

Operating instructions

[incl. installation manual]

3-jaw module

EN

Translation of the original operating instructions

Contents

| | | |
|-------|--|----|
| 1 | General..... | 8 |
| 1.1 | Information about this manual..... | 8 |
| 1.2 | Key to symbols..... | 8 |
| 1.3 | Definition of terms | 9 |
| 1.3.1 | Release setting..... | 9 |
| 1.3.2 | Complete clamping reserve | 9 |
| 1.4 | Limitation of liability | 10 |
| 1.5 | Copyright..... | 10 |
| 1.6 | Scope of delivery | 10 |
| 1.7 | Spare parts and accessories..... | 11 |
| 1.8 | Warranty terms | 12 |
| 2 | Safety | 13 |
| 2.1 | Responsibility of the operator..... | 13 |
| 2.2 | Personnel requirements | 14 |
| 2.3 | Intended use | 15 |
| 2.4 | Personal protective equipment..... | 17 |
| 2.5 | Particular hazards | 18 |
| 2.6 | Other safety instructions | 20 |
| 2.7 | Screws | 23 |
| 2.8 | Functionality..... | 23 |
| 2.9 | Environmental protection | 24 |
| 3 | Technical data | 25 |
| 3.1 | General information..... | 25 |
| 3.2 | Jaws..... | 27 |
| 3.2.1 | Hard top jaws..... | 27 |
| 3.2.2 | Soft, smooth top jaws | 30 |
| 3.3 | Performance values | 31 |
| 3.4 | Balancing quality | 32 |
| 3.5 | Speed..... | 33 |
| 3.6 | Clamping force diagram | 33 |
| 3.6.1 | Size 145/215..... | 34 |
| 3.7 | Clamping force speed diagram | 34 |
| 3.7.1 | Groove jaws for size 145 - Basic clamping device, size 65 | 34 |
| 3.7.2 | Plaster jaws for size 145 - Basic clamping device, size 65 | 35 |
| 3.7.3 | Top jaws soft for size 145 - Basic clamping device size 65 | 35 |
| 3.7.4 | Groove jaws for size 215 - Basic clamping device, size 65 | 36 |
| 3.7.5 | Plaster jaws for size 215 - Basic clamping device, size 65..... | 36 |
| 3.7.6 | Top jaws soft for size 215 - Basic clamping device size 65 | 37 |
| 3.7.7 | Grooved jaws for size 215 - Basic clamping device, size 80 | 37 |
| 3.7.8 | Plaster jaws for size 215 - Basic clamping device, size 80..... | 38 |
| 3.7.9 | Top jaws soft for size 215 - Basic clamping device size 80 | 38 |

| | | | |
|---|--------|---|-----|
| | 3.7.10 | Grooved jaws for size 215 - Basic clamping device, size 100 | 39 |
| | 3.7.11 | Plaster jaws for size 215 - Basic clamping device, size 100 | 39 |
| | 3.7.12 | Top jaws soft for size 215 - Basic clamping device size 100 | 40 |
| | 3.8 | Operating conditions | 40 |
| | 3.9 | Type designation | 40 |
| 4 | | Layout and function | 41 |
| | 4.1 | Overview and brief description | 41 |
| | 4.2 | Accessories required | 42 |
| | 4.2.1 | Basic clamping device | 42 |
| | 4.2.2 | Jaws | 42 |
| | 4.3 | Special aids | 42 |
| | 4.3.1 | Assembly key | 42 |
| 5 | | Use and limits of use | 43 |
| | 5.1 | Use | 43 |
| | 5.1.1 | Permitted clamping of the workpiece | 43 |
| | 5.2 | Selection of jaws | 45 |
| | 5.2.1 | Selection of grooved jaws | 45 |
| | 5.2.2 | Selection of plaster jaws | 66 |
| | 5.2.3 | Example | 84 |
| | 5.3 | Limits of use | 85 |
| | 5.3.1 | Nomenclature | 85 |
| | 5.3.2 | First limit [workpiece length] | 86 |
| | 5.3.3 | Second limit [workpiece mass] | 86 |
| | 5.3.4 | Third limit [clamping length] | 87 |
| | 5.3.5 | Fourth limit [forces] | 87 |
| | 5.3.6 | Sample calculation | 97 |
| 6 | | Transport, packaging, storage | 101 |
| | 6.1 | Safety, transport, packaging, storage | 101 |
| | 6.2 | Symbols on the packaging | 102 |
| | 6.3 | Transport inspection | 102 |
| | 6.4 | Unpacking and internal transportation | 103 |
| | 6.5 | Packaging | 103 |
| | 6.6 | Storage | 104 |
| | 6.7 | Preservation | 104 |
| | 6.8 | Return to storage | 104 |
| 7 | | Installation | 105 |
| | 7.1 | Installation safety | 105 |
| | 7.2 | Preliminary remarks | 107 |
| | 7.3 | Screw tightening torques | 107 |
| | 7.4 | Preparation of the machine for installation | 108 |
| | 7.5 | Preparation of the basic clamping device | 109 |
| | 7.6 | Installation of the product | 109 |

| | | |
|--------|---|-----|
| 7.6.1 | Compatibility check..... | 110 |
| 7.6.2 | Function check of the coupling range of the product | 110 |
| 7.6.3 | Preparation of the product..... | 112 |
| 7.6.4 | Installation of the adaptation clamping device | 114 |
| 7.7 | Installation of the clamping element..... | 116 |
| 7.8 | Machining the soft jaws..... | 120 |
| 7.8.1 | First limit: clamping contour..... | 120 |
| 7.8.2 | Second limit: Shoulder width | 121 |
| 7.8.3 | Procedure for machining the soft jaws..... | 122 |
| 7.9 | Automatic mode | 124 |
| 7.9.1 | Machine tool with travel measuring system | 124 |
| 7.9.2 | Machine tool without travel measuring system, with limit switch | 124 |
| 8 | Commissioning..... | 126 |
| 8.1 | Commissioning safety | 126 |
| 8.2 | Jaw position | 127 |
| 8.3 | Checking the total stroke..... | 128 |
| 8.4 | Tests | 129 |
| 8.5 | Workpiece | 130 |
| 8.6 | Procedure after a collision..... | 130 |
| 9 | Activities after end of production | 131 |
| 10 | Removal | 132 |
| 10.1 | Safe removal..... | 132 |
| 10.2 | Preparing the machine for removal | 134 |
| 10.3 | Removal of the clamping element..... | 134 |
| 10.4 | Removal of the product..... | 136 |
| 10.4.1 | Removal of the adaptation clamping device | 137 |
| 11 | Maintenance..... | 140 |
| 11.1 | Maintenance safety | 140 |
| 11.2 | Maintenance schedule | 140 |
| 11.3 | Cleaning..... | 141 |
| 11.4 | Visual inspection | 145 |
| 11.5 | Lubricating the product..... | 145 |
| 11.6 | Use of lubricants | 146 |
| 12 | Disposal..... | 147 |
| 13 | Faults..... | 148 |
| 13.1 | Procedure with faults..... | 148 |
| 13.2 | Fault table | 149 |
| 13.3 | Commissioning after a fault has been remedied | 150 |
| 14 | Annex | 151 |
| 14.1 | Contact..... | 151 |
| 14.2 | Manufacturer certification..... | 151 |

Directory of tables

| | | |
|-----------|--|----|
| Table 1: | Technical data | 26 |
| Table 2: | Hard grooved jaws | 28 |
| Table 3: | Hard plaster jaws..... | 30 |
| Table 4: | Soft, smooth top jaws | 31 |
| Table 5: | Operating conditions | 40 |
| Table 6: | Grooved jaws – clamping stage 25 mm | 46 |
| Table 7: | Grooved jaws – clamping stage 26 mm | 48 |
| Table 8: | Grooved jaws – clamping stage 34 mm | 49 |
| Table 9: | Grooved jaws – clamping stage 43 mm | 51 |
| Table 10: | Grooved jaws – clamping stage 52 mm | 52 |
| Table 11: | Grooved jaws – clamping stage 60 mm | 54 |
| Table 12: | Grooved jaws – clamping stage 61 mm | 55 |
| Table 13: | Grooved jaws – clamping stage 70 mm | 57 |
| Table 14: | Grooved jaws – clamping stage 79 mm | 58 |
| Table 15: | Grooved jaws – clamping stage 88 mm | 60 |
| Table 16: | Grooved jaws – clamping stage 89 mm | 61 |
| Table 17: | Grooved jaws – clamping stage 97 mm | 63 |
| Table 18: | Grooved jaws – clamping stage 106 mm | 64 |
| Table 19: | Grooved jaws – clamping stage 107 mm | 66 |
| Table 20: | Plaster jaws - clamping stage 25 mm..... | 67 |
| Table 21: | Plaster jaws - clamping stage 34 mm..... | 68 |
| Table 22: | Plaster jaws - clamping stage 35 mm..... | 70 |
| Table 23: | Plaster jaws - clamping stage 43 mm..... | 71 |
| Table 24: | Plaster jaws - clamping stage 52 mm..... | 73 |
| Table 25: | Plaster jaws - clamping stage 61 mm..... | 74 |
| Table 26: | Plaster jaws - clamping stage 62 mm..... | 75 |
| Table 27: | Plaster jaws - clamping stage 70 mm..... | 77 |
| Table 28: | Plaster jaws - clamping stage 79 mm..... | 78 |
| Table 29: | Plaster jaws - clamping stage 88 mm..... | 80 |
| Table 30: | Plaster jaws - clamping stage 89 mm..... | 81 |
| Table 31: | Plaster jaws - clamping stage 97 mm..... | 82 |
| Table 32: | Plaster jaws - clamping stage 106 mm..... | 84 |
| Table 33: | Nomenclature application limits..... | 86 |
| Table 34: | Contact forms / scenarios..... | 88 |
| Table 35: | Contact factor | 89 |
| Table 36: | Specific cutting forces | 90 |
| Table 37: | Friction coefficient for steel workpieces | 91 |
| Table 38: | Hard grooved jaws – mass and distance of mass center of gravity of top jaws on rotational axis | 93 |
| Table 39: | Hard plaster jaws – mass and distance of mass center of gravity of top jaws on rotational axis | 94 |
| Table 40: | Soft, smooth top jaws – mass and distance of mass center of gravity of top jaws on rotational axis..... | 94 |
| Table 41: | Constant of the jaw modules | 95 |

| | | |
|-----------|---|-----|
| Table 42: | Screw tightening torques, metric control threads..... | 108 |
| Table 43: | Screw tightening torques for aluminum components..... | 108 |
| Table 44: | Jaw position..... | 128 |
| Table 45: | Maintenance table | 141 |
| Table 46: | Fault table..... | 150 |

1 General

1.1 Information about this manual

This manual enables you to work safely and efficiently with the product.

This manual is part of the product and must be kept in a location directly beside the product that is accessible to the personnel at all times. The personnel must have read this manual carefully and understood its contents before starting any work. The basic requirement for safe work is compliance with all stipulated safety notices and work-related instructions in this manual.

If the product is passed onto a third party, this manual must accompany it.

Illustrations in this manual are there to facilitate a basic understanding, and may differ from the actual design configuration of the product.



WARNING

Serious injuries caused by individual products or by inappropriate combinations of them!

- Read and pay attention to all operating instructions for individual products and combinations of them.

1.2 Key to symbols

Safety instructions in this manual are designated by symbols. The safety notices are invoked by signal words that express the level of hazard involved.

Always comply with safety notices and exercise caution to avoid accidents, injury to people and damage to materials.

Safety notices



DANGER

... indicates an immediate and hazardous situation that can lead to death or serious injury if not avoided.



WARNING

... indicates a potentially hazardous situation that can lead to death or serious injury if not avoided.



CAUTION

... indicates a potentially hazardous situation that can lead to moderate or slight injuries if not avoided.



NOTE

... indicates a potentially hazardous situation that can lead to damage to materials if not avoided.

Tips and recommendations



INFORMATION

... highlights useful tips and recommendations as well as information for efficient and problem-free operation.



... refers to other documents relating to personal and general safety.

Warning symbols may appear on the product or its components.

Always pay attention to warning symbols, and exercise caution to avoid accidents, injury to people and damage to materials.



... warns of stored energy [for example involving springs].



... warns of hand injuries.



... draws attention to the fact that the operating instructions of the product must be read.

1.3 Definition of terms

1.3.1 Release setting

Release setting means that the clamping device is released. If the clamping device is released, this also releases the workpiece.

1.3.2 Complete clamping reserve

Complete clamping reserve means that the clamping device is clamped without a workpiece. The complete stroke has been used up, which means that the clamping device is therefore at the limit position for clamping reserve.

1.4 Limitation of liability

All details and notices in this manual were compiled with due reference to applicable standards and specifications, state-of-the-art technology and our many years of expertise and experience.

The manufacturer accepts no liability for damage arising from any of the following:

- Non-compliance with this manual
- Unintended use
- Use of untrained personnel
- Autonomous conversion work
- Technical modifications
- Use of non-approved spare parts
- Use of non-approved accessories
- Installation and use of clamping elements not made by the manufacturer

Subject to any commitments agreed to in the supplier contract, the General Terms & Conditions of Business and the delivery terms of the manufacturer and all legislative stipulations valid at the time of conclusion of this contract.

1.5 Copyright

This manual is protected by copyright, and are only intended for internal use.

The dissemination of this manual to third parties, reproductions in any shape or form - even in part - as well as commercial use and/or communication of their contents are prohibited for anything other than internal use, except with the written consent of the manufacturer.

Infringements oblige the offending party to pay compensation. Without restriction on further claims.

1.6 Scope of delivery

The scope of delivery of this product includes:

- 3-jaw module
- Assembly key
- The operating instructions
- Storage box

Additionally needed and included as optional items in the scope of delivery:

- Basic clamping device
- Set of jaws

1.7 Spare parts and accessories



WARNING

Serious injuries can be caused by incorrect or defective spare parts!

- Always use genuine spare parts made by the original manufacturer.



WARNING

Serious injuries can be caused by incorrect or defective clamping elements!

- Always use genuine clamping elements made by the original manufacturer.



WARNING

Serious injuries can be caused by incorrect or defective basic clamping devices!

- Always use genuine basic clamping devices made by the original manufacturer.



NOTE

Damage, malfunctions or total failure of the product or the machine tool caused by an incorrect or defective spare parts!

- Always use genuine spare parts made by the original manufacturer.



NOTE

Damage, malfunctions or total failure of the product or the machine tool caused by an incorrect or defective clamping elements!

- Always use genuine clamping elements made by the original manufacturer.



NOTE

Damage, malfunctions or total failure of the product or the machine tool caused by incorrect or defective basic clamping devices!

- Always use genuine basic clamping devices made by the original manufacturer.

Spare parts and accessories can be sourced from contract dealers or directly from the manufacturer [see »Contact« chapter].

Without exception, wearing parts and components in contact with the workpiece are not covered by warranty.

1.8 Warranty terms

The warranty terms are included in the manufacturer's General Terms & Conditions of Business.

2 Safety

This section provides an overview of all the important safety aspects for optimum protection of personnel, and for safe and problem-free operation.

2.1 Responsibility of the operator

The product is used in the industrial sector. The operator of the product is therefore governed by the provisions of Health & Safety at Work legislation.

As well as the safety notices in this manual, the area of use of the product must also comply with locally applicable safety, accident prevention and environmental protection specifications as well as those in the manual for the machine tool.

No modifications must be made to the product. The operator is wholly and solely responsible for any resultant personal injury and/or damage to materials.

Excepted from this are changing parts that HAINBUCH approved explicitly for autonomous machining, but specified limits must never be exceeded.



DANGER

Serious injuries caused by parts being ejected centrifugally due to a drop in actuating force / supply pressure!

- On the machine, ensure that the actuating force / the supply pressure do not drop while the product is in use.
- If no precautions have been taken on the machine to maintain the actuating force / the supply pressure, it is prohibited to use this product on the machine.
- Pay attention to the operating instructions for the machine tool.

If the basic clamping device is power-actuated, pay particular attention to the fact that end-stop requests by the machine tool must be set on the adaptation clamping device involved.



DANGER

Serious injuries caused by parts being ejected centrifugally after defective setting of the machine!

- Set up the end-stop requests by the machine tool on the product involved.
- On a regular basis, check the end-stop requests of the machine tool [see »Maintenance schedule« chapter].
- If the limit stops are not reached, the product must not be used any more.

2.2 Personnel requirements



WARNING

Serious injuries caused by incorrect handling of the product by insufficiently skilled or trained personnel!

- All activities must be performed by skilled staff from the relevant specialist field.



WARNING

Serious injuries caused by unauthorized presence of unauthorized personnel in the working area!

- Keep unauthorized people away from the working area.
- If in doubt, speak to people and direct them to leave the working area.
- Interrupt work until unauthorized people have left the working area.



NOTE

Serious damage to materials caused by incorrect handling of the product by insufficiently skilled or trained personnel!

- All activities must be performed by skilled staff from the relevant specialist field.

This manual name the following skills sets required for various different areas of activity:

Skilled specialist

Skilled specialists, due to their professional training, knowledge and experience and awareness of applicable provisions, are capable of carrying out the work entrusted to them and independently to identify and avoid potential hazards.

Hydraulics specialist

Hydraulics specialists are trained in the specific task profile for which they are employed, and are familiar with the relevant standards and legislative provisions.

Due to their vocational training and experience, hydraulics specialists can work on hydraulic systems and can independently identify and avoid potential hazards.

Pneumatics specialist

Pneumatics specialists are trained in the specific task profile for which they are employed, and are familiar with the relevant standards and legislative provisions.

Due to their vocational training and experience, pneumatics specialists can work on pneumatic systems and can independently identify and avoid potential hazards.

Electricians

Electricians are trained in the specific task profile for which they are employed, and are familiar with the relevant standards and legislative provisions.

Due to their vocational training and experience, electricians can work on electrical systems and can independently identify and avoid potential hazards.

Trainees

Trainees can only work on the machine under the supervision and direction of staff skilled in the relevant specialist field.

The only people admitted as personnel are those who can reasonably be expected to carry out their work to a reliable standard. People whose response capabilities are impaired, for example by drugs, alcohol or medication, are prohibited. For the selection of personnel, pay attention to the stipulations applicable at the place of work governing age and specific vocational requirements.

2.3 Intended use

The product is only intended for installation in a CE-compliant machine tool with a separating set of guards.

This product is intended for installation in a compatible product with corresponding attachment geometry.

The product is only intended for the type of use described in this manual [see »Use« chapter]. Furthermore, an extended form of use can be agreed contractually between manufacturer and operator.

Only skilled staff from the appropriate specialist fields may install, operate, maintain and clean the product [see »Personnel requirements« chapter].

Never exceed the technical values stipulated for the product [see »General information« and »Operating conditions« chapters].

Furthermore, never exceed the limits for use of the product [see »Limits of use« chapter].

Maintain the product at regular intervals [see »Maintenance schedule« chapter].

When used for its intended purpose, the operational safety of the product is assured, subject to compliance with relevant safety stipulations, to the full extent foreseeable.

Intended use also includes compliance with all stipulations in this manual.

Any form of use beyond the scope of intended use, or other forms of use of the product, is considered as misuse, and can lead to dangerous situations.



WARNING

Serious injuries caused by misuse of the product!

- Only in a CE-compliant machine tool with a separating set of guards.
- Only use with compatible products.
- Only use for the type of use indicated [see »Use« chapter].
- Only skilled staff from the appropriate specialist fields may use the product [see »Personnel requirements« chapter].
- Never exceed the technical data indicated on the product [see »General information« and »Operating conditions« chapters].
- Never exceed the limits for use of the product [see »Limits of use« chapter].
- Maintain the product at regular intervals [see »Maintenance schedule« chapter].
- Only use with approved attachments and/or clamping elements.



NOTE

Damage to materials caused by incorrect use of the product!

- Only in a CE-compliant machine tool with a separating set of guards.
- Only use with compatible products.
- Only use for the type of use indicated [see »Use« chapter].
- Only skilled staff from the appropriate specialist fields may use the product [see »Personnel requirements« chapter].
- Never exceed the technical data indicated on the product [see »General information« and »Operating conditions« chapters].
- Never exceed the limits for use of the product [see »Limits of use« chapter].
- Maintain the product at regular intervals [see »Maintenance schedule« chapter].
- Only use with approved attachments and/or clamping elements.

Claims of all kinds will be rejected that are due to unintended use.

Here are some examples of unintended use of the product

- If workpieces are not clamped properly.
- If people fail to observe the safety stipulations when working on the product, and failing to use additional protective equipment, for example to machine clamped workpieces.
- If the product is used on clamping devices, workpieces and/or changing parts for which it is not intended.

2.4 Personal protective equipment

During work, it is essential to wear personal protective equipment to minimize the health hazards.

Always wear the required personal protective equipment when working on any given job.

Always pay attention to any notices about personal protective equipment displayed in the working area.

Always wear



Workplace clothing

Workplace clothing should be close-fitting, with low tear-resistance, narrow cuffs and no protruding parts. It serves primarily to protect the wearer from coming into contact with moving machine parts. Do not wear rings, chains or other jewelry.



Safety footwear

To protect the wearer from any heavy items that may fall, and from losing their footing on slippery ground.



Protective goggles

To protect the eyes from projectile parts and liquid splashes.



Hair net

To protect long hair from getting snagged in rotating parts on the machine tool.

Additional personal protective equipment

When carrying out certain work, additional personal protective equipment is required. Separate reference is made to this in the individual chapters of this manual. The following section explains these additional items of personal protective equipment:



Protective gloves

To protect the hands from friction, chafing, stabbing or deeper injuries and from contact with hot surfaces.



Hard hat

To protect against falling and projectile parts and materials.

2.5 Particular hazards

The following section names residual risks resulting from the installation of the product in a machine tool. In all cases, the residual risks detected during a risk assessment of the machine tool need to be named by the operator.

Pay attention to the safety instructions named here, as well as the warning notices in other chapters of these operating instructions to reduce the risk of health hazards and to prevent dangerous situations.

Moving parts



WARNING

Serious injuries caused by touching rotating and/or moving parts!

- Do not open guards while the system is operating.
- During operation, do not reach for rotating and/or moving parts.
- Pay attention to the gap dimensions of moving parts.
- Before opening the guards, ensure that none of the parts are moving any more.

Stroke



WARNING

Serious crushing injuries caused by the stroke of the product!

- Never reach into an area where moving parts are operating.
- Prevent accidental initiation of the clamping process [for example due to an installation error with the power supply or a programming error].

Insufficient workpiece clamping



DANGER

Serious injuries caused by parts being ejected centrifugally if level of workpiece clamping is insufficient!

- Workpiece blanks must not be outside the clamping width diameter.
- Clamping of the workpiece must not be outside the defined limits [see »Limits of use« chapter].
- Do not exceed the maximum performance values [see »General information« chapter].

Insufficient workpiece clamping



WARNING

Serious injuries caused by breakage of individual components of the product when actuating force is too high!

- Check actuating force on a regular basis and adjust if necessary.

Sharp-edged parts



WARNING

Serious cut injuries caused by sharp-edged parts and burrs!

- All installation of individual parts must be performed by skilled staff from the relevant specialist field.
- Also wear the following items of personal protective equipment, in addition to the basic equipment:



2.6 Other safety instructions



DANGER

Serious injuries caused by workpieces being ejected centrifugally when clamping unit is released while still rotating!

- Never release the clamping of the workpiece while it is still rotating.



DANGER

Serious injuries caused by projectile workpieces!

- To assist clamping of the workpiece with long clamping devices, always use a tailstock / back rest or a brace.



WARNING

Serious injuries caused by the release of stored energy!

- When unfastening the relevant screws, these must be actuated crosswise in alternating fashion to reduce clamping action to a minimum.
- Do not open the screws secured with sealing lacquer.



WARNING

Serious head injuries caused by bending into the working area of the machine!

- Only ever bend into the working area of the machine if there are no cutting tools or sharp objects in it, or if these are covered.
- Never move body parts under parts in the working area of the machine with the potential to drop down.



WARNING

Serious injuries caused by snagging body parts on the rotating machine spindle!

- Never reach into the product while the machine spindle is still rotating.
- Before working on the product, ensure that the machine spindle is unable to start up.



WARNING

Serious injuries caused by reaching into slots and bores!

- Never reach into slots or bores.



WARNING

Serious injuries caused by workpieces dropping or the clamping unit getting released!

- Only unclamp the workpiece if it is protected against falling.



WARNING

Serious injuries caused by the use of damaged products or by their components and accessories!

- Check products or their components and accessories on a regular basis for visible signs of damage [see »Inspections« and »Cleaning« chapters].
- Use of damaged products, their damaged components and/or their damaged accessories is prohibited.
- Report damage to the operator immediately.
- Damaged components / accessories must be replaced with genuine spare parts / accessories made by the manufacturer.



WARNING

Serious injuries caused by unauthorized transportation of the product using the installation wrench!

- Never lift and transport the product with the installation wrench installed.



CAUTION

Cut injuries caused by sharp edges and burrs resulting from wear and/or repeated rework!

- Remove sharp edges and burrs.
- If necessary, replace worn components with genuine parts made by the manufacturer.



NOTE

Serious damage to materials / the machine tool / the product caused by workpieces being ejected centrifugally if clamping is released while they are still rotating!

- Never release the clamping of the workpiece while it is still rotating.



NOTE

Damage to materials caused by untightening the wrong screws!

- Do not open the screws secured with sealing lacquer.



NOTE

Damage to materials caused by careless handling of the product!

- Avoid introducing force to the display pin.
- Never place the product down on its front face.

2.7 Screws



WARNING

Serious injuries caused by radially installed screws being ejected centrifugally if installed incorrectly / poor handling!

- Do not open the screws secured with sealing lacquer.
- Screws and threaded pins fitted radially to the product that were bonded with adhesive need to be secured again using a standard, medium-strength screw adhesive and tightened to the specified tightening torque [see nomenclature or the »Screw tightening torques« chapter]. Before reinstallation, clean and degrease the screw and internal thread.
- Radially mounted screws and threaded pins that were not bonded with sealing lacquer or an adhesive need to be tightened back down to the specified tightening torque [see nomenclature or the »Screw tightening torques« chapter].
- If in doubt, contact the manufacturer immediately to determine how best to proceed.

2.8 Functionality



WARNING

Serious injuries caused by severe contamination of the product!

- Always comply with the cleaning instructions and intervals [see »Cleaning« chapter].

2.9 Environmental protection



NOTE

Substantial damage to the environment can result from non-compliant handling or incorrect disposal of environmentally hazardous substances!

- If environmentally hazardous substances enter the environment accidentally, take immediate remedial action.
- If in doubt, notify the relevant municipal authorities about the incident.

The following environmentally hazardous substances are used:

Lubricants, auxiliary materials and operating fluids

Lubricants such as grease and oil can contain toxic substances. These must not enter the environment.

Dispose of environmentally hazardous substances properly [see »Disposal« chapter].

3 Technical data

3.1 General information

| Size | 145 | | 215 | |
|---|-------------------------------------|--------|--------|--------|
| Size of basic clamping device | 65 | 65 | 80 | 100 |
| Clamping range [mm] | see »Surface-mounted chucks« tables | | | |
| Axial release stroke [mm] | 2.5 | 2.5 | 2.5 | 5 |
| Axial clamping reserve [mm] | 2 | 2 | 2 | 3 |
| Radial opening stroke per chuck [mm] | 1.1 | 1.1 | 1.1 | 2.5 |
| Radial reserve stroke per chuck [mm] | 0.8 | 0.8 | 0.8 | 1.25 |
| Stroke per chuck [mm] | 1.9 | 1.9 | 1.9 | 3.7 |
| Weight without jaw [kg] | 6.3 | 11.3 | 13 | 14.5 |
| Interference circle diameter with jaws in maximum position [mm] | ~149 | ~200 | ~200 | ~200 |
| Length without jaws [mm] | 37.5 | 37.5 | 37.5 | 37.5 |
| Length with jaws [mm] | 77 | 77 | 77 | 77 |
| Maximum speed [min^{-1}] | 5000 | 3000 | 3000 | 3000 |
| Axial clamping force $F_{ax\ max.}$ [kN] | 45 | 45 | 45 | 45 |
| Radial clamping force $F_{rad\ max.}$ [kN] | 60 | 60 | 60 | 60 |
| Type of gear | 1.5 x 60° [sharp-tip spline] | | | |
| Axial run-out [mm] | >0.020 | >0.020 | >0.020 | >0.020 |

| | | | | |
|--|------|------|------|------|
| Size | 145 | | 215 | |
| Size of basic clamping device | 65 | 65 | 80 | 100 |
| Balancing quality G in n planes | 16/1 | 16/1 | 16/1 | 16/1 |

Table 1: Technical data



INFORMATION

When the soft jaws are turned out, axial runout is 0.020 mm.

Take account of the axial runout error on the basic clamping device.

The installation precision for rotating clamping devices is an axial runout of 0.005 mm between the basic clamping device and the adaptation clamping device.

The repeatability precision for stationary clamping devices amounts to an axial runout of 0.003 mm on the adaptation clamping device.



INFORMATION

When necessary, the conversion of actuating force F_{ax} on the corresponding type of actuation for the basic clamping device is described in the operating instructions for the basic clamping device [see operating instructions for the basic clamping device].

3.2 Jaws

3.2.1 Hard top jaws



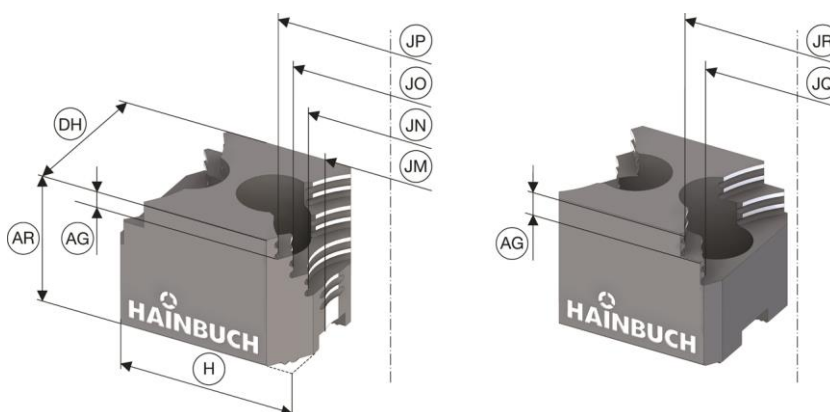
DANGER

Serious injuries caused by parts being ejected centrifugally if jaws are installed incorrectly!

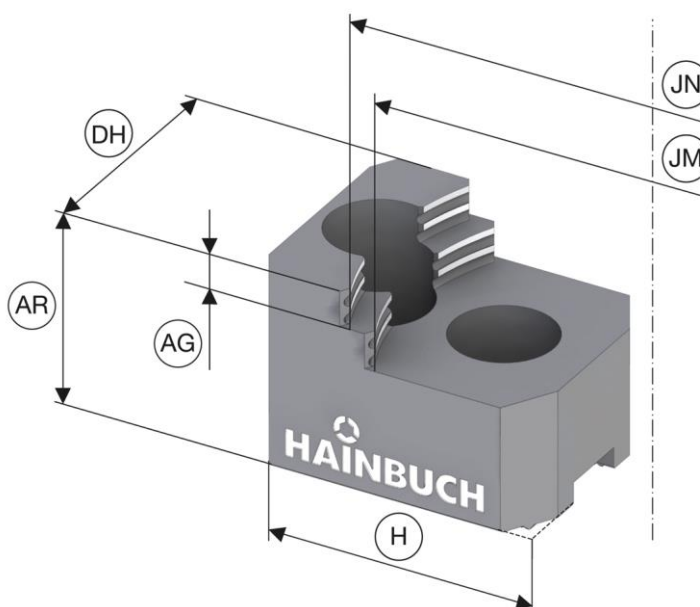
- Never use hard top jaws to clamp high-tensile material [$> 1300 \frac{N}{mm^2}$].

Hard grooved jaws

The following figure applies to grooved jaws #1 and #4.



The following figure applies to grooved jaws #2, #3, #4, #5 and #6.



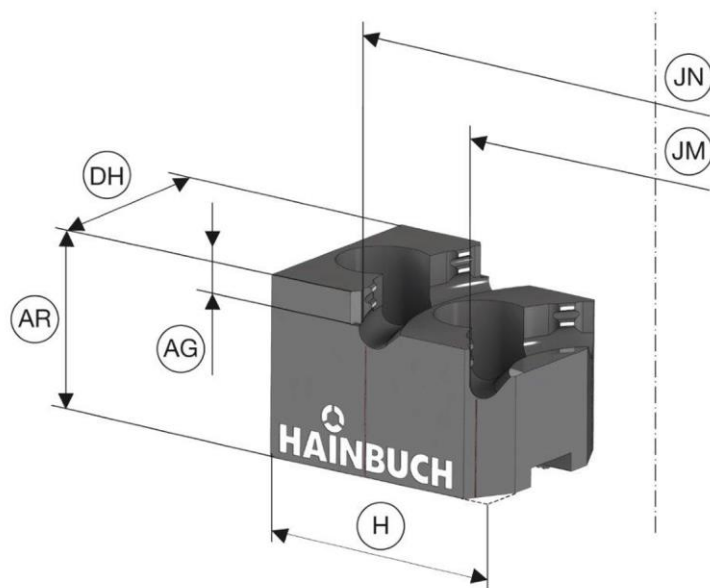
3-jaw module

Technical data

| Product | | Grooved jaw#1 | Grooved jaw#2 | Grooved jaw#3 | Grooved jaw#4 | Grooved jaw#5 | Grooved jaw#6 |
|--|----|---------------|---------------|---------------|---------------|---------------|---------------|
| Size | | 145 / 215 | 145 / 215 | 145 / 215 | 145 / 215 | 145 / 215 | 145 / 215 |
| Type of gear | | 1.5 x 60° | 1.5 x 60° | 1.5 x 60° | 1.5 x 60° | 1.5 x 60° | 1.5 x 60° |
| Length [mm] | H | 55 | 55 | 55 | 55 | 55 | 55 |
| Jaw height [mm] | AR | 40 | 40 | 40 | 40 | 40 | 40 |
| Jaw width [mm] | DH | 45 | 45 | 45 | 45 | 45 | 45 |
| Clamping range of size 145 [mm] | | 25-79 | 79-97 | 97-115 | 26-79 | 79-99 | 97-117 |
| Clamping range of size 215 [mm] | | 25-145 | 79-166 | 97-185 | 26-146 | 79-166 | 97-186 |
| Diameter of clamping stage 1 side 1 [mm] | JM | 25 | 79 | 97 | 26 | 79 | 97 |
| Diameter of clamping stage 2 side 1 [mm] | JN | 34 | 88 | 106 | 34 | 89 | 107 |
| Diameter of clamping stage 3 side 1 [mm] | JO | 43 | - | - | 43 | - | - |
| Diameter of clamping stage 4 side 1 [mm] | JP | 52 | - | - | 52 | - | - |
| Diameter of clamping stage 1 side 2 [mm] | JQ | 61 | - | - | 52 | - | - |
| Diameter of clamping stage 2 side 2 [mm] | JR | 70 | - | - | 70 | - | - |
| maximum clamping length [mm] | AG | 7 | 7 | 7 | 7 | 7 | 7 |
| Order number | | 10723/001 | 10723/002 | 10723/003 | 10723/012 | 10723/013 | 10723/014 |

Table 2: Hard grooved jaws

Hard plaster jaws



| Product | | Plaster jaw #1 | Plaster jaw #2 | Plaster jaw #3 | Plaster jaw #4 | Plaster jaw #5 | Plaster jaw #6 | Plaster jaw #7 | Plaster jaw #8 |
|--|----|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Size | | 145 / 215 | 145 / 215 | 145 / 215 | 145 / 215 | 145 / 215 | 145 / 215 | 145 / 215 | 145 / 215 |
| Plaster size | | 0.8 x 3 | 0.8 x 3 | 0.8 x 3 | 0.8 x 3 | 0.8 x 3 | 0.8 x 3 | 0.8 x 3 | 0.8 x 3 |
| Length [mm] | H | 63 | 60 | 55 | 55 | 55 | 60 | 55 | 55 |
| Jaw height [mm] | AR | 47 | 47 | 47 | 47 | 47 | 46 | 46 | 46 |
| Jaw width [mm] | DH | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| Diameter of clamping stage 1 [mm] | JM | 25 | 34 | 43 | 52 | 61 | 35 | 43 | 62 |
| Diameter of clamping stage 2 [mm] | JN | 70 | 79 | 88 | 97 | 106 | 79 | 89 | 106 |
| maximum clamping length [mm] | AG | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Clamping range of size 145 clamping stage 1 [mm] | | 25-33 | 34-42 | 43-52 | 52-60 | 61-69 | 35-43 | 43-52 | 62-71 |
| Clamping range of size 145 clamping stage 2 [mm] | | 70-79 | 79-89 | 88-98 | 97-107 | 106-116 | 78-89 | 89-99 | 106-116 |

| Product | Plaster jaw #1 | Plaster jaw #2 | Plaster jaw #3 | Plaster jaw #4 | Plaster jaw #5 | Plaster jaw #6 | Plaster jaw #7 | Plaster jaw #8 |
|--|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Clamping range of size 215 clamping stage 1 [mm] | 25-101 | 34-108 | 43-119 | 52-126 | 61-135 | 35-110 | 43-119 | 62-137 |
| Clamping range of size 215 clamping stage 2 [mm] | 70-146 | 79-158 | 88-167 | 97-177 | 106-187 | 79-158 | 89-168 | 106-187 |
| Order number | 10723/0004 | 10723/0005 | 10723/0006 | 10723/0007 | 10723/0008 | 10723/0009 | 10723/0010 | 10723/0011 |

Table 3: Hard plaster jaws

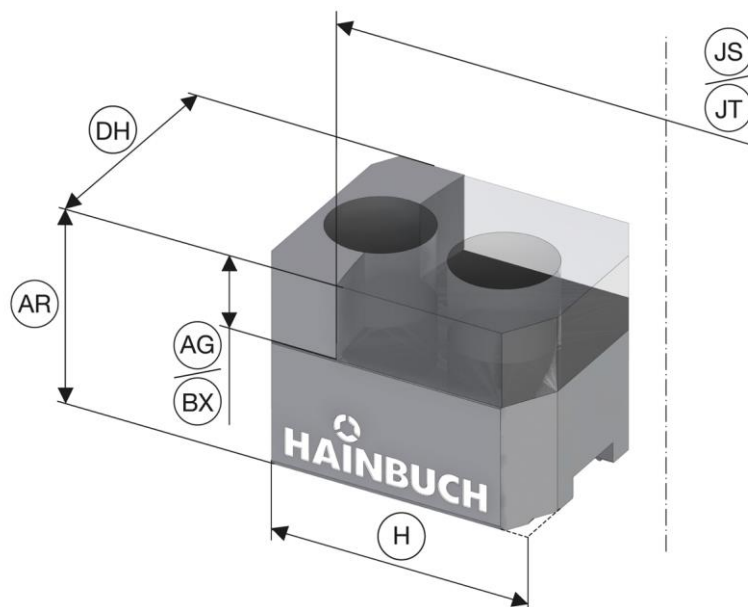
3.2.2 Soft, smooth top jaws



DANGER

Serious injuries caused by use of incorrectly machined jaws!

