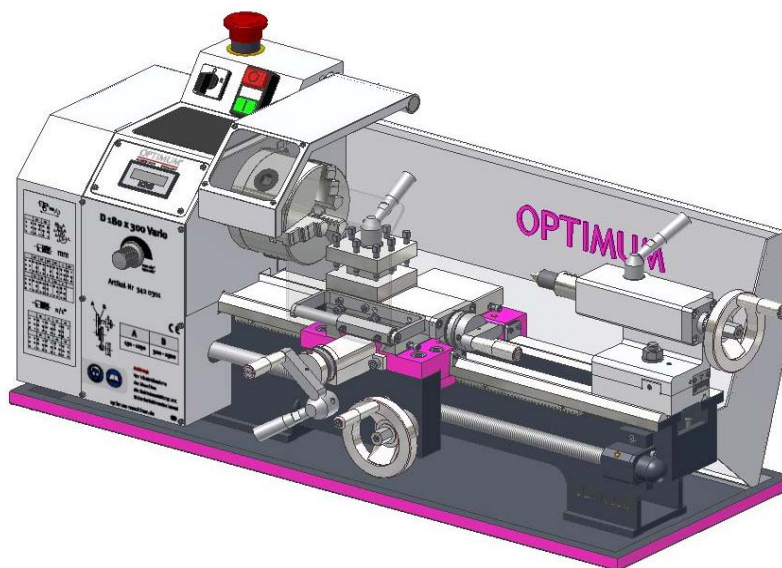


Operating manual

Version 1.3.7

Lathe

OPTI D180 x 300 VARIO



Keep for future reference!

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1 Safety

Glossary of symbols

	gives additional indications
	calls on you to get in action
	enumerations

This part of the operating manual

- does explain the meaning and how to use the warning references contained in this operating manual,
- does explain how to use the lathe,
- highlights the dangers that might arise for you and others if these instructions are not followed thoroughly,
- informs you on how to prevent dangers.

In addition to this operating manual, please note

- applicable laws and regulations,
- legal regulations for preventing an accident,
- 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 DOCUMENT CLOSE TO THE LATHE FOR FUTURE REFERENCE.



INFORMATION

If you are not able to solve a problem using this manual, please do not hesitate to contact us for further professional advice:

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

D- 96103 Hallstadt




Telefon: +49 (0) 900 - 19 68 220 (0,49 €/min.)

E-Mail: info@optimum-maschinen.de

1.1 Safety warnings (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 (pictograms) and warnings for the specific danger and its (possible) consequences.

Pictogram	Alarm expression	Definition/Consequences
	DANGER!	Imminent danger that will cause serious injury or death to personnel.
	WARNING!	Risk: a danger that might cause serious injury or death to personnel.
	CAUTION!	Danger of unsafe procedure that might cause injury to personnel 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 personnel.
	INFORMATION	Application tips and other important or useful information and notes. No dangerous or harmful consequences for personnel or objects.

In case of specific dangers we replace the pictogram by



general
danger,



with a warning
of,



injuries to
hands,



hazardous
electrical
voltage,

or



rotating parts.

1.1.2 Further ideograms



Warning of automatic start up!



Activation forbidden!



Pull the main plug!



Use safety glasses!



Use ear protection!



Use protective gloves



Use protective boots!



Wear a safety suit!



Protect the environment!



Contact address

1.2 Proper use



WARNING!

In the event of improper use, the lathe

- will endanger personnel,
- will endanger the machine and other material property of the operator,
- may affect proper operation of the machine.

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 or regularly-shaped 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® etc.

The lathe must only be installed and operated in a dry and well-ventilated place.


Improper use!

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

We do not take any liability for damage caused by improper use.

We would like to stress that any modifications to the construction, or technical or technological modifications that have not been authorised by Optimum Maschinen Germany GmbH will also render the guarantee null and void.

It is also part of proper use that

- the maximum values for the lathe are complied with,
- the operating manual is observed,
- inspection and maintenance instructions are observed  „Technical data“ on page 16.

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

WARNING!

Very serious injury due to improper use.

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



1.3 Reasonably foreseeable misuse

Any other use or any use beyond the use described under "Proper use" is regarded as improper use and is forbidden.

If it is intended to use the device in any other way as described above, it is necessary to consult the manufacturer.

It is only allowed to work metallic, cold and non-flammable material using the lathe machine.

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 misuse

- Using suitable cutting tools.
- Adapting speed settings and feed on the material and on the workpiece.
- Clamp the workpiece firmly and vibration-free.

1.4 Possible dangers caused by the lathe

The lathe has been designed and built using the latest technological advances, nonetheless there remains a residual risk, since the machine operates with

- high revolutions,
- rotating parts,
- electrical voltage and currents.

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

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



INFORMATION

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

- be duly qualified,
- strictly follow this operating manual.

Due to improper use

- there is a risk for the employee,
- the machine and further property might be endangered,
- the function of the lathe could be effected.

Always disconnect the lathe if cleaning or maintenance work is being carried out.



WARNING!

THE LATHE MAY ONLY BE USED WITH THE SAFETY DEVICES ACTIVATED.

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

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

As the machine operator, this will be your responsibility!

☞ „Safety devices“ on page 11

1.5 Qualification of personnel

1.5.1 Target group

This manual is addressed to

- operators,
- users,
- maintenance staff.



The warning notes therefore refer to both operation and maintenance of the machine.

Always disconnect the machine plug from the mains. This will prevent it being used by unauthorised personnel.



INFORMATION

All personnel involved in assembly, commissioning, operation and maintenance must

- be duly qualified,
- follow this operating manual.

In the event of improper use

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

The qualifications of the staff 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 expressly 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.

Specialist staff

Due to his professional training, knowledge and experience as well as his knowledge of relevant regulations the specialist staff is able to perform the assigned tasks and to recognise and avoid any possible dangers himself.

Instructed persons

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

1.5.2 Authorised personnel



WARNING!

Incorrect use and maintenance of the machine constitutes a danger for personnel, objects and the environment.

Only authorised personnel may operate the machine!

The only personnel authorised to use this machine and perform maintenance on it are trained and instructed technical staff working for the operator and manufacturer.

1.5.3 Obligations of the operator

The operator must instruct staff at least once a year on

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

The operator must also

- check staff's understanding,
- document training/instruction,
- require staff to confirm participation in training/instruction by means of a signature,
- check whether the staff are aware of safety and of dangers in the workplace and whether they observe the operating manual.

1.5.4 Obligations of the user

The user must

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

1.5.5 Additional qualification requirements

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

- This work must only be carried out by a qualified electrician or person working under the instructions and supervision of a qualified electrician.
- Before carrying out work on electric components or operating units the following measures must be taken, in the order given.
 - Disconnect all poles
 - Ensure that the machine cannot be turned on again
 - Check that there is no voltage

1.6 User positions

The user must stand 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. Use an appropriate suction unit.



CAUTION!

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

Take additional preventive measures in order to safely avoid health hazards before processing flammable materials (e.g. aluminum, magnesium) or before using flammable additives (e.g. spirit).



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 in 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 when

- the cause of the failure has been removed,
- it has been verified that there is no resulting 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 personnel working with the machine. The possible consequences are

- damage as a result of components or parts of components flying off at high speed,
- 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.

The lathe includes the following safety devices:

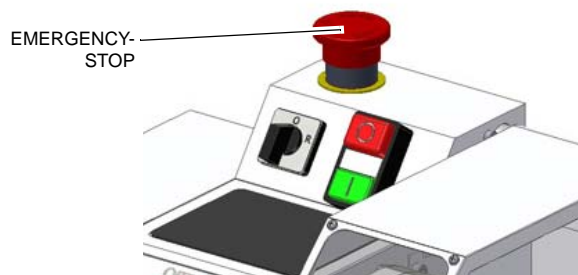
- self-latching, lockable EMERGENCY STOP button
- a protective cover on the headstock,
- a special key for the lathe chuck,
- a lathe chuck protection with position switch.

1.9 EMERGENCY-STOP

The EMERGENCY-STOP 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. .

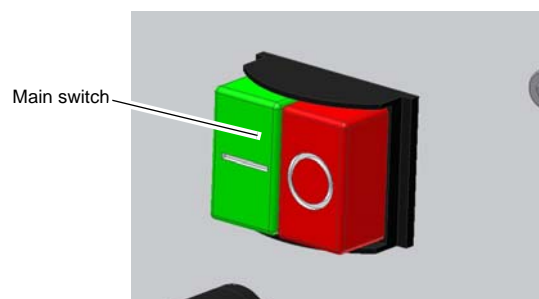


Illustr. 1-1: EMERGENCY-STOP

1.9.1 Main switch

The lathe is equipped with a main switch.

When the main switch is switched off, the power supply to the machine is completely interrupted.



Illustr. 1-2: Main switch

1.9.2 Protective cover with safety switch

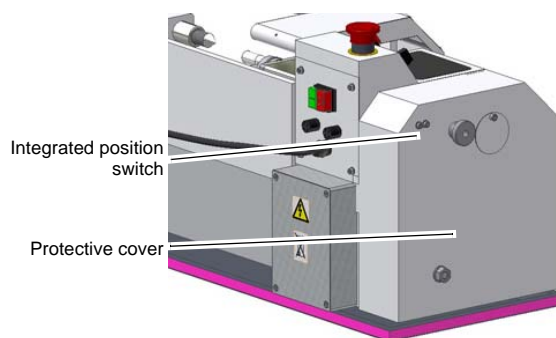
The spindle head of the lathe is equipped with a fixed, separating protective cover.

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

INFORMATION



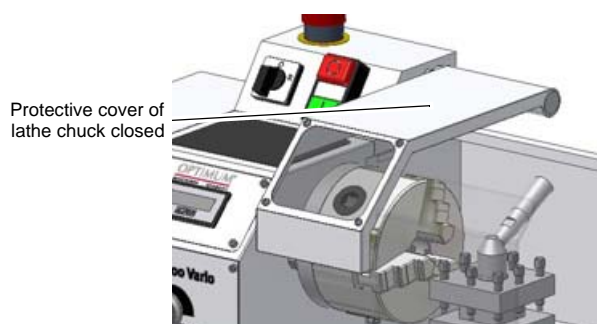
It is not possible to start the machine until the protective cover is closed.

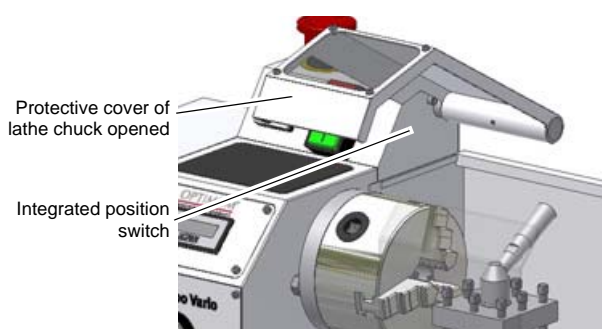


Illustr. 1-3: Protective cover of spindle head

1.9.3 Lathe chuck protection with position switch

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





Illustr. 1-4: Lathe chuck protection with position switch

1.9.4 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.



WARNING!

Only operate the lathe using this key.

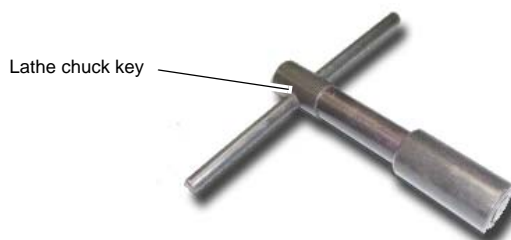


Abb. 1-5: Lathe chuck key

1.10 Safety check

Check the lathe at least once per shift. Inform the person responsible immediately of any damage, defect or change in operating function.

Check all safety devices

- at the beginning of each shift (with the machine stopped)
- once a week (with the machine in operation)
- after every maintenance and repair operation

Check that prohibition, warning and information labels and the markings on the lathe

- can be identified (if not, clean them)
- are complete



INFORMATION

Use the following table for organising the checks.

General check		
Equipment	Check	OK
Protective cover, chaw juck cover	Fitted, firmly bolted and not damaged	
Labels, markings	Installed and legible	
Date:	Checked by (signature):	

Run test		
Equipment	Check	OK
EMERGENCY STOP button	When the EMERGENCY STOP button is activated, the lathe should be switched off.	
Lathe chuck key	Once the chuck key has been released, it should be automatically pressed out of the lathe chuck.	
Position switch of the lathe chuck protection/ protective cover headstock	The lathe shall only run with the lathe chuck protection/ protective cover headstock closed.	
Date:	Checked by (signature):	

1.11 Individual protection gear



For certain work individual protection gear is required.

Protect your face and eyes: During all work, and specifically work during which your face and eyes are exposed to hazards, a safety helmet with a face guard should be worn.



Use protective gloves when lifting or handling pieces with sharp edges.



Wear safety shoes when fitting, dismantling or transporting heavy components.



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

Before starting work, make sure that the prescribed individual protection gear is available in the workplace.



CAUTION!

Dirty or contaminated body protection gear can cause disease.

Clean it after every use and once a week.

1.12 Safety during operation

In the description of work with and on the machine we highlight the dangers specific to that work.



WARNING!

Before activating the lathe, double check that this will not endanger other people and cause damage to equipment.

Avoid unsafe working practises:

- Make sure your work does not endanger anyone.
- Clamp the workpiece tightly before activating the lathe.
- For clamping workpieces, only use the special chuck key supplied.
- Mind the maximum chuck opening.
- Use protective goggles.

- Do not remove turning chips by hand. To remove turning chips, use a chip hook and/or handbrush.
- Clamp the turning tool at the correct height and with the least possible overhang.
- Turn off the lathe before measuring the workpiece.
- The instructions in this manual must be observed during assembly, handling, maintenance and repair.
- Do not work on the lathe if your concentration is reduced, for example, because you are taking medication.
- Observe the rules for preventing accidents issued by your association for the prevention of occupational accidents and safety in the workplace or other inspection authorities.
- Inform the inspector of any danger or failure.
- Stay at the lathe until all rotating parts have come to a halt.
- Use prescribed protection gear. Make sure to wear a well-fitting work suit and, where necessary, a hairnet.

1.13 Disconnecting the lathe and making it safe



- Pull the mains plug before beginning any maintenance or repair work. All machine components and hazardous voltages and movements must have been disconnected.
- Place a warning sign on the machine.

1.14 Using lifting equipment



WARNING!

Use of unstable lifting and suspension gear that might break under load can cause very serious injuries or even death.

Check that the lifting and load suspension gear is of sufficient load capacity and in perfect condition.

Observe the rules for preventing accidents issued by your association for the prevention of occupational accidents and safety in the workplace or other inspection authorities.

Hold the loads properly.

Never walk under suspended loads!

1.15 Mechanical maintenance work

Remove all protection and safety devices before beginning maintenance work and re-install them once the work has been completed. These include:

- Covers
- Safety indications and warning signs
- Earth (ground) connection


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


Check that they are working properly!

2 Technical data

The following information gives the dimensions and weight and is the manufacturer's authorised machine data.

2.1 Power connection	
Total connection rate	230V; 600 W ~ 50Hz

2.2 Machine data	
Height of centers [mm]	90
Max. swing [mm]	180
Max. swing over compound slide [mm]	110
Distance between centers [mm]	300
1. Spindle speed range indinitely variable [min ⁻¹]	150 - 1250
2. Spindle speed range indinitely variable [min ⁻¹]	300 - 2500
Spindle flange	 „Head spindle seat“ on page 29
Spindle taper	MT 3
Passage 3-jaw chuck [mm]	20
Operating travel of top slide [mm]	55
Operating travel of cross slide [mm]	75
Tailstock cone	MT 2
Tailstock sleeve travel [mm]	65
Longitudinal feed [mm/U]	0.1 and 0.2
Pitch - Metric	0.5 0.7 0.75 0.8 1 1.25 1.5 1.75 2 2.5 3
Pitch - Inches [Gg/Zoll]	10 11 14 19 20 22 40 44
Max. seat height in the toolholder [mm]	8
Height difference bottom surface of quadruplicate toolholder to center of lathe chuck [mm]	11

2.3 Dimensions	
Height / Length / Width [mm]	 „Dimensions, installation plan D180x300 Vario“ on page 18)
Total weight [kg]	55

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

2.5 Environmental conditions	
Temperature	5 - 35 °C
Humidity	25 - 80 %

2.6 Emissions

The level of noise emitted by the lathe is less than 78 dB(A).



INFORMATION

This numeric value had been measured on a new machine under conventional operating conditions. Depending on the age or wear of the machine, the noise behavior of the machine might change.

Furthermore, the extent of the noise emission is also depending on manufacturing influence factors, such as speed, material and clamping conditions.



INFORMATION

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

Unless the degree of noise emission and the degree of noise disturbance are depending on one another it is not possible to use it in order to reliably determine if it is necessary to take further preventive measures or not.

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

- Characteristics of the working chamber, e.g. size or damping behavior,
- Other noise sources, e.g. the number of machines,
- Other processes proceeding nearby and the period during which the operator is exposed to the noise.

Furthermore, the admissible pollution level may be different from one country to another due to the national regulations.

This information regarding the noise emission should allow the operator of the machine to perform a better evaluation of the endangerments and risks.



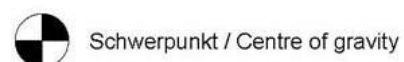
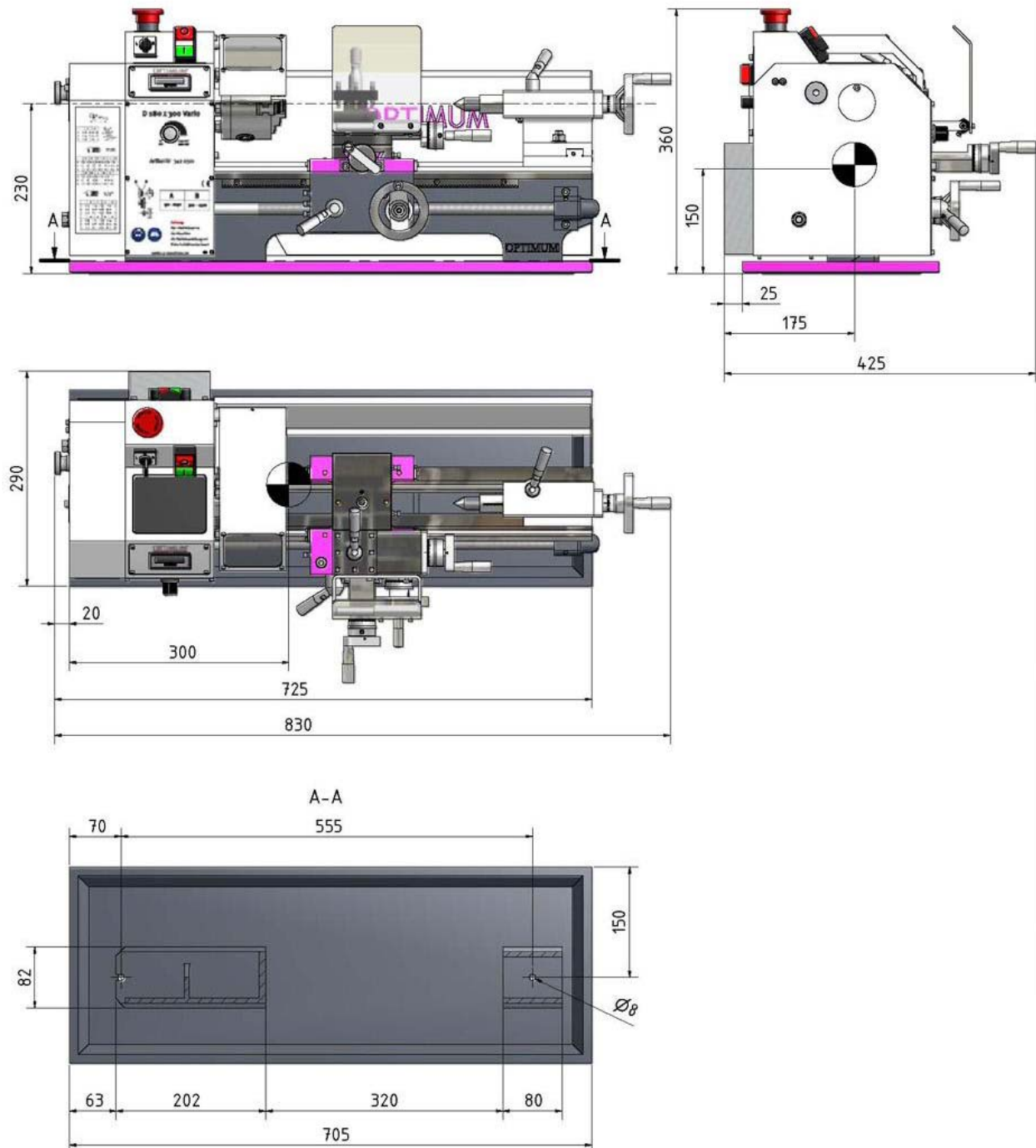
CAUTION!

