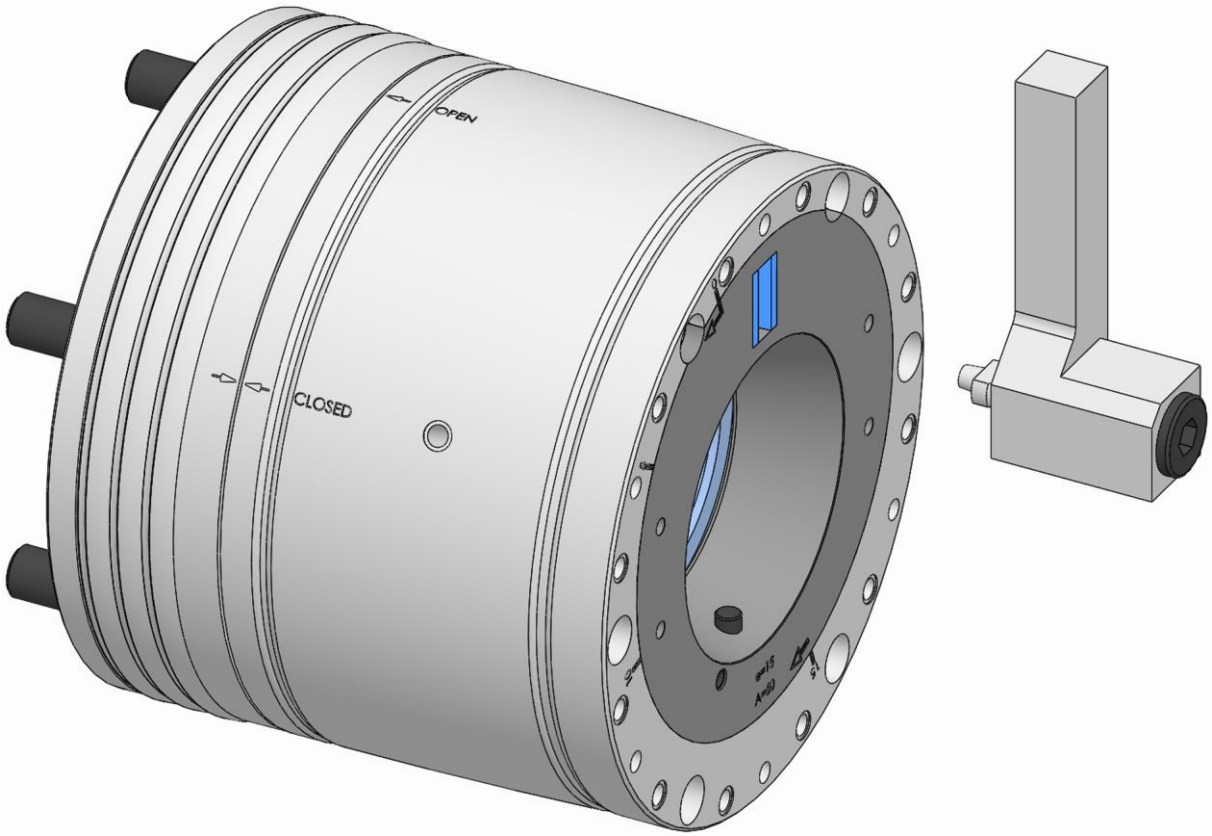
HAINBUCH



Operating instructions

[incl. installation manual]

Eccentric chuck

EN

Translation of the original operating instructions

Contents

Directory of tables

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:

- Eccentric chuck
- Adjustment tool
- The operating instructions

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

- Spindle flange
- Drawtube adapter
- Clamping head
- Changing fixture
- Face spanner

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.

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.

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.

In particular, note that end-stop requests by the machine tool must be set on the product 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.

The C axis must be adjustable using the machine controller when the clamping cylinder is opened. In this process, continue to comply with the accident prevention specifications for the machine.

It must be possible to use the machine turret as a tailstock. The tailstock must be capable of exerting force of at least $2kN$.

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.

DANGER

Serious injuries caused by misuse of the product!

- Only in a CE-compliant machine tool with a separating set of guards.
- 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.

DANGER

Serious injuries caused by parts being ejected centrifugally during commissioning without a workpiece!

- Never rotate the product without a workpiece installed.
- For commissioning, clamp an appropriate workpiece at every available clamping point.

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 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 machines, 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

When working, always wear the following items:

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.

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 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.

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.

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 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	65
Clamping range [mm]	4-65
Axial release stroke [mm]	2.5
Axial clamping reserve [mm]	2.0
Radial opening stroke in Ø [mm]	0.6
Radial reserve stroke in Ø [mm]	1.0
Total weight [kg]	34.7-36.1
Spindle flange weight [kg]	9.2-10.6
Weight of clamping unit [kg]	25.5
Dimensions [ø x length] [mm]	Ø 205.0 x 173.0
Centric maximum speed [min^{-1}]	6000
Eccentric maximum speed [min^{-1}]	3000
Maximum axial force $F_{ax\,max.}$ [kN]	45
Minimum axial clamping force $F_{ax\,max.}$ [kN]	15
Radial clamping force $F_{rad\,max.}$ [kN]	105
Maximum eccentricity [mm]	15
Repetition precision of maximum eccentricity [mm]	±0.02

Size	65
Approach dimension [mm]	60
Balancing quality G in n planes	4/1

Table 1: Technical data

3.2 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].

3.3 Balancing quality

The product is balanced in all angle positions 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!

- Never remove balancing screws and weights attached to the product.

NOTE

Material damage caused by machining with incorrectly balanced products!

- Never remove balancing screws and weights attached to the product.

3.4 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!

- Never rotate the product without a workpiece installed.
- When several clamping points are involved, clamp a suitable workpiece to each one.
- If necessary, adjust the machining forces.

3.5 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 and of the clamping diameter.

WARNING

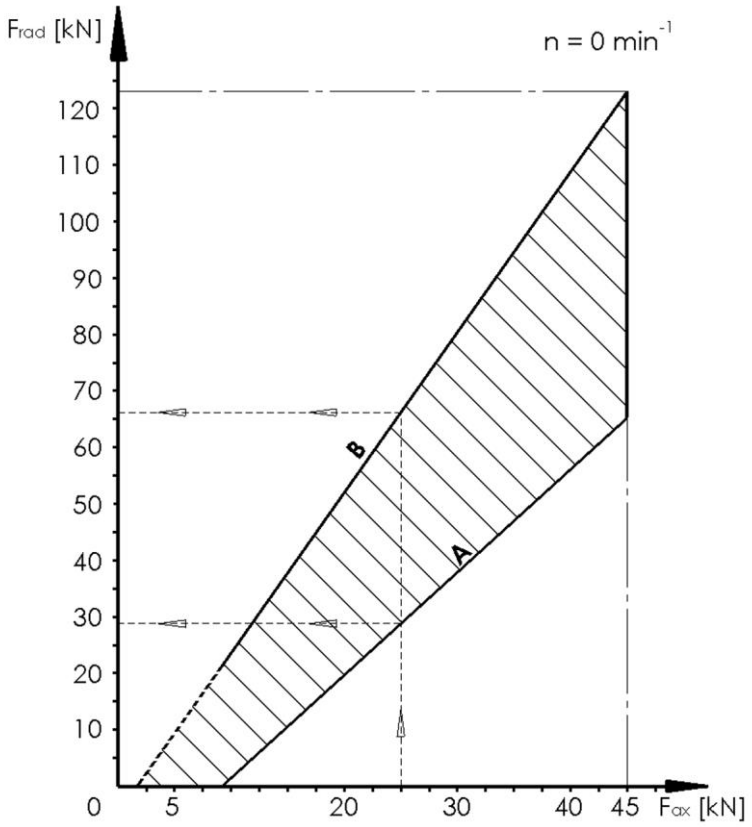
Serious injuries caused by insufficient clamping force!

- 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.

3.5.1 Size 65

Sample scan:

At an axial actuation force F_{ax} of 25 kN, the radial clamping force F_{rad} is in a range of between 28 kN and 66 kN.



A lower limit value
B upper limit value

3.6 Operating conditions

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

Table 2: Operating conditions

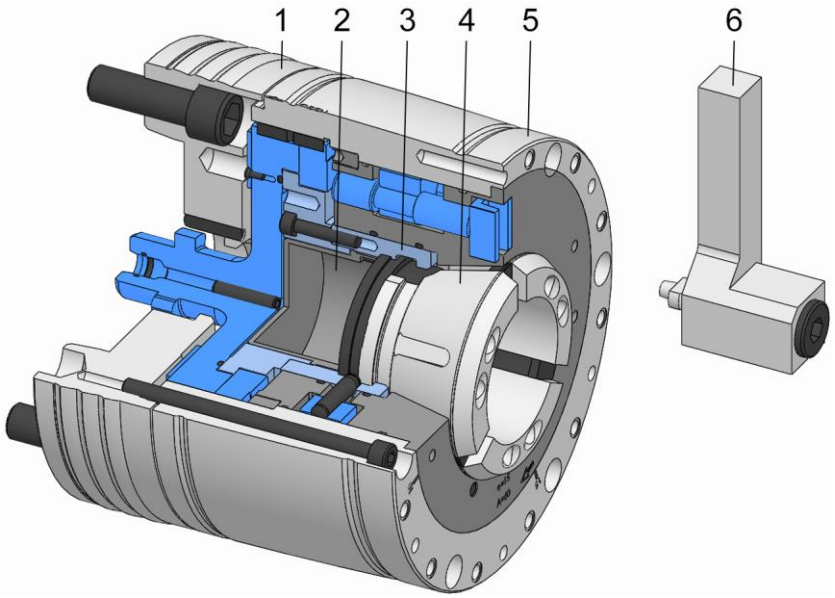
3.7 Type designation

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



1 Spindle flange
2 Protective liner
3 Coupling
4 Clamping head [clamping element]
5 Functional unit
6 Adjustment tool

Workpieces can be machined eccentrically with this clamping device.

The required eccentricity can be set via the C-axis on the machine tool with the help of the adjustment tool.

The adjustment tool is installed in the turret.

The spindle flange is mounted on the machine spindle.

The clamping device is connected to the machine tool by the bayonet on the drawtube adapter and is screwed to the spindle flange.

The clamping element was installed in the clamping device with an appropriate changing fixture and it clamps the workpiece being machined.

The clamping device functions on the pull-back principle.

The mobile coupling draws the clamping element into the stationary taper.

4.2 Accessories required

4.2.1 Spindle flange

The spindle flange helps to adapt the clamping device to suit the machine tool.

Depending on the scope of delivery, the spindle flange can either be supplied with the unit or provided by the customer.

4.2.2 Drawtube adapter

The drawtube adapter serves as a connector between the drawtube on the machine tool and the clamping device and, depending on the type of machine, can be configured in various forms.

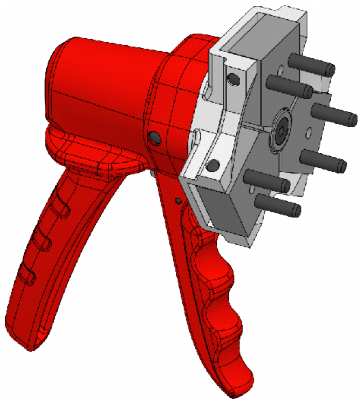
4.2.3 Clamping head

The clamping head is there to support the workpiece being machined. It consists of hard steel and rubber segments connected by vulcanization.

Depending on workpiece requirements, various sizes of clamping head are available, also with different profiles and bores.

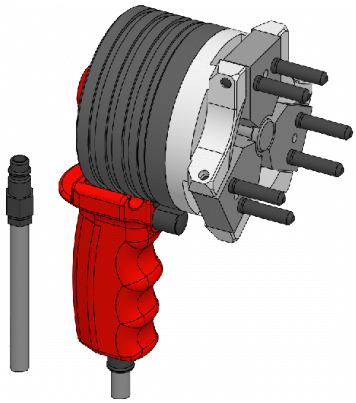
4.3 Special aids

4.3.1 Manual changing fixture



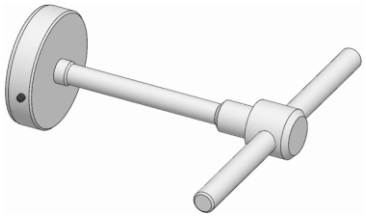
The pins on the changing fixture are installed in the changing bores in the clamping head. The changing fixture is actuated by manual force. Depending on size, the changing fixture may be designed for single-handed or for two-handed actuation. The clamping head is clamped firmly in the changing fixture and can be installed in the mounted clamping device with the help of the changing fixture.

4.3.2 Pneumatic changing fixture



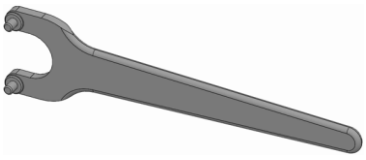
The pins on the changing fixture are installed in the changing bores in the clamping head. The changing fixture is actuated pneumatically. Depending on size, the changing fixture may be designed for single-handed or for two-handed actuation. The clamping head is clamped firmly in the changing fixture and can be installed in the mounted clamping device with the help of the changing fixture.

4.3.3 Protective liner key



The key is used for installation and removal of the protective liner.

4.3.4 Face spanner



The face spanner is used for manual adjustment of the eccentric dimension.

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.

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.

The clamping device can be used as an end-stop chuck. For this, a workpiece end-stop can be mounted.

5.2 Limits of use

Limits are set on the operation of clamping head chucks in the area where workpieces are machined.

Specifically, before using these clamping head chucks, four separately independent limits need to be checked.

5.2.1 Nomenclature

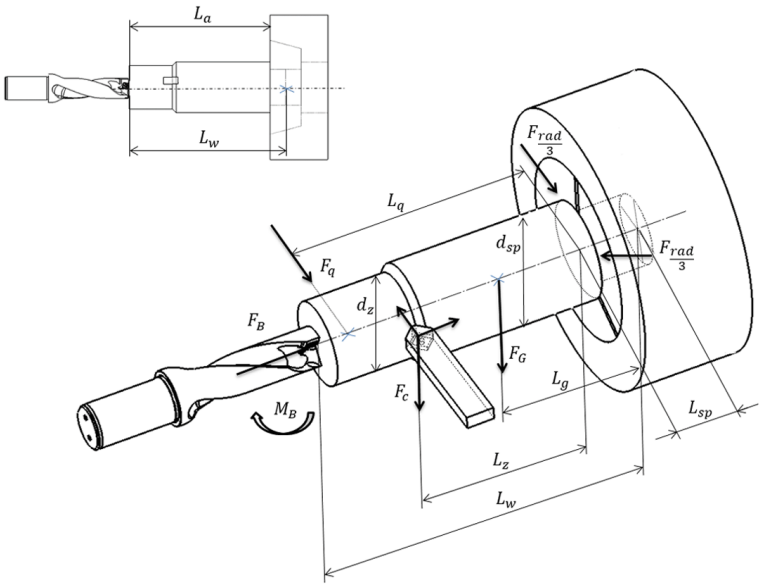
Brief designation	Unit	Explanation
a_p	mm	Chip-cutting depth of turning operation
c	-	Contact factor
D	mm	Clamping diameter of clamping head
D_B	mm	Drill diameter
d_{sp}	mm	Clamping diameter
d_z	mm	Machining diameter of turning operation
f	mm	Feed / rotational movement of turning operation Feed / cutting-drilling operation
F_{ax}	kN	Axial actuating force
F_B	N	Feed force of drilling operation
F_c	N	Cutting force of drilling operation
$F_{c\,max}$	N	Maximum cutting force of drilling operation
f_{fz}	N	Clamping force supplement for rotational compensation

Brief designation	Unit	Explanation
F_G	N	Density of workpiece
f_n	mm	Feed / rotational movement of drilling operation
F_q	N	Transverse force
$F_{q\ max}$	N	Maximum permitted transverse force
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 absorb the machining forces and torques during turning and/or drilling operations towards the chuck axis
F_t	kN	Tailstock force
$F_{t\ max}$	kN	Maximum tailstock force
k_c	$\frac{N}{mm^2}$	Specific cutting force
L	mm	Total chuck length
L_a	mm	Unclamping length
L_g	mm	Center of gravity distance between »Workpiece - clamping point«
L_q	mm	Distance, »radial bore machining - clamping point«
L_{sp}	mm	Clamping length
$L_{sp\ min}$	mm	The minimum clamping length required
$L_{sp\ v}$	mm	Total clamping length
L_w	mm	Workpiece length
L_v	mm	Clamping head, front-end length
L_z	mm	Distance between »Machining point - clamping point« when turning
m	kg	Mass of the clamping head
M_B	Nmm	Drilling operation torque
M_q	Nm	Torque due to lateral force on the chuck axis

Brief designation	Unit	Explanation
$M_{q\,max}$	Nm	Maximum torque due to lateral force on the chuck axis
m_w	kg	Workpiece mass
$m_{w\,max}$	kg	Maximum workpiece mass
n	min^{-1}	Speed
P	-	Key indicators for machining
r_s	m	Distance between mass center of gravity of clamping head segment and rotational axis of the chuck
S	-	Clamping force scatter width factor
μ_a	-	Friction coefficient in axial direction
μ_t	-	Friction coefficient in radial direction

Table 3: Nomenclature application limits

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



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

5.2.2 First limit [workpiece length]

The maximum unclamping length that can be machined without the aid of a back rest or a tailstock is 6 times the clamping diameter.

5.2.3 Second limit [workpiece mass]

The maximum workpiece mass depends on the size of the clamping head chuck [see Table 4].