- When unfastening the jaws, observe the specified limits and procedure [see the »Machining the soft jaws« chapter].



| Product | | Top jaw, short | Top jaw, long |
|---|----|----------------|---------------|
| Size | | 145 / 215 | 145 / 215 |
| Type of gear | | 1.5 x 60° | 1.5 x 60° |
| Length [mm] | H | 55 | 65 |
| Jaw height [mm] | AR | 40 | 40 |
| Jaw width [mm] | DH | 45 | 45 |
| Clamping range of size 145 at maximum clamping force [mm] | | 25-118 | 25-126 |
| Clamping range of size 145 at minimum clamping force [mm] | | 25-131 | 25-140 |
| Clamping range of size 215 at maximum clamping force [mm] | | 25-186 | 25-195 |
| Clamping range of size 215 at minimum clamping force [mm] | | 25-200 | 25-209 |
| maximum clamping length [mm] | AG | 15 | 15 |
| maximum permitted turn-out diameter for size 145 [mm] | BW | 131 | 140 |
| maximum permitted turn-out diameter for size 215 [mm] | BW | 200 | 209 |
| maximum permitted turn-out depth [mm] | BX | 15 | 15 |
| Order number | | 10724/0001 | 10724/0002 |

Table 4: Soft, smooth top jaws

3.3 Performance values



NOTE

Material damage to the products use and/or to the machine tool caused by exceeding the maximum performance values!

- Do not exceed the maximum performance values [see »General information« chapter].
- On all products used, do not exceed the lowest of the maximum performance values.
- Only use product in machine tools with the same performance values.



INFORMATION

Details of maximum performance values can be found on each product.

If, due to abrasive wear, those performance values are no long legible, refer to the operating instructions.

The achievable actuation forces may vary as a result of the maintenance status [lubrication status and level of contamination] of the product [see »Maintenance schedule« chapter].

The achievable clamping forces resulting from actuating forces must be checked at regular intervals. For this, structural clamping force measurements must be performed.

The clamping force measured must be in the approved range [see »Clamping force diagram« chapter].

3.4 Balancing quality

The product is balanced before leaving the factory [balancing quality - see »General information« chapter].



DANGER

Serious injuries caused by parts being ejected centrifugally if products are not balanced correctly!

- Do not clamp rotationally symmetrical workpieces, or do so only after contacting the manufacturer.
- Never remove balancing screws and weights attached to the product.



NOTE

Material damage caused by machining with incorrectly balanced products!

- Do not clamp rotationally symmetrical workpieces, or do so only after contacting the manufacturer.
- Never remove balancing screws and weights attached to the product.

3.5 Speed

The product is authorized for rotational operation.

The maximum speed is written on the product [maximum speed, see »General information« chapter].



DANGER

Serious injuries caused by parts being ejected centrifugally due to a non-compliant combination of several products!

- From all of the maximum speeds indicated for the combined products, always remain at the lowest of those maximum speeds.



DANGER

Serious injuries caused by workpieces being ejected centrifugally after a loss of clamping power!

- If necessary, adjust the machining forces.

3.6 Clamping force diagram

The clamping force diagram indicates the permitted range in which the radial clamping force is permitted to move in response to axial actuating force.

The clamping force diagram indicates the influences of friction.



WARNING

Serious injuries caused by insufficient clamping force!

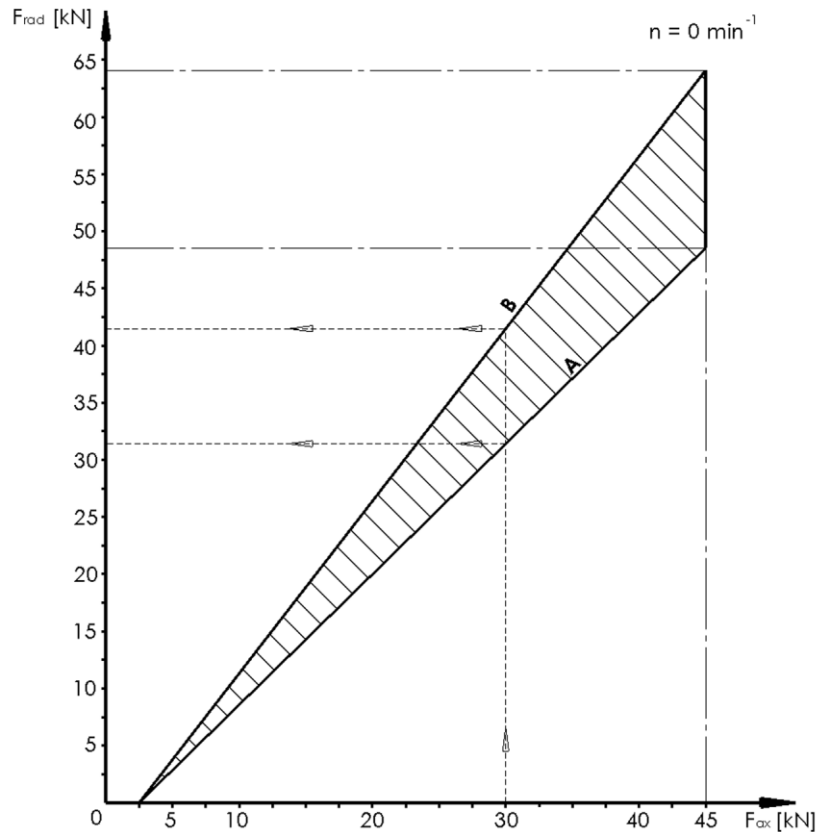
- The values measured for radial clamping force F_{rad} must be within the permitted range.
- If the values recorded are outside the permitted range, the product must be cleaned [see »Cleaning« chapter] and another clamping force test must be conducted.
- If the values recorded after cleaning is completed are outside the permitted range, you should contact the manufacturer.

3.6.1 Size 145/215

Scan sample:

At an axial actuation force F_{ax} of 30 kN, the radial clamping force F_{rad} is in a range of between 31.75 kN and 42 kN.

- A lower limit value
- B upper limit value

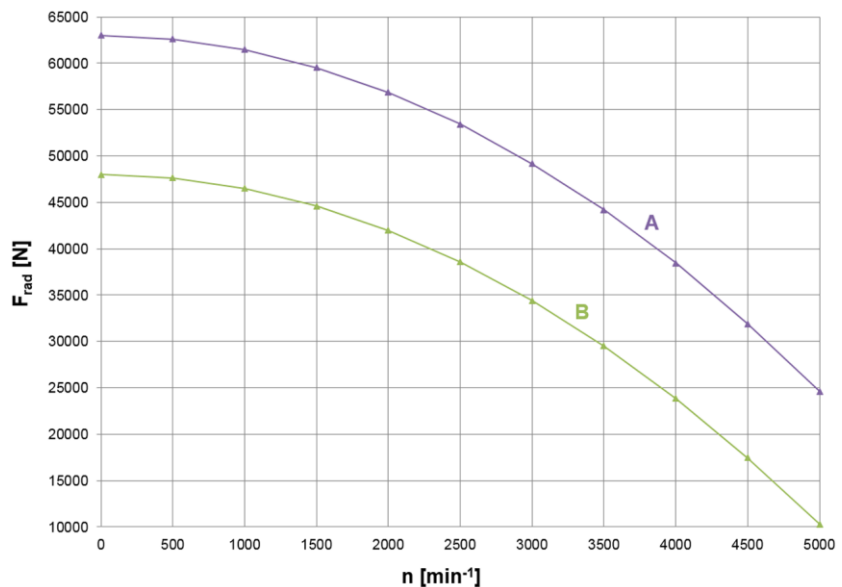


3.7 Clamping force speed diagram

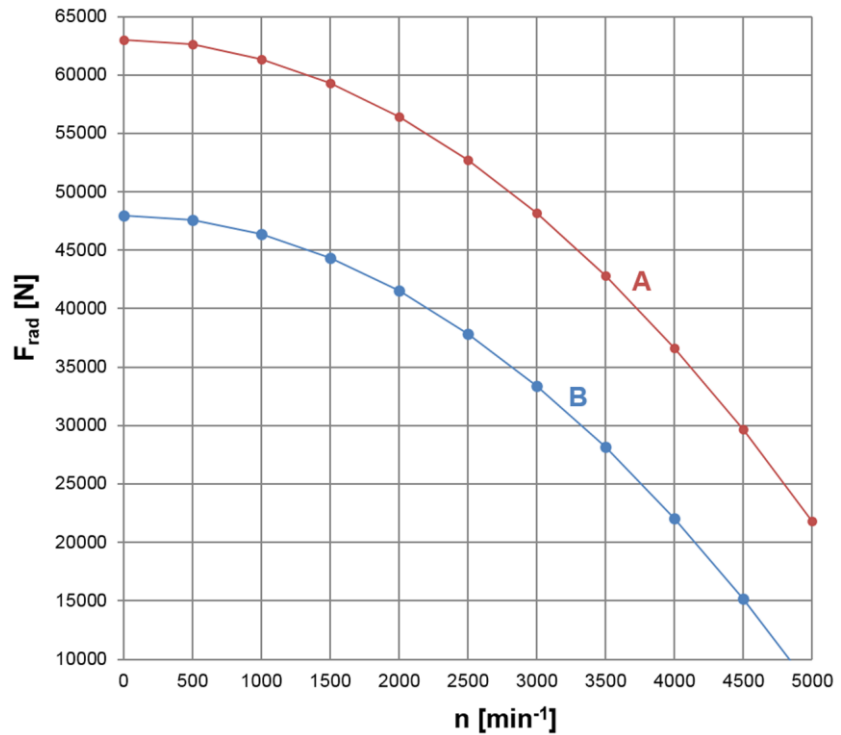
The lower limit value is relevant for determining the permitted machining force.

3.7.1 Groove jaws for size 145 - Basic clamping device, size 65

- A Grooved jaw #1 maximum
- B Grooved jaw #1 minimum

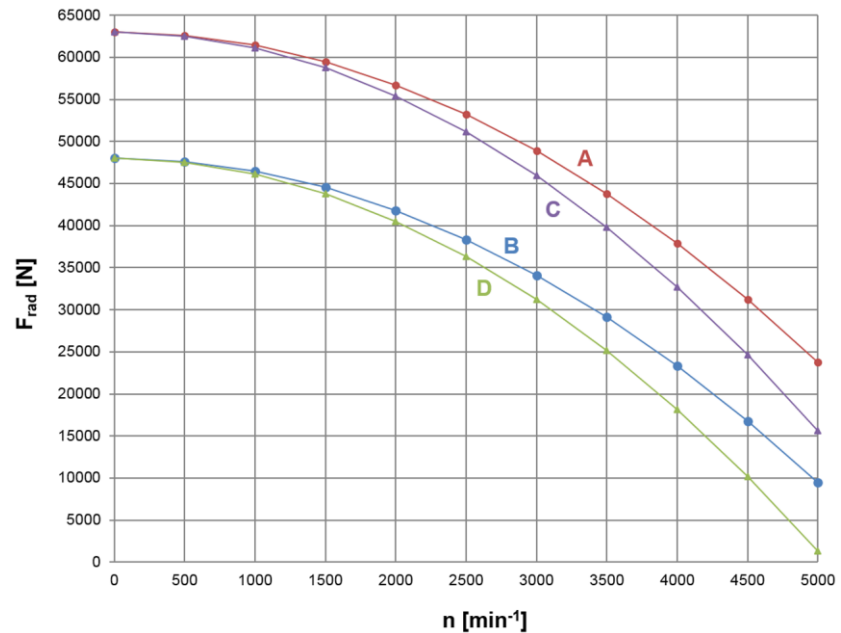


3.7.2 Plaster jaws for size 145 - Basic clamping device, size 65



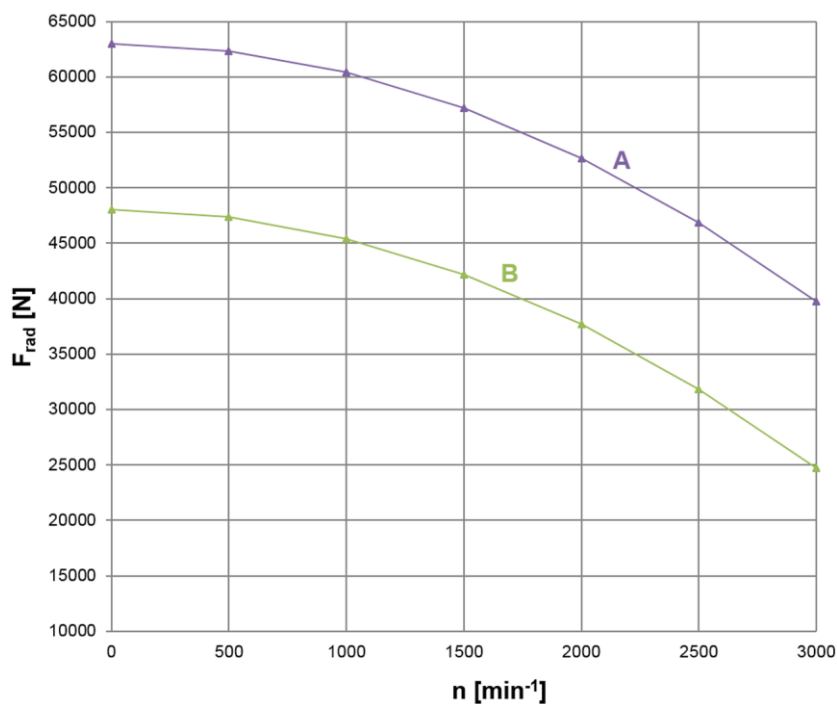
- A Plaster jaw #1 maximum
- B Plaster jaw #1 minimum

3.7.3 Top jaws soft for size 145 - Basic clamping device size 65



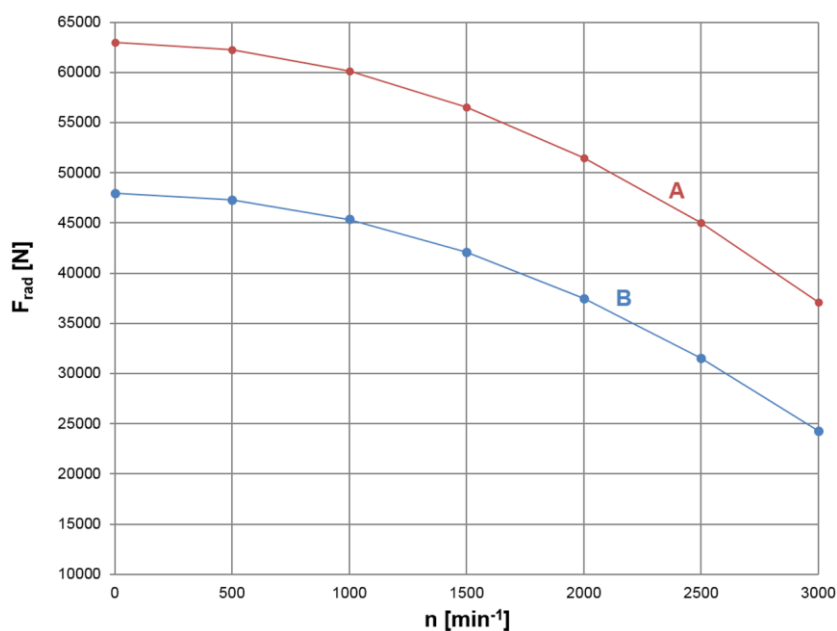
- A Soft top jaw short maximum
- B Soft top jaw short minimum
- C Soft top jaw long maximum
- D Soft top jaw long minimum

3.7.4 Groove jaws for size 215 - Basic clamping device, size 65



- A Grooved jaw #1 maximum
- B Grooved jaw #1 minimum

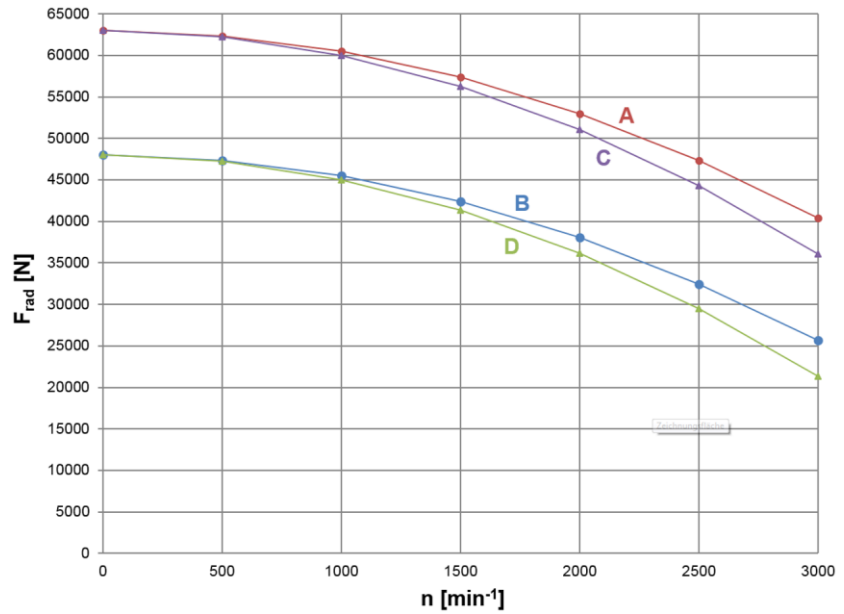
3.7.5 Plaster jaws for size 215 - Basic clamping device, size 65



- A Plaster jaw #1 maximum
- B Plaster jaw #1 minimum

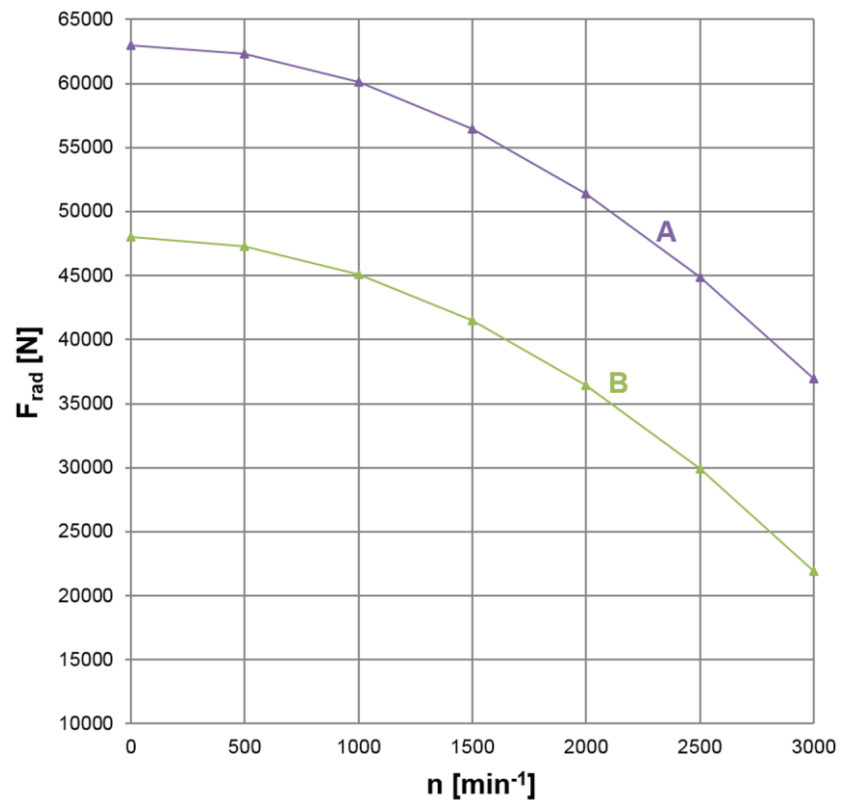
3.7.6 Top jaws soft for size 215 - Basic clamping device size 65

- A Soft top jaw short maximum
- B Soft top jaw short minimum
- C Soft top jaw long maximum
- D Soft top jaw long minimum

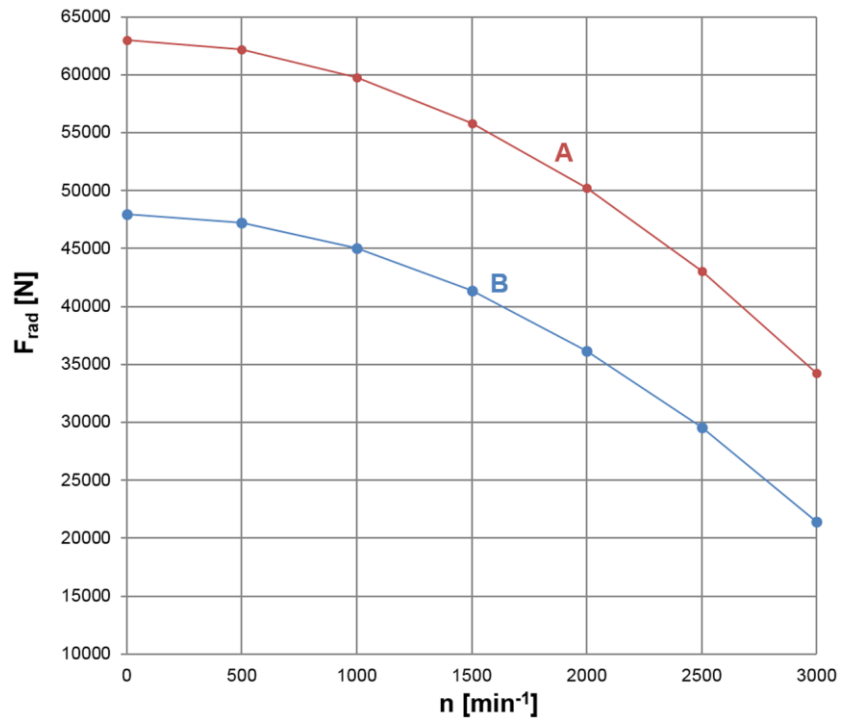


3.7.7 Grooved jaws for size 215 - Basic clamping device, size 80

- A Grooved jaw #1 maximum
- B Grooved jaw #1 minimum

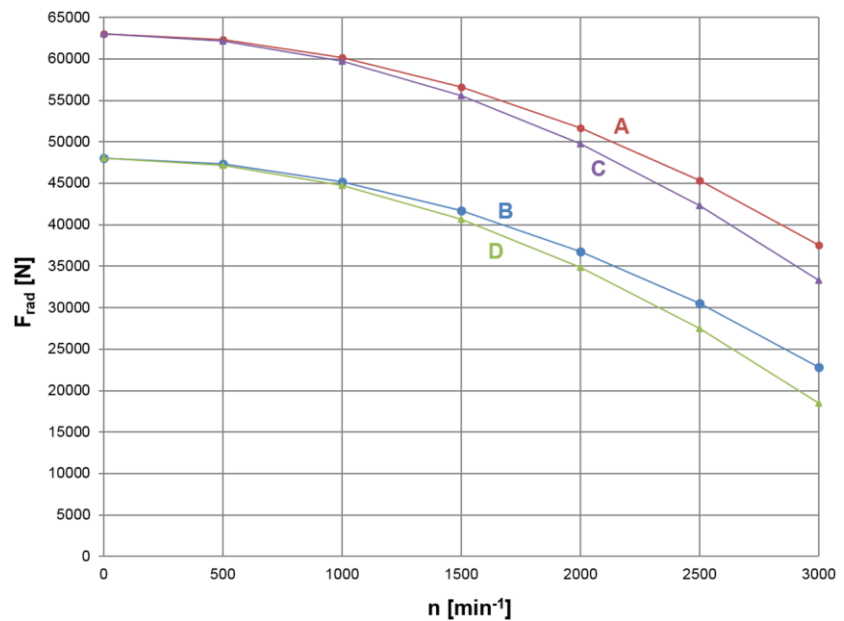


3.7.8 Plaster jaws for size 215 - Basic clamping device, size 80



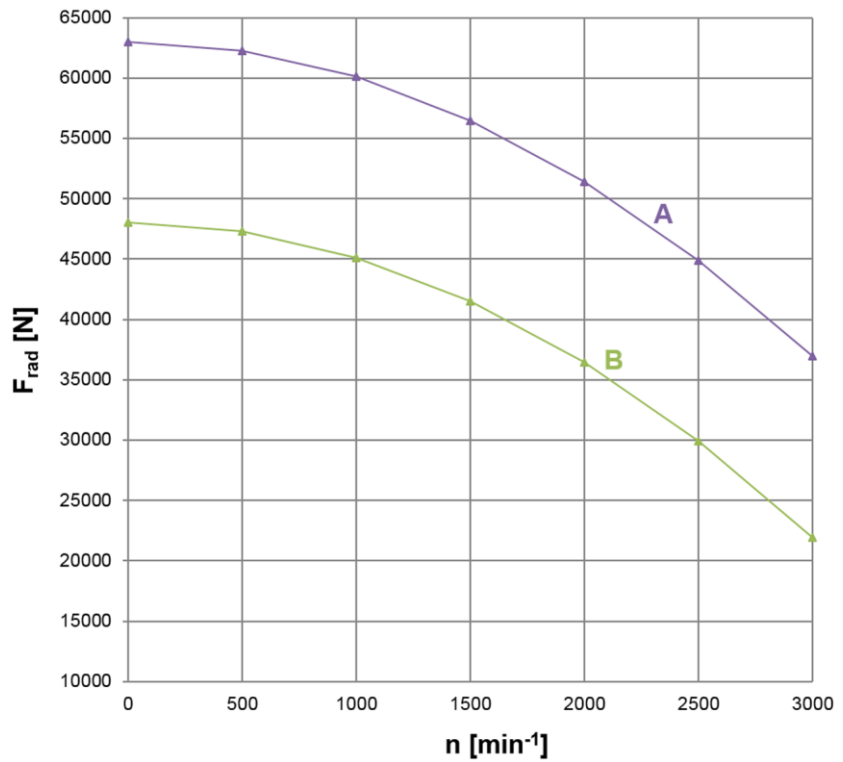
- A Plaster jaw #1 maximum
- B Plaster jaw #1 minimum

3.7.9 Top jaws soft for size 215 - Basic clamping device size 80

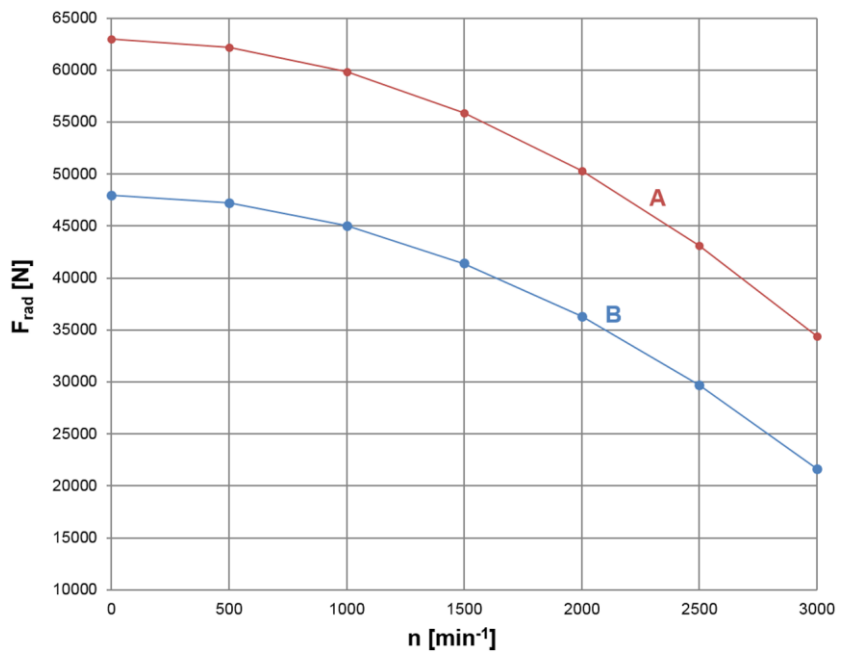


- A Soft top jaw short maximum
- B Soft top jaw short minimum
- C Soft top jaw long maximum
- D Soft top jaw long minimum

3.7.10 Grooved jaws for size 215 - Basic clamping device, size 100

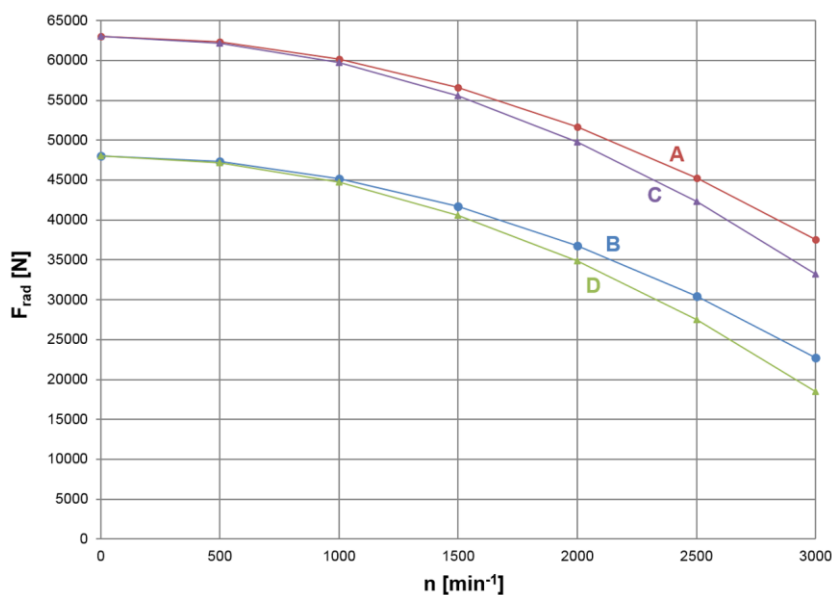


3.7.11 Plaster jaws for size 215 - Basic clamping device, size 100



3.7.12 Top jaws soft for size 215 - Basic clamping device size 100

- A Soft top jaw short maximum
- B Soft top jaw short minimum
- C Soft top jaw long maximum
- D Soft top jaw long minimum



3.8 Operating conditions

| Indication | Value | Unit |
|---------------------------|-----------|------|
| Ambient temperature range | 15 - 65 | °C |
| Workpiece temperature | ≤ 80 | °C |
| Humidity | ≤ 80 | % |

Table 5: Operating conditions

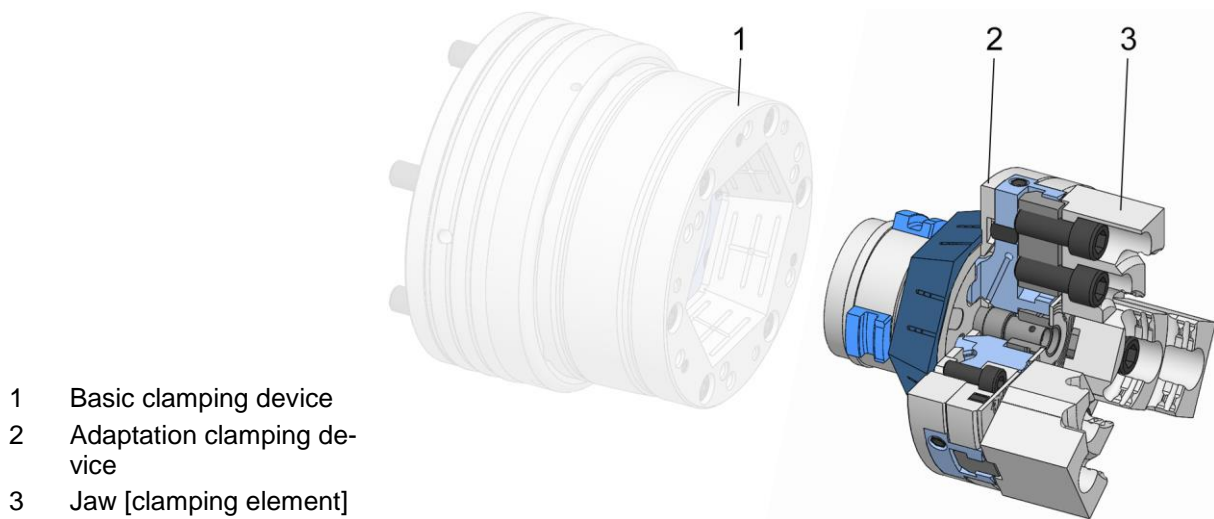
3.9 Type designation

The type designation is on the product and it includes the following indications:

- Manufacturer
- Product designation
- ID number [marked with a # symbol]
- Build year
- Maximum speed n [min^{-1}]
- Maximum actuating force $F_{ax\ max}$ [kN]
- Maximum clamping force $F_{rad\ max}$ [kN]

4 Layout and function

4.1 Overview and brief description



The adaptation clamping device is intended for use with jaws.