The machine operator has to wear an appropriate ear protection depending on the overall stress caused by noise and on the basic limit values.



We generally recommend using a sound and ear protection.

2.7 Dimensions, installation plan D180x300 Vario



Illustr.2-1: Dimensions, installations plan D180x300 Vario

3 Assembly



INFORMATION

The lathe comes pre-assembled.

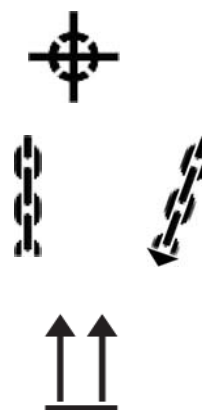
3.1 Extent of supply

When the machine is delivered, check immediately that the lathe has not been damaged during shipping and that all components are included. Also check that no fastening screws have come loose.

Compare the parts supplied with the information on the packaging list.

3.2 Transport

- Center of gravity
- Attachment positions (marking the positions for the attachment position gear)
- Prescribed transport position (marking the top side)
- Means of transportation to be used
- Weights



WARNING!

Machine parts which fall off forklift trucks or other transport vehicles could cause very serious or even fatal injuries. Follow the instructions and information on the box.



WARNING!

Use of unstable lifting and load suspension gear that breaks under load can cause very serious injuries or even death.

Check that the lifting and load suspension gear has sufficient load capacity and is in perfect condition. Observe the rules for preventing accidents issued by your association for the prevention of occupational accidents and safety in the workplace or other inspection authorities.

Hold the loads properly. Never walk under suspended loads!

3.3 Storage



ATTENTION!

Improper storage may cause important parts to be damaged or destroyed.
Store packed or unpacked parts only under the following ambient conditions.
Please follow the instructions and indications on the transportation box:

- Fragile goods (goods require careful handling)



- Protect against humidity and humid environments

☞ „Environmental conditions“ on page 18.



- Prescribed position of the packaging box (marking the top side – arrows pointing upward)



- Maximum stacking height

Example: non-stackable – do not pile any further packaging boxes on top of the first packaging box



Consult Optimum Maschinen Germany GmbH if the lathe and accessories have to be stored for a period of over three months or under different external conditions than those given here ☞ „Information“ on page 5.

3.4 Installation and assembly

3.4.1 Requirements of the installation site



ATTENTION!

Before installing the machine, have the load bearing capacity of the subsoil checked by a specialist. The floor and the ceiling of the hall have to bear the weight of the machine plus all additional parts and additional aggregates as well as the operator and the stocked materials. Reinforce the subsoil, if necessary.



INFORMATION

In order to provide for good functionality and high machining accuracy as well as long durability of the machine the site should fulfill certain criteria.

Observe the following items:

- The device must only be installed and operated in dry ventilated places.
- Avoid places nearby machines generating chips or dust.
- The site has to be vibration-free, i.e. at a distance from presses, planing machines, etc.
- The substructure has to be appropriate for turning. Also make sure that the load bearing capacity and the evenness of the floor are appropriate.
- The substructure has to be prepared in a way that possibly used coolant cannot penetrate into the ground.
- Protruding parts such as stops, handles, etc. need to be secured by measures provided by the customer if necessary in order to avoid dangers for persons.
- Provide sufficient space for assembly and operating staff as well as for material transport.
- Also allow for accessibility for setting and maintenance works.
- Make sure that the mains plug of the turning machine is freely accessible.
- Provide for sufficient illumination (minimum value: 300 lux, measured at the tool tip). In case of little intensity of illumination provide for additional illumination i.e. by a separate workplace illuminator.



INFORMATION

The mains plug of the lathe has to be freely accessible.

3.4.2 Load suspension point

- Fasten the load suspension gear around the lathe bed.
- Make sure that you distribute the loads evenly so that the lathe cannot turn over while lifting.
- Make sure that no add-on pieces or varnished parts are damaged due to the load suspension.

3.4.3 Installation



WARNING!

Danger of crushing and overturning. The lathe must be installed by at least 2 people.

- Check the horizontal orientation of the base of the lathe with a spirit level.
- Check that the foundation has sufficient floor-load capacity and rigidity.



ATTENTION!

Insufficient rigidity of the foundation leads to the superposition of vibrations between the machine and the foundation (natural frequency of components). Insufficient rigidity of the entire lathe assembly also rapidly causes the lathe to reach critical speeds, with unpleasant vibrations, leading to bad turning results.

- Position the lathe on the intended foundation.
- Secure the lathe to the foundation or substructure of the machine using the through holes.
- 📖 „Dimensions, installation plan D180x300 Vario“ on page 18

3.5

First use



ATTENTION

Before you begin with the commissioning on the machines check that all screws, fasteners and fuses are tight. If necessary they must be tightened.



WARNING!

Personnel and equipment may be endangered if the lathe is first used by inexperienced personnel.

We do not take liability for damage caused by incorrect commissioning.

3.5.1

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 transported the machine it should be warmed up at a spindle speed of only 500 1/min for the first 30 minutes.

3.5.2

Cleaning and greasing

Cleaning the machine

- Remove the anticorrosive agent applied to the lathe for transport and storage purposes. We recommend the use of stove distillate.

- Do not use any solvents, thinners or other cleaning agents which could corrode the varnish on the lathe. Follow the specifications and indications of the manufacturer of the cleaning agent.

- Lubricate all bright machine parts with non-corrosive lubricating oil.

- Grease the lathe using the lubrication chart. 📖 „Inspection and maintenance“ on page 66

- Check smooth running of all spindles.

- Control if the fastening screws of the lathe chuck are firmly tightened.

- Clamp a workpiece into the lathe chuck of the lathe or bring the clamping jaws of the lathe chuck completely together before you switch on the lathe.

Control the function of movable and fixed parts.

- Connect the electrical supply cable (safety plug with earthing).

Make sure that the current supply is working correctly



WARNING!

Do not stand directly in front of the lathe chuck when you turn on the machine for the first time.

3.5.3 Optional accessory



WARNING!

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

Only use the clamping materials (e.g. lathe chuck) which had been delivered together with the machine or as optional equipment offered by OPTIMUM.

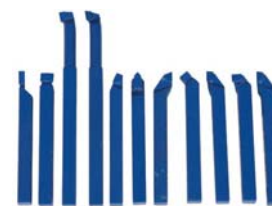
Use the working clamping materials only in the provided admissible speed range.

Workpiece clamping materials must only be modified according to the recommendations of OPTIMUM or of the clamping material manufacturer.

Denomination:	Item number	
4-jaw chuck 100mm,	344 0711	
flange for 4-jaw chuck	344 0312	
Face plate	344 0295	
Follow rest	344 0293	
Steady rest	344 0294	
Set of collet chucks, 1-16mm 15 pieces (ER25)	344 1109	
Tool holder ER 25	344 0305	
Quick change tool holder AA	338 4311	
Single tool holder WAAD	338 4312	
Set of tools Hard metal indexable inserts 10mm, 7 pieces	344 1111	

Set of tools 8mm, 11 pieces
Tipped with hard metal

344 1008



4 Operation

4.1 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.

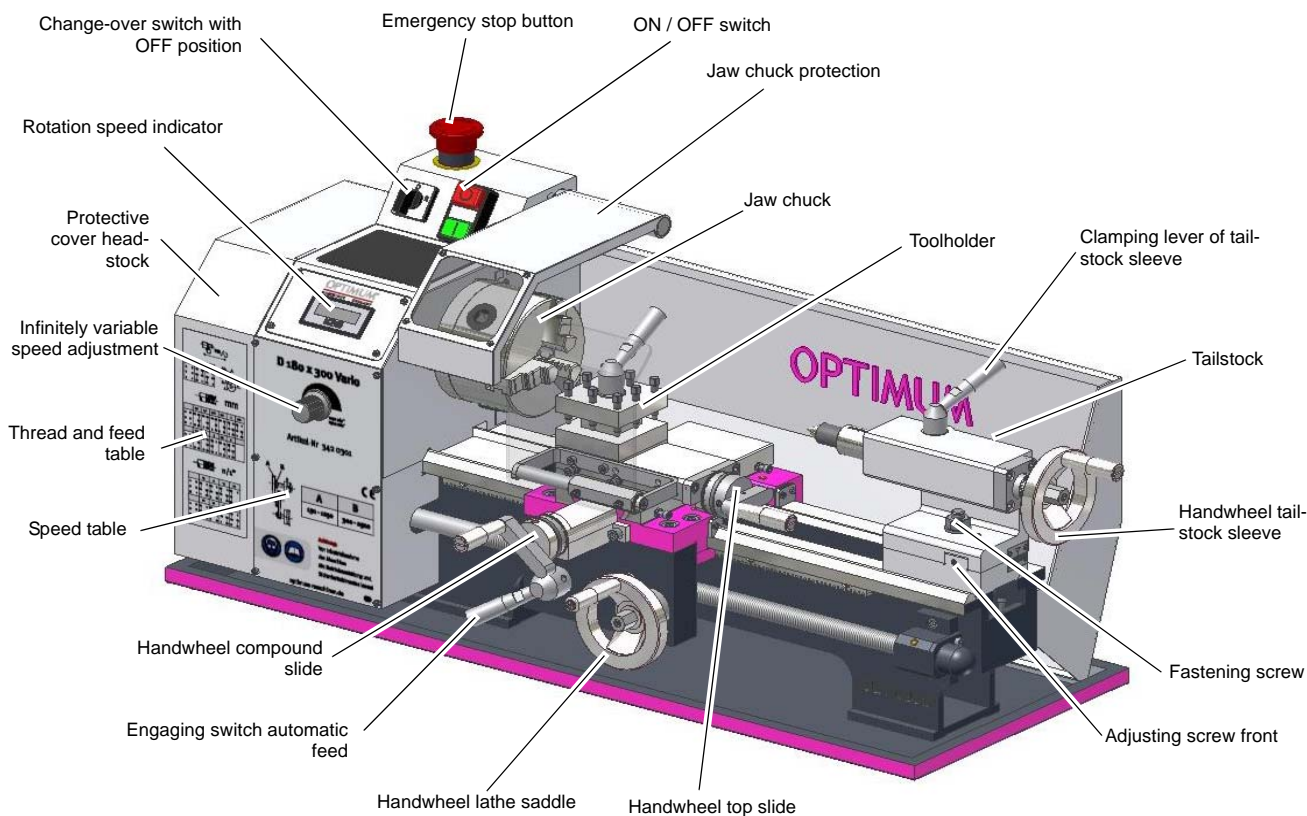


All anomalies should be eliminated immediately. Stop the machine immediately in the event of any abnormality in operation and make sure it cannot be started up accidentally or without authorisation.

Notify the person responsible immediately of any modification.

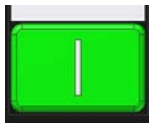
☞ „Safety during operation“ on page 14

4.2 Control and indicating elements



Illustr.4-1: OPTI D180 x 300 VARIO

4.2.1 Switching elements



Hand actuated auxiliary switch 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.



Main switch

Interrupts or connects the power supply.



Change-over 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 labeling "R" means right-handed rotation (clockwise).
- The labeling "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.

If the direction of rotation is changed during operation, the motor and the change-over switch might get damaged.

4.2.2 Switching on the machine

- Perform basic setting on the lathe (speed stage, infeed, etc.).
- Check if the protective cover of the lathe chuck and the protective cover are closed – close the protective covers if necessary.



- Turn the main switch on.



- Select the direction of rotation.



- Actuate the hand-actuated auxiliary switch "On".

4.2.3 Switching off the machine



→ Actuate the hand-actuated auxiliary switch “Off”.



→ If the machine stands still for a longer period of time, switch off the main switch.

4.2.4 Clamping the tool

Clamp the turning tool into the toolholder.

The tool must be clamped firmly and with the least possible overhang in order to absorb well and make sure that the cutting force is reliably generated during the chip formation.

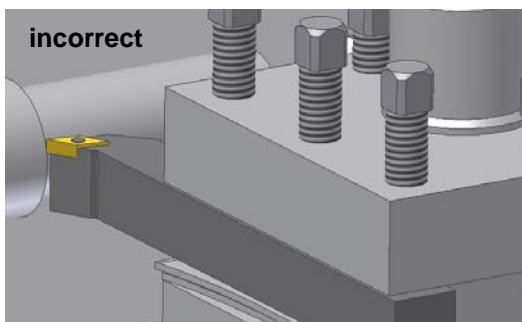
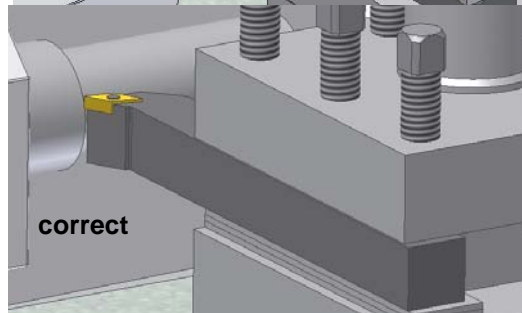
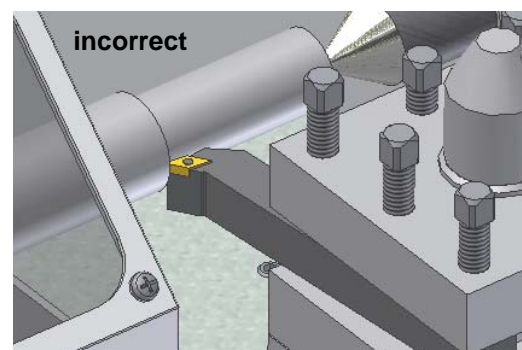
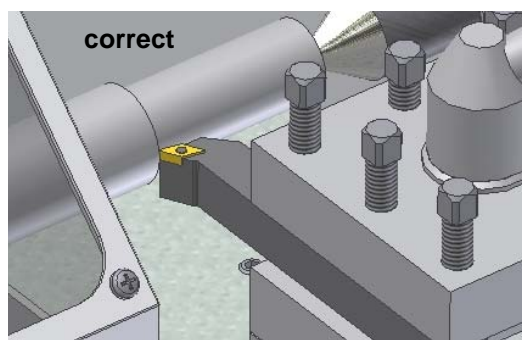


INFORMATION

The maximum height between the supporting surface of the quadruplicate toolholder and the center of the lathe chuck amounts to 11 mm.

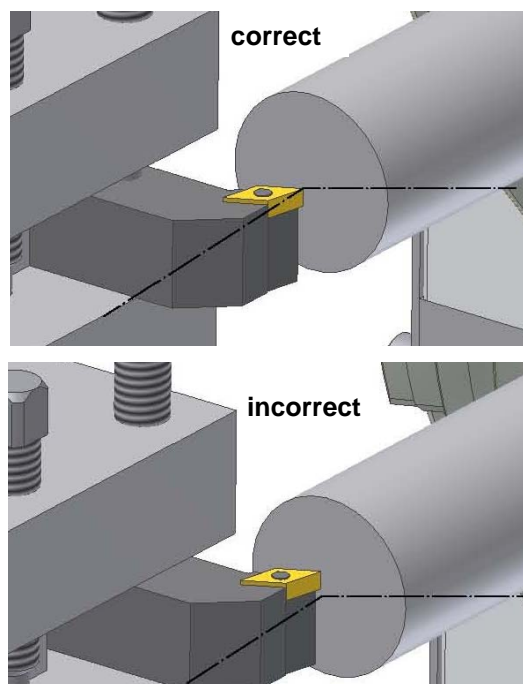
Adjust the height of the tool. Use the tailstock with the center point in order to determine its required height.

If necessary, put the steel washers beneath the tool to achieve the required height.



Illustr.4-2: Clamping the tool

The blade of the tool must be exactly adjusted to the height of centers in order to produce a shoulder-free front face. By facing, plain faces are being produced which are rectangular to the axis of rotation of the workpiece. Here it is distinguished between cross-facing, cross-slicing and longitudinal facing.



Illustr. 4-3: Clamping the tool

4.3 Clamping a workpiece into the lathe chuck

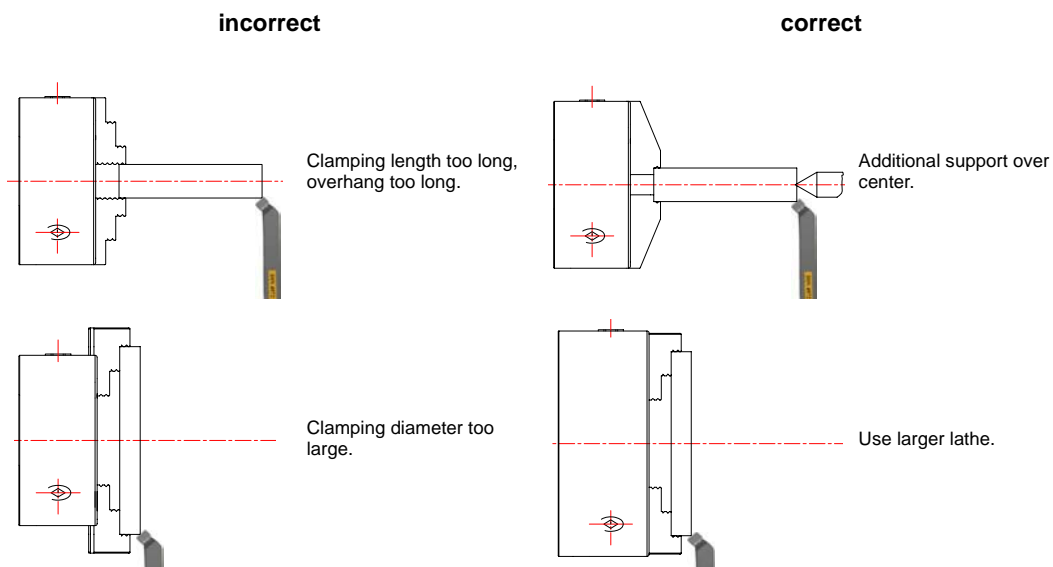
When the workpiece is being clamped unprofessionally, there is a risk of injury as the workpiece may fly off or the jaws may break. The following examples do not show all possible situations of danger.

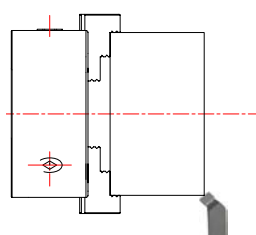
The workpieces are to be clamped safely and tightly on the lathe before starting the operation. The clamping force is to be dimensioned in a way to make sure that the workpiece is securely driven and that there are no dangers or deformations on the workpiece.



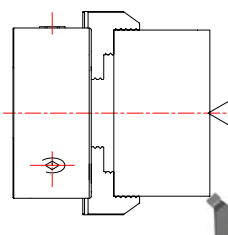
WARNING!

