

HELLER

Maintenance Instructions

H 10000 MC
SINUMERIK 840D sl

IA.003385-EN-00

Contract data	
Designation	Machining centre
Machine type	H 10000 MC
Control	SINUMERIK 840D sl
Commission No.	M54808

Customer data	
Customer	PACCAR
Location	Columbus / USA

Maintenance Instructions	<p>This manual is an integral part of the General Machine Documentation, which consists of several documents.</p> <p>The Maintenance Instructions (IA) describe all inspection and maintenance work to be performed periodically in order to keep the machine ready for operation. The document provides the following information:</p> <ul style="list-style-type: none">- Checklists as a guideline.- Detailed instructions per maintenance item how to perform work safely and professionally.
Intended readership	<p>The Maintenance Instructions are intended for all persons undertaking inspections, servicing and the error correction on the machine.</p>
Scope of these Maintenance Instructions	<p>These Maintenance Instructions are applicable only to the machine stated on the cover sheet.</p>

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1. Information and technical support

2. Safety

3. Checklist for inspection and maintenance

4. Inspection and maintenance

5. Maintenance on account of messages

6. Drawings, plans

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CHAPTER 1

Information and technical support

1 Information and technical support

1.1 Components of the General Machine Documentation

The complete General Machine Documentation for your machine consists of the following documents:

Machine Operator Manual (BD)

The Machine Operator Manual describes the preparation of the machine for operation and all activities during operation. The document contains the following information:

- Operating and monitoring devices
- Operation for production
- Operation in special situations
- Tool handling

Operator Information (BI)

Operator Information is supplied only upon request. These documents contain important additions or specific order-related details, which came to light after the copy deadline. The Operator Information supplied form part of the General Machine Documentation and must be observed accordingly.

SINUMERIK 840D - Programming Short Guide

The Programming Short Guide of Messrs. Siemens describes all the important programming steps. The document is intended to assist and jog the memory of the programmer, who would perhaps like to "brush up" on a command that is used all too infrequently or to look up the meaning of a parameter.

SINUMERIK 840D sl - Operating Manual

The Operating Manual of Messrs. Siemens describes the functionality of the standard scope of the control. The document supports the user of the machine during the following tasks:

- Setting the machine
- Machining workpiece
- Teaching programs
- Managing tool data
- Manage program

SINUMERIK 840D sl - Diagnostics Manual	<p>The Diagnostics Manual of Messrs. Siemens must be used as a reference work. The document supports the user of the machine during the following tasks:</p> <ul style="list-style-type: none"> - Correctly assessing special cases during machine operation. - Understanding the reaction of the machine to special cases. - Using the possibilities for continued operation after special cases. - Following references to more detailed documents. <p>The Diagnostics Guide describes alarms from the following areas of the control:</p> <ul style="list-style-type: none"> - NC core NCK - User interface HMI - Drive system SINAMICS and drives - Programmable logic controller PLC
Supplementary control manuals (optional)	<p>The package includes the following manuals of Messrs. Siemens:</p> <ul style="list-style-type: none"> - SINUMERIK 840D - Programming Manual - Fundamentals - SINUMERIK 840D - Programming Instructions - Production Engineering - SINUMERIK 840D - Programming Instructions - Cycles
SINUMERIK 840D sl - HELLER Programming Instructions (PA)	<p>The HELLER-Programming Instructions describe supplementary functions developed by HELLER and exceeding the standard scope of the SINUMERIK 840D sl control. The main contents are:</p> <ul style="list-style-type: none"> - Variables for workpiece information and variable programming. - M and G functions - Tool functions. - Traversing range restrictions. - Compatibility between the series and its predecessors. - Cycles.
Maintenance Instructions (IA)	<p>The Maintenance Instructions (IA) describe all inspection and maintenance work to be performed periodically in order to keep the machine ready for operation. The document provides the following information:</p> <ul style="list-style-type: none"> - Checklists as a guideline. - Detailed instructions per maintenance item how to perform work safely and professionally.
Wear Parts List (VS)	<p>The Wear Parts List provides an overview of all mechanical, hydraulic and electric wear and spare parts of the machine.</p>
Subsuppliers' Information (ZI)	<p>Subsuppliers' Information is a collection of selected original documents on components purchased by HELLER from other</p>

manufacturers. The selection focuses on documents containing information relevant to the end user.

Transportation Information (TI)

Transportation Information is available for the machine and for main components such as pallet magazine and rack-type tool magazine. The Transportation Information contains the information required to transport the machine or component by crane:

- Weight
- Lifting points
- Specified hook-up material

1.2 Using the General Machine Documentation

Importance of General Machine Documentation

All persons employed or commissioned by the owner to carry out transport, set-up, installation, commissioning, operation and maintenance of the machine must read and adhere to all instructions provided in the General Machine Documentation.



In particular, all of them must have read and understood Chapter 2 headed "Safety" in this User Information.

Senior personnel must make all relevant documentation accessible to staff and ensure that such documentation is strictly adhered to.

Only by following the rules and instructions contained in the General Machine Documentation will it be possible to avoid mistakes, ensure error-free operation and get the maximum benefit from your machine.

Changes

This technical documentation does not cover modifications made to the machine after delivery.

HELLER reserves the right to make alterations with respect to the information contained in this technical documentation due to technical progress and for the purpose of correcting errors.

Applicable rules and regulations

The owner must ensure that in addition to the General Machine Documentation, all regulations concerning accident prevention and environmental protection valid at the site of machine use are observed.

Subsuppliers' Information (ZI)

Note particularly the supplied manufacturers' documentation on external units and purchased parts.

HELLER cannot accept responsibility for the completeness and correctness of this documentation.

Availability of General Machine Documentation

The General Machine Documentation is essential for the use of the machine. The General Machine Documentation should therefore always be kept near the machine and be accessible to the appropriate personnel at all times.

1.3 Abbreviations

Machine-related designations

Job No. Five-digit job number, see machine nameplate.
The job number corresponds to the machine number.
Option: In the case of rebuilds, the order number is extended by a two-digit rebuild number.

	Modification status	Job No. example
New machines	--	12345
1nd rebuild	01	12345.01
2nd rebuild	02	12345.02

The combination of job number and rebuild number can also be found on the spine of the documentation folders.

ED Duty cycle (in performance data)
Example: Spindle power with ED S1 - 100%

HSK Hollow taper shank tool holder DIN 69 893

SK Steep taper tool holder DIN 69 871

User information

BD Machine Operator Manual

BS CNC Operator Manual

BI Operator Information

IA Maintenance Instructions

PA Programming instructions

PU Programming instructions for sub-programs

TI Transportation Information

VS Wear and spare parts list

1 Information and technical support**1.3 Abbreviations**

ZI Subsuppliers' Information

Drawings, plans

AP	Operation layout
AZ	General layout
EP	Wiring Diagram
FZ	Installation plan
HP	Hydraulic diagram
KP	Coolant diagram Cooling water diagram
PP	Pneumatic diagram
SA	Lubrication Instructions
SP	Lubrication diagram

1.4 Symbols and codes for text identification

The following symbols and codes appear in this user information.

Warning and safety precautions



The warning triangle denotes warnings and safety precautions.



For definitions of various warning levels see:
"Warning and safety precautions" **page 33**

Codes in guidance texts

- Precondition for an action or action sequence.
- Action you are to carry out.
- Behaviour of the machine (process or condition) that can be expected as the result of the previous action.



Help in the event that you cannot complete an action or achieve the expected result.

Diagnostics: Symptom and (possible) cause.

- Remedy: Actions required to solve the problem.

Names of operating elements are in *italics*. Example :
The *Pre-set start* key.

Symbol suffixes that you must enter exactly, appear in the *Courier* font. Example :
Enter `unix`.

1	Information and technical support
1.4	Symbols and codes for text identification

Other remarks



Background information or references to peculiarities and exceptional cases.



Information on environmental protection.

Cross-references



Cross-reference to another point in this user information.



Cross-reference to another user information.



Cross-reference to a drawing or diagram.

Component item numbers

- [x.y]** Position number of a component on a plan and in the corresponding equipment list. Example :
- SP [24.1] Item 24.1 in the Lubrication Diagram (SP).
- (-x/y)** Position number y of a component in the x Figure of the same subchapter. Example :
- (-1/3) Fig. n.n.n-1, Item 3.

