OPTIMUM
MASCHINEN - GERMANY

Operating manual

Version 1.0.3

Lathe

OPTI turn®
TU 1503V

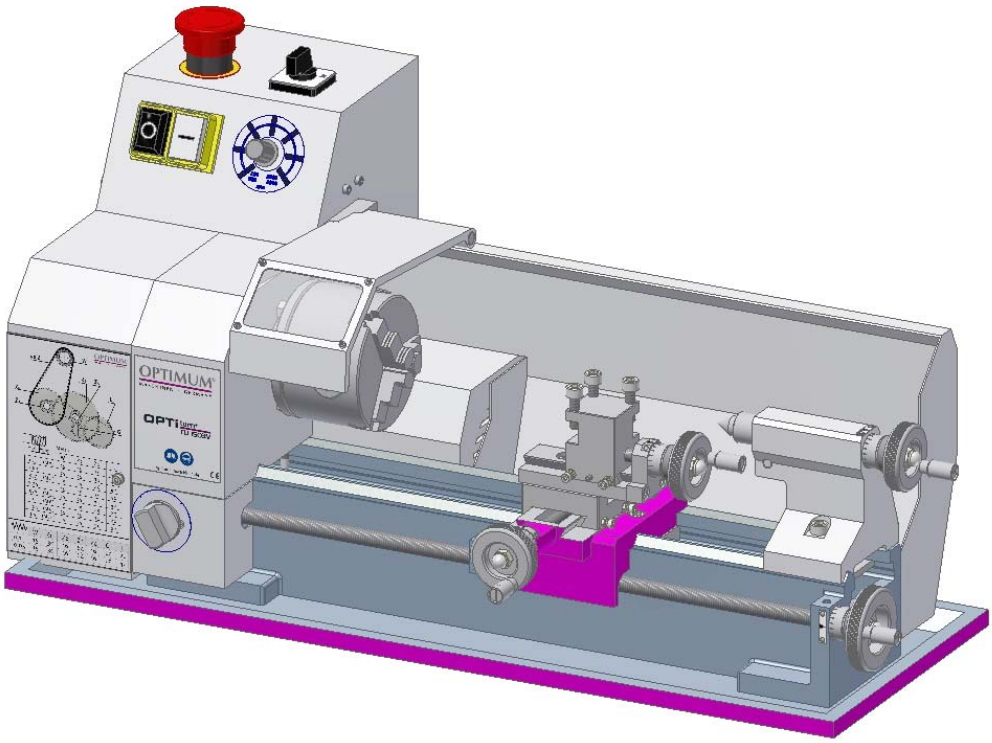

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Table of contents

Preface

Dear customer,

Thank you very much for purchasing a product made by OPTIMUM.

OPTIMUM metal working machines offer a maximum of quality, technically optimum solutions and convince by an outstanding price performance ratio. Continuous enhancements and product innovations guarantee state-of-the-art products and safety at any time.

Before commissioning the machine please thoroughly read these operating instructions and get familiar with the machine. Please also make sure that all persons operating the machine have read and understood the operating instructions beforehand.
Keep these operating instructions in a safe place nearby the machine.

Information

The operating instructions include indications for safety-relevant and proper installation, operation and maintenance of the machine. The continuous observance of all notes included in this manual guarantee the safety of persons and of the machine.

The manual determines the intended use of the machine and includes all necessary information for its economic operation as well as its long service life.

In the paragraph "Maintenance" all maintenance works and functional tests are described which the operator must perform in regular intervals.

The illustration and information included in the present manual can possibly deviate from the current state of construction of your machine. Being the manufacturer we are continuously seeking for improvements and renewal of the products. Therefore, changes might be performed without prior notice. The illustrations of the machine may be different from the illustrations in these instructions with regard to a few details. However, this does not have any influence on the operability of the machine.
Therefore, no claims may be derived from the indications and descriptions. Changes and errors are reserved!

Your suggestion with regard to these operating instructions are an important contribution to optimising our work which we offer to our customers. For any questions or suggestions for improvement, please do not hesitate to contact our service department.

If you have any further questions after reading these operating instructions and you are not able to solve your problem with a help of these operating instructions, please contact your specialised dealer or directly the company OPTIMUM.

Optimum Maschinen Germany GmbH

Dr.- Robert - Pfleger - Str. 26

D-96103 Hallstadt

Mail: info@optimum-maschinen.de

Internet: www.optimum-maschinen.com

1 Safety

Glossary of symbols

☞	gives further advice
➜	calls on you to act
❍	enumerations

This part of the operating instructions

- ❍ explains the meaning and use of the warning notices included in these operating instructions,
- ❍ defines the intended use of the lathe,
- ❍ points out the dangers that might arise for you or others if these instructions are not observed,
- ❍ informs you about how to avoid dangers.

In addition to these operation instructions, please observe

- ❍ the applicable laws and regulations,
- ❍ the legal regulations for accident prevention,
- ❍ the prohibition, warning and mandatory signs as well as the warning notes on the lathe .

European standards must be kept during installation, operation, maintenance and repair of the lathe.

If European standards are not applied at the national legislation of the country of destination, the specific applicable regulations of each country are to be observed.

If necessary, the required measures must be taken to comply with the specific regulations of each country before the lathe is used for the first time.

Always keep this documentation close to the lathe.

INFORMATION

If you are unable to solve a problem using these operating instructions, please contact us for advice:

Optimum Maschinen Germany GmbH
Dr. Robert-Pfleger-Str. 26

D- 96103 Hallstadt

Email: info@optimum-maschinen.de

1.1 Safety instructions (warning notes)

1.1.1 Classification of hazards

We classify the safety warnings into various levels. The table below gives an overview of the classification of symbols (ideogram) and the warning signs for each specific danger and its (possible) consequences.

Ideogram	Warning alert	Definition / consequence
	**DANGER!**	Threatening danger that will cause serious injury or death to people.
	WARNING!	A danger that might cause severe injury to the personnel or can lead to death.
	CAUTION!	Danger or unsafe procedure that might cause injury to people or damage to property.
	**ATTENTION!**	Situation that could cause damage to the machine and product and other types of damage. No risk of injury to people.
	**INFORMATION**	Application tips and other important or useful information and notes. No dangerous or harmful consequences for people or objects.

In case of specific dangers, we replace the pictogram by


general danger


by a warning of


injury of hands,


hazardous electrical voltage,

or


rotating parts.

1.1.2 Other pictograms

Warning danger of slipping!

Caution, danger of explosive substances!

Warning of automatic start-up!

Warning hot surface!

Warning biological hazard!

Switching on forbidden!

Pull the main plug!

Use safety glasses! protection

Use ear protection!

Use protective gloves!

Use protective boots!

Use protective suit!

Protect the environment!

Contact address

1.2 Intended use

WARNING!

In the event of improper use, the lathe

- **will endanger personnel,**
- **the machine and other material property of the operating company will be endangered,**
- **the correct function of the machine may be affected.**

The machine is designed and manufactured to be used in environments where there is no potential danger of explosion.

The lathe is designed and manufactured for straight turning and facing round and regular formed three-, six- or twelve-square workpieces in cold metal, castings and plastics or similar materials that do not constitute a health hazard or do not create dust, such as wood, Teflon®.
The lathe must only be installed and operated in a dry and ventilated place. The clamping workpieces in the feed may only be effected with the supplied the special key for chucks.

If the lathe is used in any way other than described above, modified without authorization of Optimum Maschinen Germany GmbH, then the lathe is being used improperly.

We will not be held liable for any damages resulting from any operation which is not in accordance with the intended use.

We expressly point out that the guarantee or CE conformity will expire due to any constructive technical or procedural changes which had not been performed by the company Optimum Maschinen Germany GmbH.

It is also part of intended use that you

- the operating manual is constantly observed,
- the inspection and maintenance instructions are observed.
- observe the limits of the lathe.

☞ "Technical data“ on page 16

In order to achieve optimum cutting performance, it is essential to choose the right turning tool, feed, tool pressure, cutting speed and coolant.

☞ "Appendix turning“ on page 33

WARNING!

Heaviest injuries through improper use.

It is forbidden to make any modifications or alternations to the operation values of the lathe. They could endanger the staff and cause damage to the lathe.

INFORMATION

The lathe TU1503V is built according to the standard DIN EN 55011 class B.

WARNING!

The class B (machine tools) is intended to be used in residential facilities, where the power is supplied via a public low voltage supply system.

ATTENTION!

If the lathe is not used as intended or if the safety directives or the operating instructions are ignored the liability of the manufacturer for any damages to persons or objects resulting hereof is excluded and the claim under guarantee is becoming null and void!

1.3 Reasonably foreseeable misuses

Any other use as the one determined under the "Intended use" or any use beyond the described use shall be deemed as not in conformity and is forbidden.

Any other use has to be discussed with the manufacturer.

It is only allowed to process metal, cold and non-inflammable materials with the lathe.

In order to avoid misuse, it is necessary to read and understand the operating instructions before the first commissioning.

The operators must be qualified.

1.3.1 Avoiding misuses

➜ Use of suitable cutting tools.

➜ Adapting the speed adjustment and feed to the material and workpiece.

➜ Clamp workpieces firmly and vibration-free.

1.4 Possible dangers caused by the machine

The lathe has undergone a safety inspection (analysis of danger with assessment of risks). It has been designed and built on the basis of this analysis using the latest technological advances.

Nonetheless, there remains a residual risk, since the machine operates with

- ❍ high revolutions,
- ❍ rotating parts,
- ❍ with electrical voltages and currents.

We have used construction resources and safety techniques to minimize the health risk to personnel resulting from these hazards.

If the lathe is used and maintained by the staff who are not duly qualified, there may be a risk resulting from incorrect or unsuitable maintenance of the lathe.

INFORMATION

Everyone involved in the assembly, commissioning, operation and maintenance must

- be duly qualified,
- strictly follow these operating instructions.

In the event of improper use

- there may be a risk to the personnel,
- there may be a risk to the machine and other material values,
- the correct function of the lathe may be affected.

Always disconnect the lathe if cleaning or maintenance work is being carried out, or is no longer in use.

WARNING!

The lathe may only be used with the safety devices activated.

Disconnect the lathe immediately whenever you detect a failure in the safety devices or when they are not mounted!

All additional installations carried out by the operator must incorporate the prescribed safety devices.

This is your responsibility being the operating company!

☞ **"Safety measures during operation“ on page 12**

1.5 Qualification of personnel

1.5.1 Target group

This manual is addressed to

- the operating companies,
- the operators,
- the personnel for maintenance works.

Therefore, the warning notes refer to both operation and maintenance of the machine.

Always disconnect the machine plug from the mains. This will prevent it from being used by unauthorized persons.

The qualifications of the personnel for the different tasks are mentioned below:

Operator

The operator is instructed by the operating company about the assigned tasks and possible risks in case of improper behaviour. Any tasks which need to be performed beyond the operation in the standard mode must only be performed by the operator if it is indicated in these instructions and if the operating company expressively commissioned the operator.

Electrical specialist

Due to his professional training, knowledge and experience as well as his knowledge of respective standards and regulations the electrical specialist is able to perform works on the electrical system and to recognise and avoid any possible dangers himself.

The electrical specialist is specially trained for the working environment in which he is working and knows the relevant standards and regulations.

Qualified personnel

Due to their professional training, knowledge and experience as well as their knowledge of relevant regulations the qualified personnel is able to perform the assigned tasks and to recognise and avoid any possible dangers themselves.

Instructed person

Instructed personnel were instructed by the operating company about the assigned tasks and any possible risks in case of improper behaviour.

INFORMATION

Everyone involved in the assembly, commissioning, operation and maintenance must

- be duly qualified,
- strictly follow these operating instructions.

In the event of improper use

- there may be a risk to the personnel,
- there may be a risk to the machine and other material values,
- the correct function of the lathe may be affected.

1.5.2 Authorized personnel

WARNING!

Inappropriate operation and maintenance of the machine constitutes a danger for the staff, objects and the environment.

Only authorized personnel may operate the machine!

Persons authorized to operate and maintain should be trained technical personnel and instructed by the ones who are working for the operating company and for the manufacturer.

1.5.3 Obligations of the operating company

The operator must instruct the staff at least once per year regarding

- all safety standards that apply to the machine.
- the operation,
- accredited technical guidelines.

The operator must also

- check personnel‘s state of knowledge,
- document the trainings/instructions,
- require personnel to confirm participation in training/instructions by means of a signature,
- check whether the personnel is working safety- and risk-conscious and observe the operating instructions.

1.5.4 Obligations of the operator

The operator must

- have read and understood the operating manual,
- be familiar with all safety devices and regulations,
- be able to operate the machine.

1.5.5 Additional requirements regarding the qualification

For work on electrical components or equipment, there are additional requirements:

- Must only be performed by a qualified electrician or person working under the instructions and supervision of a qualifiedelectrician.
- Before carrying out work on electrical components or operating units, the following measures must be taken, in the order given.

➜ disconnect all poles.

➜ Secure against switching on.

➜ Check if the machine is zero potential.

1.6 Operators positions

The operator's position is in front of the machine.

1.7 Safety measures during operation

CAUTION!

Risk due to inhaling of health hazardous dusts and mist.

Dependent on the material which need to be processed and the used auxiliaries dusts and mist may be caused which might impair you health.

Make sure that the generated health hazardous dusts and mist are safely sucked off at the point of origin and is dissipated or filtered from the working area. To do so, use a suitable extraction unit.

CAUTION!

Risk of fire and explosion by using flammable materials or cooling lubricants.

Before processing inflammable materials (e.g. aluminium, magnesium) or using inflammable auxiliary materials (e.g. spirit) it is necessary to take additional preventive measures in order to safely avoid health risks.

CAUTION!

Risk of winding-up or cutting damages when using hand tools.

The machine is not designed for the use of hand tools (e.g. emery cloth or files). It is forbidden to use any hand tools on this machine.

1.8 Safety devices

Use the lathe only with properly functioning safety devices.

Stop the lathe immediately if there is a failure on the safety device or if it is not functioning for any reason.

It is your responsibility!

If a safety device has been activated or has failed, the lathe must only be used if you

- the cause of the failure has been removed,
- you have made sure that there is no existing danger for personnel or objects.

WARNING!

If you bypass, remove or override a safety device in any other way, you are endangering yourself and other persons working on the machine. The possible consequences are

- **injuries may occur due to workpiece or parts of workpieces flying off,**
- **contact with rotating parts,**
- **fatal electrocution.**

WARNING!

The separating protective equipment which is made available and delivered together with the machine is designed to reduce the risk of workpieces or fractions of them which being expelled, but not to remove them completely. Always work carefully and observe the limits of their machining process.

The lathe includes the following safety devices:

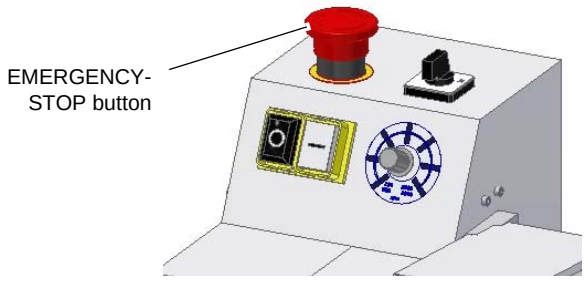
- a EMERGENCY STOP button
- a protective cover on the headstock,
- a special key for the lathe chuck,
- a lathe chuck protection with position switch.

1.9 EMERGENCY-STOP button

The EMERGENCY-STOP button switches the lathe off.

Knocking on the emergency stop device triggers an emergency stop.

After actuating the switch, turn it to the right, in order to restart the lathe.



Img.1-1: EMERGENCY-STOP button

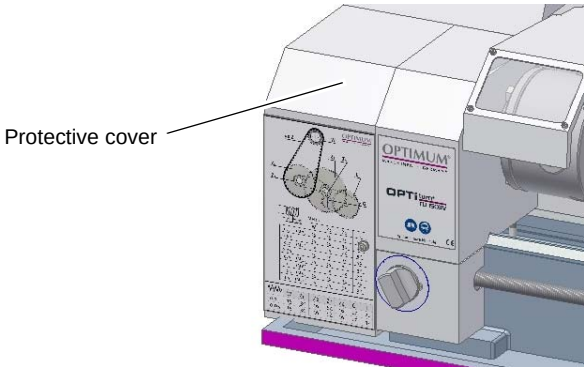
1.9.1 Protective cover with safety switch

The spindle head of the lathe is equipped with a fixed, separating protective cover.

The locked position is monitored by means of an electrical limit switch.

INFORMATION

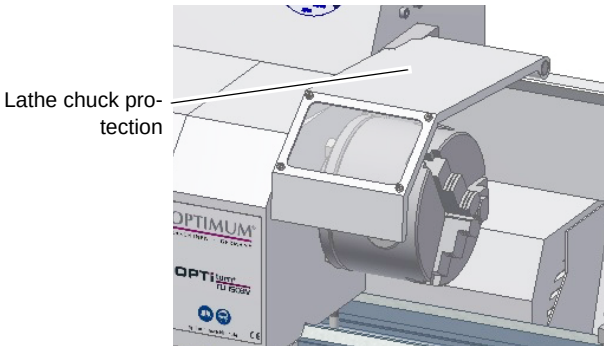
It is not possible to start the machine until the protective cover is closed.



Img.1-2: for the protective cover of the headstock

1.9.2 Lathe chuck protection with position switch

The lathe is provided with a lathe chuck protection. The lathe can only be switched on if the lathe chuck protection is closed.



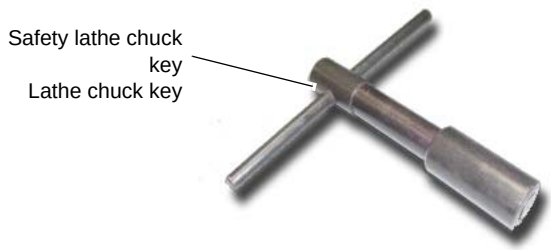
Img.1-3: lathe chuck protection

1.9.3 Lathe chuck key

The lathe is equipped with a special key for chucks. Once the lathe chuck key has been released, it is pushed out of the lathe chuck by a spring.

CAUTION!

Only operate the lathe using this key.



Img.1-4: Lathe chuck key

1.10 Safety check

Check the lathe regularly.

Check all safety devices

- before starting work,
- once a week,
- after every maintenance and repair work.

General check		
Equipment	**Check**	**OK**
Protective covers, lathe chuck protection	Mounted, firmly bolted and not damaged	
Signs, Markings	Installed and legible	

Functional check		
Equipment	**Check**	**OK**
EMERGENCY-STOP button	When the EMERGENCY STOP push button is activated, the lathe must switch off.	
Lathe chuck key	Once the chuck key has been released, it should be automatically pressed out of the lathe chuck.	
Lathe chuck protection / protective cover headstock	The lathe shall only run with the lathe chuck protection / protective cover headstock closed.	

1.11 Personnel protective equipment

For certain work personal protective equipment is required.

Protect your face and your eyes: Wear a safety helmet with facial protection when performing works where your face and eyes are exposed to hazards.

Use protective gloves when handling pieces with sharp edges.

During operation of the lathe, the wearing of gloves is prohibited because of the risk of winding up.

Use safety shoes when you assemble, disassemble or transport heavy components.

Use ear protection if the noise level (emission) in the workplace exceeds 80 dB (A).

Before starting work, make sure that the prescribed personal protective equipment is available at the workplace.

CAUTION!

Dirty or contaminated personnel protective equipment can cause diseases. Clean it each time after use and at least once a week.

1.12 For your own safety during operation

We specially point out the specific dangers when working with and on the lathe.

WARNING!

Before switching on the lathe make sure that there are no

- **no dangers generated for persons,**
- **not cause damage to equipment.**

Avoid any risky working practices:

- Make sure that nobody is endangered by your work.
- Clamp the workpiece tightly before activating the lathe.
- For clamping workpieces, only use the special chuck key supplied.
- Mind the maximum chuck opening.
- Wear safety goggles.
- Do not remove the turning chips by hand. Use a chip hook and / or a hand brush to remove turning chips.
- Clamp the turning tool at the correct height and with the least possible overhang.
- Turn off the lathe before measuring the workpiece.
- The instructions mentioned in these operating instructions have to be strictly observed during assembly, operation, maintenance and repair.
- Do not work on the lathe, if your concentration is reduced, for example, because you are taking medication.
- Observe the accident prevention regulations issued by your Employers Liability Insurance Association or other competent supervisory authority, responsible for your company.
- Stay at the lathe until all movements have come to a complete standstill.
- Use the prescribed personnel protective equipment. Make sure to wear a well-fitting work suit and, if necessary, a hairnet.

We specially point out the specific dangers when working with and on the machine.

1.13 Disconnecting and securing the lathe

- Pull the mains plug before beginning any maintenance or repair work or or switch off the supply voltage to the lathe. All machine components and hazardous voltages and movements are disconnected.
- Attach a warning sign on the machine.

1.14 Mechanical maintenance work

Remove or install protection safety devices before starting any maintenance work and re-install them once the work has been completed.This includes:

- Covers,
- Safety indications and warning signs,
- earth (ground) connections.

If you remove protection or safety devices, refit them immediately after completing the work.

Check if they are working properly!

2 Technical data

The following information are the dimensions and indications of weight and the manufacturer‘s approved machine data..

Electrical connection	
Total connection rate	230V ; 450 W ~ 50Hz
Degree of protection	IP 54

Machine data	
Height of centres [mm]	70
Max. swing [mm]	140
Max. swing over Cross slide [mm]	70
Distance between centres [mm]	250
Spindle speeds [min $^{-1}$]	120 - 3000
Spindle taper	MT1
Spindle hole, rod opening [mm]	11
Bed width [mm]	70
Travel of top slide [mm]	40
Travel of cross slide [mm]	55
Tailstock cone	MT1 shortened
Tailstock sleeve travel [mm]	30
Longitudinal feed [mm/revolution]	0.05 - 0.1
Pitch - Metric	0.5 - 1.5
Quadruple tool holder seat height [mm]	12
Level difference between bearing surface quadruple seat and turning centre [mm]	7.85 + 0 / - 0.3

Dimensions	
Height / Length / Width [mm]	290 / 560 / 320
Total weight [kg]	22

Operating material	
Slideways, lubrication nipples	e.g. machines oil (Mobil Oil, Fina, ...) We recommend the use of weapon oil, weapon oil is acid-, stain- and resin-free.

Environmental conditions	
Temperature	5 - 35 °C

Environmental conditions	
Humidity	25 - 80 %

2.1 Emissions

The generation of noise emitted by the lathe is less than 70 dB(A).
If the lathe is installed in an area where various machines are in operation, the noise exposure (immission) on the operator of the at the working place may exceed 80dB(A).

INFORMATION

This numerical value was measured on a new machine under proper operating conditions. Depending on the age respectively on the wear of the machine it is possible that the noise behaviour of the machine changes.

Furthermore, the factor of the noise emission is also depending on manufacturing influencing factors, e.g. speed, material and clamping conditions.

INFORMATION

The mentioned numerical value is the emission level and not necessarily a safe working level.

Though there is a dependency between the degree of the noise emission and the degree of the noise disturbance it is not possible to use it reliably to determine if further precaution measures are required or not.

The following factors influence the actual degree of the noise exposure of the operator:

- Characteristics of the working area, e.g. size or damping behaviour,
- Other noise sources, e.g. the number of machines,
- Other processes taking place in the proximity and the period of time during which the operator is exposed to the noise.