Do not clamp any workpieces that exceed the permitted chucking capacity of the lathe chuck. The clamping force of the chuck is too low if its capacity is exceeded. Also, the jaws may come loose.

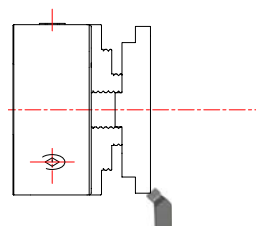




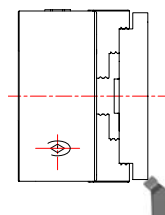
Workpiece is too heavy and clamping grade too short.



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.

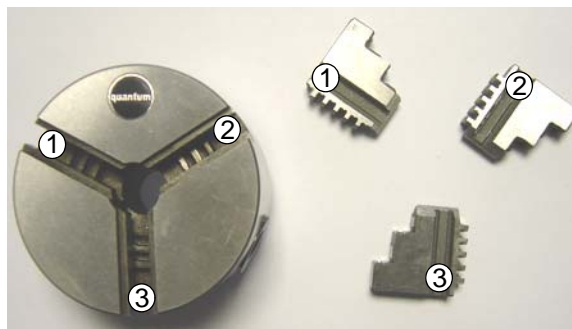


Clamp on the largest clamping diameter possible.

4.3.1 Replacing the clamping jaws on the lathe chuck

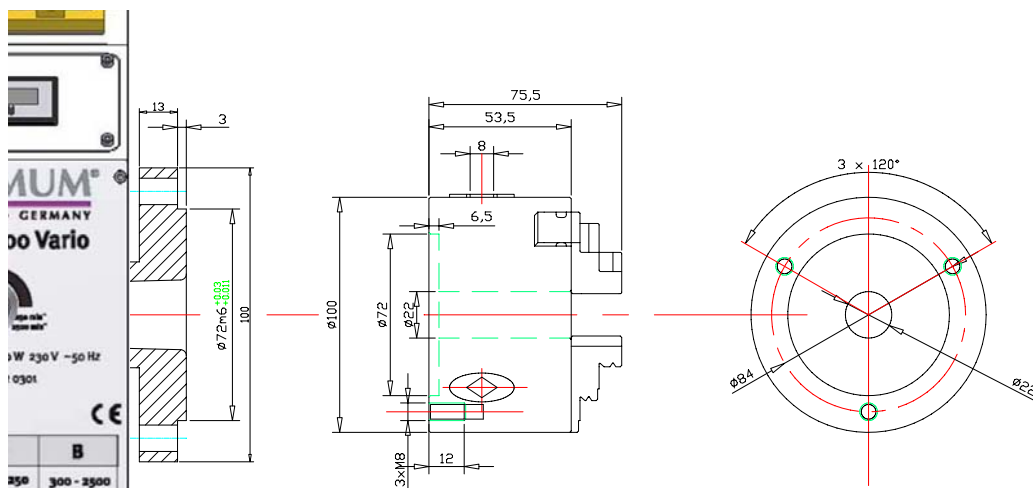
The clamping jaws and the three-jaw chuck are equipped with numbers. Insert the clamping jaws at the correct position and in the right order into the three-jaw chuck.

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



Illustr.4-4: Three-jaw chuck / clamping jaws

4.3.2 Head spindle seat



Illustr.4-5: Spindle flange

☞ „Optional accessory“ on page 23



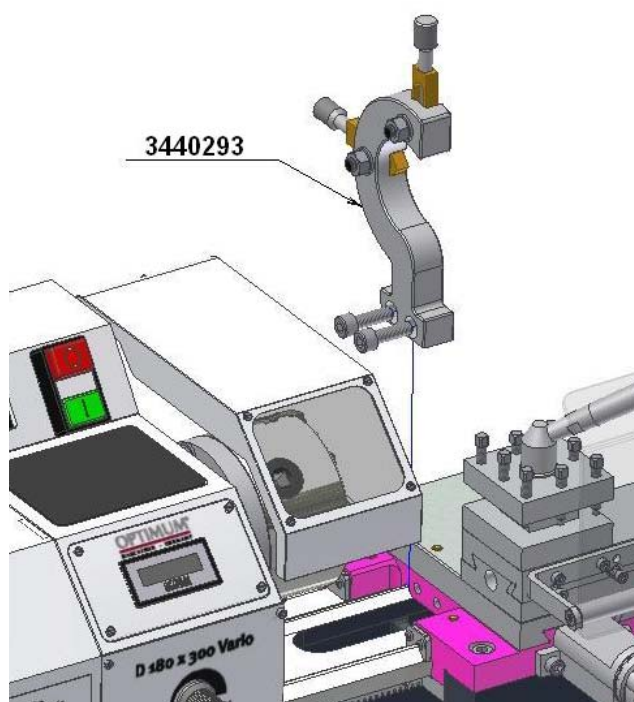
ATTENTION!

When disassembling the work support, it may fall on the engine bed and damage the guide rails. Put a wooden plank or another adequate part on the engine bed in order to avoid damage.

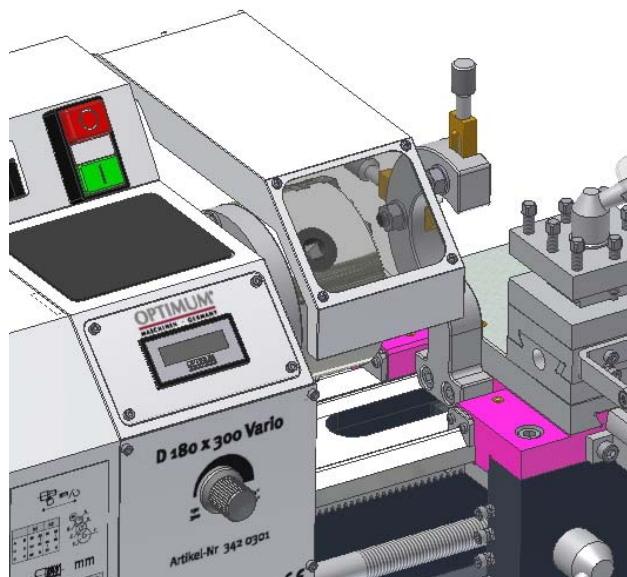


- Disconnect the machine from the electrical supply.
- Block the revolutions of the spindle for instance by inserting the square seat of the lathe chuck. Also make sure that the engine bed is not damaged by the arm of the lever.
- Loosen the three nuts on the flange of the lathe chuck to disassemble the work support.
- Remove the work support to the front.
- If required, loosen the work support by knocking slight with a plastic tip or a rubber mallet.

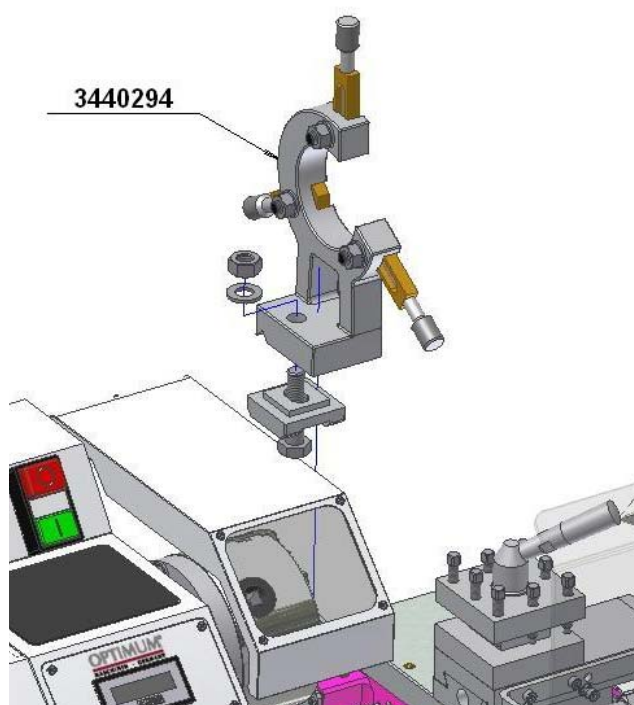
4.3.3 Mounting of follow rest



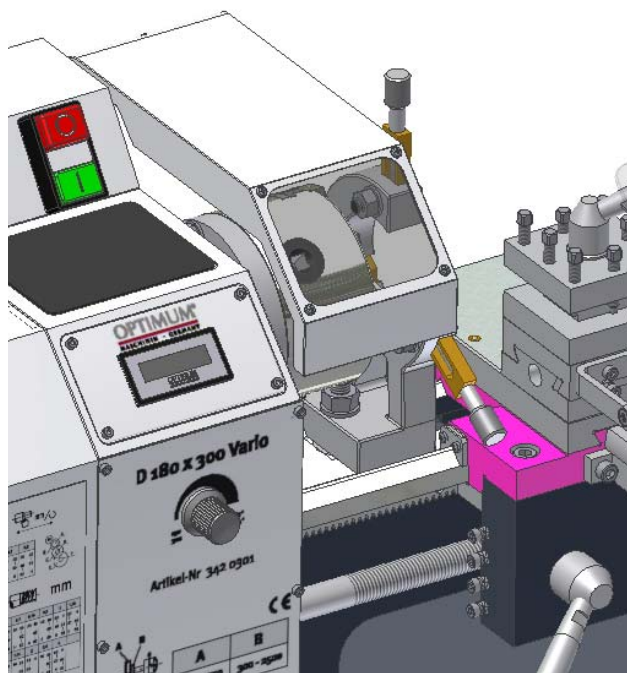
Illustr.4-6: Follow rest



4.3.4 Mounting of steady rest



Illustr.4-7: Steady rest



4.3.5 Use of collet chucks

When using collet chucks to clamp the workpiece higher machining tolerances are available. The exchange of collet chucks for a smaller or larger diameter is simple and can be easily performed.

First, the collect chuck will be pressed into the ring of the union nut and has to rest there by itself. The workpiece will be clamped by fastening the union nut.

Make sure that you are using the correct collet chuck for the corresponding diameter in order to be able to fix the workpiece safely and firmly.

☞ „Optional accessory“ on page 23

4.4 Switching ON / OFF



CAUTION!

Check that the engaging lever is not activated when cutting threads.

(☞ Illustr. 4-13: „Engaging lever "Position OFF"“ on page 35)

By switching on the lathe with high speed setting and activated engaging lever, the lathe slide will move with high speed.



ATTENTION!

Before switching on, turn the potentiometer for speed setting to a low speed setting. The electronics may be damaged if the machine is switched on at full speed setting.

The machine is switched with the ON / OFF switch. The lathe may only be switched on when the change-over switch is in the position "R" or "L".

4.4.1 Change-over switch

The sense of rotation of the lathe is performed by the change-over switch.

- The marking "R" means right-handed rotation. The lathe chuck turns anti-clockwise.
- The marking "L" means left-handed rotation. In the left-handed rotation, for instance, the lathe slide is being reversed for the thread cutting. In the position "0" the engine is switched off.



ATTENTION!

Wait until the lathe has come to a complete halt before inverting the turning direction using the control levers. Changing the turning direction during operation may cause damage to components.

4.5 Adjusting the speed

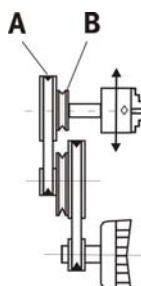
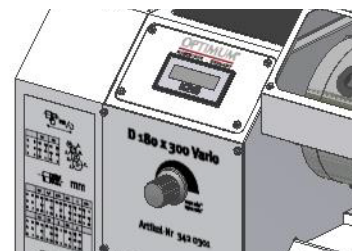
Adjust the speed with the potentionmeter.

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



WARNING!

Unplug the shockproof plug of the lathe before opening the protective cover of the headstock.



A	B
150 - 1250	300 - 2500

Illustr.4-8: Adjusting the speed

4.5.1 Changing the speed range

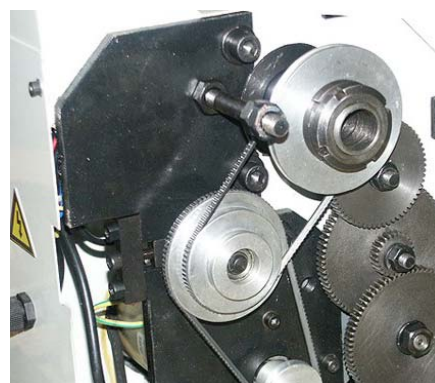


- Unplug the shockproof plug from the mains.
- Detach the protective cover of the headstock.
- Screw in the hexagon socket screw, thus the tension of the synchronous belt is being reduced.
- Lift the upper synchronous belt onto the required wheel diameter.
- Proceed the other way around to tighten the synchronous belt. The correct tension of the synchronous belt has been reached when you can still bend it approximately 3mm with your index finger.



ATTENTION!

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



Illustr.4-9: synchronous belt position change

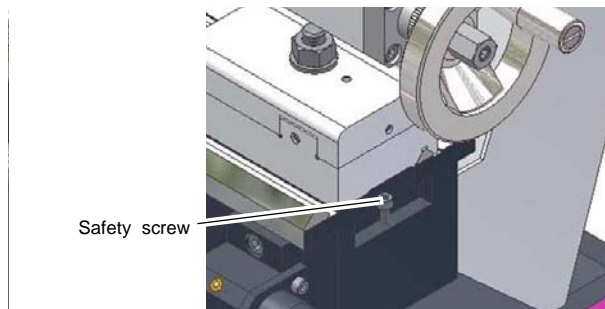
4.6 Turning between centers



ATTENTION!

For the operation between centers check the clamping of the tailstock or of the spindle sleeve!

Screw the safety screw at the end of the lathe bed in order to avoid unintentional pulling the tailstock out off the lathe bed.



Illustr.4-10: Lathe bed

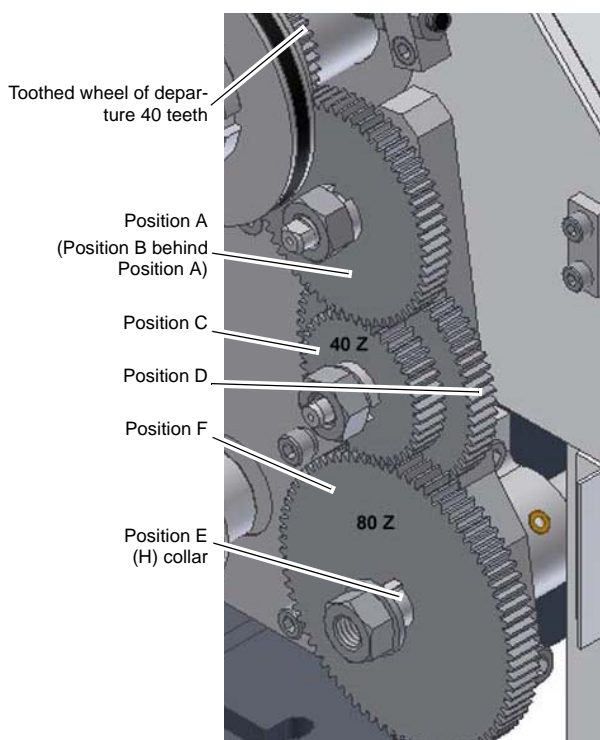
4.7 Adjusting feeds and thread pitches

In order to achieve a change of feed of a certain thread pitch, the change wheels are to be changed according to the table. You will find the complete table on the lathe.

Example:

Thread pitch 1,25mm			
A	B	52	H
C	D	40	50
E	F	H	80

- The toothed wheel of departure with 40 teeth cams in the toothed wheel A
- The toothed wheel A cams in the toothed wheel C
- The toothed wheel D cams in the toothed wheel F
- H means the vacuity (collar). You may as well use a smaller toothed wheel which does not cam in with any other toothed wheel.



Illustr.4-11: Order of the pitch 1,25mm

Example of the transmission ratio: i

The thread pitch of the leading spindle amounts to 2mm.

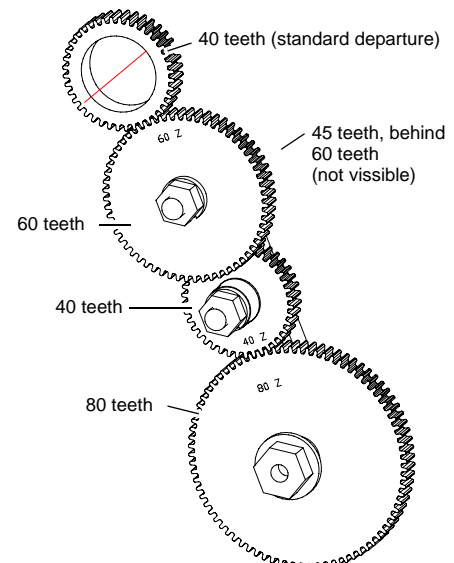
Example of thread pitch: 1,25mm:

$$i = 2 \times \frac{n_1 \times n_2 \times n_4}{n_2 \times n_3 \times n_5} = 2 \times \frac{40 \times A \times D}{A \times C \times E} = 2 \times \frac{40 \times 52 \times 50}{52 \times 40 \times 80} = 1,25 \text{ mm}$$

Example of thread pitch: 0,75mm:

$$i = 2 \times \frac{n_1 \times n_2 \times n_4}{n_2 \times n_3 \times n_5} = 2 \times \frac{40 \times B \times D}{A \times D \times F} = 2 \times \frac{40 \times 45 \times 40}{60 \times 40 \times 80} = 0,75 \text{ mm}$$

Thread pitch 0,75mm			
A	B	60	45
C	D		40
E	F	H	80



Illustr. 4-12: Order of the pitch 0,75mm

- The toothed wheel of departure with 40 teeth cams in the toothed wheel A
- The toothed wheel B cams in the toothed wheel D
- The toothed wheel D cams in the toothed wheel F



INFORMATION

Metrical threads are indicated as thread pitch. In the example above, the lathe saddle moves by 1.25mm during one turn of the lathe chuck. Inch threads are indicated as number of threads on the length of one inch. The length of one inch amounts to 25.4mm.

4.7.1

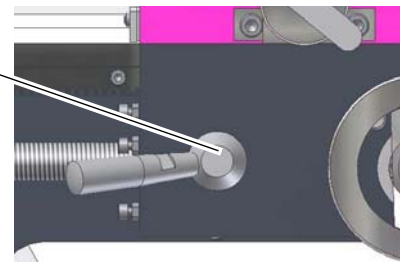
Switching on the feed



CAUTION!

When switching on the lathe with high revolution setting and the engaging lever activated, the lathe saddle moves at high speed.

Engaging lever
Position
automatic
feed "OFF"



Illustr. 4-13: Engaging lever "Position OFF"

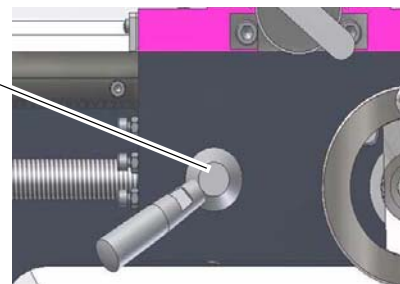


CAUTION!

If you switch on the lathe for instance at full speed of 2500 min^{-1} with the order of the toothed wheels for thread pitch 1.25mm, the lathe saddle will travel a distance of 52 mm within one second.

Threads are always cut with the least possible speed.

Engaging lever
Position
automatic
feed "ON"



Illustr. 4-14: Engaging lever "Position ON"

4.8 General working notes

4.8.1 Coolant

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

The tool should therefore be cooled during the cutting 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 cooling agents. Follow the manufacturer's disposal instructions.

5 Appendix turning

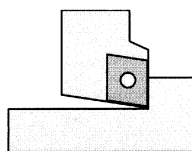
Turning is a cutting manufacturing process with certain geometrically positive or negative cutting edge geometries.