1.5 Customer service

Before contacting customer service	Providing detailed information and specific questions will help solve problems quickly, facilitate spare parts ordering and ensure that the correct parts are supplied. Before contacting customer service, make a note of the following information.
Machine information	<p>The following information should be supplied with all queries and orders:</p> <ul style="list-style-type: none">- Type- Job No.- Year of construction <p>This data appears on the nameplate. The nameplate is located near the machine's main switch.</p>
Fault information	<p>Additional information is required in the case of a fault:</p> <ul style="list-style-type: none">- Nature and extent of the problem- Related circumstances- Presumed cause
Spare parts information	<p>Additional information for spare part orders:</p> <ul style="list-style-type: none">- Number of duty cycles- 8 digit HELLER item number from Wear Parts List. In the case of production parts, this number is stamped into the part itself.
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1 Information and technical support

1.6 HELLER Addresses

CHAPTER 2

Safety

2 Safety

2.1 Designated use

State of technology	At the time of delivery the construction of the machine reflects the state of technology as well as recognised standards, rules and regulations. There is, however, a risk of hazards for the user or third parties and of damage to the machine or other equipment associated with its operation.
Using the machine	<p>The machine must be used only in fault-free condition and only for its design purpose. Safety issues must always be kept in mind as described in the General Machine Documentation. In particular, faults that affect the safety of the machine must be immediately rectified or their rectification be arranged.</p> <p>This machine is designed to be integrated into an automation system. Operation is permitted only in conjunction with the automation system. Steps must be taken to ensure that the overall system meets the requirements of the EC Machinery Directive.</p>
Correct use	The machine is intended exclusively for cutting operations on metal workpieces.

Machineable materials

All standard materials can be machined: steel, castings, non-ferrous metals and alloys, with the exception of magnesium.
It is **not permitted to machine magnesium material** on the machine!

Permissible operating modes

This machine permits all standard machining methods with defined cutting geometry: surface and circular milling, drilling, countersinking, tapping and boring. **Grinding is not permissible.**

Permissible cooling lubrication methods

The following cooling lubrication methods are permissible on this machine:

- Wet machining with water-mixed cooling lubricant
- Machining with minimum quantity lubrication
- Dry machining of grey cast iron or of other workpiece materials in combination with suitable cutting materials

Non-water-mixed cooling lubricants are not to be used. Exceptions to this rule are minimum volume lubrication systems, which are designed in such a way that the coolant lubricant cannot form an ignitable mixture in the work area.

Technical data

For application range of machine, workpiece and tool limit data, performance data and environmental conditions, see General layout (AZ) and Technical Data. The documents always appear in the Chapter headed "Drawings, Plans" in the Machine Operator Manual (BD).

Special operating modes 2 and 3

Machine operating modes 2 (setup) and 3 (manual intervention) enable axis and spindle movement when the safety door is open. Due to the high risks associated with these special modes, they are permissible exclusively for setup and testing activities that cannot be carried out in normal mode, specifically:

- Manual intervention in the machining process
- Identification and avoidance of collisions that go undetected when the safety door is closed
- Machining of critical locations on an individual workpiece
- Monitoring surface quality of an individual workpiece

Batch manufacturing is forbidden!

Improper use

The use of the machine for any other or additional purpose is deemed improper. HELLER does not accept liability for any injury or damage resulting from improper use. The owner carries the sole risk. To determine damage due to improper use, serious errors caused by a mechanical overload of the machine are permanently recorded.

Machine operation in potential explosive or residential areas is not permitted. Machine operation in water conservation areas is permitted only if the relevant structural requirements are satisfied or if the machine is fitted with the appropriate optional equipment.

**Observation of General
Machine Documentation**

"Proper use" includes observation of the complete General Machine Documentation and the specified maintenance intervals.

Maintenance

Routine maintenance is to be carried out at the specified intervals. All relevant information can be found in the Maintenance Instructions!

Liability

HELLER accepts no responsibility for damage or equipment failures arising from failure to observe the instructions provided in the General Machine Documentation.

2.2 Warning and safety precautions

Warnings

Warnings appearing within guidance documents refer to dangers of which you must be aware when executing the next working step, in order to avoid damage to yourself, other people or property.



DANGER

Warnings with this wording indicates immediate danger that will cause death or serious personal injury if the warning is not observed.

Follow the instructions.



WARNING

Warnings with this wording indicates potential danger that may cause death or serious personal injury if the warning is not observed.

Follow the instructions.



CAUTION

Warnings with this wording indicates potential danger that might cause moderate to slight personal injury or damage to property, if the warning is not observed.

Follow the instructions.

Safety instructions



Safety warnings that precede an instruction refer to dangers of which you must be generally aware when carrying out the following work, in order to avoid damage to yourself, other people or property.

2.3 Safety regulations for the machine owner

2.3.1 Organisational safety measures

Availability of General Machine Documentation	The General Machine Documentation must be permanently kept in the proximity of the machine and made accessible to the operating and maintenance personnel.
Regulations in addition to the General Machine Documentation	In addition to the General Machine Documentation, all statutory and local regulations relating to accident prevention and environment protection must be available; conformance with these regulations must be checked regularly.
Safety and hazard information	All safety and hazard information on the machine must be maintained in a legible condition and must not be removed.
Interference immunity	Fault-free operation of the machine is guaranteed only when the control cabinet doors are closed. The use of mobile and radio telephones, receivers or other high-frequency devices in the direct proximity of an open control cabinet is forbidden.
Safety equipment	The required protective clothing and equipment must be provided by the machine owner. Furthermore, it is the owner's responsibility to ensure proper use of the required protective clothing and equipment by personnel.
Password	<p>Passwords guarding access to protected control settings are to be kept secret. They may only be revealed to those persons who are entitled to change default settings and are specially trained for this work.</p> <p>Protected settings must only be changed depending on certain maintenance and repair work. Passwords are not necessary for normal machine operation. Extreme caution must be exercised when working with password-protected settings. Incorrect input may trigger malfunction, which may endanger persons and cause damage.</p>

2 Safety

2.3 Safety regulations for the machine owner

Safety keys

Safety keys are to be kept by persons trained and authorised to work on the related equipment. This applies to keys for the following equipment:

- Key switches
- Machine operating panels
- Electrical control cabinets
- Terminal boxes
- Adjustable hydraulic and pneumatic devices and equipment
- Safety equipment

Special operating modes 2 and 3

The owner must ensure that only those persons who are authorised for special machine modes 2 (setup) and 3 (manual intervention) are granted access to them. These persons must satisfy the following criteria:

- They must be specialists in their field. A specialist is any person who, by virtue of his technical training, knowledge and experience, is able to evaluate the tasks assigned to him and identify potential risks.
- They must have received specific instructions on how to handle these special operating modes.

The individual responsible for machine application must keep the keys concerned in a safe place so as to prevent unauthorised persons from gaining access to these operating modes.

The owner must also take appropriate organisational measures to ensure that machine operating modes 2 and 3 are used only for activities that can not be carried out in normal mode. Decisions on use are taken on a case-by-case basis by the individual responsible for machine application.

In all cases, the individual responsible for machine application must check the technological conditions (for example the material to be machined, used tool, rpm and speed), decide whether additional protective measures for reducing the risk of injury are required and make all necessary arrangements for same.

The owner is responsible for ensuring that all the measures required to minimise risk have been taken and that work is carried out with the highest possible degree of safety. The technical supervisors of the Trade Associations in Germany must be contacted in this respect.

Virus protection

The owner must ensure that only virus-free equipment and data carriers are used on the machine.

Operating materials and consumables For the selection of operating materials and consumables such as grease, lubrication oils, hydraulic oils, cooling lubricants, emulsions and cleaning agents, the maximum values applicable on site for substances hazardous to health must not be exceeded.

Any statutory regulations and impositions relating to waste disposal and environment protection must be observed.

2.3.2 Permissibility for modifications

Have modifications approved The machine must not be modified without HELLER's written approval. This applies particularly to fitting with additional equipment or conversions, welding on structural parts of the machine, functional modifications as well as modifications of safety equipment, for example the installation and the adjustment of safety devices and safety valves.

Fixtures Hydraulic workpiece clamping fixtures have to be designed in accordance with the HELLER construction guideline.