Using the adaptation clamping device makes it possible to extend the diameter clamping range of the basic clamping device.

The adaptation clamping device is only used for external clamping.

The adaptation clamping device sits directly on the basic clamping device.

The clamping element set is screwed onto the basic jaws in the clamping device and clamps the workpiece that is to be machined.

The clamping device functions on the deadlength principle.

4.2 Accessories required

4.2.1 Basic clamping device

The basic clamping device supports the adaptation clamping device.

4.2.2 Jaws

The jaw module can be used with hard or with soft top jaws.

Hard top jaws

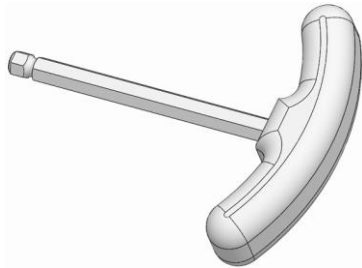
The hard top jaws are used to clamp the workpiece. They can be adjusted on the basic jaw within their clamping range, meaning that they can be adjusted to suit different clamping diameters.

Soft, smooth top jaws

Soft top jaws can be turned out up to a defined value.

4.3 Special aids

4.3.1 Assembly key



The assembly wrench is used to install and remove the product on the machine tool. This is included in the scope of delivery of the product and cannot be replaced with a conventional tool.

5 Use and limits of use

5.1 Use

The product is a clamping device that may only be used to clamp a rotationally symmetrical workpiece to enable it to be machined.

The product must only be used for the external clamping of workpieces.

The product can only be used in combination with a suitable basic clamping device from HAINBUCH.

As well as for its general field of application, this product was designed and developed for use, when necessary, in a specific and documented application [see clamping situation drawing or order confirmation].

Any other fields of application require the explicit approval of the manufacturer.

5.1.1 Permitted clamping of the workpiece

The display pin on the clamping device is the indicator for permitted clamping of the workpiece.

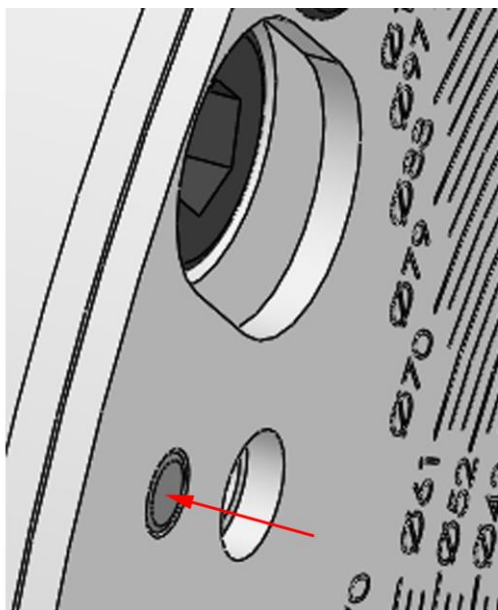


DANGER

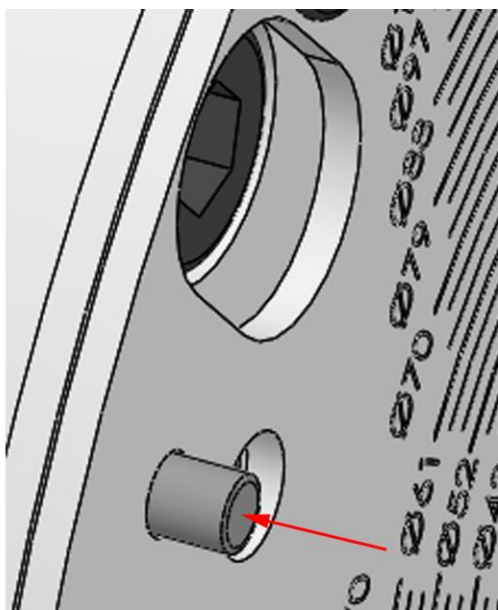
Serious injuries caused by projectile parts if the workpiece is not clamped within permitted limits!

- Never clamp outside the permitted clamping range.
- With every clamping action, check the display pin to assure safe clamping.

3-jaw module Use and limits of use



If the display pin is located completely in the clamping device after clamping action is applied, the workpiece is clamped correctly.



If the display pin protrudes after clamping the workpiece, clamping is not permitted. Machining of the workpiece is prohibited when excessive clamping action is applied. The jaws must be moved inwards. The selection of jaws and application limits must be checked again [see »Selection of jaws« and »Limits of use« chapters].

5.2 Selection of jaws

Due to the various clamping steps in the jaws and the option to adjust using the sharp-tipped gears, there are various ways of selecting an appropriate clamping stage for a given workpiece diameter.

Selection of jaws

With the clamping diameter [nominal diameter], select the next smaller clamping stage.

Select the tooth position. For this, view the corresponding table from tooth position 0 in ascending order in relation to the clamping range. Select the first clamping range at which the clamping diameter and its tolerances are covered completely.

If a selection is not possible, check the next smaller clamping stage.

The clamping stage closest to the workpiece diameter including tolerances also involves a smaller loss of centrifugal force [see »Clamping force speed diagram«].

5.2.1 Selection of grooved jaws

| Size of jaw module | Grooved jaw #1 Part number 10723/0001 Clamping stage: 25 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 25 | 0 | 23.93 - 27.12 | 23.11 - 29.81 |
| | 27.89 | 1 | 26.81 - 30.03 | 25.98 - 32.74 |
| | 30.81 | 2 | 29.72 - 32.95 | 28.88 - 35.67 |
| | 33.73 | 3 | 32.64 - 35.89 | 31.8 - 38.62 |
| | 36.67 | 4 | 35.58 - 38.84 | 34.73 - 41.57 |
| | 39.62 | 5 | 38.52 - 41.79 | 37.68 - 44.53 |
| | 42.58 | 6 | 41.47 - 44.75 | 40.63 - 47.5 |
| 215 | 45.54 | 7 | 44.43 - 47.72 | 43.59 - 50.47 |
| | 48.51 | 8 | 47.4 - 50.69 | 46.55 - 53.44 |
| | 51.48 | 9 | 50.37 - 53.66 | 49.52 - 56.42 |
| | 54.45 | 10 | 53.34 - 56.63 | 52.49 - 59.39 |
| | 57.43 | 11 | 56.32 - 59.61 | 55.46 - 62.37 |
| | 60.41 | 12 | 59.29 - 62.59 | 58.44 - 65.36 |

3-jaw module

Use and limits of use

| Size of jaw module | Grooved jaw #1 Part number 10723/0001 Clamping stage: 25 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 63.39 | 13 | 62.27 - 65.57 | 61.42 - 68.34 |
| | 66.37 | 14 | 65.26 - 68.56 | 64.4 - 71.32 |
| | 69.35 | 15 | 68.24 - 71.54 | 67.38 - 74.31 |
| | 72.34 | 16 | 71.22 - 74.53 | 70.37 - 77.3 |
| | 75.33 | 17 | 74.21 - 77.52 | 73.35 - 80.29 |
| | 78.31 | 18 | 77.2 - 80.5 | 76.34 - 83.27 |
| | 81.3 | 19 | 80.19 - 83.49 | 79.33 - 86.26 |
| | 84.29 | 20 | 83.18 - 86.48 | 82.32 - 89.25 |
| | 87.28 | 21 | 86.16 - 89.47 | 85.31 - 92.25 |
| | 90.27 | 22 | 89.16 - 92.47 | 88.3 - 95.24 |
| | 93.26 | 23 | 92.15 - 95.46 | 91.29 - 98.23 |
| | 96.25 | 24 | 95.14 - 98.45 | 94.28 - 101.22 |
| | 99.25 | 25 | 98.13 - 101.44 | 97.27 - 104.22 |
| | 102.24 | 26 | 101.12 - 104.43 | 100.26 - 107.21 |
| | 105.23 | 27 | 104.12 - 107.43 | 103.26 - 110.2 |

Table 6: Grooved jaws – clamping stage 25 mm

3-jaw module

Use and limits of use

| Size of jaw module | Grooved jaw #4 Part number 10723/0012 Clamping stage: 26 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 26 | 0 | 24.97 - 28.04 | 24.18 - 30.66 |
| | 28.79 | 1 | 27.74 - 30.86 | 26.94 - 33.51 |
| | 31.62 | 2 | 30.56 - 33.72 | 29.75 - 36.38 |
| | 34.48 | 3 | 33.41 - 36.59 | 32.59 - 39.27 |
| | 37.36 | 4 | 36.29 - 39.49 | 35.46 - 42.18 |
| | 40.26 | 5 | 39.18 - 42.4 | 38.35 - 45.1 |
| | 43.17 | 6 | 42.09 - 45.32 | 41.25 - 48.03 |
| | 46.1 | 7 | 45.01 - 48.25 | 44.17 - 50.97 |
| | 49.03 | 8 | 47.93 - 51.19 | 47.09 - 53.92 |
| | 51.97 | 9 | 50.87 - 54.13 | 50.03 - 56.87 |
| 215 | 54.92 | 10 | 53.82 - 57.08 | 52.97 - 59.82 |
| | 57.87 | 11 | 56.77 - 60.04 | 55.92 - 62.78 |
| | 60.83 | 12 | 59.72 - 63 | 58.88 - 65.74 |
| | 63.79 | 13 | 62.68 - 65.96 | 61.83 - 68.71 |
| | 66.75 | 14 | 65.65 - 68.93 | 64.8 - 71.68 |
| | 69.72 | 15 | 68.61 - 71.9 | 67.76 - 74.65 |
| | 72.69 | 16 | 71.58 - 74.87 | 70.73 - 77.63 |
| | 75.66 | 17 | 74.55 - 77.84 | 73.7 - 80.6 |
| | 78.64 | 18 | 77.53 - 80.82 | 76.67 - 83.58 |
| | 81.61 | 19 | 80.5 - 83.8 | 79.65 - 86.56 |
| | 84.59 | 20 | 83.48 - 86.78 | 82.63 - 89.54 |
| | 87.57 | 21 | 86.46 - 89.76 | 85.61 - 92.52 |
| | 90.55 | 22 | 89.44 - 92.74 | 88.59 - 95.5 |
| 93.54 | 23 | 92.42 - 95.72 | 91.57 - 98.49 | |

3-jaw module

Use and limits of use

| Size of jaw module | Grooved jaw #4 Part number 10723/0012 Clamping stage: 26 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 96.52 | 24 | 95.41 - 98.71 | 94.55 - 101.47 |
| | 99.5 | 25 | 98.39 - 101.69 | 97.53 - 104.46 |
| | 102.49 | 26 | 101.37 - 104.68 | 100.52 - 107.45 |
| | 105.48 | 27 | 104.36 - 107.67 | 103.5 - 110.43 |

Table 7: Grooved jaws – clamping stage 26 mm

| Size of jaw module | Grooved jaw #1 Part number 10723/0001 Grooved jaw #4 Part number 10723/0012 Clamping stage: 34 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 34 | 0 | 33.17 - 35.67 | 32.55 - 37.87 |
| | 36.3 | 1 | 35.43 - 38.04 | 34.77 - 40.32 |
| | 38.69 | 2 | 37.79 - 40.5 | 37.1 - 42.83 |
| | 41.16 | 3 | 40.23 - 43.02 | 39.52 - 45.41 |
| | 43.7 | 4 | 42.75 - 45.6 | 42.02 - 48.04 |
| | 46.3 | 5 | 45.32 - 48.23 | 44.58 - 50.7 |
| | 48.94 | 6 | 47.95 - 50.9 | 47.19 - 53.41 |
| 215 | 51.62 | 7 | 50.62 - 53.61 | 49.85 - 56.14 |
| | 54.33 | 8 | 53.32 - 56.34 | 52.54 - 58.9 |
| | 57.08 | 9 | 56.05 - 59.1 | 55.26 - 61.68 |
| | 59.84 | 10 | 58.81 - 61.89 | 58.01 - 64.48 |
| | 62.63 | 11 | 61.59 - 64.69 | 60.79 - 67.3 |
| | 65.44 | 12 | 64.39 - 67.51 | 63.58 - 70.13 |
| | 68.26 | 13 | 67.21 - 70.34 | 66.4 - 72.98 |

3-jaw module

Use and limits of use

| Size of jaw module | Grooved jaw #1 Part number 10723/0001 Grooved jaw #4 Part number 10723/0012 Clamping stage: 34 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 71.1 | 14 | 70.04 - 73.19 | 69.23 - 75.84 |
| | 73.95 | 15 | 72.89 - 76.05 | 72.07 - 78.71 |
| | 76.81 | 16 | 75.74 - 78.92 | 74.92 - 81.59 |
| | 79.69 | 17 | 78.61 - 81.8 | 77.79 - 84.47 |
| | 82.57 | 18 | 81.49 - 84.69 | 80.66 - 87.37 |
| | 85.46 | 19 | 84.38 - 87.58 | 83.55 - 90.27 |
| | 88.35 | 20 | 87.27 - 90.48 | 86.44 - 93.18 |
| | 91.26 | 21 | 90.17 - 93.39 | 89.34 - 96.09 |
| | 94.17 | 22 | 93.08 - 96.3 | 92.25 - 99.01 |
| | 97.08 | 23 | 95.99 - 99.22 | 95.16 - 101.93 |
| | 100 | 24 | 98.91 - 102.15 | 98.07 - 104.86 |
| | 102.93 | 25 | 101.83 - 105.07 | 101 - 107.79 |
| | 105.86 | 26 | 104.76 - 108.01 | 103.92 - 110.73 |
| | 108.79 | 27 | 107.69 - 110.94 | 106.85 - 113.66 |

Table 8: Grooved jaws – clamping stage 34 mm

3-jaw module

Use and limits of use

| Size of jaw module | Grooved jaw #1 Part number 10723/0001 Grooved jaw #4 Part number 10723/0012 Clamping stage: 43 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 43 | 0 | 42.22 - 44.57 | 41.63 - 46.63 |
| | 45.16 | 1 | 44.34 - 46.8 | 43.72 - 48.93 |
| | 47.4 | 2 | 46.55 - 49.1 | 45.91 - 51.3 |
| | 49.73 | 3 | 48.85 - 51.48 | 48.19 - 53.74 |
| | 52.13 | 4 | 51.22 - 53.92 | 50.54 - 56.23 |
| | 54.58 | 5 | 53.66 - 56.42 | 52.95 - 58.77 |
| | 57.09 | 6 | 56.15 - 58.96 | 55.43 - 61.35 |
| | 59.64 | 7 | 58.68 - 61.54 | 57.95 - 63.97 |
| | 62.23 | 8 | 61.26 - 64.16 | 60.52 - 66.61 |
| | 64.86 | 9 | 63.88 - 66.81 | 63.12 - 69.29 |
| 215 | 67.52 | 10 | 66.53 - 69.49 | 65.76 - 71.99 |
| | 70.21 | 11 | 69.2 - 72.19 | 68.43 - 74.72 |
| | 72.92 | 12 | 71.9 - 74.92 | 71.13 - 77.47 |
| | 75.65 | 13 | 74.63 - 77.67 | 73.85 - 80.23 |
| | 78.4 | 14 | 77.37 - 80.43 | 76.59 - 83.01 |
| | 81.17 | 15 | 80.14 - 83.22 | 79.34 - 85.81 |
| | 83.96 | 16 | 82.92 - 86.01 | 82.12 - 88.62 |
| | 86.76 | 17 | 85.71 - 88.82 | 84.91 - 91.44 |
| | 89.57 | 18 | 88.52 - 91.64 | 87.71 - 94.27 |
| | 92.4 | 19 | 91.34 - 94.48 | 90.53 - 97.11 |
| | 95.23 | 20 | 94.17 - 97.32 | 93.36 - 99.96 |
| | 98.08 | 21 | 97.01 - 100.17 | 96.2 - 102.82 |
| 100.93 | 22 | 99.87 - 103.03 | 99.05 - 105.69 | |

3-jaw module

Use and limits of use

| Size of jaw module | Grooved jaw #1 Part number 10723/0001 Grooved jaw #4 Part number 10723/0012 Clamping stage: 43 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 103.79 | 23 | 102.73 - 105.9 | 101.9 - 108.56 |
| | 106.66 | 24 | 105.59 - 108.77 | 104.77 - 111.44 |
| | 109.54 | 25 | 108.47 - 111.66 | 107.64 - 114.33 |
| | 112.43 | 26 | 111.35 - 114.54 | 110.52 - 117.22 |
| | 115.31 | 27 | 114.24 - 117.44 | 113.41 - 120.12 |

Table 9: Grooved jaws – clamping stage 43 mm

| Size of jaw module | Grooved jaw #1 Part number 10723/0001 Grooved jaw #4 Part number 10723/0012 Clamping stage: 52 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 52 | 0 | 51.26 - 53.5 | 50.7 - 55.45 |
| | 54.05 | 1 | 53.28 - 55.61 | 52.69 - 57.64 |
| | 56.19 | 2 | 55.38 - 57.81 | 54.77 - 59.9 |
| | 58.4 | 3 | 57.57 - 60.07 | 56.93 - 62.22 |
| | 60.68 | 4 | 59.83 - 62.4 | 59.17 - 64.6 |
| 215 | 63.03 | 5 | 62.15 - 64.78 | 61.47 - 67.03 |
| | 65.42 | 6 | 64.52 - 67.21 | 63.83 - 69.5 |
| | 67.86 | 7 | 66.95 - 69.68 | 66.25 - 72.01 |
| | 70.35 | 8 | 69.42 - 72.2 | 68.71 - 74.56 |
| | 72.88 | 9 | 71.93 - 74.75 | 71.21 - 77.14 |
| | 75.44 | 10 | 74.48 - 77.33 | 73.74 - 79.75 |
| | 78.03 | 11 | 77.06 - 79.95 | 76.31 - 82.39 |

3-jaw module

Use and limits of use

| Size of jaw module | Grooved jaw #1 Part number 10723/0001 Grooved jaw #4 Part number 10723/0012 Clamping stage: 52 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 80.65 | 12 | 79.67 - 82.58 | 78.91 - 85.05 |
| | 83.29 | 13 | 82.3 - 85.25 | 81.54 - 87.73 |
| | 85.96 | 14 | 84.96 - 87.93 | 84.2 - 90.44 |
| | 88.65 | 15 | 87.64 - 90.64 | 86.87 - 93.16 |
| | 91.36 | 16 | 90.35 - 93.36 | 89.57 - 95.89 |
| | 94.09 | 17 | 93.07 - 96.1 | 92.28 - 98.65 |
| | 96.83 | 18 | 95.8 - 98.85 | 95.02 - 101.41 |
| | 99.59 | 19 | 98.56 - 101.62 | 97.77 - 104.19 |
| | 102.36 | 20 | 101.32 - 104.4 | 100.53 - 106.99 |
| | 105.14 | 21 | 104.1 - 107.19 | 103.3 - 109.79 |
| | 107.94 | 22 | 106.89 - 109.99 | 106.09 - 112.6 |
| | 110.74 | 23 | 109.69 - 112.81 | 108.89 - 115.42 |
| | 113.56 | 24 | 112.51 - 115.63 | 111.7 - 118.25 |
| | 116.39 | 25 | 115.33 - 118.46 | 114.52 - 121.09 |
| | 119.22 | 26 | 118.16 - 121.3 | 117.35 - 123.94 |
| | 122.06 | 27 | 121 - 124.15 | 120.18 - 126.79 |

Table 10: Grooved jaws – clamping stage 52 mm

3-jaw module

Use and limits of use

| Size of jaw module | Grooved jaw #4 Part number 10723/0012 Clamping stage: 60 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 60 | 0 | 59.15 - 61.69 | 58.51 - 63.87 |
| | 62.31 | 1 | 61.44 - 64.04 | 60.78 - 66.27 |
| | 64.68 | 2 | 63.79 - 66.45 | 63.11 - 68.72 |
| | 67.09 | 3 | 66.19 - 68.9 | 65.49 - 71.21 |
| | 69.56 | 4 | 68.63 - 71.39 | 67.93 - 73.73 |
| | 72.06 | 5 | 71.12 - 73.92 | 70.4 - 76.3 |
| | 74.6 | 6 | 73.65 - 76.49 | 72.92 - 78.89 |
| | 77.18 | 7 | 76.21 - 79.08 | 75.47 - 81.51 |
| | 79.78 | 8 | 78.8 - 81.7 | 78.06 - 84.16 |
| | 82.41 | 9 | 81.42 - 84.35 | 80.67 - 86.83 |
| 215 | 85.06 | 10 | 84.07 - 87.02 | 83.31 - 89.52 |
| | 87.74 | 11 | 86.74 - 89.72 | 85.97 - 92.23 |
| | 90.44 | 12 | 89.43 - 92.43 | 88.66 - 94.95 |
| | 93.15 | 13 | 92.14 - 95.16 | 91.36 - 97.7 |
| | 95.89 | 14 | 94.86 - 97.9 | 94.08 - 100.46 |
| | 98.63 | 15 | 97.61 - 100.66 | 96.82 - 103.23 |
| | 101.4 | 16 | 100.36 - 103.43 | 99.57 - 106.01 |
| | 104.17 | 17 | 103.13 - 106.22 | 102.34 - 108.81 |
| | 106.96 | 18 | 105.92 - 109.01 | 105.12 - 111.61 |
| | 109.76 | 19 | 108.71 - 111.82 | 107.91 - 114.43 |
| | 112.57 | 20 | 111.52 - 114.63 | 110.71 - 117.25 |
| | 115.39 | 21 | 114.33 - 117.46 | 113.53 - 120.09 |
| | 118.21 | 22 | 117.16 - 120.29 | 116.35 - 122.93 |
| | 121.05 | 23 | 119.99 - 123.14 | 119.18 - 125.78 |

3-jaw module

Use and limits of use

| Size of jaw module | Grooved jaw #4 Part number 10723/0012 Clamping stage: 60 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 123.89 | 24 | 122.83 - 125.98 | 122.02 - 128.63 |
| | 126.75 | 25 | 125.68 - 128.84 | 124.86 - 131.49 |
| | 129.6 | 26 | 128.54 - 131.7 | 127.72 - 134.36 |
| | 132.47 | 27 | 131.4 - 134.57 | 130.58 - 137.23 |

Table 11: Grooved jaws – clamping stage 60 mm

| Size of jaw module | Grooved jaw #1 Part number 10723/0001 Clamping stage: 61 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 61 | 0 | 60.14 - 62.71 | 59.49 - 64.91 |
| | 63.34 | 1 | 62.46 - 65.08 | 61.79 - 67.33 |
| | 65.73 | 2 | 64.83 - 67.51 | 64.14 - 69.8 |
| | 68.16 | 3 | 67.25 - 69.98 | 66.55 - 72.3 |
| | 70.64 | 4 | 69.71 - 72.49 | 69 - 74.85 |
| | 73.17 | 5 | 72.22 - 75.04 | 71.5 - 77.42 |
| | 75.72 | 6 | 74.76 - 77.61 | 74.03 - 80.03 |
| | 78.31 | 7 | 77.34 - 80.22 | 76.6 - 82.66 |
| 215 | 80.92 | 8 | 79.94 - 82.86 | 79.19 - 85.32 |
| | 83.56 | 9 | 82.57 - 85.52 | 81.82 - 88 |
| | 86.23 | 10 | 85.23 - 88.2 | 84.47 - 90.7 |
| | 88.91 | 11 | 87.91 - 90.9 | 87.14 - 93.41 |
| | 91.62 | 12 | 90.61 - 93.61 | 89.83 - 96.15 |
| | 94.34 | 13 | 93.32 - 96.35 | 92.54 - 98.9 |
| | 97.08 | 14 | 96.06 - 99.1 | 95.27 - 101.66 |

3-jaw module

Use and limits of use

| Size of jaw module | Grooved jaw #1 Part number 10723/0001 Clamping stage: 61 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 99.84 | 15 | 98.81 - 101.87 | 98.02 - 104.44 |
| | 102.61 | 16 | 101.57 - 104.64 | 100.78 - 107.23 |
| | 105.39 | 17 | 104.35 - 107.43 | 103.55 - 110.03 |
| | 108.18 | 18 | 107.13 - 110.23 | 106.33 - 112.84 |
| | 110.98 | 19 | 109.93 - 113.04 | 109.13 - 115.66 |
| | 113.8 | 20 | 112.74 - 115.87 | 111.94 - 118.49 |
| | 116.62 | 21 | 115.56 - 118.69 | 114.75 - 121.32 |
| | 119.45 | 22 | 118.39 - 121.53 | 117.58 - 124.17 |
| | 122.29 | 23 | 121.23 - 124.38 | 120.41 - 127.02 |
| | 125.14 | 24 | 124.07 - 127.23 | 123.26 - 129.88 |
| | 127.99 | 25 | 126.92 - 130.09 | 126.11 - 132.74 |
| | 130.85 | 26 | 129.78 - 132.95 | 128.96 - 135.61 |
| | 133.72 | 27 | 132.65 - 135.82 | 131.83 - 138.49 |

Table 12: Grooved jaws – clamping stage 61 mm

3-jaw module

Use and limits of use

| Size of jaw module | Grooved jaw #1 Part number 10723/0001 Grooved jaw #4 Part number 10723/0012 Clamping stage: 70 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 70 | 0 | 69.07 - 71.84 | 68.36 - 74.19 |
| | 72.51 | 1 | 71.57 - 74.37 | 70.85 - 76.76 |
| | 75.06 | 2 | 74.1 - 76.95 | 73.37 - 79.35 |
| | 77.64 | 3 | 76.67 - 79.55 | 75.93 - 81.98 |
| | 80.24 | 4 | 79.27 - 82.17 | 78.52 - 84.63 |
| | 82.88 | 5 | 81.89 - 84.83 | 81.14 - 87.3 |
| | 85.54 | 6 | 84.54 - 87.5 | 83.78 - 90 |
| | 88.22 | 7 | 87.21 - 90.2 | 86.45 - 92.71 |
| | 90.92 | 8 | 89.91 - 92.91 | 89.13 - 95.44 |
| | 93.64 | 9 | 92.62 - 95.64 | 91.84 - 98.19 |
| 215 | 96.37 | 10 | 95.35 - 98.39 | 94.57 - 100.95 |
| | 99.12 | 11 | 98.1 - 101.15 | 97.31 - 103.72 |
| | 101.89 | 12 | 100.85 - 103.92 | 100.06 - 106.51 |
| | 104.67 | 13 | 103.63 - 106.71 | 102.83 - 109.3 |
| | 107.46 | 14 | 106.41 - 109.51 | 105.61 - 112.11 |
| | 110.26 | 15 | 109.21 - 112.32 | 108.41 - 114.93 |
| | 113.07 | 16 | 112.02 - 115.14 | 111.21 - 117.76 |
| | 115.89 | 17 | 114.83 - 117.96 | 114.03 - 120.59 |
| | 118.72 | 18 | 117.66 - 120.8 | 116.85 - 123.43 |
| | 121.56 | 19 | 120.5 - 123.64 | 119.68 - 126.28 |
| | 124.4 | 20 | 123.34 - 126.49 | 122.52 - 129.14 |
| | 127.25 | 21 | 126.19 - 129.35 | 125.37 - 132 |
| | 130.11 | 22 | 129.04 - 132.21 | 128.22 - 134.87 |

3-jaw module

Use and limits of use

| Size of jaw module | Grooved jaw #1 Part number 10723/0001 Grooved jaw #4 Part number 10723/0012 Clamping stage: 70 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 132.98 | 23 | 131.91 - 135.08 | 131.09 - 137.75 |
| | 135.85 | 24 | 134.78 - 137.96 | 133.95 - 140.63 |
| | 138.72 | 25 | 137.65 - 140.84 | 136.83 - 143.51 |
| | 141.61 | 26 | 140.53 - 143.72 | 139.7 - 146.4 |
| | 144.49 | 27 | 143.41 - 146.61 | 142.59 - 149.29 |

Table 13: Grooved jaws – clamping stage 70 mm

| Size of jaw module | Grooved jaw #2 Part number 10723/0002 Grooved jaw #5 Part number 10723/0013 Clamping stage: 79 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 79 | 0 | 78.03 - 80.92 | 77.28 - 83.37 |
| | 81.62 | 1 | 80.64 - 83.56 | 79.89 - 86.03 |
| | 84.27 | 2 | 83.28 - 86.23 | 82.52 - 88.71 |
| | 86.94 | 3 | 85.94 - 88.91 | 85.18 - 91.42 |
| | 89.63 | 4 | 88.62 - 91.62 | 87.85 - 94.14 |
| 215 | 92.34 | 5 | 91.33 - 94.34 | 90.55 - 96.88 |
| | 95.07 | 6 | 94.05 - 97.08 | 93.27 - 99.63 |
| | 97.81 | 7 | 96.79 - 99.83 | 96 - 102.4 |
| | 100.57 | 8 | 99.54 - 102.6 | 98.75 - 105.18 |
| | 103.34 | 9 | 102.31 - 105.38 | 101.51 - 107.97 |
| | 106.13 | 10 | 105.09 - 108.18 | 104.29 - 110.77 |
| | 108.92 | 11 | 107.88 - 110.98 | 107.08 - 113.59 |

3-jaw module

Use and limits of use

| Size of jaw module | Grooved jaw #2 Part number 10723/0002 Grooved jaw #5 Part number 10723/0013 Clamping stage: 79 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 111.73 | 12 | 110.68 - 113.79 | 109.88 - 116.41 |
| | 114.55 | 13 | 113.49 - 116.62 | 112.69 - 119.24 |
| | 117.37 | 14 | 116.32 - 119.45 | 115.51 - 122.08 |
| | 120.2 | 15 | 119.15 - 122.29 | 118.33 - 124.93 |
| | 123.05 | 16 | 121.98 - 125.13 | 121.17 - 127.78 |
| | 125.9 | 17 | 124.83 - 127.99 | 124.01 - 130.64 |
| | 128.75 | 18 | 127.68 - 130.85 | 126.87 - 133.51 |
| | 131.61 | 19 | 130.54 - 133.72 | 129.72 - 136.38 |
| | 134.48 | 20 | 133.41 - 136.59 | 132.59 - 139.25 |
| | 137.36 | 21 | 136.28 - 139.47 | 135.46 - 142.14 |
| | 140.23 | 22 | 139.16 - 142.35 | 138.33 - 145.02 |
| | 143.12 | 23 | 142.04 - 145.24 | 141.21 - 147.92 |
| | 146.01 | 24 | 144.93 - 148.13 | 144.1 - 150.81 |
| | 148.9 | 25 | 147.82 - 151.02 | 146.99 - 153.71 |
| | 151.8 | 26 | 150.72 - 153.92 | 149.89 - 156.62 |
| | 154.7 | 27 | 153.62 - 156.83 | 152.78 - 159.52 |

Table 14: Grooved jaws – clamping stage 79 mm

3-jaw module

Use and limits of use

| Size of jaw module | Grooved jaw #2 Part number 10723/0002 Clamping stage: 88 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 88 | 0 | 87 - 89.98 | 86.23 - 92.49 |
| | 90.7 | 1 | 89.69 - 92.69 | 88.92 - 95.22 |
| | 93.42 | 2 | 92.4 - 95.42 | 91.62 - 97.96 |
| | 96.15 | 3 | 95.13 - 98.17 | 94.34 - 100.72 |
| | 98.9 | 4 | 97.87 - 100.93 | 97.08 - 103.5 |
| | 101.66 | 5 | 100.63 - 103.7 | 99.84 - 106.28 |
| | 104.44 | 6 | 103.4 - 106.48 | 102.61 - 109.08 |
| | 107.23 | 7 | 106.19 - 109.28 | 105.39 - 111.88 |
| | 110.03 | 8 | 108.98 - 112.09 | 108.18 - 114.7 |
| | 112.84 | 9 | 111.79 - 114.91 | 110.98 - 117.53 |
| 215 | 115.66 | 10 | 114.61 - 117.73 | 113.8 - 120.36 |
| | 118.49 | 11 | 117.43 - 120.57 | 116.62 - 123.2 |
| | 121.33 | 12 | 120.27 - 123.41 | 119.45 - 126.05 |
| | 124.17 | 13 | 123.11 - 126.26 | 122.29 - 128.91 |
| | 127.02 | 14 | 125.96 - 129.12 | 125.14 - 131.77 |
| | 129.88 | 15 | 128.81 - 131.98 | 127.99 - 134.64 |
| | 132.74 | 16 | 131.67 - 134.85 | 130.85 - 137.51 |
| | 135.61 | 17 | 134.54 - 137.72 | 133.72 - 140.39 |
| | 138.49 | 18 | 137.42 - 140.6 | 136.59 - 143.28 |
| | 141.37 | 19 | 140.3 - 143.49 | 139.47 - 146.17 |
| | 144.26 | 20 | 143.18 - 146.38 | 142.35 - 149.06 |
| | 147.15 | 21 | 146.07 - 149.27 | 145.24 - 151.96 |
| | 150.04 | 22 | 148.96 - 152.17 | 148.13 - 154.86 |
| | 152.94 | 23 | 151.86 - 155.07 | 151.03 - 157.76 |

3-jaw module

Use and limits of use

| Size of jaw module | Grooved jaw #2 Part number 10723/0002 Clamping stage: 88 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 155.84 | 24 | 154.76 - 157.98 | 153.93 - 160.67 |
| | 158.75 | 25 | 157.67 - 160.88 | 156.83 - 163.58 |
| | 161.66 | 26 | 160.57 - 163.8 | 159.74 - 166.5 |
| | 164.57 | 27 | 163.49 - 166.71 | 162.65 - 169.42 |

Table 15: Grooved jaws – clamping stage 88 mm

| Size of jaw module | Grooved jaw #5 Part number 10723/0013 Clamping stage: 89 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 89 | 0 | 87.99 - 90.98 | 87.22 - 93.5 |
| | 91.71 | 1 | 90.69 - 93.7 | 89.92 - 96.24 |
| | 94.43 | 2 | 93.41 - 96.44 | 92.63 - 98.99 |
| | 97.17 | 3 | 96.15 - 99.19 | 95.36 - 101.75 |
| | 99.92 | 4 | 98.89 - 101.95 | 98.11 - 104.53 |
| | 102.69 | 5 | 101.66 - 104.73 | 100.86 - 107.32 |
| | 105.48 | 6 | 104.44 - 107.52 | 103.64 - 110.12 |
| | 108.27 | 7 | 107.22 - 110.32 | 106.42 - 112.93 |
| 215 | 111.07 | 8 | 110.02 - 113.13 | 109.22 - 115.75 |
| | 113.89 | 9 | 112.83 - 115.96 | 112.03 - 118.58 |
| | 116.71 | 10 | 115.65 - 118.78 | 114.84 - 121.41 |
| | 119.54 | 11 | 118.48 - 121.62 | 117.67 - 124.26 |
| | 122.38 | 12 | 121.32 - 124.47 | 120.51 - 127.11 |
| | 125.23 | 13 | 124.16 - 127.32 | 123.35 - 129.97 |
| | 128.08 | 14 | 127.02 - 130.18 | 126.2 - 132.83 |