[These values apply to individual workpieces. Special values apply to the machining of bar stock]

Size of the clamping head chuck	Maximum workpiece mass $m_{w\,max}[kg]$	
	Horizontal application	Vertical application
32	12	18
42	20	30
52	28	40
65	40	60
80	50	75
100	65	100
125	80	120
140	100	150
160	120	180

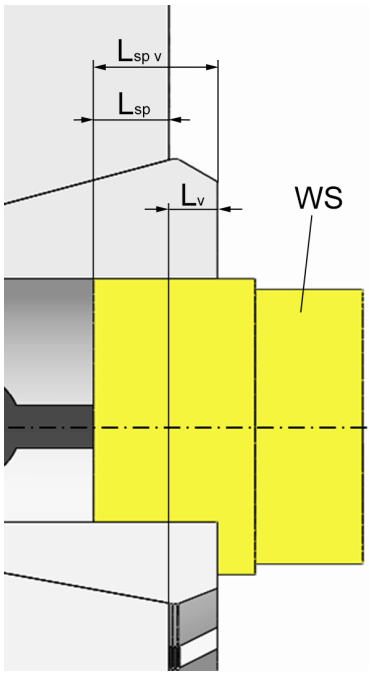
Table 4: Maximum workpiece mass

5.2.4 Third limit [clamping length]

The clamping length must not be less than the minimum length required for clamping $L_{sp} \geq L_{sp\,min}$.

The front-end length of the clamping head L_v is not considered at all here.

With offset clamping bores [head bore], it may be necessary to take account of a relief groove in the clamping head when establishing the clamping length.



WS Workpiece

The clamping length is calculated as follows:

$L_{sp} = L_{sp\,v} - L_v$

$L_{sp} \geq 0.08 * d_{sp}$ applies in all cases

In addition, the following applies:

$L_{sp} \geq 2.8mm$	[when using clamping heads with a smooth clamping bore]
$L_{sp} \geq 13mm$	[when using clamping heads with longitudinal and transverse grooves] When using clamping heads with a closed first tunnel, different details apply which may be even higher. Consult the manufacturer for these details.
$L_{sp} \geq 7mm$	[when using clamping heads with Z serrations]
$L_{sp} \geq 5mm$	[when using clamping heads with F serrations]

If HAINBUCH uses a different and shorter clamping length in this clamping situation drawing, this will have been checked against the specific parameters for this type of application and found to be sufficient.

5.2.5 Fourth limit [forces]

The following sample calculation shows how to quantify the forces that are exerted on the workpiece from an external source.

The aim here is to establish whether

1. the clamping force required to absorb external forces and torques can be applied by the clamping device.
2. the clamping device is free of visible or invisible damage caused by those external forces.

The forces and torques exerted on the clamping head and, ultimately, on the chuck are, for the most part,

a) the machining forces and torques to be absorbed
b) the density of the workpiece itself,
c) the centrifugal forces caused by the weight of the clamping head
d) where necessary, tailstock forces

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 $F_t \leq F_{t\,max}$

AND

3. Principle $F_c \leq F_{c\,max}$

[Relevant to turning and/or to axial drilling operations.]

AND

4. Principle $F_q \leq F_{q\,max}$

[Relevant to a radial drilling operation directed at the center and/or for the application of an equivalent load. If radial forces and the resultant torques are not directed at the center, due account of this can be taken by a quasi cutting force outside the center.]

AND

5. Principle $M_q \leq M_{q\,max}$

[Relevant to a radial drilling operation directed at the center and/or for the application of an equivalent load. If radial forces and the resultant torques are not directed at the center, due account of this can be taken by a quasi cutting force outside the center.]

With these principles, the assumption is that the clamping head chuck is used for a turning operation, or for an axial or radial drilling operation on the workpiece. There is no fundamental reason why the clamping head chuck cannot also be used for other machining tasks such as bypass milling or plunge-milling. In such cases, the owner must ensure that the forces and torques that occur are comparable to the equivalent permitted values for turning or drilling, to check the reliability of the application.

5.2.5.1 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.

If radial drilling operations are being performed, the required radial clamping force $F_{rad\ erf}$, and especially a check of the transverse force introduced F_q and the resultant torque M_q play a central role.

Scatter widths of clamping force

The following table illustrates clamping force scatter width factor S.

The values for the scatter width factor apply if the system is being operated in accordance with the operating instructions, that is with regular maintenance and lubrication.

Provided that the radial clamping force is measured using appropriate measuring equipment before every start-up and continuously every 100 clamping operations, it is possible to work with the reduced and 'verified' clamping force scatter width factor shown here.

Size of the clamping head chuck	Radial clamping reserve in the diameter [mm]	Clamping force scatter width factor S	Clamping force scatter width factor S 'verified'
32	1.0	2.8*	1.3
42	1.0	2.0*	1.3
52	1.0	2.0*	1.3
65	1.0	1.6*	1.3
80	1.0	1.6*	1.3

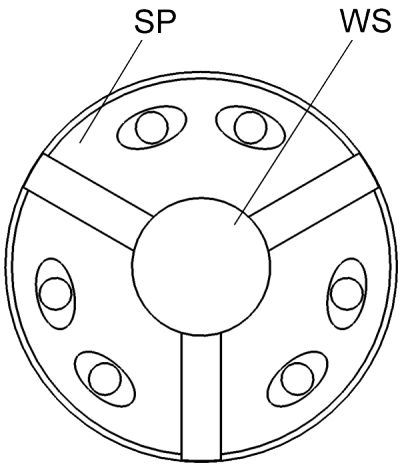
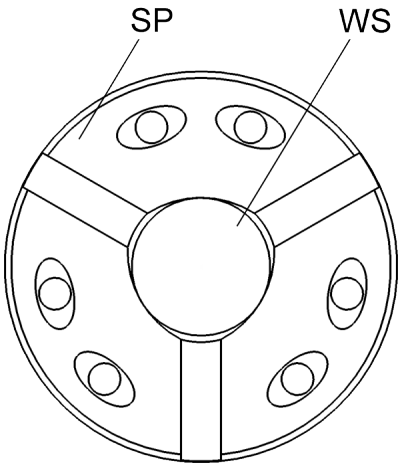
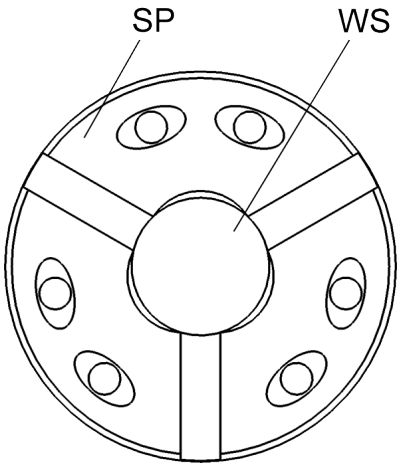
Size of the clamping head chuck	Radial clamping reserve in the diameter [mm]	Clamping force scatter width factor S	Clamping force scatter width factor S 'verified'
100	1.5	1.45	1.3
125	2.5	1.45	1.3
140	1.5	1.45	1.3
160	1.5	1.45	1.3

* If as a consequence of dimensionally accurate workpieces, only 50% of the radial clamping reserve of the clamping head chuck is used up, the clamping force scatter width factor can be reduced by factor 0.85 [example: Size 52: $S = 2.0 * 0.85 = 1.7$].

Table 5: Scatter widths of clamping force

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 diameter of the clamping head matches the clamping diameter of the workpiece.	The clamping diameter of the clamping head is greater than the clamping diameter of the workpiece.	The clamping diameter of the clamping head is less than the clamping diameter of the workpiece.
		

WS Workpiece
SP Clamping element

Table 6: Contact forms / scenarios

Contact factor c	Machining conditions	Contact form	
		Interference fit and saddle fit	Edge fit
Smooth clamping head	Dry	1.1	1.0
	Wet* / MMS**	1.3	1.2
Clamping head with longitudinal and transverse grooves	Dry	1.1	1.0
	Wet* / MMS**	1.3	1.2
Clamping head with Z or F serrations	Dry	1.0	1.0
	Wet* / MMS**	1.2	1.1

* Wet machining: Use of cooling lubricant [KSS]

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

Table 7: 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 $k_c \left[\frac{N}{mm^2}\right]$ at $f = 0.1mm$*	Specific cutting forces $k_c \left[\frac{N}{mm^2}\right]$ at $f = 0.5mm$*	Specific cutting forces $k_c \left[\frac{N}{mm^2}\right]$ at $f = 1.0mm$*
Designation	**DIN [ISO]**			
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 $k_c \left[\frac{N}{mm^2}\right]$ at $f =$ $0.1mm$*	Specific cutting forces $k_c \left[\frac{N}{mm^2}\right]$ at $f =$ $0.5mm$*	Specific cutting forces $k_c \left[\frac{N}{mm^2}\right]$ at $f =$ $1.0mm$*
Designation	**DIN [ISO]**			
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 8: Specific cutting forces

Friction coefficients

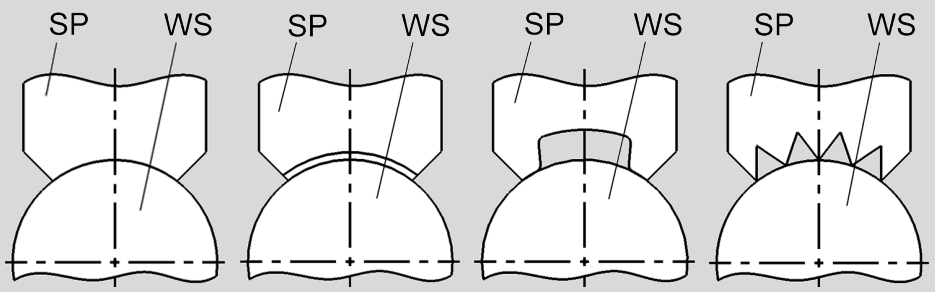
With workpieces made from a material other than steel, multiply these values by the correction values listed below.

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

NOTE

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

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

Workpiece surface	Clamping surface			
				
	Smooth clamping head	**Clamping head with longitudinal and transverse serrations**	**Clamping head with Z serrations**	**Clamping head with F serrations**
Finished, ground	$\mu_t = 0.06$ $\mu_a = 0.08$	$\mu_t = 0.07$ $\mu_a = 0.09$	$\mu_t = 0.15$ $\mu_a = 0.20$	$\mu_t = 0.17$ $\mu_a = 0.22$
Finished to roughed	$\mu_t = 0.10$ $\mu_a = 0.13$	$\mu_t = 0.11$ $\mu_a = 0.15$	$\mu_t = 0.18$ $\mu_a = 0.25$	$\mu_t = 0.23$ $\mu_a = 0.28$
Blank or unmachined	$\mu_t = 0.14$ $\mu_a = 0.16$	$\mu_t = 0.16$ $\mu_a = 0.18$	$\mu_t = 0.20$ $\mu_a = 0.28$	$\mu_t = 0.25$ $\mu_a = 0.30$
Material correction values		Aluminum alloys $= 0.97$ Brass $= 0.92$ Cast iron $= 0.80$		

WS Workpiece
SP Clamping element

Table 9: Friction coefficient for steel workpieces

Clamping head mass $m[kg]$ and distance of mass center of gravity of clamping head segments to the rotational axis $r_s[m]$

Size of clamping head	Distance to mass center of gravity $r_s[m]$ in smallest position	Clamping head mass $m[kg]$
32	0.015	0.55
42	0.021	0.70
52	0.022	1.00
65	0.027	2.20
80	0.032	2.70
100	0.045	3.60
125	0.061	9.10
140	0.062	9.10
160	0.075	12.20

Table 10: Clamping head mass and distance of mass center of gravity of clamping head segments to the rotational axis

Determining the required clamping force

INFORMATION

S from Table 5

c from Table 7

k_c from Table 8

μ_a, μ_t from Table 9

r_s, m from Table 10

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

INFORMATION

Factor 1.6 takes account of possible fluctuations that may occur during power transmission.

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 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

$$F_{sk} = \frac{\left(0.27 * \frac{L_z}{d_{sp}} + 0.63\right) * \sqrt{\left(F_c * L_z + F_G * L_g\right)^2 + (F_c * P)^2}}{0.5 * \left(0.67 * \left(1.9 * L_{sp} - 4.5mm\right) + \mu_a * d_{sp}\right)}$$

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

Surface turning / plunge-machining $P = L_z$

If the workpiece is braced against a tailstock, it is OK to continue calculating with 20% from the computed F_{sk} value.

IV

$$F_{fz} = m * r_s * \left(\frac{\pi * n}{30}\right)^2$$

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

If this condition is not satisfied, the clamping head chuck 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.

Determining the required clamping force for radial drilling operations

With radial drilling operations directed at the center, radial clamping force $F_{rad\ erf}$ is also determined in accordance with an approach

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

whereby, although based upon components $F_{sz} = 0$ and $F_{fz} = 0$, a simplified form [just transverse force] can be used:

$$F_{rad\ erf} = S * c * 1.6 * F_{sk}$$

Determining of F_{sk} can be calculated as follows for drilling operations performed radially in relation to the clamping device axis, in a similar way to Formula III:

$$F_{sk} = \frac{\left(0.27 * \frac{L_z}{d_{sp}} + 0.63\right) * (F_q * L_z + F_G * L_g)}{0.5 * (0.67 * (1.9 * L_{sp} - 4.5mm) + \mu_a * d_{sp})}$$

To calculate F_q, see the »Further to Principle 4: $F_q \leq F_{q\ max}$« chapter.

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

5.2.5.2 Further to Principle 2: $F_t \leq F_{t\ max}$

When using a tailstock, due to the additional expanding force exerted on the clamping head chuck, the permitted maximum tailstock force is limited to the following values in accordance with the size of the clamping head chuck:

Size of the clamping head chuck	$F_{t\ max}[kN]$
32	3
42	6
52	6
65	8
80	8
100	8
125	8
140	8
160	8

Table 11: Maximum permitted tailstock force

NOTE

Serious damage to materials on clamping equipment and machine tool due to non-adapted forces!

- The total of set tailstock force and axial clamping force during the clamping process must be exceeded by the release force.

When operating with a tailstock, using an end-stop in the clamping head chuck ensures that the workpiece is not displaced axially.

5.2.5.3 Further to Principle 3: $F_c \leq F_{c\,max}$

The cutting force for turning operations can achieve very high levels, especially if the workpiece does not protrude far, although machining involves no slip or leverage forces that could displace the workpiece. Therefore the cutting force also needs to be limited to reflect the size of the clamping head chuck to prevent damage to the clamping head chuck.

Size of the clamping head chuck	Up to total chuck length $L[mm]$	$F_{c\,max}[N]$
32	< 120	1900
42	< 125	3600
52	< 125	3600
65	< 140	5000
80	< 140	6000
100	< 160	8000
125	< 200	12000
140	< 200	12500
160	< 200	14000

Table 12: Maximum permitted cutting force

On extended chuck versions, the ratio of maximum permitted cutting force to chuck lengths needs to be reduced. For example, size 32 with $L = 150mm$

$\frac{120mm}{150mm} * 1900N = 1520N$

5.2.5.4 Further to Principle 4: $F_q \leq F_{q\,max}$

With drilling operations radial to the workpiece axis, the feed force of the tool generates transverse forces that ultimately act on the clamping head chuck. The application of this load during drilling operations should be viewed as equivalent to the cutting force exerted by a turning process. Accordingly,

it also has to be limited. Consult the following table for the permitted maximum values.

Feed force occurring while drilling F_B [transverse force]

[drilling of solid materials, double-bladed tool, direction of machining at an angle of 90° to the chuck axis]

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

INFORMATION

k_c from Table 8

Size of the clamping head chuck	Up to total chuck length $L[mm]$	$F_{q\,max}[N]$
32	< 120	2200
42	< 125	4200
52	< 125	4200
65	< 140	6000
80	< 140	7200
100	< 160	9000
125	< 200	13000
140	< 200	13800
160	< 200	15000

Table 13: Maximum permitted transverse force

On extended chuck versions, the ratio of maximum permitted transverse force to chuck lengths needs to be reduced. For example, size 32 with $L = 150mm$

$\frac{120mm}{150mm} * 2200N = 1760N$

5.2.5.5 Further to Principle 5: $M_q \leq M_{q\,max}$

With drilling operations that are radial to the workpiece axis, the transverse force examined under Principle 4 exerts an additional torque M_q on the clamping head and/or on the chuck. This moment must not rise in an unlimited way to prevent damage to the clamping head chuck, even if the clamping of the workpiece may still hold firmly. The following table shows the related permissible maximum values.

Torque M_q occurring through the introduction of transverse force F_q

$M_q = F_q * L_q$

Size of the clamping head chuck	Up to total chuck length $L[mm]$	$M_{q\,max}[Nm]$
32	< 120	120
42	< 125	210
52	< 125	210
65	< 140	300
80	< 140	360
100	< 160	450
125	< 200	650
140	< 200	690
160	< 200	750

Table 14: Maximum permitted torque due to transverse force

On extended chuck versions, the ratio of maximum permitted torque to chuck lengths needs to be reduced. For example, size 32 with $L = 150mm$

$\frac{120mm}{150mm} * 120Nm = 96Nm$

5.2.6 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 $d_{sp} = 60mm$
- Workpiece length $L_w = 150mm$ [$151.5mm$ blank]
- Machining diameter of turning operation $d_z = 57.0mm$
- Workpiece mass $m_w = 3.3kg$

  $\rightarrow F_G = m_w * 9.81\frac{m}{s^2}$

  $\rightarrow F_G = 33N$

Process data

- Speed$n = 800min^{-1}$
- Feed $f = 0.25mm$
- Chip-cutting depth $a_p = 1.5mm$
- Use of cooling lubricant
- Total clamping length$L_{sp\,v} = 20mm$

Clamping head chuck

- Pull-back SPANNTOP size 65
- Clamping head used
  - Smooth
  - Clamping diameter of clamping head $D = 60mm$
  - Front-end length $L_v = 3mm$

Detailed observation

This satisfies the first condition, which is that the unclamping length must not exceed six times the clamping diameter.