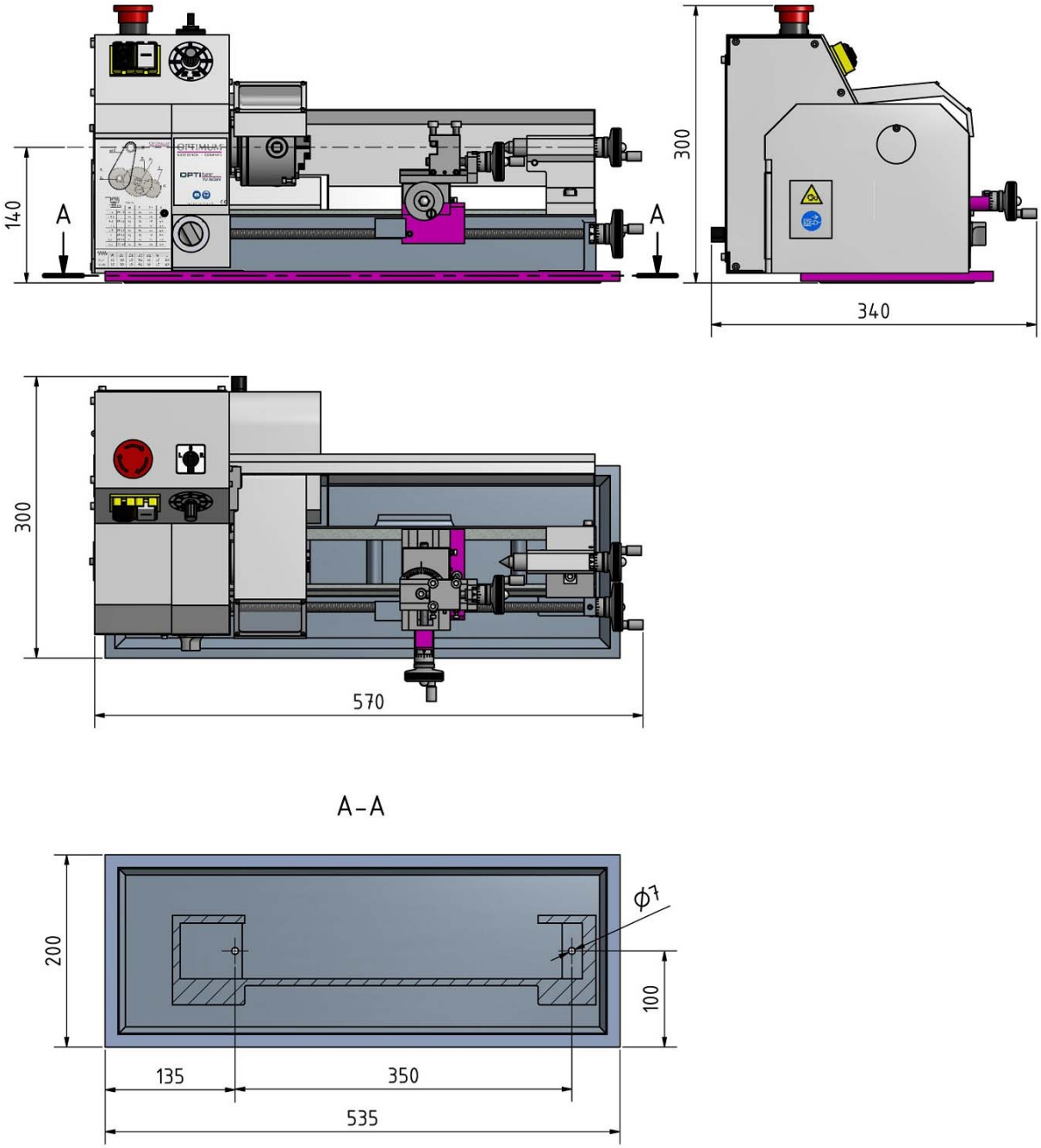
Furthermore, it is possible that the admissible exposure level might be different from country to country due to national regulations.
This information about the noise emission shall allow the operator of the machine to more easily evaluate the endangering and risks.

CAUTION!

Depending on the overall noise exposure and the basic limit values the machine operators must wear an appropriate hearing protection.

We generally recommend to use a noise protection and a hearing protection.

2.2 Dimensions, installation plan



Img. 2-1: Dimensions, installation plan

3 Unpacking and connecting

INFORMATION

The lathe is delivered pre-assembled. When the lathe is delivered, check immediately before and after unpacking hat the lathe has not been damaged during shipping and that all components are included. Also check that no fastening screws have come loose.

3.1 Scope of delivery

Compare the scope of delivery with the packing list.

3.2 Storage

ATTENTION!

In case of wrong and improper storage electrical and mechanical machine components might get damaged and destroyed.

Store packed and unpacked parts only under the intended environmental conditions.

Follow the instructions and information on the transport case.

- Fragile goods
  (Goods require careful handling)

- Protect against moisture and humid environment

☞ "Environmental conditions“ on page 16

- Prescribed position of the packing case
  (Marking of the top surface - arrows pointing to the top)

- Maximum stacking height

  Example:not stackable - do not stack a second packing case
  on top of the first packaging case

Consult Optimum Maschinen Germany GmbH if the machine and accessories are stored for more than three months or are stored under different environmental conditions than those given here . ☞ "Information“ on page 6

3.3 Installation and assembly

3.3.1 Requirements regarding the installation site

INFORMATION

In order to attain good functionality and a high processing accuracy as well as a long durability of the machine the installation site should fulfil certain criteria.

Please observe the following points:

- The device must only be installed and operated in a dry and well-ventilated place.
- Avoid places nearby machines generating chips or dust.
- The installation site must be free from vibrations also at a distance of presses, planing machines, etc.
- The substructure must be suitable for turning. Also make sure that the floor has sufficient load bearing capacity and is level.
- The substructure must be prepared in a way that possibly used coolant cannot penetrate into the floor.
- Any parts sticking out such as stops, handles, etc. have to be secured by measures taken by the customer if necessary in order to avoid endangerment of persons.
- Provide sufficient space for the staff preparing and operating the machine and transporting the material.
- Also consider that the machine is accessible for setting and maintenance works.
- The mains plug and the main switch of the lathe has to be freely accessible.
- Provide for sufficient illumination (Minimum value: 300 lux).
  In case of little intensity of illumination provide for additional illumination i.e. by a separate workplace illumination.

INFORMATION

The mains plug of the lathe must be freely accessible.

3.3.2 Assembling

ATTENTION!

The lathe can slip slowly during operation on the ground. Attach the machine to the ground.

➜ Attach the lathe to the provided through holes (2 pieces) along with the chip pan and the intended base.

☞ "Dimensions, installation plan“ on page 18

ATTENTION!

Tighten the setscrews on the lathe only until it is firmly secured and can neither move during operation nor be turned over. If the fixing screws are too tight in particular in connection with an uneven substructure it may result in a broken stand of the machine bed.

3.4 First commissioning

ATTENTION!

Before commissioning the machine check all screws, fixtures resp. safety devices and tighten up the screws if necessary!

WARNING!

Risk by using improper tool holders or by operating them at inadmissible speeds.

Only use the tool holders (e.g. drill chuck) which were delivered with the machine or which are offered as optional equipment by OPTIMUM.

Only use tool holders in the intended admissible speed range.

Tool holders may only be modified in compliance with the recommendation of OPTIMUM or of the manufacturer of the clamping devices.

WARNING!

When first commissioning the lathe by inexperienced staff you endanger people and the machine.

We do not take any liability for damages caused by incorrectly performed commissioning.

3.4.1 Warming up the machine

ATTENTION!

If the lathe and in particular the lathe spindle is immediately operated at maximum load when it is cold it may result in damages.

If the machine is cold such as e.g. directly after having transportation, the machine should be warmed up for the first 30 minutes at a spindle speed of only 500 1/min.

3.4.2 Cleaning and lubricating

➜ Remove the anti-corrosive agents on the lathe which had been applied for transportation and storage. Therefore, we recommend you to use paraffin.

ATTENTION!

Do not use any solvents, cellulose thinner or any other cleaning agents which might affect the coating of the lathe when cleaning the lathe. Observe the indications and notes of the manufacturer for cleaning agents.

➜ Oil all blank machine parts using an acid-free lubricating oil.

➜ Lubricate the machine. ☞ "Inspection and maintenance“ on page 58

3.4.3 Functional test

➜ Check if all spindles are running smoothly.

➜ Check the state of the lathe chuck and the turning jaws.

3.4.4 Functional check

➜ Clamp a workpiece into the lathe chuck of the machine or close the jaws of the lathe chuck fully before turning on the machine.

WARNING!

- **Mind the maximum chuck opening.**
- **Do not stand in front of the lathe chuck when turning on the machine for the first time.**

4 Assembly and function

The machine is a centre lathe. It has been designed and manufactured for straight turning and facing round or regularly-formed square workpieces in metal, plastics or similar materials for model making.

The hollow work spindle enables you to clamp longer workpieces with a diameter of up to 10 mm.

The speed is changed progressively in the predefined speed range of the corresponding V-belt pulley.

The leadscrew enables longitudinal feed and thread-cutting.

When turning between centres, the tailstock is used to hold the centre and, when drilling, countersinking or reaming, to hold the tool with a drill chuck.

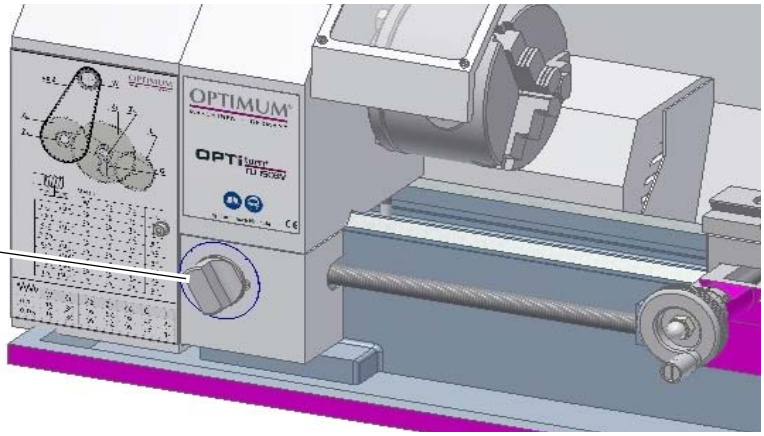
4.1 Construction features

- Electronic continuous speed regulation with dynamically readjusting control,
- Powerful DC motor with high capacity from 120 rpm upwards^{-1},
- Spindle-bearing arrangement with precision ball bearings,
- Prismatic bed made from ground grey cast iron,
- High concentricity precision of the work spindle < 0.015 mm,
- Left- and right-hand motor rotation controlled by a switch,
- Turning graduated collars,
- Leadscrew for thread-cutting or feed for straight turning with change gear set
- Tailstock sleeve and handwheel with adjustable precision scaling.

4.2 Spindle stock with feed gear

The spindle stock houses the feed gear for adjusting the feed speeds and the reducing gear for adjusting the speed range.

The automatic feed is activated by switching the engaging switch on the spindle stock.

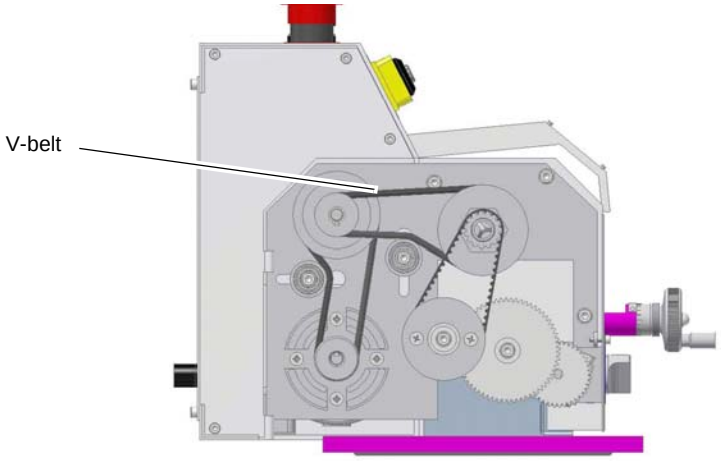


Img. 4-1: Engaging switch

4.2.1 Gear

By changing the position of the V-belt on the pulleys you can select two speed ranges.

The potentiometer is used to change the speed within the corresponding speed range.



Img. 4-2: V-belt

4.2.2 Feed gear

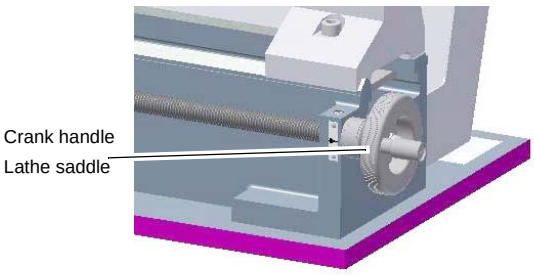
The feed gear is used to obtain the feeds for straight turning and threading by changing the change gears.

The travel of the lathe saddle for each revolution of the spindle, and depending on the change gears installed is shown in the table.

☞ "Feed table / Table for thread cutting“ on page 31

4.3 Lathe saddle

The lathe saddle (saddle slide) glides along the prismatic slideways of the lathe bed. It allows feed movement parallel to the work-piece axis. Feed motion is carried out using the crank or automatically via the feed gear through the leadscrew.



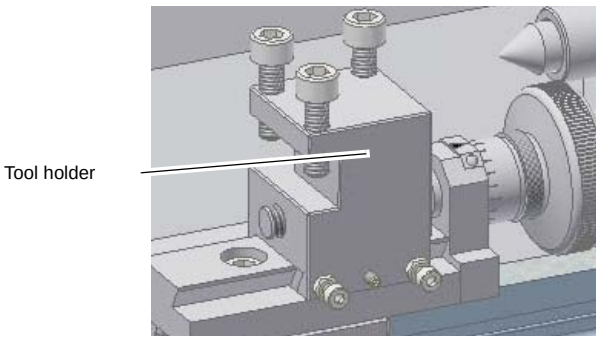
Img. 4-3: Crank of lathe saddle

4.4 Top slide

The tools (cutting tools) are fitted to the toolholder of the top slide.

The top slide glides on a rotating swivel piece which runs on bearings on the top of the cross slide. The swivel piece is clamped with a screw.

☞ "Turning short tapers with the top slide“ on page 29



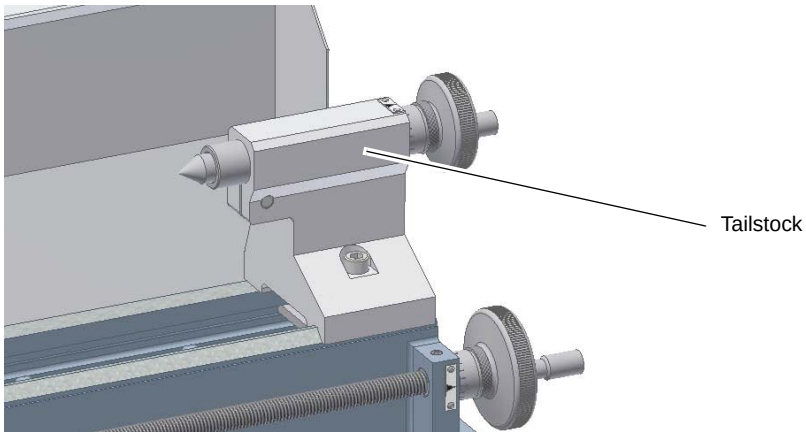
Img. 4-4: Tool holder

4.5 Cross slide

The cross slide is connected to the lathe saddle (saddle slide) with the help of a dovetail slideway. Movement is at right angles to the workpiece axis by means of the cross slide.

4.6 Tailstock

The tailstock consists of a guide plate with gripping yoke and upper part. It is readjusted manually and clamped on the slideways of the lathe bed with the help of the clamping screw and the gripping yoke. The upper part houses the spindle sleeve. It has a small inside cone MT1 in shortened version. The spindle sleeve may be adjusted longitudinally via a threaded spindle. Clamping is by means of a clamping screw.



Img. 4-5: Tailstock

5 Handling

5.1 Safety

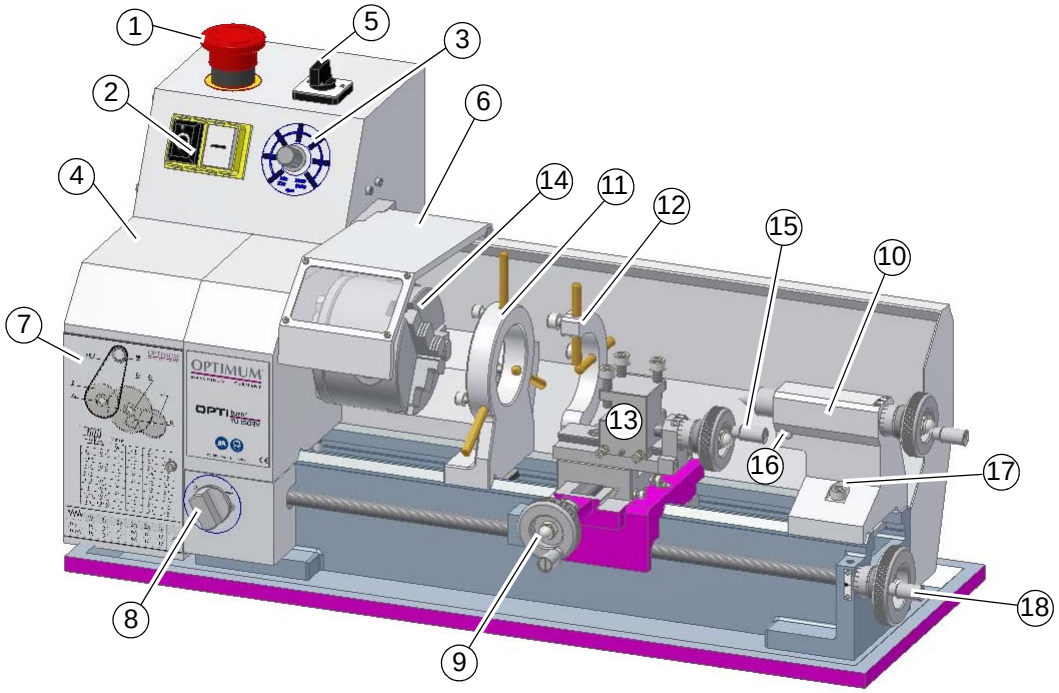
Use the lathe only under the following conditions:

- The lathe is in proper working order.
- The lathe is used as prescribed.
- The operating manual is followed.
- All safety devices are installed and activated.

All failures should be eliminated immediately. Stop the immediately in the event of any abnormality in operation and make sure it cannot be started-up accidentally or without authorisation.

☞ "For your own safety during operation“ on page 14

5.2 Control and indicating elements



Pos.	Designation	Pos.	Designation
1	EMERGENCY-STOP button	2	ON / Off - Switch
3	Speed adjustment	4	for the protective cover of the headstock
5	Rotation direction switch	6	Lathe chuck protection
7	Change wheel and feed table	8	Shift lever automatic feed
9	Handwheel cross slide	10	Tailstock
11	Steady rest (example)	12	Follow rest (example)
13	Tool holder	14	Lathe chuck
15	Handwheel top slide	16	Clamping screw tailstock sleeve
17	Clamping screw tailstock	18	Handwheel lathe saddle

5.2.1 Switching elements

Push button ON

The “hand actuated auxiliary switch ON” switches the rotation of the lathe on.

Hand actuated auxiliary switch OFF

The “hand actuated auxiliary switch OFF” switches the rotation of the lathe off.

Speed adjustment

It is possible to set the required speed using the speed adjustment.

Rotation direction switch

The direction of rotation of the lathe can be switched by actuating the change-over switch.

It is possible to select a speed for each direction of rotation.

- The labelling “R” means right-handed rotation.
- The labelling “L” means left-handed rotation.

ATTENTION!

Wait until the rotation of the spindle has come to complete standstill before changing the direction of rotation by actuating the change-over switch.

A change over of the rotation direction during operation may result in a destruction of the motor and of the rotation direction switch.

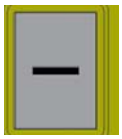
5.2.2 Switching on the machine

➜ Perform basic setting on the lathe (speed stage, feed, etc.).

➜ Check if the protective cover of the lathe chuck and the protective cover are closed – close the protective covers if necessary.

➜ Select the direction of rotation.

➜ Actuate the push button „ON“.



5.2.3 Switching off the machine

➜ Actuate the push button "OFF".

If the machine stands still for a longer period of time, disconnect the machine from the electrical power supply.

WARNING!

Risk by using improper workpiece clamping materials or by operating the machine with inadmissible speed.

Only use the tool holders (e.g. drill chuck) which were delivered with the machine or which are offered as optional equipment by OPTIMUM.

Only use tool holders in the intended admissible speed range.

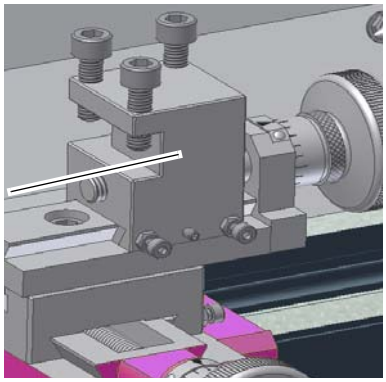
Tool holders may only be modified in compliance with the recommendation of OPTIMUM or of the manufacturer of the clamping devices.

5.3 Clamping a tool

Clamp the lathe tool into the tool holder.

The lathe tool needs to be clamped as short and tight as possible when turning in order to be able to absorb the cutting force well and reliably during the chip formation.

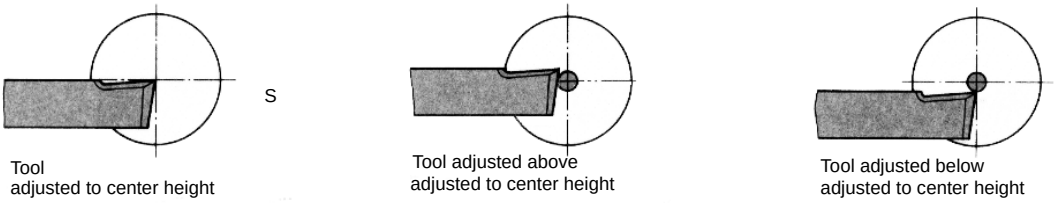
Adjust the height of the tool. Use the tailstock with the center point in order to determine the required height. If necessary, put the steel washers beneath the tool to achieve the required height.



Img.5-1: Tool holder

5.3.1 Tool height

For the facing process, the cutting edge of the tool must be exactly aligned with the height of the lathe centre to obtain a shoulder-free face. The facing process is a turning operation in which the turning tool feeds perpendicular to the axis of rotation of the workpiece in order to produce a flat surface. Here it is distinguished between cross-facing, cross-slicing and longitudinal facing.



Img.5-2: Height of tool

5.4 Speed adjustment

Adjust the speed with the potentiometer.

In order to use another speed range, you must change the position of the V-belt on the pulleys.

WARNING!