Consequences of unauthorized modifications Any modifications performed by the owner without written approval by HELLER will render warranty null and void for all parts affected by the modification. HELLER does not accept liability for any injury or damage resulting from unauthorized modifications.

On machines with EC marking, new evaluation due to the Machinery Directive becomes necessary after any modification which may reduce safety. The manufacturer's declaration of conformity or installation expires if the requirements of the machinery directive are no longer met.

Measures for protection of employees All modifications require that the owner follows the applicable regulations for the protection of employees. In the EU member states, the Material/Tools For The Work Place Directive is decisive, and in Germany the "Betriebssicherheitsverordnung" (operational safety directive).

Transport If lifting equipment is to be used to transport machine parts, the safety instructions relating to transport of the machine and its components must be adhered to.



See also:
"Safety during transport work" **page 60**

2.3.3 Permissible spare parts

Technical requirements Spare parts must meet the technical requirements specified by HELLER. These requirements are always met by genuine HELLER spare parts.

Liability HELLER does not accept liability for damage caused through the use of Third Party Spare Parts.

2.3.4 Requirements to be met by operating and maintenance personnel

Observation of General Machine Documentation and "Safety" Chapter Before working on or with the machine, all persons involved in its transport, erection, wiring, commissioning, operation or maintenance must have read and fully understood the General Machine Documentation, in particular this chapter on safety.

Service personnel The machine must be operated only by suitably qualified and trained persons.

Maintenance personnel Maintenance work on the machine must be undertaken only by suitably trained persons.

Working in special operating modes 2 and 3 Work may only be carried out in special operating modes 2 (setup) and 3 (manual intervention) by individuals who meet the following preconditions:

- They must be specialists in their field. A specialist is any person who, by virtue of his technical training, knowledge and experience, is able to evaluate the tasks assigned to him and identify potential risks.
- They must have been specifically authorised by the owner to carry out these activities.
- They must have received specific instructions on how to handle these special operating modes.
- They must be confident in handling the machine.

Special operating mode 2 is intended for setup and installation work in manual mode. This requires in particular confidence with handling "JOG" and "INC" (incremental) NC modes. It is also advantageous to have knowledge of CNC programming.

Special operating mode 3 is for running in machining programs in semi-automatic mode. This also calls for knowledge of:

- A knowledge of the programs, sub-programs and cycles installed on the machine
- Safe handling of "MDA" and "Teach In" and "Single Block" NC modes.

HELLER Training

On completion of the installation work, the persons that are to operate the machine will be instructed by qualified HELLER employees or representatives in the correct operation of the machine.

More extensive training can be provided through training courses held by HELLER.

Training of new personnel

The owner undertakes to train and instruct any new operating and maintenance personnel to the same extent and with the same care in the operation and maintenance of the machine, taking into account all safety regulations.

Operator supervision

Any staff involved in training of a general or specific nature must be under constant supervision by a fully trained person while operating the machine.

Clarification of responsibilities

If several persons carry out work on the machine, their respective tasks and responsibilities must be clearly defined and followed. In the interest of safety there must be no ambiguities regarding areas of responsibility.

2.4 Safety regulations for personnel

2.4.1 General safety-conscious behaviour

Observation of General Machine Documentation and "Safety" Chapter	Before working on or with the machine, all persons involved in its transport, erection, wiring, commissioning, operation or maintenance must have read and fully understood the General Machine Documentation, in particular this chapter on safety.
Principle of operation	No operation or procedure that may compromise personal or equipment safety must be carried out.
Virus protection	Only virus-free equipment and data carriers may be used on the machine.
No program modifications	Program changes in the machine's programmable control systems are not permitted if they affect safe machine operation.
Safety and hazard information	All safety and warning signs on the machine must be observed and maintained in a legible condition at all times.
Workplace organisation	The operator's working area and machine access areas must be kept free from tools, materials and other objects. A clean and orderly working area at and around the machine must be maintained.
Operation of controls and actuators	Controls and actuators must not be operated wilfully or without due care and attention. This can result in injury or machine damage.

2.4.2 Entering and leaving the machine

Stay in the hazard area	Before performing any work or observations in the machine's hazard area, clarify which moving parts of the machine are in the area and what functions and range of movements these parts have. Ensure that there is always a safe escape route from the hazard area.
Secure against lock-in	Before entering the machine, any movable guards must be secured against closure. It is imperative to prevent the possibility of a safeguard being closed from the outside while a person is inside the danger area.

Slip hazard	Exercise caution when entering the machine. Ensure a firm footing. Slip hazard!
Don't leave anything behind	Never leave tools or other objects in the work area, as this may cause severe damage to the machine.

2.4.3 Safe use of the machine

Operate only with operational safety devices The machine may be used only when all safety devices and safety-related devices, such as guards, EMERGENCY STOP devices, silencers and exhauster units are installed and fully functional.

Do not disable any safety devices Under no circumstances must safety devices be removed, disabled, or their function be impaired. Manipulation of safety devices can result in serious or fatal injury.

The function of interlocking guards must not be bypassed by using dummy actuating elements, e.g. loose actuators of safety switches.

Interference immunity Fault-free operation of the machine is guaranteed only when the control cabinet doors are closed. The use of mobile and radio telephones, receivers or other high-frequency devices in the direct proximity of an open control cabinet is forbidden.

Special operating modes 2 and 3 Work may only be carried out in special operating modes 2 (setup) and 3 (manual intervention) by individuals who meet the following preconditions:

- They must be specialists in their field. A specialist is any person who, by virtue of his technical training, knowledge and experience, is able to evaluate the tasks assigned to him and identify potential risks.
- They must have been specifically authorised by the owner to carry out these activities.
- They must have received specific instructions on how to handle these special operating modes.

Special operating modes 2 and 3 can be used only for activities that can not be carried out in normal mode. Decisions on use are taken on a case-by-case basis by the individual responsible for machine application.

In all cases, the individual responsible for machine application must check the technological conditions (for example the material to be machined, used tool, rpm and speed), decide whether additional

protective measures for reducing the risk of injury are required and make all necessary arrangements for same.

As work is being carried out, every single step must be checked to establish whether it can be carried out with the safety door closed or in normal operating mode 1 (automatic). Wherever possible, the safety door must be kept closed and normal mode selected.

The machine must not be operated without supervision in special modes 2 or 3.

On completion of the work, the instructed individual must immediately switch back to normal operating mode 1 (automatic), remove the key and hand it straightaway to the person responsible for machine application for safe-keeping.

Persons in hazard area?	<p>Before closing any movable guards of the machine, ensure that no persons are in the hazard area.</p> <p>Before switching on or starting the machine, ensure that this will not compromise the safety of any persons.</p>
Fault handling procedure	<p>In case of changes to the machine that have an impact on safety and in the case of general faults, the machine is to be stopped immediately and secured against a renewed commissioned. The fault must be reported immediately to the responsible person or department and remedied without delay.</p>

2.4.4 Safe tool handling

Danger of injury	Tools have sharp edges and can easily cause injury.
Observation of permissible speed	Every tool must be used only up to its individual maximum speed. Excessive peripheral speeds can result in tool breakage representing a risk of accident to the operator.
Balancing of tools	All tools must be balanced according to the instructions of the machine and tool manufacturers. If data differ, always the highest balance quality required is decisive.
Correct fitting of tools	Ensure that tools required for machining are inserted and positioned correctly in the machine.

Correct tool change position	If specific tool changing positions have been defined for the machine, tools must only be changed manually if the corresponding operating unit is in the tool change position.
Securing the machine	During a manual tool change, the machine must be secured against accidental start-up and the movable guards secured against accidental closure.