This also satisfies the second condition, which is that the workpiece mass must not exceed m_w $40kg$ of size 65 of clamping head chuck.

This more than satisfies the third condition, which is that the workpiece must at least be clamped with $0.08 * d_{sp} = 0.08 * 60mm = 4.8mm$, with a clamping length of $L_{sp} = L_{sp\,v} - L_v = 20mm - 3mm = 17mm$.

To check the fourth condition, the required level of clamping force needs to be established first, in accordance with Principle 1.

INFORMATION

S	from Table 5
c	from Table 7
k_c	from Table 8 [interpolated for $f = 0.25mm$]
μ_a, μ_t	from Table 9
r_s, m	from Table 10

I	$F_{rad\,erf} = S * c * \left(1.6 * (F_{sz} + F_{sk}) + F_{fz}\right)$

from Table 5 $S = 1.6$

from Table 7 $c = 1.3$

$$F_{rad\,erf} = 1.6 * 1.3 * \left(1.6 * (F_{sz} + F_{sk}) + F_{fz}\right)$$

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 9 $\mu_t = 0.14$, $\mu_a = 0.16$

Turning:

$F_c = 1.3 * a_p * f * k_c$

$F_c = 1.3 * 1.5mm * 0.25mm * 2515 \frac{N}{mm^2} = 1226N$

Drilling:

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

$$F_{sz} = 1.3 * \sqrt{\left(\frac{1226N * 57mm + 2 * 0Nmm}{60mm * 0.14}\right)^2 + \left(\frac{1226N + 0N}{0.16}\right)^2}$$

$$F_{sz} = 14703N$$

III

$$F_{sk} = \frac{\left(0.27 * \frac{L_z}{d_{sp}} + 0.63\right) * \sqrt{\left(F_c * L_z + F_G * L_g\right)^2 + (F_c * P)^2}}{0.5 * \left(0.67 * \left(1.9 * L_{sp} - 4.5mm\right) + \mu_a * d_{sp}\right)}$$

$L_z = L_w = 133mm$, since the shaft should be surface-turned at the front end of the shaft.

$L_g = 75mm$, since the center of gravity is located centrally on the longitudinal axis of the workpiece.

$L_{sp} = 17mm$, corresponds to the total clamping length less the front-end length of the clamping head.

$P = \frac{d_z}{2} = \frac{57mm}{2} = 28.5mm$, because of a longitudinal turning operation

$$F_{sk} = \frac{\left(0.27 * \frac{133mm}{60mm} + 0.63\right) * \sqrt{(1226N * 133mm + 33N * 75mm)^2 + (1226N * 28.5mm)^2}}{0.5 * (0.67 * (1.9 * 17mm - 4.5mm) + 0.16 * 60mm)}$$

$$F_{sk} = \frac{207838Nmm}{14.11mm} = 14727N$$

IV

$$F_{fz} = m * r_s * \left(\frac{\pi * n}{30}\right)^2$$

from Table 10: $m = 2.2kg$, $r_s = 0.027m$

$$F_{fz} = 2{,}2kg * 0{,}027m * \left(\frac{\pi * 800min^{-1}}{30}\right)^2$$

$$F_{fz} = 417N$$

$$F_{rad\,erf} = 1.6 * 1.3 * \left(1.6 * (F_{sz} + F_{sk}) + F_{fz}\right)$$

$$F_{rad\,erf} = 1.6 * 1.3 * (1.6 * (14703N + 14727N) + 417N)$$

$$F_{rad\,erf} = 98810N = 99kN$$

Since the size 65 clamping head chuck can exert a maximum radial clamping force of $F_{rad\ max} = 105kN$, this satisfies Principle 1.

In this example, Principle 2 does not apply because work is performed without a tailstock in this case.

Principle 3 would also be satisfied, because the calculated cutting force of $F_c = 1226N$ is well below the limit of $F_{c\ max} = 5000N$.

On the other hand, Principles 4 and 5 are immaterial in this example because both principles only need to be considered in relation to radial drilling operations.

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 clamping head chuck, or you can consult the clamping force diagram [see »Clamping force diagram« chapter].

When full axial force is exerted on the clamping head chuck with $F_{ax\ max} = 45kN$, nominal radial $105kN$ forces are being applied to the workpiece.

In the example calculated here, an axial force of at least $F_{ax} = 43kN$ must be applied, resulting in a radial clamping force of $F_{rad} = 99kN$.

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 clamping head chuck is in good condition in terms of the level of contamination.

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

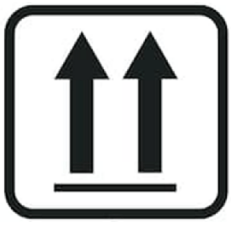
Fragile

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 air-tight 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 sort, 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 in a safe condition. Use an appropriate container for the product, on a non-slip surface, or fit the floor of the shelving unit with an all-round safety border.
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].

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 15: 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 16: Screw tightening torques for aluminum components

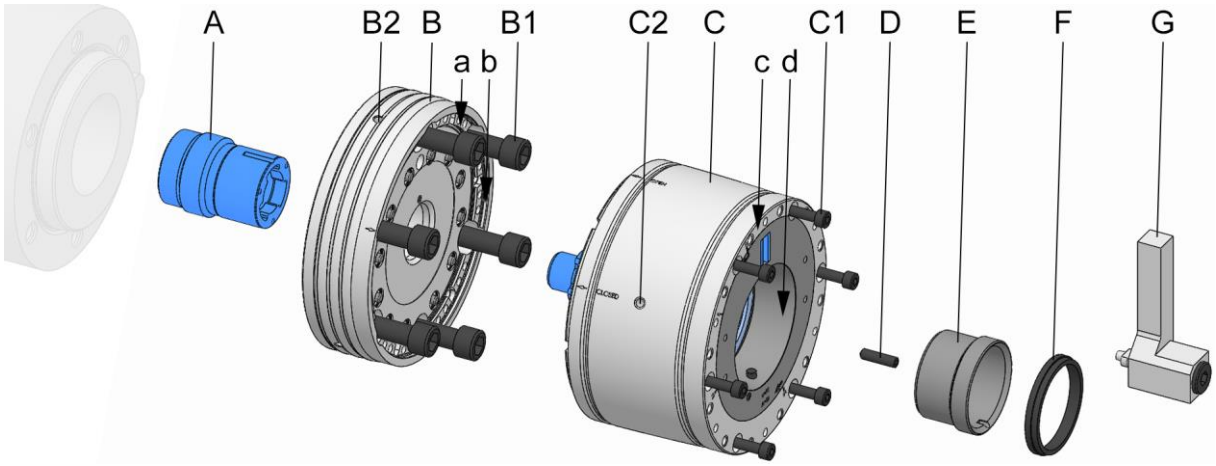
7.4 Preparation of the machine for installation

1. Set the machine into set-up mode.

INFORMATION
The minimum operating pressure is reached when the drawtube can still just be moved without triggering an error message.

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 Installation of the product



A Drawtube adapter
B Spindle flange
B1 Fixing screws on spindle flange
B2 Transport thread spindle flange
C Functional unit
C1 Fixing screws, function unit
C2 Transport thread on functional unit
D Threaded dowel
E Protective liner
F Swarf baffle ring
G Adjustment tool
a Test surface, face run-out, spindle flange
b Test surface, axial run-out, spindle flange
c Test surface, face run-out, functional unit
d Test surface, axial run-out, functional unit

Special aids needed:

- Face spanner

1. As described in the »Preparation of the machine for installation« chapter, prepare for the following steps.
2. Install the adjustment tool on the machine turret.

7.5.1 Compatibility check

Check the compatibility of the product and the connection point of the machine.

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.

It may be necessary to install an adapter between the actuating element on the machine and the product.

7.5.2 Preparation of the product

The product is supplied in assembled condition.

The following preparatory steps are needed to install the product.

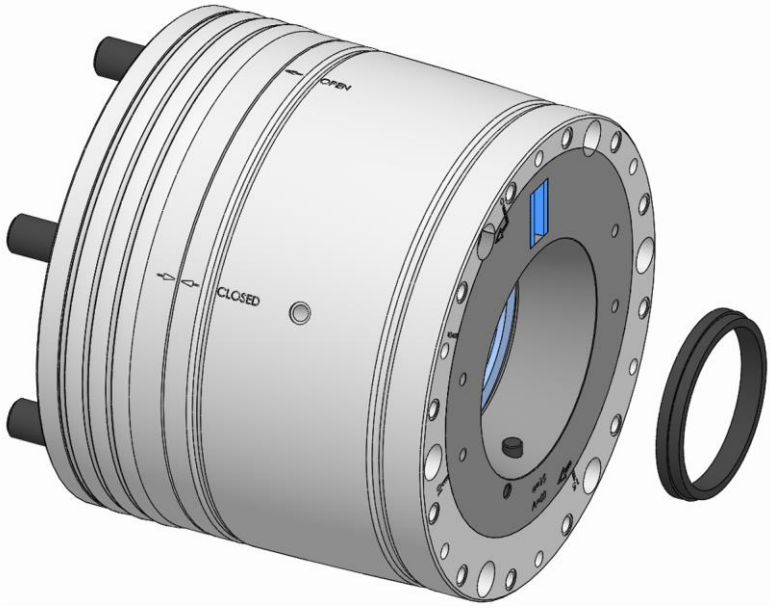
If the prepared bleeding of the product is not to be used, continue with a check of the protective liner.

NOTE

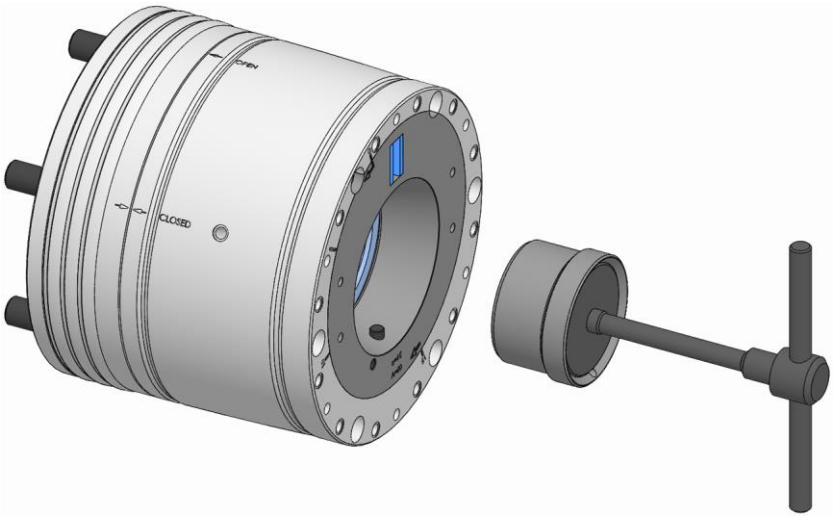
Damage to materials caused by contamination of the product mechanism!

- If the prepared bleeding of the product is not used, it is essential for the protective liner to be installed.

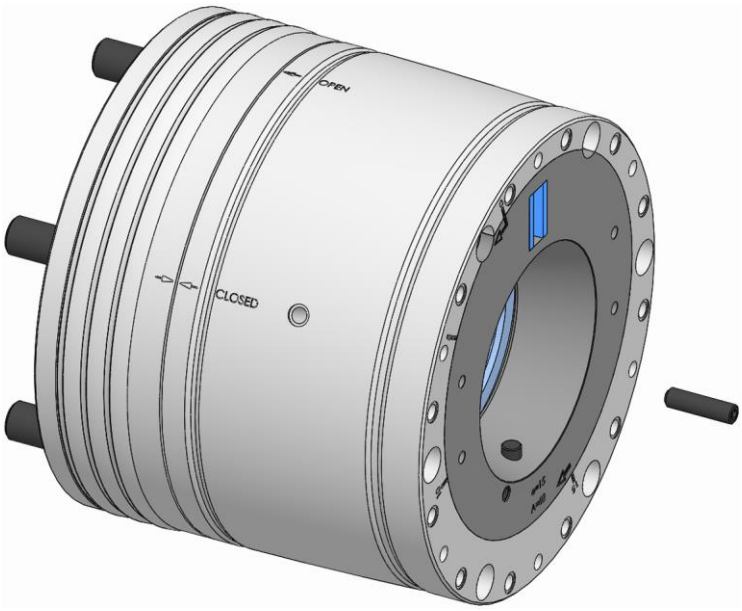
The following preparatory steps are needed to install the product if the prepared bleeding of the product is to be used.



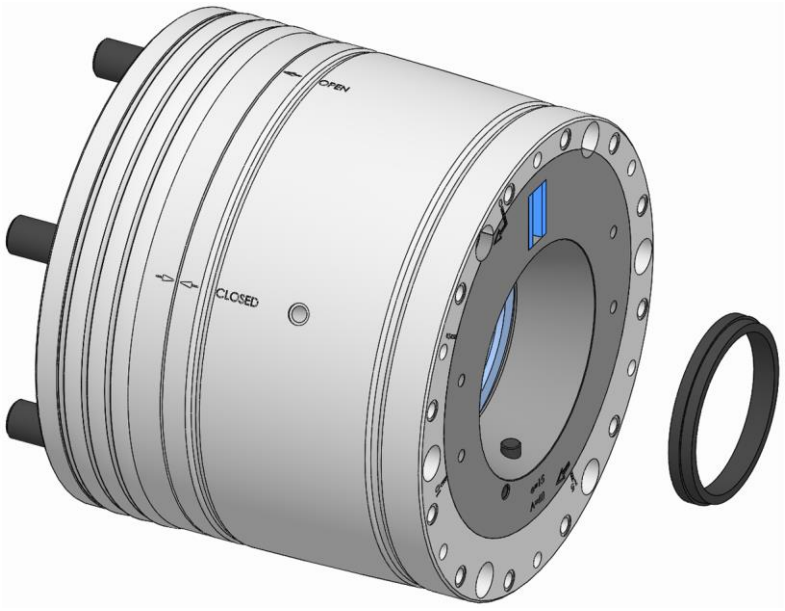
1. Remove the swarf baffle ring from the product.



2. Using the protective liner's assembly key, unscrew the protective liner and remove it from the product.



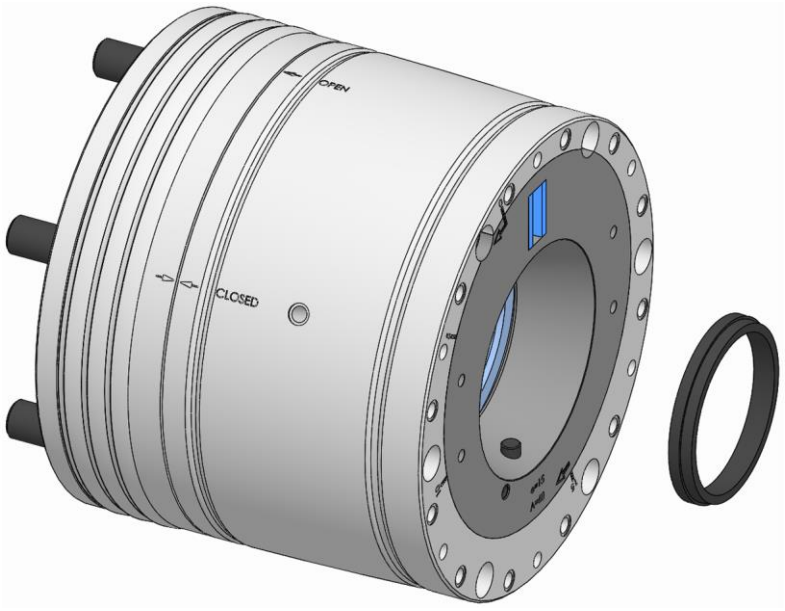
3. Unscrew and remove the threaded dowel from the product.



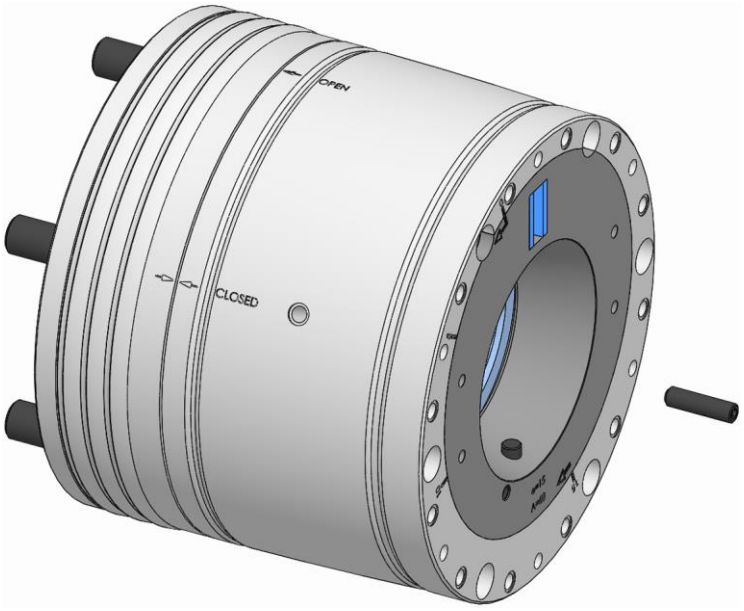
4. Insert the swarf baffle ring in the product.