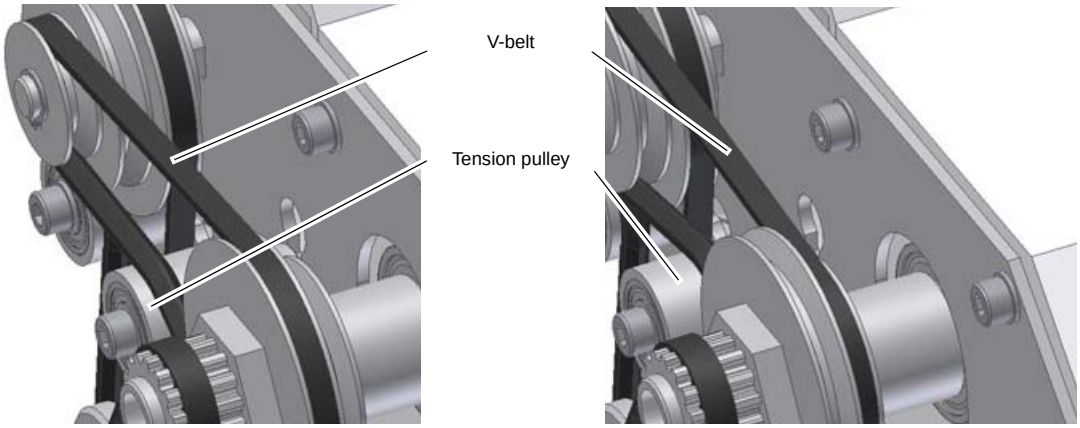
Unplug the shockproof plug of the lathe before opening the protective cover of the spindle stock.

5.4.1 Changing the speed range

➜ Unplug the shockproof plug from the mains.
➜ Open the protective cover of the spindle stock.
➜ Loosen the Allen screw of the tensioning pulley.
➜ Lift the V-belt to the relevant position.
❍ Turn the pulley by hand in order to facilitate positioning on the other pulley diameter. Make sure that the synchronous belt does not twist.
❍ Handle the V-belt with care. It must not be damaged or overstretched.
➜ Push the tensioning pulley upwards to tension the V-belt.
➜ Fit the tensioning pulley.
❍ The correct tension of the V-belt has been reached, when you can still bend it approximately 3mm with your index finger.

ATTENTION!

Make sure the tension of the V-belt is correct. Excessive or insufficient tension may cause damage.



Position of the front V- belt;
Speed range: 120 - 1500 min^{-1}

Position of the rear V-belt;
Speed range: 320 - 3000 min^{-1}

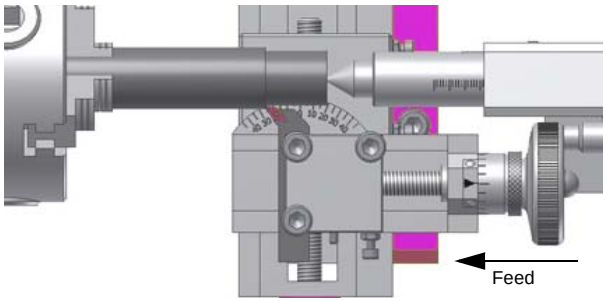
Img.5-3: V- belt positions and speed ranges

5.5 Straight turning

See also ☞ "Anhang Drehen“ on page 34

5.5.1 Manually

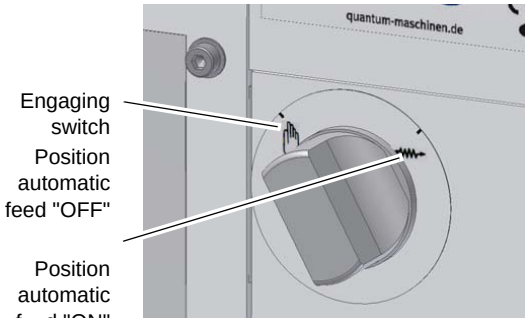
In the straight turning operation, the tool feeds parallel to the axis of rotation of the workpiece. The feed can be either manual - by turning the handwheel on the lathe saddle or the top slide - or by activating the automatic feed. The cross feed for the depth of cut is achieved using the cross slide.



Img.5-4: Graph: Straight turning

5.5.2 About self-acting feed

☞ "Adjusting feeds and thread pitches“ on page 31



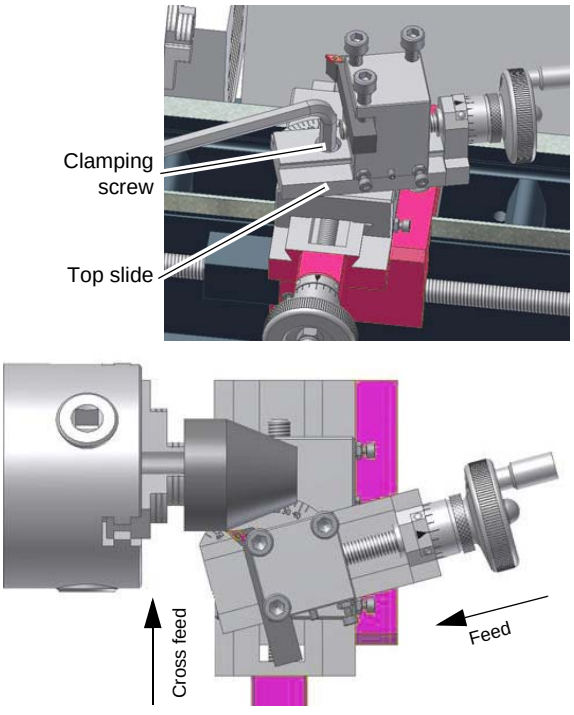
Img.5-5: Engaging switch

5.6 Turning short tapers with the top slide

See also ☞ "Anhang Drehen“ on page 34

To turn short tapers the top slide is to be adjusted according to the required angle.

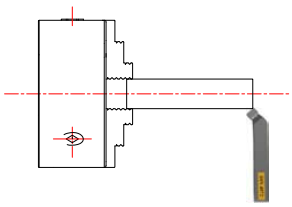
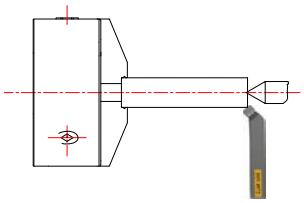
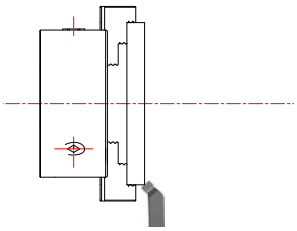
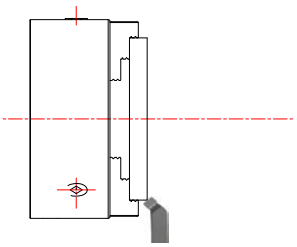
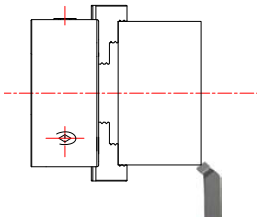
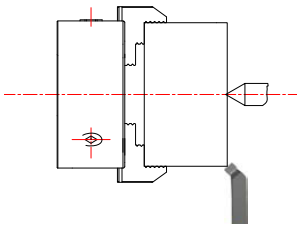
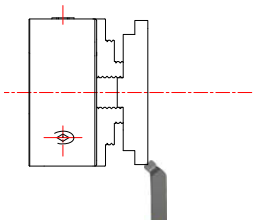
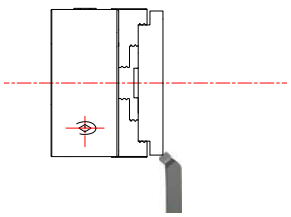
➜ Loosen the clamping screw.
➜ Swivel the top slide.
➜ Clamp the top slide again.



Img.5-6: Turning tapers

5.7 Clamping a workpiece into the three jaw chuck

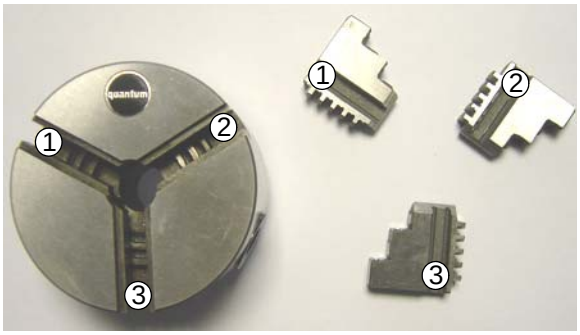
When the workpiece is being clamped unprofessionally, there is a risk of injury as the workpiece may fly off or the jaws may break. The following examples do not show all possible situations of danger.

wrong		correct	
	Clamping length too long, overhang too long.		Additional support over center.
	Clamping diameter too large.		Use larger lathe.
	Workpiece is too heavy and clamping grade too short.		Support over center, enlarges clamping grade. Enlarged clamping grades are not available for this three-jaw chuck. Possibly use larger lathe.
	Clamping diameter too short.		Clamp on the largest clamping diameter possible.

5.7.1 Replacing the clamping jaws on the lathe chuck

The clamping jaws and the three-jaw chuck are equipped with numbers. Insert the clamping jaws at the correct position and in the right order into the three-jaw chuck.

After the replacement, bring the jaws completely together in order to control if they are inserted correctly.

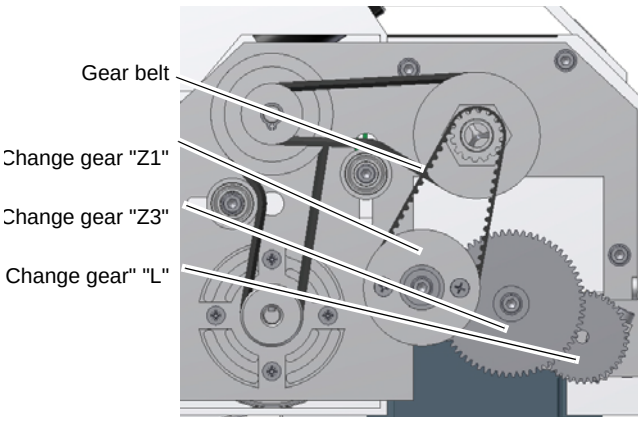


Img.5-7: Three-jaw chuck / clamping jaws

5.8 Adjusting feeds and thread pitches

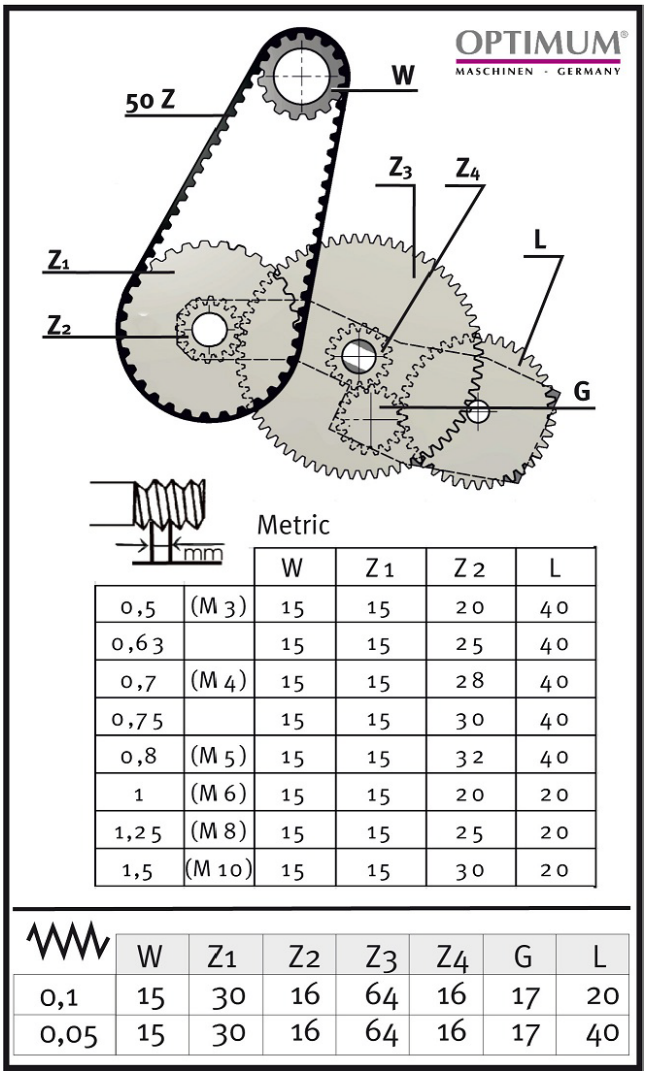
To change the feed or obtain a certain metric thread pitch, change the change gears according to the table.

The table may also be found in the inner part of the protective cover of the spindle stock.



Img. 5-8: Headstock

5.9 Feed table / Table for thread cutting



Metric

		W	Z1	Z2	L
0,5	(M 3)	15	15	20	40
0,63		15	15	25	40
0,7	(M 4)	15	15	28	40
0,75		15	15	30	40
0,8	(M 5)	15	15	32	40
1	(M 6)	15	15	20	20
1,25	(M 8)	15	15	25	20
1,5	(M 10)	15	15	30	20

	W	Z1	Z2	Z3	Z4	G	L
0,1	15	30	16	64	16	17	20
0,05	15	30	16	64	16	17	40

Img. 5-9: Feed table and table for thread cutting

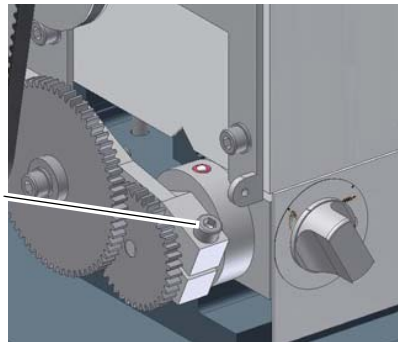
5.10 Changing the change gears

Example: To obtain a thread pitch of 1 mm, you have to perform the following tasks.

➜ Unplug the shockproof plug from the mains.

➜ Open the protective cover of the spindle stock.

➜ Open the clamping screw of the change gear quadrant and remove the V-belt.



Img.5-10: Change gear quadrant

➜ Feed gear

➜ Substitute the change gear "Z1 / Z2" for the change gear with the tooth combination Z1 = 15 ; Z2 = 20

➜ Substitute the change gear "L" for the 20-toothed change gear.

❍ Push the change gear combination "Z1 / Z2" and "L" onto the quadrant together so that they can be easily turned.

➜ Tighten the V-belt and tighten the clamping screw of the quadrant.

❍ The correct tension of the V-belt has been reached, when you can still bend it approximately 3mm with your index finger.

ATTENTION!

Make sure the tension of the V-belt is correct. Excessive or insufficient tension may cause damage. The V-belt must have 50 teeth, another V-belt leads to a different thread pitch.

5.10.1 Switching on the feed

➜ Check if you have adjusted the least possible spindle speed.

➜ Bring the lathe saddle as far as possible towards the tailstock.

➜ Turn the engaging switch to the right.

❍ Moving the handwheel on the lathe saddle makes it easier to engage the switch.

5.11 General working advice - coolant

Friction during the cutting process causes high temperatures at the cutting edges of the tool.

The tool should be cooled during the milling process. Cooling the tool with a suitable cooling lubricant ensures better working results and a longer edge life of the cutting tool.

INFORMATION

Use a water-soluble and non-pollutant emulsion as a cooling agent.This can be acquired from authorised distributors.

Make sure that the cooling agent is properly retrieved. Respect the environment when disposing of any lubricants and coolants. Follow the manufacturer's disposal instructions.

6 Appendix turning

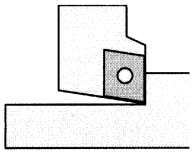
Turning is a cutting manufacturing process with certain geometrically positive or negative cutting edge geometries.

For the machining on the outside tool holder with quadrate shaft and for the machining on the inside boring bars with rounded or oblated shafts are used (refer to ISO-code for tool holders and boring bars).

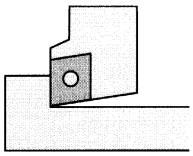
To determine the machining direction, we distinguish between right, left and neutral tools.

On this type of lathes you generally work with right tools, as the tools are used before the center of turning.

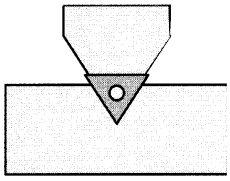
Machining direction for tool holders



Img.6-1: right holder

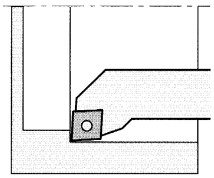


Img.6-3: left holder

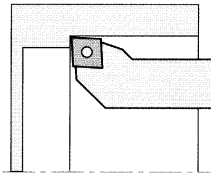


Img.6-5: neutral holder

Machining direction for boring bars

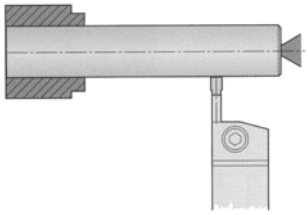


Img.6-2: right boring bar

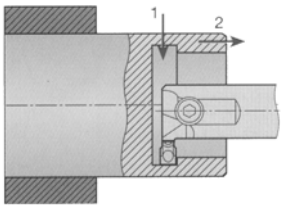


Img.6-4: left boring bar

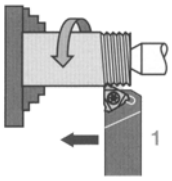
For the machining of a workpiece on the outer or inner diameter tools with different forms are required for longitudinal turning, facing, contour turning or thread cutting as well as for grooving, cutting off and cutting.



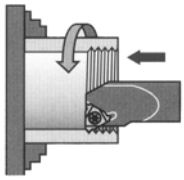
Img.6-6: tool holder for grooving, cutting off and cutting



Img.6-7: boring bar for grooving



Img.6-8: tool holder for thread cutting



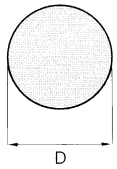
Img.6-9: boring bar for thread cutting

6.1 ISO-designation system for tool holder, inside machining

Material of the body

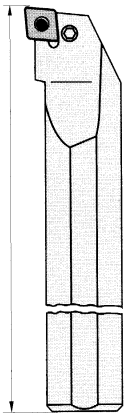
Identification of letter	Material of the body	Construction features
S	Steel cutter	none
A		with inner coolant feeding
B		with vibration damping
D		with vibration damping and inner coolant feeding
C	hard metal cutter with steel head	none
E		with inner coolant feeding
F		with vibration damping
G		with vibration damping and inner coolant feeding
H	heavy metal	none
J		with inner coolant feeding

Shank diameter



08
10
12
16
20
25
32
40
50

Tool length

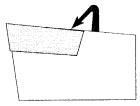


Identification letters for the length

A	32 mm
B	40 mm
C	50 mm
D	60 mm
E	70 mm
F	80 mm
G	90 mm
H	100 mm
J	110 mm
K	125 mm
L	140 mm
M	150 mm
N	160 mm
P	170 mm
Q	180 mm
R	200 mm
S	250 mm
T	300 mm
U	350 mm
V	400 mm
W	450 mm
X	special length
Y	500 mm

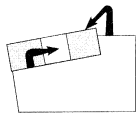
Type of fixture

C



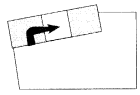
clamped from above

M



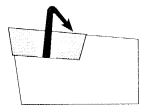
clamped from above
clamped the hole

P



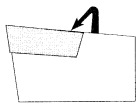
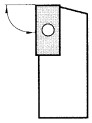
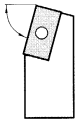
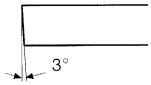
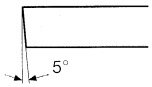
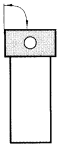
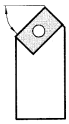
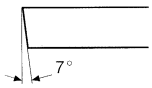
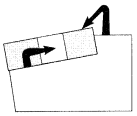
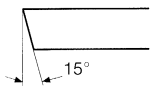
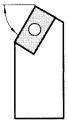
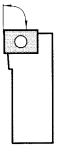
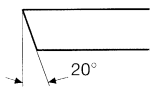
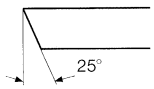
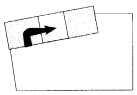
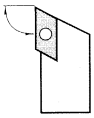
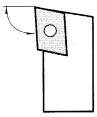
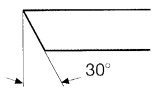
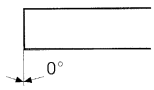
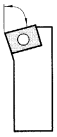
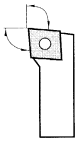
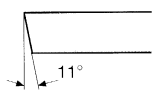
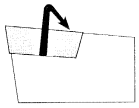
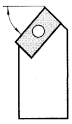
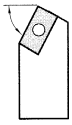
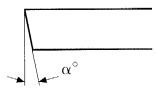
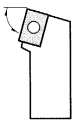
above the hole clamping

S

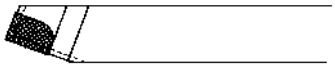


screwed through the hole

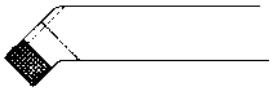
6.2 ISO-designation system for tool holder, outside machining

Type of fixture	Form of the indexable inserts			Form of the tool holder				Free angle of the indexa	
C  clamped at the top	A		85°	A	 90°	B	 75°	A	 3°
	B		82°					B	 5°
	C		80°	C	 90°	D	 45°	C	 7°
M  clamped at the top above the hole	D		55°					D	 15°
	E		75°	E	 60°	F	 90°	E	 20°
	H		120°					F	 25°
P  clamped above the hole	K		55°	G	 90°	J	 93°	G	 30°
	L		90°					N	 0°
	M		86°	K	 75°	L	 95°	P	 11°
S  screwed through the hole	O		135°						
	P		108°	M	 50°	N	 63°	O	 α°
	R		-					free angles where special indications are required	
	S		90°	R	 75°	S	45°		
	T		60°						
	V		35°	T	60°	U	93°		
	W		80°						
				V	72,5°	W	60°		
						Y	85°		

6.3 Cutter with hard metal reversible carbide tip soldered on



Img.6-10: straight cutter DIN 4971
ISO 1



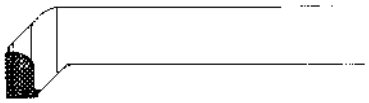
Img.6-11: bent cutter DIN 4972
ISO 2

Img.6-12: inside tool DIN 4973
ISO 8

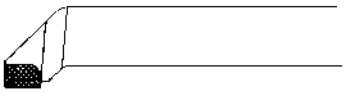
Img.6-13: internal side turning tool for corner work
DIN 4974
ISO 9

Img.6-14: tip of cutter DIN 4975

Img.6-15: cutter width DIN 4976
ISO 4

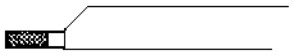


Img.6-16: offset face turning tool DIN 4977
ISO 5



Img.6-17: offset tool for corner work DIN 4978
ISO 3

Img.6-18: offset side turning tool DIN 4980
ISO 6



Img.6-19: cut off tool DIN 4981
ISO 7

Lathe tools made of high-speed steel (HSS) and lathe tools with hard metal tips soldered on are solid tools. The cutting edge geometry is to be ground for the corresponding machining. ☞ "Grinding or regrinding of cutting edge geometries of turning tools“ on page 53

For tool holders with indexable inserts the cutter geometry of the tool holder and of the corresponding indexable insert is given. For this type of tools there are four types of fixture for the indexable inserts.
☞ "ISO-designation system for tool holder, outside machining“ on page 35

6.4 Cut the first chips

In order to cut the first chips, a tool holder for the outside machining and a cutter bar for the inside machining are required. Furthermore, some twist drills (HSS) are required to centrically drill the part to be turned.