2.4.5 Safe workpiece handling

Danger to life	Mortal danger due to fast-rotating rotary table CP and CT series machines have a fast rotary table that reaches high speeds (e.g. n _{max} =1000 rpm for sizes 2000 and 4000). Failure to follow the safety instructions in the operating instructions or the user information on the machine means mortal danger for the operator. HELLER accepts no liability for contraventions/failure to follow these safety instructions. It is essential to observe the following points during turning work: <ul style="list-style-type: none">- Only fixtures and heavy-duty clamping chucks that meet HELLER's technical requirements and conform to the currently applicable safety standards are allowed to be used. The technical requirements also include pneumatic clamping path monitoring.- All fixtures, including pallet and workpiece must be balanced on the rotary table prior to being turned. Follow the procedure in the relevant operating instructions, chapter 5 "Balancing rotary table".
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2.4.6 Safe fixture change

Fitting a fixture	Ensure that the correct fixture has been selected and correctly fitted. The use of an unsuitable fixture or the incorrect installation of a fixture can put the operator at risk and/or cause serious damage to the machine.
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2.4.7 Safe workpiece change

Mounting workpieces

The workpiece must be placed correctly in the fixture or clamped onto the pallet. Where an fixture is clamped manually, all securing elements must be properly tightened.

An incorrectly loaded machine presents a risk of injury to the operator and damage to the machine.

2.5 Safety equipment

Accident prevention	To prevent accidents, always wear tight fitting clothes. Remove ties, scarves, rings and necklaces as they can become caught in moving machine parts. Long hair must be covered by suitable headwear.
Wear protective clothing	Operating and maintenance personnel are required to wear the following protective equipment:
Goggles/glasses	Flying metal chips, compressed air and water jets can cause serious eye injury or loss of eyesight. When working on a machine it is therefore necessary to wear unbreakable safety glasses with side protectors.
Footwear	Safety shoes with steel toe caps must be worn to prevent crushing injuries of the feet.
Gloves	High temperatures and sharp edges occur on workpieces during machining. Do not touch workpieces, tools or chips with an unprotected hand. Wear appropriate protective gloves. Similarly, wear suitable gloves when handling operating materials and consumables. When working close to moving machine parts, do not wear gloves as they can easily become trapped.
Ear protection	Prolonged exposure to loud noise causes hearing damage. Ear protectors must be worn if noise emission levels at the machine exceed the permissible maximum value.
Safety helmet	A safety helmet must always be worn if there is a danger of head injury, in particular caused by falling tools or workpieces, when performing overhead assembly or dismantling operations and when working with lifting equipment.
Working clothes	Within high fire risk areas, hardly inflammable protective work clothing must be worn.

2.6 Safety and control elements

Master switch	<p>Before starting any maintenance work on the machine or on the control cabinet, the main switch must be turned off and secured against being turned on providing nothing to the contrary has been specified in the Maintenance Instructions for the individual case. Components that are still live when the main switch is turned off carry a notice to that effect.</p> <p>Before switching the machine off at the main switch, carry out the shutdown procedure as described in the machine operator manual (BD).</p>
Emergency stop device	<p>Operating the EMERGENCY STOP stops all machine movement.</p> <ul style="list-style-type: none"> - Only use the emergency stop in case of a real danger. - Do not use the emergency stop function to terminate an operation or to turn off the machine! - Operating the "Emergency stop" while machining is in progress can cause tool breakage!
Stop button	<p>Operating the stop button stops all feed movements immediately. There is a delay before the spindle runs down. Which allows the tool to run chip clearance and to clear the chips.</p>
MOTORS OFF	<p>Operating the <i>Motors off</i> button shuts all motors down.</p>
"Setup" and "Manual intervention" switch	<p>Apart from the following exceptions, these switches must be set to "Off" position and keys removed at all times. As a result, the machine operating mode 1 (automatic) is active.</p> <p>Machine operating modes 2 (setup) and 3 (manual intervention) enable workpieces to be machined with the safety door open. Due to the high risks involved, the individual responsible for machine application may hand the keys to these switches only to authorised individuals and only for setup and testing activities that can not be carried out in normal mode.</p> <p>On completion of the work, the instructed individual must immediately switch back to machine operating mode 1 (Automatic), remove the keys and hand them straightaway to the person responsible for machine application for safe-keeping.</p>
Safety doors	<p>The task of safety doors is to protect operators from moving machine parts.</p> <p>Behaviour in machine operating mode 1 (Automatic): while a drive is running, the safety doors concerned are electrically locked and</p>

held closed such that they cannot be opened. If the safety door is unlocked, the drives are in Safe operational stop.

In special operating modes 2 (setup) and 3 (manual intervention), the machining axes and the spindles can be traversed at reduced speed with the safety doors open.

If persons need to enter the work area to carry out work, the open safety doors must be secured against accidental closure. This is achieved by placing a padlock in the actuator of the safety switch or an appropriate holder on the safety door. The key must then be removed and carried on your person. This means that the safety door can not be closed. The machine can now only be operated under particular preconditions and only at low speed.

Brake on vertical and oblique axes

When the feed drive is shut down, the vertical and oblique slide units are held in place by a brake. Since the drives are not self-locking, the slide unit can, when the brake is released, move downwards under its own weight and cause a collision. When carrying out maintenance work, secure the slide unit before releasing the brake.

Compressed air shut-off valve

The compressed air maintenance unit of the machine is equipped with a shut-off valve. The compressed air from the site supply can be shut off by manually operating the valve.

Cooling lubricant shut-off valve

If cooling lubricant is supplied by the customer, the feed line is equipped with a manual shut-off valve. This shut-off valve is normally connected at the feed line connection to the machine.

2.7 What to do in an emergency

2.7.1 Emergency stop

Initiate the emergency stop

The EMERGENCY STOP should be operated in the following situations:

- When life is at risk.
- When the machine or the workpiece is in danger of being damaged.

Activate the EMERGENCY STOP function

The following controls will activate the EMERGENCY STOP function:

- Emergency stop switch
- Emergency stop ripcord (if installed)

Activating the EMERGENCY STOP function will stop the machine as fast as possible. Workpieces and tools may be damaged.

The EMERGENCY STOP function does not completely shut down the machine.

Unlock emergency stop device

Unlocking the EMERGENCY STOP device will not cause the machine to be restarted automatically.

2.7.2 First Aid

Precautions

The following issues must be clarified promptly:

- Who is the responsible first aid person?
- Where is the nearest first aid kit?
- Where is the nearest accident reporting facility?
- Where is the nearest telephone?
- What is the emergency number for first aid/medical emergencies?

- Accident emergency procedure**
- Always proceed as follows:
1. Take immediate action. If necessary, stop the machine.
 2. Report the accident. When reporting an accident, give the following information:
 - Where did the accident take place?
 - What happened?
 - How many people are injured?
 - What type of injuries?
 - Who is raising the alarm?
 - Await further questions.
 3. Provide first aid.
 4. Direct emergency services to the scene of the accident.

2.7.3 Person in constrained position

- Precautions**
- The following issues must be clarified promptly:
- Where can persons become pinched or trapped?
 - What action can be taken to ensure release?

- Accident emergency procedure**
- Always proceed as follows:
1. Take immediate action. If necessary, stop the machine.
 2. Establish:
 - Where precisely are the persons in such constrained positions?
 - What type of constrained position is it?
 - Are the persons injured?
 - How urgently should the persons be rescued?
 - How can the persons be released from the constrained position quickly without sustaining further injury?
 3. Report the accident. When reporting an accident, give the following information:
 - Where did the accident take place?
 - What happened?
 - How many people are injured?
 - What type of injuries?
 - Who is raising the alarm?
 - Await further questions.
 4. Assess the situation.
 5. Agree rescue measures with all involved.
 6. Implement rescue measures.

2.7.4 Fire fighting

Precautions

The following issues must be clarified promptly:

- Where is the nearest fire extinguisher located?
- Where is the fire extinguishing equipment (fire blanket)?
- Where is the nearest fire alarm located?
- Where is the nearest telephone?
- What is the emergency number for the fire brigade?

Fire emergency procedure

Always proceed as follows:

1. Take immediate action.
2. Report fire. When reporting a fire, give the following details:
 - Where is the fire?
 - What is on fire?
 - How many people are injured?
 - Who is raising the alarm?
 - Await further questions.
3. Turn off the machine:
 - Press the emergency stop button.
 - Switch off main switch on control cabinet.
4. Provide first aid.
5. Extinguish fire. Only attempt to extinguish the fire or stop it from spreading if this is possible without personal risk.
6. Direct the fire brigade to the fire.

2.8 Special hazards

2.8.1 Electrical hazards

Voltage

Electrical voltage can cause death if not treated with care. Do not operate the machine if the control cabinet doors, terminal boxes or operating panels are open.