If the protective liner is already installed, continue with the check of the spindle flange.

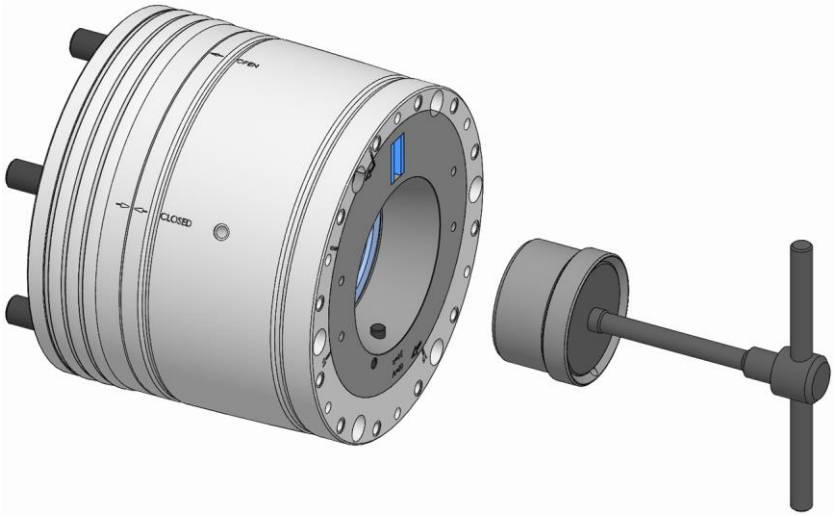
If the protective liner has been removed, the following preparatory steps are needed to install the product.



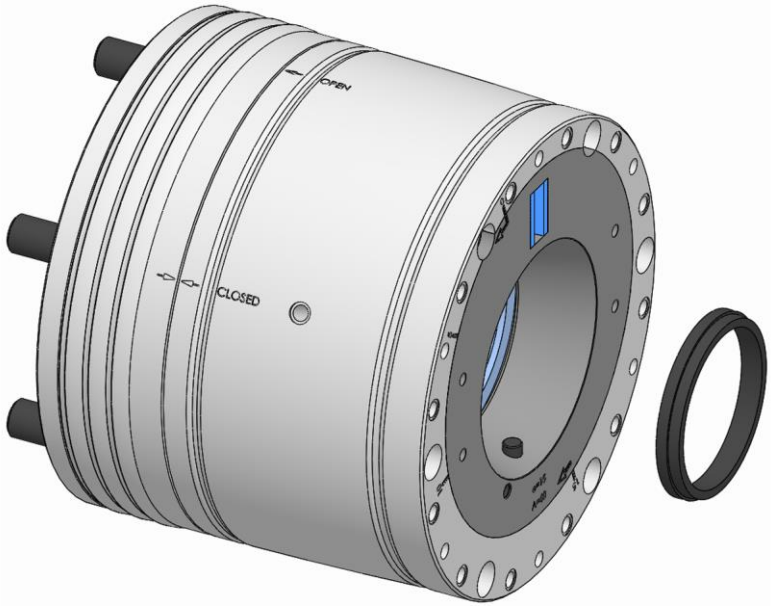
1. Remove the swarf baffle ring from the product.



2. Screw the threaded dowel into the product.



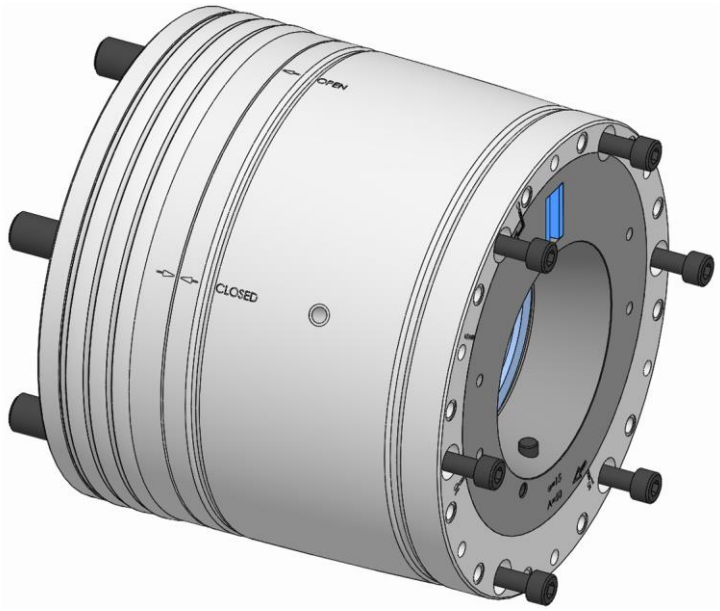
3. Using the protective liner’s assembly key, screw the protective liner into the product.



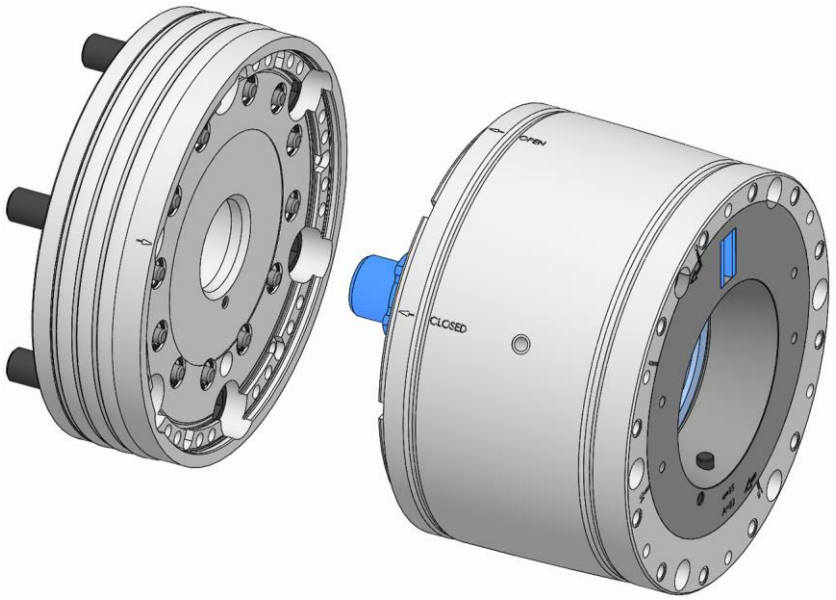
4. Insert the swarf baffle ring in the product.

If the spindle flange is included in the scope of delivery, or is already present, continue with the check of the centric position of the functional unit.

If the spindle flange is installed on the clamping device, the following preparatory steps are needed to install the product.



1. Unfasten and remove the fixing screws on the functional unit.



2. Take down the functional unit from the spindle flange.

INFORMATION

The functional unit must be in a centric position for installation of the functional unit on the machine.

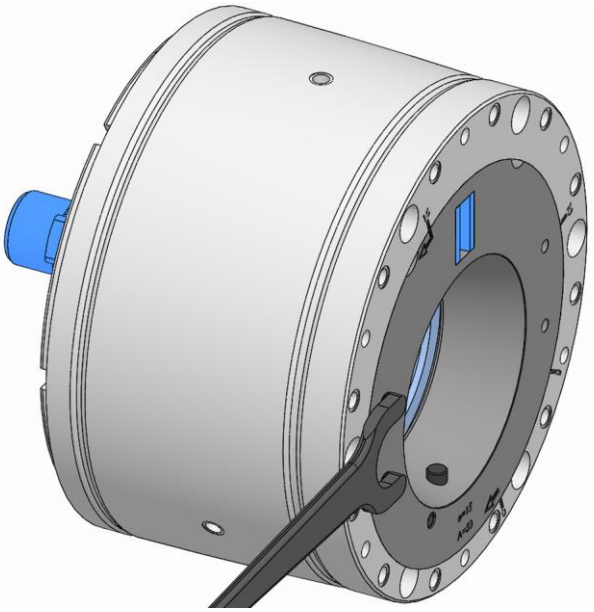
With the help of the scale on the functional unit, check if the eccentric screw is in position »0«.

3. Check the eccentric setting of the functional unit.

If the functional unit is in a centric position, no further preparatory steps are needed to install the product.

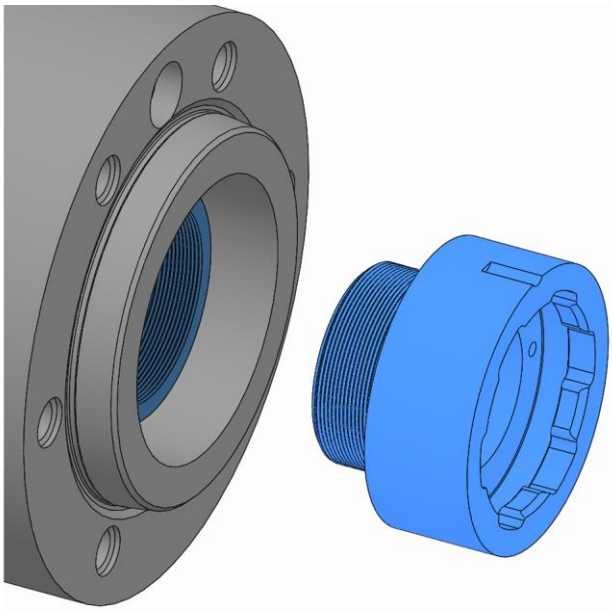
If the functional unit is not in a centric position, the following preparatory steps are needed to install the product.

1. Move the functional unit to its rear end-stop.

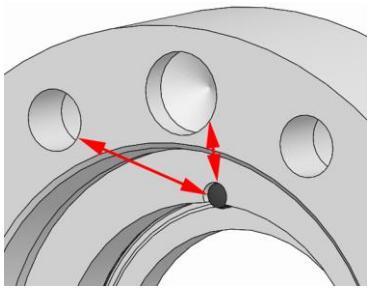


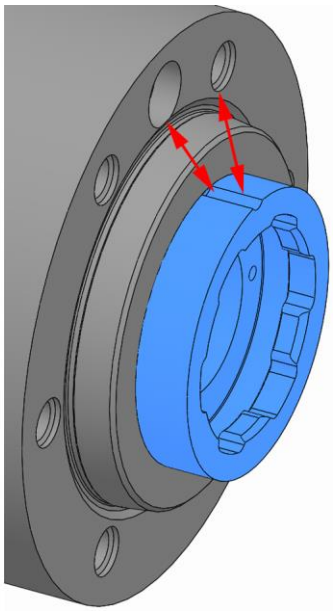
2. Use the face spanner to rotate the functional unit into a centric position.

7.5.3 Installation of the drawtube adapter



1. Using its thread, screw the drawtube adapter firmly home on the machine drawtube.

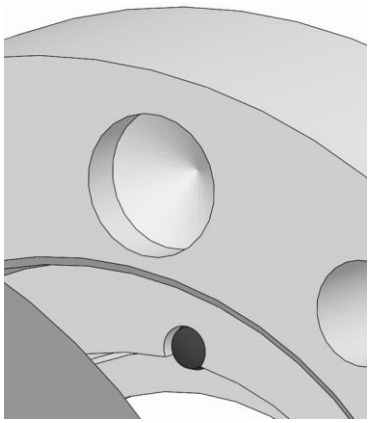


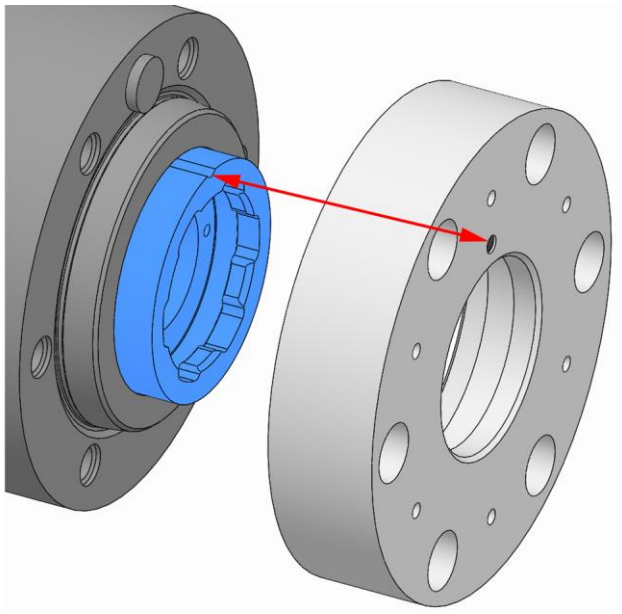


2. Turn back the drawtube adapter until the correct position for installation of the spindle flange is reached. To define the correct position, check the position of the pin in the spindle flange against the hole pattern for the fixing screws in the spindle flange or if necessary to the bore for the positioning block. Then move the drawtube adaptor into the corresponding position relative to the threads in the machine spindle or if necessary to the positioning block, if fitted.

7.5.4 Installation of a spindle flange that can be aligned

1. Attach any lifting gear that may be required.
2. If necessary, fit the mounting aid onto a vertically suspended spindle.
3. Using the least possible force and speed, move the drawtube on the machine to its front limit stop [see »Preparing the machine for installation« chapter].

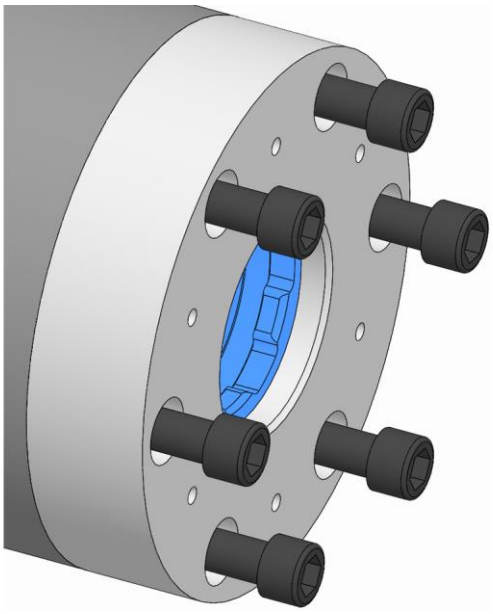




INFORMATION

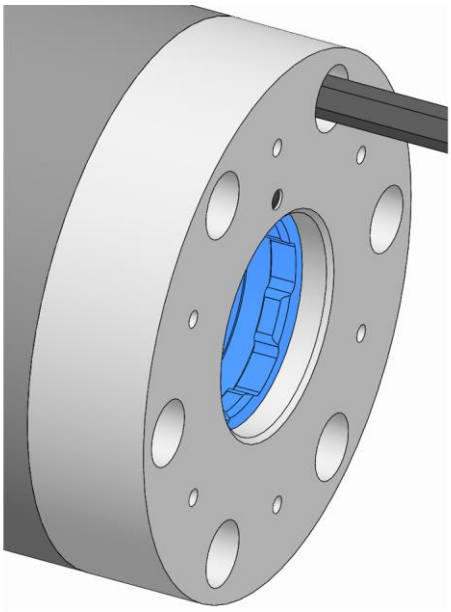
The positioning block on the machine spindle and the positioning bore in the spindle flange can be used for positioning.

4. Fit the spindle flange on the machine spindle. Position the spindle flange using its pin and, if necessary, position it over the machine spindle using its bore.



5. Screw in the spindle flange fixing screws and tighten them gently.
6. Unfasten and remove any lifting gear that may have been required.
7. Remove the mounting aid on a vertically suspended spindle if one was used.

8. Check the face run-out on the test surface of the spindle flange [ideally ≤ 0.005 mm] and, if necessary, correct carefully with a plastic hammer.



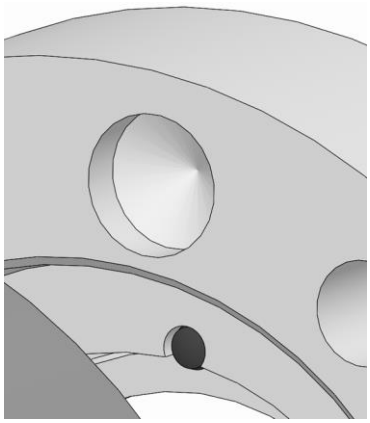
9. Screw in the drift body fixing screws on the spindle flange and tighten to the specified tightening torque [see »Screw tightening torques« chapter].
10. Check face run-out on the test surface of the spindle flange [ideally ≤ 0.005 mm].

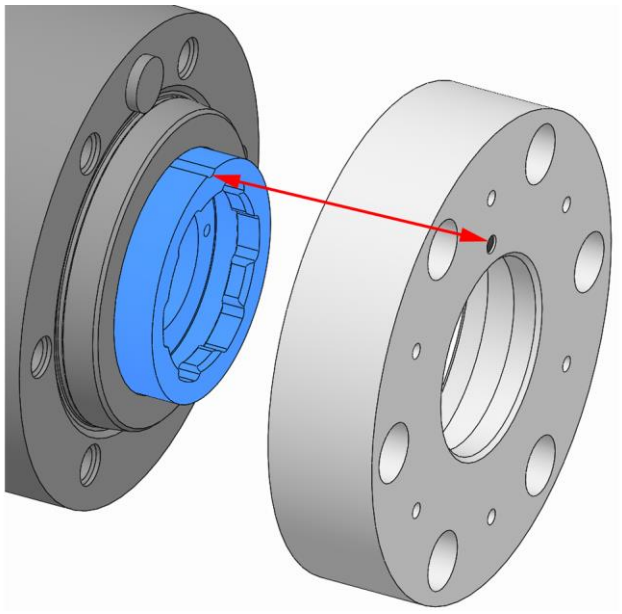
Whenever the face run-out is greater than the maximum permitted value:

11. Remove the spindle flange.
12. Clean the locating face and the mating faces of the machine spindle and the spindle flange.
13. If there is a burr or slight damage, rub down the locating face of the spindle flange and the machine spindle gently with an oil stone.
14. Reinstall the spindle flange.
15. Repeat the alignment process.
16. Repeat the face run-out test.

