Lift the chuck to the front of the spindle lug using an eye bolt flush with the center of the spindle.
- Screw the rotating center sleeve (item 11) onto the draw tube using the enclosed assembly tool (item 19) as far as this will go.

- Alternately tighten the mounting screws supplied to fix the chuck to the spindle nose.
- Check radial and axial run-out at the checking edge.
- Ensure that the actuating force is functioning.
- Insert and fasten the center sleeve (item 4) in the chuck body (item 1) with the screws (item 24).
- Move the cylinder to the front position. Unlock the wedge bars with the jaw change key supplied and insert or offset the base jaws into the chuck's jaw guidance as shown on markings 1, 2 or 3.
- Check that the base jaw and the jaw stroke can easily move.

The parts are disassembled in the same way but in the reverse order.

Lubricating before commissioning the lathe chuck
Before commissioning, move the chuck into the open position. Using a high-pressure grease press, press SCHUNK special grease LINOMAX plus into the lubricating nipple every 3 strokes. For optimum grease distribution and to achieve the maximum clamping force, close and open the chuck several times over the entire clamping stroke. Check the clamping force and if necessary repeat the lubrication procedure.

At regular intervals, check that the retainer ring (item 10) is seated firmly.

6 Function and handling

The item numbers specified for the corresponding individual components relate to chapter drawings.(☞ 9, Page 42)

6.1 Function of the chuck

The quick-change power chuck is actuated using rotating solid or open-center hydraulic cylinders. The axial tensile or pressure forces are converted to the radial jaw clamping force via wedge bars positioned tangentially to the chuck body.

Due to the internal mechanics, the chuck has a backlash when the stroke is reversed, i.e. the jaws stop briefly when the stroke is reversed. Due to the tolerances of the components and the different friction ratios between them, the movement of the jaws may not be exactly simultaneous, especially after a jaw change.

6.2 Handling the chuck and the base jaws

The clamping and opening path of the chuck jaws is determined by the clamping cylinder. The base jaws with screwed-on top jaws are moved or changed in the open clamping position. For safety reasons, the serration for the base jaws is still half engaged in this chuck piston position. The base jaws are unlocked manually.

⚠ CAUTION

There is a risk of crushing during manual loading due to the large jaw stroke.
We recommend automatic loading.
If manual loading is used, set up the jaw position so that there is no risk of injury when inserting the parts. The maximum opening gap must be less than 4 mm when the workpiece is in contact with one of the jaws.

For each jaw guidance, a jaw-change bolt (item 6) with hexagon socket (which can be turned using the jaw change key (item 90) is arranged on the chuck perimeter. Turning the jaw-change bolt (item 6) moves the serration for the wedge bar (item 5) out of the serration for the base jaw (item 2). In this position, the base jaws can be moved or changed radially inwards or outwards. It is not possible to pull out the jaw change key in this position.

The jaw change key is locked so long as the chuck jaws have not been moved into the functional area! The functional area means that the base jaw is engaged by the serration of the wedge bar.

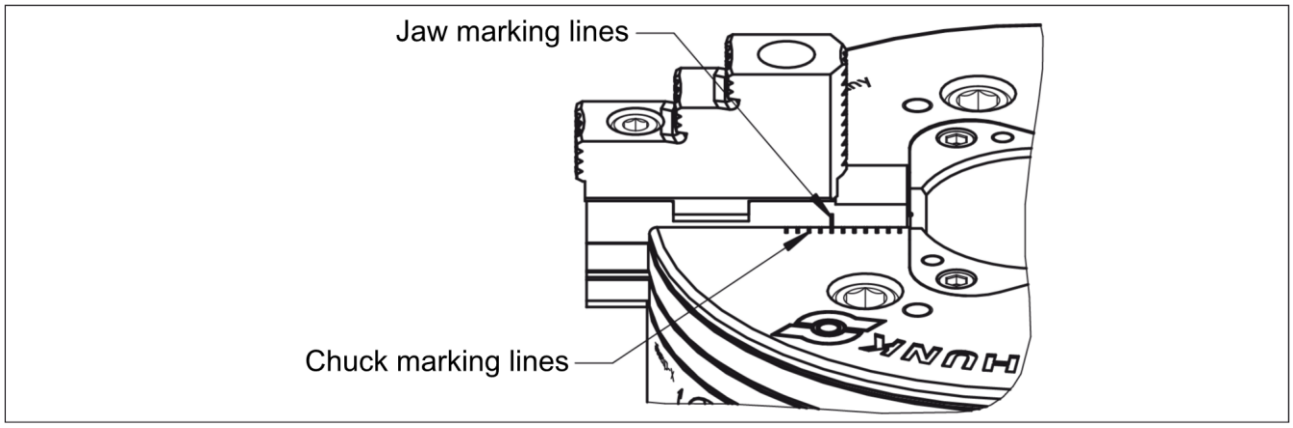
	CAUTION
	The jaw-change bolt (item 6) may only be turned when the chuck is in open position. **Risk of damage to the chuck.**