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

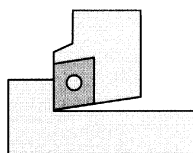
To determine the machining direction, we distinguish between right, left and neutral tools.

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

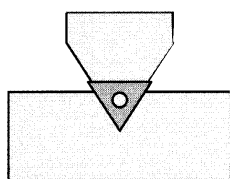
Machining direction for tool holders



Illustr. 5-1: right holder

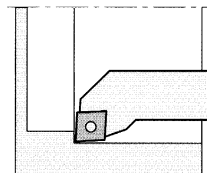


Illustr. 5-3: left holder

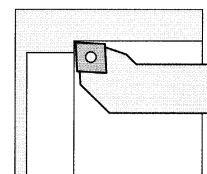


Illustr. 5-5: neutral holder

Machining direction for boring bars

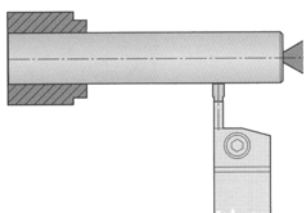


Illustr. 5-2: right boring bar

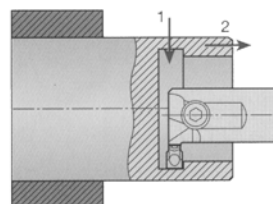


Illustr. 5-4: left boring bar

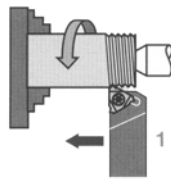
For the machining of a workpiece on the outer or inner diameter tools with different forms are required for longitudinal turning, facing, contour turning or thread cutting as well as for grooving, cutting off and cutting.



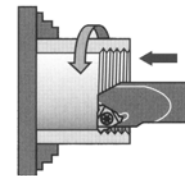
Illustr. 5-6: tool holder for grooving, cutting off and cutting



Illustr. 5-7: boring bar for grooving

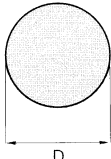
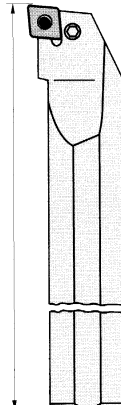
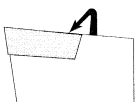
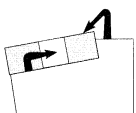
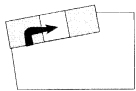
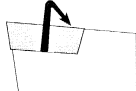


Illustr.5-8: tool holder for thread cutting

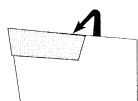

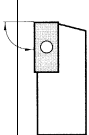
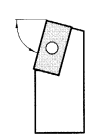
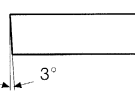

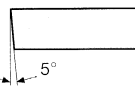

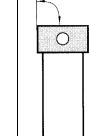
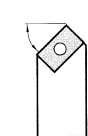
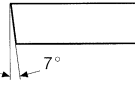
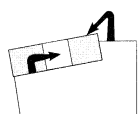

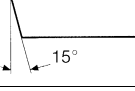

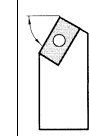
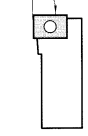
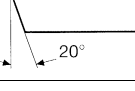

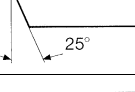
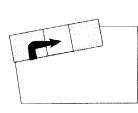

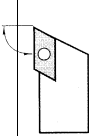
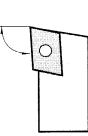
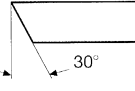

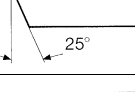

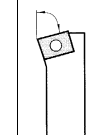
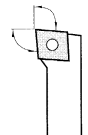
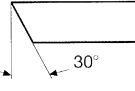
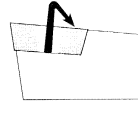

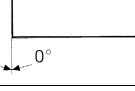

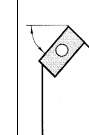
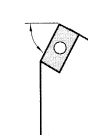
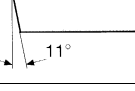


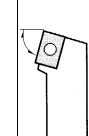
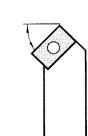
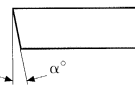


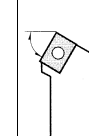
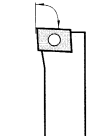

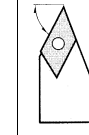
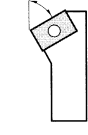
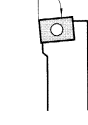


Illustr.5-9: boring bar for thread cutting

5.1 ISO-designation system for tool holder, inside machining

Material of the body			Shank diameter	Tool length	Type of fixture
Identification letter	Material of the body	Construction features			
S	steel cutter	none			C  clamped at the top
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	08 10 12 16 20 25 32 40 50		M  clamped at the top above the hole
E		with inner coolant feeding			
F		with vibration damping			
G		with vibration damping and inner coolant feeding			
H	heavy metal	none		Identification letters for the length	P  clamped above the hole
J		with inner coolant feeding			
				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	S  screwed through the hole

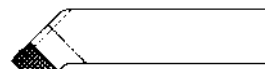
5.2 ISO-designation system for tool holder, outside machining

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

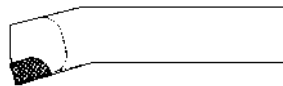
5.3 Cutter with hard metal reversible carbide tip soldered on



Illustr.5-10: straight cutter DIN 4971
ISO 1



Illustr.5-11: bent cutter DIN 4972
ISO 2



Illustr.5-12: inside tool DIN 4973
ISO 8



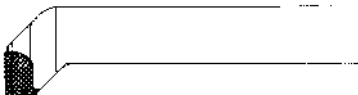
Illustr.5-13: internal side turning tool for corner
work DIN 4974 ISO 9



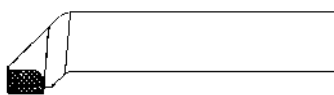
Illustr.5-14: tip of cutter DIN 4975



Illustr.5-15: cutter width DIN 4976
ISO 4



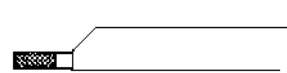
Illustr.5-16: offset face turning tool DIN 4977
ISO 5



Illustr.5-17: offset tool for corner work DIN 4978
ISO 3



Illustr.5-18: offset side turning tool DIN 4980
ISO 6



Illustr.5-19: cutoff 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 61

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 picture for the indexable inserts ☞ „ISO-designation system for tool holder, outside machining“ on page 39

5.4 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 centers 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

according 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.

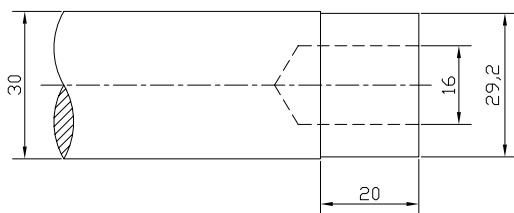


ATTENTION!

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 centers 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 $v_c = 80 \text{ m/min}$
- $a_p = 0,4 \text{ mm}$ for outside machining; $a_p = 0,2 \text{ mm}$ for inside machining
- $f = 0,05 \text{ mm/U}$ (value for automatic feed)

The speed which is to be set is calculated with

the formular

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

5.5 Outside machining, longitudinal turning and facing

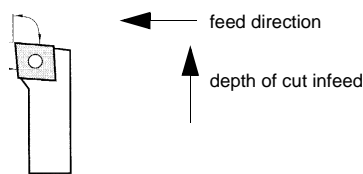
For longitudinal turning, the tool holder is moved parallel to the rotation axis. The feed is performed by turning the handwheel of the slide (therefore the bedslide is to be fixed with the clamping screw). Furthermore you have to pay attention that the angular scale of the compound slide is set to zero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

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

Switching off is to be done manually!

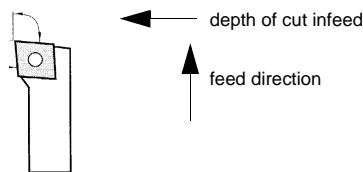
Pay also attention to the correct gear pairing!

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



Illustr.5-20: longitudinal turning

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



Illustr.5-21: facing

5.6 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 centers. If the drill rod has got a streight shank, a prison or a special streight 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 you may perform about 75% of the lathe work on the inside diameter.
- 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! A 4,0mm and a 11,5mm drill are used.

- With the drill rod only the predetermined diameter is followed. The feed is performed by turning the handwheel of the compound slide parallel to the rotation axis (please also follow the indications for longitudinal turning. The infeed of the cutting depth is performed with the hand-wheel of the compound slide in direction away from the center.
- 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 $4 \times$ drill hole diameter as an empirical formula.

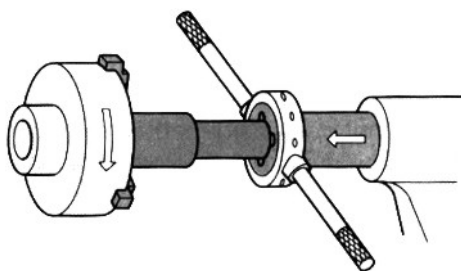
5.7

Tapping of external and internal threads

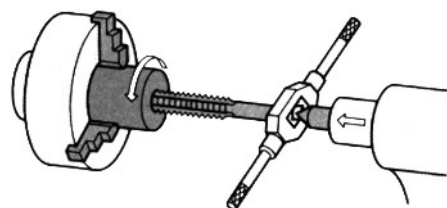
Threads with smaller diameters and standard thread pitches should be tapped manually on the lathe with screw-taps or dies by turning the clamping chuck as this is more simple to produce.

ATTENTION !

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

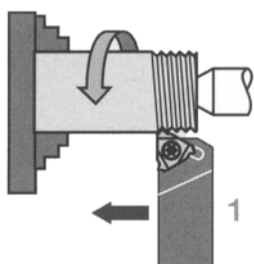


Illustr.5-22: die

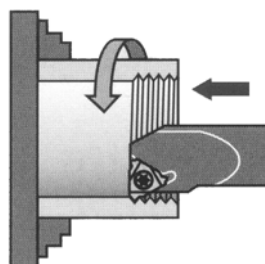


Illustr.5-23: screw tap

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).

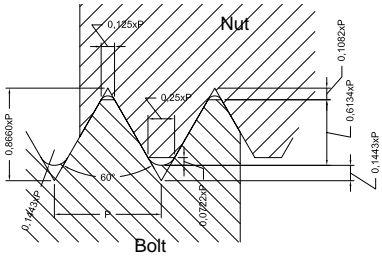
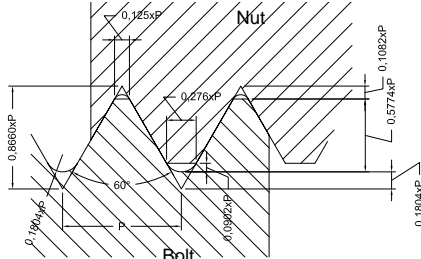


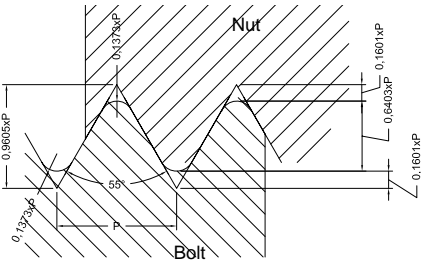
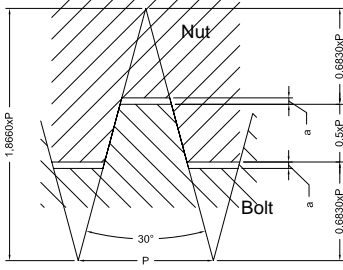
Illustr.5-24: tap external thread

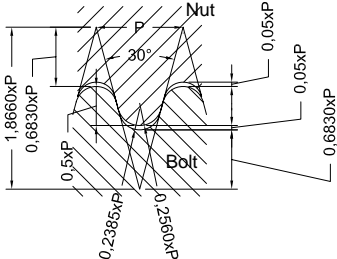
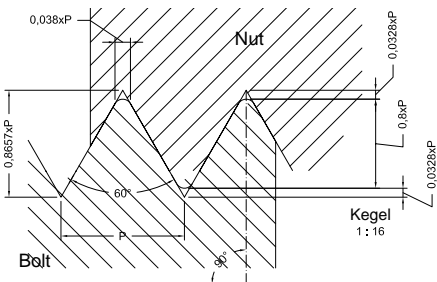


Illustr.5-25: tap internal thread

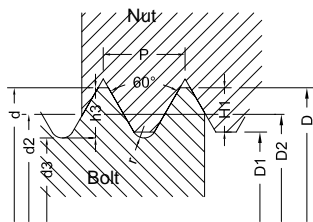
5.7.1 Thread types

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 industry and aerospace

Whitworth		B.S.W. W	1/4" in. -20 B.S.W.	Cylindrical threads, pipe threads or conical pipe threads for connections which seal within the thread
ISO-trapezoid thread (one- and multiple-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 1/2" NPT	Fittings and tube joints

5.7.2 Metric thread (60° flank angle)



pitch P
 depth of thread of the bolt $h_2 = 0,6134 \times P$
 depth of thread of the nut $h_1 = 0,5413 \times P$
 rounding $r = 0,1443 \times P$
 flank diameter $d_2 = D_2 = d - 0,6493$
 core removing hole drill $= d - P$
 flank angle = 60°

Metric coarse-pitch thread

Sizes in mm: preferably use the threads in column 1

Denomination of thread $d = D$		Pitch P	Flank diameter $d_2 = D_2$	Core diameter		Depth of thread		Rounding r	Core removing hole drill
Column 1	Column 2			Bolt d_3	Nut D_1	Bolt h_3	Nut H_1		
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 diame- ter d2 = D2	Core diameter		Denomina- tion of thread d x P	Flank diameter d2 = D2	Core diameter	
		Bolt	Nut			Bolt	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

5.7.3 British threads (55° flank angle)

BSW (Ww.): British Standard Withworth Coarse Thread Series is the most common coarse-pitch 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. 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: British Standard Pipe - Taper Thread. Conic tube thread, cone 1:16; designation: 1/4" - 19 BSPT

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

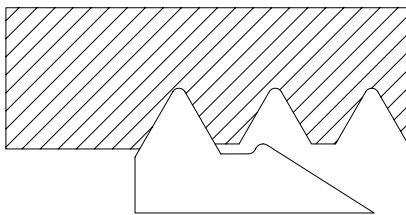
Nominal diameter of the thread		Threads in 1"				Threads in 1"		
		BSW	BSF	BSP/BSPT		BA-threads		
Inch	mm			(R)	D. [mm]	Nr.		D. [mm]
55° Flank angle						47 1/2° Flank angle		
1/16	1,588	60	-	-		16	134	0,79
3/32	2,382	48	-	-		15	121	0,9
1/8	3,175	40	-	28	9,73	14	110	1,0
5/32	3,970	32	-	-	-	13	102	1,2
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

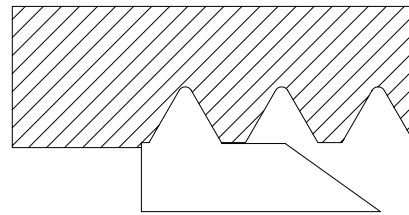
5.7.4 Indexable inserts

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.



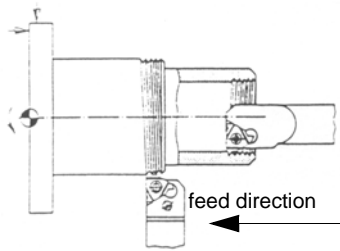
Illustr.5-26: partial profile indexable insert



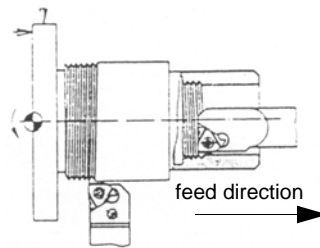
Illustr.5-27: full profile indexable insert

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

Right-handed tool holders or drill rods are used. In order to tap 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.

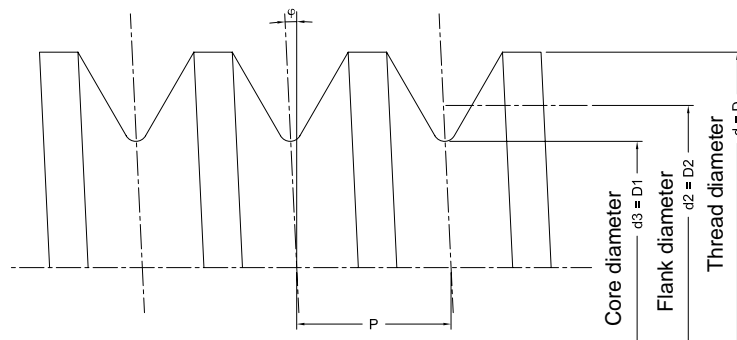


Illustr.5-28: right-handed thread with the machine spindle turning to the right



Illustr.5-29: 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.



Illustr.5-30: Pitch angle

Pitch angle φ

Pitch P

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

5.7.5 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 D140 and D180, turning tool No.6 and for lathe D210, D240, D250, D280 turning tool No.13.

Pointing turning tools are also appropriate (☞ „tip of cutter DIN 4975“ on page 40) with hard metal plates soldered on of the complete set for the lathe D140 and D180, 8mm, 11-pieces, item No. 344 1008 and for lathe D210, D240, D250, D280, 8mm, 11-pieces, item No. 344 1108 .

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

Set of turning tools HM 8mm 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

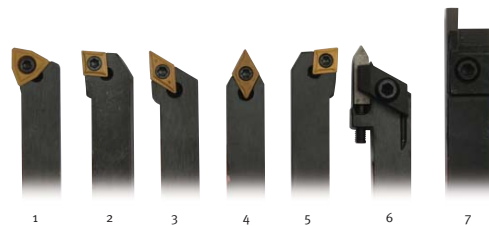
Turning tool 3: SDJCR/L0810D07

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 10mm344 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: SCLCR/L1010E06

Turning tool 10: SDJCR/L1010E07

Turning tool 11: SDNCN/L1010E07

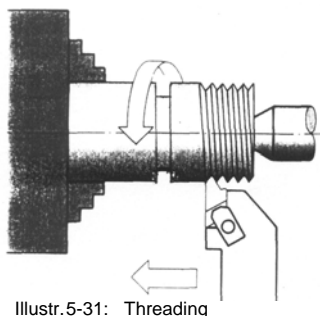
Turning tool 12: SCLCR/L1010E06

Turning tool 13: LW1010R/L04

Turning tool 14: QA1012R/L03

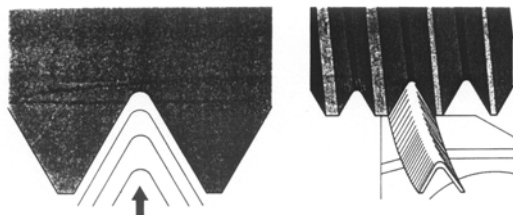


- Steel sheets are to be laid under the complete tool holder or turning tool to achieve exactly the turning center.
- The lowest spindle speed is set so that the lathe will not coast too long !
- Mount gear pairing for pitch 1,0mm in the change gear !



Illustr.5-31: Threading

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 centers is checked (as described).



Illustr. 5-32: radial infeed

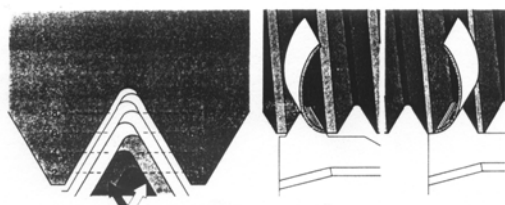
The depth of thread is manufactured in various passes. The infeed is to be reduced after each pass.

The first pass takes place with an infeed of 0,1 to 0,15mm.

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.



Illustr. 5-33: alternate infeed

For larger pitches the alternate flank infeed is selected. The compound slide is offset alternately to the left and to the right by 0,05 to 0,10mm each. 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 compound 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 compound slide is also set to zero (this is important for the lateral offset when turning threads with larger pitches).