Electrical connections

The connection from the machine to the electrical power supply and any work on the electrical equipment or control cabinet may be carried out only by qualified specialist personnel. The conditions and guidelines applicable to the installation site must be respected when setting up and operating electrical equipment.

Inspection of electrical equipment

The electrical equipment of the machine must be checked at regular intervals. Any defects, such as loose connections or burned cables, must be rectified immediately.



See also:
"Safety when working on electrical equipment" **page 57**

2.8.2 Hazards from hydraulic and pneumatic compressed media and cooling lubricants

Regular inspection of fittings

Media escaping at high pressure can cause injury, explosion or fire. If damage such as abrasion or leaks are detected on pressure hoses, pressure lines and connections, immediately shut down the machine, even if the defects are minor. Only put the machine back into operation after the fault has been rectified.



See also:
"Safety when working on hydraulic, pneumatic, lubrication or lubricating coolant supply systems" **page 56**

2.8.3 Hazards from auxiliary materials and consumables

Hidden dangers	Grease, lubrication oils, hydraulic oils, cooling lubricants, emulsions and cleaning agents are hazardous to health and the environment. Substances can have any of the following properties: <ul style="list-style-type: none">- They may ignite easily.- They may form vapours damaging to health.- They may cause skin ailments and allergies.
Observation of applicable regulations	Limit values for health or environmentally damaging substances must not be exceeded. Any statutory regulations and impositions relating to waste disposal and environment protection must be observed.
Prevention of hazards	The operating materials must satisfy the following conditions: <ul style="list-style-type: none">- No explosive mixtures must be allowed to form.- All substances used must be compatible with each other.- Machine components (especially cables, connectors, seals) must not be exposed to attack. This may happen in particular if the original product has been replaced. <p>To avoid risk of slipping, operating and auxiliary materials must not be placed near the machine.</p>

2.8.4 Hazards from gases and vapours

Extract.	Extraction or ventilation equipment must not be switched off or removed during machine operation.
Health hazards	When safeguards are opened, gases, vapours and suspended matter such as cooling lubricant mist and dust from castings may escape and cause a health risk. Adequate ventilation or an other means of extraction must therefore be provided.
Oil mist	Do not inhale oil mist. Oil mist damages health and may contain carcinogenic substances.

2.8.5 Noise hazards

Noise protection	The silencing equipment on the machine must be in the protective position during machine operation.
Ear protection	Ear protectors must be worn if noise emission levels at the machine exceed the permissible maximum value. Prolonged exposure to loud noise causes hearing damage.

2.8.6 Laser radiation hazards

Potential eye and skin injury	<p>Laser radiation occurs in machines using laser technology with tool break monitoring or to measure tool position. Laser radiation can cause irreparable eye injury and damage to the skin. Safeguard yourself from risks as follows:</p> <ul style="list-style-type: none">- Do not look straight into the beam or at reflections on bright surfaces, not even when using optical equipment.- Avoid prolonged direct exposure of the skin to radiation.- Operate the machine only when all safeguards is operational and the guard panels are fully in place.
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2.8.7 Hazards posed by dry machining or Minimal quantity lubrication

No explosive dust/air mixture	No explosive dust/air mixture may be generated during the machining of workpieces. Adequate air recirculation must be provided in the work area.
No ignition sources	Sparks or burning chips must never occur during machining.


2.8.8 Hazard in case of power failure

Spindle after-run	A power failure can cause the tool spindle to run on. With safety doors that do not lock under off-circuit conditions the machining area might be accessed too early.
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Make sure, especially if the power fails, that the tool spindle stops before the safety door is open.

2.9 Safety during maintenance

2.9.1 Safety precautions for maintenance work

Qualified personnel	Maintenance work may be carried out only by personnel with the appropriate specialist training.
Observation of General Machine Documentation	The maintenance activities and intervals regarding replacement of consumables and wear parts, as specified in the General Machine Documentation, must be adhered to.
Appointment of supervisory personnel	The operating personnel must be notified prior to commencement of any maintenance work. A head supervisor is to be appointed.
First steps	<p>The following safety precautions must be taken before carrying out any maintenance work:</p> <ul style="list-style-type: none">- Position the machine parts in such a way that the part to be serviced is easily accessible.- Before removing any guard panels, make sure that the machine is in the appropriate operating status and secure it against being switched on.- Provide support for vertical slides or similar machine parts prior to all work in their area. <p>If necessary, demarcate the maintenance area as appropriate and place warning signs.</p>
Exercise caution when carrying out maintenance work	<p>In the following cases, no persons must be in the machine's danger area.</p> <ul style="list-style-type: none">- If machine movements can be carried out.- If any pressure lines or vessels are under pressure.- If any electrical components are live.
Transport of sub-assemblies	When replacing larger sub-assemblies, these must be carefully attached and secured to lifting gear.
	See also: "Safety during transport work" page 60
Use of working aids	For assembly work above floor level, use appropriate steps and working platforms that comply to applicable safety standards. Do not use machine parts as steps or working platforms. For maintenance

2 Safety
2.9 Safety during maintenance

work at greater heights, safety harnesses must be worn. Keep all handles, treads, railings, platforms, and ladders free from dirt and lubricants.

Use of appropriate tools	Appropriate workshop equipment is essential for carrying out maintenance work.
Involved parties shall communicate with each other	Working in teams, the involved persons must be able to make themselves understood to their work colleagues, even if a high noise level or other environmental influences make communication difficult. Commands and feedback must be defined before each working step to ensure an efficient coordination.
Completion of work	<p>After work at vertical slides or similar machine parts, provided supports must be removed.</p> <p>If, in the course of maintenance work, guard panels and safety devices were removed, these must be refitted immediately after completion of the work and their functionality tested.</p> <p>Loosened screw connections must be re-tightened to the correct torque and screw retainers put back in place.</p>

2.9.2 Cleaning the machine

Detergents	<p>The machine must not be cleaned using substances that cause irritation or are harmful to health or the environment, such as chlorinated hydrocarbons (PER, TRI etc.).</p> <p>Ensure that cleaning agents are disposed of in an environment friendly way.</p>
Do not use cleaning devices	Under no circumstances should steam or water jets or compressed air be used for cleaning, as there is a risk of dirt or cleaning agents getting into the guideways or seals. This can impair the function of switching elements or measuring systems.
Removing swarf	Remove chips using an appropriate tool such as a hand broom. Do not touch swarf with bare hands: wear suitable protective gloves.

2.9.3 Safety when working on hydraulic, pneumatic, lubrication or lubricating coolant supply systems

Applicable regulations and skilled personnel	Work on hydraulic, pneumatic, lubrication or cooling lubricant systems is to be carried out only by suitably trained persons; applicable regulations and codes of practice must be adhered to.
Releasing pressure	<p>Before disconnecting any line or removing a control or drive unit, the system must be relieved from pressure.</p> <p>Procedure:</p> <ul style="list-style-type: none"> - Lower or support any loads. - Switch off pump. - Release pressure from vessel. <p>Even on machines equipped with an automatic pressure release facility, the pressure gauges should be checked to ensure that there is no residual pressure in the system.</p>
Pressure accumulator	<p>Accumulators are equipped with safety valves. The safety valves are pre-adjusted and sealed.</p> <p>Any adjustment to the safety valves results in danger to life and is prohibited.</p>
Checking accumulators	Accumulators must be checked and serviced in accordance with statutory regulations.
Filling accumulators	<p>Accumulators must only be filled with nitrogen.</p> <p>Observe the nitrogen bottle fill pressure. If the fill pressure is greater than the maximum operating pressure of the accumulator, a tested safety valve must be inserted in the connecting line.</p>
Regular inspection of fittings	<p>The integrity of pressure lines and connectors must be checked at regular intervals and replaced even if only slight damage is apparent. Fluids escaping under high pressure pose a risk of injury, explosion and fire. Any leaks and damages to hoses and pressure lines must therefore be rectified immediately.</p> <p>Escape of oil into the ground must be prevented under all circumstances.</p>
Pressure hoses	Pressure hoses must be replaced regularly according to applicable regulations.
Professional connection	Hydraulic and compressed air lines must be routed and connected correctly. It must be ensured that connectors are not mixed up. All

fittings, as well as the length and quality of the hose lines must comply with technical requirements.

Correct venting of lines If, during re-commissioning after repairs or moving of the machine, any air remaining in the hydraulic system is not purged, damage to tubing, hosing and machine components may result.