For the "do-it-yourselfer" it is recommended to use lathe tools with indexable inserts and screwed clamping. The lathe tool does not require grinding and the indexable insert have a positive cutting form level.

Before you can set the tools you have to determine the shank height and width respectively the shank diameter.

The indicated height of centres is the measure from the cutting point to the lathe bed. As there is no tool holder yet, the difference in height is to be determined from the bearing surface of the tool holder in the quadruple holder to the rotation axis. For some machines, the difference in height to the rotation axis is indicated in the technical data.

For tools according to ISO or DIN, the shank height is equal to the height of the cutting point. After clamping the tool holder, the height of the cutting point is to be checked. For drill rods ac-

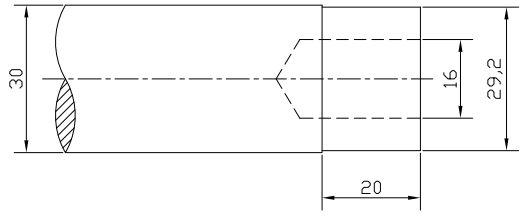
cording to ISO, the height of the cutting point is half the shank diameter and for flattened drill rods half the flattened height. For inside tools according to DIN the height of the cutting point corresponds to 0,8 x shank diameter respectively shank height.

ATTENTION!

If due to a variation in tolerance there is a slug or cone on the plane face, the exact height of centers is to be found by facing trials (put the tool holder higher for slugs and lower for cones).

The height of centres is to be checked each time when the turning tools are changed!

For example, a shaft with a diameter of 30mm is to be machined of C45. The outside diameter is to be turned and faced 20mm and a hole of 16mm is to be drilled.



Selecting the tools

- tool holder for turning and facing with 95° tool cutting edge angle
- indexable insert with a point angle of 80°
- we select a coated hard metal HC M15/K10 as cutting material With this tool about 75% of all lathe work on the outside diameter may be performed.

Selecting the cutting data

- A hard metal with the designation HC M15/K10 is selected as cutting material, cutting-speed ϑ_c = 80 m/min
- ap = 0,4mm for outside machining; ap = 0,2 mm for inside machining
- f = 0,05 mm/U (value for automatic feed)

The speed which is to be set is calculated with the formula

$$n = \frac{\vartheta c \times 1000}{d \times 3,14} = \frac{80 \times 1000}{30 \times 3,14} = 849 \text{min}^{-1}$$

6.5 Outside machining, longitudinal turning and facing

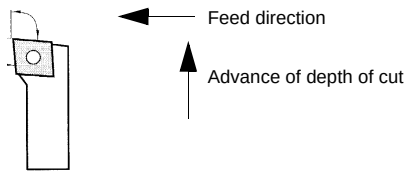
For longitudinal turning, the tool holder is moved parallel to the rotation axis. The feed is performed by turning the handwheel of the top slide (therefore the bedslide is to be fixed with the clamping screw). Furthermore you have to pay attention that the angular scale of the top slide is set to zero so that no tapers are being produced.

The feed may also be performed automatically over the leading spindle by shifting the engaging lever of the leadscrew nut. Pay attention that the feed is not automatically switched off.

The feed switching off is to be done manually!

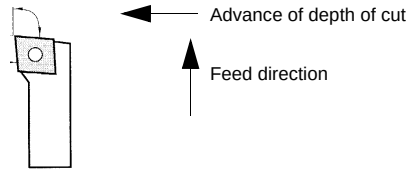
Pay also attention to the correct toothed pairing of change gear!

The infeed of the depth of cut is performed over the handwheel of the cross slide in direction to the rotation axis.



Img.6-20: Straight turning

For facing the bedslide is to be fixed with the clamping screw. The feed is performed by turning the handwheel of the cross slide. The infeed of the depth of cut is performed with the handwheel of the top slide.



Img.6-21: Facing operation

6.6 Inside machining, drilling and longitudinal turning

Selecting the tools

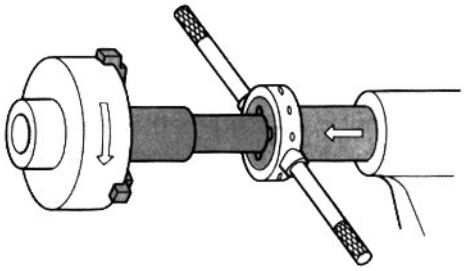
- drill chuck with morse cone seat.
- twist drill with center drill.
- drill rod with 95° tool cutting edge angle. This drill rod has a shank diameter of 8,0mm, e.g. a cutting point height of 4,0mm. For a drill rod shank with a flattening at the top, a support may be put beneath the tool in order to achieve the require height of centres. If the drill rod has got a straight shank, a prison or a special straight shank seat is required.
- For drill rods please take into account that there is a predetermined minimum turning diameter in this example of 11mm.
- The advantage in selecting these tools is that you may use the same indexable inserts as for the outside machining.
- With this tool about 75% of all lathe work on the outside diameter may be performed.
- In order to machine centric holes on the lathe, twist drills (HSS) are required. Furthermore a drill chuck with a chucking capacity of 1 to 13mm or 3-16mm with a more cone seat (example morse cone seat of the size 2) is required.
  The drill chuck with the morse cone seat is held by the tailstock sleeve and the twist drills are clamped into the drill chuck. The feed for drilling is performed after clamping the tailstock to its position with the handwheel on the tailstock sleeve.
- To make sure that the twist drill will not run off center when spot-drilling, the workpiece is to be centered with a center drill. For holes from 6,0mm onward you should predrill with a smaller drill. The drill diameter must be as large as the core diameter of the drill of the hole diameter which is to be drilled! For drilling comes a 4.0 mm and 11.5 mm drill bit are used.
- With the drill rod only the predetermined diameter is followed. The feed is performed by turning the handwheel of the top slide parallel to the rotation axis (please also follow theindications for longitudinal turning. The infeed of the depth of cut is performed over the handwheel of the cross slide in direction to the rotation axis.
- Please make sure that the drill rods are clamped as short as possible (to avoid oscillations).. You may assure a projection length from the drill rod seat of 4 x drill hole diameter as an empirical formula.

6.7 Tapping of external and internal threads

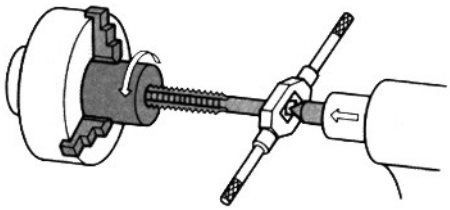
Threads with smaller diameters and standard thread pitches should be tapped manually on the lathe with screw-taps or dies by turning the clamping chuck as this is more simple to produce.

CAUTION!

Pull off the mains plug of the lathe if you want to tap a thread as described above.

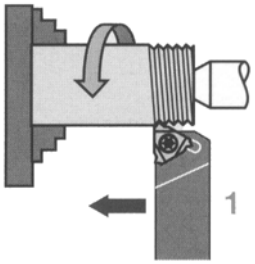


Img. 6-22: die

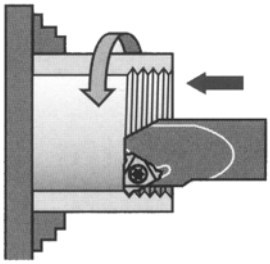


Img. 6-23: screw tap

Bolts and nuts with large thread diameters, deviating thread pitches or special types of thread,right-handed and left-handed threads may be produced by threading. For this manufacturing there are as well tool holders and drill rods with exchangeable indexable inserts (one-edged or multiple-edged).

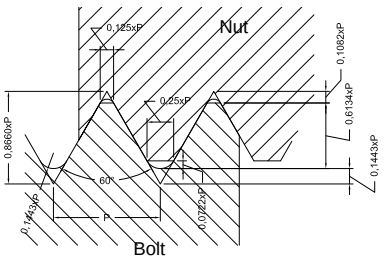
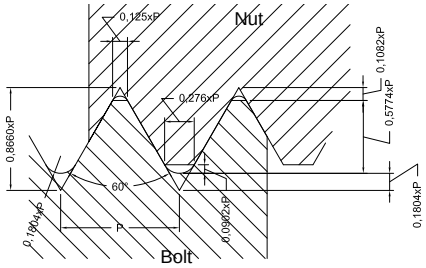


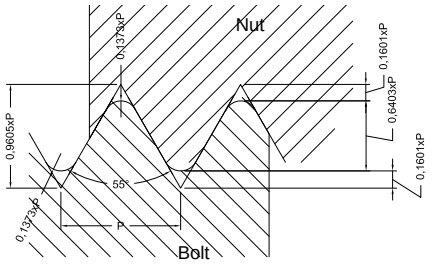
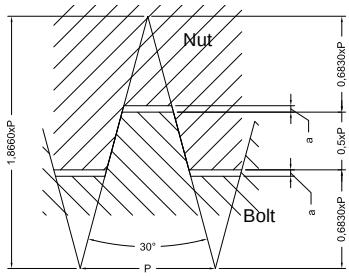
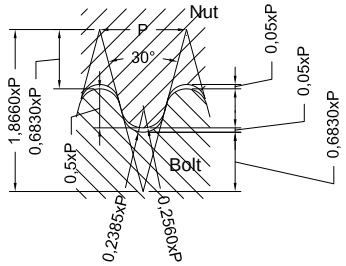
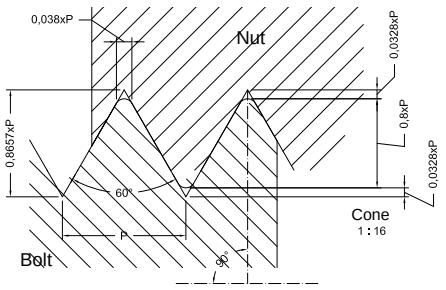
Img. 6-24: Tap external thread



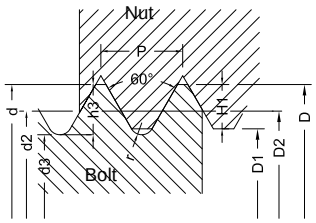
Img. 6-25: Tap internal thread

6.7.1 Thread types

Designation	Profile	Code letter	Short term (e. g.)	Application
ISO-thread		M UN UNC UNF UNEF UNS	M4x12 1/4" - 20UNC - 2A 0,250 - UNC - 2A	Machine tools and general mechanical engineering
UNJ		UNJ	1/4" - 20UNJ	Aircraft and aerospace industry

Whitworth		B.S.W. W	1/4" in. -20 B.S.W.	Cylindrical threads, Pipe threads, or conical pipe threads for thread connections which seal
ISO-trapezoid thread (one- and multi-ple- threaded)		TR	Tr 40 x 7 Tr 40 x 14 P7	Motion thread, Leading spindle and transport spindle
Round thread		RD	RD DIN 405	Fittings and for purposes of the fire brigade
NPT		NPT	1“ – 11 ½“ NPT	Fittings and tube joints

6.8 Metric threads (60° flank angle)



pitch P

depth of thread of the bolt h2=0,6134 x P

depth of thread of the nut H1 = 0,5413 x P

rounding r = 0,1443 x P

flank diameter d2 = D2 =d - 0,6493

core removing hole drill = d - P

flank angle = 60°

Metric coarse-pitch thread

Sizes in mm: preferably use the threads in column 1

Thread denomination d = D		pitch P	Flank diameter d2 = D2	Core diameter		Depth of thread		Rounding r	Core removing hole driill
Column 1	Column 2			Bolt d3	Nut D1	Bolt h3	Nut H1		
M 1		0.25	0.838	0.693	0.729	0.153	0.135	0.036	0.75
	M 1.1	0.25	0.938	0.793	0.829	0.153	0.135	0.036	0.85
M 1.2		0.25	1.038	0.893	0.929	0.153	0.135	0.036	0.95
	M 1.4	0.3	1.205	1.032	1.075	0.184	0.162	0.043	1.1
M 1.6		0.35	1.373	1.171	1.221	0.215	0.189	0.051	1.3
	M 1.8	0.35	1.573	1.371	1.421	0.215	0.189	0.051	1.5
M 2		0.4	1.740	1.509	1.567	0.245	0.217	0.058	1.6
	M 2.2	0.45	1.908	1.648	1.713	0.276	0.244	0.065	1.8
M 2.5		0.45	2.208	1.948	2.013	0.276	0.244	0.065	2.1
M 3		0.5	2.675	2.387	2.459	0.307	0.271	0.072	2.5
	M 3.5	0.6	3.110	2.764	2.850	0.368	0.325	0.087	2.9
M 4		0.7	3.545	3.141	3.242	0.429	0.379	0.101	3.3
M 5		0.8	4.480	4.019	4.134	0.491	0.433	0.115	4.2
M 6		1	5.350	4.773	4.917	0.613	0.541	0.144	5.0
M 8		1.25	7.188	6.466	6.647	0.767	0.677	0.180	6.8
M 10		1.5	9.026	8.160	8.376	0.920	0.812	0.217	8.5
M 12		1.75	10.863	9.853	10.106	1.074	0.947	0.253	10.2
	M14	2	12.701	11.546	11.835	1.227	1.083	0.289	12
M 16		2	14.701	13.546	13.835	1.227	1.083	0.289	14
	M18	2.5	16.376	14.933	15.294	1.534	1.353	0.361	15.5
M 20		2.5	18.376	16.933	17.294	1.534	1.353	0.361	17.5
	M 22	2.5	20.376	18.933	19.294	1.534	1.353	0.361	19.5
M 24		3	22.051	20.319	20.752	1.840	1.624	0.433	21
	M 27	3	25.051	23.319	23.752	1.840	1.624	0.433	24

M 30		3.5	27.727	25.706	26.211	2.147	1.894	0.505	26.5
M 36		4	33.402	31.093	31.670	2.454	2.165	0.577	32
M 42		4.5	39.077	36.479	37.129	2.760	2.436	0.650	37.5
M 48		5.5	44.752	41.866	41.866	3.067	2.706	0.722	43
M 56		5.5	52.428	49.252	49.252	3.374	2.977	0.794	50.5
M 64		6	60.103	56.639	56.639	3.681	3.248	0.866	58

Metric fine-pitch thread

Denomination of thread d x P	Flank diameter d2 = D2	Core diameter Bolt	Core diameter Nut	Denomination of thread d x P	Flank diameter d2 = D2	Core diameter Bolt	Core diameter Nut
M2 x 0,2	1.870	1.755	1.783	M16 x 1,5	15.026	14.160	14.376
M2.5 x 0.25	2.338	2.193	2.229	M20 x 1	19.350	18.773	18.917
M3 x 0,35	2.773	2.571	2.621	M20 x 1.5	19.026	18.160	18.376
M4 x 0,5	3.675	3.387	3.459	M24 x 1,5	23.026	22.160	22.376
M5 x 0,5	4.675	4.387	4.459	M24 x 2	22.701	21.546	21.835
M6 x 0,75	5.513	5.080	5.188	M30 x 1,5	29.026	28.160	28.376
M8 x 0,75	7.513	7.080	7.188	M30 x 2	28.701	27.546	27.835
M8 x 1	7.350	6.773	6.917	M36 x 1,5	35.026	34.160	34.376
M10 x 0,75	9.513	9.080	9.188	M36 x 2	34.701	33.546	33.835
M10 x 1	9.350	8.773	8.917	M42 x 1,5	41.026	40.160	40.376
M12 x 1	11.350	10.773	10.917	M42 x 2	40.701	39.546	39.835
M12 x 1.25	11.188	10.466	10.647	M46 x 1,5	47.026	46.160	46.376
M16 x 1	15.350	14.773	14.917	M48 x 2	46.701	45.546	45.835

6.8.1 British thread (55° flank angle)

BSW (Ww.): British Standard Withworth Coarse Thread Series is the most common coarse thread in Great Britain and corresponds in its usage category to the metric coarse-pitch thread. The designation of a hexagon head screw 1/4" - 20 BSW x 3/4" , is here: . 1/4" is the nominal diameter of the screw and 20 is the number of threads in 1" of length.

BSF: British Standard Fine Thread Series. British Standard Fine Thread Series. BSW- and BSF are the thread selection for the common screws. This fine thread is very common in the British machine tool industry, but it is replaced by the American UNF thread.

BSP (R): British Standard Pipe Thread. Cylindric pipe thread; designation in Germany: R 1/4" (nominal width of the tube in inch). Tube threads are larger in their diameter as "BSW". Designation 1/8" - 28 BSP

BSPT: BSPT: British Standard Pipe - Taper Thread. Conic tube thread, cone 1:16; designation: 1/4" - 19 BSPT

BA: BA: British Association Standard Thread (47 1/2° flank angle). Common with instruments and watches, is being replaced by the metric ISO thread and by the ISO miniature thread. It consists of numeric designations from 25 to 0=6,0mm max diameter.

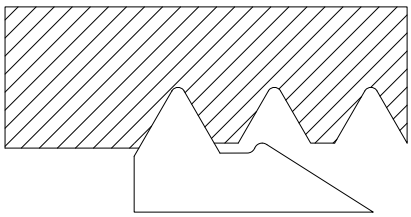
Table of the British threads

Nominal diameter of the thread		Threads in 1"				Threads in 1"		
		BSW	BSF:	BSP/BSPT		BA-threads		
[Inch]	mm			(R)	D. [mm]	No.		D [mm]
		55° Flank angle				47 1/2° Flank angle		
1/16	1.588	60	-	-		16	134	0.79
3/32	2.382	48	-	-		15	121	0.9
1/8	3.175	40	-	28	9.73	14	110	1.0
5/32	3.970	32	-	-	-	13	102	1.2
3/16	4.763	24	32	-	-	12	90.9	1.3
7/32	5.556	24	28	-	-	11	87.9	1.5
1/4	6.350	20	26	19	13.16	10	72.6	1.7
9/32	7.142	20	26	-	-	9	65.1	1.9
5/16	7.938	18	22	-	-	8	59.1	2.2
3/8	9.525	16	20	19	16.66	7	52.9	2.5
7/16	11.113	14	18	-	-	6	47.9	2.8
1/2	12.700	12	16	14	20.96	5	43.0	3.2
9/16	14.288	12	16	-	-	4	38.5	3.6
5/8	15.875	11	14	14	22.91	3	34.8	4.1
11/16	17.463	11	14	-	-	2	31.4	4.7
3/4	19.051	10	12	14	26.44	1	28.2	5.3
13/16	20.638	10	12	-	-	0	25.3	6.0
7/8	22.226	9	11	14	30.20			
15/16	23.813	9	11	-	-			
1	25.401	8	10	11	33.25			
1 1/8	28.576	7	9	-	-			
1 1/4	31.751	7	9	11	41.91			
1 3/8	34.926	6	8	-	-			
1 1/2	38.101	6	8	11	47.80			
1 5/8	41.277	5	8	-	-			
1 3/4	44.452	5	7	11	53.75			
1 7/8	47.627	4 1/2	7	-	-			
2	50.802	4 1/2	7	11	59.62			

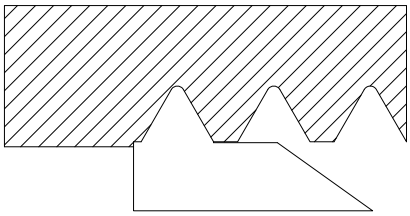
6.8.2 Indexable inserts

For indexable inserts there are partial profile and full profile indexable inserts. The partial profile indexable inserts are designed for a certain pitch range (e.g. 0.5 - 3mm).

- The partial profile indexable insert is optimally appropriate for the single-piece production.
- The full profile indexable insert is only designed for a certain pitch.



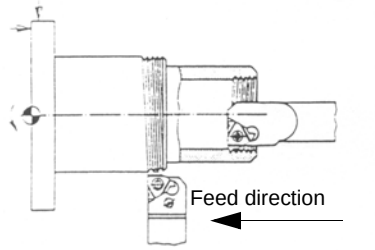
Img. 6-26: partial profile indexable insert



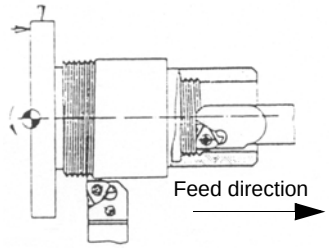
Img. 6-27: full profile indexable insert

Determining the machining method of right-handed and left-handed threads:

Right-handed tool holders or drill rods are used. In order to top right-handed threads the feed direction towards the clamping chuck is selected and the machine spindle turns to the right (the turning direction of the machine spindle is determined when you look into the spindle from the rear side). If a left-handed thread is to be tapped, the feed direction is selected away from the clamping chuck in direction to the tailstock and the machine spindle turns to the right.

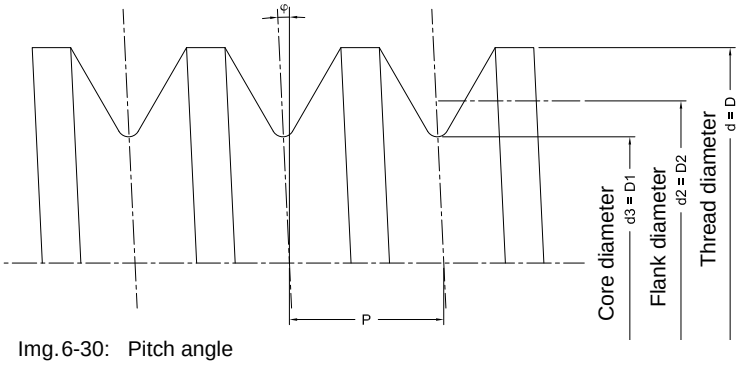


Img. 6-28: right-handed thread with the machine spindle turning to the right



Img. 6-29: left-handed thread with the machine spindle turning to the right

As for thread cutting there are other conditions as for longitudinal turning, the forward cutter must show a larger clearance as the pitch angle of the thread.



Img. 6-30: Pitch angle

Pitch angle φ

Pitch P

$$\tan\varphi = \frac{P}{D_2 \times \pi}$$

6.8.3 Examples for thread cutting

As an example, a metric external thread M30 x 1,0 mm made of brass is being machined.

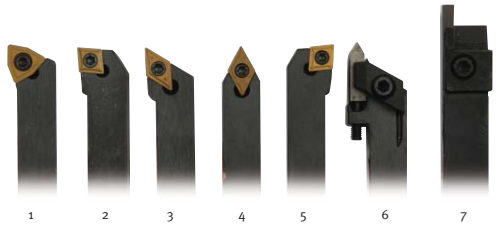
Selecting the tool holder

For lathe TU1503V and TU1804V , TU2004V, turning tool No.6 and for lathe TU2404 , TU2404V, TU2506 , TU2506V, TU2807 , TU2807V turning tool No.13.

Pointing turning tools are also appropriate Img.6-14: “tip of cutter DIN 4975“ on page 36with hard metal plates soldered on of the complete set for the lathe TU1503V and TU1804V , TU2004V, 8mm, 11-pieces, item no. 344 1008 and for lathe TU2404 , TU2404V, TU2506 , TU2506V, TU2807 , TU2807V, 8mm, 11-pieces, item no. 344 1108 .

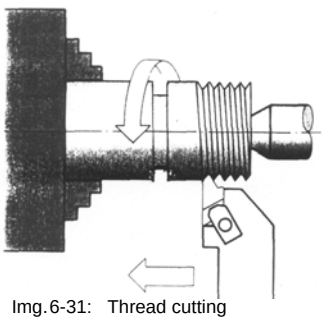
The above mentioned thread turning tools have a point angle of 60°.