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

In standstill of the lathe a connection to the leadspindle is made by shifting the operating lever of the lead-screw nut. 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 compound 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 runout of the thread and cam the cutter out by turning the handwheel of the compound 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 compound 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 !

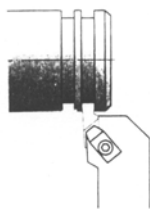
5.8 Recessing, cutting off and turning off

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.

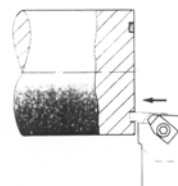
When cutting off the finished workpiece is separated from the feed stock.

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

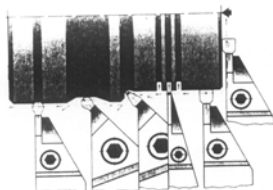
For each of these machining methods there are indexables inserts with sintered cutting form levels available.



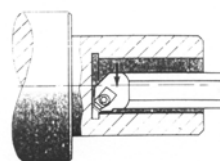
Illustr.5-34: outside recessing



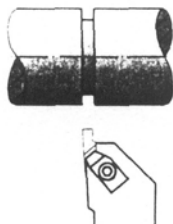
Illustr.5-35: recessing on plane faces



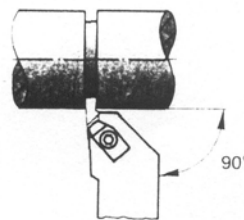
Illustr.5-36: cutting off, turning off



Illustr.5-37: inside recessing



Illustr.5-38: recessing 1



Illustr.5-39: 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 D140 and D180, turning tool No.7, and for lathe D210, D240, D250, D280 turning tool No. 14

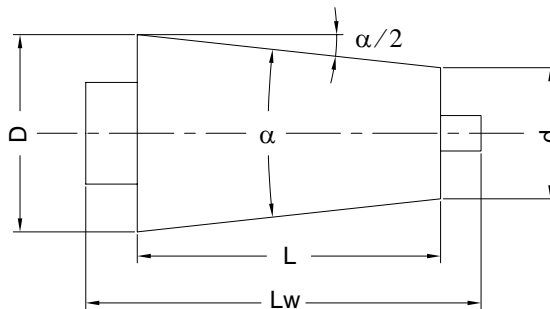
For small lathes the cutting speed for this machining compared to the cutting speed for longitudinal turning is reduced by about 60% in order to prevent oscillations.

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

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

The tool is positioned and fixed with the bedslide. The exact position is set with the handwheel of the compound slide. With the indexable insert the outer diameter is slit slightly (by turning the handwheel of the compound 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.

5.9 Turning cones with high precision



Illustr.5-40: designations on the cone

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

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

1. **By twisting the compound slide and 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.

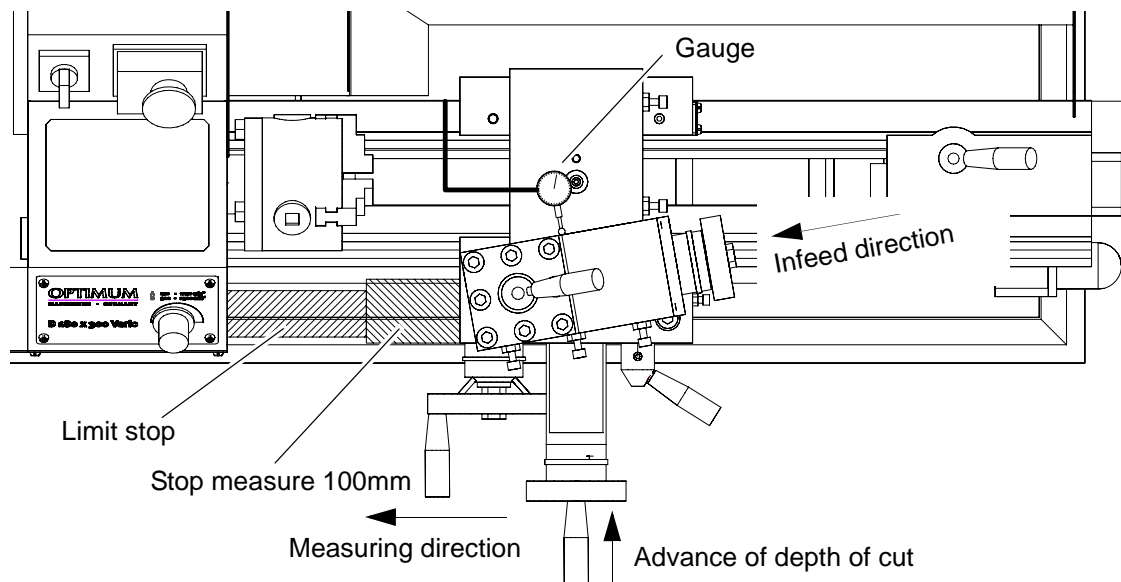
Calculation

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

step by step		
$K_v = \frac{L}{D-d}$	$V_d = \frac{100\text{mm}}{K_v}$	$V_o = \frac{V_d}{2}$
by one calculation step (summary)		
$V_o = \frac{100\text{mm} \times (D-d)}{2 \times L}$		
example: D = 30,0mm ; d = 24,0mm ; L = 22,0mm		
$V_o = \frac{100\text{mm} \times (30\text{mm} - 24\text{mm})}{2 \times 22\text{mm}} = \frac{100\text{mm} \times 6\text{mm}}{44\text{mm}} = 13,63\text{mm}$		

The stop measure (100mm) is to be put between a fixed limit stop and the bedslide. Put the gauge with stand on the lathe bed and horizontally align the test prod with the testprod with the compound slide (90° to the compound slide). The twisting measure is calculated with the above mentioned formula. The compound 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 compound slide. The depth of cut is advanced with the handwheel of the compound slide.

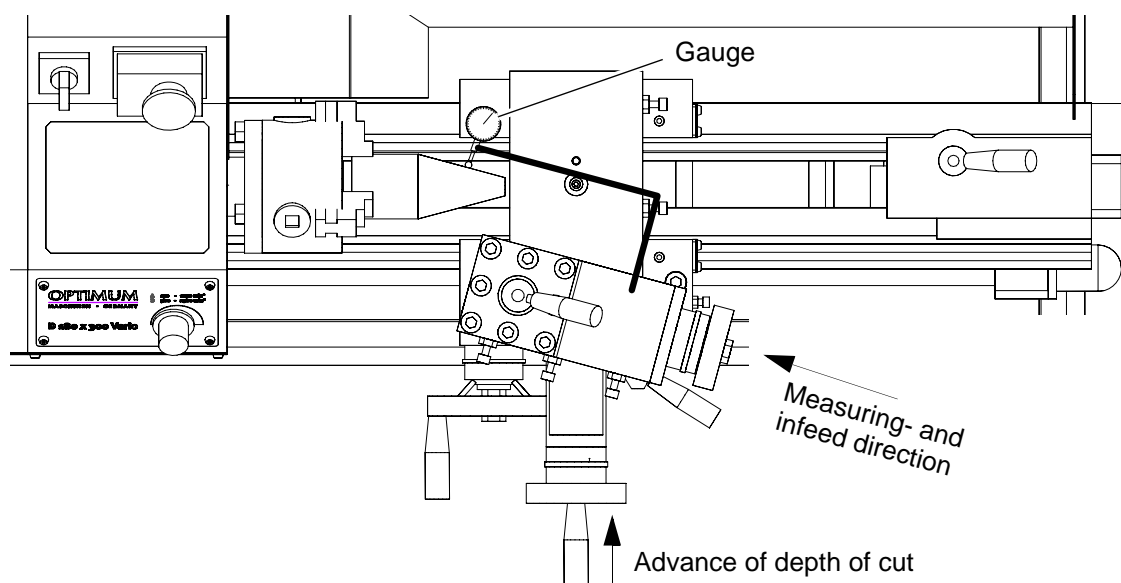


Illustr.5-41: Cone setting with stop measure

3. By measuring an existing cone with gauge and stand

The stand is put on the compound slide. The gauge is aligned horizontally and 90° to the compound slide. The compound slide is approximately adjusted to the cone angle and the test prod brought in contact with the cone surface (fix the bedslide). Now the compound 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 compound 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.



Illustr.5-42: determining the cone with a gauge

4. By offsetting the tailstock as the cone length is larger than the adjustable stroke of the compound 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). ➡ „designations on the cone“ on page 56

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 centerings is 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:

$$V_r = \frac{L_w}{2 \times K_v}$$

$$\text{or} \quad V_r = \frac{D-d}{2 \times L} \times L_w$$

$$V_{r_{\max}} = \frac{L_w}{50}$$

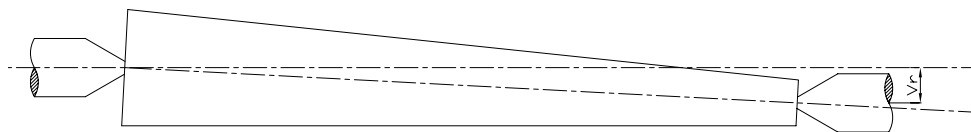
The tailstock offset must not exceed the value "Vr_{max}" as the workpiece tumbles !

Example:

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

$$V_r = \frac{150}{2 \times 40} = 1,875 \text{ mm}$$

$$V_{r_{\max}} = \frac{150}{50} = 3 \text{ mm}$$



Illustr. 5-43: Workpiece between points: tailstock offset Vr

5.10 Cutting material

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.

5.10.1 Cutting materials for chipping

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 (cast iron, 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 / Chemical Vapor Deposition.

The most common layers of mechanically resistant materials are:

- TiN / titanium nitride,
- TiC / titanium carbide,
- TiCN / titanium carbon nitride,
- Al₂O₃ / aluminum 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-metallic anorganic material.

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

Mixed ceramics made of aluminum oxide and an addition of titanium carbide has good wear resistance 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 nonferrous and non-metallic materials in the finishing.

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

5.11 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 61

Criteria of the cutting conditions:

Cutting speed: V_c (m/min)

Depth of cut: a_p (mm)

Infeed: f (mm/U)

Cutting speed:

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

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

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 infed shall result in a figure between 4 and 10.

Example: $a_p = 1,0\text{mm}$; $f = 0,14\text{mm/U}$; and this equals to in a value of 7,1 !

Infeed:

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

Example: $r = 0,4\text{mm}$; equals to $f_{\text{max.}} = 0,2\text{mm/U}$!

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

Example: $r = 0,4\text{mm}$; equals to $f_{\text{max.}} = 0,12\text{mm/U}$!

5.11.1 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
non-alloyed 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
aluminum 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-Al₂O₃ - TiCN - TiN

HC M15/K10 = CVD - coating TiAlN

5.12 Grinding or regrinding of cutting edge geometries of turning tools

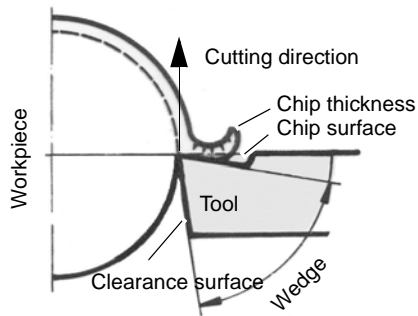
This affects all cutters made of high-speed steel (HSS) and tools with carbide tipped tools soldered on according to DIN 4971 - 4977 and 4980 - 4981.

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

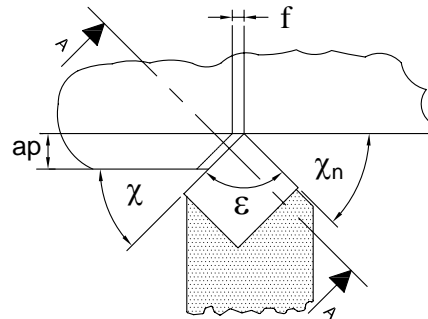
The HSS-square turned piece DIN 4964 type B are without a polished section, they are to be ground before they are first used.

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

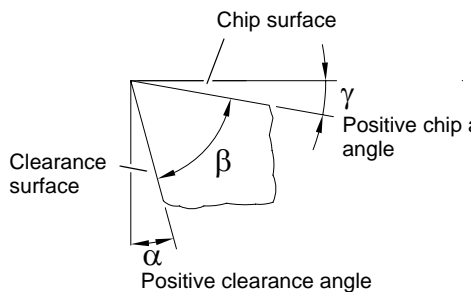
5.12.1 Terms for the turning tool



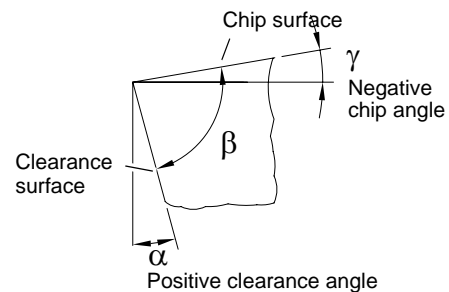
Illustr.5-44: Geometrically determined cutter for the separation process



Illustr.5-45: Cut and chip size



Illustr.5-46: Cut A - A, positive cutter



Illustr.5-47: 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	V_c
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. A 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.

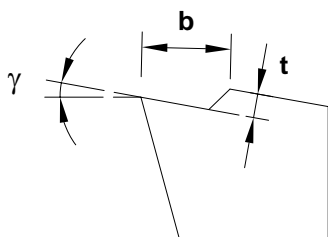
5.12.2 Cutting edge geometry for turning tools

	High-speed steel		Hard metal	
	Clearance angle	Chip angle	Clearance angle	Chip angle
Steel	+5° bis +7°	+5° bis +6°	+5° bis +11°	+5° bis +7°
Cast non	+5° bis +7°	+5° bis +6°	+5° bis +11°	+5° bis +7°
NE - metal	+5° bis +7°	+6° bis +12°	+5° bis +11°	+5° bis +12°
Aluminum alloys	+5° bis +7°	+6° bis +24°	+5° bis +11°	+5° bis +24°

5.12.3 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



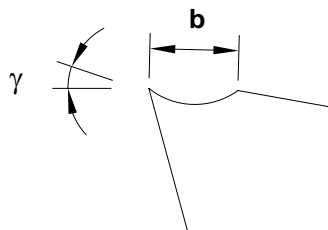
Illustr. 5-48: cutting form level

$b = 1,0\text{mm to } 2,2\text{mm}$

$t = 0,4\text{mm to } 0,5\text{mm}$

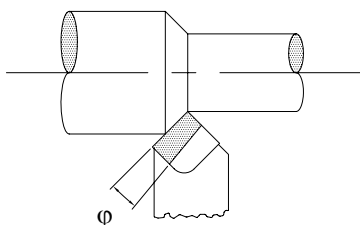
For infeeds of 0,05 to 0,5mm/U and depths of cut of 0,2mm to 3,0mm

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

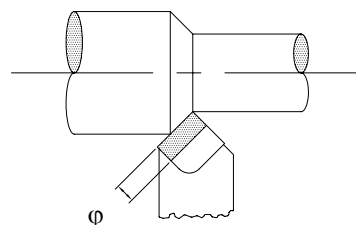


Illustr. 5-49: cutting form level with fillet

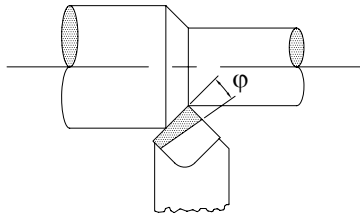
$b = 2,2\text{mm with fillet}$



Illustr. 5-50: Positive apex angle for planing



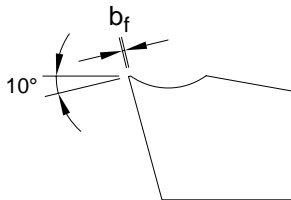
Illustr. 5-51: Neutral apex angle for planing and roughing



Illustr. 5-52: Negative apex angle for roughing

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

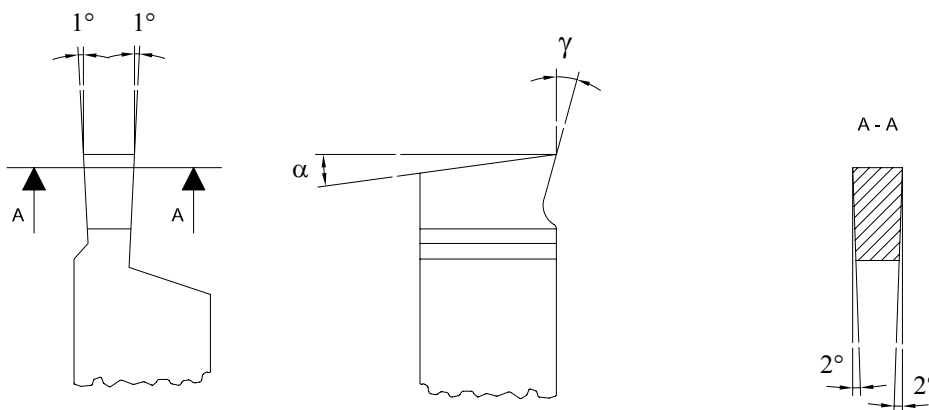
For the roughing, a small chamfer must be produced with the grindstone in order to stabilize the cutting edge against striking chips ($b_f = f \times 0,8$).



Illustr. 5-53: Stabilize cutting edge

Polished section for recessing and cutting off

(for chip angle refer to table)





Illustr. 5-54: Polished section recessing and cutting off

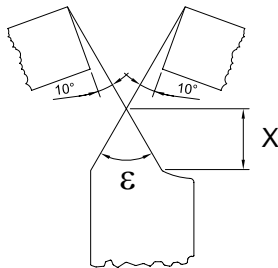
Polished section for threading

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

Also refer to:

-  „Thread types“ on page 44
-  „Pitch angle“ on page 51

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.



Illustr.5-55: Polished section for threading

5.13 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

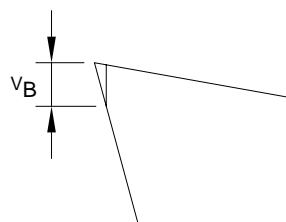
The wear of clearance surface V_B and the creater wear on the chipping surface is the most common type of tool wear. They are mainly formed by friction. The clearance surface wear has effects on the dimensional accuracy of the workpieces and on the cutting force (the cutting force increases by 10% for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

The clearance wear is generally used as lifetime criteria.

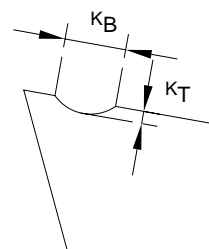
Crackings on the cutting edge may be caused by casting crusts or forging skins. Another cause may be ridge cracks (cracks transversal to the edge) which are caused by thermal and mechanical shock loads such as interrupted cuts or short contact times for very hard cutting materials.

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.



Illustr.5-56: Clearance surface wear



Illustr.5-57: Creater wear

6 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

- **safe operation,**
- **faulty-free operation,**
- **long service life of the lathe and**
- **the quality of the products you manufacture.**

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

6.1 Safety



WARNING!