7.5.5 Installation of a spindle flange that cannot be aligned

1. Attach any lifting gear that may be required.
2. If necessary, fit the mounting aid onto a vertically suspended spindle.
3. Using the least possible force and speed, move the drawtube on the machine to its front limit stop [see »Preparing the machine for installation« chapter].

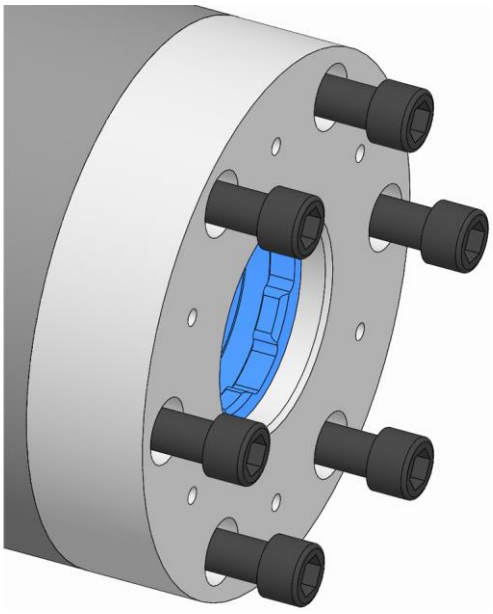




INFORMATION

The positioning block on the machine spindle and the positioning bore in the spindle flange can be used for positioning.

4. Fit the spindle flange on the machine spindle. Position the spindle flange using its pin and, if necessary, position it over the machine spindle using its bore.



5. Screw in the changing part fixing screws on the spindle flange and tighten to the specified tightening torque [see »Screw tightening torques« chapter].
6. Unfasten and remove any lifting gear that may have been required.
7. Remove the mounting aid on a vertically suspended spindle if one was used.

8. Check face run-out on the test surface of the spindle flange [ideally ≤ 0.005 mm].
9. Check axial run-out on the test surface of the spindle flange [ideally ≤ 0.005 mm].

Whenever the face run-out and/or the axial run-out is greater than the maximum permitted value:

10. Remove the spindle flange.
11. Clean the locating face and the mating faces of the machine spindle and the spindle flange.
12. If there is a burr or slight damage, rub down the locating face of the spindle flange and the machine spindle gently with an oil stone.
13. Reinstall the spindle flange.
14. Repeat the face run-out test.
15. Repeat the axial run-out test.

7.5.6 Installation of the functional unit of an alignable clamping device

1. Attach any lifting gear that may be required.
2. If necessary, fit the mounting aid onto a vertically suspended spindle.

NOTE

Damage to materials caused by incorrect position of drawtube adapter!

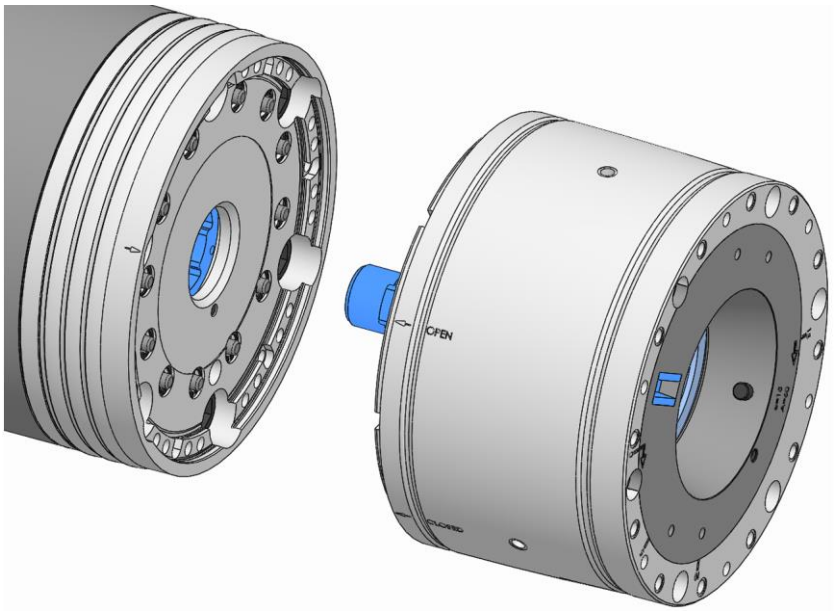
- Ensure that the drawtube adapter and spindle flange are mounted correctly.
- The machine drawtube can only be moved to its front limit stop using the least possible force and speed [see »Preparing the machine for installation« chapter].
- The pin on the spindle flange must engage in the drawtube adapter groove.
- It the pin on the spindle flange fails to engage in the drawtube adapter groove, remove the spindle flange and reposition the drawtube adapter.

3. Using the least possible force and speed, move the machine drawtube to its front limit stop [see »Preparing the machine for installation« chapter].

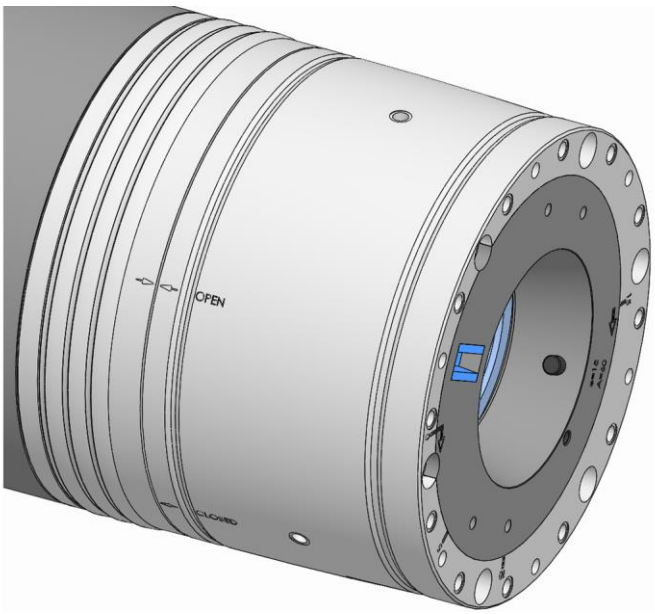
INFORMATION

The functional unit must be in a centric position for installation of the functional unit on the machine.

With the help of the scale on the functional unit, check if the eccentric screw is in position »0«.



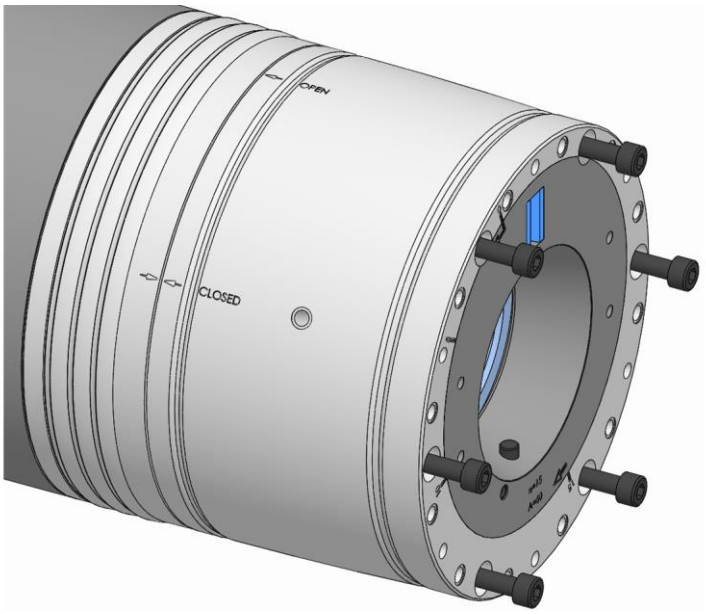
4. Fit the functional unit on the spindle flange until the »OPEN« marks on the functional unit and the spindle flange are aligned.



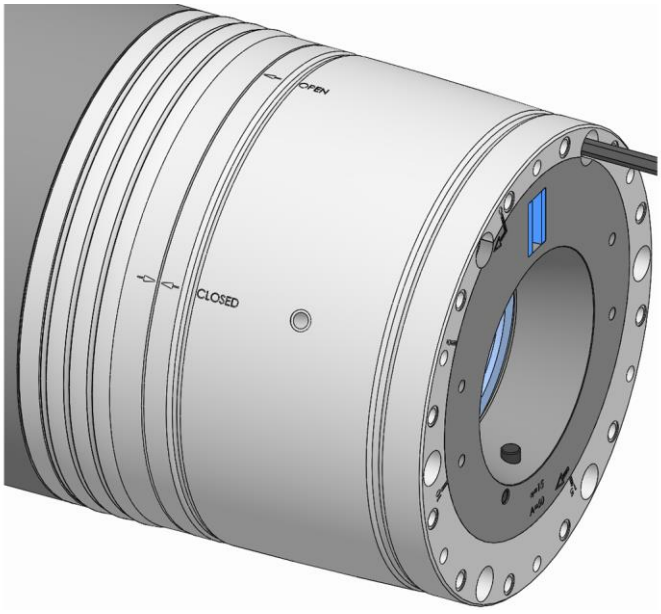
INFORMATION

If lifting gear needs to be used, rotate the functional unit by turning the spindle flange and machine spindle together.

5. Rotate the functional unit on the spindle flange or the spindle with the installed spindle flange against the functional unit until the »CLOSED« marks on the functional unit and the spindle flange are aligned.



6. Screw in the fixing screws on the functional unit evenly and alternately, crosswise, and tighten them gently.
7. Unfasten and remove any lifting gear that may have been required.
8. Remove the mounting aid on a vertically suspended spindle if one was used.
9. Check the face run-out on the test surface of the functional unit [ideally ≤ 0.01 mm] and, if necessary, correct carefully with a plastic hammer.

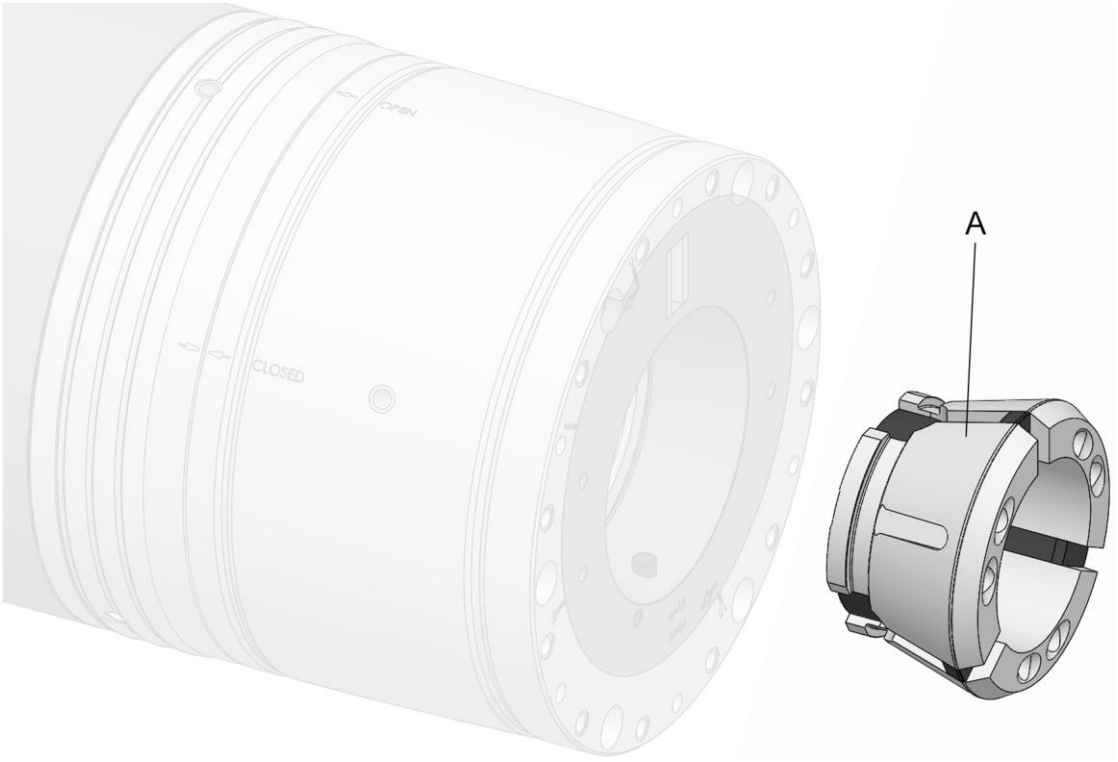


10. Tighten the fixing screws on the functional unit to the specified tightening torque evenly, alternately and crosswise [see »Screw tightening torques« chapter].
11. Check face run-out on the test surface of the functional unit [ideally ≤ 0.01 mm].

Whenever the face run-out is greater than the maximum permitted value:

12. Remove the functional unit.
13. Clean the locating face and the mating faces of the spindle flange and the functional unit.
14. If there is a burr or slight damage, rub down the locating face of the spindle flange or the functional unit gently with an oil stone.
15. Reinstall the functional unit.
16. Repeat the alignment process.
17. Repeat the face run-out test.

7.6 Installation of the clamping element



A Clamping head [clamping element]

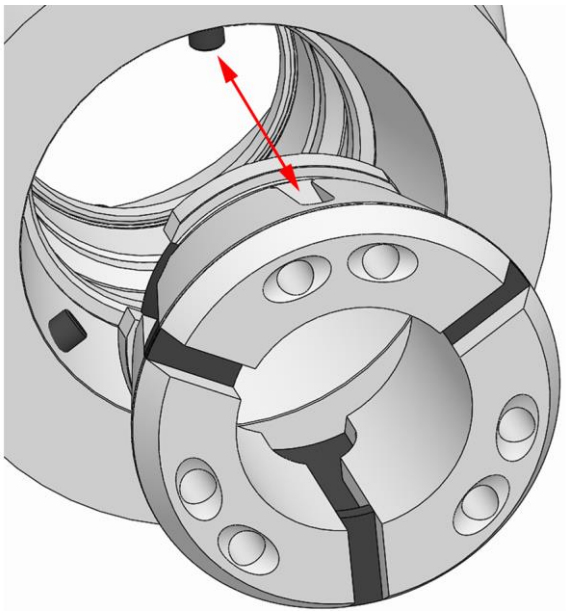
INFORMATION

Before installing the clamping element, install the changing part if necessary, otherwise it can no longer be installed.

Special aids needed:

- Changing fixture

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



WARNING

Serious crushing injuries caused by reaching into the coupling / slot area in the clamping head or into the changing fixture!

- During actuation, never reach into the coupling / slot area in the clamping head or into the changing fixture.

4. Install the clamping head in the product with an appropriate changing fixture. For this the anti-twist devices in the clamping taper of the product and the grooves in the clamping head must be aligned.
5. Unfasten and remove the changing fixture.

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

Malfunction of eccentric adjustment through use of incorrect coolants!

- Only use cooling emulsions.

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.

NOTE

Damage to clamping elements caused by using the wrong cooling lubricants!

- Never use cooling lubricants that contain ester or a polar solvent.

8.2 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 front and rear limit positions.

Then deduct the value obtained in the rear limit position from the value obtained from the front limit position. This figure must then be equal to or greater than the nominal total stroke.

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

8.3 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.
- None of the rubber segments on the clamping elements and attachments are torn or exhibit porous areas.
- 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.

8.4 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.

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:

8.5 Setting the eccentric dimension

The eccentric dimension is set using the C axis on the machine.

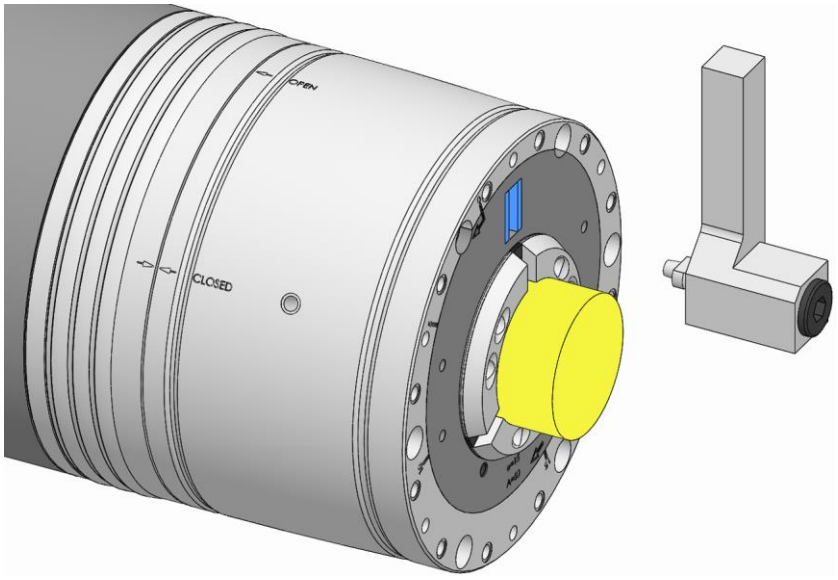
NOTE

Damage to materials caused by inaccurate setting of the eccentric dimension!