Set of turning tools HM 9mm 344 1011
7-pieces with HM indexable inserts
TiN-coated in a wooden case
ISO designation tool holder
Turning tool 1: SWGCR/L0810D05
Turning tool 2: SCLCR/L0810D06
Turning tool 3: SDJCR/L0810D07
Turning tool 4: SDNCN/L0810D07
Turning tool 5: SCLCL0810D06
Turning tool 6: LW0810R/L 04
Turning tool 7: QA0812R/L03



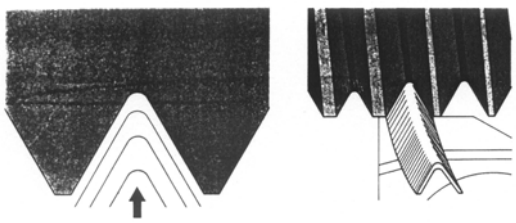
Set of turning tools HM 10mm 344 1111
7-pieces with HM indexable inserts
TiN-coated in a wooden case
ISO designation tool holder
Turning tool 8: SWGCR/L1010E05
Turning tool 9: SCLCR1010E06
Turning tool 10: SDJCR/L1010E07
Turning tool 11: SDNCN/L1010E07
Turning tool 12: SCLCR/L1010E06
Turning tool 13: LW1010R/L04
Turning tool 14: QA1012R/L03

- ➜ Steel sheets are to be laid under the complete tool holder or turning tool to achieve exactly the turning center.
- ➜ The lowest spindle speed is set so that the lathe will not coast too long !
- ➜ Mount gear pairing for pitch 1,0mm in the change gear !



Img.6-31: Thread cutting

The outer diameter had been turned to 30,0mm and the tool holder is clamped in the quadruple holder for threading aligned angular to the rotation axis. The height of centres is checked (as described).



Img.6-32: radial infeed

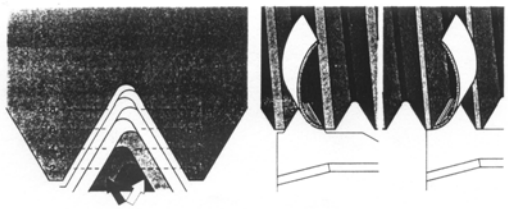
The depth of thread is manufactured in various passes. The infeed is to be reduced after each pass.

The first pass takes place with an infeed of 0.1 - 0.15 mm

For the last pass the infeed shall not be below 0,04mm.

For pitches up to 1,5mm the infeed may be radial.

For our example 5 to 7 passes are being determined.



Img.6-33: Alternate infeed

For larger pitches the alternate flank infeed is selected. The top slide is from the 2nd passage in each case 0.05 - 0.10 mm adjusted alternately to the left and right. The last two passes are performed without lateral offset. When the depth of thread is achieved, two passes are performed without infeed.

To machine internal threads, about 2 passes shall be selected additionally for the infeed (drill rods are more instable).

The cutting point is slit slightly by turning the handwheel of the cross slide the scale is turned to zero. This is the point of departure for the infeed of the depth of thread.

The scale of the top slide is also set to zero (this is important for the lateral offset whenturning threads with larger pitches).

The cutting point is set just in front of the starting point of the start of the thread by actuating thehandwheel of the bedslide.

The cutting point is set just in front of the starting point of the start of the thread by actuating thehandwheel of the bedslide. With this connection, the adjusted thread pitch is transferred to the bedslide and to the tool holder.

ATTENTION!

This connection must not be disconnected until the thread is finished!

Starting the threading:

- Radial infeed over the handwheel of the cross slide.
- Turn the change-over, switch to the right
- Start the machine and have the first cutting process run.

ATTENTION!

Always have the thumb ready on the OFF-switch in order to prevent a collision with the workpiece or with the clamping chuck !

- Immediately turn off the machine at the run out of the thread and cam the cutter out by turning the handwheel of the cross slide.
- Turn the change-over, switch to the left.
- Turn the machine on and return the bedslide to the starting point and switch the machine off.
- Radial infeed over the handwheel of the cross slide.
- Turn the change-over, switch to the right
- Switch the machine on and have the second cutting process run.
- Repeat this procedure as often as necessary until the depth of thread is achieved.
- To check the thread you may use a thread gauge or a workpiece with an internal thread M30 x 1.0
- If the thread is having the exact size, the thread cutting process may be terminated. Now you may again shift the operating lever of the lead-screw nut in standstill. In this way, the connection between the lead spindle and the bedslide is interrupted.
- Now the toothed wheels for the longitudinal feed are to be mounted again!

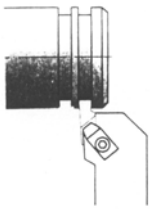
6.9 Recessing, cutting off and turning off

When recessing, grooves at the outer or inner diameter are manufactured e.g. for o-rings and locking rings. There is also the possibility to manufacture recesses on the plane face.

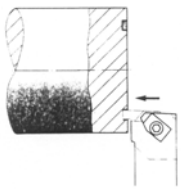
When cutting off the finished workpiece is separated from the feed stock.

The turning off is a combination of recessing and longitudinal turning.

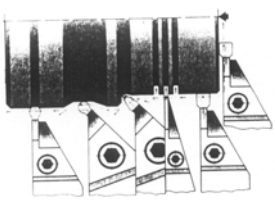
For each of these machining methods there are indexables inserts with sintered cutting form levels available.



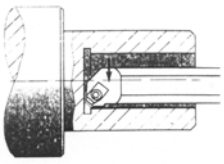
Img. 6-34: outside recessing



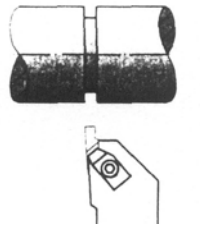
Img. 6-35: recessing on plane faces



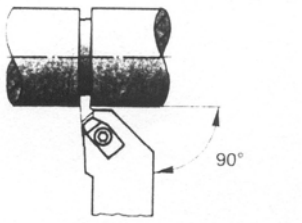
Img. 6-36: cutting off, turning off



Img. 6-37: inside recessing



Img.6-38: recessing 1



Img.6-39: recessing 2

On a shaft made of brass, an undercut for a thread M30 is to be machined. Groove with 5,0mm with a depth of 2,5mm.

Selecting the tool holder For lathe TU1503V and TU1804V , TU2004V, turning tool No.7 and for lathe TU2404 , TU2404V, TU2506 , TU2506V, TU2807 , TU2807V turning tool No.14.

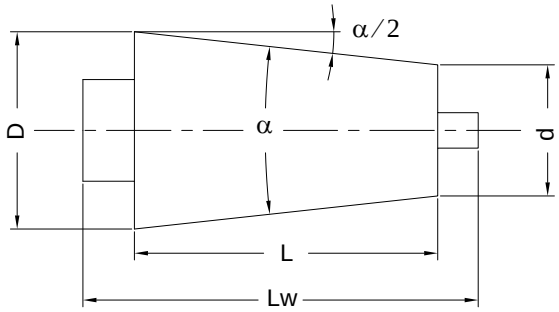
For small lathes the cutting speed for this machining compared to the cutting speed for longitudinalturning is reduced by about 60% in order to prevent oscillations.

Cutting speed Vc = 40 m/min, the speed to be set would be 425min^{-1} .

The tool holder is clamped into the quadruple holder, aligned angular to the rotation axis and the height of centres is checked.

The tool is positioned and fixed with the bedslide. The exact position is set with the handwheel of the top slide. With the indexable insert the outer diameter is slit slightly (by turning the handwheel of the cross slide). Set the scale to zero and the first recess of 3,0mm width may be machined. Apply some machine oil on the cutter to grease it! Another recess of 2,0mm is required to achieve a groove width of 5,0mm.

6.10 Turning of cones with high precision



Img.6-40: Designation on the cone

D = large diameter [mm]
d = small diameter [mm]
L = cone length [mm]
Lw = workpiece length [mm]
α = cone angle
$\alpha/2$ = setting angle
Kv = cone proportion
Vr = tailstock offset
Vd = measure change [mm]
Vo = twist measure of top slide [mm]

There are different possibilities to machine a cone on a common small lathe:

1. By twisting the top slide by setting the setting-angle with the angular scale.
   But there the graduation of the scale is too inaccurate. For chamfers and conic passings the graduation of the angular scale is sufficient.
2. By a simple calculation, a stop measure of 100mm length (of your own production) and a gauge with stand.

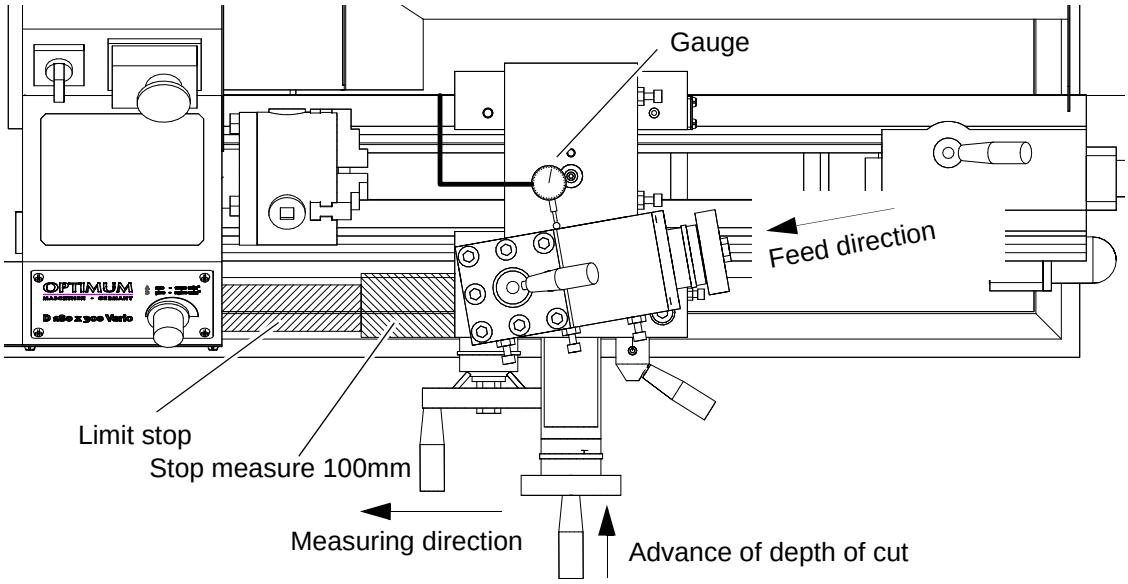
Calculation

of the offset of the top slide relating to the stop measure with a length of 100mm.

Step by step		
$Kv = \frac{L}{D-d}$	$Vd = \frac{100mm}{Kv}$	$Vo = \frac{Vd}{2}$

by one calculation step (summary)
$Vo = \frac{100mm \times (D-d)}{2 \times L}$
Example: D = 30.0 mm ; d = 24.0 mm ; L = 22.0 mm
$Vo = \frac{100mm \times (30mm-24mm)}{2 \times 22mm} = \frac{100mm \times 6mm}{44mm} = 13,63mm$

The stop measure (100mm) is to be put between a fixed unit stop and the bedslide. Put the gauge with stand on the lathe bed and horizontally align the test prod with the test prod with thetop slide (90° to the top slide). The twisting measure is calculated with the above mentioned formula.
The top slide is twisted by this value (then set the gauge to zero). After removing the stop measure, the bedslide will be aligned to the limit stop. The gauge must indicate the calculated value "Vo" Then the workpiece and the tool are clamped and positioned (the bedslide is fixed). The infeed is performed with the handwheel of the top slide. The depth of cut is advanced with the handwheel of the cross slide.

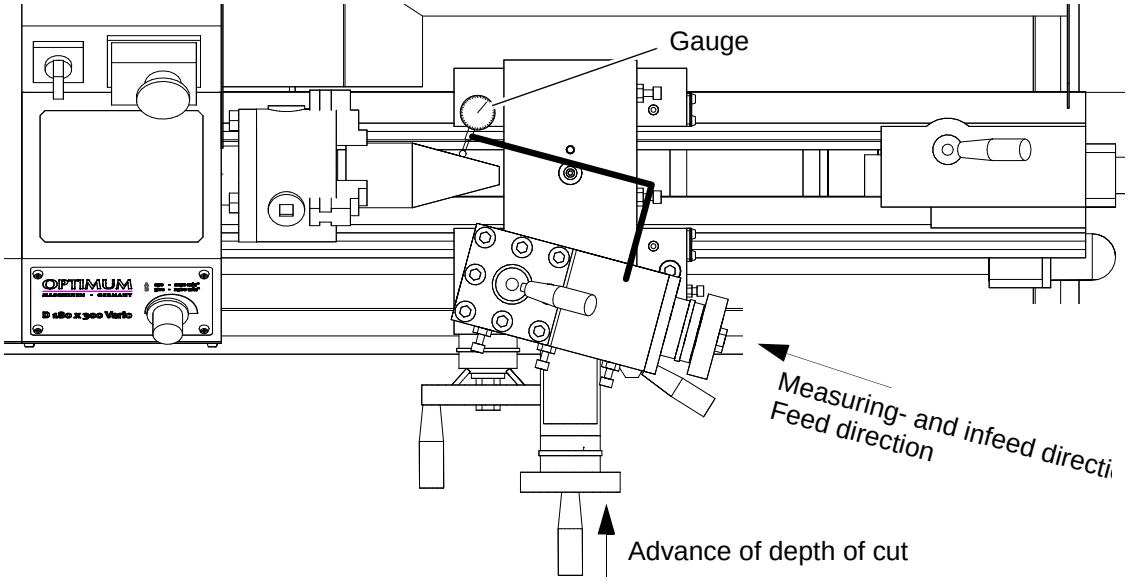


Img.6-41: Cone setting with stop measure

3. By measuring an existing cone with gauge and stand.

The stand is put on the top slide. The gauge is aligned horizontally and 90° to the top slide. The top slide is approximately adjusted to the cone angle and the test prodbrought in contact with the cone surface (fix the bedslide). Now the top slide is twisted in a way that the gauge does not indicate any travel of the pointer over the whole length of the cone (offset over the handwheel of the top slide).

Then you may start reaming the lathe as described under point 2. The workpiece might be a flange for lathe chucks or a face plate.



Img.6-42: Cone setting with stop measure

4. By offsetting the tailstock as the cone length is larger than the adjustable stroke of the top slide.

The workpiece is clamped between two points, therefore center holes are required on the face. They are to be drilled before removing the lathe chuck. The slaving of the workpiece is performed by a pulling pin and a lathe carrier.

The calculated value "Vr" is the offset measure of the tailstock. The offset is monitored with the gauge (also the return travel).

☞ "Designation on the cone“ on page 48

For this type of cone machining the lowest speed is used !

Annotation:

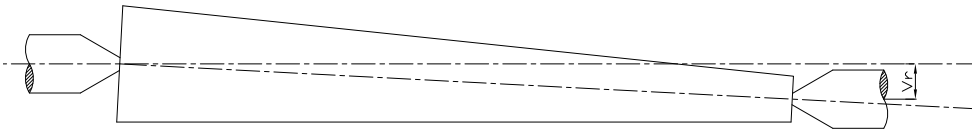
In order to check the position of the tailstock axis to the rotation axis, a shaft with two centeringsis clamped between the points. The stand with the gauge is put on the bedslide. The gauge is aligned 90° to the rotation axis and horizontally brought into contact with the shaft. The gauge will pass along the shaft with the bedslide. There must not be any travel of the pointer along the whole length of the shaft. If a deviation is being shown, the tailstock is to be corrected.

Calculation		
$Vr = \frac{Lw}{2 \times Kv}$	or	$Vr = \frac{D - d}{2 \times L} \times Lw$
$Vr_{max} = \frac{Lw}{50}$	The tailstock offset must not exceed the value *"Vrmax"* as the workpiece tumbles!	

Example:

Kv = 1 : 40 ; Lw = 150 mm ; L = 100 mm

$$Vr = \frac{150}{2 \times 40} = 1,875mm \qquad Vr_{max} = \frac{150}{50} = 3mm$$



Img. 6-43: Workpiece between points: Tailstock offset Vr

6.11 Cutting materials

The basic requirement for a cutting material is that it is harder than the material which is to be worked. The larger the difference is, the higher the wear resistance of the cutting material.

High-speed steel (HSS)

High-speed steel is a high-alloy tool steel with high tenacity. The cutting edges may be ground sharp-edged and the tools may be used with low cutting speed.

Hard metal (uncoated and coated)

Hard metal is a sintered material on the basis of tungsten carbide which may be applied for almost all materials which are to be chipped due to the different composition. There are some more wear-resistant types of hard metal and others with a higher tenacity.

The hard metals are divided into three main groups:

P - for long-chipping materials (steel, meltable cast iron)

M - for long- and short-chipping material (stainless steel, machining steel)

K - for short-chipping materials (castiron, NE metals, hardened steel)

An additional classification is performed with an annexed figure:

The lower the figure (P10), the higher is the wear resistance (planing)

The higher the figure (P40), the higher the tenacity (roughing).

In order to make hard metals more wear resistant, they may be coated with mechanically resistant materials. These layers may be applied as single or multiple-layer coatings.

There are two procedures:

- PVD / Physical Vapor Deposition,
- CVD / Chemikal Vapor Deposition.

The most common layers of mechanically resistant materials are:

- TiN / titanium nitride,
- TiC / titanium carbide,
- TiCN / titanium carbon nitride,
- Al_2O_3 / aluminium oxide,

as well as their combinations

The PVD-coated indexable inserts have sharper cutting edges and thus lower cutting forces. Also well appropriate for small lathes.

Cermet (uncoated and coated)

Cermet (ceramic-metal) is a hard metal on the basis of titanium carbide. The cutting material has very good wear resistance and edge strength. Indexable inserts made of Cermet are used with high cutting speeds for planing.

Cutting ceramics

Cutting ceramics is composed of non-metalic anorganic material.

Oxide ceramics on the basis of aluminium oxide and an addition of zircon. The main application is the machining of cast iron.

Mixed ceramics made of aluminium oxide an addition of titanium carbide has good a wear´r-esistance on the edge strength. This cutting material is applied in the machining of chill casting.

Non-oxide ceramics on the basis of silicon nitride is insensible against thermal shock (it may be used with coolants). Non-alloy cast iron is chipped.

Cubic boron nitride (CBN)

Cubic boron nitride has a high tenacity and a good high temperature strength. It is appropriate for the planing of hardened materials.

Polycrystalline diamond (PKD)

Polycrystalline diamond has a good wear resistance. Good surface qualities with stable cutting conditions are being achieved. Fields of application are non ferrous and non-metallic materials in the finishing.

For other application references please refer to the documents of the tools' manufacturer.

6.12 Standard values for cutting data when turning

The better the cutting data are selected, the better the turning result. Some standard values for cutting speeds of different materials are listed on the following pages.

☞ "Cutting speed table“ on page 53

Criteria of the cutting conditions:

Cutting speed: Vc (m/min)

Depth of cut: ap (mm)

Infeed: f (mm/rev)

Cutting speed:

In order to get the speed for the machine settings of the selected cutting speeds the following formula is to be applied:

$$n = \frac{Vc \times 1000}{d \times 3,14}$$

Speed: n (1/min)

Workpiece diameter: d (mm)

For lathes without continuously adjustable drive (V-belt drive, speed gear) the nearest speed is being selected.

Depth of cut:

In order to achieve a good chipping, the results of the depth of cut divided by the infeed shall result in a figure between 4 and 10.

Example: ap = 1.0mm; f = 0.14mm/U ; and this equals to in a value of 7.1 !

Infeed

The infeed for roughing/turning is to be selected in a way that it does not exceed buff the value of the corner radius.

Example: r = 0.4mm ; equals to fmax. = 0.2 mm/rev !

For planing/turning the infeed should be maximum 1/3 of the corner radius.

Example: r = 0.4mm ; equals to fmax. = 0.12mm/rev !

6.13 Cutting speed table

	Turning								Drilling
Materials	Cutting materials								
	HSS	P10	P20	P40	K10	HC P40	HC K15	HC M15/ K10	HSS
non-alloyed steel; steel casting; C45; St37	35 - - 50	100 - - 150	80 - - 120	50 - - 100	- -	70 - - 180	150 - - 300	90 - - 180	30 - - 40
low-alloy steel, steel casting; 42CrMo4; 100Cr6	20 - - 35	80 - - 120	60 - - 100	40 - - 80	- -	70 - - 160	120 - - 250	80 - - 160	20 - - 30
high-alloyed steel; steel casting; X38CrMoV51; S10-4-3-10	10 - - 20	70 - - 110	50 - - 90	- -	- -	60 - - 130	80 - - 220	70 - - 140	8 - - 15
rust-resistant steel X5CrNi1810; X10CrNiMoTi12	- -	- -	- -	- -	30 - - 80	- -	- -	50 - - 140	10 - - 15
grey cast iron GG10 ; GG40	15 - - 40	- -	- -	- -	40 - - 190	- -	90 - - 200	70 - - 150	20 - - 30
cast iron with nodular graphite GGG35 ; GGG70	10 - - 25	- -	- -	- -	25 - - 120	- -	80 - - 180	60 - - 130	15 - - 25
copper, brass	40 - - 90	- -	- -	- -	60 - - 180	- -	90 - - 300	60 - - 150	30 - - 80
aluminium alloys	40 - - 100	- -	- -	- -	80 - - 200	- -	100 - - 400	80 - - 200	40 - - 80

Description of the coated hard metals:

HC P40 = a PVD - coating TiAlN

HC K15 = a CVD - coating TiN-Al_2O_3 - TiCN - TiN

HC M15/K10 = CVD - coating TiAiN

6.14 Grinding or regrinding of cutting edge geometries of turning tools

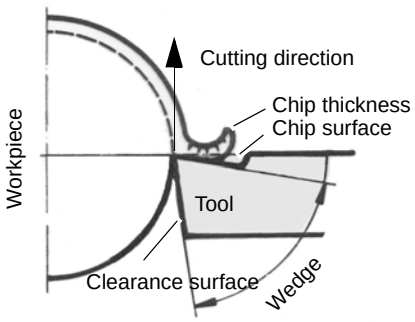
This affects all cutters made of high-speed steel (HSS) and tools with carbide tipped tools soldered on according to DIN 4971 - 4977 and 4980 - 4981.

The soldering steels may be used with the delivered edge polished section. But this is not the optimum cutting edge geometry for all applications.

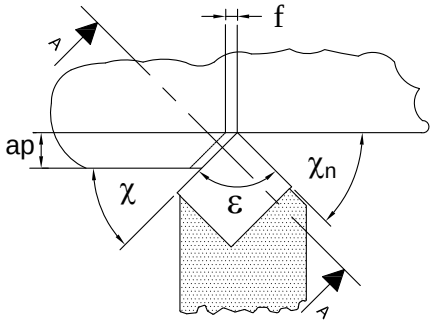
The HSS-square turned piece DIN 4964 type B are without a polished section, they are to be ground before they are first used.

Special fused alumina for HSS and silicone carbide or diamonds for hard metal may be used as grinding medium.