3-jaw module

Use and limits of use

| Size of jaw module | Grooved jaw #5 Part number 10723/0013 Clamping stage: 89 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 130.94 | 15 | 129.87 - 133.04 | 129.05 - 135.7 |
| | 133.81 | 16 | 132.74 - 135.92 | 131.92 - 138.58 |
| | 136.68 | 17 | 135.61 - 138.79 | 134.79 - 141.46 |
| | 139.56 | 18 | 138.48 - 141.67 | 137.66 - 144.35 |
| | 142.44 | 19 | 141.37 - 144.56 | 140.54 - 147.24 |
| | 145.33 | 20 | 144.25 - 147.45 | 143.42 - 150.13 |
| | 148.22 | 21 | 147.14 - 150.35 | 146.31 - 153.03 |
| | 151.12 | 22 | 150.04 - 153.25 | 149.21 - 155.94 |
| | 154.02 | 23 | 152.94 - 156.15 | 152.1 - 158.84 |
| | 156.92 | 24 | 155.84 - 159.06 | 155.01 - 161.75 |
| | 159.83 | 25 | 158.75 - 161.97 | 157.91 - 164.67 |
| | 162.74 | 26 | 161.65 - 164.88 | 160.82 - 167.58 |
| | 165.66 | 27 | 164.57 - 167.8 | 163.73 - 170.5 |

Table 16: Grooved jaws – clamping stage 89 mm

3-jaw module

Use and limits of use

| Size of jaw module | Grooved jaw #3 Part number 10723/0003 Grooved jaw #6 Part number 10723/0014 Clamping stage: 97 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|-----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 97 | 0 | 95.98 - 99.02 | 95.19 - 101.58 |
| | 99.75 | 1 | 98.72 - 101.78 | 97.93 - 104.36 |
| | 102.52 | 2 | 101.49 - 104.56 | 100.69 - 107.14 |
| | 105.3 | 3 | 104.26 - 107.35 | 103.47 - 109.94 |
| | 108.1 | 4 | 107.05 - 110.15 | 106.25 - 112.75 |
| | 110.9 | 5 | 109.85 - 112.96 | 109.05 - 115.57 |
| | 113.71 | 6 | 112.66 - 115.78 | 111.85 - 118.4 |
| | 116.53 | 7 | 115.48 - 118.61 | 114.67 - 121.24 |
| | 119.37 | 8 | 118.31 - 121.45 | 117.5 - 124.08 |
| | 122.2 | 9 | 121.14 - 124.29 | 120.33 - 126.93 |
| 215 | 125.05 | 10 | 123.99 - 127.14 | 123.17 - 129.79 |
| | 127.91 | 11 | 126.84 - 130 | 126.02 - 132.66 |
| | 130.77 | 12 | 129.7 - 132.87 | 128.88 - 135.53 |
| | 133.63 | 13 | 132.56 - 135.74 | 131.74 - 138.4 |
| | 136.5 | 14 | 135.43 - 138.61 | 134.61 - 141.28 |
| | 139.38 | 15 | 138.31 - 141.5 | 137.48 - 144.17 |
| | 142.26 | 16 | 141.19 - 144.38 | 140.36 - 147.06 |
| | 145.15 | 17 | 144.07 - 147.27 | 143.25 - 149.95 |
| | 148.04 | 18 | 146.96 - 150.17 | 146.13 - 152.85 |
| | 150.94 | 19 | 149.86 - 153.07 | 149.03 - 155.76 |
| | 153.84 | 20 | 152.76 - 155.97 | 151.93 - 158.66 |
| | 156.74 | 21 | 155.66 - 158.88 | 154.83 - 161.57 |
| 159.65 | 22 | 158.57 - 161.79 | 157.73 - 164.48 | |

3-jaw module

Use and limits of use

| Size of jaw module | Grooved jaw #3 Part number 10723/0003 Grooved jaw #6 Part number 10723/0014 Clamping stage: 97 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 162.56 | 23 | 161.47 - 164.7 | 160.64 - 167.4 |
| | 165.48 | 24 | 164.39 - 167.61 | 163.55 - 170.32 |
| | 168.39 | 25 | 167.3 - 170.53 | 166.47 - 173.24 |
| | 171.31 | 26 | 170.22 - 173.46 | 169.39 - 176.17 |
| | 174.24 | 27 | 173.14 - 176.38 | 172.31 - 179.09 |

Table 17: Grooved jaws – clamping stage 97 mm

| Size of jaw module | Grooved jaw #3 Part number 10723/0003 Clamping stage: 106 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|--|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 106 | 0 | 104.96 - 108.05 | 104.16 - 110.65 |
| | 108.8 | 1 | 107.75 - 110.85 | 106.95 - 113.46 |
| | 111.6 | 2 | 110.55 - 113.66 | 109.75 - 116.28 |
| | 114.42 | 3 | 113.36 - 116.49 | 112.56 - 119.11 |
| | 117.24 | 4 | 116.19 - 119.32 | 115.38 - 121.95 |
| | 120.07 | 5 | 119.02 - 122.16 | 118.2 - 124.8 |
| | 122.92 | 6 | 121.85 - 125 | 121.04 - 127.65 |
| 215 | 125.76 | 7 | 124.7 - 127.86 | 123.88 - 130.51 |
| | 128.62 | 8 | 127.55 - 130.72 | 126.73 - 133.37 |
| | 131.48 | 9 | 130.41 - 133.58 | 129.59 - 136.25 |
| | 134.35 | 10 | 133.28 - 136.46 | 132.46 - 139.12 |
| | 137.22 | 11 | 136.15 - 139.33 | 135.33 - 142.01 |
| | 140.1 | 12 | 139.03 - 142.22 | 138.2 - 144.89 |

3-jaw module

Use and limits of use

| Size of jaw module | Grooved jaw #3 Part number 10723/0003 Clamping stage: 106 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|--|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 142.99 | 13 | 141.91 - 145.1 | 141.08 - 147.78 |
| | 145.87 | 14 | 144.8 - 148 | 143.97 - 150.68 |
| | 148.77 | 15 | 147.69 - 150.89 | 146.86 - 153.58 |
| | 151.66 | 16 | 150.58 - 153.79 | 149.75 - 156.48 |
| | 154.57 | 17 | 153.48 - 156.7 | 152.65 - 159.39 |
| | 157.47 | 18 | 156.39 - 159.6 | 155.55 - 162.3 |
| | 160.38 | 19 | 159.29 - 162.51 | 158.46 - 165.21 |
| | 163.29 | 20 | 162.2 - 165.43 | 161.37 - 168.13 |
| | 166.21 | 21 | 165.12 - 168.34 | 164.28 - 171.05 |
| | 169.12 | 22 | 168.03 - 171.26 | 167.2 - 173.97 |
| | 172.04 | 23 | 170.95 - 174.19 | 170.12 - 176.9 |
| | 174.97 | 24 | 173.87 - 177.11 | 173.04 - 179.82 |
| | 177.89 | 25 | 176.8 - 180.04 | 175.96 - 182.75 |
| | 180.82 | 26 | 179.73 - 182.97 | 178.89 - 185.69 |
| | 183.75 | 27 | 182.66 - 185.9 | 181.82 - 188.62 |

Table 18: Grooved jaws – clamping stage 106 mm

3-jaw module

Use and limits of use

| Size of jaw module | Grooved jaw #6 Part number 10723/0014 Clamping stage: 107 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|--|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 107 | 0 | 105.96 - 109.05 | 105.16 - 111.65 |
| | 109.8 | 1 | 108.75 - 111.86 | 107.95 - 114.47 |
| | 112.61 | 2 | 111.56 - 114.67 | 110.75 - 117.29 |
| | 115.43 | 3 | 114.37 - 117.5 | 113.57 - 120.13 |
| | 118.26 | 4 | 117.2 - 120.33 | 116.39 - 122.97 |
| | 121.09 | 5 | 120.03 - 123.18 | 119.22 - 125.82 |
| | 123.94 | 6 | 122.87 - 126.03 | 122.06 - 128.67 |
| | 126.79 | 7 | 125.72 - 128.88 | 124.9 - 131.53 |
| | 129.64 | 8 | 128.58 - 131.74 | 127.76 - 134.4 |
| | 132.51 | 9 | 131.44 - 134.61 | 130.62 - 137.28 |
| 215 | 135.38 | 10 | 134.31 - 137.49 | 133.48 - 140.15 |
| | 138.25 | 11 | 137.18 - 140.37 | 136.36 - 143.04 |
| | 141.13 | 12 | 140.06 - 143.25 | 139.23 - 145.93 |
| | 144.02 | 13 | 142.94 - 146.14 | 142.12 - 148.82 |
| | 146.91 | 14 | 145.83 - 149.03 | 145 - 151.72 |
| | 149.81 | 15 | 148.72 - 151.93 | 147.89 - 154.62 |
| | 152.7 | 16 | 151.62 - 154.83 | 150.79 - 157.52 |
| | 155.61 | 17 | 154.52 - 157.74 | 153.69 - 160.43 |
| | 158.51 | 18 | 157.43 - 160.65 | 156.59 - 163.34 |
| | 161.42 | 19 | 160.33 - 163.56 | 159.5 - 166.26 |
| | 164.33 | 20 | 163.25 - 166.47 | 162.41 - 169.18 |
| | 167.25 | 21 | 166.16 - 169.39 | 165.33 - 172.1 |
| | 170.17 | 22 | 169.08 - 172.31 | 168.24 - 175.02 |
| | 173.09 | 23 | 172 - 175.23 | 171.16 - 177.95 |

| Size of jaw module | Grooved jaw #6 Part number 10723/0014 Clamping stage: 107 mm | | Clamping diameter in clamping position [mm] | |
|--------------------|--|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 176.01 | 24 | 174.92 - 178.16 | 174.08 - 180.87 |
| | 178.94 | 25 | 177.85 - 181.09 | 177.01 - 183.8 |
| | 181.87 | 26 | 180.78 - 184.02 | 179.94 - 186.74 |
| | 184.8 | 27 | 183.71 - 186.95 | 182.87 - 189.67 |

Table 19: Grooved jaws – clamping stage 107 mm

5.2.2 Selection of plaster jaws

| Size of jaw module | Plaster jaw #1 Part number 10723/0004 Clamping stage: 25 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 25 | 0 | 24.18 - 26.67 | 23.57 - 28.88 |
| | 27.3 | 1 | 26.42 - 29.06 | 25.76 - 31.37 |
| | 29.72 | 2 | 28.8 - 31.56 | 28.11 - 33.94 |
| | 32.24 | 3 | 31.29 - 34.13 | 30.56 - 36.58 |
| | 34.83 | 4 | 33.86 - 36.78 | 33.11 - 39.27 |
| | 37.49 | 5 | 36.49 - 39.47 | 35.73 - 42 |
| | 40.19 | 6 | 39.18 - 42.2 | 38.4 - 44.77 |
| | 42.94 | 7 | 41.91 - 44.97 | 41.12 - 47.56 |
| 215 | 45.71 | 8 | 44.67 - 47.77 | 43.88 - 50.38 |
| | 48.52 | 9 | 47.47 - 50.59 | 46.66 - 53.22 |
| | 51.34 | 10 | 50.28 - 53.42 | 49.47 - 56.07 |
| | 54.18 | 11 | 53.12 - 56.28 | 52.31 - 58.94 |
| | 57.04 | 12 | 55.97 - 59.15 | 55.15 - 61.82 |
| | 59.92 | 13 | 58.84 - 62.03 | 58.02 - 64.71 |
| | 62.8 | 14 | 61.72 - 64.93 | 60.9 - 67.61 |

3-jaw module

Use and limits of use

| Size of jaw module | Plaster jaw #1 Part number 10723/0004 Clamping stage: 25 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 65.7 | 15 | 64.62 - 67.83 | 63.79 - 70.52 |
| | 68.6 | 16 | 67.52 - 70.74 | 66.68 - 73.44 |
| | 71.52 | 17 | 70.43 - 73.66 | 69.59 - 76.36 |
| | 74.43 | 18 | 73.34 - 76.58 | 72.51 - 79.29 |
| | 77.36 | 19 | 76.27 - 79.51 | 75.43 - 82.23 |
| | 80.29 | 20 | 79.2 - 82.44 | 78.36 - 85.17 |
| | 83.23 | 21 | 82.13 - 85.38 | 81.29 - 88.11 |
| | 86.17 | 22 | 85.07 - 88.33 | 84.23 - 91.06 |
| | 89.11 | 23 | 88.01 - 91.27 | 87.17 - 94.01 |
| | 92.06 | 24 | 90.96 - 94.22 | 90.11 - 96.96 |
| | 95.01 | 25 | 93.91 - 97.18 | 93.06 - 99.92 |
| | 97.97 | 26 | 96.86 - 100.13 | 96.01 - 102.87 |
| | 100.92 | 27 | 99.82 - 103.09 | 98.97 - 105.84 |

Table 20: Plaster jaws - clamping stage 25 mm

| Size of jaw module | Plaster jaw #2 Part number 10723/0005 Clamping stage: 34 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 34 | 0 | 33.23 - 35.57 | 32.65 - 37.64 |
| | 36.15 | 1 | 35.34 - 37.81 | 34.72 - 39.97 |
| | 38.42 | 2 | 37.56 - 40.14 | 36.91 - 42.39 |
| | 40.78 | 3 | 39.89 - 42.57 | 39.21 - 44.87 |
| 215 | 43.22 | 4 | 42.3 - 45.06 | 41.6 - 47.42 |
| | 45.73 | 5 | 44.79 - 47.61 | 44.07 - 50.01 |

3-jaw module

Use and limits of use

| Size of jaw module | Plaster jaw #2 Part number 10723/0005 Clamping stage: 34 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 48.29 | 6 | 47.33 - 50.21 | 46.6 - 52.65 |
| | 50.91 | 7 | 49.93 - 52.85 | 49.18 - 55.33 |
| | 53.56 | 8 | 52.56 - 55.53 | 51.8 - 58.04 |
| | 56.25 | 9 | 55.24 - 58.24 | 54.47 - 60.77 |
| | 58.96 | 10 | 57.95 - 60.97 | 57.17 - 63.53 |
| | 61.71 | 11 | 60.68 - 63.73 | 59.89 - 66.31 |
| | 64.47 | 12 | 63.44 - 66.51 | 62.65 - 69.11 |
| | 67.26 | 13 | 66.22 - 69.31 | 65.42 - 71.92 |
| | 70.06 | 14 | 69.02 - 72.13 | 68.21 - 74.75 |
| | 72.88 | 15 | 71.83 - 74.96 | 71.02 - 77.59 |
| | 75.72 | 16 | 74.66 - 77.8 | 73.85 - 80.45 |
| | 78.56 | 17 | 77.5 - 80.66 | 76.68 - 83.31 |
| | 81.42 | 18 | 80.35 - 83.52 | 79.53 - 86.18 |
| | 84.29 | 19 | 83.22 - 86.39 | 82.39 - 89.07 |
| | 87.16 | 20 | 86.09 - 89.28 | 85.26 - 91.95 |
| | 90.05 | 21 | 88.97 - 92.17 | 88.14 - 94.85 |
| | 92.94 | 22 | 91.86 - 95.06 | 91.03 - 97.75 |
| | 95.84 | 23 | 94.75 - 97.97 | 93.92 - 100.66 |
| | 98.74 | 24 | 97.66 - 100.87 | 96.82 - 103.57 |
| | 101.65 | 25 | 100.56 - 103.79 | 99.73 - 106.49 |
| | 104.56 | 26 | 103.48 - 106.71 | 102.64 - 109.41 |
| | 107.48 | 27 | 106.39 - 109.63 | 105.56 - 112.34 |

Table 21: Plaster jaws - clamping stage 34 mm

3-jaw module

Use and limits of use

| Size of jaw module | Plaster jaw #6 Part number 10723/0009 Clamping stage: 35 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 35 | 0 | 34.21 - 36.61 | 33.61 - 38.73 |
| | 37.21 | 1 | 36.37 - 38.9 | 35.74 - 41.1 |
| | 39.52 | 2 | 38.65 - 41.28 | 37.99 - 43.55 |
| | 41.92 | 3 | 41.02 - 43.73 | 40.33 - 46.07 |
| | 44.4 | 4 | 43.47 - 46.25 | 42.76 - 48.64 |
| | 46.93 | 5 | 45.98 - 48.83 | 45.25 - 51.25 |
| | 49.52 | 6 | 48.55 - 51.45 | 47.81 - 53.91 |
| | 52.15 | 7 | 51.17 - 54.11 | 50.41 - 56.6 |
| | 54.82 | 8 | 53.82 - 56.8 | 53.06 - 59.32 |
| | 57.52 | 9 | 56.51 - 59.52 | 55.74 - 62.07 |
| 215 | 60.25 | 10 | 59.23 - 62.27 | 58.45 - 64.84 |
| | 63.01 | 11 | 61.98 - 65.04 | 61.19 - 67.63 |
| | 65.79 | 12 | 64.75 - 67.83 | 63.95 - 70.43 |
| | 68.58 | 13 | 67.53 - 70.64 | 66.73 - 73.26 |
| | 71.39 | 14 | 70.34 - 73.46 | 69.53 - 76.09 |
| | 74.22 | 15 | 73.16 - 76.3 | 72.35 - 78.94 |
| | 77.06 | 16 | 76 - 79.15 | 75.18 - 81.8 |
| | 79.91 | 17 | 78.84 - 82.01 | 78.03 - 84.66 |
| | 82.77 | 18 | 81.7 - 84.88 | 80.88 - 87.54 |
| | 85.64 | 19 | 84.57 - 87.75 | 83.75 - 90.43 |
| | 88.52 | 20 | 87.45 - 90.64 | 86.62 - 93.32 |
| | 91.41 | 21 | 90.33 - 93.53 | 89.5 - 96.22 |
| | 94.3 | 22 | 93.22 - 96.43 | 92.39 - 99.12 |
| | 97.2 | 23 | 96.12 - 99.34 | 95.29 - 102.03 |

3-jaw module

Use and limits of use

| Size of jaw module | Plaster jaw #6 Part number 10723/0009 Clamping stage: 35 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 100.11 | 24 | 99.03 - 102.25 | 98.19 - 104.95 |
| | 103.02 | 25 | 101.94 - 105.16 | 101.1 - 107.87 |
| | 105.94 | 26 | 104.85 - 108.08 | 104.02 - 110.79 |
| | 108.86 | 27 | 107.77 - 111.01 | 106.93 - 113.72 |

Table 22: Plaster jaws - clamping stage 35 mm

| Size of jaw module | Plaster jaw #3 Part number 10723/0006 Plaster jaw #7 Part number 10723/0010 Clamping stage: 43 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 43 | 0 | 42.13 - 44.74 | 41.47 - 46.99 |
| | 45.38 | 1 | 44.48 - 47.17 | 43.8 - 49.48 |
| | 47.83 | 2 | 46.9 - 49.66 | 46.2 - 52.02 |
| | 50.33 | 3 | 49.39 - 52.21 | 48.67 - 54.61 |
| | 52.89 | 4 | 51.93 - 54.8 | 51.2 - 57.24 |
| | 55.5 | 5 | 54.52 - 57.43 | 53.77 - 59.9 |
| | 58.14 | 6 | 57.15 - 60.1 | 56.39 - 62.6 |
| 215 | 60.81 | 7 | 59.81 - 62.79 | 59.04 - 65.32 |
| | 63.52 | 8 | 62.5 - 65.52 | 61.73 - 68.06 |
| | 66.25 | 9 | 65.23 - 68.26 | 64.44 - 70.83 |
| | 69 | 10 | 67.97 - 71.03 | 67.18 - 73.61 |
| | 71.77 | 11 | 70.73 - 73.81 | 69.94 - 76.41 |
| | 74.56 | 12 | 73.52 - 76.62 | 72.72 - 79.22 |
| | 77.37 | 13 | 76.32 - 79.43 | 75.51 - 82.05 |

3-jaw module

Use and limits of use

| Size of jaw module | Plaster jaw #3 Part number 10723/0006 | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Plaster jaw #7 Part number 10723/0010 Clamping stage: 43 mm | | | |
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 80.18 | 14 | 79.13 - 82.26 | 78.32 - 84.89 |
| | 83.02 | 15 | 81.96 - 85.1 | 81.15 - 87.74 |
| | 85.86 | 16 | 84.8 - 87.95 | 83.98 - 90.6 |
| | 88.71 | 17 | 87.65 - 90.81 | 86.83 - 93.47 |
| | 91.58 | 18 | 90.51 - 93.68 | 89.69 - 96.35 |
| | 94.45 | 19 | 93.38 - 96.56 | 92.55 - 99.23 |
| | 97.33 | 20 | 96.25 - 99.44 | 95.43 - 102.12 |
| | 100.21 | 21 | 99.14 - 102.34 | 98.31 - 105.02 |
| | 103.11 | 22 | 102.03 - 105.23 | 101.2 - 107.92 |
| | 106.01 | 23 | 104.92 - 108.14 | 104.09 - 110.83 |
| | 108.91 | 24 | 107.83 - 111.04 | 106.99 - 113.74 |
| | 111.82 | 25 | 110.73 - 113.96 | 109.9 - 116.66 |
| | 114.73 | 26 | 113.65 - 116.87 | 112.81 - 119.58 |
| | 117.65 | 27 | 116.56 - 119.79 | 115.73 - 122.51 |

Table 23: Plaster jaws - clamping stage 43 mm

3-jaw module

Use and limits of use

| Size of jaw module | Plaster jaw #4 Part number 10723/0007 Clamping stage: 52 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|-----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 52 | 0 | 51.18 - 53.64 | 50.56 - 55.77 |
| | 54.25 | 1 | 53.4 - 55.95 | 52.76 - 58.14 |
| | 56.57 | 2 | 55.7 - 58.31 | 55.03 - 60.55 |
| | 58.95 | 3 | 58.06 - 60.73 | 57.37 - 63.02 |
| | 61.39 | 4 | 60.47 - 63.2 | 59.77 - 65.53 |
| | 63.87 | 5 | 62.94 - 65.72 | 62.23 - 68.09 |
| | 66.4 | 6 | 65.45 - 68.27 | 64.72 - 70.67 |
| | 68.96 | 7 | 68 - 70.86 | 67.26 - 73.29 |
| | 71.56 | 8 | 70.59 - 73.48 | 69.84 - 75.94 |
| | 74.19 | 9 | 73.2 - 76.13 | 72.45 - 78.61 |
| 215 | 76.84 | 10 | 75.85 - 78.81 | 75.09 - 81.3 |
| | 79.52 | 11 | 78.52 - 81.5 | 77.75 - 84.02 |
| | 82.23 | 12 | 81.21 - 84.22 | 80.44 - 86.75 |
| | 84.95 | 13 | 83.93 - 86.96 | 83.15 - 89.51 |
| | 87.69 | 14 | 86.66 - 89.71 | 85.88 - 92.27 |
| | 90.45 | 15 | 89.41 - 92.48 | 88.62 - 95.05 |
| | 93.22 | 16 | 92.18 - 95.26 | 91.39 - 97.85 |
| | 96 | 17 | 94.96 - 98.05 | 94.16 - 100.65 |
| | 98.8 | 18 | 97.75 - 100.86 | 96.95 - 103.47 |
| | 101.61 | 19 | 100.56 - 103.68 | 99.75 - 106.3 |
| | 104.43 | 20 | 103.38 - 106.51 | 102.57 - 109.13 |
| | 107.26 | 21 | 106.2 - 109.34 | 105.39 - 111.98 |
| | 110.1 | 22 | 109.04 - 112.19 | 108.23 - 114.83 |
| 112.95 | 23 | 111.88 - 115.04 | 111.07 - 117.69 | |

3-jaw module

Use and limits of use

| Size of jaw module | Plaster jaw #4 Part number 10723/0007 Clamping stage: 52 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 115.8 | 24 | 114.74 - 117.9 | 113.92 - 120.56 |
| | 118.66 | 25 | 117.6 - 120.77 | 116.77 - 123.43 |
| | 121.53 | 26 | 120.46 - 123.64 | 119.64 - 126.31 |
| | 124.41 | 27 | 123.33 - 126.52 | 122.51 - 129.19 |

Table 24: Plaster jaws - clamping stage 52 mm

| Size of jaw module | Plaster jaw #5 Part number 10723/0008 Clamping stage: 61 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 61 | 0 | 60.14 - 62.71 | 59.49 - 64.91 |
| | 63.34 | 1 | 62.46 - 65.08 | 61.79 - 67.33 |
| | 65.73 | 2 | 64.83 - 67.51 | 64.14 - 69.8 |
| | 68.16 | 3 | 67.25 - 69.98 | 66.55 - 72.3 |
| | 70.64 | 4 | 69.71 - 72.49 | 69 - 74.85 |
| | 73.17 | 5 | 72.22 - 75.04 | 71.5 - 77.42 |
| | 75.72 | 6 | 74.76 - 77.61 | 74.03 - 80.03 |
| | 78.31 | 7 | 77.34 - 80.22 | 76.6 - 82.66 |
| 215 | 80.92 | 8 | 79.94 - 82.86 | 79.19 - 85.32 |
| | 83.56 | 9 | 82.57 - 85.52 | 81.82 - 88 |
| | 86.23 | 10 | 85.23 - 88.2 | 84.47 - 90.7 |
| | 88.91 | 11 | 87.91 - 90.9 | 87.14 - 93.41 |
| | 91.62 | 12 | 90.61 - 93.61 | 89.83 - 96.15 |
| | 94.34 | 13 | 93.32 - 96.35 | 92.54 - 98.9 |
| | 97.08 | 14 | 96.06 - 99.1 | 95.27 - 101.66 |

3-jaw module

Use and limits of use

| Size of jaw module | Plaster jaw #5 Part number 10723/0008 Clamping stage: 61 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 99.84 | 15 | 98.81 - 101.87 | 98.02 - 104.44 |
| | 102.61 | 16 | 101.57 - 104.64 | 100.78 - 107.23 |
| | 105.39 | 17 | 104.35 - 107.43 | 103.55 - 110.03 |
| | 108.18 | 18 | 107.13 - 110.23 | 106.33 - 112.84 |
| | 110.98 | 19 | 109.93 - 113.04 | 109.13 - 115.66 |
| | 113.8 | 20 | 112.74 - 115.87 | 111.94 - 118.49 |
| | 116.62 | 21 | 115.56 - 118.69 | 114.75 - 121.32 |
| | 119.45 | 22 | 118.39 - 121.53 | 117.58 - 124.17 |
| | 122.29 | 23 | 121.23 - 124.38 | 120.41 - 127.02 |
| | 125.14 | 24 | 124.07 - 127.23 | 123.26 - 129.88 |
| | 127.99 | 25 | 126.92 - 130.09 | 126.11 - 132.74 |
| | 130.85 | 26 | 129.78 - 132.95 | 128.96 - 135.61 |
| | 133.72 | 27 | 132.65 - 135.82 | 131.83 - 138.49 |

Table 25: Plaster jaws - clamping stage 61 mm

| Size of jaw module | Plaster jaw #8 Part number 10723/0011 Clamping stage: 62 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 62 | 0 | 61.12 - 63.74 | 60.46 - 65.98 |
| | 64.38 | 1 | 63.49 - 66.16 | 62.8 - 68.44 |
| | 66.81 | 2 | 65.9 - 68.63 | 65.2 - 70.95 |
| | 69.29 | 3 | 68.36 - 71.13 | 67.65 - 73.49 |
| 215 | 71.81 | 4 | 70.86 - 73.68 | 70.14 - 76.06 |
| | 74.36 | 5 | 73.4 - 76.25 | 72.67 - 78.67 |

3-jaw module

Use and limits of use

| Size of jaw module | Plaster jaw #8 Part number 10723/0011 Clamping stage: 62 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 76.94 | 6 | 75.98 - 78.86 | 75.23 - 81.3 |
| | 79.56 | 7 | 78.58 - 81.49 | 77.83 - 83.95 |
| | 82.2 | 8 | 81.21 - 84.15 | 80.45 - 86.63 |
| | 84.86 | 9 | 83.86 - 86.83 | 83.1 - 89.33 |
| | 87.55 | 10 | 86.54 - 89.53 | 85.77 - 92.05 |
| | 90.25 | 11 | 89.24 - 92.25 | 88.47 - 94.78 |
| | 92.98 | 12 | 91.96 - 94.99 | 91.18 - 97.53 |
| | 95.72 | 13 | 94.69 - 97.74 | 93.91 - 100.3 |
| | 98.47 | 14 | 97.44 - 100.5 | 96.65 - 103.08 |
| | 101.24 | 15 | 100.21 - 103.28 | 99.41 - 105.87 |
| | 104.02 | 16 | 102.98 - 106.07 | 102.19 - 108.67 |
| | 106.82 | 17 | 105.77 - 108.87 | 104.97 - 111.48 |
| | 109.62 | 18 | 108.57 - 111.69 | 107.77 - 114.3 |
| | 112.44 | 19 | 111.39 - 114.51 | 110.58 - 117.13 |
| | 115.26 | 20 | 114.21 - 117.34 | 113.4 - 119.97 |
| | 118.09 | 21 | 117.04 - 120.18 | 116.22 - 122.81 |
| | 120.94 | 22 | 119.87 - 123.02 | 119.06 - 125.67 |
| | 123.78 | 23 | 122.72 - 125.88 | 121.9 - 128.53 |
| | 126.64 | 24 | 125.57 - 128.74 | 124.75 - 131.39 |
| | 129.5 | 25 | 128.43 - 131.6 | 127.61 - 134.27 |
| | 132.37 | 26 | 131.3 - 134.48 | 130.48 - 137.14 |
| | 135.24 | 27 | 134.17 - 137.35 | 133.35 - 140.03 |

Table 26: Plaster jaws - clamping stage 62 mm

3-jaw module

Use and limits of use

| Size of jaw module | Plaster jaw #1 Part number 10723/0004 Clamping stage: 70 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 70 | 0 | 69.03 - 71.92 | 68.29 - 74.37 |
| | 72.62 | 1 | 71.64 - 74.56 | 70.89 - 77.04 |
| | 75.27 | 2 | 74.28 - 77.23 | 73.52 - 79.73 |
| | 77.95 | 3 | 76.95 - 79.93 | 76.18 - 82.44 |
| | 80.65 | 4 | 79.64 - 82.64 | 78.87 - 85.18 |
| | 83.37 | 5 | 82.35 - 85.38 | 81.57 - 87.92 |
| | 86.11 | 6 | 85.08 - 88.13 | 84.3 - 90.69 |
| | 88.86 | 7 | 87.83 - 90.89 | 87.04 - 93.47 |
| | 91.63 | 8 | 90.6 - 93.68 | 89.8 - 96.26 |
| | 94.42 | 9 | 93.38 - 96.47 | 92.58 - 99.07 |
| 215 | 97.22 | 10 | 96.17 - 99.28 | 95.37 - 101.89 |
| | 100.03 | 11 | 98.98 - 102.09 | 98.17 - 104.71 |
| | 102.85 | 12 | 101.79 - 104.92 | 100.98 - 107.55 |
| | 105.68 | 13 | 104.62 - 107.76 | 103.81 - 110.39 |
| | 108.51 | 14 | 107.45 - 110.6 | 106.64 - 113.25 |
| | 111.36 | 15 | 110.3 - 113.46 | 109.48 - 116.11 |
| | 114.22 | 16 | 113.15 - 116.32 | 112.33 - 118.97 |
| | 117.08 | 17 | 116.01 - 119.18 | 115.19 - 121.85 |
| | 119.95 | 18 | 118.88 - 122.06 | 118.06 - 124.73 |
| | 122.83 | 19 | 121.75 - 124.94 | 120.93 - 127.61 |
| | 125.71 | 20 | 124.63 - 127.82 | 123.8 - 130.5 |
| | 128.59 | 21 | 127.51 - 130.71 | 126.69 - 133.4 |
| | 131.49 | 22 | 130.4 - 133.61 | 129.58 - 136.3 |
| | 134.38 | 23 | 133.3 - 136.51 | 132.47 - 139.2 |

3-jaw module

Use and limits of use

| Size of jaw module | Plaster jaw #1 Part number 10723/0004 Clamping stage: 70 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 137.28 | 24 | 136.2 - 139.41 | 135.37 - 142.11 |
| | 140.19 | 25 | 139.1 - 142.32 | 138.27 - 145.02 |
| | 143.1 | 26 | 142.01 - 145.23 | 141.18 - 147.93 |
| | 146.01 | 27 | 144.92 - 148.15 | 144.09 - 150.85 |

Table 27: Plaster jaws - clamping stage 70 mm

| Size of jaw module | Plaster jaw #2 Part number 10723/0005 Plaster jaw #6 Part number 10723/0009 Clamping stage: 79 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 79 | 0 | 77.98 - 81.01 | 77.2 - 83.56 |
| | 81.74 | 1 | 80.72 - 83.76 | 79.93 - 86.33 |
| | 84.5 | 2 | 83.47 - 86.54 | 82.68 - 89.12 |
| | 87.28 | 3 | 86.24 - 89.32 | 85.44 - 91.92 |
| | 90.07 | 4 | 89.02 - 92.12 | 88.22 - 94.73 |
| | 92.87 | 5 | 91.82 - 94.93 | 91.02 - 97.55 |
| | 95.68 | 6 | 94.63 - 97.76 | 93.83 - 100.38 |
| 215 | 98.51 | 7 | 97.45 - 100.59 | 96.64 - 103.22 |
| | 101.35 | 8 | 100.29 - 103.43 | 99.47 - 106.07 |
| | 104.19 | 9 | 103.13 - 106.28 | 102.31 - 108.93 |
| | 107.04 | 10 | 105.98 - 109.14 | 105.16 - 111.8 |
| | 109.91 | 11 | 108.84 - 112.01 | 108.02 - 114.67 |
| | 112.77 | 12 | 111.7 - 114.88 | 110.88 - 117.55 |
| | 115.65 | 13 | 114.58 - 117.76 | 113.75 - 120.44 |

3-jaw module

Use and limits of use

| Size of jaw module | Plaster jaw #2 Part number 10723/0005 | | Plaster jaw #6 Part number 10723/0009 Clamping stage: 79 mm | |
|--------------------|---|----------------|---|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 118.53 | 14 | 117.45 - 120.65 | 116.63 - 123.33 |
| | 121.42 | 15 | 120.34 - 123.54 | 119.51 - 126.22 |
| | 124.31 | 16 | 123.23 - 126.44 | 122.4 - 129.12 |
| | 127.21 | 17 | 126.13 - 129.34 | 125.3 - 132.03 |
| | 130.11 | 18 | 129.03 - 132.24 | 128.19 - 134.94 |
| | 133.02 | 19 | 131.93 - 135.15 | 131.1 - 137.85 |
| | 135.93 | 20 | 134.84 - 138.06 | 134.01 - 140.77 |
| | 138.84 | 21 | 137.75 - 140.98 | 136.92 - 143.69 |
| | 141.76 | 22 | 140.67 - 143.9 | 139.83 - 146.61 |
| | 144.68 | 23 | 143.59 - 146.82 | 142.75 - 149.54 |
| | 147.61 | 24 | 146.51 - 149.75 | 145.67 - 152.47 |
| | 150.53 | 25 | 149.44 - 152.68 | 148.6 - 155.4 |
| | 153.46 | 26 | 152.37 - 155.61 | 151.53 - 158.33 |
| | 156.4 | 27 | 155.3 - 158.55 | 154.46 - 161.27 |