	CAUTION
	The chuck piston (item 3) must not be moved as long as the jaw change key (item 90) is located in one of the jaw-change bolts (item 8) for the chuck. **Risk of damage to the chuck.**

6.3 Base jaw position

Marking lines for jaw positioning are milled into the face side of the chuck. A single marking line is milled into the jaws. This line must be exactly above a marking line on the face side of the chuck when the jaws are changed or shifted.

It is vital that this jaw position is adhered to so that all teeth are engaged for the force transmission from the wedge bars to the base jaws or top jaws.



6.4 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 (☞ 4, Page 28).

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

6.5 Functional testing

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.

DANGER

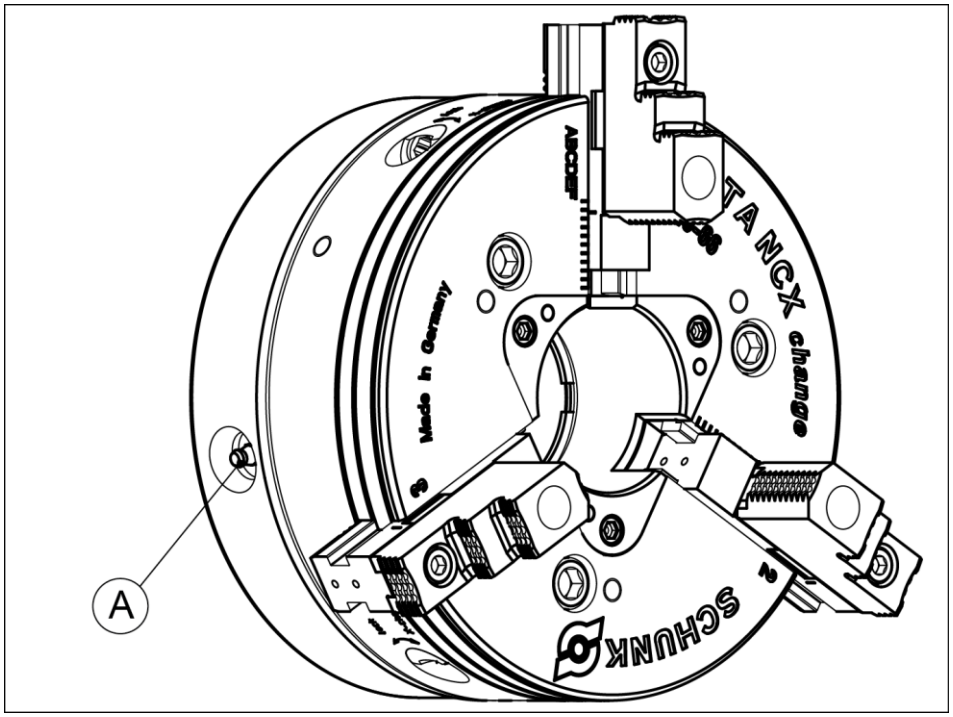
Risk of fatal injury to operating personnel if the top speed is exceeded, resulting in workpiece loss and parts flying off!

- A reliable speed limiter must be installed in the machine tool or technical equipment and proof must be provided that the speed limiter is effective!

7 Maintenance

7.1 Lubrication

To maintain the safe function and high quality of the chuck, it has to be regularly lubricated.