The consequences of incorrect maintenance and repair work may include:

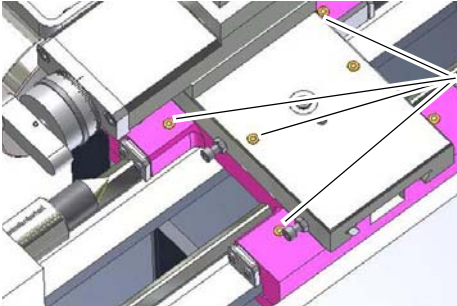
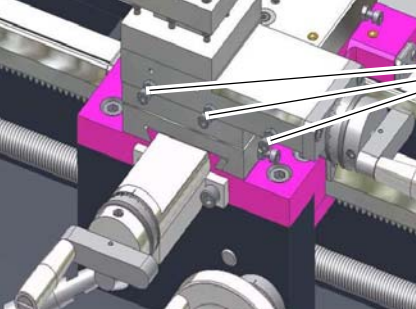
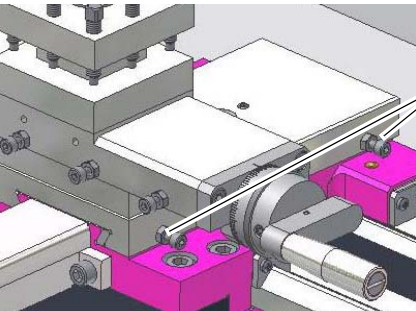
- **very serious injury to employees working on the lathe,**
- **damage to the lathe.**

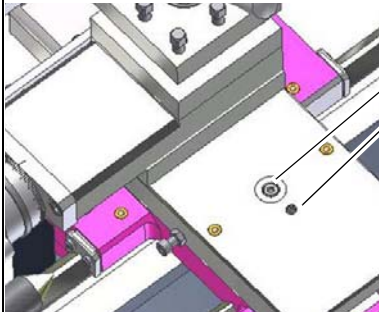
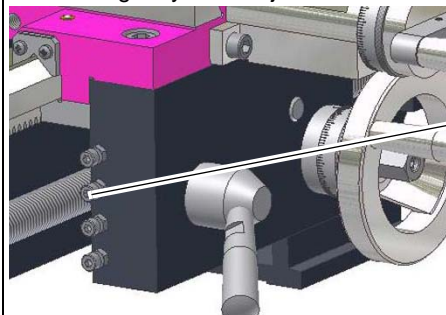
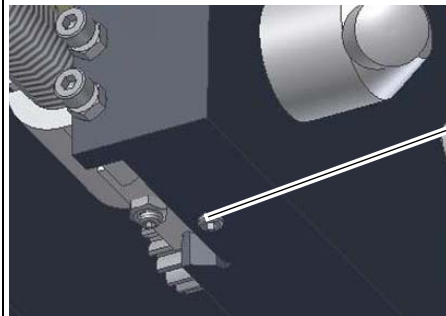
Only qualified employees should carry out maintenance and repair work on the lathe.

6.2 Inspection and maintenance

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

Interval	Where?	What?	How?
Every week	Machine bed	Lubricate	<ul style="list-style-type: none"> Lubricate all blank steel parts with a non-corrosive oil.  „Operating material“ on page 16
	Headstock	Inspection	<ul style="list-style-type: none"> Control the tension of the synchronous belts.  Illustr. 4-9: „synchronous belt position change“ on page 33)
		Lubricate	<ul style="list-style-type: none"> Slightly lubricate the change wheels and the leading spindle with a lithium grease.

Interval	Where?	What?	How?
Every week	Lathe slide	Lubricate	<ul style="list-style-type: none"> Lubricate the lubricating nipples on the lathe slide.  <p>Lubricating nipples</p> <p>Illustr. 6-1: Lathe slide</p>
Semestrial	Headstock	Visual inspection	<ul style="list-style-type: none"> Control if the synchronous belts are porous or worn.
As required	Top slide	Readjust	<ul style="list-style-type: none"> Readjust the guide clearance of the top slide.  <p>Readjusting screws</p> <p>Illustr. 6-2: Lathe slide</p>
As required	Compound slide	Readjust	<ul style="list-style-type: none"> Readjust the guide clearance of the compound slide.  <p>Readjusting screws</p> <p>Illustr. 6-3: Lathe slide</p>

Interval	Where?	What?	How?
As required	Spindle nut of the compound slide	Readjust	<ul style="list-style-type: none"> The set screw widens the flanks of screw thread of the spindle nut. If required, turn the set screw only slightly. A too widened set screw will lead to excessive wear.  <p>Illustr. 6-4: Lathe slide</p>
As required	Lead- screw nut	Readjust	<ul style="list-style-type: none"> The clearance of the lead-screw nut for opening and closing may be readjusted.  <p>Illustr. 6-5: Lathe slide</p>
As required	Lead- screw nut	Readjust	<ul style="list-style-type: none"> The locking split of the lead-screw nut may only be adjusted when it is closed. If the locking split is too small or too large this will lead to excessive wear.  <p>Illustr. 6-6: Lathe slide</p>



INFORMATION!

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

6.3 Repair

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

If the repairs are carried out by qualified technical staff, then the instructions given in this manual must be followed.

Optimum Maschinen Germany GmbH does not take responsibility nor does it guarantee against damage and operating abnormalities resulting from failure to observe 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.

7 Abnomalties

7.1 Abnomalties in the lathe

Abnomalty	Cause/ possible effects	Solution
Surface of workpiece too rough	<ul style="list-style-type: none"> • Tool blunt • Tool springs • Feed too high • Radius at the tool tip too small 	<ul style="list-style-type: none"> • Resharpen tool • Clamp tool with less overhang • Reduce feed • Increase radius
Workpiece becomes coned	<ul style="list-style-type: none"> • Top slide is not exactly set to zero (when turning with the top slide) 	<ul style="list-style-type: none"> • Set top slide to exact zero position
Lathe is chattering	<ul style="list-style-type: none"> • Feed too high • Main bearings have clearance 	<ul style="list-style-type: none"> • Reduce feed • Have the main bearings re-adjusted
Center runs hot	<ul style="list-style-type: none"> • Workpiece has expanded 	<ul style="list-style-type: none"> • Loosen tailstock center
Tool has a short edge life	<ul style="list-style-type: none"> • Hard casting skin • Cutting speed too high • Crossfeed too high • Insufficient cooling 	<ul style="list-style-type: none"> • First break casting skin • Reduce cutting speed • Lower crossfeed (smooth finish allowance not over 0,5 mm) • More coolant
Flank wear too high	<ul style="list-style-type: none"> • Clearance angle too small (tool "pushes") • Tool tip not adjusted to center height 	<ul style="list-style-type: none"> • Increase clearance angle • Correct height adjustment of the tool
Cutting edge breaks off	<ul style="list-style-type: none"> • Wedge angle too small (heat build-up) • Grinding cracks due to wrong cooling • Excessive clearance in the spindle bearing arrangement (vibrations) 	<ul style="list-style-type: none"> • Increase wedge angle • Cool uniformly • Have the clearance in the spindle bearing arrangement re-adjusted.
Cut thread is wrong	<ul style="list-style-type: none"> • Tool is clamped incorrectly or has been started grinding the wrong way • Wrong pitch • Wrong diameter 	<ul style="list-style-type: none"> • Adjust tool to the center • Grind angle correctly • Adjust right pitch • Turn the workpiece to the correct diameter