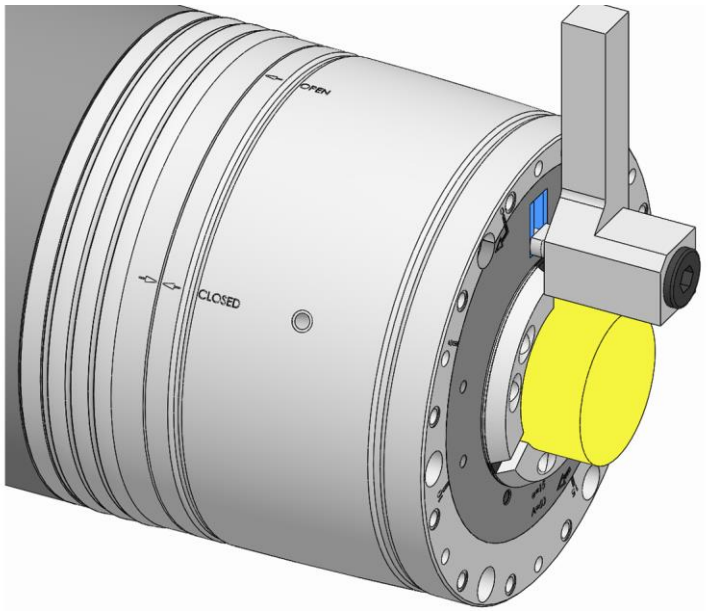
- The eccentric dimension must never be set if the clamping device is in its release position.
- Manual adjustment of the eccentric dimension must only take place when faults occur or when not installed and without a spindle flange.

After installation, the clamping device is in a centric position [datum position]. The following steps are needed to set the eccentric dimension:

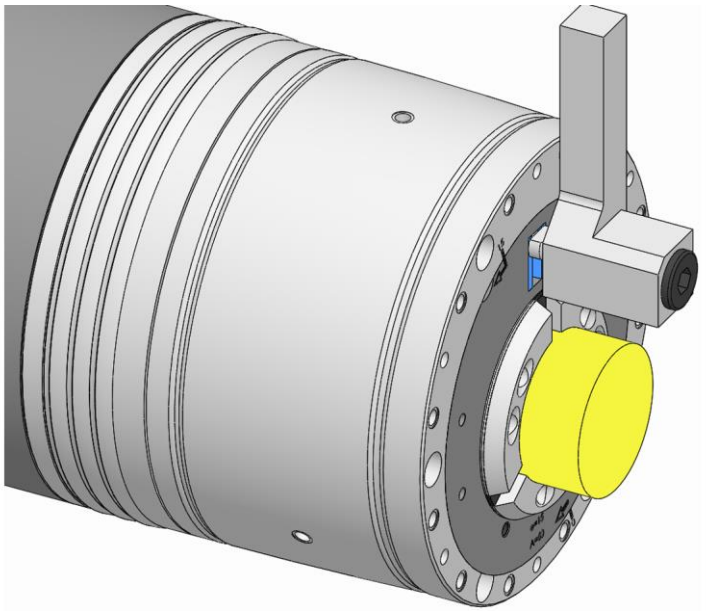
1. Install the workpiece in the product and, if necessary, secure it to prevent it from falling.
2. Clamp the workpiece. To do this, move the drawtube to its rear limit stop.
3. Remove the workpiece mounting if one was used.



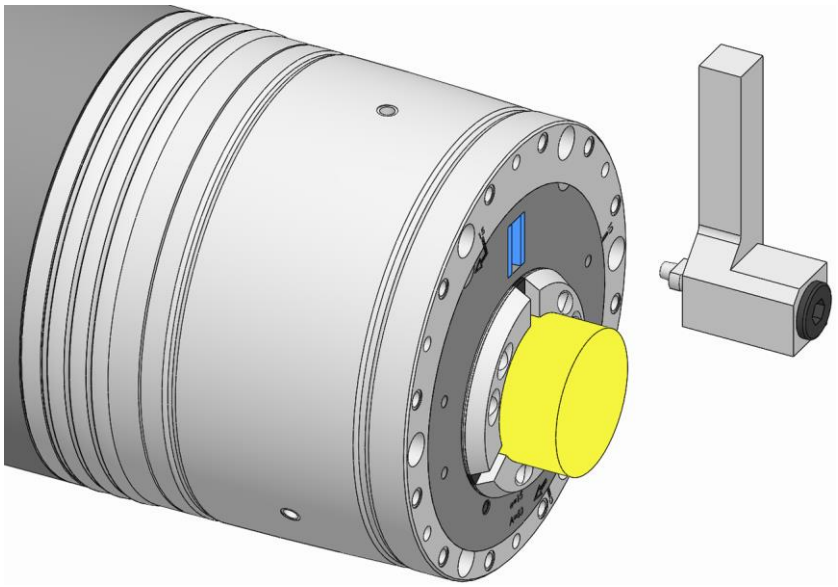
4. Position the adjusting tool from the middle of the adjustment journal to approach dimension A [see marking or »General information« chapter]. When doing so, ensure that the adjustment journal is positioned symmetrically with the clamping bolt groove.



5. With the help of the positioned adjustment tool, actuate the clamping bolt on the clamping device with a force of $1.2kN$.
6. Move the machine drawtube to the front limit stop.



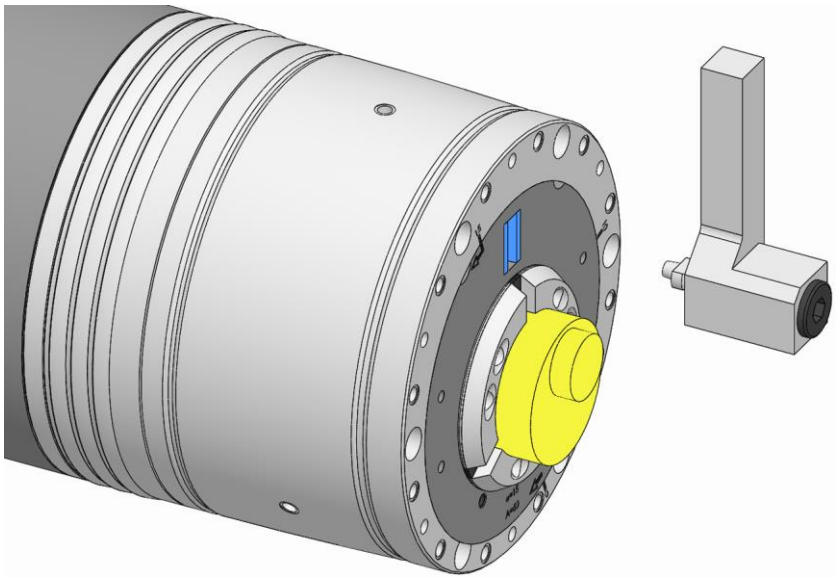
7. Set the eccentric dimension by rotating the C axis clockwise through the corresponding adjustment angle α [see the following table].
8. Move the machine drawtube to its rear limit stop.



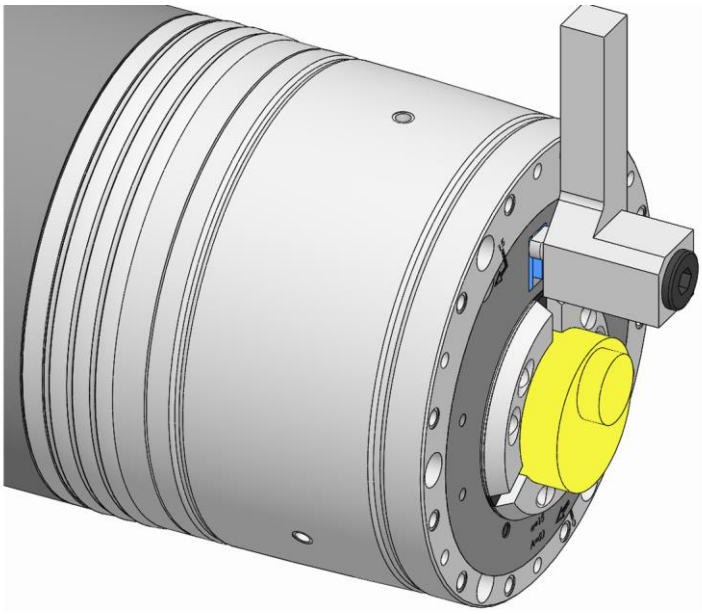
9. Retract the adjustment tool from the clamping bolt of the clamping device.
10. Machine the workpiece.

INFORMATION
Within a single fixture setting, only the eccentric can be produced.

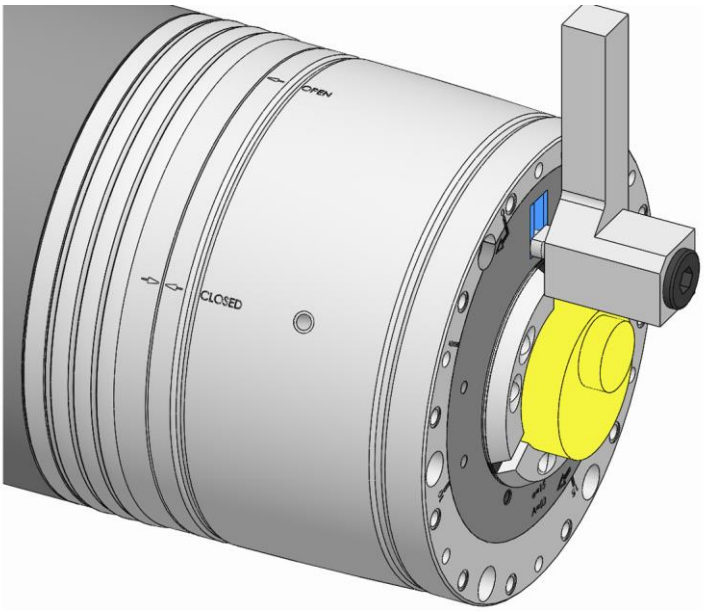
The workpiece can only be loaded or removed if the clamping device is in its centric position.



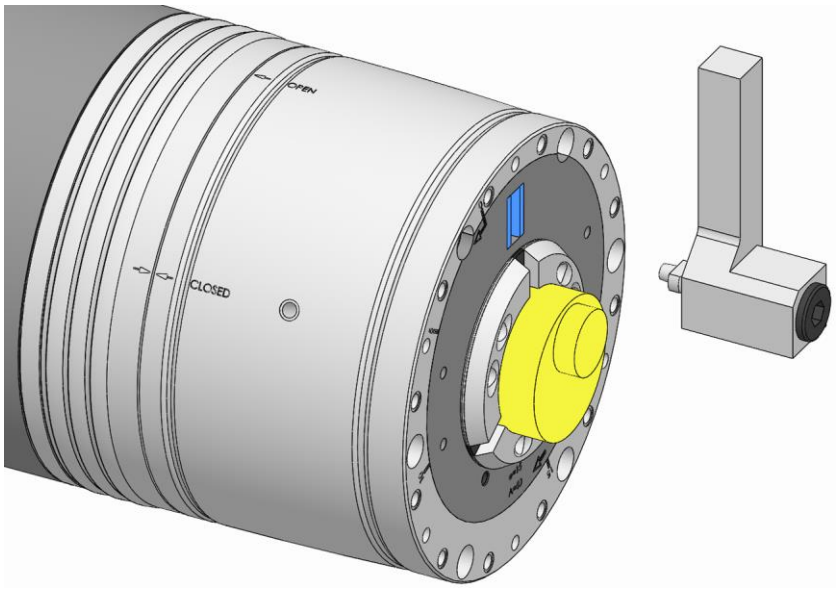
11. Position the adjusting tool from the middle of the adjustment journal to approach dimension A [see marking or »General information« chapter]. When doing so, ensure that the adjustment journal is positioned symmetrically with the clamping bolt groove.



12. With the help of the positioned adjustment tool, actuate the clamping bolt on the clamping device with a force of $1.2kN$.
13. Move the machine drawtube to the front limit stop.



14. Set the eccentric dimension by rotating the C axis counter-clockwise through the corresponding adjustment angle α into its datum position [see the following table].
15. Move the machine drawtube to its rear limit stop.



16. Retract the adjustment tool from the clamping bolt of the clamping device.
17. If necessary, secure the workpiece to prevent it from falling.

INFORMATION

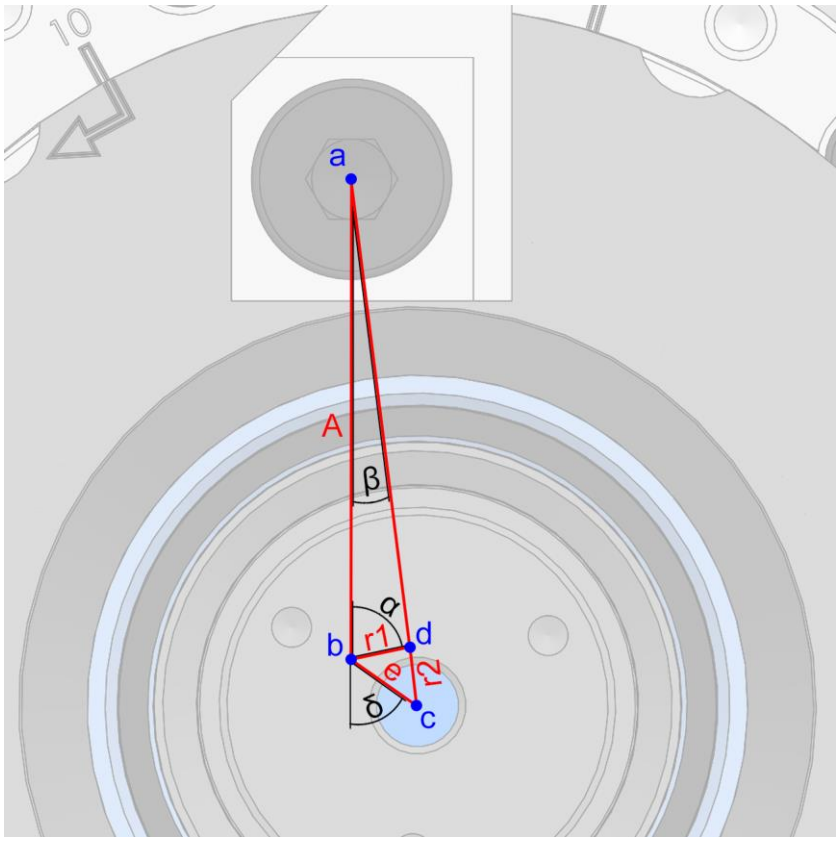
During the release stroke, the position of the alignment unit is corrected mechanically in datum position.

18. Move the machine drawtube to the front limit stop.
19. Remove the workpiece from the product. To do this, remove the workpiece mounting if one was used.

8.6 Setting angle for the corresponding eccentric dimension

The following tables provide an indication of the angles to be set for machining the workpiece in relation to the eccentric dimension e.

To achieve maximum precision, a correction must be made to angular rotation of the C axis after the first workpiece has been machined.



a	Deflection point
b	Machine spindle axis
c	Eccentric drum axis
d	Clamping taper axis
A	Approach dimension
r1	Eccentricity of eccentric drum in the housing
r2	Eccentricity of clamping taper in the housing
e	Eccentricity
α	Setting dimension
β	Alignment angle
δ	Flush alignment angle

The setting angle α indicates the angle by which the C axis needs to be rotated to achieve the desired eccentricity e.

The alignment angle β indicates the angle through which the C axis must be rotated to move the clamping device into a vertical position via the axis linking the centers of the clamping device and the eccentric. The alignment angle β can only be set after the desired eccentricity has been set, once the adjustment tool has been removed.

The flush alignment angle δ indicates the angle by which the C axis needs to be rotated in order to move the workpiece axis into the vertical half-way between centric and eccentric positions. The flush alignment angle δ can only be set after the desired eccentricity has been set, once the adjustment tool has been removed.

Select the table on the basis of maximum eccentricity e and the approach dimension A of the clamping device [see marking or »General information« chapter].