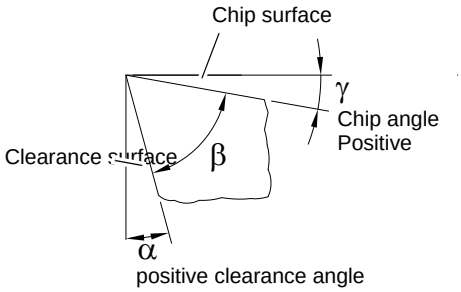
6.14.1 Terms for the rotating tool



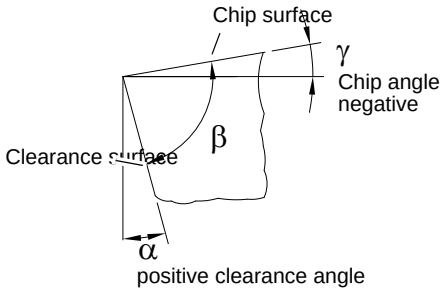
Img.6-44: Geometrically determined cutter for the separation process



Img.6-45: Cut and chip size



Img.6-46: Cut A - A, positive cutter



Img.6-47: Cut A - A, negative cutter

Wedge angle	β	The following factors influence the chip break when turning	
Chip angle	γ	Setting angle	χ
Clearance angle	α	Corner radius	r
Clearance angle minor cutting edge	α_n	Cutting edge geometry	
Setting angle	χ	Cutting speed:	Vc
Setting angle minor cutting edge	χ_n	Depth of cut:	ap
Point angle	ε	Infeed	f
Depth of cut:	ap (mm)		
Infeed	f (mm/U)		

In most cases the setting angle is depending on the work piece. A setting angle of 45° to 75° is suitable for roughing. setting angle of 90° to 95° (no tendency to chattering) is suitable for planing.

The corner angle serves as passing from the major cutting edge to the minor cutting edge. Together with the infeed it determines the surface quality. The corner radius must not be selected too large as this might result in vibrations.

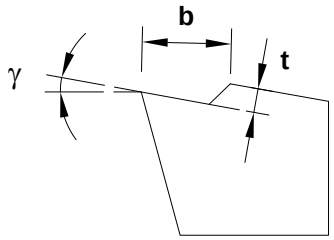
6.14.2 Cutting edge geometry for turning tools

	High-speed steel		Hard metal	
	Clearance angle	Chip angle	Clearance angle	Chip angle
Steel	+5° to +7°	+5° to +6°	+5° to +11°	+5° to +7°
Cast non	+5° to +7°	+5° to +6°	+5° to +11°	+5° to +7°
non-ferrous metal	+5° to +7°	+6° to +12°	+5° to +11°	+5° to +12°
aluminium alloys	+5° to +7°	+6° to +24°	+5° to +11°	+5° to +24°

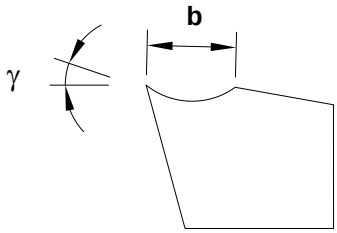
6.14.3 Types of cutting form levels

They are needed to influence the chip drain and the chip shape in order to achieve optimum chipping conditions.

Examples of types of cutting form levels



Img. 6-48: Cutting form level



Img. 6-49: Cutting form level with fillet

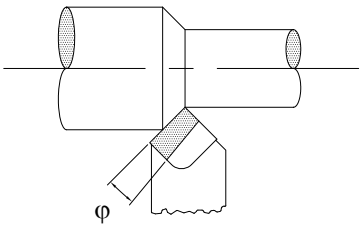
b = 1.0 mm to 2.2 mm

t = 0.4 mm to 0.5 mm

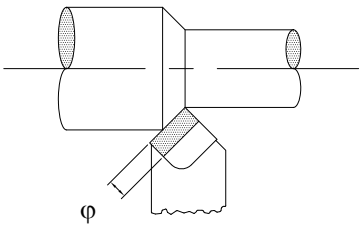
b = 2.2mm with fillet

For infeeds of 0.05 to 0.5mm/U and depths of cut of 0.2mm to 3.0mm.

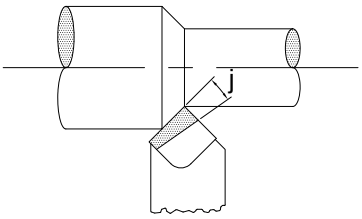
The different apex angles (φ) of the cutting form level need to conduct the chip.



Img. 6-50: Positive apex angle for planing



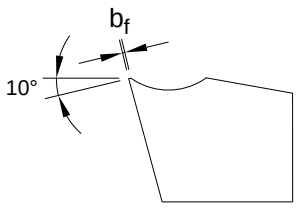
Img. 6-51: Neutral apex angle for planing and roughing



Img. 6-52: Negative apex angle for roughing

The ready-ground major cutting edge must be slightly ground with a grindstone for the planing.

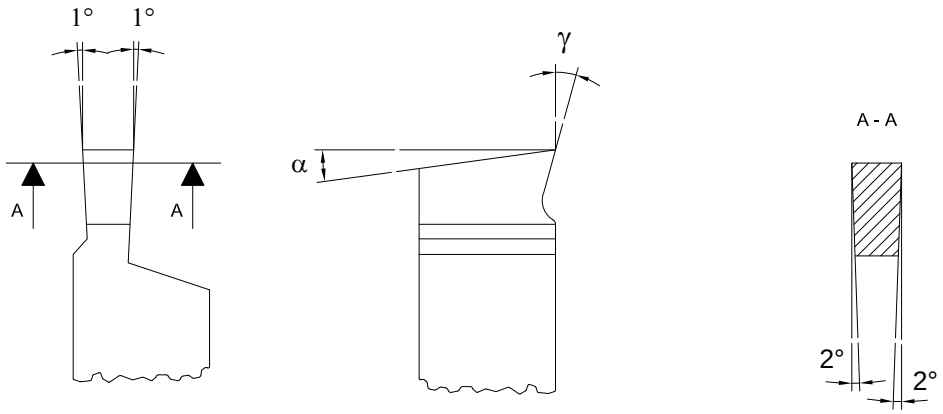
For the roughing, a small chamfer must be produced with the grindstone in order to stabilize the cutting edge against striking chips (b_f = f x 0.8).



Img. 6-53: Stabilize cutting edge

Polished section for recessing and cutting off

(for chip angle refer to table)



Img. 6-54: Polished section recessing and cutting off

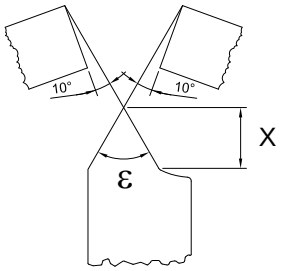
Polished section for threading

The point angle or the shape for chasing tools is depending on the type of thread.

Also refer to:

- ☞ "Thread types“ on page 39
- ☞ "Pitch angle“ on page 44

The measure X must be larger than the depth of thread. Make save that no chip angle is being ground as in this case there would be a strain of the profile.



Img. 6-55: Polished section for threading

6.15 Lifetime and wear characteristics

In the chipping shaping by lifetime we understand the time which the cutting edge survives (pure contact time).

The causes for the end of the lifetimes may be the following:

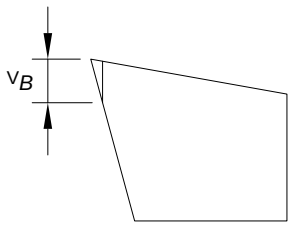
- dimensional deviation
- too high cutting pressure
- bad surface quality
- high burr formation for tool exit

The wear of clearance surface V_B and the crater wear K_T on the chipping surface is the most common type of tool wear. They are mainly formed by friction. The clearance surface wear has effects on the dimensional accuracy of the workpieces and on the cutting force (the cutting-force increases by 10% for each 0,1mm V_B). The clearance wear is generally used as lifetime criteria.

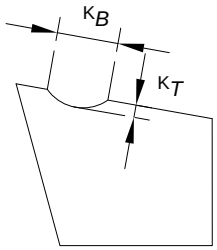
Crackings on the cutting edge may be caused by casting crusts or forging skins. Another cause may be ridge cracks (cracks transversal to the edge). Which are caused by thermal and mechanical shock loads such as interrupted cuts or short contact times for very hard cutting materials.

The cutting edge crack may be caused by selecting a too rough cutting material or by wrong selection for cutting data.

If a thermal excessive strain of the cutting material is existing, there would be a plastic deformation on the cutter.



Img. 6-56: Clearance surface wear



Img. 6-57: Crater wear

7 Maintenance

In this chapter you will find important information about

- Inspection
- Maintenance
- Repair

of the lathe.

ATTENTION !

Properly performed regular maintenance is an essential prerequisite for

- **operational safety,**
- **failure-free operation,**
- **long durability of the lathe and**
- **the quality of the products which you manufacture.**

Installations and equipment from other manufacturers must also be in good order and condition.

7.1 Safety

WARNING!

The consequences of incorrect maintenance and repair work may include:

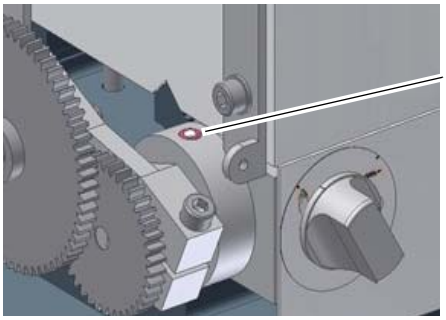
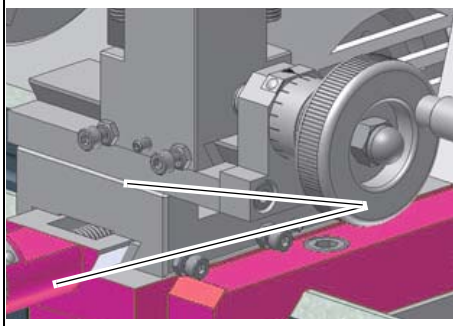
- **Very serious injury to personnel working on the lathe,**
- **Damage to the lathe.**

Only qualified personnel should carry out maintenance and repair work on the lathe.

7.2 Inspection and maintenance

The type and level of wear depends to a large extent on the individual usage and operating conditions. For this reason, all the intervals are only valid for the authorised conditions.

Interval	Where?	What?	How?
every week	**Machine bed**	Lubricate	➜ Lubricate all bright steel parts with non-corrosive lubricating oil. ☞ "Operating material“ on page 16
	Spindle stock	Testing	➜ Check that the fastening screws of the change gears on the quadrant and the fastening screws of the V-belt pulleys are firmly tightened.

Interval	Where?	What?	How?
Every month	Spindle stock	Lubricating	➜ Grease the leadscrew on the lubricating nipple.  Img. 7-1: Feed gear
every six months		Visual inspection	➜ Control if the synchronous belts are porous or worn.
as required	Lathe saddle	Readjusting	➜ Readjust the slideway clearance of the cross and top slide.  Img. 7-2: Lathe saddle

INFORMATION

The work spindle bearing is pre lubricated. It is not necessary to lubricate it again.

7.3 Repair

For any repair work, get assistance from an employee of 's technical service or send us the lathe.

If the repairs are carried out by qualified technical staff, they must follow the indications given in these operating instructions.

The company Optimum Maschinen Germany GmbH does not take responsibility nor does it guarantee for damages and failures resulting of non-observance of this operating manual. For repairs only use faultless and suitable tools and original spare parts or parts from series expressly authorised by Optimum Maschinen Germany GmbH.