Lubrication

A	Three lubrication nipples on the chuck perimeter (3 x 120°)

Move the chuck into the closed position. Lubricate the chuck at the three lubrication nipples (**A** - see Fig. "Lubrication") using a high-pressure grease gun with two to six strokes (depending on the chuck side) of SCHUNK LINO MAX special grease at each nipple.

For optimum grease distribution, the clamping piston must travel the entire clamping stroke several times after lubrication. Check clamping force, repeat procedure, if necessary.

Chuck Size	165	210	260	315
Number of strokes	2	4	4	6

Lubricate all three segments evenly in order to avoid imbalances.

(For product information about LINO MAX, see the "Accessories" chapter of the SCHUNK lathe chuck catalog or contact SCHUNK.)

	**⚠ CAUTION** **Allergic reactions due to grease in contact with skin!** Wear gloves.

7.2 Maintenance intervals

Lubrication of the grease areas:

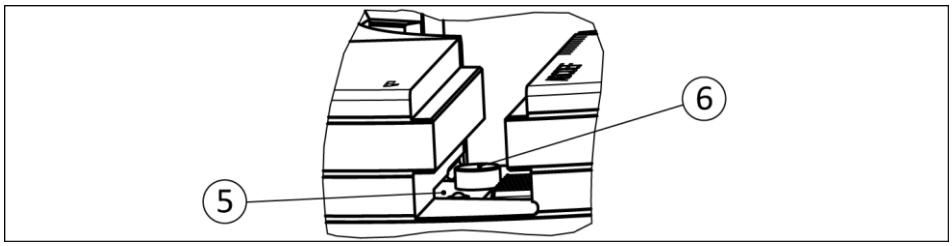
Lubrication interval	Strain
every 8 hours	normal / coolant utilization
after 1200 hours or as needed	Total cleaning with disassembly of the chuck, depending on type and degree of contamination

7.3 Technical condition

With the smallest possible actuating pressure (clamping cylinder), the base jaws should move evenly. This method only provides a limited indication and does not replace the measurement of the clamping force.

If the clamping force has dropped too far or if the base jaws and clamping piston no longer move properly, the chuck has to be disassembled, cleaned, and relubricated.

Functional test when changing jaws
If a jaw is removed from the jaw guidance, turn the release key counterclockwise.The monitoring pin (item 6) must exit from the wedge bar (item 5). If this is not the case, the chuck must be disassembled and cleaned.



Only original SCHUNK spare parts may be used.

7.4 Disassembling and assembling the chuck

The lathe chuck may only be disassembled once it has been uninstalled (see chapter "Mounting the lathe chuck" (☞ 5, Page 29))**.**

- Move the jaws to the outermost position permissible and leave them in the chuck, move the piston to the front end position (chuck open).
- Remove the screws (item 24) and use the threaded extraction hole to push off the center sleeve (item 4) away from the chuck body (item 1), and then pull it out completely.
- Turn the chuck to the chuck face (front side).
- Remove the screws (item 25) and remove the mount (item 7) from the chuck body (item 1).
- Use a sliding hammer to remove the cylindrical pins (item 20) and pull off the jaw-change bolts (item 6) with the ball (item 23).
- Lift the piston (item 3) from the chuck body (item 1) using the wedge bars (item 5), paying attention to the balls (item 22) in the wedge bars (item 5).
- Remove the bolt (item 9) from the wedge bar (item 4) and use a punch to drive out the cylindrical pin (item 21) toward the center of the chuck. Remove the spring (item 28) and the monitoring pin (item 8) from the wedge bar (item 5).
- Unscrew the ring (item 10) from the piston (item 3) and remove the center sleeve (item 11).

Clean all individual components and check them for damage and wear.

In the wedge bars (pos. 5) there is also a spring-loaded pressure piece (pos. 33) for pre-positioning the jaws. This can be damaged by fine chips. To replace the spring-loaded pressure pieces (pos. 33) in case of damage, it is sufficient to disassemble the mount (pos. 7).

The spring-loaded pressure pieces (pos. 33) are disassembled by being unscrewed towards the toothing side with a hexagon socket wrench. If disassembly is carried out with the wedge bar installed (pos. 5), this must be moved to the release position.