8.6.1 Setting angle for clamping devices with maximum eccentricity $e = 15mm$ and approach dimension $A = 51mm$

Eccentricity e $[mm]$	Setting angle α [°]	Alignment angle β [°]	Flush alignment angle δ [°]
0	0.000	0.000	0.000
0.1	0.652	0.112	89.730
0.2	1.303	0.225	89.461
0.3	1.955	0.337	89.191
0.4	2.607	0.449	88.921
0.5	3.259	0.561	88.651
0.6	3.911	0.674	88.381
0.7	4.564	0.786	88.111
0.8	5.217	0.898	87.840
0.9	5.870	1.009	87.570
1	6.524	1.121	87.298
1.1	7.178	1.233	87.027
1.2	7.833	1.344	86.755
1.3	8.489	1.455	86.483
1.4	9.145	1.566	86.211
1.5	9.801	1.677	85.938
1.6	10.459	1.788	85.664
1.7	11.117	1.898	85.390
1.8	11.776	2.008	85.116
1.9	12.436	2.118	84.841
2	13.097	2.227	84.565
2.1	13.759	2.337	84.289
2.2	14.422	2.446	84.012
2.3	15.086	2.554	83.734

Eccentricity e $[mm]$	Setting angle α [°]	Alignment angle β [°]	Flush alignment angle δ [°]
2.4	15.751	2.662	83.456
2.5	16.418	2.770	83.176
2.6	17.085	2.878	82.896
2.7	17.754	2.985	82.615
2.8	18.425	3.092	82.334
2.9	19.097	3.198	82.051
3	19.770	3.304	81.767
3.1	20.445	3.410	81.482
3.2	21.121	3.514	81.197
3.3	21.799	3.619	80.910
3.4	22.479	3.723	80.622
3.5	23.160	3.826	80.333
3.6	23.844	3.929	80.043
3.7	24.529	4.032	79.751
3.8	25.216	4.133	79.459
3.9	25.906	4.235	79.165
4	26.597	4.335	78.869
4.1	27.290	4.435	78.572
4.2	27.986	4.534	78.274
4.3	28.684	4.633	77.975
4.4	29.384	4.731	77.673
4.5	30.087	4.828	77.371
4.6	30.792	4.925	77.066
4.7	31.500	5.021	76.761
4.8	32.210	5.116	76.453

Eccentricity e $[mm]$	Setting angle α [°]	Alignment angle β [°]	Flush alignment angle δ [°]
4.9	32.923	5.210	76.143
5	33.639	5.304	75.832
5.1	34.358	5.396	75.519
5.2	35.079	5.488	75.204
5.3	35.804	5.579	74.888
5.4	36.531	5.669	74.569
5.5	37.262	5.758	74.248
5.6	37.996	5.847	73.925
5.7	38.733	5.934	73.600
5.8	39.474	6.020	73.273
5.9	40.219	6.106	72.944
6	40.966	6.190	72.612
6.1	41.718	6.273	72.278
6.2	42.473	6.356	71.941
6.3	43.232	6.437	71.602
6.4	43.996	6.517	71.261
6.5	44.763	6.596	70.916
6.6	45.534	6.674	70.570
6.7	46.310	6.750	70.220
6.8	47.090	6.825	69.868
6.9	47.875	6.900	69.513
7	48.664	6.972	69.154
7.1	49.458	7.044	68.793
7.2	50.256	7.114	68.429
7.3	51.060	7.183	68.062

Eccentricity e $[mm]$	Setting angle α [°]	Alignment angle β [°]	Flush alignment angle δ [°]
7.4	51.869	7.251	67.691
7.5	52.683	7.317	67.317
7.6	53.503	7.382	66.939
7.7	54.328	7.445	66.559
7.8	55.158	7.506	66.174
7.9	55.994	7.567	65.786
8	56.837	7.625	65.394
8.1	57.685	7.682	64.998
8.2	58.540	7.737	64.599
8.3	59.401	7.791	64.195
8.4	60.269	7.843	63.787
8.5	61.143	7.893	63.375
8.6	62.025	7.941	62.958
8.7	62.913	7.988	62.537
8.8	63.809	8.033	62.112
8.9	64.713	8.075	61.681
9	65.624	8.116	61.246
9.1	66.543	8.155	60.806
9.2	67.471	8.191	60.360
9.3	68.406	8.226	59.910
9.4	69.351	8.258	59.454
9.5	70.305	8.288	58.992
9.6	71.267	8.316	58.524
9.7	72.240	8.342	58.051
9.8	73.222	8.365	57.571

Eccentricity e [mm]	Setting angle α [°]	Alignment angle β [°]	Flush alignment angle δ [°]
9.9	74.214	8.386	57.086
10	75.217	8.404	56.593
10.1	76.230	8.419	56.095
10.2	77.255	8.432	55.589
10.3	78.291	8.443	55.076
10.4	79.339	8.450	54.556
10.5	80.399	8.455	54.028
10.6	81.472	8.457	53.492
10.7	82.558	8.455	52.948
10.8	83.658	8.451	52.396
10.9	84.772	8.443	51.835
11	85.901	8.432	51.266
11.1	87.045	8.418	50.686
11.2	88.205	8.400	50.098
11.3	89.381	8.379	49.499
11.4	90.575	8.353	48.889
11.5	91.787	8.324	48.269
11.6	93.017	8.291	47.637
11.7	94.267	8.254	46.993
11.8	95.538	8.212	46.337
11.9	96.830	8.167	45.668
12	98.144	8.116	44.986
12.1	99.483	8.061	44.289
12.2	100.846	8.000	43.577
12.3	102.235	7.934	42.850

Eccentricity e [mm]	Setting angle α [°]	Alignment angle β [°]	Flush alignment angle δ [°]
12.4	103.652	7.863	42.106
12.5	105.099	7.787	41.344
12.6	106.577	7.704	40.564
12.7	108.087	7.615	39.764
12.8	109.633	7.519	38.943
12.9	111.217	7.416	38.100
13	112.841	7.306	37.232
13.1	114.509	7.188	36.340
13.2	116.223	7.061	35.419
13.3	117.989	6.926	34.469
13.4	119.809	6.781	33.486
13.5	121.690	6.626	32.468
13.6	123.638	6.459	31.410
13.7	125.660	6.280	30.310
13.8	127.765	6.088	29.161
13.9	129.962	5.880	27.959
14	132.265	5.656	26.695
14.1	134.691	5.412	25.361
14.2	137.259	5.147	23.944
14.3	139.998	4.856	22.429
14.4	142.945	4.534	20.795
14.5	146.155	4.175	19.010
14.6	149.712	3.765	17.027
14.7	153.755	3.288	14.767
14.8	158.559	2.707	12.074

Eccentricity e $[mm]$	Setting angle α [°]	Alignment angle β [°]	Flush alignment angle δ [°]
14.9	164.831	1.930	8.550
15	180.000	0.000	0.000

Table 17: Setting angle for clamping devices with maximum eccentricity e=15 mm and approach dimension A=51 mm

8.6.2 Setting angle for clamping devices with maximum eccentricity $e = 15mm$ and approach dimension $A = 60mm$

Eccentricity e $[mm]$	Setting angle α [°]	Alignment angle β [°]	Flush alignment angle δ [°]
0	0.000	0.000	0.000
0.1	0.668	0.095	89.714
0.2	1.337	0.191	89.427
0.3	2.006	0.286	89.140
0.4	2.674	0.382	88.854
0.5	3.343	0.477	88.567
0.6	4.012	0.573	88.280
0.7	4.682	0.668	87.993
0.8	5.352	0.763	87.706
0.9	6.022	0.858	87.418
1	6.692	0.953	87.130
1.1	7.363	1.048	86.842
1.2	8.035	1.142	86.554
1.3	8.707	1.237	86.265
1.4	9.380	1.331	85.976
1.5	10.053	1.425	85.686
1.6	10.727	1.519	85.396
1.7	11.402	1.613	85.106
1.8	12.078	1.707	84.815

Eccentricity e $[mm]$	Setting angle α [°]	Alignment angle β [°]	Flush alignment angle δ [°]
1.9	12.754	1.800	84.523
2	13.431	1.893	84.231
2.1	14.110	1.986	83.938
2.2	14.789	2.079	83.645
2.3	15.469	2.171	83.351
2.4	16.151	2.263	83.056
2.5	16.834	2.355	82.761
2.6	17.517	2.446	82.464
2.7	18.202	2.537	82.167
2.8	18.889	2.628	81.869
2.9	19.577	2.718	81.571
3	20.266	2.808	81.271
3.1	20.957	2.898	80.971
3.2	21.649	2.987	80.669
3.3	22.343	3.076	80.367
3.4	23.038	3.164	80.063
3.5	23.735	3.252	79.758
3.6	24.434	3.339	79.453
3.7	25.135	3.426	79.146
3.8	25.837	3.513	78.838
3.9	26.542	3.599	78.528
4	27.248	3.684	78.218
4.1	27.957	3.769	77.906
4.2	28.667	3.853	77.593
4.3	29.380	3.937	77.278

Eccentricity e $[mm]$	Setting angle α [°]	Alignment angle β [°]	Flush alignment angle δ [°]
4.4	30.095	4.020	76.963
4.5	30.812	4.103	76.645
4.6	31.532	4.185	76.326
4.7	32.254	4.266	76.006
4.8	32.979	4.347	75.684
4.9	33.706	4.427	75.360
5	34.436	4.506	75.035
5.1	35.169	4.585	74.708
5.2	35.904	4.663	74.379
5.3	36.643	4.740	74.049
5.4	37.384	4.817	73.716
5.5	38.128	4.892	73.382
5.6	38.876	4.967	73.046
5.7	39.626	5.041	72.708
5.8	40.380	5.115	72.367
5.9	41.137	5.187	72.025
6	41.898	5.259	71.680
6.1	42.662	5.329	71.334
6.2	43.430	5.399	70.985
6.3	44.201	5.468	70.633
6.4	44.976	5.536	70.280
6.5	45.756	5.603	69.924
6.6	46.539	5.669	69.565
6.7	47.326	5.734	69.204
6.8	48.118	5.798	68.840

Eccentricity e $[mm]$	Setting angle α [°]	Alignment angle β [°]	Flush alignment angle δ [°]
6.9	48.913	5.861	68.474
7	49.714	5.923	68.104
7.1	50.519	5.983	67.732
7.2	51.328	6.043	67.357
7.3	52.142	6.101	66.980
7.4	52.961	6.159	66.599
7.5	53.785	6.215	66.215
7.6	54.615	6.269	65.827
7.7	55.449	6.323	65.437
7.8	56.289	6.375	65.043
7.9	57.135	6.426	64.646
8	57.986	6.476	64.245
8.1	58.843	6.524	63.841
8.2	59.706	6.571	63.433
8.3	60.575	6.617	63.021
8.4	61.451	6.661	62.605
8.5	62.333	6.703	62.185
8.6	63.222	6.744	61.761
8.7	64.118	6.784	61.333
8.8	65.020	6.821	60.901
8.9	65.930	6.858	60.464
9	66.848	6.892	60.022
9.1	67.773	6.925	59.576
9.2	68.706	6.956	59.125
9.3	69.647	6.985	58.669

Eccentricity e $[mm]$	Setting angle α [°]	Alignment angle β [°]	Flush alignment angle δ [°]
9.4	70.597	7.013	58.208
9.5	71.555	7.038	57.742
9.6	72.522	7.062	57.270
9.7	73.498	7.083	56.793
9.8	74.484	7.103	56.310
9.9	75.479	7.121	55.821
10	76.485	7.136	55.326
10.1	77.500	7.149	54.824
10.2	78.527	7.160	54.317
10.3	79.565	7.169	53.802
10.4	80.614	7.175	53.281
10.5	81.675	7.179	52.752
10.6	82.748	7.181	52.216
10.7	83.834	7.180	51.673
10.8	84.933	7.176	51.121
10.9	86.046	7.169	50.562
11	87.173	7.160	49.994
11.1	88.315	7.148	49.417
11.2	89.472	7.133	48.830
11.3	90.645	7.115	48.235
11.4	91.835	7.093	47.629
11.5	93.042	7.069	47.013
11.6	94.268	7.041	46.386
11.7	95.512	7.009	45.749
11.8	96.776	6.974	45.099

Eccentricity e [mm]	Setting angle α [°]	Alignment angle β [°]	Flush alignment angle δ [°]
11.9	98.061	6.935	44.437
12	99.368	6.892	43.762
12.1	100.698	6.845	43.074
12.2	102.052	6.794	42.371
12.3	103.431	6.738	41.654
12.4	104.838	6.678	40.920
12.5	106.272	6.613	40.170
12.6	107.738	6.543	39.403
12.7	109.235	6.467	38.616
12.8	110.766	6.386	37.810
12.9	112.334	6.299	36.982
13	113.942	6.205	36.132
13.1	115.591	6.105	35.257
13.2	117.287	5.998	34.356
13.3	119.031	5.883	33.426
13.4	120.830	5.760	32.465
13.5	122.688	5.628	31.470
13.6	124.610	5.487	30.438
13.7	126.605	5.335	29.365
13.8	128.680	5.172	28.246
13.9	130.846	4.996	27.075
14	133.116	4.805	25.845
14.1	135.504	4.599	24.547
14.2	138.033	4.373	23.170
14.3	140.728	4.126	21.699

Eccentricity e $[mm]$	Setting angle α [°]	Alignment angle β [°]	Flush alignment angle δ [°]
14.4	143.626	3.853	20.113
14.5	146.782	3.547	18.383
14.6	150.277	3.200	16.461
14.7	154.249	2.795	14.273
14.8	158.966	2.301	11.668
14.9	165.120	1.640	8.260
15	180.000	0.000	0.000

Table 18: Setting angle for clamping devices with maximum eccentricity e=15 mm and approach dimension A=60 mm

8.7 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. Move product into release position.
2. Switch off machine tool and secure it to prevent it from being switched back on.
3. 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:

4. Clean the product of swarf and production residue with a soft, lint-free cloth and apply a light coating of oil.
5. 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

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

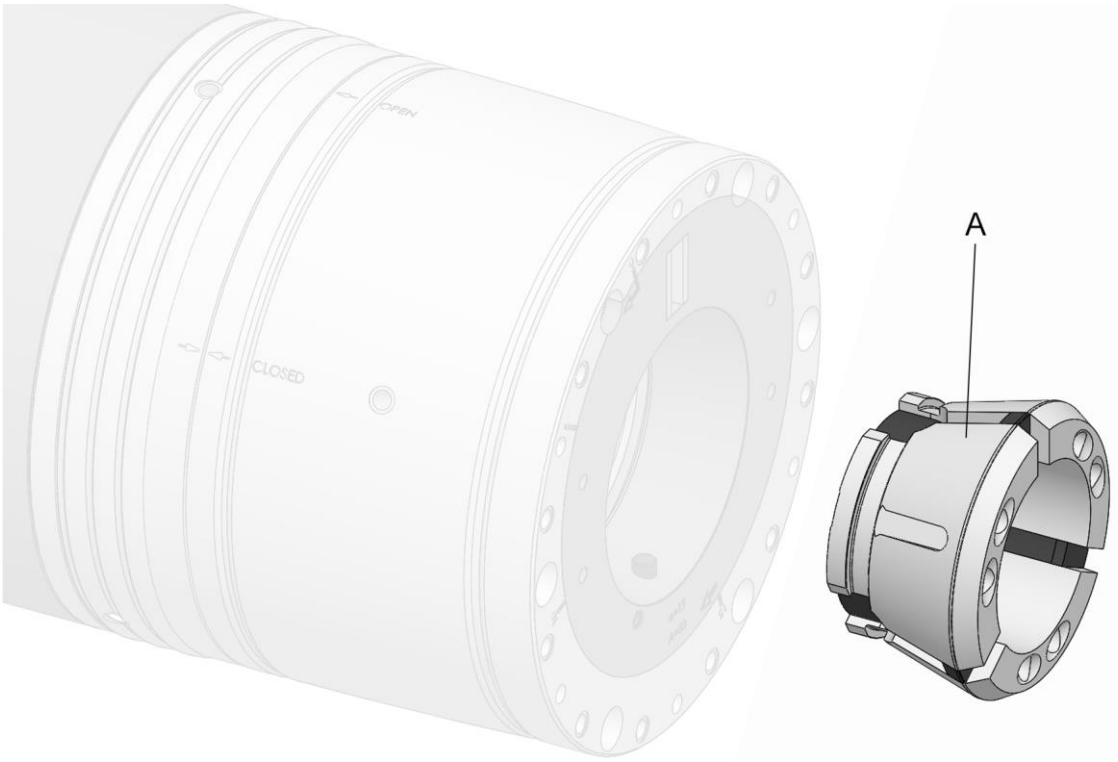
10.2 Preparing the machine for removal

1. Set the machine into set-up mode.

INFORMATION
The minimum operating pressure is reached when the drawtube can still just be moved without triggering an error message.

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

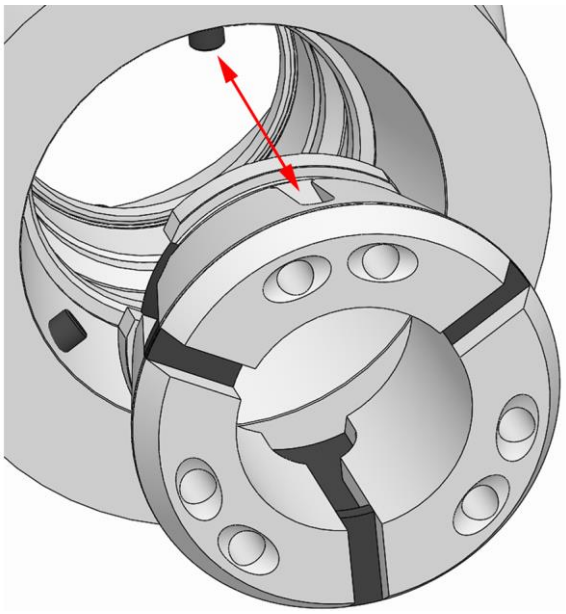


A Clamping head [clamping element]

Special aids needed:

- Changing fixture

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



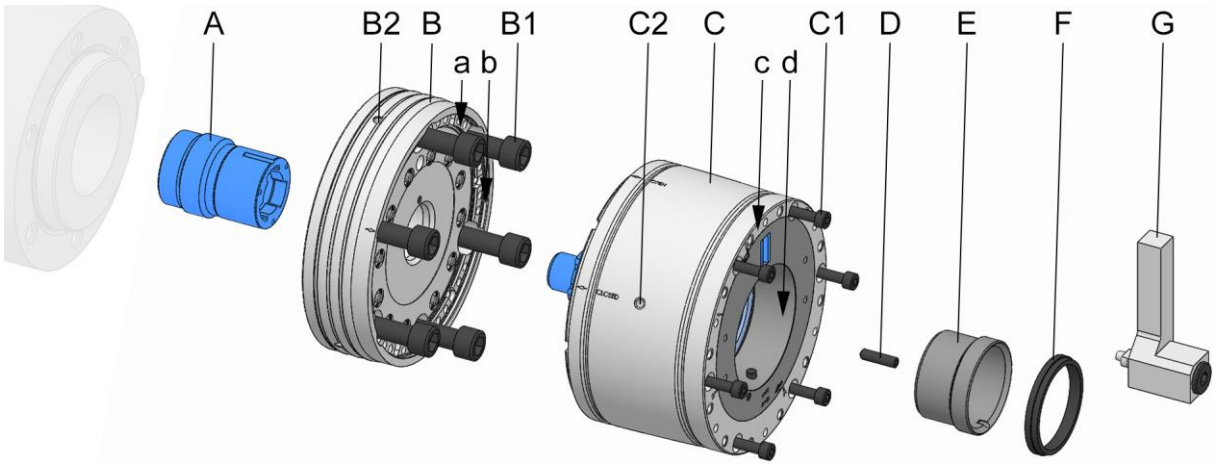
WARNING

Serious crushing injuries caused by reaching into the coupling / slot area in the clamping head or into the changing fixture!