8 Ersatzteile - Spare parts

8.1 Ersatzteilzeichnung Antrieb - Drawing spare parts actuation

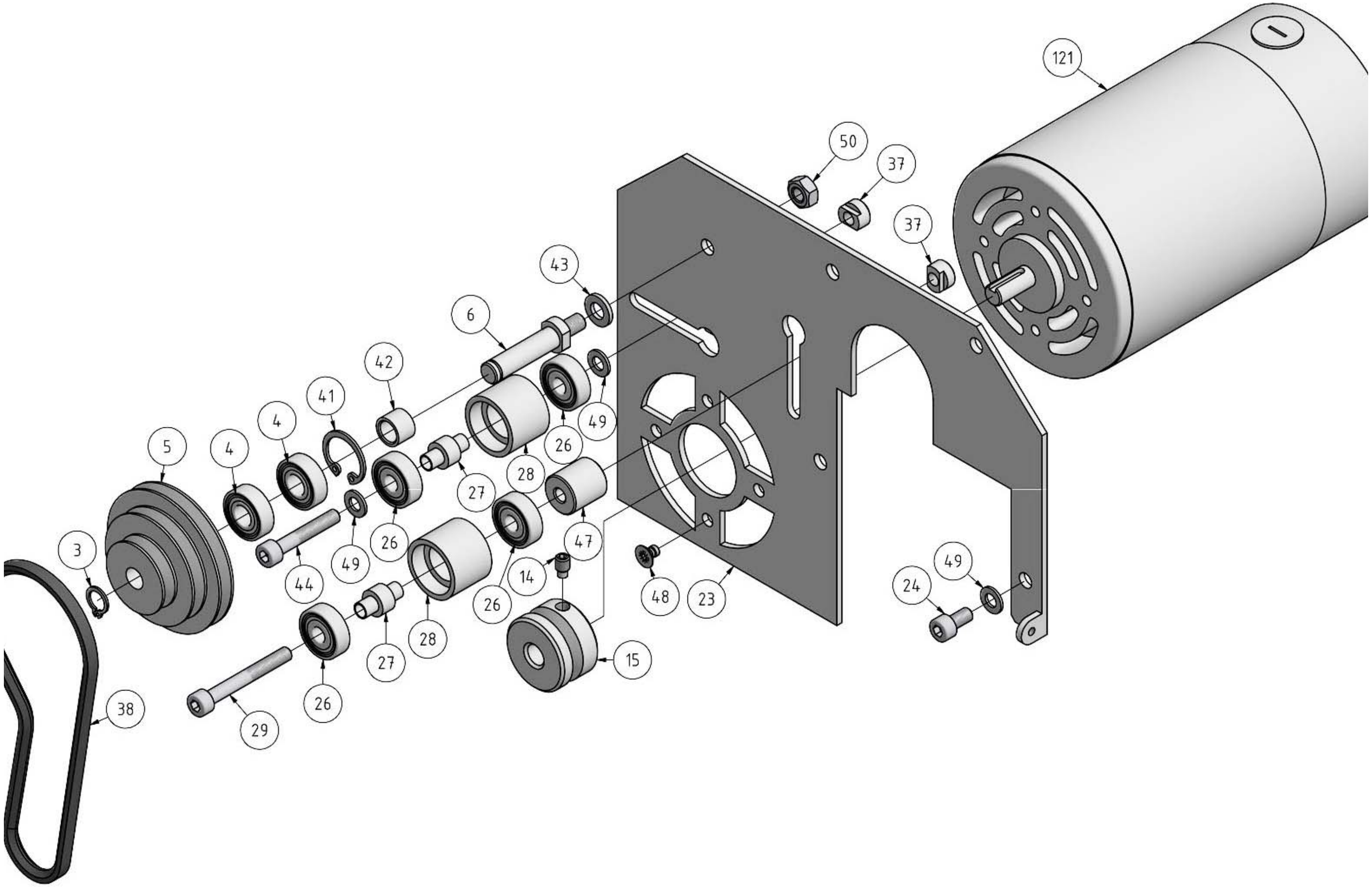


Abb. 8-1: Antrieb - Actuation

8.2 Ersatzteilzeichnung Spindelstock - Drawing spare parts headstock

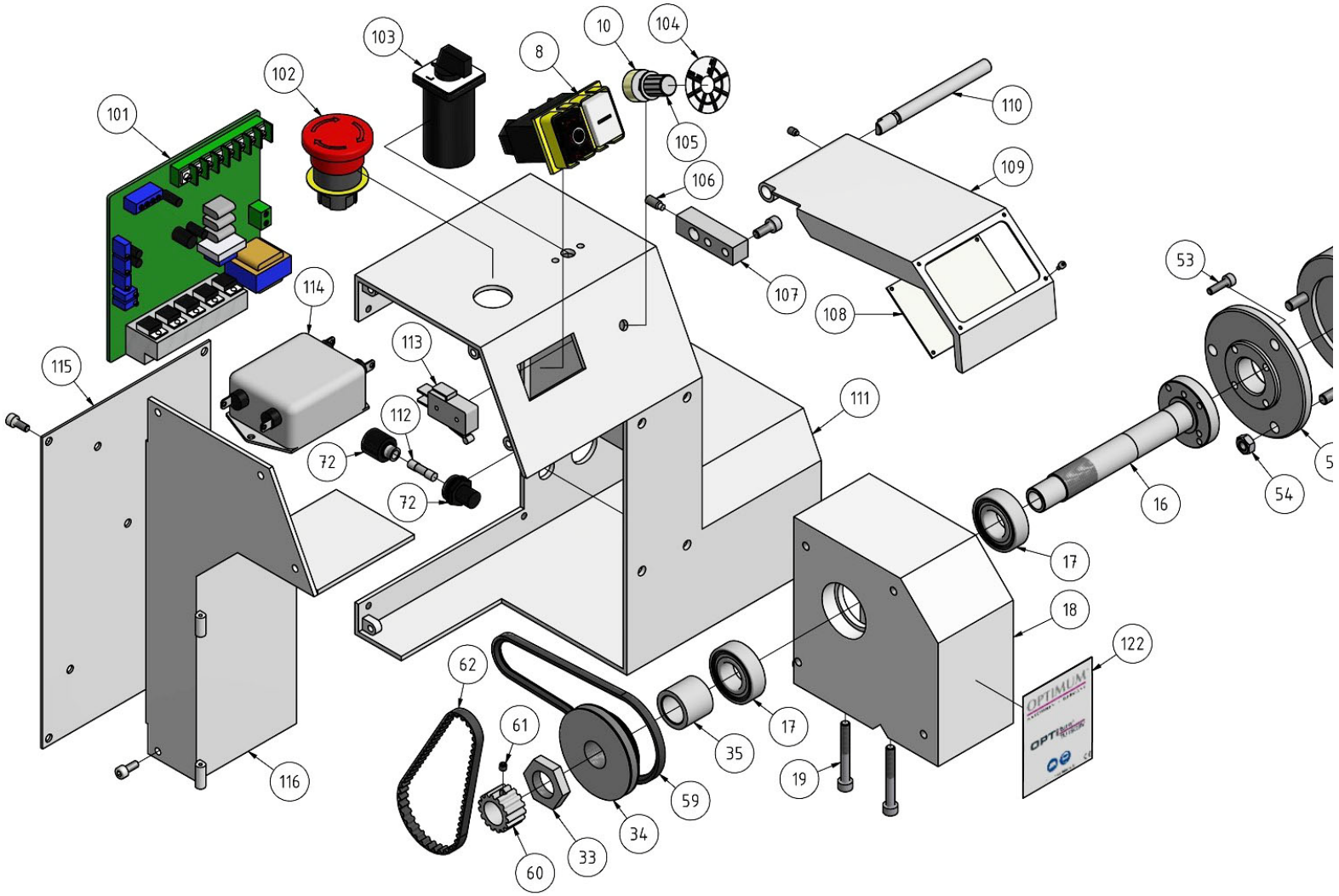


Abb. 8-2: Spindelstock - Headstock

8.3 Ersatzteilzeichnung Abdeckungen - Drawing spare parts covers

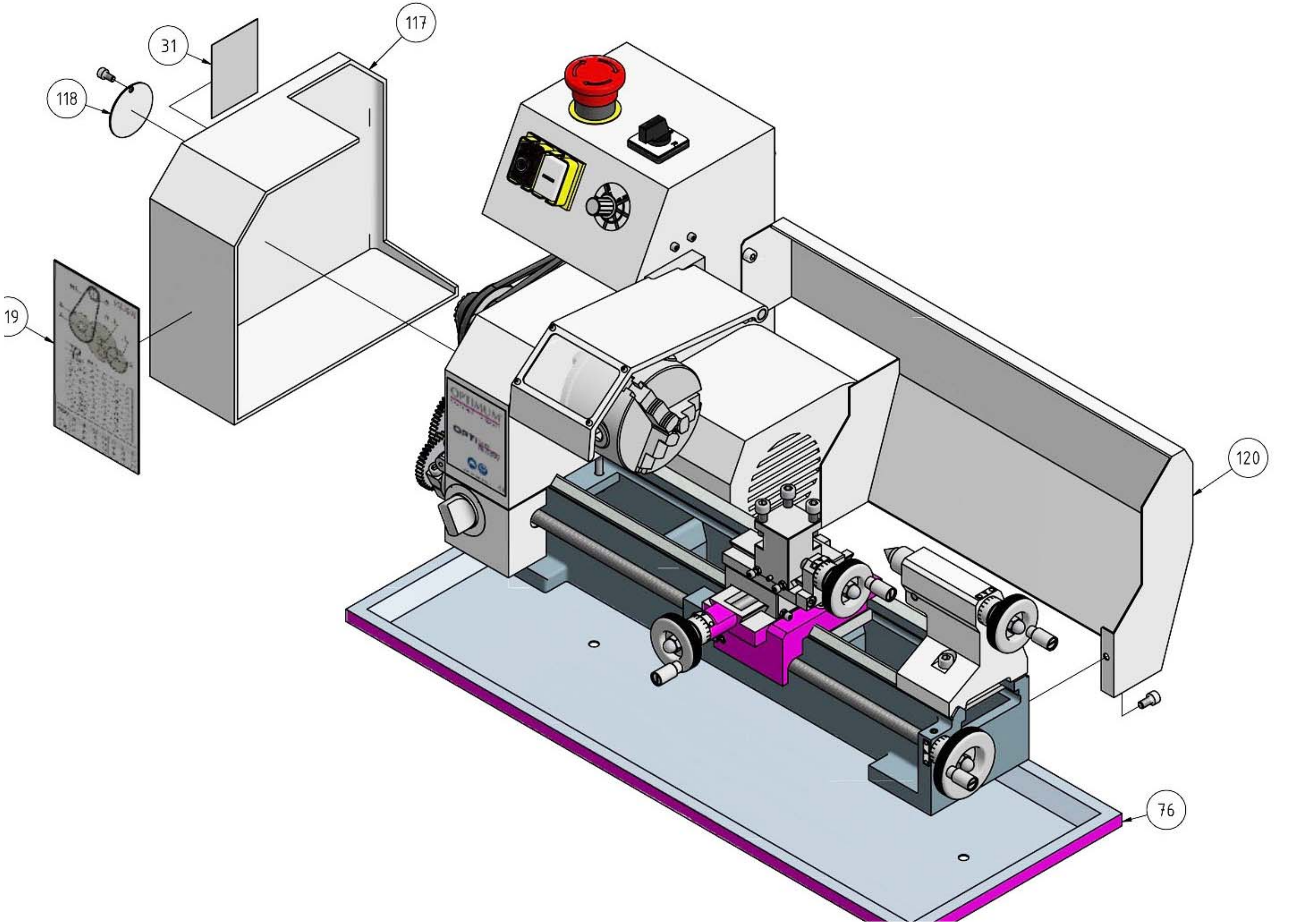


Abb.8-3: Abdeckungen - Covers

8.3.1 Ersatzteilliste Antrieb, Spindestock - Spare parts list actuation, headstock

Pos.	Bezeichnung	Designation	Menge Quan-tity	Grösse Size	Artikelnummer Article no.
3	Sicherungsring	Retaining ring	2	DIN 471 - 8x0,8	
4	Kugellager	Ball bearing	2	698-2Z	040698.Z
5	Keilriemenscheibe	V-belt pulley	1		0342025105
6	Feste Welle	Fix shaft	1		
14	Gewindestift	Grub screw	1	GB 79-85 - M5 x 8	0342025107
15	Motorscheibe	Motor pulley	1		0342025115
16	Spindel	Spindle	1		0342025116
17	Kugellager	Ball bearing	2	6003-2Z	0406003.2R
18	Spindelstock	Head stock	1		0342025118
19	Innensechskantschraube	Socket head screw	4	GB 70-85 - M5 x 40	
23	Grundplatte	Support plate	1		0342025123
24	Innensechskantschraube	Socket head screw	4	GB 70-85 - M5 x 10	
26	Kugellager	Ball bearing	4	626-2Z	040626
27	Buchse	Bushing	2		0342025127
28	Spannrolle	Tension pulley	2		0342025128
29	Innensechskantschraube	Socket head screw	1	GB 70-85 - M5 x 40	
33	Sechskantmutter	Hexagon nut	1		0342025133
34	Keilriemenscheibe	V-belt pulley	1		0342025134
35	Abstandshülse	Spacer	1		0342025135
37	Klemmmuter	Klamping nut	2		0342025137
38	Keilriemen	V-Belt	1		03912060
41	Sicherungsring	Retaining ring	1	DIN 472 - 19 x 1	
42	Buchse	Bushing	1		0342025142
43	Scheibe	Washer	1	DIN 125 - A 6,4	
47	Buchse	Bushing	1		0342025147
48	Schraube	Screw	4	ISO 7046-M4 x 6	
49	Scheibe	Washer	4	DIN 125 - A 5,3	
50	Sechskantmutter	Hexagon nut	1	ISO 4032 - M6	
53	Innensechskantschraube	Socket head screw	4	GB 70-85 - M4 x 14	
54	Sechskantmutter	Hexagon nut	3	ISO 4032 - M6	
55	Flansch	Flange	1		0342025155
56	Gewindebolzen	Thread bolt	3		
57	Dreibackenfutter	3-jaw chuck	1		3440287
59	Keilriemen	V-Belt	1		0342025159
60	Zahnrad	Gear belt	1	Z=16	03420251519
61	Gewindestift	Grub screw	1	DIN 4026/M4x4	
62	Zahnriemen	Gear belt	1		0391265
72	Sicherungsgehäuse	Fuse housing	2		0342025172
76	Spänewanne	Chip pan	1		0342025176
101	Steuerplatine	Control card	1		03420260101
102	Not-Aus-Schalter	Emergehcy stip button	1		03420260102
103	Drehrichtungsschalter	Change over switch	1		03420260103
104	Skala	Scale	1		03420260104
105	Knopf	Knob	1		03420260105
106	Gewindestift	Grub pin	1		03420260106
107	Platte	Plate	1		03420260107
108	Schutzglas	Safety glass	1		03420260108
109	Drehfutterschutz	Lathe chuck safety	1		03420260109
110	Welle	Shaft	1		03420260110
111	Gehäuse	Housing	1		03420260111
112	Sicherung	Fuse	1		03420260112
113	Sicherheitsschalter	Safety switch	1		03420260113
114	Netzfilter	Line filter	1		03420260114
115	Abdeckung	Cover	1		03420260115
116	Halter	Holder	1		03420260116
117	Riemenabdeckung	Belt cover	1		03420260117
118	Abdeckung	Cover	1		03420260118
119	Wechselradtabelle	Change wheel table	1		03420260119
120	Spritzwand	Dash panel	1		03420260120
121	Motor	Motor	1		03420260121
122	Maschinenlabel	Machine label	1		03420260122

8.4 Ersatzteilzeichnung Planschlitten, Oberschlitten- Drawing spare parts cross slide, top slide

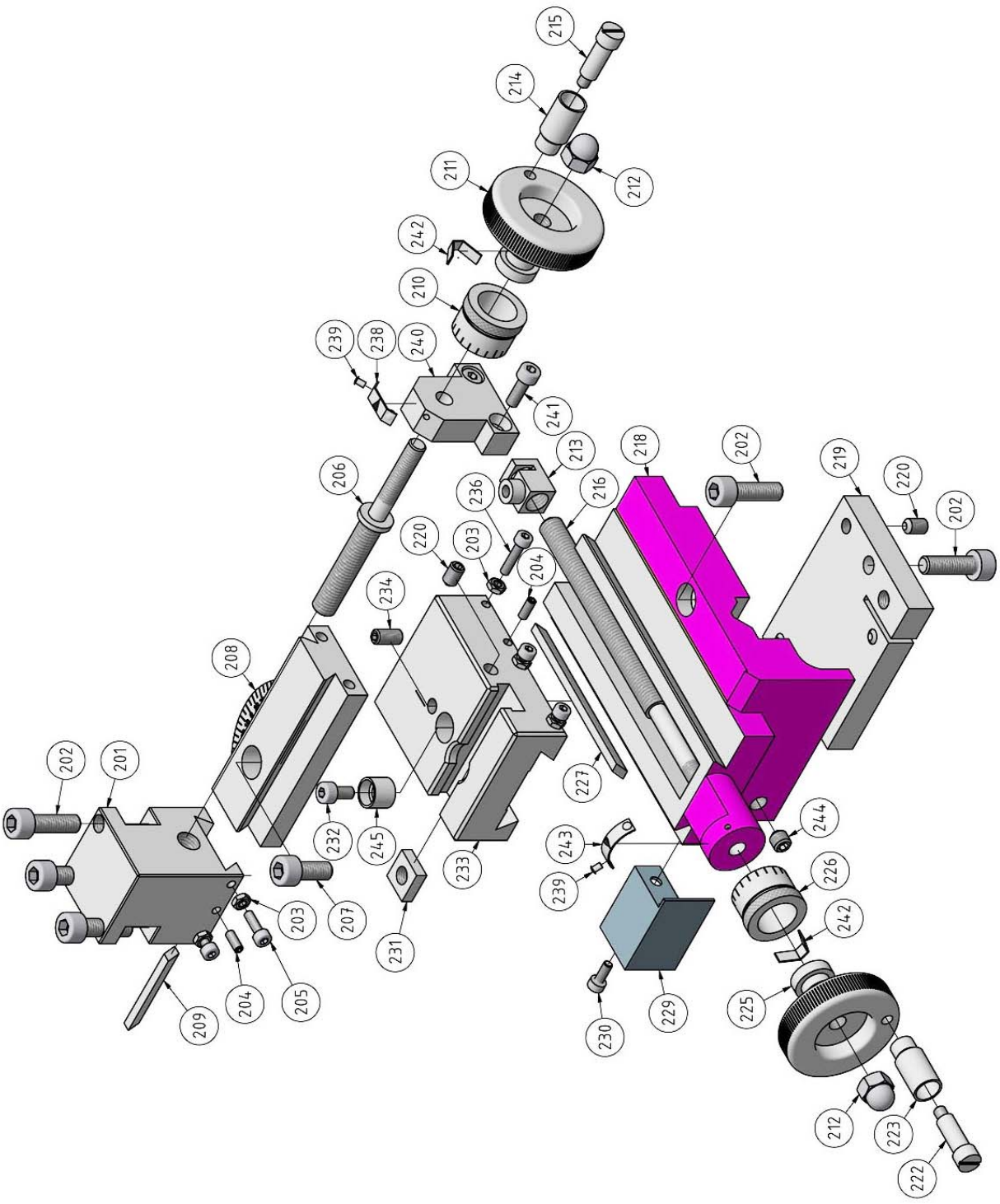


Abb.8-4: Planschlitten, Oberschlitten - Cross slide, top slide

8.4.1 Ersatzteile Planschlitten, Oberschlitten - Spare parts list cross slide, top slide

Pos.	Bezeichnung	Designation	Menge Quan-tity	Grösse Size	Artikelnummer Article no.
201	Werkzeughalter	Tool rest	1		03420251201
202	Innensechskantschraube	Socket head screw	3	GB 70-85 - M6 x 20	
203	Sechskantmutter	Hexagon nut	5	ISO 4032 - M3	
204	Gewindestift	Grub screw	2	GB 78-85 - M3 x 8	
205	Innensechskantschraube	Socket head screw	2	GB 70-85 - M3 x 10	
206	Spindel	Top lead screw	1		03420251206
207	Innensechskantschraube	Socket head screw	1	GB 70-85 - M6 x 14	
208	Oberschlitten	Top slide	1		03420251208
209	Keilleiste	Gib	1		03420251209
210	Skalenring	Scale ring	1		03420251210
211	Handrad	Handwheel	1		03420251211
212	Hutmutter	Cap nut	2	GB 923-88 - M6	
213	Spindelmutter	Feeding nut	1		03420251213
214	Hülse	Sleeve	1		03420251214
215	Schraube	Screw	1		03420251215
216	Spindel	Feeding lead screw	1		03420251216
218	Planschlitten	Cross slide	1		03420251218
219	Klemmplate	Clamping plate	1		03420251219
220	Gewindestift	Grub screw	5	GB 80-85 - M5 x 8	
222	Schraube	Screw	1		03420251222
223	Hülse	Sleeve	1		03420251223
225	Handrad	Hand wheel	1		03420251225
226	Skalenring	Scale ring	1		03420251226
227	Keilleiste	Gib	1		03420251227
229	Abdeckung	Cover	1		03420251229
230	Innensechskantschraube	Socket head screw	1	GB 70-85 - M3 x 8	
231	Vierkantmutter	4-side nut	1		03420251231
232	Innensechskantschraube	Socket head screw	1	GB 70-85 - M4 x 8	
233	Planschlitten	Cross slide	1		03420251233
234	Gewindestift	Grub screw	1	GB 78-85 - M5 x 10	
236	Innensechskantschraube	Socket head screw	3	GB 70-85 - M3 x 14	
238	Skala	Scale	1		03420251238
239	Niet	Rivet	4		
240	Halter	Holder	1		03420251240
241	Innensechskantschraube	Socket head screw	2	GB 70-85 - M4 x 12	
242	Feder	Spring			03420251242
243	Scala	Scale	1		03420251243
244	Gewindestift	Grub screw	1	GB 80-85 - M6 x 6	
245	Buchse	Bushing	1		03420251245
226	Skalenring	Scale ring	1		03420251226
227	Keilleiste	Gib	1		03420251227
229	Abdeckung	Cover	1		03420251229
230	Innensechskantschraube	Socket head screw	1	GB 70-85 - M3 x 8	
231	Vierkantmutter	4-side nut	1		03420251231
232	Innensechskantschraube	Socket head screw	1	GB 70-85 - M4 x 8	
233	Planschlitten	Cross slide	1		03420251233
234	Gewindestift	Grub screw	1	GB 78-85 - M5 x 10	
236	Innensechskantschraube	Socket head screw	3	GB 70-85 - M3 x 14	
238	Skala	Scale	1		03420251238
239	Niet	Rivet	4		
240	Halter	Holder	1		03420251240
241	Innensechskantschraube	Socket head screw	2	GB 70-85 - M4 x 12	
242	Feder	Spring			03420251242
243	Scala	Scale	1		03420251243
244	Gewindestift	Grub screw	1	GB 80-85 - M6 x 6	
245	Buchse	Bushing	1		03420251245

8.5 Ersatzteilzeichnung Maschinenbett - Drawing spare parts machine bed

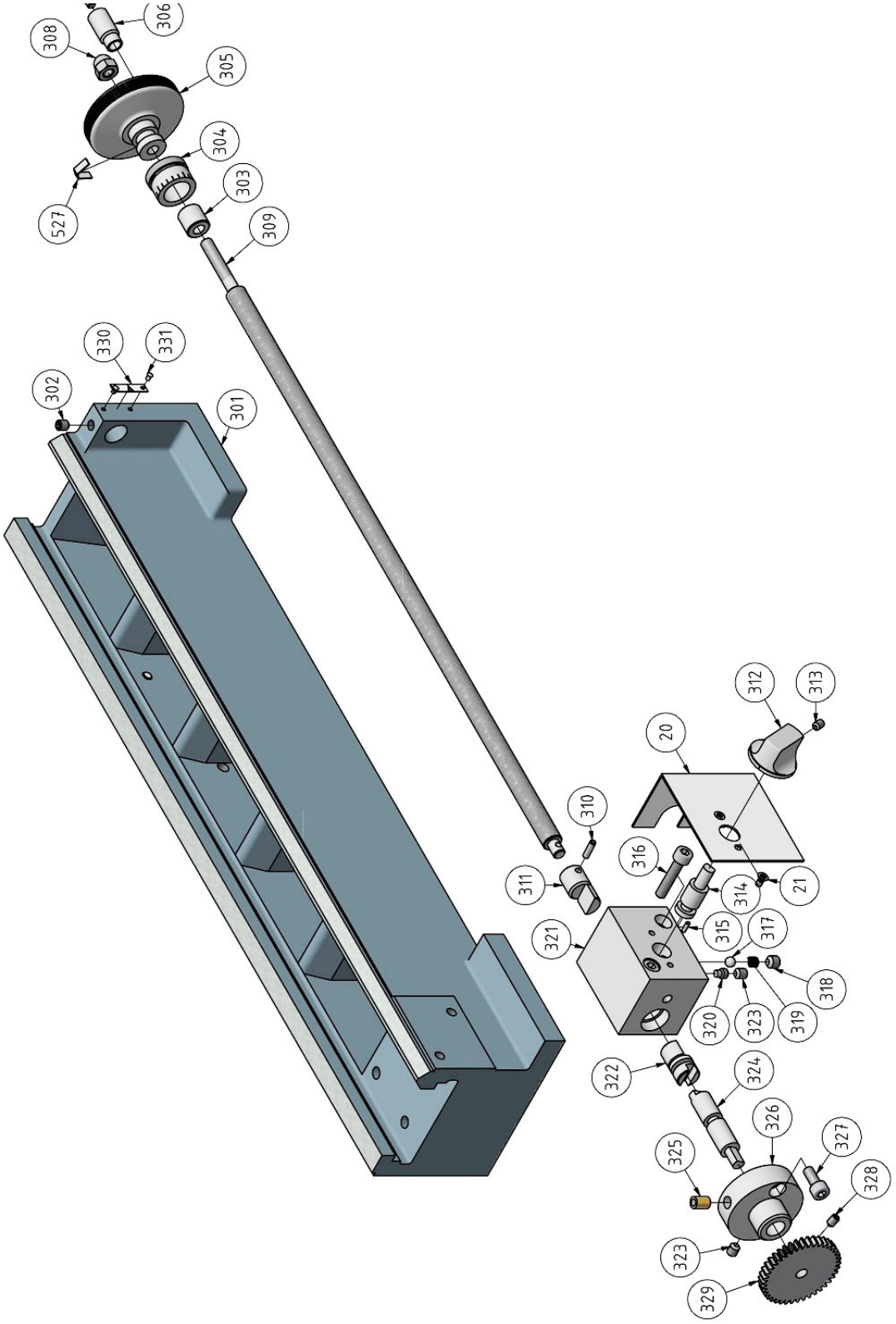


Abb. 8-5: Maschinenbett - Machine bed

8.5.1 Ersatzteile Maschinenbett - Spare parts list machine bed

Pos.	Bezeichnung	Designation	Menge Quan-tity	Grösse Size	Artikelnummer Article no.
301	Maschinenbett	Machine bed	1		03420251301
302	Gewindestift	Grub screw	3	GB 80-85 - M5 x 6	
303	Buchse	Bushing	1		03420251303
304	Skalenring	Scale ring	1		03420251304
305	Handrad	Handwheel	1		03420251305
306	Hülse	Sleeve	1		03420251306
307	Schraube	Screw	1		03420251307
308	Hutmuter	Cap nut	1	GB 923-88 - M6	
309	Leitspindel	Lead spindle	1		03420251309
310	Zylinderstift	Straight pin	1	GB 879-86 - 3 x 10	
311	Kupplung	Clutch	1		03420251311
312	Drehknopf	Knob	1		03420251312
313	Gewindestift	Grub screw	1	GB 80-85 - M4 x 6	
314	Welle	Shaft	1		03420251314
315	Zylinderstift	Straight pin	1	GB 119-86 - 2 x 6	
316	Innensechskantschraube	Socket head screw	2	GB 70-85 - M5 x 25	
317	Stahlkugel	Steel ball	1		03420251317
318	Gewindestift	Grub screw	1	GB 80-85 - M6 x 6	
319	Feder	Spring	1		03420251319
320	Gewindestift	Grub screw	1	GB 79-85 - M5 x 6	
321	Halter links	Left support	1		03420251321
322	Verbindung	Connector	1		03420251322
323	Gewindestift	Grub screw	1	GB 80-85 - M5 x 6	
324	Welle	Shaft	1		03420251324
325	Schmiernippel	Lubrication cup	1		03420251325
326	Flansch	Flange	1		03420251531
327	Innensechskantschraube	Socket head screw	1	GB 70-85 - M5 x 12	
328	Gewindestift	Grub screw	1	GB 80-85 - M4 x 6	
329	Zahnrad	Gear	1	Z=20	03420251505
329	Zahnrad	Gear	1	Z=40	03420251506
330	Skala	Scale	1		03420251331
331	Niet	Rivet	2		03420251332

8.6 Ersatzteilzeichnung Reitstock - Drawing spare parts tailstock

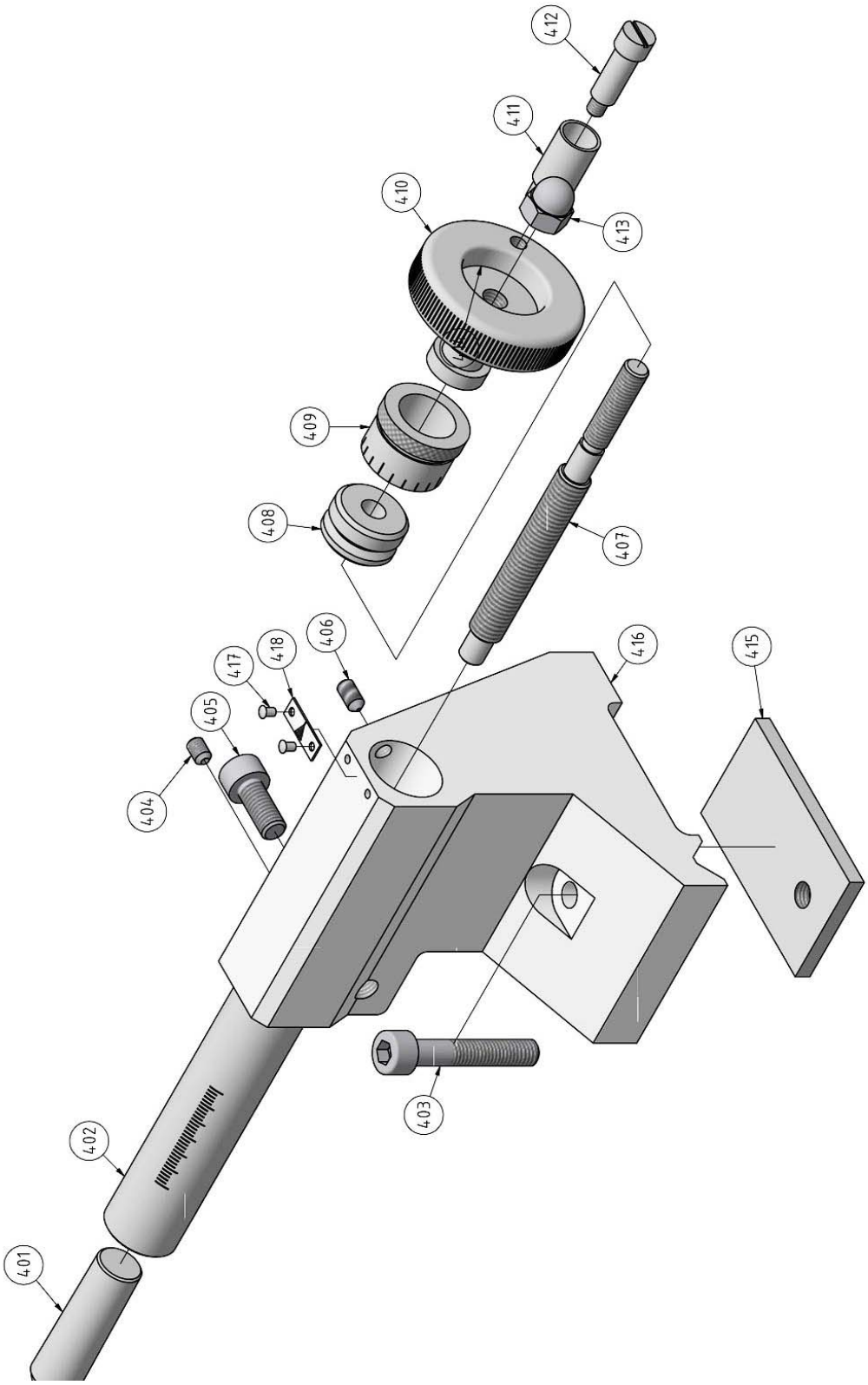


Abb. 8-6: Reitstock - Tailstock

8.6.1 Ersatzteile Reitstock - Spare parts tailstock

Pos.	Bezeichnung	Designation	Menge Quan-tity	Grösse Size	Artikelnummer Article no.
401	Zentrierspitze	Dead center	1		03420251401
402	Pinole	Pinole	1		03420251402
403	Innensechskantschraube	Socket head screw	1	GB 70-85 - M6 x 35	
404	Gewindestift	Grub screw	1	GB 80-85 - M4 x 6	
405	Innensechskantschraube	Socket head screw	1	GB 70-85 - M6 x 14	
406	Gewindestift	Grub screw	1	ISO 4027 - M4 x 8	
407	Spindel	Spindle	1		03420251407
408	Buchse	Bushing	1		03420251408
409	Skalenring	Skale ring	1		03420251409
410	Handrad	Handwheel	1		03420251410
411	Hülse	Sleeve	1		03420251411
412	Schraube	Screw	1		03420251412
413	Hutmutter	Cap screw	1	GB 923-88 - M6	
414	Feder	Spring	1		03420251414
415	Klemmplate	Clamping plate	1		03420251415
416	Gehäuse Reitstock	Tailstock body	1		03420251416
417	Niet	River	2		03420251417
418	Skala	Scale	1		03420251418
	Reitstock komplett	Tailstock complete			03420251416CPL