Assembly is performed in the reverse order:

Insert the hexagon socket wrench from the underside of the wedge bar (item 5) through the hole, place the spring-loaded pressure piece (item 33) on the wrench and screw it in backwards. Determine the depth of engagement together with chuck body (pos. 1) and base jaws (pos. 2).

Only original SCHUNK spare parts may be used.

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

Before installation, lubricate parts well with LINO MAX plus special grease paste.

⚠ CAUTION

Allergic reactions due to grease in contact with skin!
Wear gloves.

8 Chuck mounts and Spare parts

8.1 Chuck mounts

SCHUNK type	Chuck mount	ID No.
ROTA NCX 165-53	DIN ISO 702-4-No. 5 (Z140) DIN ISO 702-1-A5	0800800 0800801
ROTA NCX 210-66	DIN ISO 702-4-No. 6 (Z170) DIN ISO 702-1-A6	0800810 0800811
ROTA NCX 260-81	DIN ISO 702-4-No. 8 (Z220) DIN ISO 702-1-A6 DIN ISO 702-1-A8	0800820 0800821 0800822
ROTA NCX 315-106	DIN ISO 702-4-No. 11 (Z300) DIN ISO 702-1-A6 DIN ISO 702-1-A8 DIN ISO 702-1-A11	0800830 0800831 0800832 0800833

8.2 Spare parts

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

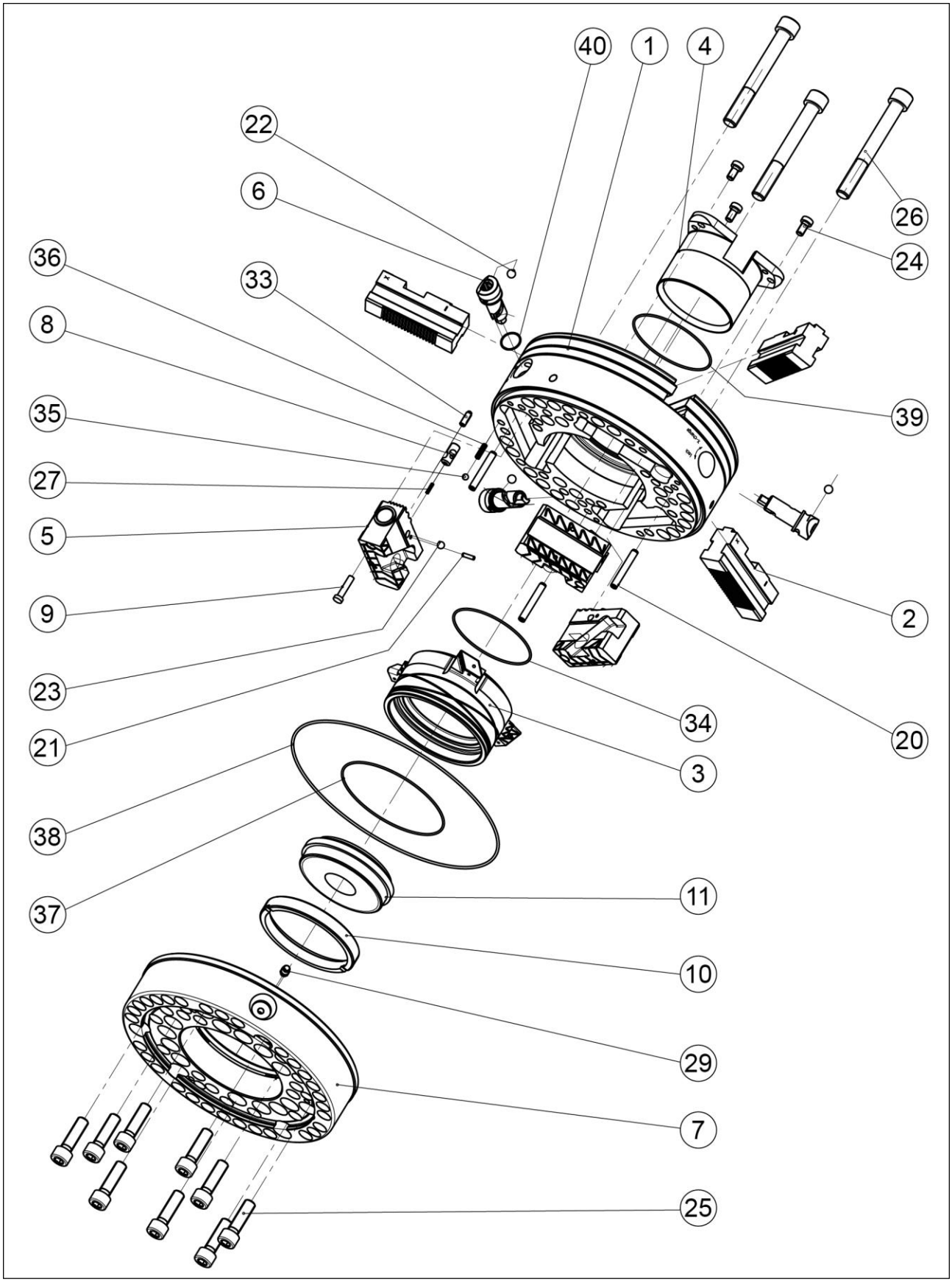
Seals, sealing elements, screw connections, springs, bearings, screws and wiper bars plus parts coming into contact with the workpiece are not covered by the warranty.