Table 28: Plaster jaws - clamping stage 79 mm

3-jaw module

Use and limits of use

| Size of jaw module | Plaster jaw #3 Part number 10723/0006 Clamping stage: 88 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 88 | 0 | 86.97 - 90.03 | 86.18 - 92.616 |
| | 90.77 | 1 | 89.74 - 92.82 | 88.94 - 95.41 |
| | 93.56 | 2 | 92.52 - 95.61 | 91.72 - 98.21 |
| | 96.36 | 3 | 95.31 - 98.42 | 94.51 - 101.03 |
| | 99.17 | 4 | 98.12 - 101.24 | 97.31 - 103.86 |
| | 101.99 | 5 | 100.94 - 104.07 | 100.13 - 106.7 |
| | 104.83 | 6 | 103.77 - 106.91 | 102.96 - 109.55 |
| | 107.67 | 7 | 106.61 - 109.76 | 105.79 - 112.4 |
| | 110.52 | 8 | 109.45 - 112.61 | 108.64 - 115.26 |
| | 113.37 | 9 | 112.31 - 115.47 | 111.49 - 118.13 |
| 215 | 116.24 | 10 | 115.17 - 118.34 | 114.35 - 121.01 |
| | 119.11 | 11 | 118.04 - 121.22 | 117.21 - 123.89 |
| | 121.99 | 12 | 120.91 - 124.1 | 120.09 - 126.78 |
| | 124.87 | 13 | 123.79 - 126.99 | 122.97 - 129.67 |
| | 127.76 | 14 | 126.68 - 129.88 | 125.85 - 132.57 |
| | 130.65 | 15 | 129.57 - 132.78 | 128.74 - 135.47 |
| | 133.55 | 16 | 132.47 - 135.68 | 131.64 - 138.37 |
| | 136.45 | 17 | 135.37 - 138.59 | 134.54 - 141.28 |
| | 139.36 | 18 | 138.28 - 141.5 | 137.44 - 144.19 |
| | 142.27 | 19 | 141.18 - 144.41 | 140.35 - 147.11 |
| | 145.19 | 20 | 144.1 - 147.33 | 143.26 - 150.03 |
| | 148.1 | 21 | 147.01 - 150.25 | 146.18 - 152.95 |
| | 151.02 | 22 | 149.93 - 153.17 | 149.1 - 155.88 |
| | 153.95 | 23 | 152.86 - 156.09 | 152.02 - 158.81 |

3-jaw module

Use and limits of use

| Size of jaw module | Plaster jaw #3 Part number 10723/0006 Clamping stage: 88 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 156.88 | 24 | 155.78 - 159.02 | 154.94 - 161.74 |
| | 159.81 | 25 | 158.71 - 161.96 | 157.87 - 164.67 |
| | 162.74 | 26 | 161.64 - 164.89 | 160.8 - 167.61 |
| | 165.67 | 27 | 164.58 - 167.83 | 163.73 - 170.55 |

Table 29: Plaster jaws - clamping stage 88 mm

| Size of jaw module | Plaster jaw #7 Part number 10723/0010 Clamping stage: 89 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 89 | 0 | 87.97 - 91.04 | 87.17 - 93.62 |
| | 91.78 | 1 | 90.74 - 93.83 | 89.94 - 96.42 |
| | 94.57 | 2 | 93.53 - 96.63 | 92.73 - 99.24 |
| | 97.38 | 3 | 96.33 - 99.44 | 95.53 - 102.06 |
| | 100.19 | 4 | 99.14 - 102.27 | 98.33 - 104.89 |
| | 103.02 | 5 | 101.97 - 105.1 | 101.15 - 107.74 |
| | 105.86 | 6 | 104.8 - 107.94 | 103.99 - 110.59 |
| | 108.7 | 7 | 107.64 - 110.8 | 106.82 - 113.44 |
| 215 | 111.56 | 8 | 110.49 - 113.65 | 109.67 - 116.31 |
| | 114.42 | 9 | 113.35 - 116.52 | 112.53 - 119.18 |
| | 117.29 | 10 | 116.21 - 119.39 | 115.39 - 122.06 |
| | 120.16 | 11 | 119.09 - 122.27 | 118.26 - 124.94 |
| | 123.04 | 12 | 121.96 - 125.16 | 121.14 - 127.83 |
| | 125.93 | 13 | 124.85 - 128.05 | 124.02 - 130.73 |
| | 128.82 | 14 | 127.74 - 130.94 | 126.91 - 133.63 |

3-jaw module

Use and limits of use

| Size of jaw module | Plaster jaw #7 Part number 10723/0010 Clamping stage: 89 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 131.71 | 15 | 130.63 - 133.84 | 129.8 - 136.53 |
| | 134.61 | 16 | 133.53 - 136.74 | 132.7 - 139.44 |
| | 137.52 | 17 | 136.43 - 139.65 | 135.6 - 142.35 |
| | 140.43 | 18 | 139.34 - 142.56 | 138.51 - 145.26 |
| | 143.34 | 19 | 142.25 - 145.48 | 141.42 - 148.18 |
| | 146.26 | 20 | 145.17 - 148.4 | 144.33 - 151.1 |
| | 149.18 | 21 | 148.09 - 151.32 | 147.25 - 154.03 |
| | 152.1 | 22 | 151.01 - 154.24 | 150.17 - 156.96 |
| | 155.02 | 23 | 153.93 - 157.17 | 153.09 - 159.89 |
| | 157.95 | 24 | 156.86 - 160.1 | 156.86 - 160.1 |
| | 160.88 | 25 | 159.79 - 163.03 | 158.95 - 165.75 |
| | 163.82 | 26 | 162.72 - 165.97 | 161.88 - 168.69 |
| | 166.75 | 27 | 165.66 - 168.91 | 164.81 - 171.63 |

Table 30: Plaster jaws - clamping stage 89 mm

| Size of jaw module | Plaster jaw #4 Part number 10723/0007 Clamping stage: 97 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 97 | 0 | 95.95 - 99.06 | 95.15 - 101.68 |
| | 99.81 | 1 | 98.76 - 101.88 | 97.96 - 104.51 |
| | 102.64 | 2 | 101.58 - 104.72 | 100.77 - 107.35 |
| | 105.47 | 3 | 104.41 - 107.56 | 103.6 - 110.2 |
| 215 | 108.32 | 4 | 107.25 - 110.41 | 106.44 - 113.06 |
| | 111.17 | 5 | 110.1 - 113.26 | 109.29 - 115.92 |

3-jaw module

Use and limits of use

| Size of jaw module | Plaster jaw #4 Part number 10723/0007 Clamping stage: 97 mm | | Clamping range [workpiece] [mm] | |
|--------------------|---|----------------|----------------------------------|--------------------------------|
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 114.03 | 6 | 112.96 - 116.13 | 112.14 - 118.79 |
| | 116.89 | 7 | 115.82 - 119 | 115 - 121.67 |
| | 119.77 | 8 | 118.69 - 121.88 | 117.87 - 124.55 |
| | 122.65 | 9 | 121.57 - 124.76 | 120.75 - 127.44 |
| | 125.53 | 10 | 124.45 - 127.65 | 123.63 - 130.33 |
| | 128.42 | 11 | 127.34 - 130.54 | 126.51 - 133.23 |
| | 131.32 | 12 | 130.23 - 133.44 | 129.4 - 136.13 |
| | 134.21 | 13 | 133.13 - 136.34 | 132.3 - 139.04 |
| | 137.12 | 14 | 136.03 - 139.25 | 135.2 - 141.95 |
| | 140.03 | 15 | 138.94 - 142.16 | 138.11 - 144.86 |
| | 142.94 | 16 | 141.85 - 145.08 | 141.02 - 147.78 |
| | 145.85 | 17 | 144.76 - 147.99 | 143.93 - 150.7 |
| | 148.77 | 18 | 147.68 - 150.91 | 146.85 - 153.62 |
| | 151.69 | 19 | 150.6 - 153.84 | 149.77 - 156.55 |
| | 154.62 | 20 | 153.53 - 156.77 | 152.69 - 159.48 |
| | 157.55 | 21 | 156.45 - 159.69 | 155.61 - 162.41 |
| | 160.48 | 22 | 159.38 - 162.63 | 158.54 - 165.35 |
| | 163.41 | 23 | 162.31 - 165.56 | 161.47 - 168.28 |
| | 166.34 | 24 | 165.25 - 168.5 | 164.41 - 171.22 |
| | 169.28 | 25 | 168.19 - 171.44 | 167.34 - 174.16 |
| | 172.22 | 26 | 171.12 - 174.38 | 170.28 - 177.11 |
| | 175.16 | 27 | 174.06 - 177.32 | 173.22 - 180.05 |

Table 31: Plaster jaws - clamping stage 97 mm

3-jaw module

Use and limits of use

| Size of jaw module | Plaster jaw #5 Part number 10723/0008 | | Clamping range [workpiece] [mm] | |
|--------------------|--|-----------------|----------------------------------|--------------------------------|
| | Plaster jaw #8 Part number 10723/0011 Clamping stage: 106 mm | | | |
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| 145 / 215 | 106 | 0 | 104.93 - 108.1 | 104.11 - 110.77 |
| | 108.87 | 1 | 107.8 - 110.98 | 106.98 - 113.65 |
| | 111.75 | 2 | 110.67 - 113.86 | 109.85 - 116.54 |
| | 114.63 | 3 | 113.56 - 116.75 | 112.73 - 119.43 |
| | 117.52 | 4 | 116.44 - 119.65 | 115.62 - 122.33 |
| | 120.42 | 5 | 119.34 - 122.55 | 118.51 - 125.24 |
| | 123.32 | 6 | 122.24 - 125.45 | 121.4 - 128.14 |
| | 126.22 | 7 | 125.14 - 128.36 | 124.31 - 131.06 |
| | 129.13 | 8 | 128.05 - 131.27 | 127.21 - 133.97 |
| | 132.05 | 9 | 130.96 - 134.19 | 130.12 - 136.89 |
| 215 | 134.96 | 10 | 133.87 - 137.11 | 133.04 - 139.81 |
| | 137.89 | 11 | 136.79 - 140.03 | 135.96 - 142.74 |
| | 140.81 | 12 | 139.72 - 142.96 | 138.88 - 145.67 |
| | 143.74 | 13 | 142.64 - 145.89 | 141.8 - 148.6 |
| | 146.67 | 14 | 145.57 - 148.82 | 144.73 - 151.54 |
| | 149.6 | 15 | 148.5 - 151.75 | 147.66 - 154.47 |
| | 152.54 | 16 | 151.44 - 154.69 | 150.6 - 157.41 |
| | 155.47 | 17 | 154.38 - 157.63 | 153.53 - 160.36 |
| | 158.41 | 18 | 157.32 - 160.57 | 156.47 - 163.3 |
| | 161.36 | 19 | 160.26 - 163.52 | 159.41 - 166.25 |
| | 164.3 | 20 | 163.2 - 166.46 | 162.36 - 169.19 |
| | 167.25 | 21 | 166.15 - 169.41 | 165.3 - 172.14 |
| 170.2 | 22 | 169.09 - 172.36 | 168.25 - 175.09 | |

| Size of jaw module | Plaster jaw #5 Part number 10723/0008 | | Clamping range [workpiece] [mm] | |
|--------------------|--|----------------|----------------------------------|--------------------------------|
| | Plaster jaw #8 Part number 10723/0011 Clamping stage: 106 mm | | | |
| | Clamping diameter in clamping position [mm] | Tooth position | Basic clamping device size 65/80 | Basic clamping device size 100 |
| | 173.15 | 23 | 172.04 - 175.31 | 171.2 - 178.05 |
| | 176.1 | 24 | 175 - 178.26 | 174.15 - 181 |
| | 179.05 | 25 | 177.95 - 181.22 | 177.1 - 183.96 |
| | 182.01 | 26 | 180.9 - 184.17 | 180.06 - 186.91 |
| | 184.96 | 27 | 183.86 - 187.13 | 183.01 - 189.87 |

Table 32: Plaster jaws - clamping stage 106 mm

5.2.3 Example

Workpiece data

- Clamping diameter $90 \pm 0.5\text{mm}$

Jaw module

- Jaw module size 215 for basic clamping device size 100
- plaster jaw

Checking

The next smaller clamping stage to the nominal diameter is clamping stage 89mm .

The minimum and maximum dimensions for the clamping diameter are 89.5mm and 90.5mm respectively.

Viewed in ascending order from tooth position 0, the clamping range that fully covers the clamping diameter, including tolerances, is 87.17mm to 93.62mm . This clamping range corresponds to tooth position 0.

The workpiece can be clamping with plaster jaw #7.

The plaster jaw must be installed in tooth position 0.

5.3 Limits of use

Limits are set on the operation of the jaw modules.

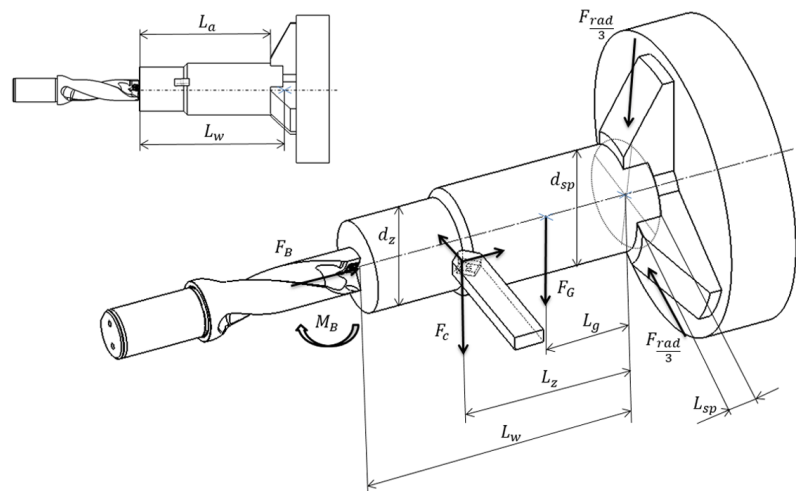
5.3.1 Nomenclature

| Brief designation | Unit | Explanation |
|-------------------|------------------|--|
| a_p | mm | Chip-cutting depth of turning operation |
| c | - | Contact factor |
| D_S | mm | Bore diameter |
| d_{sp} | mm | Clamping diameter |
| d_z | mm | Machining diameter of turning operation |
| f | mm | Feed / rotational movement of turning operation Feed / cutting-drilling operation |
| F_B | N | Feed force of drilling operation |
| F_c | N | Cutting force of drilling operation |
| f_{fz} | N | Clamping force supplement for rotational compensation |
| F_G | N | Density of workpiece |
| f_n | mm | Feed / rotational movement of drilling operation |
| F_{rad} | N | Radial clamping force |
| $F_{rad\ erf}$ | N | Required radial clamping force |
| F_{sk} | N | Clamping force to prevent the workpiece getting levered out |
| F_{sz} | N | Clamping force to support the chip-cutting operation |
| k_c | $\frac{N}{mm^2}$ | Specific cutting force |
| L_a | mm | Unclamping length |
| L_g | mm | Center of gravity distance between »Workpiece - clamping point« |
| L_{sp} | mm | Clamping length |
| L_w | mm | Workpiece length |
| L_z | mm | Distance between »Machining point - clamping point« |
| m | kg | Dimensions of top jaws including slot nut and screws |

| Brief designation | Unit | Explanation |
|-------------------|------------|--|
| M_B | Nmm | Drilling operation torque |
| m_w | kg | Workpiece mass |
| n | min^{-1} | Speed |
| P | - | Key indicators for machining |
| q | kgm | Constant for the relevant jaw module |
| q_{spe} | kgm | Constant for the relevant clamping elements |
| r_s | m | Distance between mass center of gravity of top jaws and rotational axis of the chuck |
| μ_a | - | Friction coefficient in axial direction |
| μ_t | - | Friction coefficient in radial direction |

Table 33: Nomenclature application limits

The graphic in the sketch below shows the forces and moments used in the following sample calculations:



$$F_G [N] = m_w [kg] * 9.81 \left[\frac{m}{s^2} \right]$$

5.3.2 First limit [workpiece length]

The maximum workpiece length that can be machined without the aid of a back rest or a tailstock must not exceed twice the clamping diameter of the workpiece.

5.3.3 Second limit [workpiece mass]

The maximum workpiece mass is 38kg.

5.3.4 Third limit [clamping length]

The minimum clamping length is 6mm for soft, smooth top jaws and for hard grooved jaws. The minimum clamping length for hard plaster jaws is 8.5mm . Below this, workpiece clamping is not secure.

5.3.5 Fourth limit [forces]

It is a great deal more difficult to quantify the forces acting on the jaw module.

Here is a simplified calculation operation and an example based on directive VDI 3106. It is intended to provide the operator with an aid to assessment, showing if the planned application falls within the permitted range.

As a safety precaution, when dealing with machining tasks that border on the limits, the calculation stipulated in directive VDI 3106 should be performed.

The underlying approach for the simplified calculation is to establish if the required clamping force needed to contend with external forces and torques falls within the maximum radial clamping force figure written on the jaw module.

The forces and torques exerted on the jaw module are primarily the machining forces and torques to be absorbed, the weight of the actual workpiece and the centrifugal forces caused by the weight of the jaws.

Principles for the forces exerted externally



WARNING

Serious injuries caused by failure to comply with the principles that govern safe machining!

- Those principles must be maintained at all times to assure a safe machining process.

Pay attention to the following principles:

1. Principle

$$F_{rad} \geq F_{rad\ erf}$$

AND

2. Principle

$$F_c = 4500N$$

[when using soft, smooth top jaws or hard grooved jaws]

$$F_c = 7500N$$

[when using hard plaster jaws]

5.3.5.1 Further to Principle 1: $F_{rad} \geq F_{rad\ erf}$

Determining the required clamping force

The following equations are used to determine the required clamping force $F_{rad\ erf}$ at rotational speed.

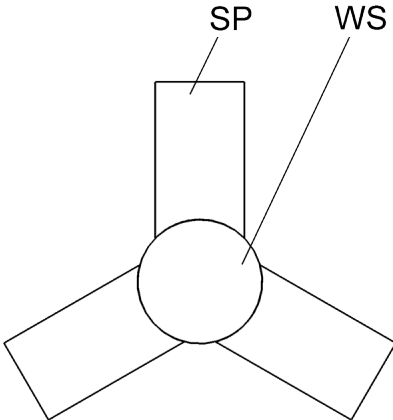
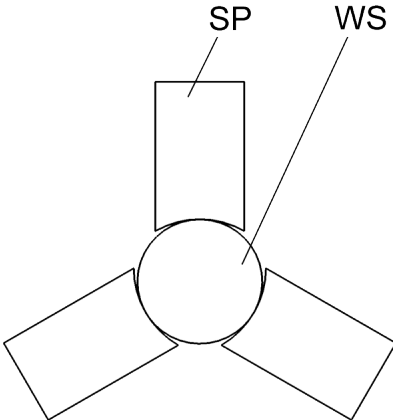
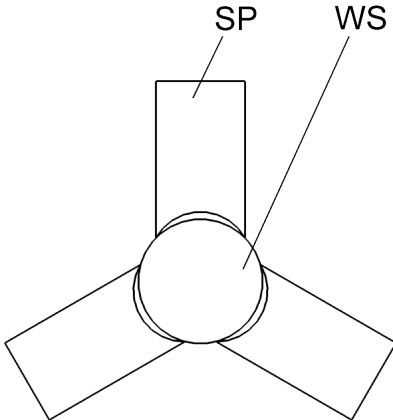
These equations apply to longitudinal turning and to face turning operations. Drilling operations on the front end of workpieces can also be calculated. Superimposed, simultaneous machining operations, for example by several tools or turret heads can also be superimposed computationally. In other words, the required radial clamping forces for individual machining operations need to be added together.

However, it is rare for axial drilling and turning operations to be superimposed because their opposing directions of rotation usually preclude them from running simultaneously.

For computational purposes, the calculation should be based upon the point with the highest forces, that is the least favorable machining moment. If in doubt, several blade engagement situations need to be checked to record the least favorable one.

Contact factor

Consult the following tables for the contact factor, depending on the form of contact or the contact scenario.

| Interference fit | Saddle fit | Edge fit |
|---|---|--|
| The clamping step diameter of the jaw matches the clamping diameter of the workpiece. | The clamping step diameter of the jaw is greater than the clamping diameter of the workpiece. | The clamping step diameter of the jaw is less than the clamping diameter of the workpiece. |
|  |  |  |

WS Workpiece

SP Clamping element

Table 34: Contact forms / scenarios

To define the contact shape, the clamping step diameter of the jaw kit used is needed [see »General information« chapter].

| Contact factor c | Machining conditions | Contact form | |
|---------------------|----------------------|---------------------------------|----------|
| | | Interference fit and saddle fit | Edge fit |
| Soft top jaw smooth | Dry | 1.5 | 1.0 |
| | Wet* / MMS** | 2.5 | 1.2 |
| Hard grooved jaw | Dry | 1.5 | 1.0 |
| | Wet* / MMS** | 2.5 | 1.2 |
| Hard plaster jaw | Dry | 1.0 | 1.0 |
| | Wet* / MMS** | 1.0 | 1.0 |

* Wet machining: Use of cooling lubricant [KSS]

** MMS [MQL]: Use of minimum-quantity lubrication

Table 35: Contact factor

Specific cutting forces

These are approximate values, reflecting the relatively arbitrary sub-categorization of materials. As a result, relatively large deviations from real values can be present.

For deviating workpiece materials and/or for machining tasks in the boundary area of the clamping device, the respective k_c values of the workpiece material being machine needs to be determined precisely, and/or the supplier of the material needs to be consulted.

The following applies to drilling operations with a double-bladed tool:

$$f = \frac{f_n}{2}$$

| Workpiece materials | | Specific cutting forces | Specific cutting forces | Specific cutting forces |
|---|--|--|--|--|
| Designation | DIN [ISO] | $k_c \left[\frac{N}{mm^2} \right]$ at $f = 0.1mm^*$ | $k_c \left[\frac{N}{mm^2} \right]$ at $f = 0.5mm^*$ | $k_c \left[\frac{N}{mm^2} \right]$ at $f = 1.0mm^*$ |
| Cast iron | For example EN-GJL-250 | 1980 | 1260 | 900 |
| Spherulitic graphite iron [unhardened] | For example EN-GJS-400-15 | 2120 | 1190 | 1060 |
| construction steels without alloys or with only a low alloy content [of average strength] / cementation steels [unhardened] | For example S235JR [1.0037] S275JR [1.0044] Ck10 [1.1121] 16MnCr5 [1.7131] 18CrNi8[1.5920] | 2920 | 1840 | 1500 |

| Workpiece materials | | Specific cutting forces | Specific cutting forces | Specific cutting forces |
|--|--|--|--|--|
| Designation | DIN [ISO] | $k_c \left[\frac{N}{mm^2} \right]$ at $f = 0.1mm^*$ | $k_c \left[\frac{N}{mm^2} \right]$ at $f = 0.5mm^*$ | $k_c \left[\frac{N}{mm^2} \right]$ at $f = 1.0mm^*$ |
| construction steels without alloys or with only a low alloy content [unhardened, with higher strength] | S355J2G3 [1.0570] E360 [1.0070] | 3350 | 2000 | 1600 |
| Tempered steels [pre-annealed] | C45 [1.0503] C60 [1.0601] 42CrMo4 [1.7225] 34CrNiMo6 [1.6582] | 2850 | 1960 | 1660 |
| tool steels without alloys or with only a low alloy content [unhardened] | C105W1 [1.1545] | 3100 | 2100 | 1690 |
| Machining steels | 35S20 [1.0726] 60S20 [1.0728] | 1700 | 1480 | 1400 |
| Stainless steels | | 3600 | 2450 | 2100 |
| Hardened steels | | 4800 | | |
| Aluminum forging alloy <16% Si | | 1340 | 900 | 750 |
| Aluminum casting alloy <16% Si | | 1520 | 1000 | 850 |
| Brass | | 1300 | 850 | 700 |

* For feed rates between 0.05 mm and 0.1 mm, use the $f=0.1$ mm value with a 20% allowance.

** For feed rates between 0.1 mm and 0.5 mm, employ interpolation.

*** For feed rates between 0.5 mm and 1.0 mm, employ interpolation. For feed rates > 1.0 mm, use gap $f=1.0$ mm.

Table 36: Specific cutting forces

Friction coefficients

With workpieces made from a material other than steel, multiply these values by the correction values listed below.

When the workpiece is made of hardened steel, the values for smooth jaws always apply to ground workpiece surfaces.



NOTE

Damage to materials caused by using the wrong jaws when clamping hardened materials!

- For the clamping of hardened materials, or of very high-tensile materials $R_m > 1300 \left[\frac{N}{mm^2} \right]$, only smooth clamping heads are permitted!
- Other versions of jaw may get damaged and lose their ability to achieve higher friction coefficients on soft materials.

| Workpiece surface | Clamping surface | | | |
|----------------------------|----------------------------------|----------------------------------|----------------------------------|------------------------|
| | SP WS | SP WS | SP WS | SP WS |
| | | | | |
| | Soft, smooth top jaw | Hard grooved jaw | Hard plaster jaw | Hard claw jaw |
| Finished, ground | $\mu_t = 0.06$ $\mu_a = 0.08$ | $\mu_t = 0.07$ $\mu_a = 0.09$ | $\mu_t = 0.10$ $\mu_a = 0.15$ | |
| Finished to roughed | $\mu_t = 0.10$ $\mu_a = 0.13$ | $\mu_t = 0.11$ $\mu_a = 0.15$ | $\mu_t = 0.17$ $\mu_a = 0.25$ | Individual, on request |
| Blank or unmachined | $\mu_t = 0.14$ $\mu_a = 0.16$ | $\mu_t = 0.16$ $\mu_a = 0.18$ | $\mu_t = 0.24$ $\mu_a = 0.30$ | |
| Material correction values | Aluminum alloys = 0.97 | | | |
| | Brass = 0.92 | | | |
| | Cast iron = 0.80 | | | |

WS Workpiece

SP Clamping element

Table 37: Friction coefficient for steel workpieces

Mass $m[kg]$ and distance of mass center of gravity to jaw on the rotational axis $r_s[m]$

| Size of jaw module | Top jaws | Clamp- ing stage | Clamp- ing range | Distance to mass center of gravity $r_{s\ max}[m]$ in small- est position | Mass $m[kg]$ |
|---------------------|---------------------|------------------------|------------------------|--|-----------------|
| 145 | Hard grooved jaw #1 | All | 25-79 | 0.0465 | 0.665 |
| | Hard grooved jaw #2 | All | 79-97 | 0.0473 | 0.647 |
| | Hard grooved jaw #3 | All | 97-115 | 0.0472 | 0.610 |
| | Hard grooved jaw #4 | All | 26-79 | 0.0465 | 0.665 |
| | Hard grooved jaw #5 | All | 79-99 | 0.0473 | 0.647 |
| | Hard grooved jaw #6 | All | 97-117 | 0.0472 | 0.610 |
| 215 | Hard grooved jaw #1 | 25 | 25-107 | 0.0825 | 0.665 |
| | | 34 | 34-110 | | |
| | | 43 | 43-117 | | |
| | | 52 | 52-124 | | |
| | | 61 | 61-133 | | |
| | | 70 | 70-145 | | |
| | Hard grooved jaw #2 | 79 | 79-155 | 0.0833 | 0.647 |
| | | 88 | 88-166 | | |
| | Hard grooved jaw #3 | 97 | 97-175 | 0.0832 | 0.610 |
| | | 106 | 106-185 | | |
| | Hard grooved jaw #4 | 26 | 26-107 | 0.0825 | 0.665 |
| | | 34 | 34-110 | | |
| | | 43 | 43-117 | | |
| | | 52 | 52-124 | | |
| | | 60 | 60-134 | | |
| 70 | | 70-146 | | | |
| Hard grooved jaw #5 | 79 | 79-155 | 0.0833 | 0.647 | |
| | 89 | 89-167 | | | |

3-jaw module

Use and limits of use

| Size of jaw module | Top jaws | Clamping stage | Clamping range | Distance to mass center of gravity $r_{s\ max}[m]$ in smallest position | Mass $m[kg]$ |
|--------------------|---------------------|----------------|----------------|---|--------------|
| | Hard grooved jaw #6 | 97 | 97-175 | 0.0832 | 0.610 |
| | | 107 | 107-186 | | |

Table 38: Hard grooved jaws – mass and distance of mass center of gravity of top jaws on rotational axis

| Size of jaw module | Top jaws | Clamping stage | Clamping range | Distance to mass center of gravity $r_{s\ max}[m]$ in smallest position | Mass $m[kg]$ |
|--------------------|---------------------|----------------|----------------|---|--------------|
| 145 | Hard plaster jaw #1 | 25 | 25-34 | 0.0465 | 0.808 |
| | | 70 | 70-79 | | |
| | Hard plaster jaw #2 | 34 | 34-42 | 0.4660 | 0.782 |
| | | 79 | 79-89 | | |
| | Hard plaster jaw #3 | 43 | 43-52 | 0.0474 | 0.713 |
| | | 88 | 88-98 | | |
| | Hard plaster jaw #4 | 52 | 52-60 | 0.0474 | 0.697 |
| | | 97 | 97-107 | | |
| | Hard plaster jaw #5 | 61 | 61-69 | 0.0475 | 0.677 |
| | | 106 | 106-116 | | |
| | Hard plaster jaw #6 | 35 | 35-43 | 0.4660 | 0.782 |
| | | 79 | 79-89 | | |
| | Hard plaster jaw #7 | 43 | 43-52 | 0.0474 | 0.713 |
| | | 89 | 89-99 | | |
| | Hard plaster jaw #8 | 62 | 62-71 | 0.0475 | 0.677 |
| | | 106 | 106-116 | | |
| 215 | Hard plaster jaw #1 | 25 | 25-103 | 0.0825 | 0.808 |
| | | 70 | 70-148 | | |
| | Hard plaster jaw #2 | 34 | 34-108 | 0.0826 | 0.782 |

3-jaw module

Use and limits of use

| Size of jaw module | Top jaws | Clamping stage | Clamping range | Distance to mass center of gravity $r_{s\ max}[m]$ in smallest position | Mass $m[kg]$ |
|--------------------|---------------------|----------------|----------------|---|--------------|
| | | 79 | 79-158 | | |
| | Hard plaster jaw #3 | 43 | 43-119 | 0.0834 | 0.713 |
| | | 88 | 88-167 | | |
| | Hard plaster jaw #4 | 52 | 52-126 | 0.0834 | 0.697 |
| | | 97 | 97-177 | | |
| | Hard plaster jaw #5 | 61 | 61-135 | 0.0835 | 0.677 |
| | | 106 | 106-187 | | |
| | Hard plaster jaw #6 | 35 | 35-110 | 0.0826 | 0.782 |
| | | 79 | 79-158 | | |
| | Hard plaster jaw #7 | 43 | 43-119 | 0.0834 | 0.713 |
| | | 89 | 89-168 | | |
| | Hard plaster jaw #8 | 62 | 62-137 | 0.0835 | 0.677 |
| | | 106 | 106-187 | | |

Table 39: Hard plaster jaws – mass and distance of mass center of gravity of top jaws on rotational axis

| Size of jaw module | Top jaws | Distance to mass center of gravity $r_{s\ max}[m]$ in smallest position | Mass $m[kg]$ |
|--------------------|----------------------------|---|--------------|
| 145 | Soft, smooth top jaw short | 0.0442 | 0.767 |
| | Soft, smooth top jaw long | 0.0490 | 0.894 |
| 215 | Soft, smooth top jaw short | 0.0802 | 0.767 |
| | Soft, smooth top jaw long | 0.0850 | 0.894 |

Table 40: Soft, smooth top jaws – mass and distance of mass center of gravity of top jaws on rotational axis



INFORMATION

The mass figure for the soft, smooth top jaws corresponds to the mass of a jaw that has not been re-worked.

To optimize this calculation, the mass of the machined jaw together with the slot nut and the fixing screws can be established and used for further calculation.

Constant q [kgm] for the jaw modules

| Size of jaw module | Build size of the basic clamping device | Constant q [kgm] |
|--------------------|---|------------------------|
| 145 | 65 | $q = 0.041 \text{kgm}$ |
| 215 | 65 | $q = 0.090 \text{kgm}$ |
| 215 | 80 | $q = 0.090 \text{kgm}$ |
| 215 | 100 | $q = 0.091 \text{kgm}$ |

Table 41: Constant of the jaw modules

Determining the required clamping force



INFORMATION

c From Table 35

k_c From Table 36

μ_a, μ_t From Table 37

r_s, m From Table 38, Table 39 or Table 40

q From Table 41

I

$$F_{rad\ erf} = 1.6 * c * (1.6 * (F_{sz} + F_{sk}) + F_{fz})$$



INFORMATION

The leading factor 1.6 here is the safety factor required as a result of fluctuations in clamping force. In addition, factor 1.6 takes account of any fluctuations in machining force that may occur.

II

$$F_{SZ} = 1.3 * \sqrt{\left(\frac{F_c * d_z + 2 * M_B}{d_{sp} * \mu_t}\right)^2 + \left(\frac{F_c + F_B}{\mu_a}\right)^2}$$

Turning [inner and outer]

$$F_c = 1.3 * a_p * f * k_c$$

Drilling [drilling of solid materials, double-bladed tool, concentrically towards the workpiece axis]

$$F_B = 0.45 * D_B * f_n * k_c$$

$$M_B = \frac{f_n * D_B^2 * k_c}{5700}$$



INFORMATION

When calculating machining forces, a level of tool blunting is built in, corresponding to a wear mark width of 0.3mm.

III

$$F_{sk} = \frac{\sqrt{(F_c * L_z + F_G * L_g)^2 + (F_c * P)^2}}{0.325 * (0.67 * L_{sp} + \mu_a * d_{sp})}$$

Longitudinal turning

$$P = \frac{d_z}{2}$$

Surface turning / plunge-machining

$$P = L_z$$

IV

$$F_{fz} = (q_{spe} + q) * \left(\frac{\pi * n}{30}\right)^2$$



INFORMATION

The constant of the clamping elements q_{spe} can be inscribed on the clamping jaw set.

$$q_{spe} = 3 * m * r_{s \max}$$

With reference to the principle defined at the start, this means that the radial clamping force of the jaw module equates to at least the computed level of radial clamping force required $F_{rad \text{ erf}}$ to resolve this use of the jaw module.

If this condition is not satisfied, the jaw module would not be suitable. It would not then be possible to perform this machining task.

When clamping and machining workpieces with bigger errors in axial and face run-out, please note that the cutting cross-section fluctuates greatly. Particular attention needs to be paid to the resultant local increase in cutting force.

5.3.5.2 Further to Principle 2: $F_c \leq 4500N$ or $F_c \leq 7500N$

The cutting force must be less than its maximum permitted limit.

When using soft, smooth top jaws or hard grooved jaws, the maximum cutting force is $F_{c\ max} = 4500N$.

When using hard plaster jaws, the maximum cutting force is $F_{c\ max} = 7500N$.

5.3.6 Sample calculation

Applied to a specific example

Longitudinal turning of an offset shaft made of 16MnCr5 [blank clamping diameter] unsupported in a horizontal position.

Workpiece data

- Clamping diameter $d_{sp} = 150mm$
- Workpiece length $L_w = 80mm$
- Machining diameter of turning operation $d_z = 148.0mm$
- Workpiece mass $m_w = 11.1kg$
 - $F_G = m_w * 9.81 \frac{m}{s^2}$
 - $F_G = 109N$

Process data

- Speed $n = 250min^{-1}$
- Feed $f = 0.25mm$
- Chip-cutting depth $a_p = 1.0mm$
- Use of cooling lubricant

Jaw module

- Jaw module size 215 for basic clamping device size 65
- Jaws used
 - 10723/0002 [grooved jaw #2]
 - Clamping stage 88
 - Diameter of clamping step $D = 88mm$
 - Edge fit because $D = 88mm < d_{sp} = 150mm$

Detailed observation

This satisfies the first condition, which is that the workpiece length must not exceed twice the clamping diameter.

This also satisfies the second condition, which is that the workpiece mass m_w must not exceed $38kg$.

This also satisfies the third condition, which is that the workpiece must at least be clamped with $6mm$, with a selected clamping length of $7mm$.

To check the fourth condition, the required level of radial clamping force needs to be established.