8 Ersatzteile - Spare parts - D180x300 Vario

8.1 Ersatzteilzeichnung Antrieb - Drawing spare parts drive

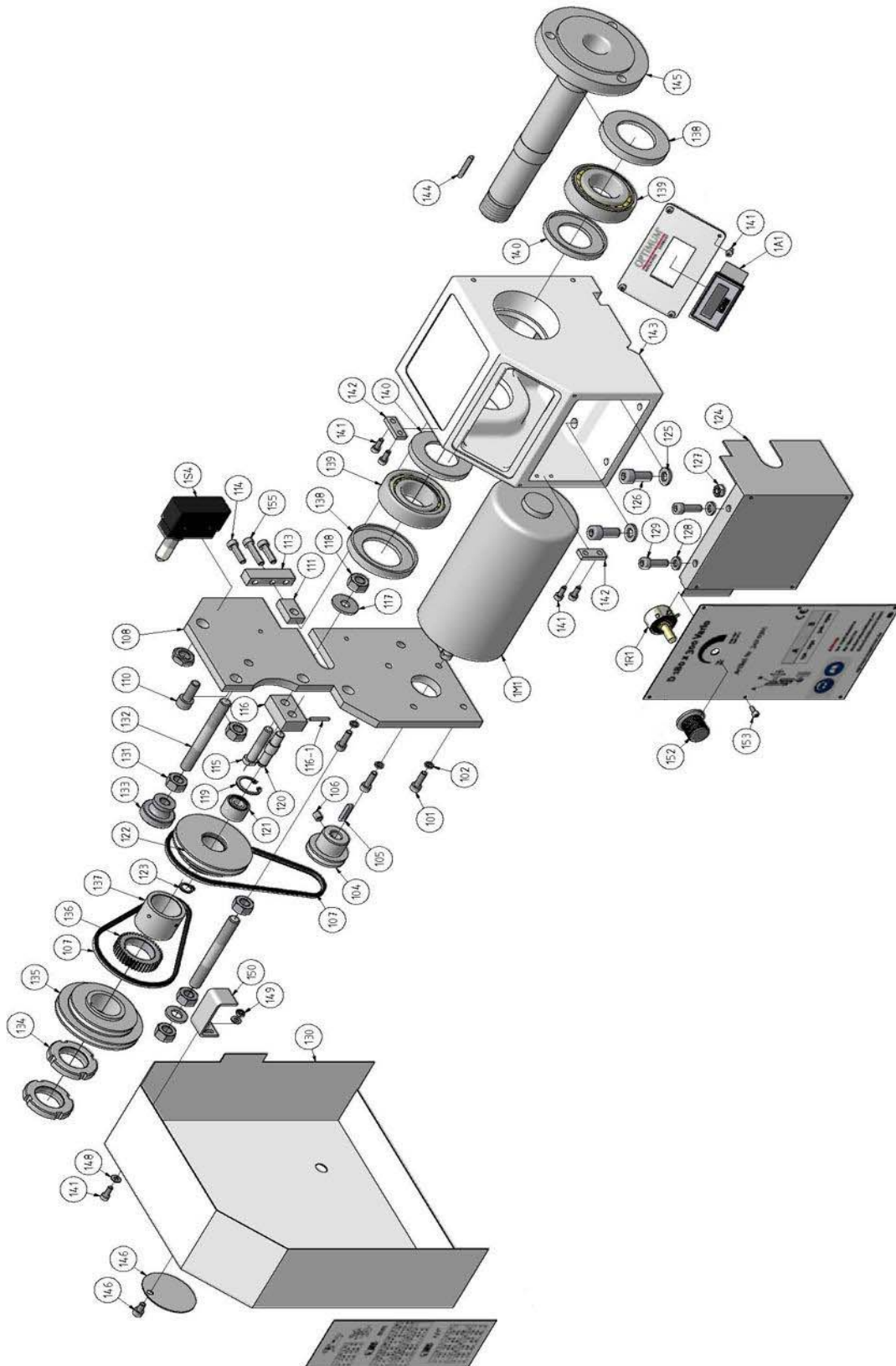


Abb.8-1: Antrieb - Drive

8.2 Ersatzteilzeichnung Oberschlitten und Planschlitten - Drawing spare parts top slide and cross slide

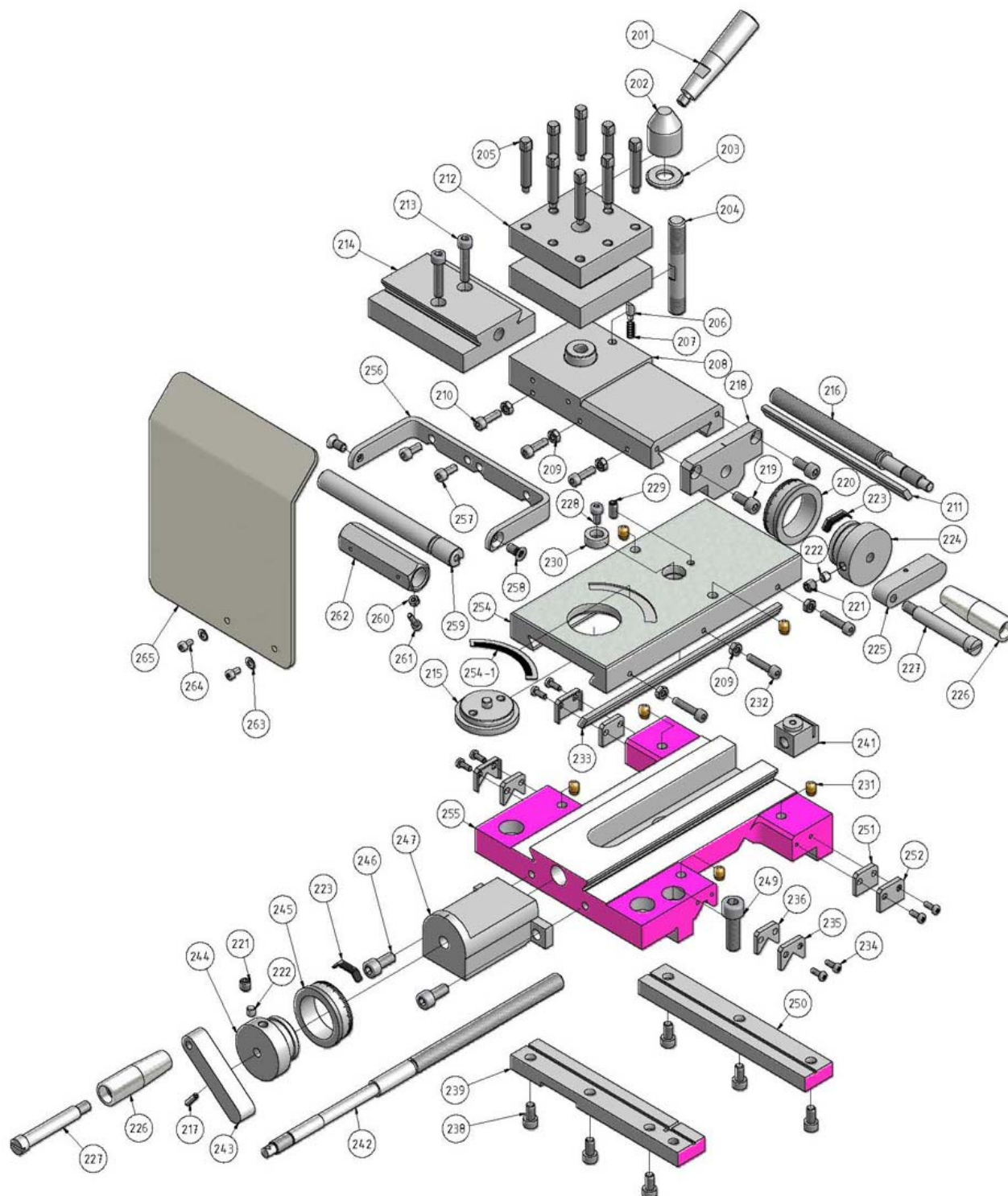


Abb.8-2: Oberschlitten und Planschlitten - Top slide and cross slide

8.3 Ersatzteilzeichnung Bettschlitten - Drawing spare parts lathe saddle

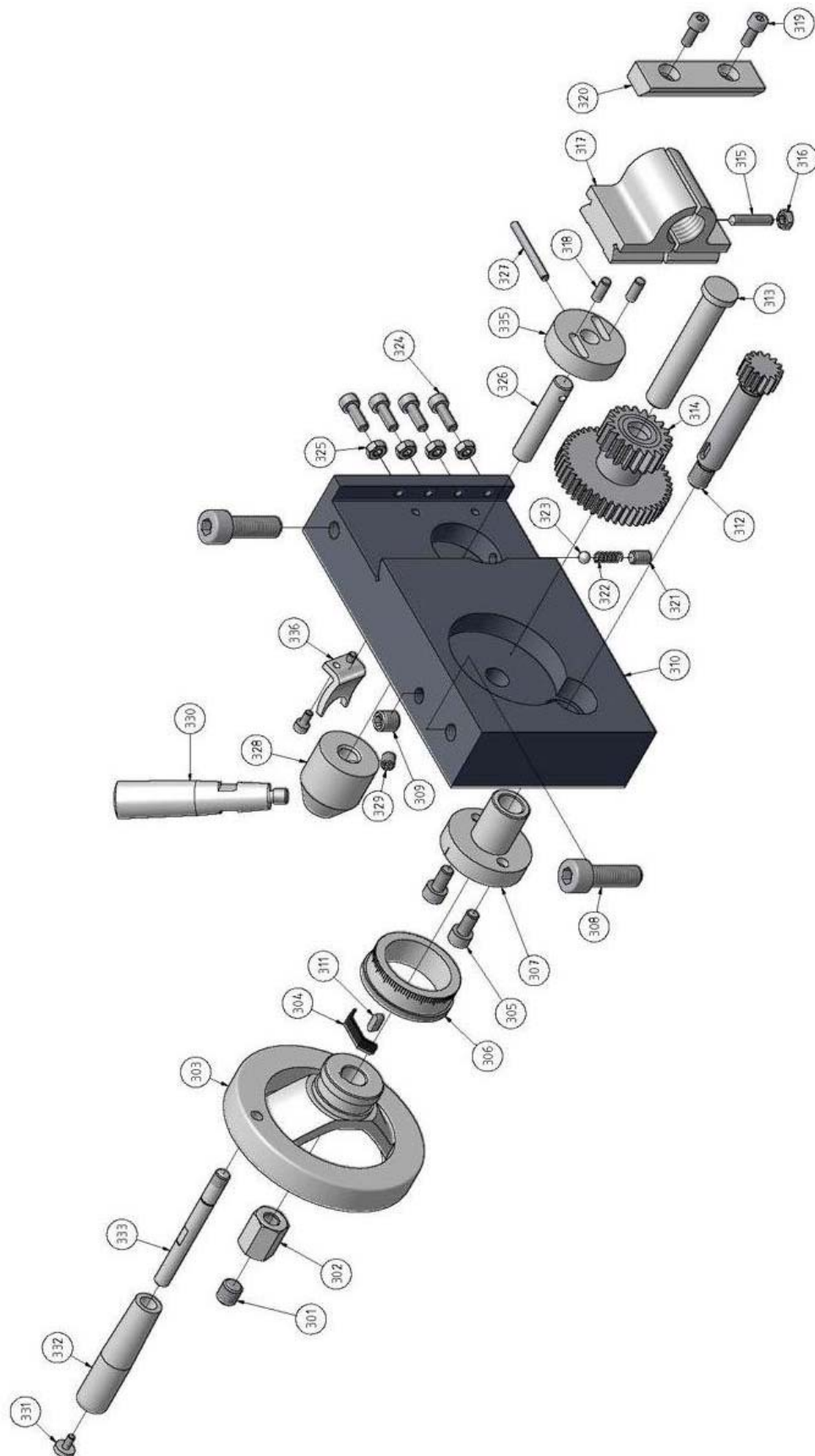


Abb.8-3: Bettschlitten - Lathe saddle

8.4 Ersatzteilzeichnung Maschinenbett - Drawing spare parts lathe bed

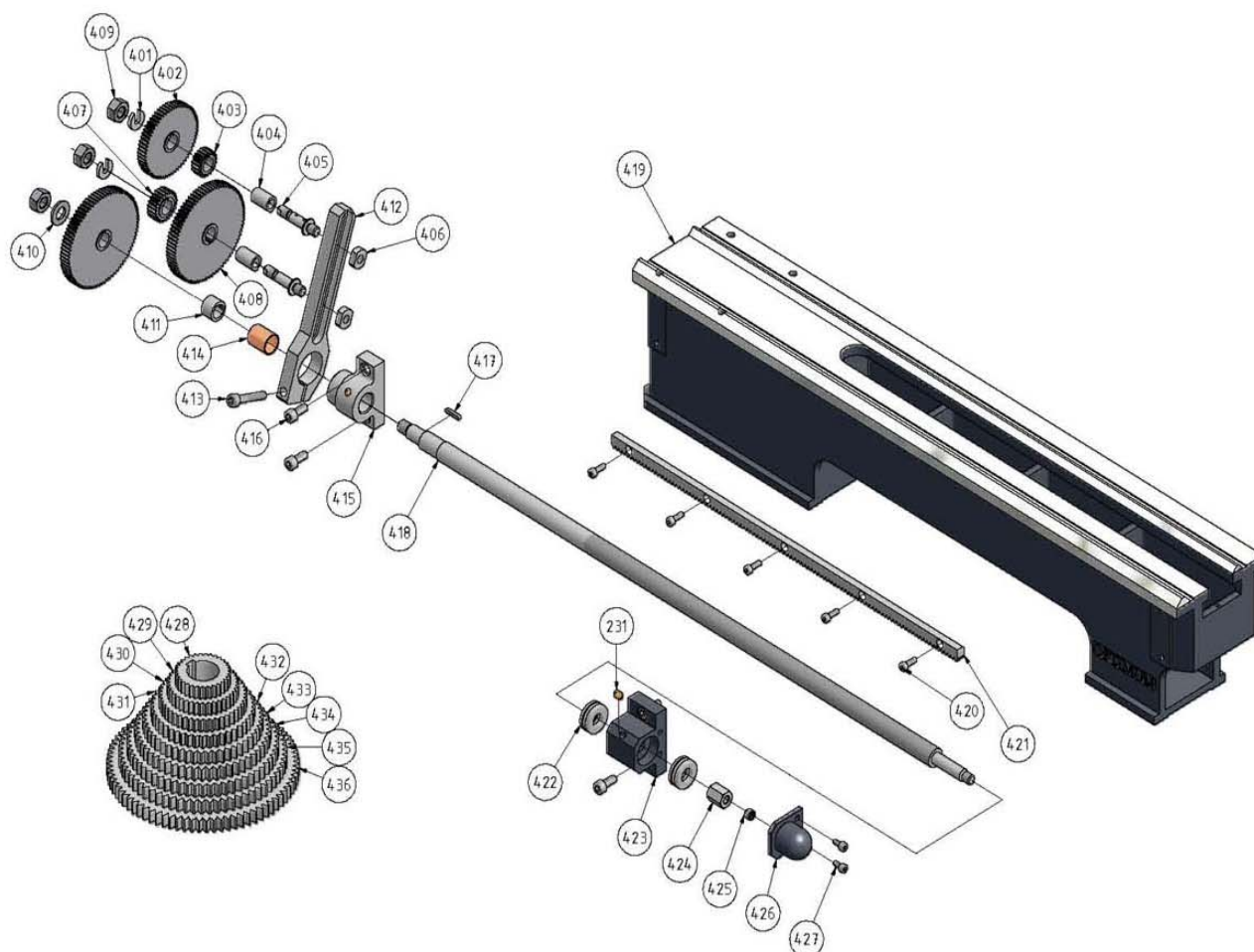


Abb.8-4: Maschinenbett - Lathe bed

8.5 Ersatzteilzeichnung Reitstock - Drawing spare parts teilstock

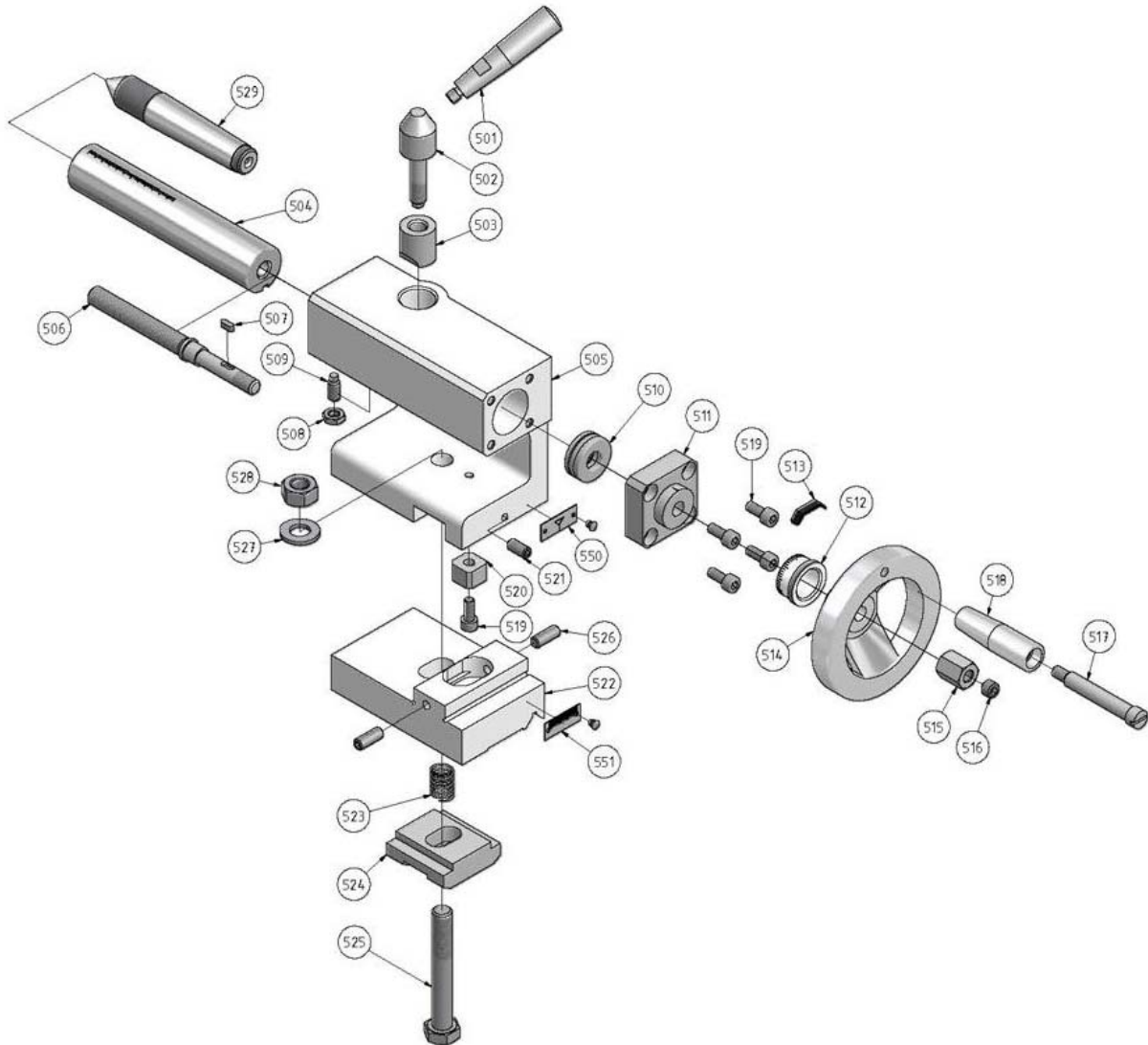


Abb.8-5: Reitstock - Teilstock

8.6 Ersatzteilzeichnung Zubehör - Drawing spare parts accessory

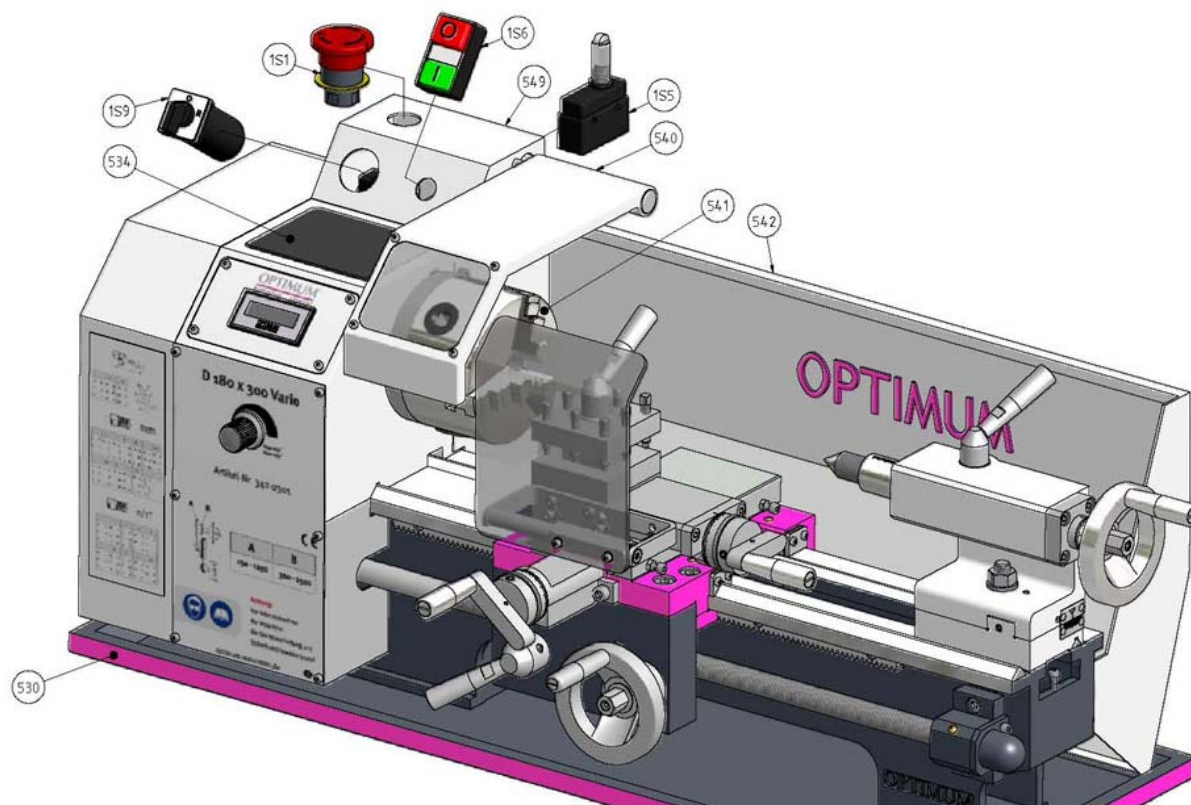


Abb.8-6: Vorderansicht - Front view

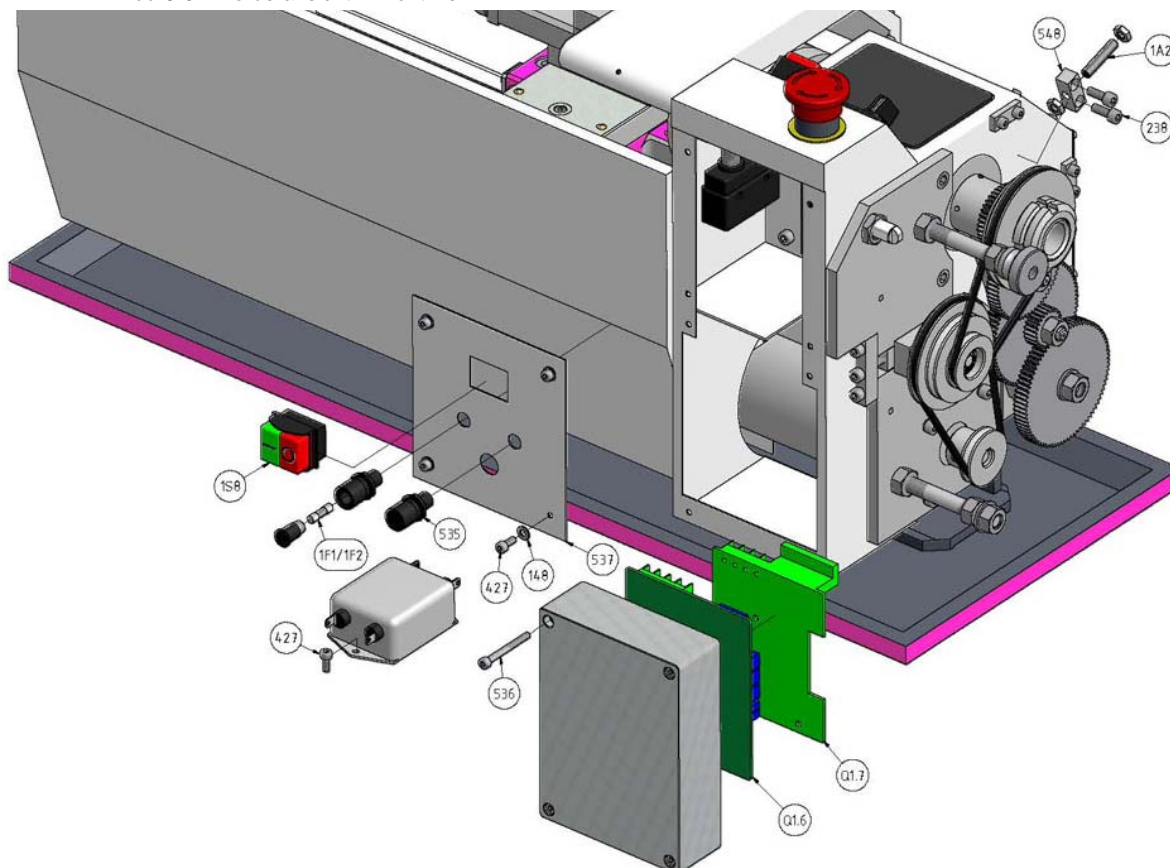


Abb.8-7: Hinteransicht - Back view

8.7 Schaltplan - Wiring diagram

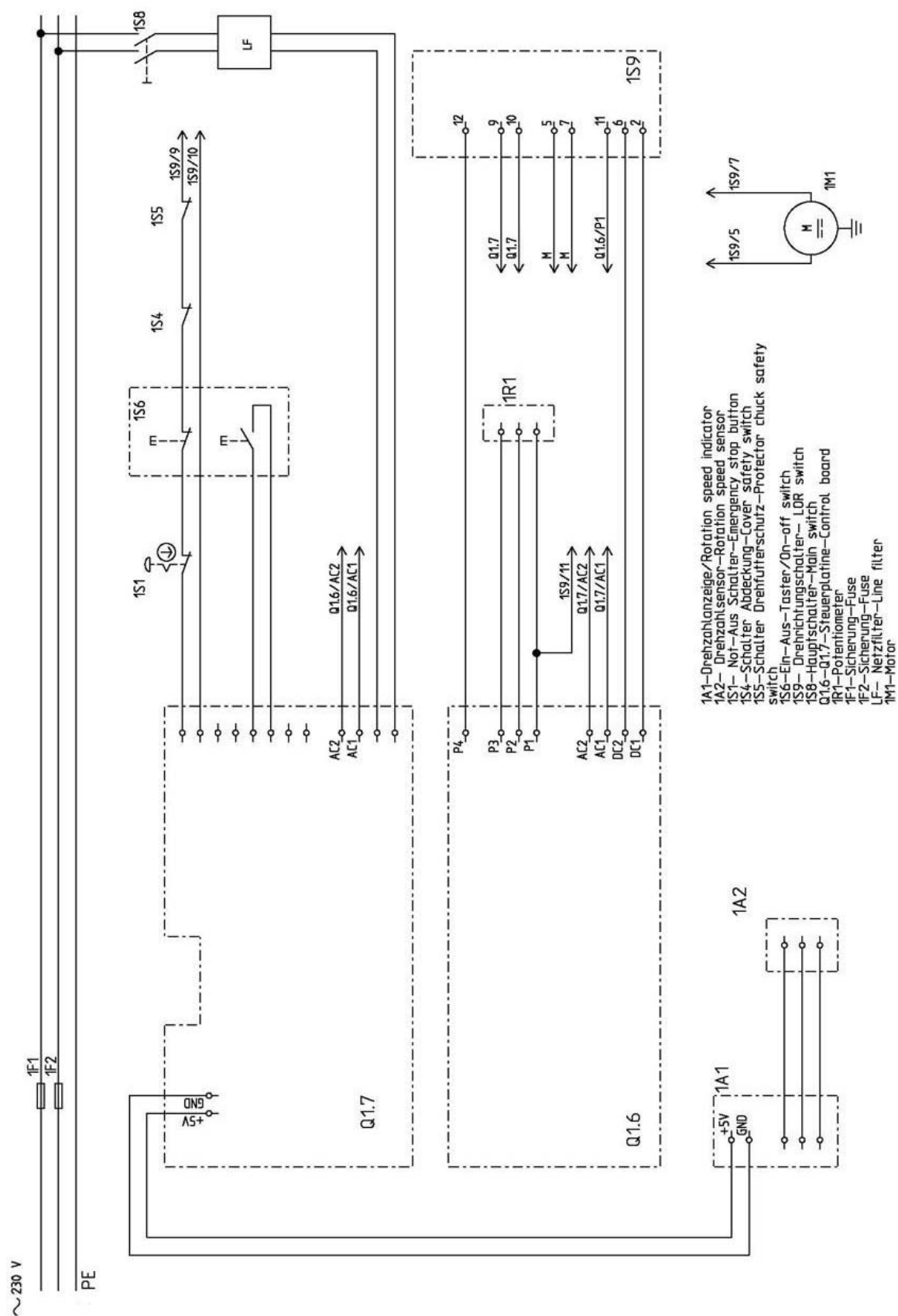


Abb.8-8: Schaltplan - Wiring diagram

8.8 Maschinenschilder - Machine labels

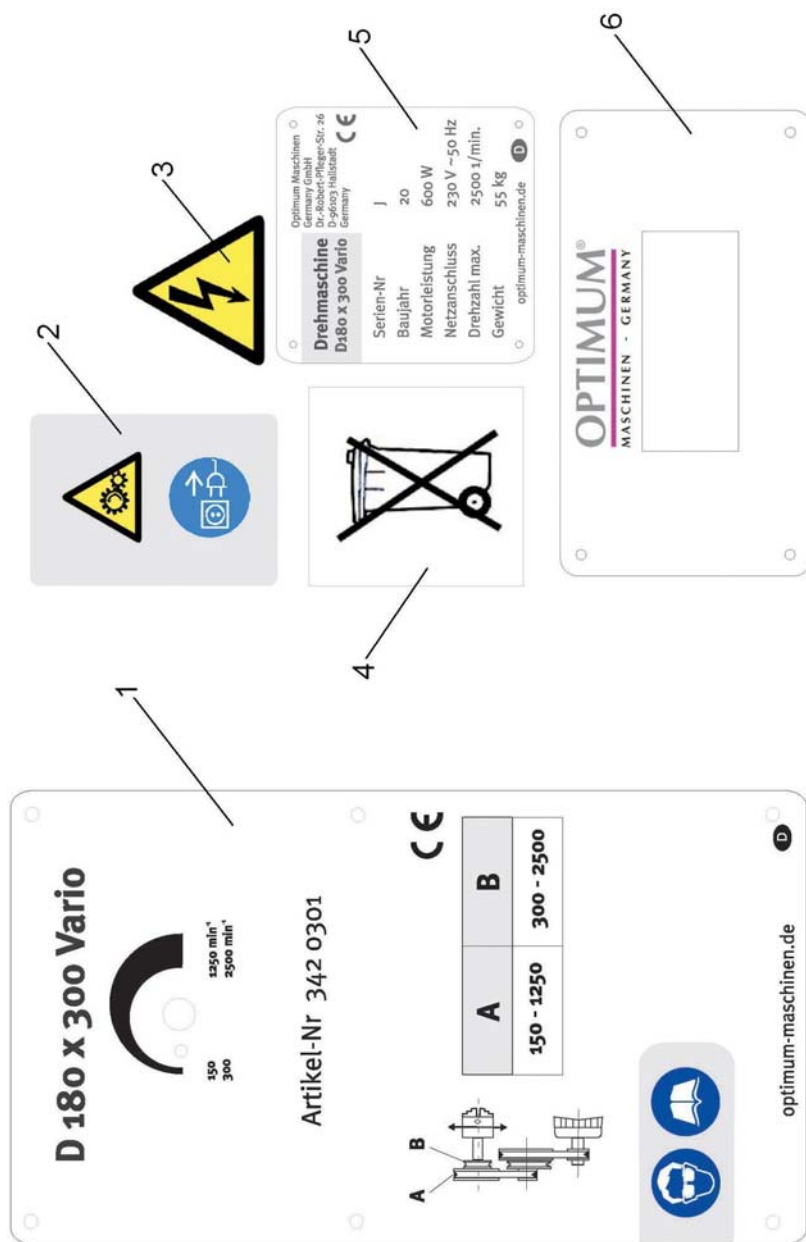


Abb.8-9: Maschinenschilder - Machine labels

8.8.1 Maschinenschilder - Machine labels

Pos.	Bezeichnung	Designation	Menge	Grösse	Artikelnummer
			Quan- tity	Size	Article no.
1	Frontschild	Front label	1		03420301L01
2	Sicherheitsschild	Safety label	1		03420301L02
3	Sicherheitsschild	Safety label	1		03420301L03
4	Hinweisschild	Instruction label	1		03420301L04
5	Maschinenschild	Machine label	1		03420301L05
6	Schild Drehzahlanzeige	Rotation speed indicator	1		03420301L06