2.9.4 Safety when working on electrical equipment

Applicable regulations and skilled personnel Work on electrical equipment and in the control cabinet should be carried out only by qualified engineers. The guidelines and regulations for setting up and operating electrical equipment applicable to the installation site must be respected.

Isolating the machine Machine and installation components on which maintenance work is to be carried out must - if specified - be isolated from the electrical power supply.
 First ensure that the isolated components are voltage free and then earth and short-circuit them and isolate them from adjacent, live modules.
 Note that the control cabinet is still live when the main switch has been turned off.

Interference voltage circuits If interference voltage circuits are present, these must be isolated separately.
 Note that the control cabinet is still live when the main switch has been turned off.

Stored electrical charges Watch out for residual or stored electric charges. Use a measuring device to check that components are not live.

Working on high-voltage assemblies Before working on high voltage assemblies, connect the mains cable to earth after isolating the power supply. Capacitors must be short circuited with an earth rod.

Guarding the danger area The danger area must be guarded and identified with a warning sign.

Original fuses Use only original fuses with the specified current strength and the specified time response behaviour.

Handling of faults If a fault occurs in the power supply system, switch off the machine immediately.

Earthed tools	When working with earthed tools, such as soldering irons and electric hand drills, the machine main switch and, if applicable, any external power circuits must be switched off.
Printed circuit boards and connectors	Isolate the machine from the power supply before removing printed circuit boards or connectors. Protect unused connectors from dirt by using blanking covers and plugs.

2.9.5 Safety during troubleshoot and fault rectification

Act with special caution in the event of fault	If a fault occurs on the machine, special caution must be exercised. The fault as well as improper interventions by staff can cause consecutive errors. Especially in the event of error burst, the machine's reaction is unpredictable.
Initial precautions	Urgent measures to be taken: <ul style="list-style-type: none">- Immediately interrupt active automatic programs.- Switch off motors.- If required, press EMERGENCY STOP, or switch off the machine's main switch and secure against switching on again. Inform responsible persons: <ul style="list-style-type: none">- Strict compliance with scheduled workflow is required.- Immediately inform the person having a key to enable special operating modes. Special operating modes that allow fast axis and spindle movements with the work area safety door open must not be enabled on faulty machines.
Working inside the operating machine	If entering the machine in ON state during troubleshooting or fault rectification is unavoidable, all applicable measures to avoid

machine movements and automatic operations must be taken while persons are in the hazard area:

- Clarify what movable parts are present in the work area and what function and travel range these parts do have. Ensure that there is always a safe escape route from the hazard area. Block any hazardous, movable machine parts using timber beams.
- Ascertain whether the machine or individual parts possibly can start up automatically. Typical cases:
 - Times at which the warmup programme starts
 - Times at which the washing programme of a rack-type magazine starts
 - Machine parts with inherent power supply and/or control (pallet magazine, automatic loading system, linked machines, cooling lubricant unit, chip conveyor)
- Ascertain whether there are further risks, for example due to pressurised media or electric tensions.
- Call in a second person, who activates the EMERGENCY STOP device or turns the main switch off in an emergency. Ensure that involved persons are able to make themselves understood to each other.
- Keep unauthorised persons away from the machine. Cordon off access to the machine and attach warning signs.
- Ensure that motors are switched off.
- In order to prevent unauthorised persons from triggering fast axis movements accidentally, open the work area safety door and secure it against being closed by means of a hook padlock. But note that, under certain conditions, axis movements at reduced speed can still be triggered even with the work area safety door open.
- Leave the danger zone before machine movements are activated.

2.10 Safety during transport work

Recognising danger	Never stand under a suspended load, as this can cause loss of life.
Observing Transportation Information	<p>The Transportation Information contains the information required to transport the machine or component by crane:</p> <ul style="list-style-type: none">- Weight- Lifting points- Specified hook-up material <p>Strictly adhere to the instructions in the Transportation Information.</p>
Qualified personnel	Securing of loads and instructing goods vehicle drivers must be carried out by qualified persons. The person issuing instructions must be in visual and verbal contact with the crane driver.
Lifting gear	<p>All lifting equipment must be in perfect condition and must be designed for the weight to be carried. Chains, slings, hooks and lifting bolts must be of sufficient carrying capacity.</p> <p>If you use the existing transport threads for the transport of the machine and its components use only eye bolts which are rotatable when tightened.</p>
Securing traversing slides	Any traversing slides must be moved to a point where their weight is neutralised and secured.
Securing lifting rods	Lifting rods must be secured with retaining collars. The sling or the machine component must not be allowed to slip on the bar/rod.
Transport stays	Transport securing devices must only be removed after final erection.
Protection of sensitive parts	If the component to be lifted has sharp edges, use a cushion to avoid damage to the rope or the component.
Correct lifting of loads	<p>Machine components must never be lifted suddenly or jolted with a crane or lifting gear. Start lifting slowly.</p> <p>When selecting the point at which to suspend the load, ensure that the weight is correctly balanced and suspended horizontally.</p>

2 **Safety**
2.10 **Safety during transport work**

CHAPTER 3

Checklist for inspection and maintenance

3 Checklist for inspection and maintenance

3.1 Notes on using the checklists

What do the checklists contain?

The following checklists contain all regular inspection and maintenance work in tabular form. Each line describes a maintenance item using the following information:

- Interval
- Assembly
- Action
- Reference to the chapter where the activity is described in detail

The interval column is sub-divided into Categories A, B and C.

- A Interval in operating time of the machine
- B Interval in realtime, independent of the running time of the machine
- C Maintenance work as indicated on the machine's main operator panel

Double detail under A and B mean: This work must be carried out after operating time A or realtime B, whichever occurs earlier.

Abbreviations for time units:

- h Hours
- d days
- w Weeks
- m Months
- a years

How do you use the checklists?

After intervals of 8, 50, 200 etc. hours have lapsed, follow the checklist in Section 3.2. You can carry out this work during production.

The checklist is split into intervals, starting with the shortest operating time interval (8 hours). Complete all work from the first to the last line of the due interval.

Example: After 200 operating hours, complete all work for 8, 50 and 200 hour intervals.

3 Checklist for inspection and maintenance

3.1 Notes on using the checklists

Once production is finished, carry out the work stated in Sections 3.3 et seq. These sub-chapters divide the work according to the various starting statuses of the machine.



Use the checklists as a guide only! Make sure you follow the cross-references to Section 4 and 5! Here you will find a detailed description of how you can carry out the individual activities correctly and safely.

3.2 Activities during production

Interval	Assembly	Action	Sec.
A	B	C	
8 h	Cooling lubricant system	Check condition of the cooling lubricant	4.6.1
50 h	Machining unit	Checking tool holder blow-off procedure	4.8.3
200 h	Spindle and control cabinet cooling	Check filling level in cooling unit	4.3.1
2000 h	Machine frame	Checking quiet running of the machine	4.12.5
3 m	Pneumatics	Checking automatic drain of filter pressure regulator	4.5.2
3 m	Pneumatics	Checking automatic drain of compressed air filter	4.5.4
3 m	Pneumatics	Checking automatic drain of the maintenance unit for the measuring scale sealing air	4.5.6
	Central lubrication 1	Topping up oil in the lubrication unit tank	5.3.1
	Central lubrication 2	Topping up oil in the lubrication unit tank	5.4.1
	Cooling lubricant system	Switch double filter to alternative chamber and clean the clogged one	5.5.1