Item	Designation	Quantity
1	Chuck body	1
2	Base jaws	3
3	Piston	1
4	Center sleeve	1
5	Wedge bar	3
6	Jaw-change bolt	3
7	Mount	1
8	Monitoring pin	3
9	Bolt	3
10	Ring	1
11	Center sleeve	1
20	Cylindrical pin	3
21	Cylindrical pin	3

Item	Designation	Quantity
22	Steel ball for jaw-change bolt	3
23	Steel ball for wedge bar	3
24	Screw	3
25	Screw	9
26	Screw	3
27	Spring	3
29	Lubrication nipple	3
33	Spring-loaded pressure pieces	3 (size 315: 6)
34	O-ring	1
35	Steel ball	3 (size 315: 0)
36	Spring	3 (size 315: 0)
37	O-ring	3 (size 315: 0)
38	O-ring	1
39	O-ring	1
40	O-ring	3

Item	Designation	Quantity
49	Jaw change key	1
50	Assembly tool for center sleeve	1
51	Locking bolt for assembly tool	1
52	Eye bolt (starting from size 210)	1 (size 165: 0)

9 Drawing



10 Translation of the original declaration of incorporation

in terms of the Directive 2006/42/EG, Annex II, Part 1.B of the European Parliament and of the Council on machinery.

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 partly completed 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 Lathe Chuck with Quick Jaw Change System ROTA-NCX in sizes: 165-53; 210-66; 255-81; 315-106
ID number	0800800; 0800801; 0800810; 0800811; 0800820; 0800821; 0800822; 0800830; 0800831; 0800832; 0800833

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

Applied harmonized standards, especially:

EN ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN 1550:1997+A1:2008	Machine-tools safety - Safety requirements for the design and construction of work holding chucks

Other related technical standards and specifications:

DIN ISO 702-1:2010-04	Machine tools - Connecting dimensions of spindle noses and work holding chucks - Part 1: Conical connection
DIN ISO 702-4:2010-04	Machine tools - Connecting dimensions of spindle noses and work holding chucks - Part 4: cylindrical assembly
VDI 3106:2004-04	Determination of permissible speed (rpm) of lathe chucks (jaw chucks)

The manufacturer agrees to forward on demand the relevant technical documentation for the partly completed machinery in electronic form to national authorities.

The relevant technical documentation according to Annex VII, Part B, belonging to the partly completed machinery, has been created.