8.8.2 Ersatzteilliste - Spare parts list

Pos.	Bezeichnung	Designation	Menge	Grösse	Artikel- nummer
			Qty.	Size	Item no.
101	Innensechskantschraube	Hexagon socket screw	4	DIN 912 M5x25	
102	Federring	Split washer	4	DIN 127 5	03420301102
104	Riemenscheibe Motor	Motor pulley	1		03420301104
105	Passfeder	Key	1	DIN 6885-A4x4x20	03420301105
106	Gewindestift	Set screw	1	DIN 915 M6x8	
107	Zahnriemen	Synchronous belt	2	Gates 5M-365	03420301107
108	Trägerplatte	Supporting plate	1		03420301108
109	Scheibe	Washer	3	8	
110	Innensechskantschraube	Hexagon socket screw	3	DIN 912 M8x20	
111	Gleitstein	Sliding nut	1		03420301111
112	Innensechskantschraube	Hexagon socket screw	1	DIN 912 M6 x 30	
113	Gegenlager	Thrust bearing	1		03420301113
114	Innensechskantschraube	Hexagon socket screw	2	DIN 912 M6 x 20	
115	Achse	Axis	1		03420301115
116	Lagerbock	Bearing block	1		03420301116
116-1	Passstift	Alignment pin	1	4x22	034203011161
117	Scheibe	Washer	1	8	
118	Sechskantmutter	Hexagon nut	3	M8	
119	Sicherungsring	Locking ring	1	DIN 471-8 x 0.8	03420301119
120	Zwischenwelle	Countershaft	1		03420301120
121	Rillenkugellager	Deep groove ball bearing	2	608-RZ	040608.2R
122	Riemenscheibe Zwischenwelle	Pulley countershaft	1		03420301122
123	Sicherungsring	Locking ring	1	DIN 471-22 x 1	03420301123
124	Abdeckung	Bottom cover	1		03420301124
125	Scheibe	Washer	4	M8	
126	Schraube	Screw	4	M8x25	
127	Mutter	Nut	2	M5	
128	Scheibe	Washer	2	5	
129	Innensechskantschraube	Hexagon socket screw	2	DIN912/M5x25	
130	Riemenabdeckung	Pulley cover	1		03420301130
131	Mutter	Nut	2	M10	
132	Gewindebolzen	Threaded bolt	2	M10x80	03420301132
133	Rändelmutter	Knurled nut	2	M10	03420301133
134	Nutmutter	Groove nut	2	DIN 1804-M27x1-w	03420301134
135	Riemenscheibe Antrieb	Drive pulley	1		03420301135
136	Zahnrad	Toothed wheel	1	40 theeth	03420301136
137	Hülse	Bushing	1		03420301137
138	Lagerabdeckung	Bearing cover	2		03420301138
139	Kegelrollenlager	Taper roller bearing	2	30206/P5	04030206
140	Lagerabdeckung	Bearing cover	2		03420301140
141	Innensechskantschraube	Hexagon socket screw	4	DIN 912 M4 x 10	
142	Fixierplatte	Fixing plate	2		03420301142
143	Gehäuse Spindelstock	Headstock housing	1		03420301143
144	Passfeder	Key	1	DIN 6885-A3x3x15	03420301144
145	Spindel	Spindle	1		03420301145
146	Innensechskantschraube	Hexagon socket screw	1	DIN 912 M4 x 10	
148	Scheibe	Washer	4	DIN 125/4	
149	Sechskantmutter	Sechskantmutter	2	ISO 4032/M4	
150	Winkel	Angle	1		03420301150
152	Drehknopf	Knob	1		03420301152
153	Innensechskantschraube	Hexagon socket screw	6	DIN 912 M3 x 8	
155	Innensechskantschraube	Hexagon socket screw	1	DIN 912 M5 x 25	
201	Griff	Handle	1		03420301201
202	Klemmmutter	Clamping nut	1		03420301202
203	Unterlagscheibe	Washer	1		03420301203
204	Gewindebolzen	Threaded bolt	1		03420301204
205	Innensechskantschraube	Hexagon socket screw	8	DIN 912 M6 x 25	
206	Rastbolzen	Stop bolt	1		03420301206
207	Feder	Spring	1	Ø5x10x Ø1	03420301207
208	Oberschlitten	Top slide	1		03420301208
209	Mutter	Nut	12	M4	
210	Innensechskantschraube	Hexagon socket screw	3	DIN 912 M4x14	
211	Keilleiste	Gib	1		03420301211
212	Vierfachstahlhalter	Tool holder	1		03420301212
213	Innensechskantschraube	Hexagon socket screw	2	DIN 912 M5 x 30	

Pos.	Bezeichnung	Designation	Menge	Grösse	Artikelnummer
			Qty.	Size	Item no.
214	Schwalbenschwanzführung	Dovetail guide	1		03420301214
215	Drehring	Swivel	1		03420301215
216	Spindel	Spindle	1		03420301216
217	Spannstift	Dowel pin	2	3x12	03420301217
218	Lagerbock	Bearing block	1		03420301218
219	Innensechskantschraube	Hexagon socket screw	2	DIN 912 M5 x 12	
220	Skalenring	Scale ring	1		03420301220
221	Gewindestift	Set screw	2	DIN 915 M6 x 6	
222	Stift	Pin	2		03420301222
223	Federblech	Spring steel sheet	2		03420301223
224	Führungsscheibe	Guiding disk	2		03420301224
225	Hebel	Lever	1		03420301225
226	Griffhülse	Handle	2		03420301226
227	Befestigungsschraube	Fixing screw	2		03420301227
228	Innensechskantschraube	Hexagon socket screw	1	DIN 912 M4x8	
229	Gewindestift	Set screw	1	DIN 914 M5 x 10	
230	Hülse	Bushing	1		03420301230
231	Öler	Oiler	6	D=6mm	03420301231
232	Innensechskantschraube	Hexagon socket screw	3	DIN 912 M4x20	
233	Kelleiste	Gib	1		03420301233
234	Linsenkopfschraube	Tallow-drop screw	8	M3 x 8	
235	Halter Abstreifer	Holder stripper	2		03420301235
236	Abstreifer	Stripper	2		03420301236
238	Innensechskantschraube	Hexagon socket screw	6	DIN 912 M5x10	
239	Befestigungsschiene	Fastening gib	1		03420301239
240	Innensechskantschraube	Hexagon socket screw	6	M4 x 10	
241	Spindelmutter	Spindle nut	1		03420301241
242	Spindel	Spindle	1		03420301242
243	Hebel	Lever	1		03420301243
244	Führungsscheibe	Guide disk	1		03420301244
245	Skalenring	Scale ring	1		03420301245
246	Innensechskantschraube	Hexagon socket screw	2	DIN 912 M6x50	
247	Lagerbock	Bearing block	1		03420301247
249	Innensechskantschraube	Hexagon socket screw	1	DIN 912 M8x25	
250	Befestigungsschiene	Fixing gib	1		03420301250
251	Abstreifer	Stripper	2		03420301251
252	Halter Abstreifer	Holder stripper	2		03420301252
254	Planschlitten	Cross slide	1		03420301254
254-1	Skala	Scale	1		034203012541
255	Bettschlitten	Bed slide	1		03420301255
256	Bügel	Holder	1		03420301256
257	Innensechskantschraube	Hexagonal socket screw	2	GB70-85/M4x10	
258	Schraube	Screw	2	M5x10	
259	Welle	Shaft	1		03420301259
260	Sechskantmutter	Hexagonal nut	1	GB6170-86/M3	
261	Innensechskantschraube	Hexagonal socket screw	1	GB70-85/M3x10	
262	Sechskanthülse	Hexagonal case	1		03420301262
263	Scheibe	Washer	2	GB77.1-85/3	
264	Innensechskantschraube	Hexagonal socket screw	2	GB70-85/M3x6	
265	Späneschutzschild	Splinter shield	1		03420301265
301	Gewindestift	Set screw	1	DIN 9124 M8 x 8	
302	Befestigungsmutter Handrad	Fixing nut handwheel	1	M8 H=16mm	
303	Handrad	Handwheel	1		03420301303
304	Federblech	Spring steel sheet	1		03420301304
305	Innensechskantschraube	Hexagon socket screw	2	DIN 914 M5x10	
306	Skalenring	Scale ring	1		03420301306
307	Gleitlagerung	Track bed shaft	1		03420301307
308	Innensechskantschraube	Hexagon socket screw	2	DIN 912 M8x25	
309	Gewindestift	Set screw	1	DIN 914 M5x8	
310	Schlosskasten	Apron	1		03420301310
311	Passfeder	Key	1	DIN 6885-A3x3x8	03420301311
312	Zahnwelle	Gear shaft	1	14 theeth, module 1	03420301312
313	Welle	Shaft	1		03420301313
314	Zahnradkombination	Gear combination	1	44/21 theeth, module 1 / 1,25	03420301314
315	Gewindestift	Set screw	1	DIN 914 M4x35	
316	Mutter	Nut	1	M4	
317	Schlossmutter	Apron nut	1		03420301317

Pos.	Bezeichnung	Designation	Menge	Grösse	Artikelnummer
			Qty.	Size	Item no.
318	Passstift	Alignment pin	2	Ø4 x 10	
319	Innensechskantschraube	Hexagon socket screw	2	DIN 912 M4x10	
320	Nachstelleiste	Gib	1		03420301320
321	Gewindestift	Set screw	1	DIN 913 M6x8	
322	Feder	Spring	1	Ø0.6x Ø3.5x12	03420301322
323	Stahlkugel	Steel ball	1	Ø 4.5	03420301323
324	Innensechskantschraube	Hexagon socket screw	4	DIN 912 M4x12	
325	Mutter	Nut	4	M4	
326	Welle	Shaft	1		03420301326
327	Spannstift	Dowel pin	1	DIN 1481 3x30	03420301327
328	Drehknopf	Turning knob	1		03420301328
329	Gewindestift	Set screw	1	DIN 914 M5x6	
330	Einrückhebel	Engaging lever	1		03420301330
331	Schraube	Screw	1		03420301331
332	Hülse	Sleeve	1		03420301332
333	Welle	Shaft	1		03420301333
334	Sicherungsring	Retaining ring	1		03420301334
335	Scheibe	Washer	1		03420301335
336	Rastblech	Locking plate	1		03420301336
401	Sicherungsscheibe	Locking washer	2		03420301401
402	Zahnrad	Gear	1	60 theeth	03420301402
403	Zahnrad	Gear	1	20 theeth	03420301403
404	Hülse	Bushing	2		03420301404
405	Achswelle	Axle shaft	2		03420301405
406	Nutenstein	Nut stone	2	M8	03420301406
407	Zahnrad	Gear	1	24 theeth	03420301407
408	Zahnrad	Gear	2	80 theeth	03420301408
409	Mutter	Nut	1	M10	
410	Scheibe	Disk	1	10	
411	Hülse	Bushing	1		03420301411
412	Wechselradschere	Change gear shear	1		03420301412
413	Innensechskantschraube	Hexagon socket screw	1	DIN 912 M6x35	
414	Gleitlager	Slide bearing	1		03420301414
415	Lagerbock	Bearing block	1		03420301415
416	Schraube	Screw	4	M6x14	
417	Passfeder	Key	1	DIN 6885-A3x3x16	03420301417
418	Leitspindel	Leadscrew	1		03420301418
419	Maschinenbett	Bed	1		03420301419
420	Innensechskantschraube	Hexagon socket screw	5	DIN 912 M4x12	
421	Zahnstange	Rack	1		03420301421
422	Axial- Rillenkugellager	Axial deep groove ball bearing	2	51100	04051100
423	Lagerbock	Bearing block	1		03420301423
424	Befestigungsmutter	Fixing nut	1		03420301424
425	Stellschraube, Gewindestift	Adjusting screw set screw	1	DIN 915 M8x6	
426	Schutzabdeckung	Protective cover	1		03420301426
427	Innensechskantschraube	Hexagon socket screw	2	DIN 912 M4x10	
428	Zahnrad	Gear	1	25 theeth	03420301428
429	Zahnrad	Gear	1	30 theeth	03420301429
430	Zahnrad	Gear	1	33 theeth	03420301430
431	Zahnrad	Gear	1	35 theeth	03420301431
432	Zahnrad	Gear	1	40 theeth	03420301432
433	Zahnrad	Gear	1	45 theeth	03420301433
434	Zahnrad	Gear	1	50 theeth	03420301434
435	Zahnrad	Gear	1	52 theeth	03420301435
436	Zahnrad	Gear	1	66 theeth	03420301436
501	Klemmhebel	Clamping lever	1		03420301501
502	Klemmschraube	Clamping screw	1		03420301502
503	Klemmhülse	Clamping bushing	1		03420301503
504	Reitstockpinole	Pinole	1		03420301504
505	Reitstockgehäuse	Tailstock housing	1		03420301505
506	Reitstockspindel	Tailstock spindle	1		03420301506
507	Passfeder	Key	1	DIN 6885-A3x3x8	03420301507
508	Mutter	Nut	1	M6	
509	Gewindestift	Set screw	1	DIN 915 M6x14	
510	Axial- Rillenkugellager	Axial deep groove ball bearing	1	51100	04051100
511	Lagerbock	Bearing block	1		03420301511

Pos.	Bezeichnung	Designation	Menge	Grösse	Artikelnummer
			Qty.	Size	Item no.
512	Skalenring	Scale ring	1		03420301512
513	Federblech	Spring steel sheet	1		03420301513
514	Handrad	Handwheel	1		03420301514
515	Befestigungsmutter	Fixing nut	1	M8 H=16mm	
516	Gewindestift	Set screw	1	DIN 914 M8 x 6	
517	Befestigungsschraube	Fixing screw	1		03420301517
518	Griff	Grip	1		03420301518
519	Innensechskantschraube	Hexagon socket screw	5	DIN 912 M5x12	
520	Anschlag	Stop	1		03420301520
521	Gewindestift	Set screw	2	DIN 915 M6x12	
522	Reitstock Unterteil	Tailstock bottom part	1		03420301522
523	Feder	Spring	1	1x12xL	03420301523
524	Klemmplatte	Clamping plate	1		03420301524
525	Sechskantschraube	Hexagon screw	1	DIN 931 M10x70	
526	Gewindestift	Set screw	2	DIN 915 M6x16	
527	Scheibe	Washer	1	10	
528	Mutter	Nut	1	M10	
529	Mitlaufende Körnerspitze	Revolving centre	1		03420301529
530	Spänewanne	Chip tray	1		03420301997
534	Gummiablage/ Werkzeug	Rubber place for tools	1		03420301631
535	Sicherungsgehäuse	Fuse housing	2		03420301535
536	Innensechskantschraube	Hexagon socket screw	4	DIN 912 M4x45	
537	Abdeckung	Cover	1		03420301537
540	Drehfutterschutz	Protection lathe chuck	1		03420301000
541	Dreibackenfutter	3-jaw chuck	1		03420301639
542	Spritzwand	Rear splash guard	1		03420301998
545	Abdeckung	Cover	1		03420301545
548	Halter	Holder	1		03420301548
549	E-Box	E-Box	1		03420301549
550	Skala oben	Scale top			03420301550
551	Skala unten	Scale below			03420301551
Ersatzteilliste Elektrik/ Spare parts electrical					
1A1	Drehzahlanzeige	Rotation speed indicator	1		03020245167
1A2	Drehzahlsensor	Rotation speed sensor	1		03338120279
1S1	Not-Aus-Schalter	Emergency stop button	1		03338120S1.2
1S4	Schalter Abdeckung	Cover safety switch	1		0460015
1S5	Drehfutterschutz	Protector chuck safety switch	1		0460015
1S6	Ein-Aus-Taster	On-off switch	1		03338120S1.3
1S8	Hauptschalter	Main switch	1		03338120S1.1
1S9	Drehrichtungsschalter	Change-over switch	1		0460009
Q1,6	Steuerplatine	Control board	1		03338120Q1.6
Q1,6	Steuerplatine	Control board	1		03338120Q1.7
1R1	Potentiometer	Potentiometer	1		03338120R1.5
1F1/ 1F2	Sicherung	Fuse	2		034203011F1
LF	Netzfilter	Line filter	1		03420301LF
1M1	Motor	Motor	1		03420301103
					03420301M1
Teile ohne Abbildung - Parts without illustration					
	Drehfutterschlüssel	Key for lathe chucks	1		0340200
	Zubehör kplt.	Accessory box cpl.	1		03420301000
	Oberschlitten kplt.	Top slide cpl.	1		03420301999
	Wechselradsatz kplt.	Change gear set cpl.	1		03420301437
	Reitstock kplt.	Tailstock cpl.	1		03420301996

9 Appendix

9.1 Copyright

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This document is copyright. All derived rights are also reserved, especially those of translation, re-printing, use of figures, broadcast, reproduction by photo-mechanical or similar means and recording in data processing systems, whether partial or total.

The company reserves the right to make technical alterations without prior notice.

9.2 Terminology/Glossary

Term	Explanation
Headstock	Housing for the feed gear and the synchronous belt pulleys.
Lathe chuck	Clamping tool for holding the workpiece.
Drill chuck	Device for holding the bit
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 bit, 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.

9.3 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 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.

9.4 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.

9.4.1 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.
- Disconnect 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.

9.4.2 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.

9.4.3 Disposing of the old device



INFORMATION

Please make sure in your own interest and in the interest of the environment that all component parts of the machine will be disposed of in the provided and admitted ways.

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.

9.4.4 Disposal of electrical and electronic components

Please make sure that electrical components are disposed of in a professional way according to the legal requirements.

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.

9.4.5 Disposal of lubricants and coolants



ATTENTION

Please imperatively make sure to dispose of the used coolant and lubricants in an environmentally compatible way. Observe the disposal notes of your 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.

9.5 Disposal



Disposal of used electric and electronic machines

(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 handled as common household waste, but that it 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.

9.6 RoHS , 2002/95/CE



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

9.7 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

E-Mail: info@optimum-maschinen.de

9.8 EC Declaration of Conformity

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

hereby declares that the following product,

Type of machine: OPTI D180 x 300 VARIO

Designation of the machine: Lathe

Serial number: _ _ _ _ _

Year of manufacture: 20__

all relevant provisions of the **Machinery Directive (2006/42/EC)** corresponds.

The machine continues to comply with all provisions of the **Directives Electrical equipment (2006/95/EC)** and **electromagnetic compatibility (2004/108/EC)**.

The following harmonized standards were applied:

DIN EN 12100-1:2003/ A1:2009 Safety of machinery - Basic concepts, general principles for design - Part 1: Basic terminology, methodology

DIN EN 12100-2:2003/ A1:2009 Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles


DIN EN 60204-1 Safety of machinery - Electrical equipment of machines - General requirements

The following technical standards were applied:

DIN EN 12840: 06/2001 Safety of machine tools - Manually controlled turning machines with or without automatic control.

Responsible for documentation: Kilian Stürmer, Tel.: +49 (0) 951 96822-0

Address: Dr.-Robert-Pfleger-Str. 26
D - 96103 Hallstadt



Kilian Stürmer
(Manager)

Hallstadt, 4/January/2012

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