3 Checklist for inspection and maintenance

3.2 Actions starting when machine is on

3.3 Actions starting when machine is on

Interval	Assembly	Action	Sec.
A	B	C	
50 h	Pneumatics	Draining water separator	4.5.1
200 h	Rotary feed table	Checking oil level in rotary feed table	4.11.1
200 h	Machine frame	Removing chips from the work area	4.12.1
200 h	Machine frame	Running cleaning stroke of linear axes	4.12.3
200 h	Machine frame	Checking safety pane of work area safety door	4.12.10
200 h	Machine frame	Checking safety pane of the workpiece setting station safety door (front door)	4.12.12
500 h	Machining unit	Cleaning and checking tool holding fixture	4.8.4
1000 h	Machining unit	Check tool pull-in force.	4.8.5
1000 h	Tool magazine	Cleaning and checking tool holders, tool cartridges and tools	4.9.1
1000 h	Machine frame	Checking dirt wipers and concertina covers	4.12.2
1000 h	Machine frame	Check emergency stop device	4.12.4
1000 h	Measuring Probe (option)	Cleaning and checking measuring probe	4.13.1
1500 h	Chip disposal	Cleaning and checking fill level sensor	4.7.1
2000 h	Machine frame	Checking linear roller guides and axis drives	4.12.9
5000 h	Tool magazine	Tensioning magazine chains	4.9.3
3 m	Pneumatics	Replacing the filter pressure regulator element	4.5.3
3 m	Pneumatics	Replace filter element of the compressed air filter.	4.5.5
3 m	Pneumatics	Replacing filter elements of the maintenance unit for the measuring scale sealing air	4.5.7

3 Checklist for inspection and maintenance

3.2 Actions starting when machine is on

Interval	Assembly	Action	Sec.
A			
B			
C			
1 a	Tool magazine	Cleaning drip pan	4.9.2
1 a	Rotary feed table	Oil change in rotary feed table	4.11.2
1 a	Machine frame	Checking completeness and condition of guard panels	4.12.6
2 a	Tool magazine	Lubricate traverse attachment and guide of the tool setting station	4.9.4
2 a	Tool magazine	Lubricate guideways of the tool change door.	4.9.5
8 a	Machine frame	Replacing safety pane of work area safety door	4.12.11
8 a	Machine frame	Replacing safety pane of the workpiece setting station safety door (front door)	4.12.13
x	Measuring Probe (option)	Replacing battery	5.6.1

3 Checklist for inspection and maintenance

3.3 Actions starting when main switch is off

3.4 Actions starting when main switch is off

Interval	Assembly	Action	Sec.
A	B	C	
1000 h	Spindle and control cabinet cooling	Clean splash guard in the cooling water supply line	4.3.3
1500 h	Chip disposal	Checking the scraper belt	4.7.2
10000 h	Tool changer	Replacing timing belt of tool changer	4.10.1
1 a	Spindle and control cabinet cooling	Changing cooling water in cooling unit	4.3.2
1 a	Hydraulic system	Oil change in hydraulic reservoir	4.4.1
1 a	Chip disposal	Tensioning scraper conveyer	4.7.3
3 a	Chip disposal	Oil change on the belt drive gear unit	4.7.5
	Hydraulic system	Replacing return line filter element	5.2.1
	Central lubrication 1	Replace filter element of the pressure filter	5.3.2
	Central lubrication 2	Replace filter element of the pressure filter	5.4.2

3.5 Actions starting when main switch is off, machining unit secured

Interval	Assembly	Action	Sec.
A			
B			
C			
500 h	Machining unit	Check oil level in the gear lubrication	4.8.1
500 h	Machining unit	Checking leakage discharge of the rotary distributor	4.8.6
1000 h	Machining unit	Check cooling air paths of the main spindle motor for contamination	4.8.7
1 a	Chip disposal	Clean and check chip conveyor	4.7.4
1 a	Machining unit	Oil change in the guide slides	4.8.2

3 Checklist for inspection and maintenance

3.5 Actions starting when safety doors are open, main switch off, machining unit secured

3.6 Actions starting when safety doors are open, main switch off, machining unit secured

Interval	Assembly	Action	Sec.
A	B	C	
10000 h	Rotary feed table	Replace timing belt of the rotary table drive	4.11.3
1 a	Machine frame	Cleaning the machine	4.12.7
1 a	Machine frame	Inspection of fluid equipment	4.12.8
2 a	Machine frame	Check conveyor helixes and slide rails for wear	4.12.14
4 a	Hydraulic system	Replacing hydraulic hose lines	4.4.2
	Hydraulic system	Check hydraulic equipment for tightness, replenish oil	5.2.2
			x

CHAPTER 4

Inspection and maintenance

4 Inspection and maintenance

4.1 Notes for the proper maintenance

4.1.1 Obligations of the owner and maintenance personnel

Regular maintenance by qualified personnel is essential

Inadequate or improper maintenance can cause equipment failures and affect the operating safety and durability of the machine. Regular inspections and maintenance routines are therefore essential. It is recommended that maintenance is carried out only by trained personnel.

Warranty limits

The contractually agreed warranty does not exempt the machine owner from the obligation to maintain the machine from commissioning onwards in accordance with the manufacturer's instructions. HELLER shall not be responsible for damage caused by inadequate maintenance.



Whenever maintenance work is carried out, the instructions in the Chapter on "Safety" in these Maintenance Instructions and the applicable safety regulations must always be followed and strictly adhered to!

Observe particularly the instructions in Section 4.2. This Chapter describes preparatory and conclusive safety measures for work in the danger zone of movable machine parts and automatically operated devices.

4.1.2 Training and customer service

HELLER Training

HELLER runs training programmes to pass on technical knowledge and machine-specific expertise to its customers.

We offer the following courses for maintenance personnel:

- Mechanical maintenance training course
- Electrical maintenance training course

4 Inspection and maintenance

4.1 Notes for the proper maintenance

Technical support

The HELLER Customer Service provides specialist support. It provides advice by telephone and will send a customer service engineer out to you if required.



For HELLER Nürtingen Customer Service, see:
"Customer service" **page 22**



For HELLER international addresses, see:
"HELLER Addresses" **page 23**

Spare parts

Always ensure that you have an adequate supply of spare parts to avoid unnecessary machine shut-down.

If possible use only original HELLER parts! HELLER shall not be responsible for parts you purchase from alternative suppliers. Please contact the HELLER Customer Service Team if you have any queries.

4.1.3 System for the following maintenance regulations

Division of sub-Chapters

The maintenance items are divided into function groups and assemblies in the following order:

- Media
- Machining unit
- Assemblies for tool handling
- Assemblies for workpiece handling
- Machine frame
- Optional equipment

Structure of the descriptions

Each assembly starts with an overview. A schematic top view of the machine indicates the location of the units and the components addressed in the following maintenance items.

All maintenance items are described to one standard according to the following plan:

- Interval and component
- Required consumables, spare parts, aids and documentation
- Preparation and execution of the work

Assumed knowledge

Anyone carrying out maintenance work must be able to operate the machine. None of the basic operating procedures described in the Machine Operator Manual (BD) appear in the following maintenance

instructions in any further detail, prior knowledge of these procedures is assumed.

Intervals

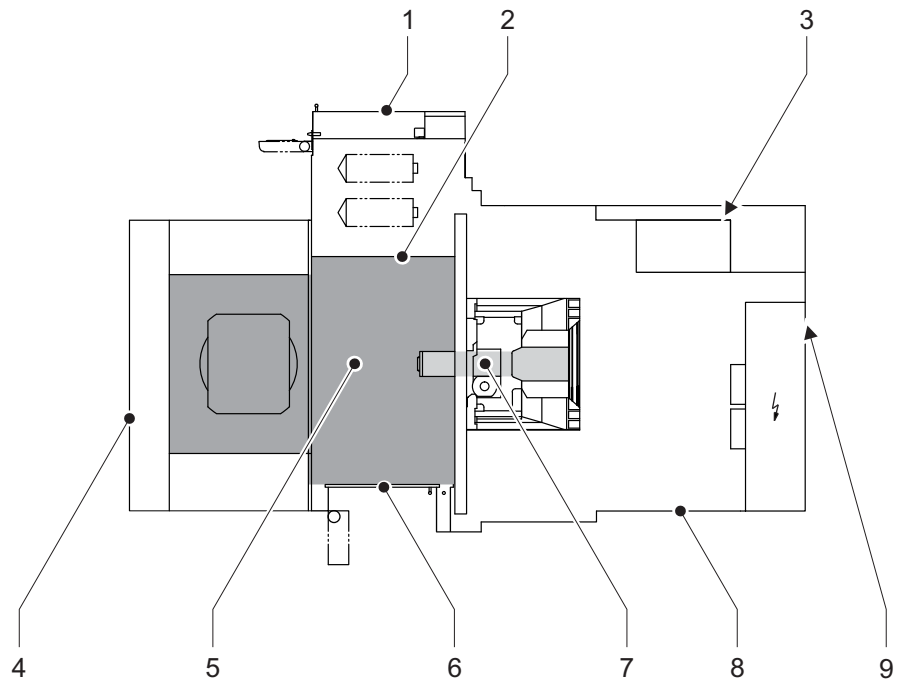
The maintenance work intervals are stated in either operating time or realtime. Double detail means: This work must be carried out after operating time A or realtime B, whichever occurs earlier.