8.7 Ersatzteilzeichnung Wechselradgetriebe - Drawing spare parts change gear

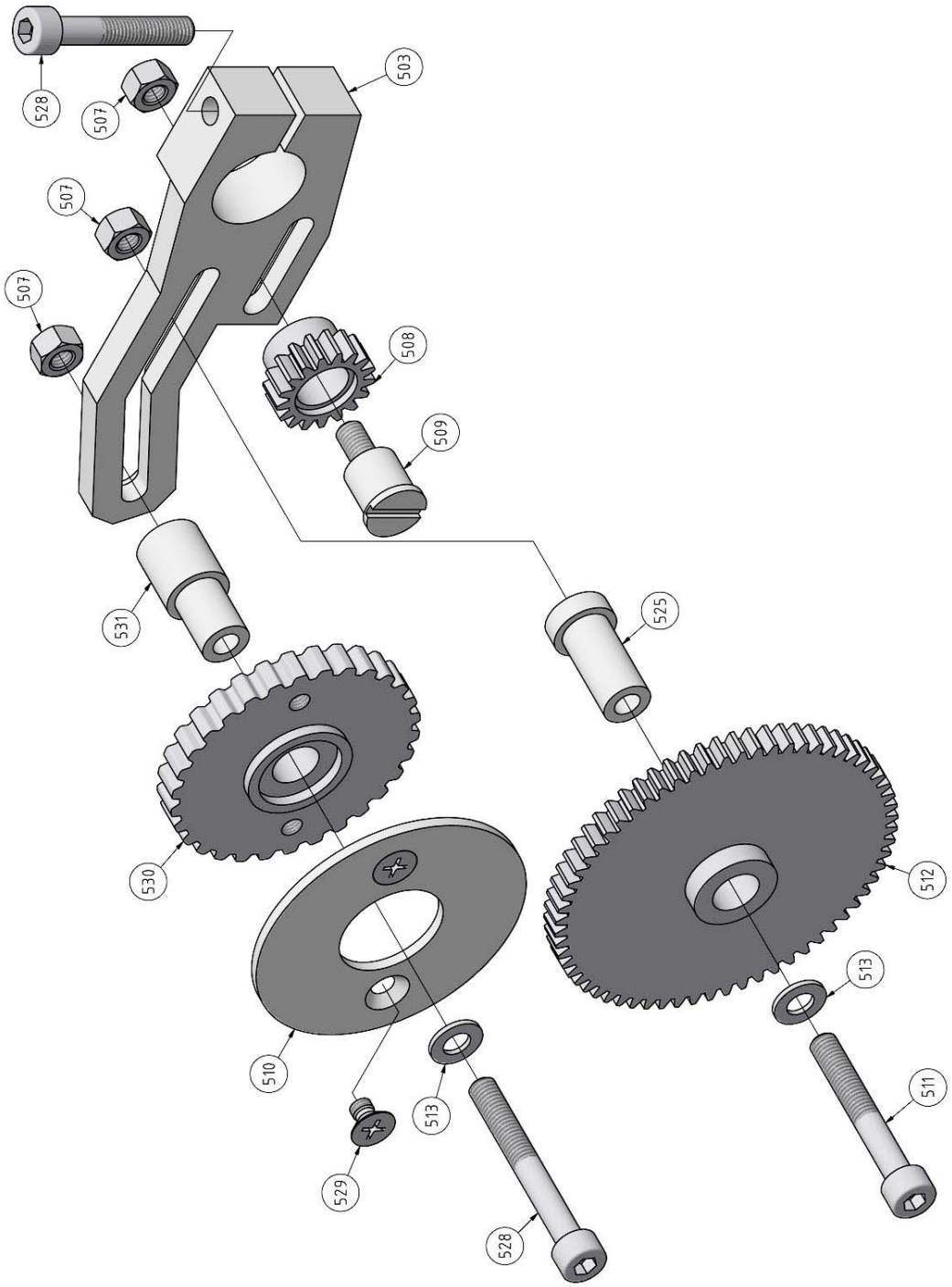


Abb.8-7: Wechselradgetriebe - Change gear

8.7.1 Ersatzteile Wechselradgetriebe - Spare parts change gear

Pos.	Bezeichnung	Designation	Menge Quan-tity	Grösse Size	Artikelnummer Article no.
503	Führungsplatte	Support plate	1		03420251503
507	Sechskantschraube	Socket head screw	3	GB 6170-86 - M5	
508	Zahnrad	Gear	1	Z=17	03420251508
509	Schraube	Screw	1		03420251509
510	Scheibe	Washer	1		03420251510
511	Innensechskantschraube	Socket head screw	1	GB 70-85 - M5 x 35	
512	Zahnrad	Gear	1	Z=16/64	03420251512
513	Scheibe	Washer	2	DIN 125 - A 5,3	
520	Zahnrad	Gear	1	Z=30	03420251520
521	Zahnrad	Gear	1	Z=28	03420251521
522	Zahnrad	Gear	1	Z=25	03420251522
523	Zahnrad	Gear	1	Z=20	03420251523
524	Zahnrad	Gear	1	Z=32	03420251524
525	Buchse	Bushing	1		03420251525
528	Innensechskantschraube	Socket head screw	1	GB 70-85 - M5 x 30	
529	Schraube	Screw	2	ISO 7046-M4 x 6	
530	Zahnrad	Gear	1	Z=30/16	03420251530
531	Buchse	Bushing	1		03420251531
	Zubehör komplett	Accessory box cpl.			0341438

8.8 Maschinenschilder - Machine labels

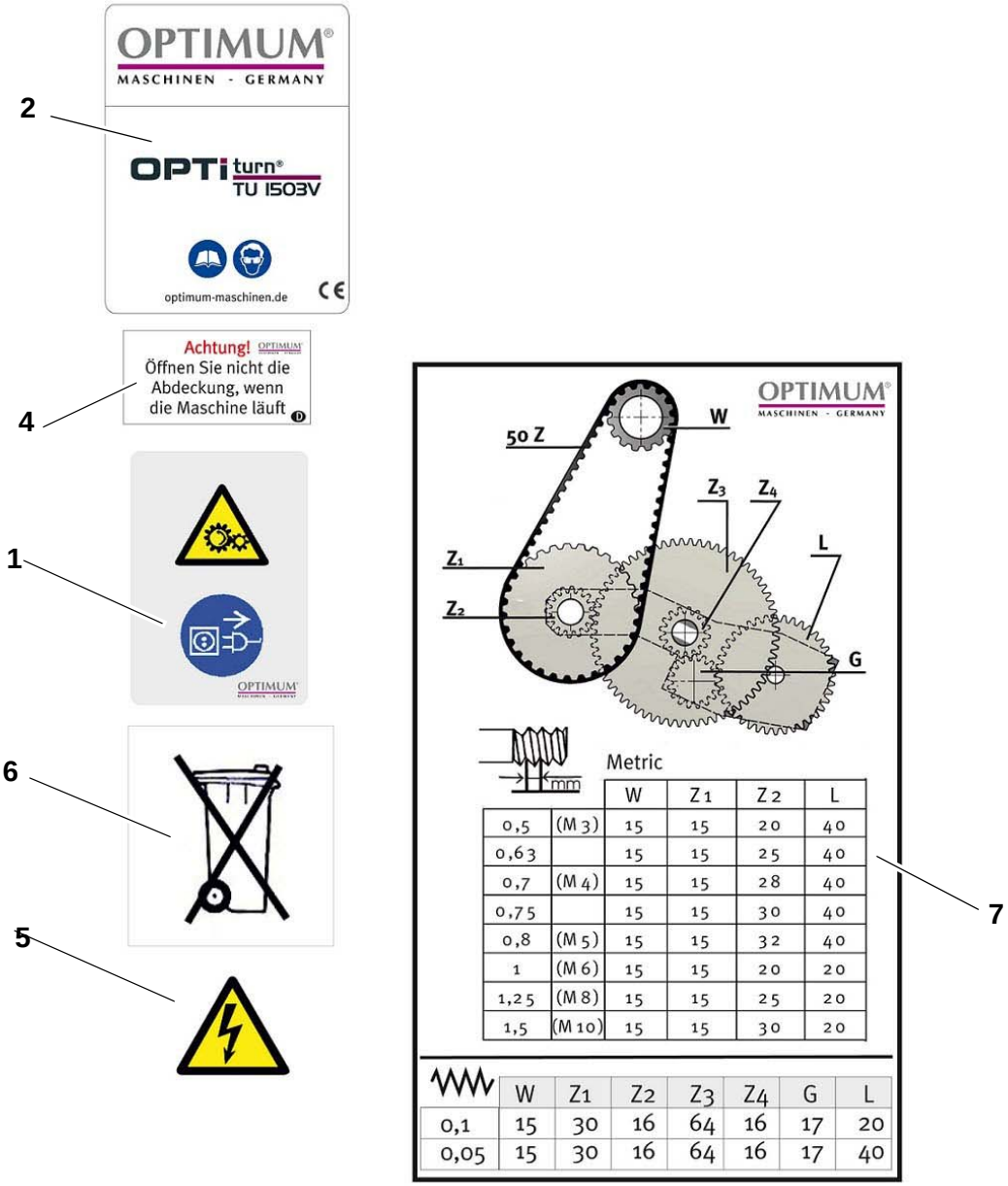


Abb. 8-8: Maschinenschilder - Machine labels

8.8.1 Maschinenschilder - Machine labels

Pos.	Bezeichnung	Designation	Menge Quan-tity	Grösse Size	Artikelnummer Article no.
1	Sicherheitsschild	Safety label	1		03420251L01
2	Frontschild	Front label	1		03420251L02
4	Sicherheitsschild	Safety label	1		03420251L04
5	Sicherheitsschild	Safety label	1		03420251L05
6	Hinweisschild	Instruction label	1		03420251L06
7	Gewindeschneidtabelle	Tapping table	1		03420251L07

8.9 Schaltplan - Wiring diagram

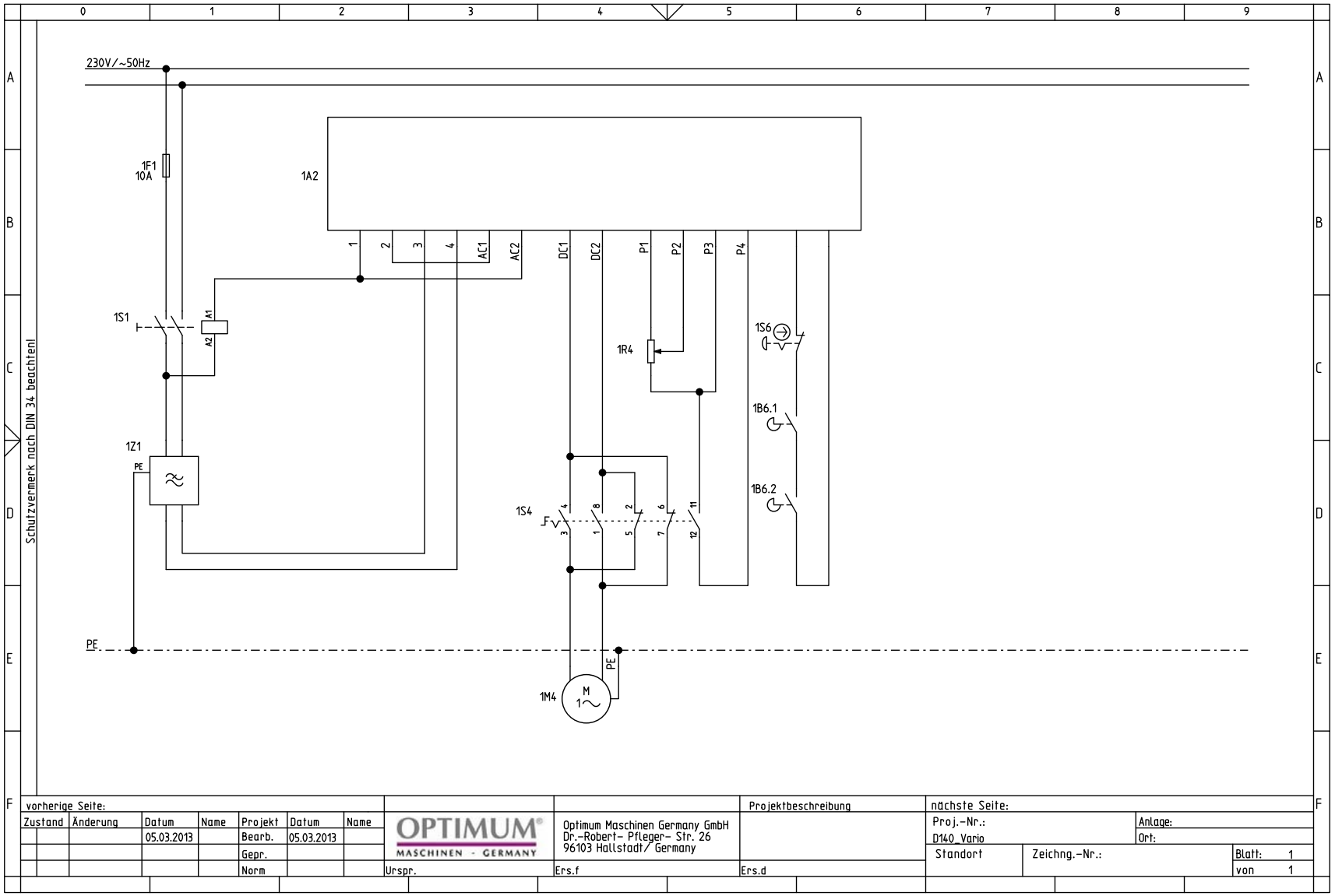


Abb. 8-9: Schaltplan - Wiring diagram

8.9.1 Ersatzteile elektrische Bauteile - Spare parts electrical components

Pos.	Bezeichnung	Designation	Menge Quan-tity	Grösse Size	Artikelnummer Article no.
1F1	Sicherung	Fuse	1		034202601F1
1S1	Ein-Aus-Schalter	On-Off switch	1		034202601S1
1Z1	Netzfilter	Line filter	1		034202601Z1
1A2	Steuerplatine	Control board	1		034202601A2
1R4	Potentiometer	Potentiometer	1		034202601R4
1S4	Drehrichtungsschalter	Change over switch	1		034202601S4
1M4	Motor	Motor	1		034202601M4
1S6	Not-Aus-Schalter	Emergency stop button	1		034202601S6
1B6.2	Sicherheitsschalter Riemenabdekkung	Belt cover safety switch	1		034202601B6.2
1B6.1	Sicherheitsschalter Drehfut-terschutz	Drill chuck safety switch	1		034202601B6.1

9 Malfunctions

9.1 Malfunctions on the lathe

Malfunction	Cause/ possible effects	Solution
Surface of workpiece too rough	• Tool blunt • Tool springs • Feed too high • Radius at the tool tip too small	• Resharpen tool • Clamp tool with less overhang • Reduce feed • Increase radius
Workpiece becomes conical	• Top slide is not exactly set to zero (when turning with the top slide)	• Set top slide to exact zero position
Lathe is chattering	• Feed too high • Main bearings have clearance	• Reduce feed • Have the main bearings readjusted
Center runs hot	• Workpiece has expanded	• Loosen tailstock center
Tool has a short edge life	• Hard casting skin • Cutting speed to high • Crossfeed to high • Insufficient cooling	• First break casting skin • Reduce cutting speed • Lower crossfeed (smooth finish allowance not over 0,5 mm) • More coolant
Flank wear too high	• Clearance angle too small (tool "pushes") • Tool tip not adjusted to center height	• Increase clearance angle • Correct height adjustment of the tool
Cutting edge breaks off	• Wedge angle too small (heat buildup) • Grinding cracks due to wrong cooling • Excessive clearance in the spindle bearing arrangement (vibrations)	• Increase wedge angle • Cool uniformly • Have the clearance in the spindle bearing arrangement readjusted. If necessary, replace the tapered roller bearings.
Cut thread is wrong	• Tool is clamped incorrectly or has been started grinding the wrong way • Wrong pitch • Wrong diameter	• Adjust tool to the center • Grind angle correctly • Adjust right pitch • Turn the workpiece to the correct diameter

10 Appendix

10.1 Copyright

10.2 Terminology/Glossary

Term	Explanation
Spindle stock	Housing for the feed gear and the synchronous belt pulleys.
Lathe chuck	Clamping tool for holding the workpiece.
Drill chuck	Drill bit chuck
Lathe saddle	Slide on the slideway of the machine bed which feeds parallel to the tool axis.
Cross slide	Slide on the lathe saddle which moves transversely to the tool axis.
Top slide	Swivelling slide on the cross slide.
Taper mandrel	Taper of the bid, the drill chuck or the center.
Tool	Cutting tool, bit, etc.
Workpiece	Piece to be turned or machined.
Tailstock	Movable turning aid.
Rest	Follow or steady support for turning long workpieces.
Lathe dog	Device or clamping aid for driving pieces to be turned between centers.

10.3 Change information operating manual

Chapter	Short note	new version number
5.2	Control and indicating elements	1.0.1
EC declaration	changed standard	1.0.2

10.4 Liability claims for defects / warranty

Beside the legal liability claims for defects of the customer towards the seller the manufacturer of the product, OPTIMUM GmbH, Robert-Pfleger-Straße 26, D-96103 Hallstadt, does not grant any further warranties unless they are listed below or had been promised in the frame of a single contractual agreement.

- The processing of the liability claims or of the warranty is performed as chosen by OPTIMUM GmbH either directly or through one of its dealers.
  Any defective products or components of such products will either be repaired or replaced by components which are free from defects. The property of replaced products or components passes on to OPTIMUM Maschinen Germany GmbH.
- The automatically generated original proof of purchase which shows the date of purchase, the type of machine and the serial number, if applicable, is the precondition in order to assert liability or warranty claims. If the original proof of purchase is not presented, we are not able to perform any services.
- Defects resulting of the following circumstances are excluded from liability and warranty claims:
  - Using the product beyond the technical options and proper use, in particular due to overstraining of the machine.
  - Any defects arising by one's own fault due to faulty operations or if the operating manual is disregarded.
  - Inattentive or incorrect handling and use of improper equipment.
  - Non-authorized modifications and repairs.
  - Insufficient installation and safeguarding of the machine
  - Disregarding the installation requirements and conditions of use.
  - Atmospheric discharges, overvoltage and lightning strokes as well as chemical influences.
- The following items are as well not subject to the liability or warranty claims:
  - Wearing parts and components which are subject to a standard wear as intended such as e.g. V-belts, ball bearings, illuminants, filters, sealings, etc.
  - Non reproducible software errors
- Any services which OPTIMUM GmbH or one of its agents performs in order to fulfill in the frame of an additional guarantee are neither an acceptance of the defects nor an acceptance of its obligation to compensate. Such services do neither delay nor interrupt the warranty period.
- Place of jurisdiction among traders is Bamberg.
- If one of the above mentioned agreements is totally or partially inefficient and/or null, it is considered as agreed what is closest to the will of the warrantor and which remains in the framework of the limits of liability and warranty which are predefined by this contract.

10.5 Note regarding disposal / options to reuse:

Please dispose of your device environmentally friendly by disposing of scrap in a professional way.

Please neither throw away the packaging nor the used machine later on, but dispose of them according to the guidelines established by your city council/municipality or by the corresponding waste management enterprise.

10.5.1 Decommissioning

CAUTION!

Used devices need to be decommissioned in a professional way in order to avoid later misuses and endangerment of the environment or persons.

- **Pull off the mains plug.**
- **Cut the connection cable.**
- **Remove all environmentally hazardous operating fluids from the used device.**
- **If applicable remove batteries and accumulators.**
- **Disassemble the machine if required into easy-to-handle and reusable assemblies and component parts.**
- **Supply the machine components and operating fluids to the provided disposal routes.**

10.5.2 Disposal of the packaging of new devices

All used packaging materials and packaging aids of the machine are recyclable and generally need to be supplied to the material reuse.

The packaging wood can be supplied to the disposal or the reuse.

Any packaging components made of cardboard box can be chopped up and supplied to the waste paper collection.

The films are made of polyethylene (PE) and the cushion parts are made of polystyrene (PS). These materials can be reused after reconditioning if they are forwarded to a collection station or to the appropriate waste management enterprise.

Only forward the packaging materials correctly sorted to allow a direct reuse.

10.5.3 Disposing of the old device

INFORMATION

Please take care in your interest and in the interest of the environment that all component parts of the machine are only disposed of in the intended and admitted way.

Please note that the electrical devices include lots of reusable materials as well as environmentally hazardous components. Account for separate and professional disposal of the component parts. In case of doubt, please contact your municipal waste management. If appropriate, call on the help of a specialist waste disposal company for the treatment of the material.

10.5.4 Disposal of electrical and electronic components

Please make sure that the electrical components are disposed of professionally and according to the legal regulations.

The device includes electric and electronic components and must not be disposed of with the rubbish. According to the European directive 2002/96/EG regarding electrical and electronic used devices and the execution of national rights used electrical tools and electrical machines need to be collected separately and be supplied to an environmentally compatible reuse.

Being the machine operator you should obtain information regarding the authorized collection or disposal system which applies for your company.

Please make sure that the batteries and/or accumulators are disposed of in a professional way according to the legal regulations. Please only throw discharged batteries in the collection boxes in shops or at municipal waste management companies.

INFORMATION

Used coolant emulsions and oils should not be mixed up since it is only possible to reuse used oils which had not been mixed up without pre-treatment.

The disposal notes for the used lubricants are made available by the manufacturer of the lubricants. If necessary, request the product-specific data sheets.

10.6 Disposal via municipal collection

Disposal of used electrical and electronic components
(Applicable in the countries of the European Union and other European countries with a separate collecting system for those devices).

The sign on the product or on its packing indicates that the product must not be handles as common household waist, but that is needs to be delivered to a central collection point for recycling. Your contribution to the correct disposal of this product will protect the environment and the health of your fellow men. The environment and the health are endangered by incorrect disposal. Recycling of material will help to reduce the consumption of raw materials. Your District Office, the municipal waste collection station or the shop where you have bought the product will inform you about the recycling of this product.

10.7 RoHS, 2002/95/EC

The sign on the product or on its packing indicates that this product complies with the European guideline 2002/95/EC.

10.8 Product follow-up

We are required to perform a follow-up service for our products which extends beyond shipment.

We would be grateful if you could send us the following information:

- Modified settings
- Any experiences with the lathe which might be important for other users
- Recurring failures

Optimum Maschinen Germany GmbH
Dr.-Robert-Pfleger-Str. 26

D-96103 Hallstadt

Fax +49 (0) 951 - 96 555 - 888
Email: info@optimum-maschinen.de

CE

EC - declaration of conformity

Machinery Directive 2006/42/EC Annex II 1.A

The manufacturer / retailer:	Optimum Maschinen Germany GmbH Dr.-Robert-Pfleger-Str. 26 D - 96103 Hallstadt

hereby declares that the following product,

Product designation:	Lathe
Designation of the machine:	TU1503V
Serial number:	_ __ __ __ __
Year of manufacture:	20__

Manual geared drill for private persons as well as for craft and industrial plants which meets all the relevant provisions of the above mentioned Directive 2006/42/EC as well as the other directives applied (below) including their amendments in force at the time of declaration. The following other EU Directives have been applied: EMC Directive 2014/30/EC, Low Voltage Directive 2006/95/EC

The safety objective meet the requirement of EC Directive 2006/95/EC

The following harmonized standards were applied:

EN 1037:1995+A1:2008 Safety of machinery - Prevention of unexpected start-up

EN 1088:1995+A2:2008 Safety of machinery - Interlocking devices associated with guards - Principles for design and selection

EN ISO 23125:2010 - Machine tools - Safety - Turning machines (ISO 23125:2010 + Amd. 1:2012)

DIN EN 55011 2009/A1:2010 Industrial, scientific high frequency equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement

EN 50581:2012 Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

EN 60204-1:2006/AC: 2010 Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:2005 (modified))

EN ISO 12100:2010 Safety of machinery - General principles for design - Risk assessment and risk reduction (ISO 12100:2010)

EN ISO 13857:2008 Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs

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Index