- During actuation, never reach into the coupling / slot area in the clamping head or into the changing fixture.

4. Remove the clamping head from the product with an appropriate changing fixture.

10.4 Removal of the product



A	Drawtube adapter
B	Spindle flange
B1	Fixing screws on spindle flange
B2	Transport thread spindle flange
C	Functional unit
C1	Fixing screws, function unit
C2	Transport thread on functional unit
D	Threaded dowel
E	Protective liner
F	Swarf baffle ring
G	Adjustment tool
a	Test surface, face run-out, spindle flange
b	Test surface, axial run-out, spindle flange
c	Test surface, face run-out, functional unit
d	Test surface, axial run-out, functional unit

1. As described in the »Preparing the machine for removal« chapter, prepare for the following steps.
2. Remove the adjustment tool from the machine turret.

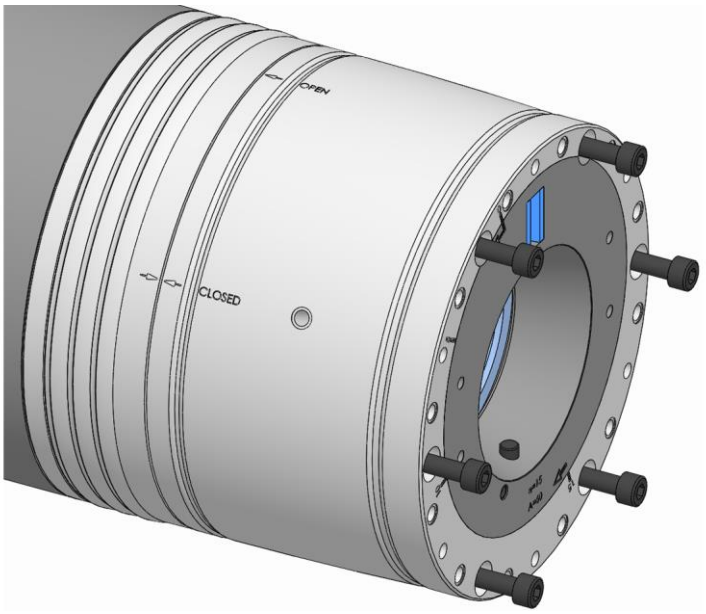
10.4.1 Removal of the functional unit

INFORMATION

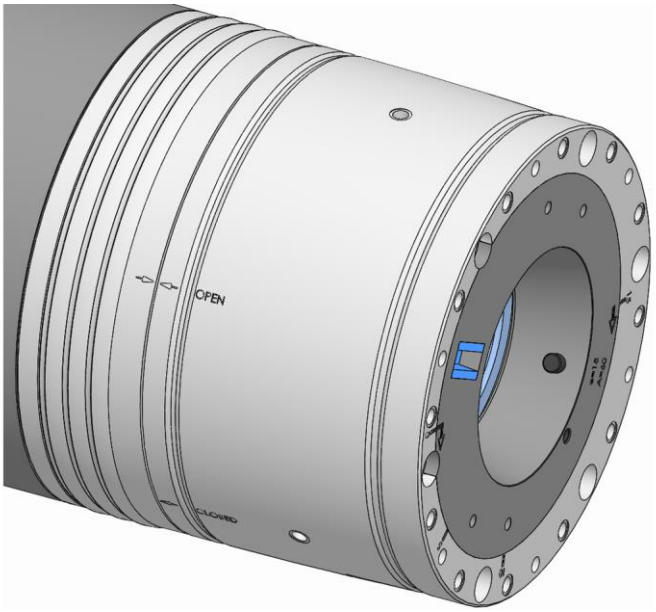
The functional unit must be in a centric position for removal of the functional unit from the machine.

With the help of the scale on the functional unit, check if the eccentric screw is in position »0«.

1. Attach any lifting gear that may be required.
2. If necessary, fit the mounting aid onto a vertically suspended spindle.
3. Move the machine drawtube to the front limit stop.



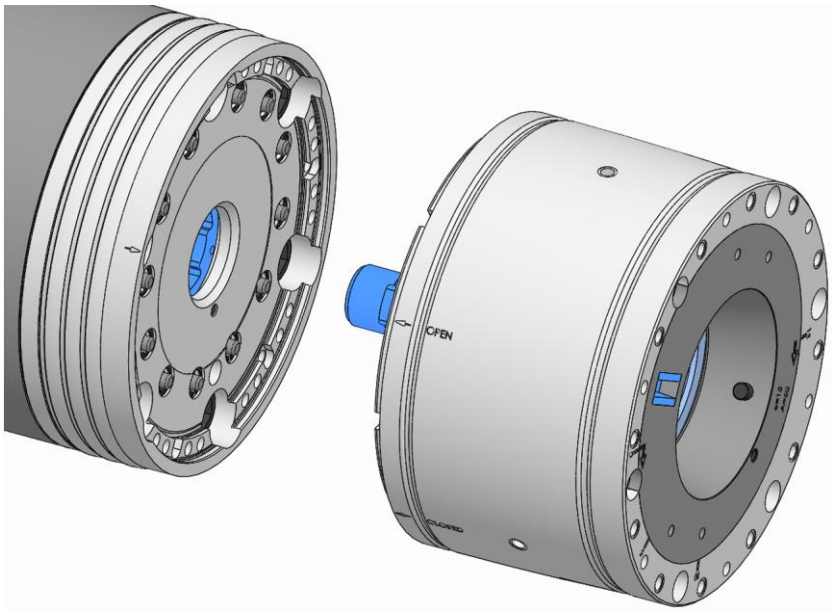
4. Unfasten and remove the fixing screws on the functional unit evenly, alternately and crosswise.



INFORMATION

If lifting gear needs to be used, rotate the functional unit by turning the spindle flange and machine spindle together.

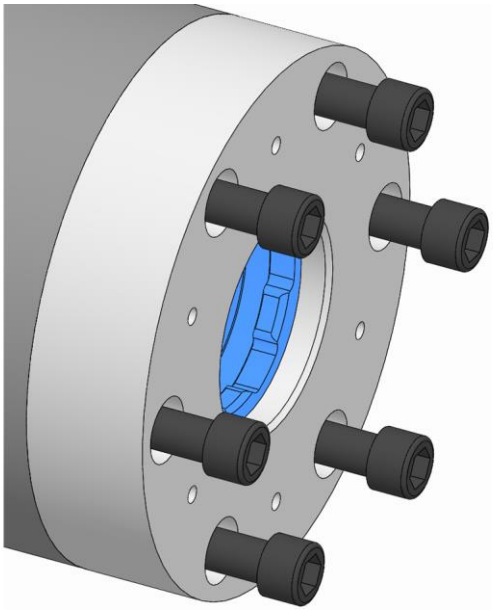
5. Rotate the functional unit on the spindle flange or the spindle with the installed spindle flange against the functional unit until the »OPEN« marks on the functional unit and the spindle flange are aligned.



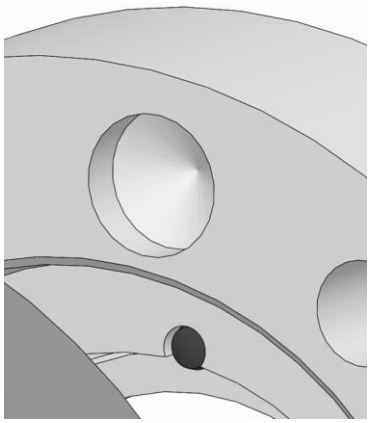
6. Take down the functional unit from the spindle flange.

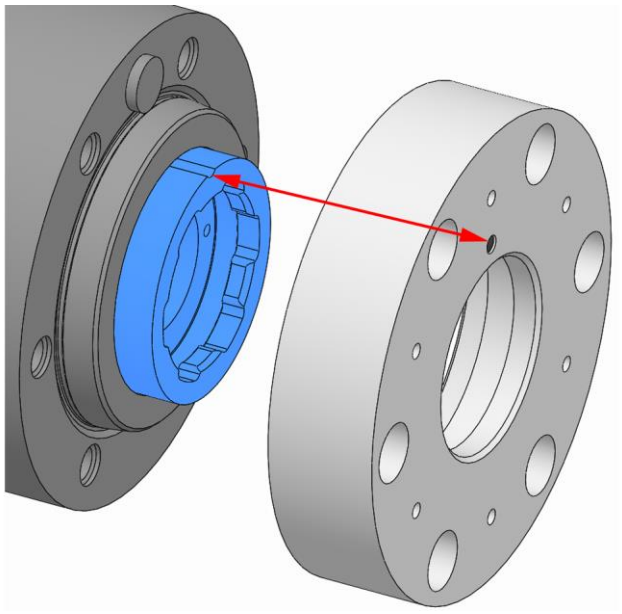
10.4.2 Removal of the spindle flange

1. Attach any lifting gear that may be required.
2. If necessary, fit the mounting aid onto a vertically suspended spindle.
3. Using the least possible force and speed, move the machine drawtube to its rear limit stop [see »Preparing the machine for removal« chapter].



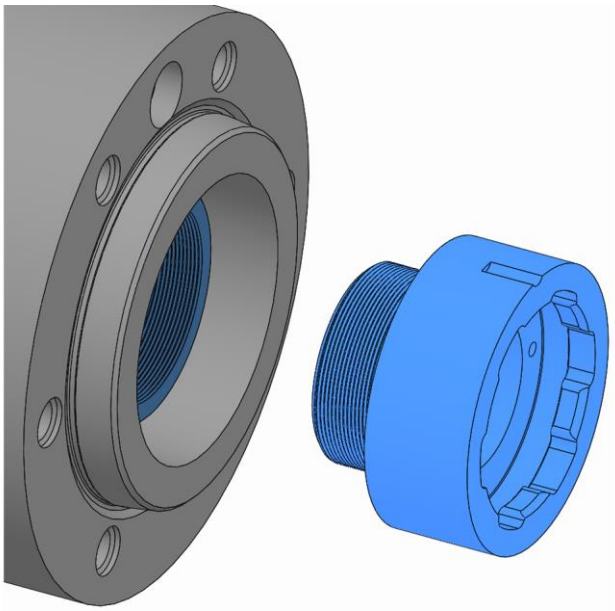
4. Unfasten and remove the fixing screws on the spindle flange.





5. Take down the spindle flange from the machine spindle.

10.4.3 Removal of the drawtube adapter



1. Unscrew and remove the drawtube adapter from the drawtube on the machine using its thread.

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].

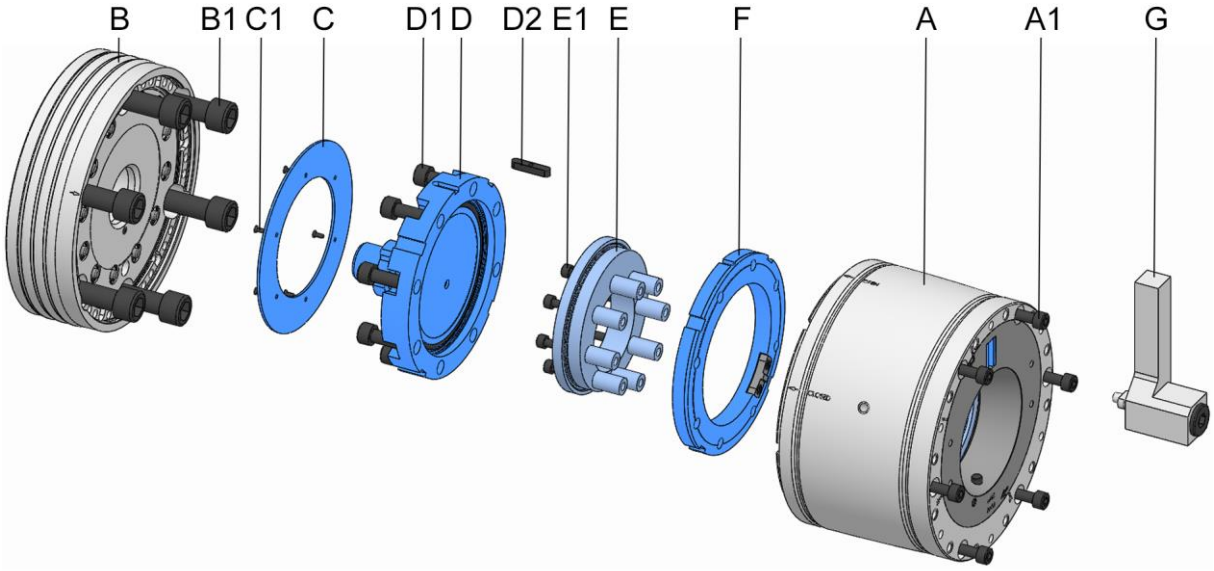
Interval	Maintenance work
daily	Visual inspection of clamping and mating surfaces for signs of wear, nicks and cracks [see »Visual inspection« chapter]
	Visual inspection of rubber on clamping element for signs of wear, nicks and cracks [see »Visual inspection« chapter]
	Complete cleaning if heavily soiled [see »Cleaning« chapter]
	Conduct a structural clamping force measurement
weekly or after 40 operating hours*	Remove the clamping element [see »Removal of the clamping element« chapter]
	Clean the clamping element, clamping taper and coupling area [see »Cleaning« chapter]

Interval	Maintenance work
	Lubricate the product [see »Lubricating the product« chapter]
six-monthly or after 1500 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 19: Maintenance table

11.3 Cleaning



A Clamping element receiver
A1 Fixing screws clamping element receiver
B Spindle flange
B1 Fixing screws on spindle flange
C Cover
C1 Cover fixing screws
D Bayonet adapter
D1 Fixing screws on bayonet adapter
D2 Fitted key on bayonet adapter
E Adapter
E1 Fixing screws adapter
F Disc
G Adjustment tool

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 clamping elements caused by the wrong solvent!

- 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 changing parts and the clamping element from the product [see »Removal of changing parts« and »Removal of clamping element« chapters].
2. Remove the product from the machine [see »Removal of the product« 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.

3. Dismantle the product as shown on the exploded drawing.
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 in accordance with the exploded drawing and lubricate mating surfaces during assembly. 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].
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 clamping element 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 lubricating the unit, set maximum eccentricity 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.

A piston-actuated grease gun can be used to apply the grease. The piston-actuated grease gun is filled with the selected grade of grease, which is then pressed into the product. For this, the piston-actuated grease gun has a pointed mouthpiece.

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 clamping device	Dirt in the parts in the power flow	Remove, disassemble and clean the clamping element and clean the clamping device if necessary	Skilled specialist
	Defective drawtube adapter	Discussion with the manufacturer	Manufacturer
	Incorrect drawtube position	Check drawtube position and align with the clamping device	Skilled specialist
	Dirt in the spring chamber	Removing, disassembling and cleaning the clamping device	HAINBUCH

Fault	Possible cause	Remedial action	Remedied by
	Springs fatigued	Replace the springs	
Clamping element cannot be swapped in / out	Defective axial strokes in the clamping device	See fault »Defective axial strokes in the clamping device«	
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	
	Stroke limitation by the workpiece end-stop	Use an appropriate workpiece end-stop	
Clamping force is too high	Axial actuating force on drawtube too high	Check machine setting and correct if necessary	Skilled specialist
Eccentricity alters while a workpiece is being machined	Axial actuating force on drawtube too weak	Check machine setting and correct if necessary	Skilled specialist
The eccentric dimension cannot be set	Mechanical friction is too great [idling moment >5 Nm]	Lubricate the clamping device	Skilled specialist
	Dirt inside the functional unit	Remove clamping device, disassemble and clean the functional unit	HAINBUCH
		When working without bleeding, install the protective liner	Skilled specialist
Geometry deviation on the workpiece	Concentricity error on the clamping device	Check axial run-out of the clamping device and correct if necessary	Skilled specialist
	Face run-out error of the clamping device	Check face run-out of the clamping device and clean the mating surfaces if necessary	
	Dirty end-stop area	Remove the workpiece end-stop and clean the mating surfaces	
	Dirty coupling area in the clamping element	Remove the clamping element, clean the coupling area and the clamping element	
	Dirty clamping taper	Remove clamping element / functional unit and clean the clamping taper	

Fault	Possible cause	Remedial action	Remedied by
	Geometry error on the workpiece due to incorrect type of clamping element	Use a suitable clamping element	
	Incorrect eccentric setting	Check settings and correct if necessary	
	Elastic distortion	Reduce the clamping force to the level applicable for the clamping device and the workpiece	
		Check the workpiece material	
Indentations on the clamping surface	Clamping force is too high	Reduce the clamping force to the level applicable for the clamping device and the workpiece	Skilled specialist
	Incorrect type of clamping element	Use a suitable clamping element	
	Dirty clamping element	Clean the clamping element	
	Damaged clamping element	Replace the clamping element	
	Dimensional difference between workpiece diameter and clamping bore is too big	Use clamping element with a suitable clamping diameter	

Table 20: 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.

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