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

Signature: see original declaration

Mengen, January 2016 p.p. Philipp Schräder; Head of Engineering Design

11 Appendix on Declaration of Incorporation, as per 2006/42/EC, annex II, No. 1 B

1. Description of the basic safety and health protection requirements, as per 2006/42/EC, annex I, that apply to and are fulfilled for the scope of the partly completed machine:

Product designation	Power Lathe Chuck with Quick Jaw Change System
Type designation	ROTA-NCX in sizes: 165-53; 210-66; 255-81; 315-106
ID number	0800800; 0800801; 0800810; 0800811; 0800820; 0800821; 0800822; 0800830; 0800831; 0800832; 0800833

		To be provided by the System Integrator for the overall machine	Fulfilled for the scope of the partly completed machine	Not relevant
1.1	**Essential Requirements**			
1.1.1	Definitions		X	
1.1.2	Principles of safety integration		X	
1.1.3	Materials and products		X	
1.1.4	Lighting			X
1.1.5	Design of machinery to facilitate its handling		X	
1.1.6	Ergonomics			X
1.1.7	Operating positions			X
1.1.8	Seating			X
1.2	**Control Systems**			
1.2.1	Safety and reliability of control systems			X
1.2.2	Control devices			X
1.2.3	Starting			X
1.2.4	Stopping			X
1.2.4.1	Normal stop			X
1.2.4.2	Operational stop			X
1.2.4.3	Emergency stop			X
1.2.4.4	Assembly of machinery			X
1.2.5	Selection of control or operating modes			X
1.2.6	Failure of the power supply			X
1.3	**Protection against mechanical hazards**			
1.3.1	Risk of loss of stability		X	
1.3.2	Risk of break-up during operation		X	
1.3.3	Risks due to falling or ejected objects			X
1.3.4	Risks due to surfaces, edges or angles		X	
1.3.5	Risks related to combined machinery			X
1.3.6	Risks related to variations in operating conditions		X	
1.3.7	Risks related to moving parts		X	
1.3.8	Choice of protection against risks arising from moving parts			X
1.3.8.1	Moving transmission parts			X
1.3.8.2	Moving parts involved in the process			X
1.3.9	Risks of uncontrolled movements			X
1.4	**Required characteristics of guards and protective devices**			
1.4.1	General requirements			X
1.4.2	Special requirements for guards			X
1.4.2.1	Fixed guards			X
1.4.2.2	Interlocking movable guards			X
1.4.2.3	Adjustable guards restricting access			X
1.4.3	Special requirements for protective devices			X

1.5	**Risks due to other hazards**			
1.5.1	Electricity supply			X
1.5.2	Static electricity			X
1.5.3	Energy supply other than electricity			X
1.5.4	Errors of fitting		X	
1.5.5	Extreme temperatures		X	
1.45.6	Fire			X
1.5.7	Explosion			X
1.5.8	Noise		X	
1.5.9	Vibrations		X	
1.5.10	Radiation	X		
1.5.11	External radiation	X		
1.5.12	Laser radiation	X		
1.5.13	Emissions of hazardous materials and substances			X
1.5.14	Risk of being trapped in a machine			X
1.5.15	Risk of slipping, tripping or falling			X
1.5.16	Lightning			X
1.6	**Maintenance**			
1.6.1	Machinery maintenance		X	
1.6.2	Access to operating positions and servicing points		X	
1.6.3	Isolation of energy sources			X
1.6.4	Operator intervention			X
1.6.5	Cleaning of internal parts			X
1.7	**Information**			
1.7.1	Information and warnings on the machinery		X	
1.7.1.1	Information and information devices		X	
1.7.1.2	Warning devices			X
1.7.2	Warning of residual risks		X	
1.7.3	Marking of machinery	X		
1.7.4	Instructions	X		
1.7.4.1	General principles for the drafting of instructions		X	
1.7.4.2	Contents of the instructions	X		
1.7.4.3	Sales literature		X	
	The classification from Annex 1 is to be supplemented from here forward.			
2	Supplementary essential health and safety requirements for certain categories of machinery			X
2.1	Foodstuffs machinery and machinery for cosmetics or pharmaceutical products			X
2.2	Portable hand-held and/or guided machinery			X
2.2.1	Portable fixing and other impact machinery			X
2.3	Machinery for working wood and material with similar physical characteristics			X
3	Supplementary essential health and safety requirements to offset hazards due to the mobility of machinery			X
4	Supplementary essential health and safety requirements to offset hazards due to lifting operations			X
5	Supplementary essential health and safety requirements for machinery intended for underground work			X
6	Supplementary essential health and safety requirements for machinery presenting particular hazards due to the lifting of persons			X