INFORMATION

| | |
|----------------|--|
| c | From Table 35 |
| k_c | From Table 36 [interpolated for $f = 0.25mm$] |
| μ_a, μ_t | From Table 37 |
| r_s, m | From Table 38 |
| q | From Table 41 |

I

$$F_{rad\ erf} = 1.6 * c * (1.6 * (F_{SZ} + F_{Sk}) + F_{fz})$$

From Table 35: $c = 1.2$

$$F_{rad\ erf} = 1.6 * 1.2 * (1.6 * (F_{SZ} + F_{Sk}) + F_{fz})$$

II

$$F_{SZ} = 1.3 * \sqrt{\left(\frac{F_c * d_z + 2 * M_B}{d_{sp} * \mu_t}\right)^2 + \left(\frac{F_c + F_B}{\mu_a}\right)^2}$$

From Table 37: $\mu_t = 0.16, \mu_a = 0.18$

Turning:

$$F_c = 1.3 * a_p * f * k_c$$

$$F_c = 1.3 * 1.0mm * 0.25mm * 2515 \frac{N}{mm^2} = 818N$$

Drilling:

Not relevant here because no drilling is envisaged. Therefore $F_B = 0N$ and $M_B = 0Nmm$

$$F_{SZ} = 1.3 * \sqrt{\left(\frac{818N * 148mm + 2 * 0Nmm}{150mm * 0.16}\right)^2 + \left(\frac{818N + 0N}{0.18}\right)^2}$$

$$F_{SZ} = 8826N$$

III

$$F_{sk} = \frac{\sqrt{(F_c * L_z + F_G * L_g)^2 + (F_c * P)^2}}{0.325 * (0.67 * L_{sp} + \mu_a * d_{sp})}$$

$L_z = L_w = 80mm$, since the shaft should be surface-turned at the front end of the shaft.

$L_g = 40mm$, since the center of gravity is located centrally on the longitudinal axis of the work-piece.

$L_{sp} = 7mm$, equates to the full clamped length of selected top jaws.

$P = \frac{d_z}{2} = \frac{148mm}{2} = 74mm$, because of a longitudinal turning operation

$$F_{sk} = \frac{\sqrt{(818N * 80mm + 109N * 40mm)^2 + (818N * 74mm)^2}}{0.325 * (0.67 * 7mm + 0.18 * 150mm)}$$

$$F_{sk} = \frac{92391Nmm}{10.3mm} = 8970N$$

IV

$$F_{fz} = (q_{spe} + q) * \left(\frac{\pi * n}{30}\right)^2$$

From Table 38: $m = 0.647kg$, $r_{s\ max} = 0.0833m$

From Table 41: $q = 0.090kgm$

$q_{spe} = 3 * m * r_{s\ max} = 3 * 0.647kg * 0.0833m$

$q_{spe} = 0.1617kgm$

$$F_{fz} = (0.1617kgm + 0.090kgm) * \left(\frac{\pi * 250min^{-1}}{30}\right)^2$$

$$F_{fz} = 173N$$

$$F_{rad\ erf} = 1.6 * 1.2 * (1.6 * (F_{sz} + F_{sk}) + F_{fz})$$

$$F_{rad\ erf} = 1.6 * 1.2 * (1.6 * (8826N + 8970N) + 173N)$$

$$F_{rad\ erf} = 55002N = 55kN$$

Since the size 215 jaw module can exert a maximum radial clamping force of $F_{rad\ max} = 60kN$, this satisfies Principle 1.

Principle 2 would also be satisfied, because the calculated cutting force of $F_c = 818N$ is well below the limit of $F_{c\ max} = 4500N$.

Result of the sample calculation

All limits have been checked.

The axial actuation force is proportional to the radial clamping force and interpolation can therefore be used to determine this on the basis of the values for $F_{ax\ max}$ and $F_{rad\ max}$, as indicated on the jaw module, or you can consult the clamping force diagram [see »Clamping force diagram« chapter].

When full axial force is exerted on the jaw module with $F_{ax\ max} = 45kN$, nominal radial $60kN$ forces are being applied to the workpiece.

In the example calculated here, an axial force of at least $F_{ax} = 41kN$ must be applied, resulting in a radial clamping force of $F_{rad} = 55kN$.

This satisfies condition $F_{rad} \geq F_{rad\ erf}$.

Machining can then be performed.

The value is close to the limit value. This ensures that the jaw module is in good condition in terms of the level of contamination and lubrication.

It is advisable to conduct a check on radial clamping force using an appropriate clamping force meter before the machining operation. The values established must lie within an appropriate range for the rotational speed [see »Clamping force diagram« chapter].

6 Transport, packaging, storage

6.1 Safety, transport, packaging, storage



WARNING

High level of physical strain due to the weight of the product or of its components if not transported properly!

- From a weight of 10 kg, use appropriate transport equipment, lifting gear and lifting tackle.



WARNING

Serious crushing injuries and breakages caused by falling parts if transported incorrectly!

- Ensure that the product cannot roll away or fall.
- Place on a non-slip surface.
- When using lifting gear, use appropriate load-bearing equipment and lifting tackle.



WARNING

Serious injuries caused by transporting off-center equipment!

- Pay attention to marks on the packaging items.
- Attach the crane hook directly above the center of gravity.
- Raise carefully and correct the lifting points if necessary.



WARNING

Serious injuries caused by incorrect transport with lifting gear!

- Never raise loads above people.
- Never step under suspended loads.
- Pay attention to information about the intended lifting points. Ensure that the lifting gear is mounted on a secure base.
- Only use authorized and undamaged lifting gear, load-bearing equipment and lifting tackle.
- Never exceed the maximum load-bearing capacity of lifting gear, load-bearing equipment and lifting tackle.



NOTE

Damage to materials caused by falling parts if transported incorrectly!

- Ensure that the product cannot roll away or fall.
- Place on a non-slip surface.
- When using lifting gear, use appropriate load-bearing equipment and lifting tackle.

6.2 Symbols on the packaging



Fragile

Designates packaging items with fragile or breakable contents.

Handle the packaging item with care. Do not drop it and protect it against collision impacts.



Keep it dry

Keep packaging items dry and protect them from the ingress of water.



Position designation

Points to the correct upright position of the packaging item.

6.3 Transport inspection

Check the delivery on receipt immediately to ensure it is complete and has not been damaged in transit.

Proceed as follows if you find any externally visible signs of damage while in transit:

- Refuse to accept the delivery, or only subject to later approval
- Make a note of the extent of damage on the transportation documents or on the delivery note of the transportation company
- Initiate a complaint



INFORMATION

Raise a complaint for every defect as soon as it is discovered. Compensation claims can only be enforced during the applicable complaint periods.

6.4 Unpacking and internal transportation

The total weight of the product depends on its size.

Depending on the weight involved, it may be necessary to use lifting gear to lift the product or its components out of the packaging safely, to transport them and to position and install them in the machine tool or on the machine table.

1. The product is packaged in a stable position, and it has threads / bores for transportation.
2. Lifting tackle can be installed in these transportation threads / bores. To lift the product out of its packaging, the front-end functional threads can if necessary be used to attach lifting tackle to upright packaged products.
3. Attach load-bearing equipment to the lifting tackle.
4. Subject to weight, use lifting gear to lift the product out of its packaging safely, and place it down on a stable, flat surface.
5. Secure the product to prevent it from rolling away.
6. When transporting on a trolley or car, ensure that the product is securely mounted on a non-slip surface before starting to move it.

6.5 Packaging

The individual packaging items are packaged in an appropriate manner for the type of transportation involved. Always use environmentally compatible materials for packaging purposes.

Packaging should protect individual components from damage in transit, corrosion and other forms of damage, up until installation. For this reason, do not destroy the packaging, and do not remove it until shortly before installation.



INFORMATION

The packaging units are packaged, wrapped in airtight film and placed in cardboard boxes. On the individual weights of each of the sizes [see »General information« chapter].

Dispose of packaging material in accordance with applicable legislative provisions and local regulations.



NOTE

Damage to the environment caused by improper disposal of packaging materials!

- Dispose of packaging materials in an environmentally responsible manner.
- Pay attention to local disposal regulations and, if necessary, appoint a specialist waste disposal company with this work.

6.6 Storage



INFORMATION

The packaged items may display information relating to storage and readmission to storage that extend beyond the scope of these requirements. Pay attention to these notices.

Store packaged items under the following conditions:

- Safe for storage.
- Do not store outdoors.
- Store in a dry, dust-free place.
- Avoid exposure to aggressive media.
- Protect against direct sunlight.
- Avoid mechanical vibration.
- Storage temperature: 15 to 35°C.
- Relative humidity: Maximum 60%.
- In the event of storage for more than 3 months:
 - On a regular basis, check the general condition of all parts and packaging.
 - If necessary, refresh the preservation or replace it.

6.7 Preservation

1. Clean and lubricate the product [see »Cleaning« and »Lubricating the product« chapters].
2. Apply a light coating of preserving oil to the inner and outer faces of the product. Wipe away surplus preserving oil with a soft, lint-free, tear-resistant cloth.
3. Pack product air-tight in foil.
4. Return product to storage [see »Return to storage« chapter].

6.8 Return to storage

Return product to storage under the following conditions:

1. Preserve the product [see »Preservation« chapter].
2. The product must be stored safely in its storage box.
3. For storage conditions, see the »Storage« chapter.

7 Installation

7.1 Installation safety



WARNING

Serious injuries caused by unskilled staff during installation / removal!

- Installation and removal must be performed by skilled staff from the relevant specialist field.



WARNING

Serious injuries can be caused if the machine tool starts up accidentally!

- Set the machine tool into set-up mode.
- Remove all tools, auxiliary equipment and items of test equipment immediately from the working area of the machine.
- Remove all lifting gear from the product and from the working area of the machine.



WARNING

Serious injuries caused by the escape of media under high pressure!

- Shut down media delivery during installation and removal.
- Relieve any pressure trapped in the system.
- Shut down the system.



WARNING

Serious crushing injuries and breakages caused by falling parts during incorrect installation or removal!

- Ensure that the product cannot roll away or fall.
- If necessary, use an appropriate mounting aid for installation or removal on a vertically suspended machine spindle.



WARNING

Serious crushing injuries caused by improper machine movement during installation or removal!

- Machine movements are only permitted in set-up mode during installation and removal.
- Never reach into a gap.
- Pay attention to the gap dimensions of moving parts.



WARNING

Serious head injuries caused by bending into the working area of the machine!

- Only ever bend into the working area of the machine if there are no cutting tools or sharp objects in it, or if these are covered.
- Never move body parts under parts in the working area of the machine with the potential to drop down.
- Depending on weight, use an appropriate mounting aid for installation or installing on a vertically suspended machine spindle.



WARNING

High level of physical strain due to the weight of the product or of its components if not transported properly!

- From a weight of 10 kg, use appropriate transport equipment, lifting gear and lifting tackle.



CAUTION

Serious cut injuries caused by sharp-edged changing parts and/or clamping elements!

- All installation / removal of changing parts and clamping elements must be performed by skilled staff from the relevant specialist field.



NOTE

Damage to materials caused by lifting gear left in the product!

- Always remove lifting gear immediately after installing the product.



NOTE [only for aluminum components]

Damage to materials can be caused by incorrect screw tightening torques on aluminum components!

- Pay attention to the reduced screw tightening torques for aluminum components [see »Screw tightening torques« chapter].



INFORMATION

The product is equipped with a safety function that only enables the installation wrench from being installed or removed while the coupling sliders are extended.

7.2 Preliminary remarks

- In accordance with their thread size and strength class, screws must be tightened crosswise to the specified tightening torque [see »Screw tightening torques« chapter]. When tightening the screws, do so evenly to prevent any distortion under load.
- To avoid precision errors, clean all screw-fitting points and mating surfaces [Notes on cleaning, see »Cleaning« chapter]. Factory wetting of flat surfaces and, where necessary of clamping elements, only serves as a corrosion inhibitor. This is not functionally related lubrication.
- Only apply lubricant to the mechanical mating surfaces. Pay attention to notes about lubricants [see »Use of lubricants« chapter].
- Avoid too much lubricant on the locating face because this can cause face run-out errors.
- Apply grease to the sealing elements [for example O-rings, rectangular rings] and sealing surfaces. Pay attention to notes about greases [see »Use of lubricants« chapter].
- Do not damage the functional surfaces [flat, mating, tapered and sealing surfaces].

7.3 Screw tightening torques

The tables show the specified values.

Knowledge of the applicable guidelines and design criteria is essential.



NOTE

Damage to materials caused by defective screw tightening torques!

- To secure the product to the machine, pay attention to the values specified by HAINBUCH and by the machine manufacturer for screw tightening torques. If the machine manufacturer stipulates different values, you must consult HAINBUCH.

Metric control threads

The following table contains the guide values in Nm for screw tightening torques for achieving the highest permitted pre-load for metric control threads.

- Total friction coefficient $\mu_{ges} = 0.12$

| Thread designation | Tightening torque at screw quality [Nm] | |
|--------------------|---|------|
| | 10.9 | 12.9 |
| M4 | 4 | 5 |
| M5 | 7 | 9 |
| M6 | 12 | 15 |
| M8 | 25 | 38 |
| M10 | 50 | 70 |
| M12 | 100 | 130 |
| M16 | 220 | 300 |
| M20 | 400 | 550 |
| M24 | 600 | 800 |

Table 42: Screw tightening torques, metric control threads

Aluminum components

The following table contains the reduced screw tightening torques for securing aluminum components.

| Thread designation | Tightening torque [Nm] | Minimum screw depth [mm] |
|--------------------|------------------------|--------------------------|
| M6 | 10 | 12 |
| M8 | 23 | 16 |
| M10 | 46 | 20 |

Table 43: Screw tightening torques for aluminum components

7.4 Preparation of the machine for installation

1. Set the machine into set-up mode.
2. Reduce the operating pressure to a minimum.
3. Remove cutting tools and/or sharp objects from the working area of the machine, or cover them.

7.5 Preparation of the basic clamping device

To install the adaptation clamping device, the basic clamping device must be prepared.



In addition to these operating instructions, you should also read and follow the operating instructions for the associated basic clamping device.

1. Check the total stroke of the basic clamping device [see operating instructions for the basic clamping device].
2. Remove the clamping element from the basic clamping device [see operating instructions for the basic clamping device].

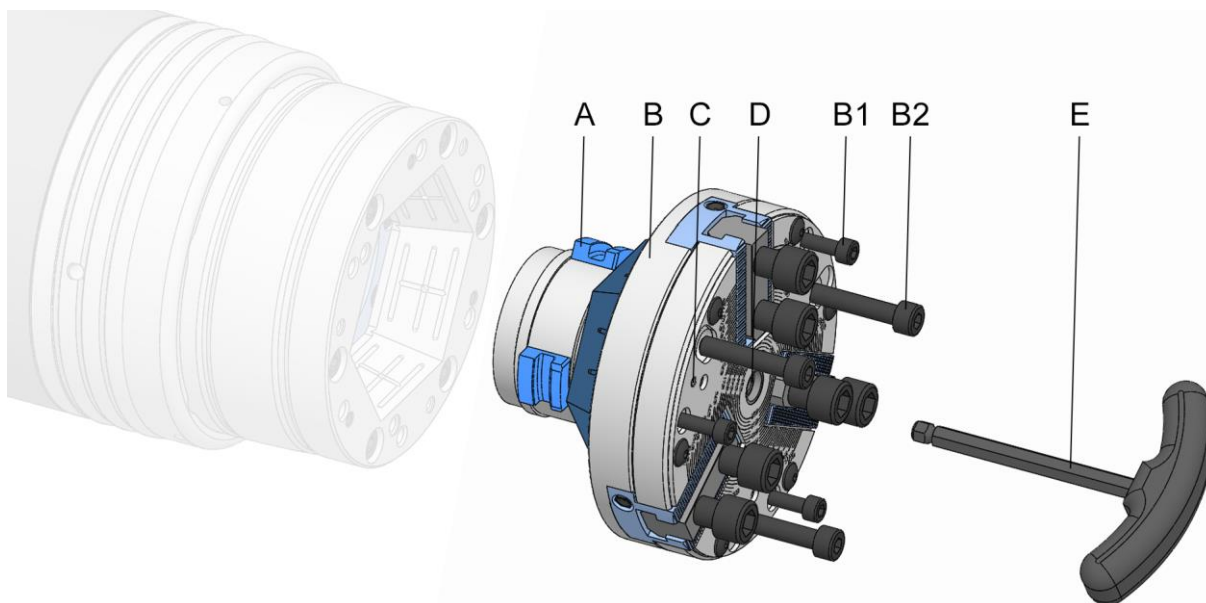


INFORMATION

Before installation of the adaptation clamping device, the base end-stop must be removed from the basic clamping device.

3. Remove the changing parts from the basic clamping device [see operating instructions for the basic clamping device].

7.6 Installation of the product



- A Coupling slider
- B Adaptation clamping device
- B1 Fixing screws, adaptation clamping device 1
- B2 Fixing screws, adaptation clamping device 2
- C Display pin
- D Locking pin
- E Assembly key

Special aids needed:

- Assembly key

1. As described in the »Preparation of the machine for installation« chapter, prepare for the following steps.
2. As described in the »Preparation of the basic clamping device« chapter, prepare the basic clamping device for the following steps.

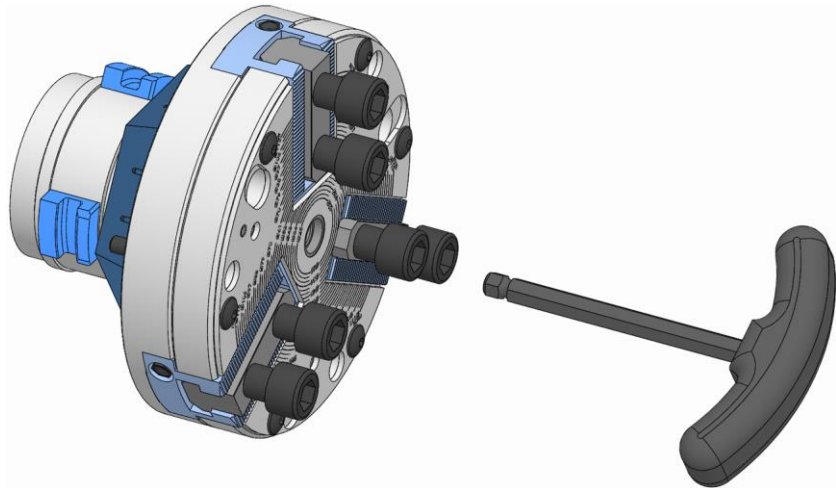
7.6.1 Compatibility check

Check the compatibility of the product and the connection point of the basic clamping device.

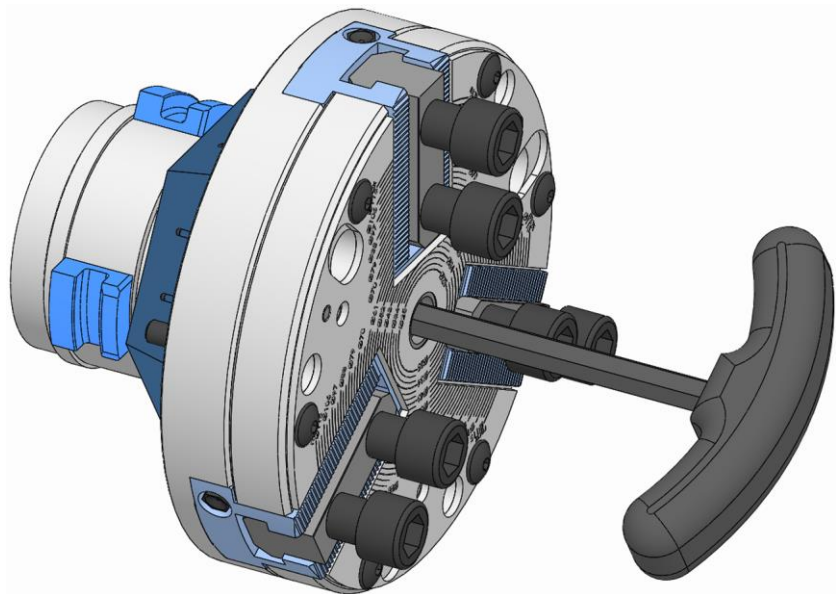
For this, check that the connection point and the product share the same adaptation geometry. Also check if the actuating element / coupling element is suitable.

7.6.2 Function check of the coupling range of the product

Check that the coupling range function on the product.

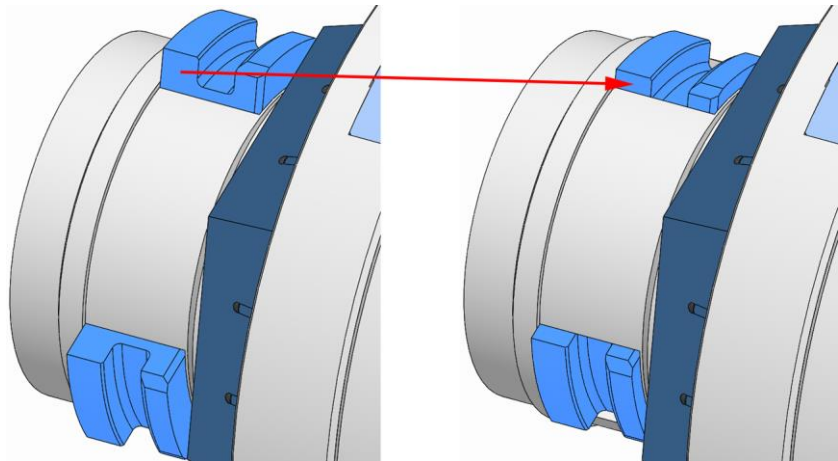


1. Insert the installation wrench in the locking pin of the product until it engages audibly.

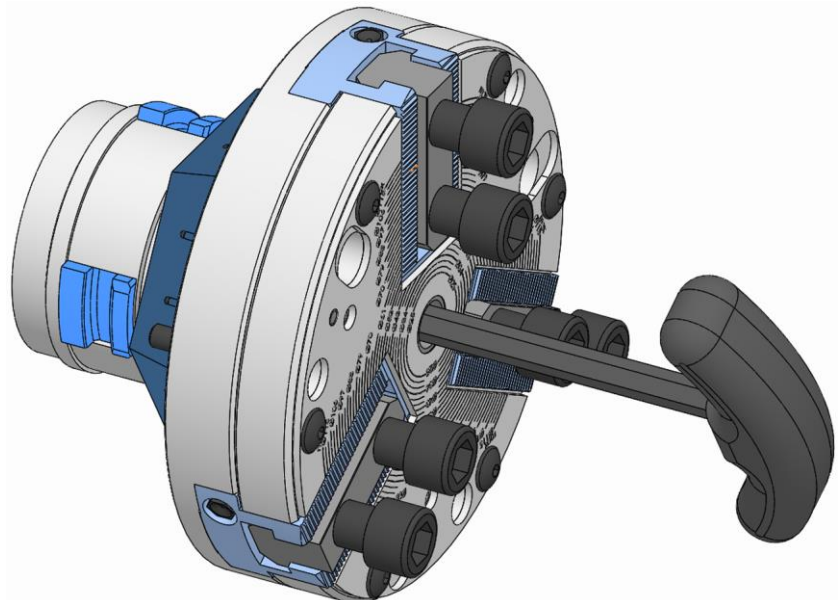


2. Turn the locking pin fully home counter-clockwise using the installation slider. Pay attention to movement of the coupling slider.

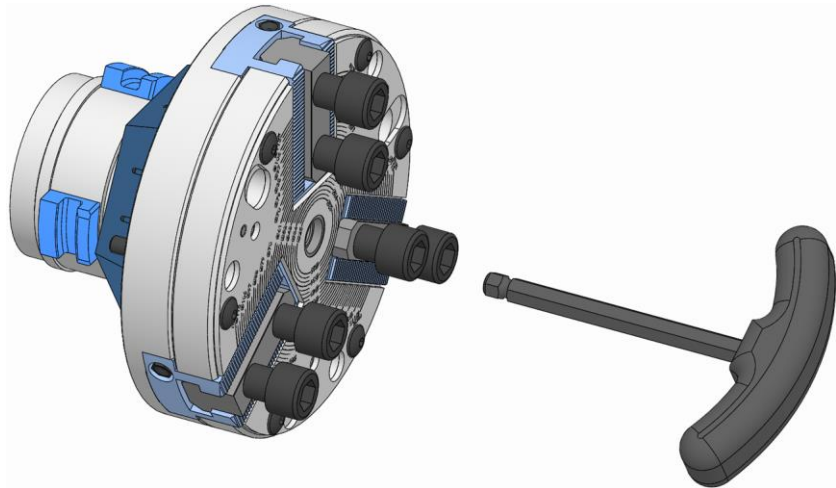
3-jaw module Installation



3. Check the movement of all coupling sliders. When turning the locking pin counter-clockwise, all coupling sliders must move inwards.



4. Turn the locking pin fully home counter-clockwise using the installation wrench.



5. Remove the installation wrench.

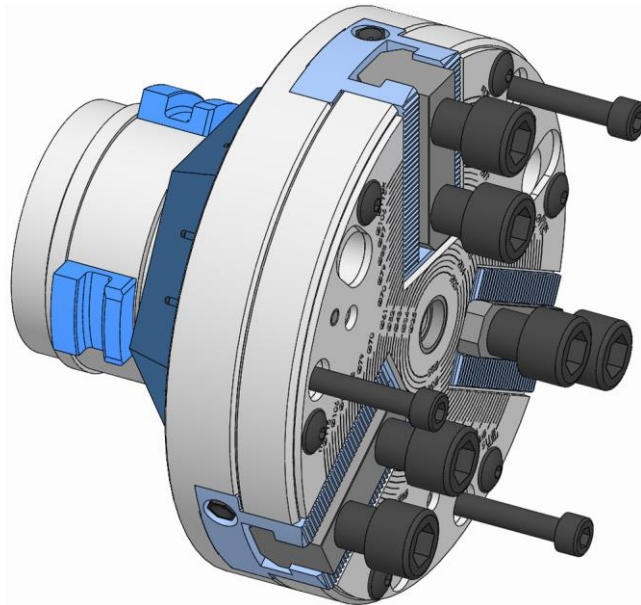
If the coupling slider does not move inwards automatically, the product must be cleaned [see »Cleaning« chapter].

7.6.3 Preparation of the product

The product is supplied in assembled condition.

The following preparatory steps are needed to install the product.

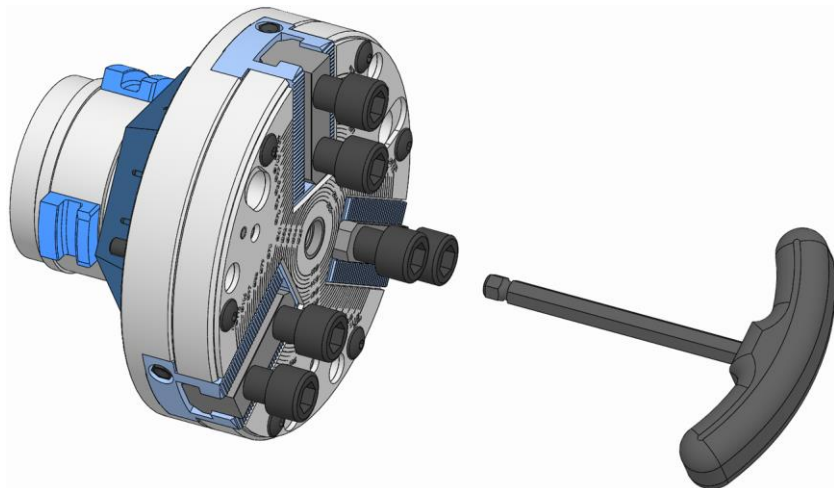
1. Select the fixing screws for the adaptation clamping device in accordance with the basic clamping device.



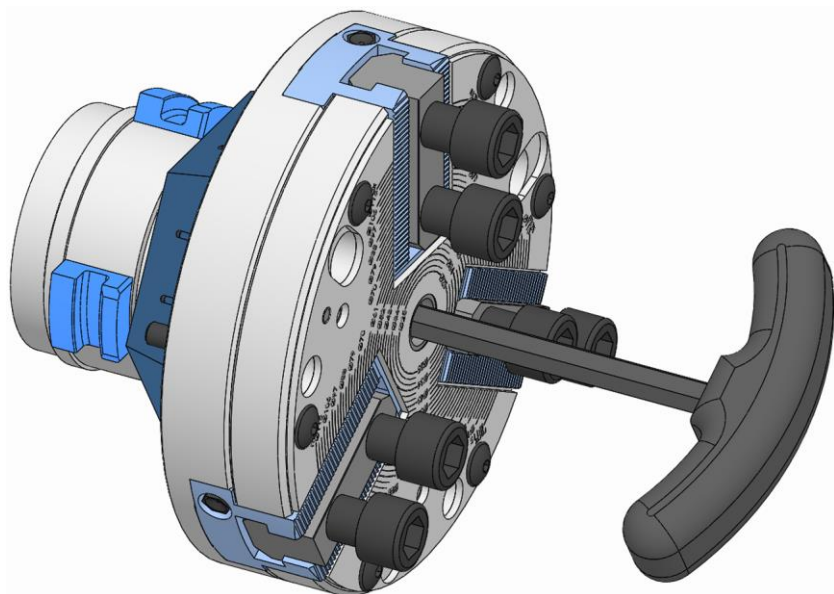
INFORMATION

The fixing screws for the adaptation clamping device are secured to prevent them from falling out once installed.

2. Install the fixing screws for the adaptation clamping device in the bores provided.



3. Insert the installation wrench in the locking pin of the product until it engages audibly.



4. Turn the locking pin fully home counter-clockwise using the installation wrench.

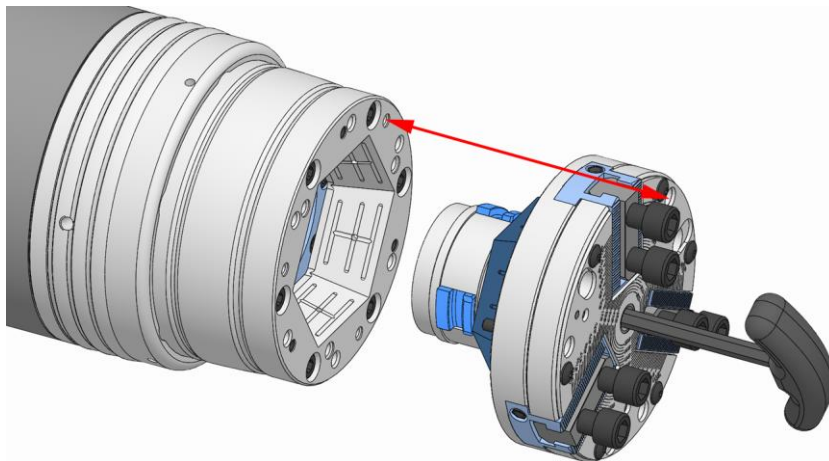


INFORMATION

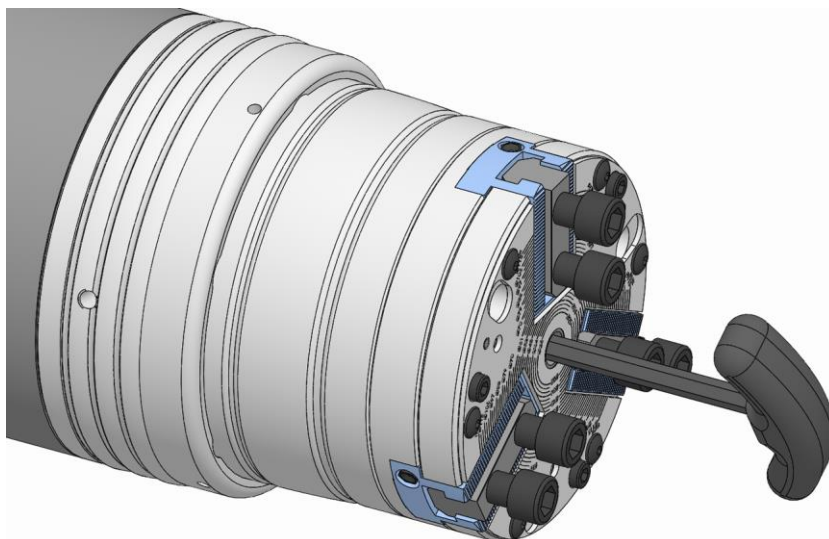
The coupling sliders are retracted. The assembly key cannot be pulled off.

7.6.4 Installation of the adaptation clamping device

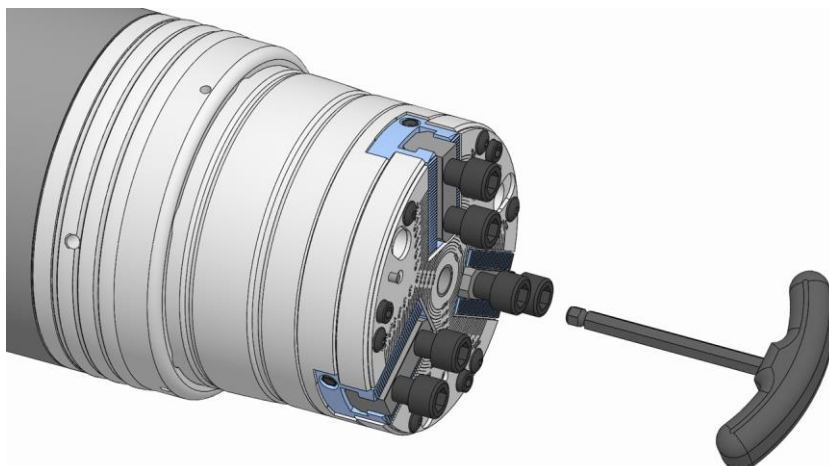
1. Attach any lifting gear that may be required.
2. If necessary, fit the mounting aid onto a vertically suspended spindle.
3. Move the basic clamping device into its clamping reserve position.



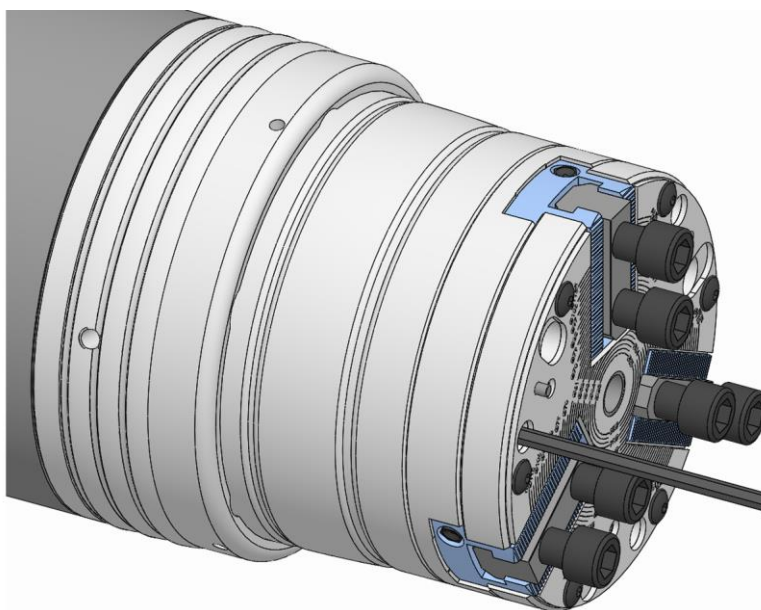
4. Set down the adaptation clamping device on the basic clamping device so that the hole pattern on the basic clamping device and the adaptation clamping devices are aligned. For this, the surfaces of the clamping taper in the basic clamping device and the adaptation clamping device must be aligned.



5. Turn the locking pin fully home counter-clockwise using the installation wrench.



6. Remove the installation wrench.



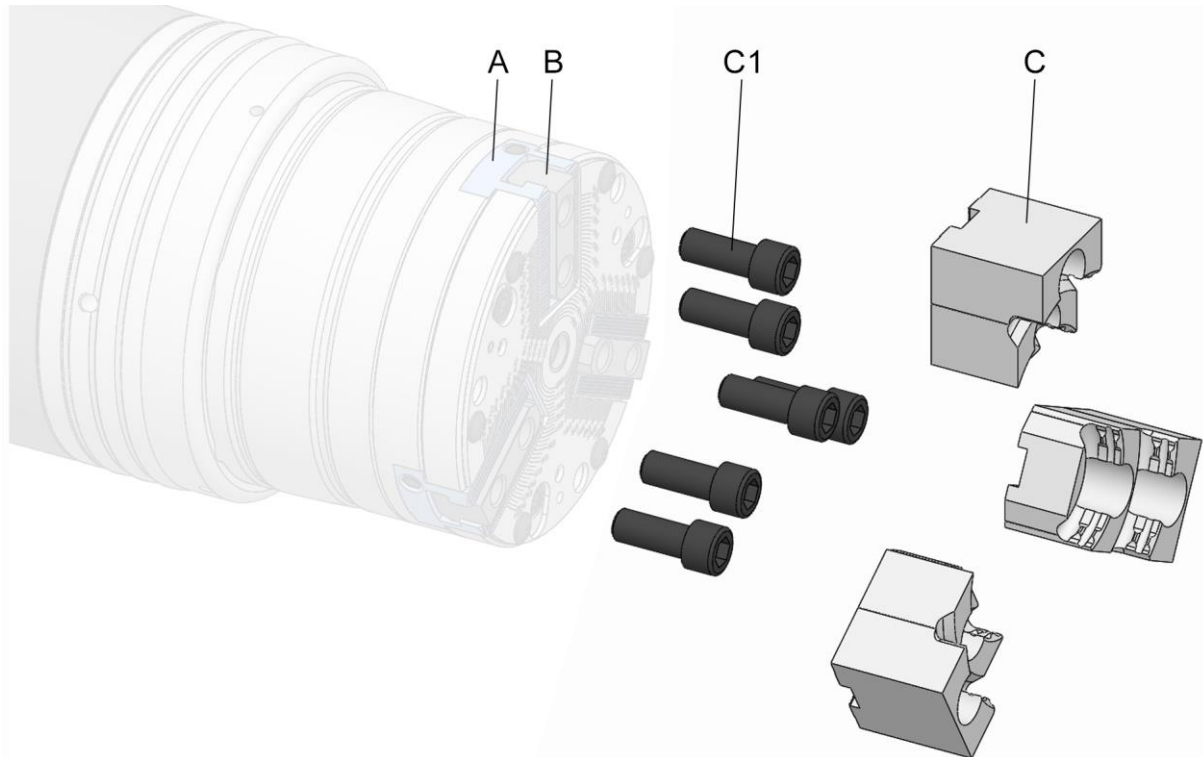
7. Screw in the adaptation clamping device fixing screws and tighten to the specified tightening torque [see »Screw tightening torques« chapter].
8. Unfasten and remove any lifting gear that may have been required.
9. Remove the mounting aid on a vertically suspended spindle if one was used.
10. Check the display pin. For this, move the clamping device into release position. The display pin must be in the clamping device. Then move the clamping device into clamping reserve position. The display pin must protrude.

If the display pin is not in the clamping device in release position, or if the display pin does not protrude in clamping reserve position, the clamping device is not installed correctly.

1. Remove the adaptation clamping device.

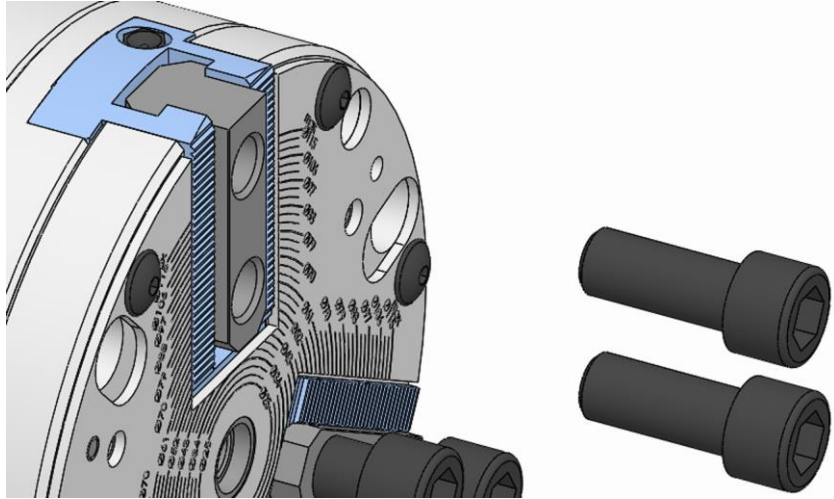
2. Prepare the basic clamping device [see »Preparation of the basic clamping device«].
3. Prepare the adaptation clamping device.
4. Adaptation clamping device reinstalled.
5. Repeat the check of the display pin.

7.7 Installation of the clamping element

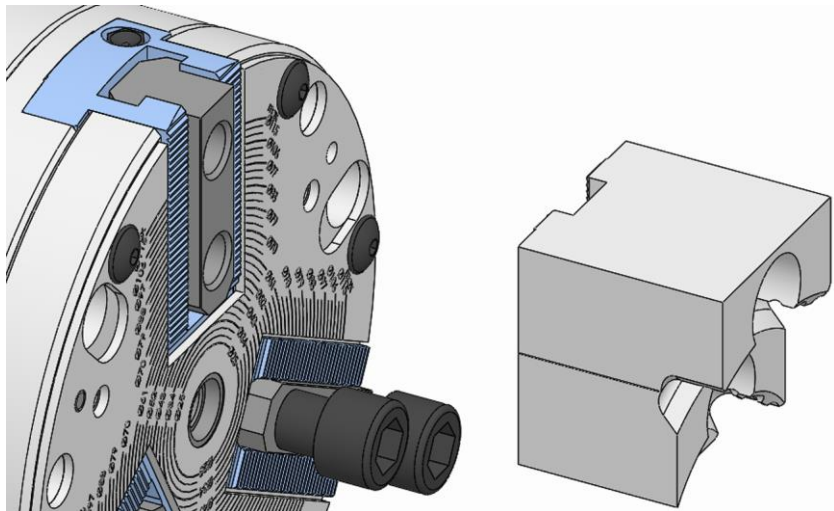


- A Basic chuck
- B Sliding block
- C Jaw [clamping element]
- C1 Jaw fixing screws

1. As described in the »Preparation of the machine for installation« chapter, prepare for the following steps.
2. Move the clamping device into release position.



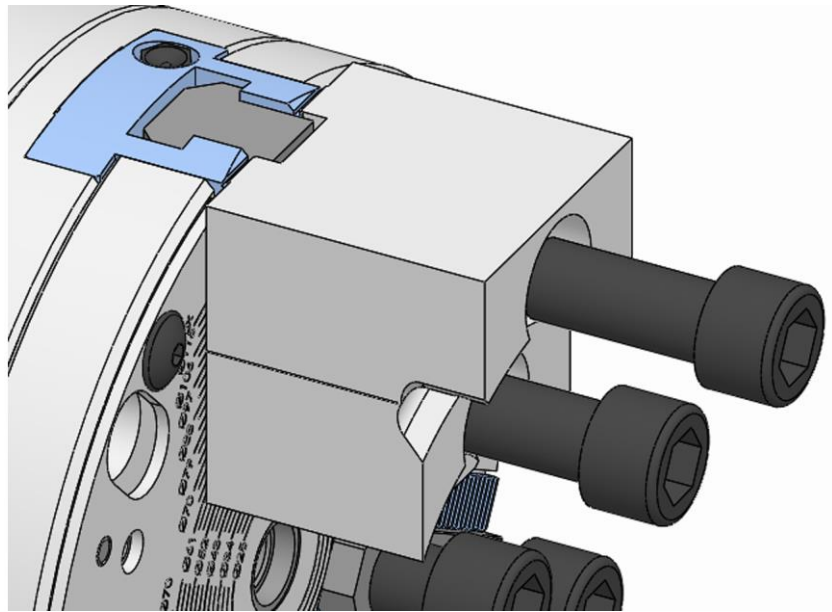
3. Unfasten and remove the fixing screws on the jaw.



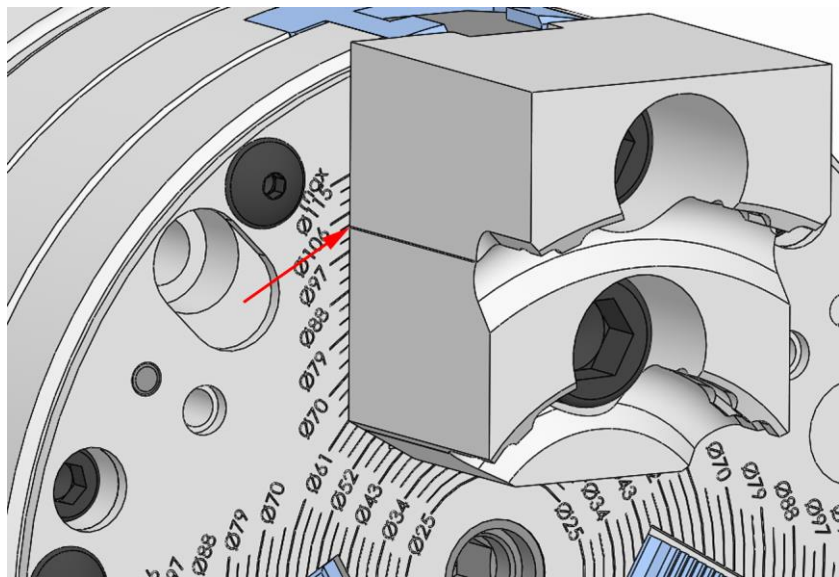
INFORMATION

The jaws can be marked with nomenclature to assign them to the basic jaws.

4. Fit the jaw to the slot nut on the product. Where necessary, pay attention to the marking.



5. Screw in the jaw fixing screws and tighten them gently, so that it is still possible to lift and move the jaw.

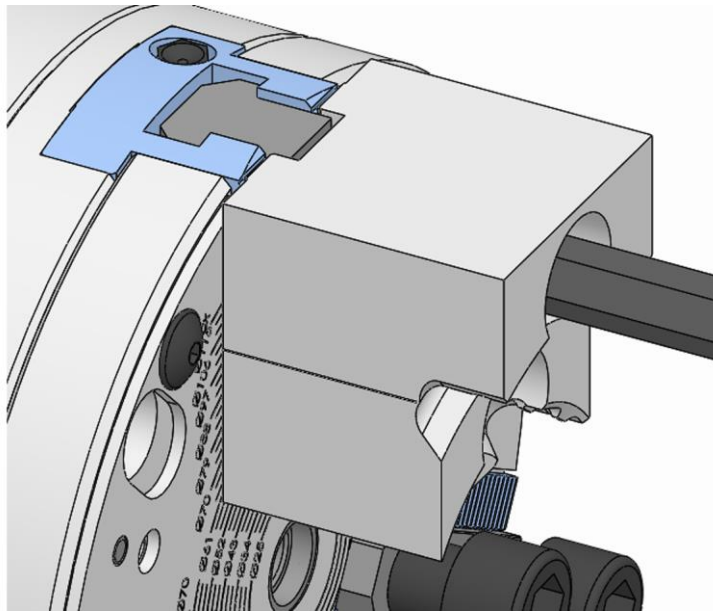


DANGER

Serious injuries caused by projectile workpieces when the maximum position is exceeded!

- The slot nut must not be more than flush with the external diameter of the basic jaw.
- Use appropriate jaws.

6. Position the jaw with the help of markings and the scale on the product.



DANGER

Serious injuries caused by parts being ejected centrifugally after incorrect installation of jaws!

- To secure the jaws, only use M12x30 screws in quality grade 12.9.
- Ensure that the jaws are only clamped with slot nuts.

7. Tighten the jaw fixing screws to the specified tightening torque of 130 Nm.



WARNING

Serious injuries caused by the imbalance of eccentrically clamped workpieces!

- Install all jaws on the same scale step.
- All jaws must share the same distance between basic jaw and clamping jaw.

8. Install the other jaws as described. For this, position the jaws on the same scale step.
9. Conduct a clamping test [see »Permitted clamping of the workpiece« chapter].

7.8 Machining the soft jaws



DANGER

Serious injuries caused by use of incorrectly machined jaws!

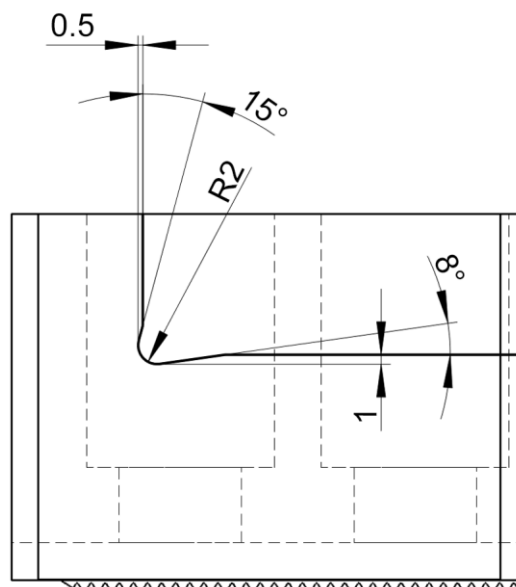
- The operator is solely responsible for the machining of jaws.
- When machining jaws, observe the specified limits and procedure.
- When inserting clamping stages in soft jaws, do not machine the screw heads at the same time.
- Welding repairs to jaws are not permitted.

Soft, smooth jaws can be machined to individual requirements by the user.

However, there are limits on the acceptable extent of machining geometries and these must be maintained at all times, otherwise the jaws may fail under load.

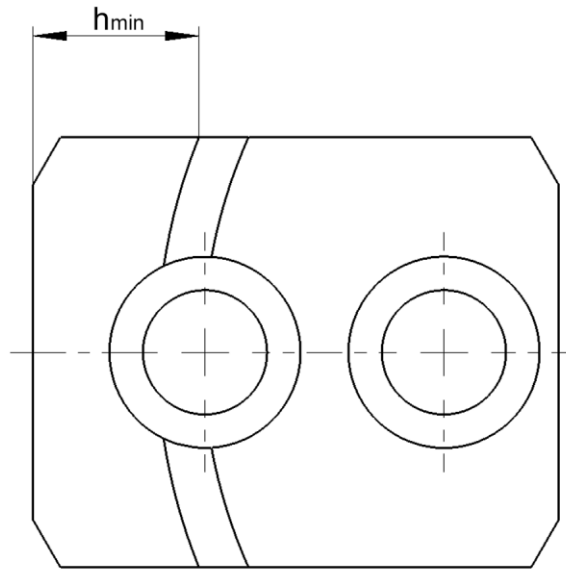
7.8.1 First limit: clamping contour

Never drop below the marks on the jaw.

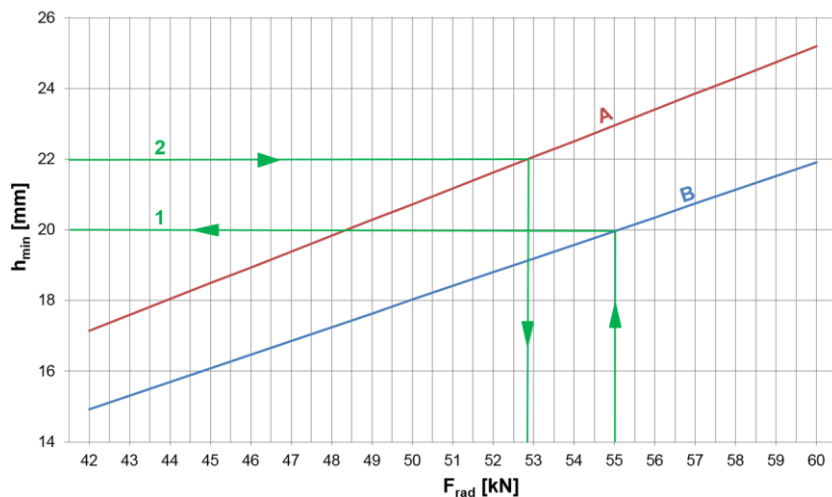


This figure shows the specified turned contour. This must be complied with.

7.8.2 Second limit: Shoulder width



- 1 Scan sample 1
- 2 Scan sample 2
- A Slight edge fit
- B Interference fit and saddle fit



This diagram illustrates the minimum shoulder width h_{min} , dependent on clamping force F_{rad} .

When clamping a workpiece, if an edge seat [see »Limits of use« chapter] is created, this can lead to peak stresses in the top jaw. For this reason, an allowance at minimum shoulder width is essential.

The minimum shoulder width required must be taken from the diagram.

If a jaw has already been machined, this diagram can be used to establish the maximum permitted clamping force.

This clamping force limit for the jaw is never synonymous with the minimum clamping force to be established and that is needed to clamp a workpiece securely.

Both criteria must be satisfied independently of one another.

Scan sample 1

At a required clamping force of $F_{rad} = 55kN$ and interference fits, the shoulder width must be at least $h_{min} = 20mm$.

Scan sample 2

With a shoulder width of $h_{min} = 22mm$ the soft, smooth jaws can be operated at a maximum clamping force of $F_{rad max} = 52.8 kN$.

7.8.3 Procedure for machining the soft jaws



DANGER

Serious injuries caused by projectile workpieces, ejected when materials break!

- Always comply with the maximum turn-out contour.
- When turning large diameters, the jaws must be installed with their wide side facing outwards.
 - for size 215: From $\varnothing 190$
 - for size 145: From $\varnothing 105$



INFORMATION

To minimize the loss of centrifugal force, always attach the jaws as wide as possible to either side of the fulcrum.

1. Install the jaws in a suitable position [see »Installation of the clamping element« chapter].
2. Move the clamping device into release position.



INFORMATION

To achieve the best possible concentricity, set the clamping force to the value at which the workpiece should be clamped.

3. Set the clamping force. During this, pay attention to the max. permitted clamping force.



DANGER

Serious injuries caused by projectile workpieces, ejected by incorrect clamping of the clamping ring!

- The clamping ring must be clamped by the jaws.
- Never clamp the clamping ring with the basic jaws.
- Observe the correct clamping position.



INFORMATION

The correct clamping position is reached once the basic jaws are flush with the outside of the circumference. This assures a clamping stroke reserve.

4. Clamp the clamping ring. Observe the position of the basic jaws.



DANGER

Serious injuries caused by projectile workpieces, ejected when materials break!

- Always comply with the maximum clamping contour.



INFORMATION

For maximum repeat accuracy, jaws must be machined in the clamping device under clamping pressure.

5. Machine the jaws.
6. Check the position of the basic jaws as well as the reserve stroke by means of a clamping trial. [see »Jaw position« chapter].

7.9 Automatic mode

In contrast to manual loading of the workpiece, the display pin can only be checked during installation.

In Automatic mode, to ensure that the display pin is not actuated, a possible path to sense the limit positions should be extended to include sensing of reserve stroke. The following chapters describe this in greater detail.

7.9.1 Machine tool with travel measuring system

The position for the sensing of reserve stroke must be located before the mechanical actuator mechanism to balance out tolerances. The sensing of reserve stroke must be set to $+0.7\text{mm}$ before the axial limit stop of the installed chuck. Preferably, a machine tool with a travel measuring system on the clamping cylinder is used.

7.9.2 Machine tool without travel measuring system, with limit switch

A sample workpiece with an appropriately machined set-up diameter can be used to set machine tools without a travel measuring system on the clamping cylinder.

For this, the set-up diameter is clamped in the desired clamping stage and the limit position switch is adjusted until the limit position switch reports that the end-stop has been reached.

When this is the case, the limit position is set up correctly.

Procedure

1. Depending on the diameter of the sample workpiece, select the next smallest clamping stage at which the clamping diameter and its tolerances can be covered.
2. Turn the smaller diameter of this stipulated clamping range off the sample workpiece. The tolerance for the diameter is $0/-0.1\text{ mm}$.
3. Install the jaws in the specified tooth position. Tooth position 0 represents the smallest spline setting on the clamping device, tooth position 2 means an offset outwards of 2 teeth.
4. To clamp the sample workpiece, reduce the supply pressure to $\frac{1}{3}$ of the maximum clamping force.
5. Clamp the sample workpiece to the turned diameter. This corresponds to the smallest setting for the clamping device. The display pin must not protrude.
6. Setting up the limit position switch. In precisely this position, the switch must report the stop signal to the machine spindle.

Example

Sample workpiece data

- Clamping diameter $60^{+0.6}_{0}mm$

Jaw module

- Jaw module size 215 for basic clamping device size 65
- Jaws: Plaster jaws

Setting the limit switches

1. Selection of the next lower clamping stage [see »Selection of jaws« chapter]:
 - Clamping stage 52
 - Tooth position 3
 - Plaster jaw #4
2. Turn a diameter of $58.06^{0}_{-0.1}mm$ on sample workpiece
3. Install plaster jaw #4 in tooth position 3 [see »Installation of the clamping element« chapter].
4. Clamp the sample workpiece to the turned diameter $58.06^{0}_{-0.1}mm$ with $\frac{1}{3}$ of maximum clamping force.
5. Check the display pin. This must not protrude.
6. Move the limit switch from maximum position towards the indexing cam until the cam reports the stop signal to the machine spindle. Secure the limit switch in this position.

8 Commissioning

For commissioning purposes, set the operating pressure to the permitted, established machining value.

The machine tool must not start up until full operating pressure has built up.

8.1 Commissioning safety



DANGER

Serious injuries caused by workpieces being ejected centrifugally or dropping out if clamping force is insufficient!

- Workpiece blanks must not be outside the clamping width diameter.
- Prior to commissioning, set the actuation force to the permitted, established machining value.
- Clamping of the workpiece must not be outside the defined limits [see »Limits of use« chapter].
- Check the clamping force at regular intervals and correct if necessary.



WARNING

Serious injuries can be caused if the machine tool starts up accidentally!

- Prior to commissioning, close all safety doors or hoods on the machine tool.



WARNING

Serious injuries caused by tools and items of test equipment being ejected centrifugally!

- Prior to commissioning, ensure that all tools and items of test equipment are removed from the working area of the machine.



NOTE

Serious damage to materials / the product caused by workpieces being ejected centrifugally or dropping out if clamping force is insufficient!

- Workpiece blanks must not be outside the clamping width diameter.
- Prior to commissioning, set the actuation force to the permitted, established machining value.
- Clamping of the workpiece must not be outside the defined limits [see »Limits of use« chapter].
- Check the clamping force at regular intervals and correct if necessary.



NOTE

Damage to components caused by cooling lubricants with sufficient levels of corrosion inhibitor!

- The components made of steel materials must be protected before the usual oxidation process.
- Only ever use cooling lubricants with sufficient levels of corrosion inhibitor.



NOTE

Damage to materials caused by contaminated / unprocessed cooling lubricants!

- For the product to function properly, in particular for internal flushing with cooling lubricants and/or when using tools with internal flushing, ensure that the cooling lubricant is cleaned / processed, and that it contains no particles measuring >100 microns [filtered with a mesh width of 100 microns].



NOTE

Damage to seals caused by using the wrong coolant lubricants!

- To clean the product, never use a cooling lubricant that attacks and damages the sealing elements installed. Those installed sealing elements can be made of NBR, Viton and PUR materials.
- Never use cooling lubricants that contain ester or a polar solvent.

8.2 Jaw position

The position of the basic jaw relative to the external diameter of the product provides information about the position in which the clamping device is located.

The display pin provides information about the permitted clamping of a workpiece [see »Permitted clamping of the workpiece« chapter].



INFORMATION

The offset values may differ slightly due to individual tolerances.

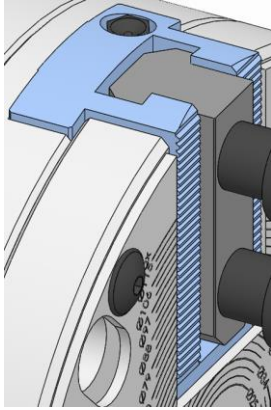
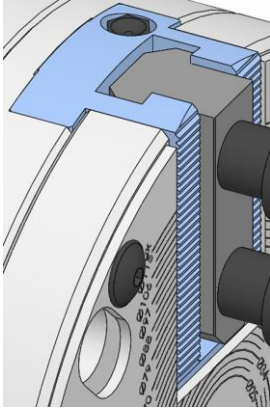
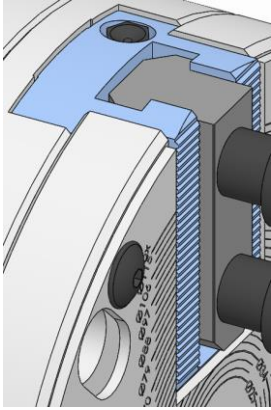
| Release setting | Clamping position | Clamping reserve |
|---|--|--|
|  |  |  |
| In release position, the basic jaw protrudes by the opening stroke of each jaw [see »General information« chapter]. | In the ideal clamping position, the basic jaw is flush with the outer diameter of the product. | In terms of clamping reserve, the basic jaw protrudes by the reserve stroke of each jaw [see »General information« chapter]. |
| | There is a display pin in the product | Display pin protrudes |

Table 44: Jaw position

8.3 Checking the total stroke



WARNING

Serious crushing injuries caused by moving parts when stroke positions are being tested!

- Set the machine into set-up mode.
- Reduce the operating pressure to a minimum.
- Never reach into moving parts.
- Pay attention to the gap dimensions of moving parts.

Prior to commissioning, check the complete stroke to ensure that there is sufficient reserve stroke and opening stroke.

For this, the same measurement of the moving part must be performed at fixed points in release position and in clamping reserve position.

Then deduct the value obtained in the clamping reserve position from the value obtained from the release position. This figure must then be equal to or greater than the nominal total stroke.

For the radial nominal total stroke, the values of radial clamping reserve and radial opening stroke must be added together [see »General information« chapter].

8.4 Tests



NOTE

Serious damage to, or destruction of, the machine tool and the workpiece caused by damaged, incomplete or incorrectly installed products!

- Only install undamaged and complete products properly.
- If in doubt, contact the manufacturer.

Assure the following points before every installation and/or before every time the products are put into service:

- The products used are undamaged.
- All fixing screws are present on the products, and are tightened to the correct tightening torque.
- Serrations and grooved profiles must not be excessively rounded because this would prevent the friction coefficient from being achieved.
- None of the edges and races are chipped or show any signs of wear.
- The speed set on the machine tool must not exceed the maximum speed of the product. Always take the lowest value of all maximum speeds for combined products indicated.
- Pay attention to the level of actuating force established to enable the workpiece to be clamped with sufficient clamping force.
- Do not exceed the maximum actuating force indicated on the product. Always take the lowest value of all actuating forces indicated for combined products.
- All installation tools are removed from the machining area.
- Clamping device and workpiece are compatible - check clamping diameter on a regular basis.
- Conduct a clamping force measurement.

8.5 Workpiece



DANGER

Serious injuries caused by parts being ejected centrifugally if level of workpiece clamping is insufficient!

- Never utilize the full clamping reserve.
- Do not exceed the permitted maximum clamping reserve stroke.
- The remaining clamping reserve must always be adapted to suit the workpiece material provided and its possible distortions.



DANGER

Serious injuries caused by parts being ejected centrifugally when workpiece is not clamped at permitted level!

- Pay attention to the permitted clamping of the workpiece [see »Permitted clamping of the workpiece« chapter].



WARNING

Crushing injuries to hands / fingers is workpiece is installed incorrectly!

- Do not place hands / fingers between workpiece and clamping device.
- Never reach into the clamping area.



CAUTION

Burns caused by high workpiece temperature!

- Give preference to automatic loading.
- Also wear the following items of personal protective equipment, in addition to the basic equipment:



8.6 Procedure after a collision

In the event of a collision, the product and its components must be checked for cracks and damage before being used again.

For this, remove the product from the machine [see »Removal of the product« chapter] and dismantle it [for level of disassembly, see »Cleaning« chapter].

9 Activities after end of production

1. Switch off machine tool and secure it to prevent it from being switched back on.
2. Open the safety door / hood.



WARNING

Eye injuries and cuts caused by failure to wear protective clothing during cleaning operation!

- Never use compressed air to clean the product.
- Also wear the following items of personal protective equipment, in addition to the basic equipment:



3. Clean the product of swarf and production residue with a soft, lint-free cloth and apply a light coating of oil.
4. Close the safety door / hood.

10 Removal

If a break in production occurs that lasts for more than three days, the product must be removed and stored safely in accordance with the manufacturer's stipulations [see »Transport, packaging, storage« chapter].

10.1 Safe removal



WARNING

Serious injuries caused by unskilled staff during installation / removal!

- Installation and removal must be performed by skilled staff from the relevant specialist field.



WARNING

Serious injuries can be caused if the machine tool starts up accidentally!

- Set the machine tool into set-up mode.
- Remove all tools, auxiliary equipment and items of test equipment immediately from the working area of the machine.
- Remove all lifting gear from the product and from the working area of the machine.



WARNING

Serious injuries caused by the escape of media under high pressure!

- Shut down media delivery during installation and removal.
- Relieve any pressure trapped in the system.
- Shut down the system.



WARNING

Serious crushing injuries and breakages caused by falling parts during incorrect installation or removal!

- Ensure that the product cannot roll away or fall.
- If necessary, use an appropriate mounting aid for installation or removal on a vertically suspended machine spindle.



WARNING

Serious crushing injuries caused by improper machine movement during installation or removal!

- Machine movements are only permitted in set-up mode during installation and removal.
- Never reach into a gap.
- Pay attention to the gap dimensions of moving parts.



WARNING

Serious head injuries caused by bending into the working area of the machine!

- Only ever bend into the working area of the machine if there are no cutting tools or sharp objects in it, or if these are covered.
- Never move body parts under parts in the working area of the machine with the potential to drop down.
- Depending on weight, use an appropriate mounting aid for installation or installing on a vertically suspended machine spindle.



WARNING

High level of physical strain due to the weight of the product or of its components if not transported properly!

- From a weight of 10 kg, use appropriate transport equipment, lifting gear and lifting tackle.



CAUTION

Serious cut injuries caused by sharp-edged changing parts and/or clamping elements!

- All installation / removal of changing parts and clamping elements must be performed by skilled staff from the relevant specialist field.



INFORMATION

The product is equipped with a safety function that only enables the installation wrench from being installed or removed while the coupling sliders are extended.



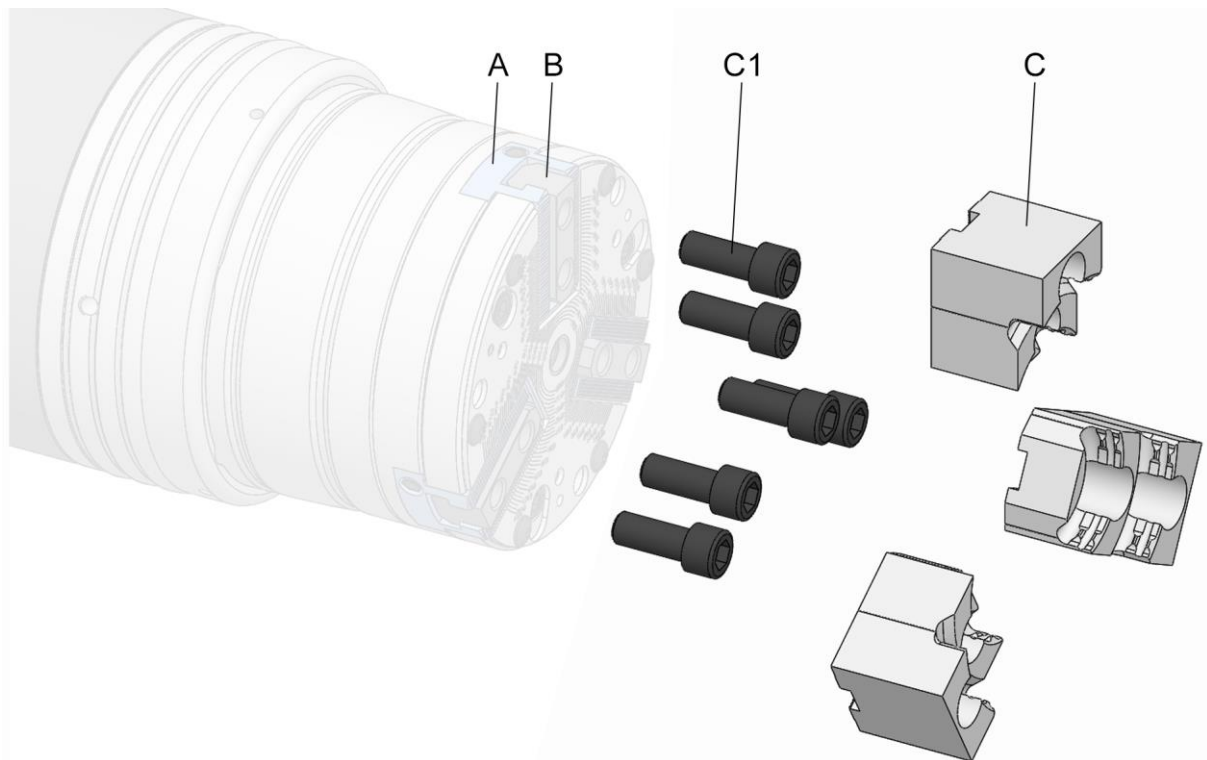
INFORMATION

If necessary, use any forcing / extraction threads in the components of the product, changing parts or clamping elements.

10.2 Preparing the machine for removal

1. Set the machine into set-up mode.
2. Reduce the operating pressure to a minimum.
3. Remove cutting tools and/or sharp objects from the working area of the machine, or cover them.
4. Remove operating and auxiliary materials as well as remaining processing materials and dispose of them in an environmentally responsible manner.

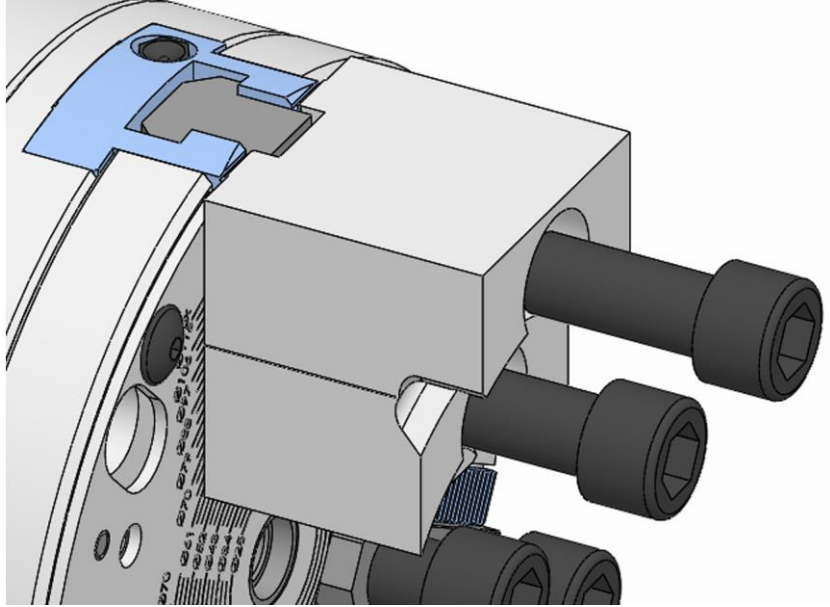
10.3 Removal of the clamping element



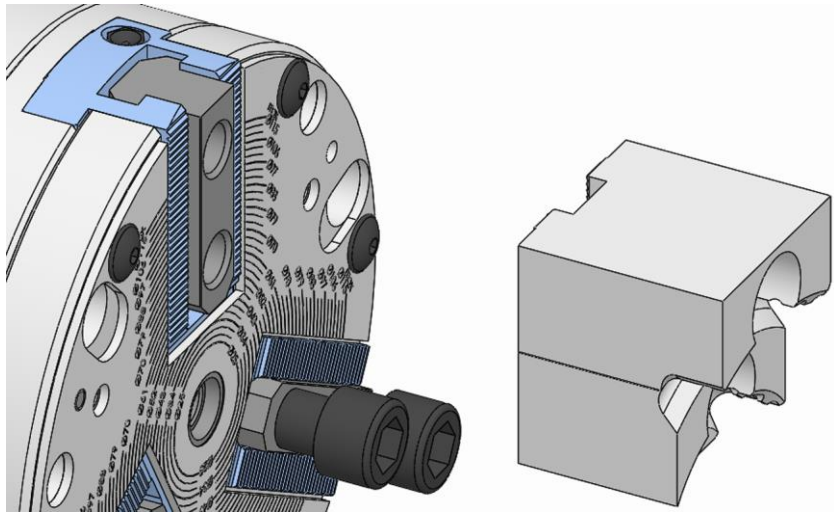
- A Basic chuck
- B Sliding block
- C Jaw [clamping element]
- C1 Jaw fixing screws

3-jaw module Removal

1. As described in the »Preparing the machine for removal« chapter, prepare for the following steps.
2. Move the clamping device into release position.

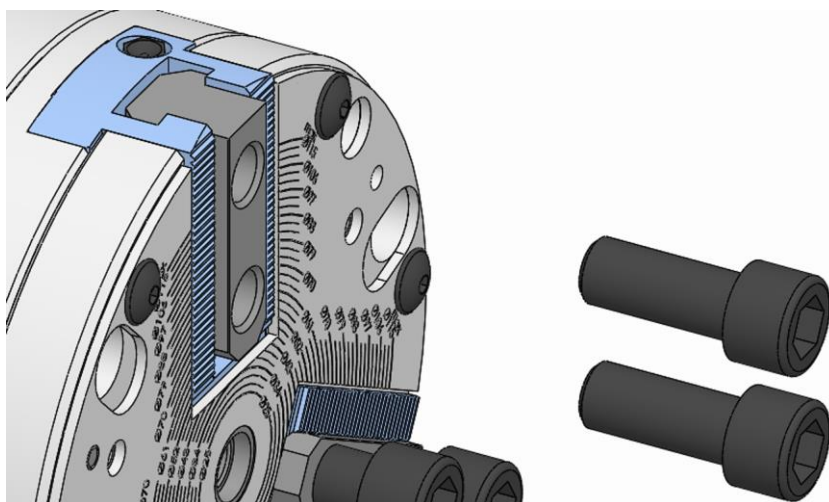


3. Unfasten and remove the fixing screws on the jaw.



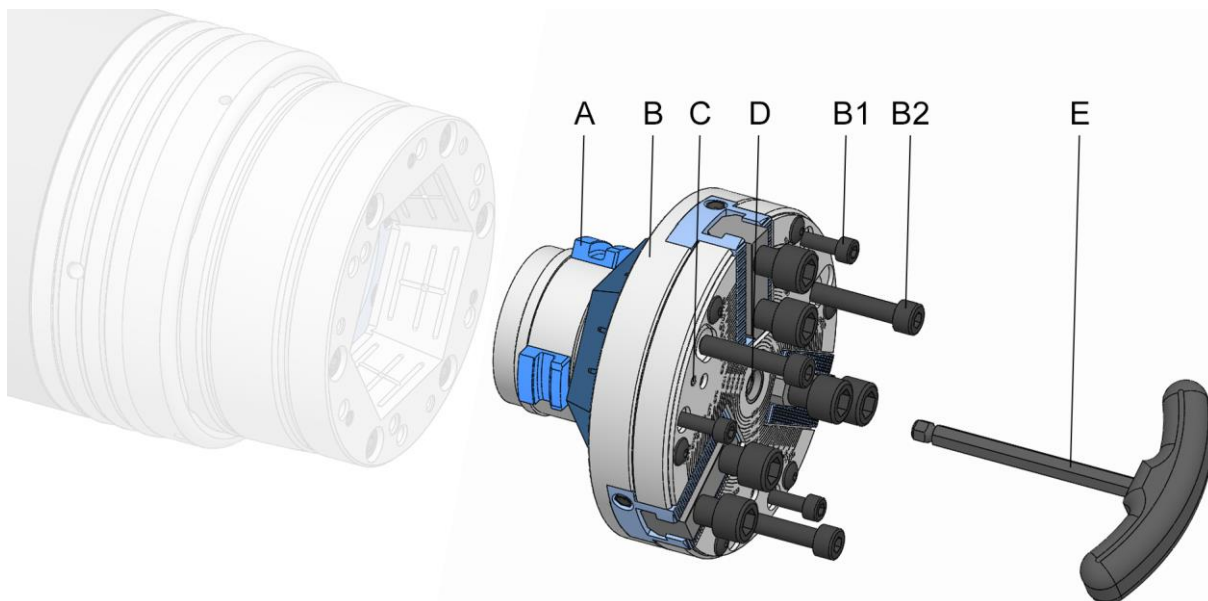
4. Remove the jaw from the slot nut on the product.

3-jaw module Removal



5. Screw in the clamping device fixing screws and tighten them.
6. Remove the other jaws as described.

10.4 Removal of the product



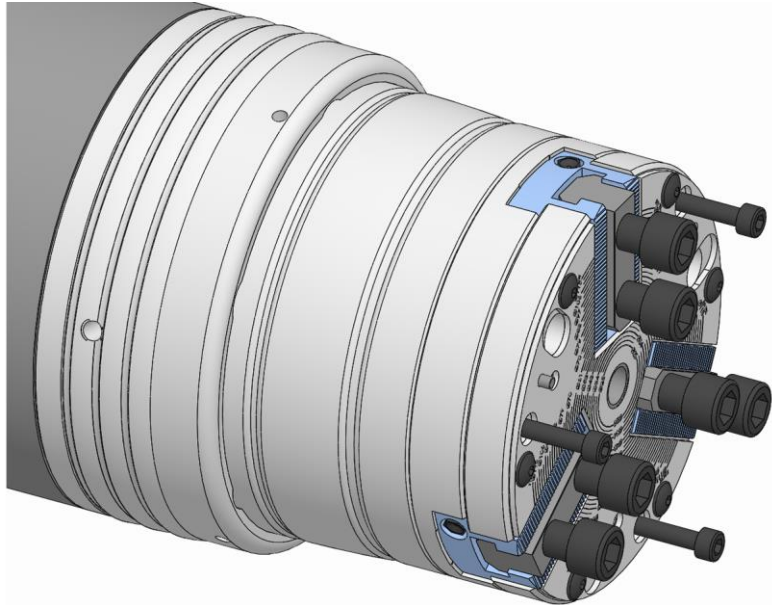
- A Coupling slider
- B Adaptation clamping device
- B1 Fixing screws, adaptation clamping device 1
- B2 Fixing screws, adaptation clamping device 2
- C Display pin
- D Locking pin
- E Assembly key

Special aids needed:

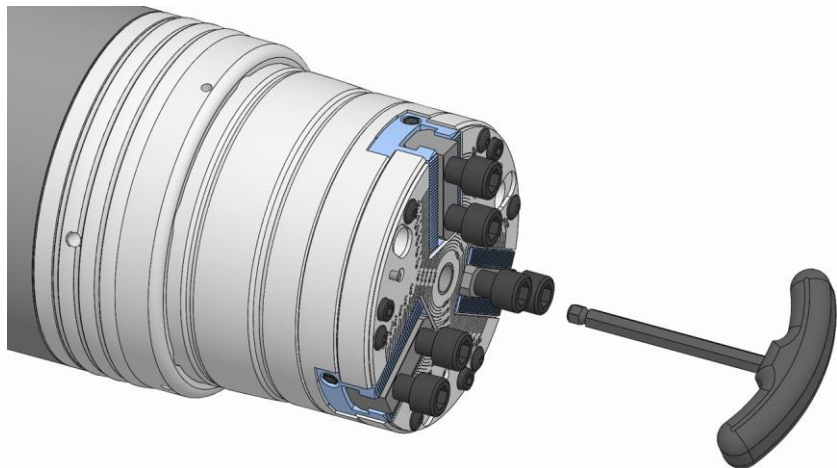
- Assembly key
1. As described in the »Preparing the machine for removal« chapter, prepare for the following steps.

10.4.1 Removal of the adaptation clamping device

1. Attach any lifting gear that may be required.
2. If necessary, fit the mounting aid onto a vertically suspended spindle.
3. Move the basic clamping device into its clamping reserve position.

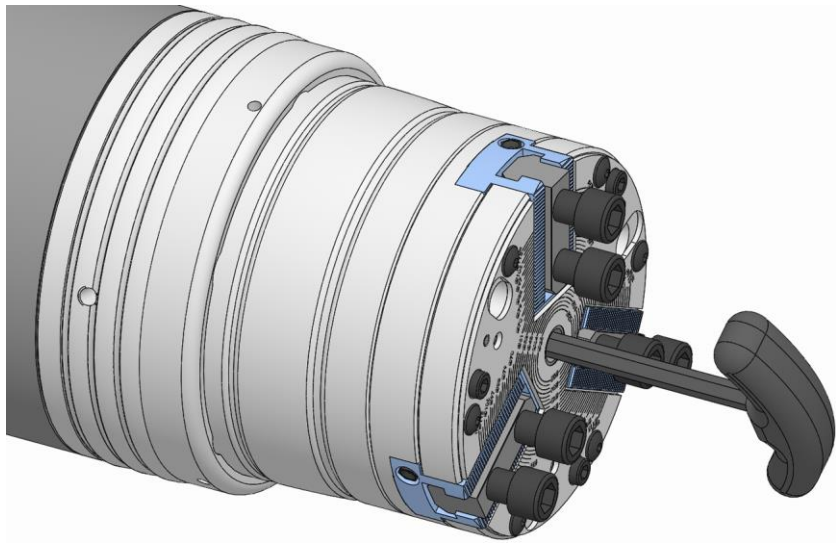


4. Unfasten and remove the fixing screws on the adaptation clamping device.



5. Insert the installation wrench in the locking pin of the product until it engages audibly.

3-jaw module Removal

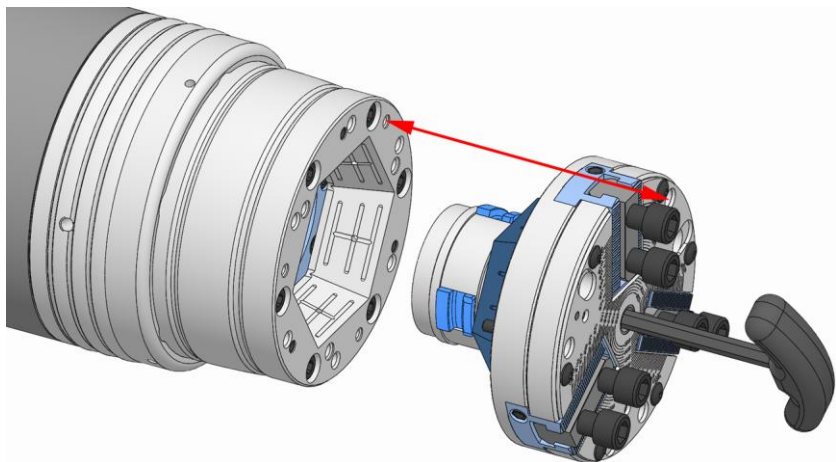


6. Turn the locking pin fully home counter-clockwise using the installation wrench.



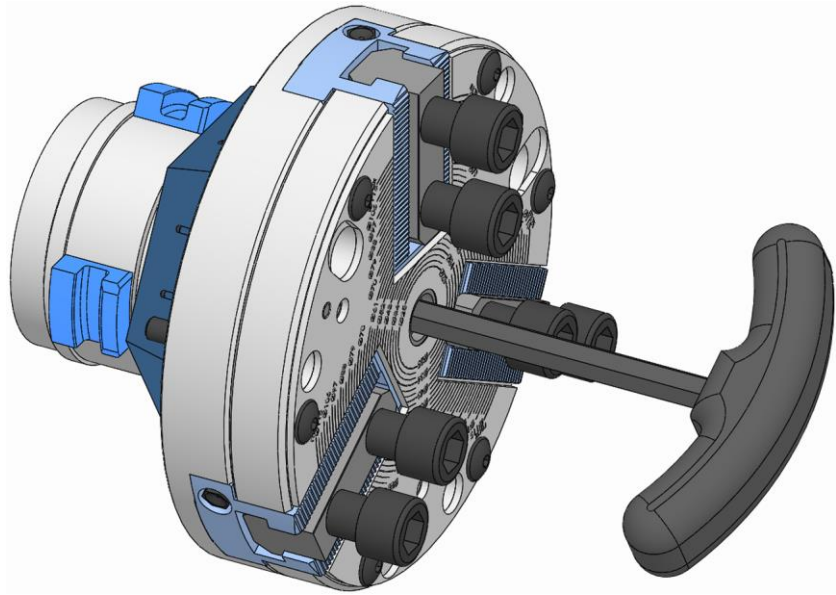
INFORMATION

The coupling sliders are retracted. The assembly key cannot be pulled off.

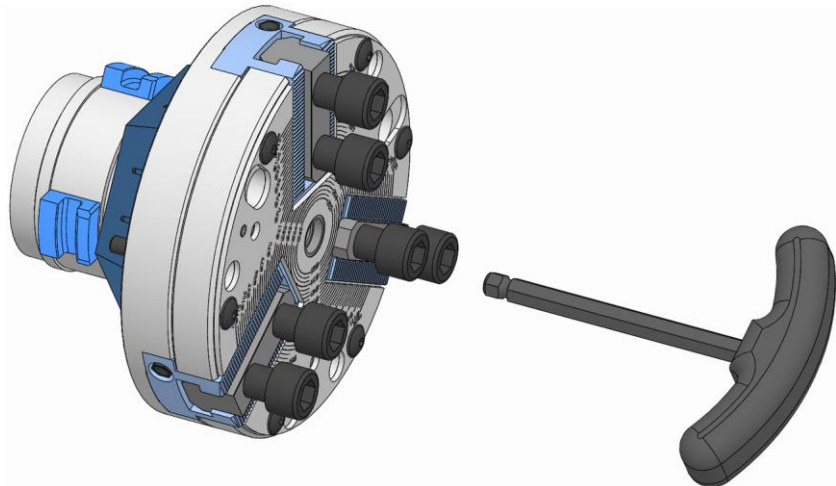


7. Remove the adaptation clamping device from the basic clamping device.

3-jaw module Removal



8. Turn the locking pin fully home counter-clockwise using the installation wrench.



9. Remove the installation wrench.

11 Maintenance

11.1 Maintenance safety



WARNING

Serious injuries caused by parts being ejected centrifugally after a loss of clamping power!

- Maintain the maintenance and cleaning intervals of the product at all times.
- It is essential to check the maintenance status of the product at regular intervals with a structural clamping force measurement.



CAUTION

Health risks caused by incorrect handling of cleaning agents!

- Pay attention to hazard specifications and the safety data sheet of the manufacturer.



INFORMATION

If necessary, use any forcing / extraction threads in the components of the product, changing parts or clamping elements.

11.2 Maintenance schedule

The following sections describe the maintenance work needed to ensure optimum and fault-free operation.

If increased levels of wear are detected during regular checks, shorten the maintenance intervals to reflect the actual rate at which signs of wear appear.

Contact the manufacturer for questions relating to maintenance work and maintenance intervals [see »Contact« chapter].

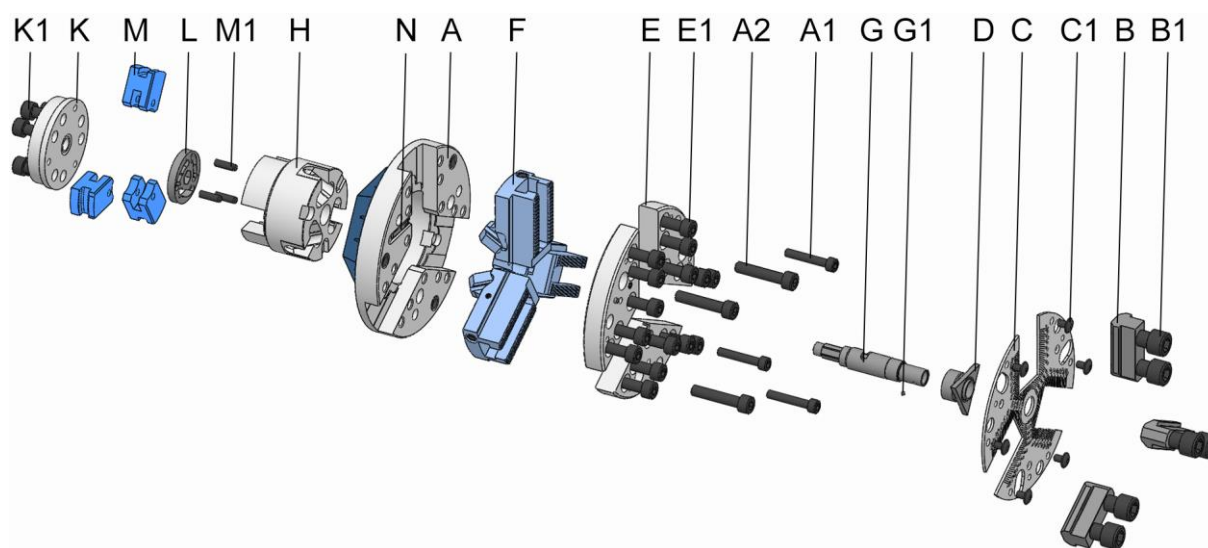
| Interval | Maintenance work |
|--------------------------------------|--|
| daily | Visual inspection of clamping and mating surfaces for signs of wear, nicks and cracks [see »Visual inspection« chapter] |
| | Visual inspection of the rubber on the CENTREX ring and on the locating taper for wearing points, nicks and cracks [see »Visual inspection« chapter] |
| | Complete cleaning if heavily soiled [see »Cleaning« chapter] |
| | Check the total stroke [see »Checking the total stroke« chapter] |
| | Conduct a structural clamping force measurement |
| weekly or after 40- operating hours* | Lubricate the product [see »Lubricating the product« chapter] |

| Interval | Maintenance work |
|--|--|
| six-monthly or after 3000 operating hours* | Completely clean the product [see »Cleaning« chapter] Lubricate the product [see »Lubricating the product« chapter] |
| with storage | See »Storage« chapter |

* depending upon which stipulation is achieved first

Table 45: Maintenance table

11.3 Cleaning



- A Flange
- A1 Fixing screws on flange 1
- A2 Fixing screws on flange 2
- B Sliding block
- B1 Sliding block fixing screws [jaw]
- C Scale plate
- C1 Scale plate fixing screws
- D Stop piece
- E Disc
- E1 Disc fixing screws
- F Base chuck
- G Locking pin
- G1 Detent taper on locking pin
- H Draw piece
- K Coupling cover
- K1 Coupling cover fixing screws
- L Cam disc
- M Coupling slider
- M1 Coupling slider pin
- N Lever



WARNING

Eye injuries and cuts caused by failure to wear protective clothing during cleaning operation!

- Never use compressed air to clean the product.
- Also wear the following items of personal protective equipment, in addition to the basic equipment:



NOTE

Damage to seals caused by the wrong solvent!

- To clean the product, never use a solvent that attacks and damages the sealing elements installed. Those installed sealing elements can be made of NBR, Viton and PUR materials.
- To clean the product, never use a solvent that contains ester, nor a polar solvent.



NOTE

Damage to materials caused by incorrect installation of sealing elements!

- Replace missing or damaged sealing elements.
- Ensure that the sealing elements do not fall out or get damaged during installation / removal, and apply a thin coat of grease if necessary.

Cleanliness of the relevant limit stop and guide diameter are essential for achieving axial and face run-out tolerances.

1. Remove the clamping element from the product [see »Removal of the clamping element« chapter].
2. Remove the product from the basic clamping device [see »Removal of the adaptation clamping device« chapter].



WARNING

Serious injuries caused by imbalance resulting from incorrect reassembly!

- The product components must be installed back in the same position.
- If necessary, mark out the relative positions of components prior to disassembly.



NOTE

Damage to materials caused by incorrect Removal of the product!

- More extensive disassembly than shown on the exploded drawing is prohibited.



INFORMATION

During removal of the product, take care not to lose any components.

3. Dismantle the product as shown on the exploded drawing. Pay attention to the following during disassembly:
 - Do not lose the detent ball when removing the stop part and/or the locking pin.
 - The guide grooves for the basic jaws must not be swapped over.
 - To remove the locking pin, turn it firmly home in a clockwise direction.
 - Pay attention to the position of cam disc and coupling slider.
 - Do not remove the lever. Fold up carefully for cleaning purposes.
4. Clean all oil and grease residues off all components with an ester-free, non-polar, soft, lint-free cloth and check for visible signs of damage.
5. Assemble the product as shown on the exploded drawing. Pay attention to the following during assembly:
 - Replace worn or damaged fixing screws.
 - Tighten all fixing screws to the specified tightening torque [see nomenclature and/or »Screw tightening torques« chapter]. When tightening the screws, do so evenly to prevent any distortion under load.
 - Only apply lubricant to the mechanical mating surfaces. Pay attention to notes about lubricants [see »Use of lubricants« chapter].
 - Avoid too much lubricant on the locating face because this can cause face run-out errors.

- Apply grease to the sealing elements [for example O-rings, rectangular rings] and sealing surfaces. Pay attention to notes about greases [see »Use of lubricants« chapter].
 - After cleaning, fold the lever back down carefully.
 - Install the coupling slider and the cam disc in the correct position.
 - The coupling sliders must be located at the ends of the grooves on the cam disc which are closest to the outer diameter of the cam disc.
 - Install the locking pin. Ensure that the cam disc is not twisted, and that the coupling sliders do not move.
 - Turn the locking pin fully home counter-clockwise. The cam disc must rotate at the same time, and the coupling sliders must retract.
 - Install the basic jaws in the guide grooves without swapping sides.
 - The disc with the display pin must be arranged facing the lever.
 - When a disc is inserted, place a 0.02 mm feeler gauge strip between the disc and the corresponding pair of basic jaws. Press the discs gently against the basic jaws. Screw in the disc fixing screws for the disc and tighten them gently. Remove the feeler gauge strip. Tighten the disc fixing screws to the specified tightening torque [see »Screw tightening torques« chapter].
 - To check the ease of movement of the basic jaws, pull the draw piece then press it back into place. The force applied must not exceed 60 N.
 - Secure the locking pin detent ball in the locking pin with lubricant.
 - Install the stop component with the rubber lying over the detent ball of the locking pin.
 - After installing the scale plate, the display pin must be flush with the scale plate.
 - Check the display pin function. The display pin must protrude in clamping reserve position [see »Jaw position« chapter].
6. Lubricate the product [see »Lubricating the product« chapter].

11.4 Visual inspection

Perform a daily visual inspection of the product to identify any damage to the product at an early stage.

Check the product for cracks and damage, in particular on the clamping and end-stop surfaces.

The rubber on the CENTREX ring also needs to be examined for cracks and signs of damage.

A check is also required to ensure that all fixing screws are tightened down.

If damage is detected, the relevant components must be exchanged immediately for genuine spare parts from the manufacturer.

Complete cleaning of the product is required if heavily soiled [see »Cleaning« chapter].

11.5 Lubricating the product



DANGER

Serious injuries caused by workpiece being ejected centrifugally due to insufficient lubrication of the product!

- Never drop below the lower limit value for clamping force [see »Clamping force diagram« chapter].
- Always comply with the maintenance intervals [see »Maintenance schedule« chapter].

Lubrication takes place every time the system is cleaned, maintained or assembled, and also when required.

The product is equipped with grease nipples.



WARNING

Collision impact and cut injuries can be caused by slipping when applying grease with a piston-actuated grease gun!

- Ensure that the piston-actuated grease gun is positioned correctly.

1. With the help of the piston-action grease gun [not included in the scope of delivery], squeeze grease into the grease nipple until no more grease can be injected.
2. At all lubrication points, remove escaping, consumed or surplus grease, and dispose of it in accordance with locally enforceable legislative provisions.
3. After lubrication, perform the entire stroke several times.

11.6 Use of lubricants

To achieve ultimate performance from the products, use the specified lubricants.

Only use grease that complies with the fundamental requirements governing adhesion, pressure resistance and solubility in coolants. Furthermore, there must be no particles of dirt in the grease because these cause an operational malfunction if they come between two interference fit surfaces. For this, the following lubricants are recommended:

Special grease GL 261

[see the HAINBUCH product catalogue]



NOTE

Malfunction of the product due to a combination of different greases!

- Never mix different greases with one another.
- Clean the product completely before using a different grease.

12 Disposal

If no agreement exists for return or disposal, send dismantled components off for recycling.



NOTE

Substantial damage to the environment can result from incorrect disposal of environmentally hazardous substances!

- Lubricants, auxiliary materials and operating fluids are governed by legislation for the processing of special-category waste: All disposal to be performed by authorized waste disposal specialists.

Catch exchanged oils and greases in suitable containers and dispose of them in accordance with applicable local provisions.

The local municipal authority or specialist waste disposal companies can provide information about environmentally compliant disposal.

13 Faults

The following chapter describes possible causes for faults, and the work involved in remedial action.

If multiple faults occur, shorten the maintenance intervals in accordance with actual load levels.

Contact the manufacturer if faults occur that cannot be remedied by following these instructions [see »Contact« chapter].

13.1 Procedure with faults

This applies in all cases:

1. With faults that constitute an immediate danger to people or capital equipment, press the Emergency Stop button on the machine tool immediately.
2. Establish the cause of the fault.
3. If troubleshooting requires work to be conducted in the danger area, switch the machine tool into set-up mode.
4. Notify the person on location of the fault immediately.
5. Depending on the type of fault, get it remedied by authorized and appropriately skilled specialists.



INFORMATION

The troubleshooting table in the following section provides information about who is authorized to remedy a given fault.

6. In the event of a fault not caused by the product, the fault may be caused by something close to the machine tool. For this, refer to the operating instructions of the machine tool.

13.2 Fault table

| Fault | Possible cause | Remedial action | Remedied by |
|---|---|--|--------------------|
| Defective axial strokes in the adaptation clamping device | Dirt in the parts in the power flow | Remove and clean the clamping element and, if necessary, remove, dismantle and clean the adaptation clamping device | Skilled specialist |
| | Incorrect coupling position | Check the coupling position and align with the adaptation clamping device | |
| Adaptation clamping element cannot be swapped in or out | Defective axial strokes in the basic clamping device | See operating instructions for the basic clamping device | Skilled specialist |
| | Actuating key cannot be installed | When removed, check the condition of the locking pin by rotating it clockwise with a suitable tool until the coupling sliders are fully extended | |
| Clamping force is too weak | Workpiece outside the clamping width diameter | Use a suitable clamping element | Skilled specialist |
| | Axial actuating force on drawtube too weak | Check machine setting and correct if necessary | |
| Clamping force is too high | Axial actuating force on drawtube too high | Check machine setting and correct if necessary | Skilled specialist |
| Geometry deviation on the workpiece | Axial run-out error on the adaptation clamping device | Check axial run-out of the adaptation clamping device and correct if necessary | Skilled specialist |
| | Face run-out error on the adaptation clamping device | Check face run-out of the adaptation clamping device and clean the mating surfaces and locating taper if necessary | |
| | Clamping elements installed incorrectly | Check the gap dimension and correct if necessary | |
| | Dirty locating area on the clamping element | Remove the clamping element; clean the coupling area and the clamping element | |
| | Geometry error on the workpiece due to incorrect type of clamping element | Use a suitable clamping element | |
| | Elastic distortion | Reduce the clamping force to the level applicable for the adaptation clamping device and the workpiece | |

| Fault | Possible cause | Remedial action | Remedied by |
|--------------------------------------|--|--|--------------------|
| | | Check the workpiece material | |
| Indentations on the clamping surface | Clamping force is too high | Reduce the clamping force to the level applicable for the adaptation clamping device and the workpiece | |
| | Incorrect type of clamping element | Use a suitable clamping element | |
| | Dirty clamping element | Clean the clamping element | Skilled specialist |
| | Damaged clamping element | Replace the clamping element | |
| | Dimensional difference between workpiece diameter and clamping elements is too great | Use clamping element with a suitable clamping diameter | |

Table 46: Fault table

13.3 Commissioning after a fault has been remedied

After the fault has been remedied, perform the following steps to recommission it:

1. Reset the emergency stop equipment.
2. Acknowledge the fault on the control unit of the machine tool.
3. Ensure that no-one is in the danger area.
4. Start the machine tool.

14 Annex

14.1 Contact

The following hotlines are available to you for orders, schedule tracking and emergencies.

Order hotline

Ordered quickly, supplied swiftly. Just phone:

+49 7144. 907-333

Tracking hotline

Current status of your order? Just call:

+49 7144. 907-222

24 hour emergency phone line

Has a system crash occurred, or some other technical emergency?

Our experts are there for you around the clock:

+49 7144. 907-444

For advice or help, you can contact the sales partners and service staff listed in www.hainbuch.com.

14.2 Manufacturer certification

Manufacturer certification is supplied with the product and with this manual.

Index directory

A

| | |
|-----------------------------|----|
| Accessories, required | |
| Basic clamping device | 42 |
| Jaws | 42 |

| | |
|---------------------------|----|
| Accessories, special aids | |
| Assembly wrench..... | 42 |

| | |
|----------------------|-----|
| Automatic mode | 124 |
|----------------------|-----|

B

| | |
|------------------------|----|
| Balancing quality..... | 32 |
|------------------------|----|

| | |
|-------------------------|----|
| Brief description | 41 |
|-------------------------|----|

C

| | |
|---------------------------------|-----|
| Checking the total stroke | 128 |
|---------------------------------|-----|

| | |
|---------------|-----|
| Cleaning..... | 141 |
|---------------|-----|

| | |
|-----------------|----|
| Copyright | 10 |
|-----------------|----|

D

| | |
|---------------------------|---|
| Definition of terms | 9 |
|---------------------------|---|

E

| | |
|------------------------|-----|
| End of production..... | 131 |
|------------------------|-----|

| | |
|--------------------------------|----|
| Environmental protection | 24 |
|--------------------------------|----|

F

| | |
|-------------------|-----|
| Fault table | 149 |
|-------------------|-----|

| | |
|--------------|-----|
| Faults | 148 |
|--------------|-----|

| | |
|--|-----|
| Function check of the coupling range | 110 |
|--|-----|

H

| | |
|---------------|----|
| Hazards | 18 |
|---------------|----|

I

| | |
|-----------------------|-----|
| Installation | |
| Clamping element..... | 116 |

| | |
|--|-----|
| Preparation of the basic clamping device | 109 |
|--|-----|

| | |
|---------------------------------|-----|
| Preparation of the machine..... | 108 |
|---------------------------------|-----|

| | |
|----------------------------------|-----|
| Preparation of the product | 112 |
|----------------------------------|-----|

| | |
|---------------|-----|
| Product | 109 |
|---------------|-----|

| | |
|---------------------------|-----|
| Installation safety | 105 |
|---------------------------|-----|

| | |
|--------------------|----|
| Intended use | 15 |
|--------------------|----|

K

| | |
|---------------------|---|
| Key to symbols..... | 8 |
|---------------------|---|

L

| | |
|--------------|----|
| Layout | 41 |
|--------------|----|

| | |
|-----------------|----|
| Liability | 10 |
|-----------------|----|

| | |
|--------------------|----|
| Limits of use..... | 85 |
|--------------------|----|

| | |
|------------------|---------|
| Lubricants | 24, 146 |
|------------------|---------|

M

| | |
|----------------------------|-----|
| Maintenance schedule | 140 |
|----------------------------|-----|

| | |
|-------------|----|
| Misuse..... | 16 |
|-------------|----|

O

| | |
|----------------------------|----|
| Operating conditions | 40 |
|----------------------------|----|

P

| | |
|-----------------|-----|
| Packaging | 103 |
|-----------------|-----|

| | |
|--------------------------|----|
| Performance values | 31 |
|--------------------------|----|

| | |
|------------------------------|----|
| Personnel requirements | 14 |
|------------------------------|----|

| | |
|-------------------|----|
| Electricians..... | 15 |
|-------------------|----|

| | |
|-----------------------------|----|
| Hydraulics specialist | 15 |
|-----------------------------|----|

| | |
|-----------------------------|----|
| Pneumatics specialist | 15 |
|-----------------------------|----|

| | |
|-------------------------|----|
| Skilled specialist..... | 14 |
|-------------------------|----|

| | |
|----------------|----|
| Trainees | 15 |
|----------------|----|

| | |
|--------------------|-----|
| Preservation | 104 |
|--------------------|-----|

| | |
|----------------------|--|
| Protective equipment | |
|----------------------|--|

| | |
|----------------|----|
| Hair net | 18 |
|----------------|----|

| | |
|----------------|----|
| Hard hat | 18 |
|----------------|----|

| | |
|------------------------|----|
| Protective gloves..... | 18 |
|------------------------|----|

| | |
|--------------------------|----|
| Protective goggles | 18 |
|--------------------------|----|

| | |
|-----------------------|----|
| Safety footwear | 18 |
|-----------------------|----|

| | |
|-------------------------|----|
| Workplace clothing..... | 17 |
|-------------------------|----|

R

| | |
|---------|--|
| Removal | |
|---------|--|

| | |
|-----------------------|-----|
| Clamping element..... | 134 |
|-----------------------|-----|

| | |
|----------------------------------|-----|
| Preparation of the machine | 134 |
|----------------------------------|-----|

| | |
|--------------|-----|
| Product..... | 136 |
|--------------|-----|

S

| | |
|--------|--|
| Safety | |
|--------|--|

| | |
|---------------------|-----|
| Commissioning | 126 |
|---------------------|-----|

| | |
|---------------|----|
| General | 13 |
|---------------|----|

| | |
|-------------------|-----|
| Maintenance | 140 |
|-------------------|-----|

| | |
|--------------|-----|
| Removal..... | 132 |
|--------------|-----|

| | |
|-----------------------------------|-----|
| Transport, packaging, storage ... | 101 |
|-----------------------------------|-----|

| | |
|------------------------|----|
| Scope of delivery..... | 10 |
|------------------------|----|

| | |
|--------------------------|--|
| Screw tightening torques | |
|--------------------------|--|

| | |
|--------------------------|-----|
| Aluminum components..... | 108 |
|--------------------------|-----|

| | |
|------------------------------|-----|
| Metric control threads | 108 |
|------------------------------|-----|

| | |
|------------------|----|
| Spare parts..... | 11 |
|------------------|----|

| | |
|------------|----|
| Speed..... | 33 |
|------------|----|

| | |
|--------------|-----|
| Storage..... | 104 |
|--------------|-----|

| | |
|--------------------------------|-----|
| Symbols on the packaging | 102 |
|--------------------------------|-----|

T

| | |
|--------------------------------|-----|
| Technical data..... | 25 |
| Tests | 129 |
| Transport inspection | 102 |
| Transportation, internal | 103 |
| Type designation..... | 40 |

U

| | |
|-----------------|-----|
| Unpacking | 103 |
| Use..... | 43 |

W

| | |
|---------------|----|
| Warranty..... | 12 |
|---------------|----|



HAINBUCH GMBH · SPANNENDE TECHNIK

Postfach 1262 · 71667 Marbach / Erdmannhäuser Strasse 57 · 71672 Marbach · Germany

Tel. +49 7144.907-0 · Fax +49 7144.18826 · verkauf@hainbuch.de · www.hainbuch.com

24 hour emergency phone line + 49 7144.907-444

04.2023 · 034.11/0010 EN · Technical modifications reserved