Regulations for external units

The machine contains components that HELLER purchases from other manufacturers. We have integrated the subsuppliers' maintenance instructions into these maintenance instructions to save you having to look in several documents. Under the term "Subsuppliers' Information" (ZI), you will also find the original documents of the subsuppliers, organised alphabetically according to the names of the manufacturers. Note the cross-references in the following sub-Chapters to the Subsuppliers' Information, since these may contain further information.

4.2 Special safety measures

4.2.1 Preventing the safety and maintenance doors from closing



4.2.1 - 1 Schematic representation of the machine

- 1 Tool setting station safety door
- 2 Tool change door
- 3 Compressed air shut-off valve
- 4 Workpiece setting station safety door (front door)
- 5 Work area
- 6 Work area safety door
- 7 Machining unit
- 8 Maintenance area safety door
- 9 Master switch



When the machine is started, fatal injury can occur if persons are accidentally trapped in the machine.

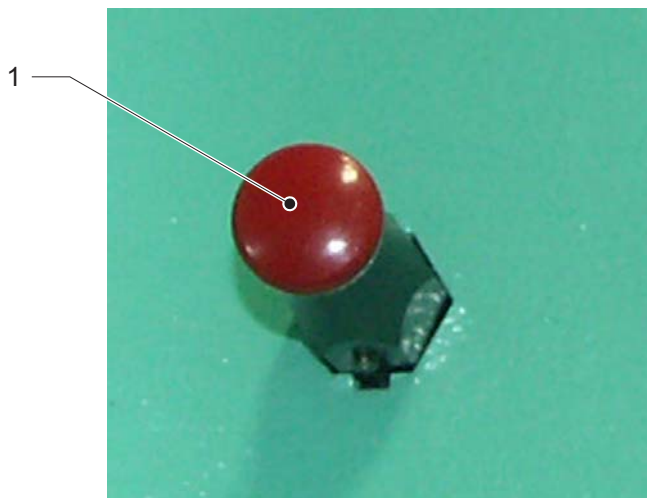
Before you enter the machine, secure the used door to prevent closing. You must eliminate the possibility of the door being closed from outside while a person is in the machine.

Procedure

Securing work area safety door to prevent closing

i

As long as the work area safety door is not locked, the motors cannot be switched on. The escape button on the inside of the safety switch services as an escape release in case of emergency. When this button is pressed, the machine is brought to an EMERGENCY Stop and the work area safety door is unlocked.



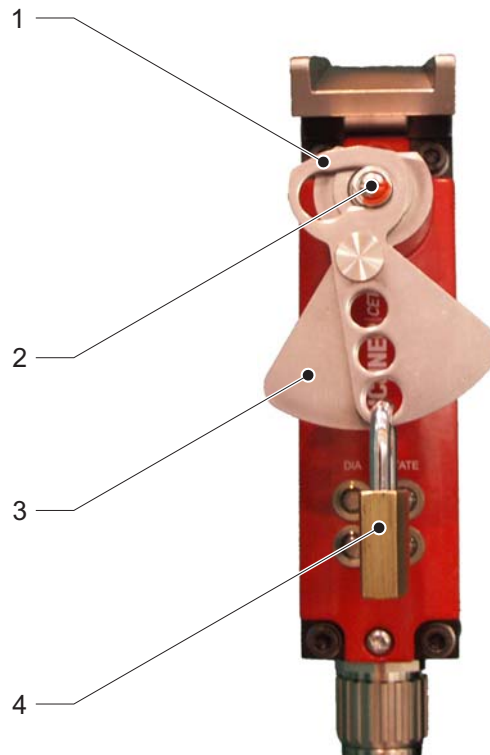
4.2.1 - 2 Escape release, work area safety door

1 Escape button

- Machine switched on at main switch.
- Ensure that the loading hatch in the work area hood is closed.
- Unlock safety switch and open work area safety door.

4 Inspection and maintenance

4.2 Special safety measures



4.2.1 - 3 Safety switch with lock insert

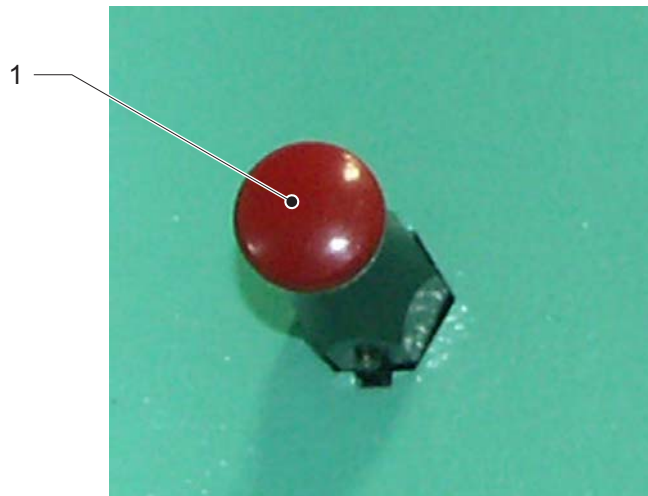
- 1 Lock insert
- 2 Pushbutton
- 3 Lever
- 4 Padlock

- Press the push button and line up the holes in the two levers.
- Hook padlock into lock insert and lock.
- The tumbler is not activated. Do not remove padlock before the end of work and before the work area is vacated.
- On completion of work:
 - Remove padlock.
 - Move lock insert to the home position (cutting position).
- Do not remove padlock before the end of work and before the work area is vacated.

Secure maintenance area safety door to prevent closing

i

As long as the maintenance area safety door is not locked, the motors cannot be switched on. The escape button on the inside of the safety switch services as an escape release in case of emergency. When this button is pressed, the machine is brought to an EMERGENCY Stop and the maintenance area safety door is unlocked.



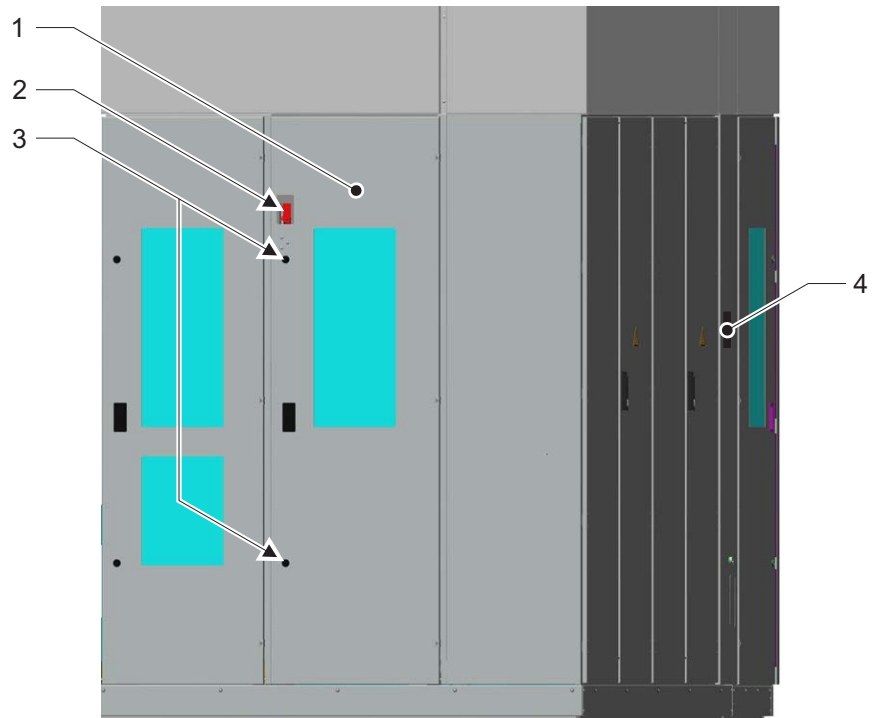
4.2.1 - 4 Escape release, maintenance area safety door

1 Escape button

Machine switched on at main switch.

4 Inspection and maintenance

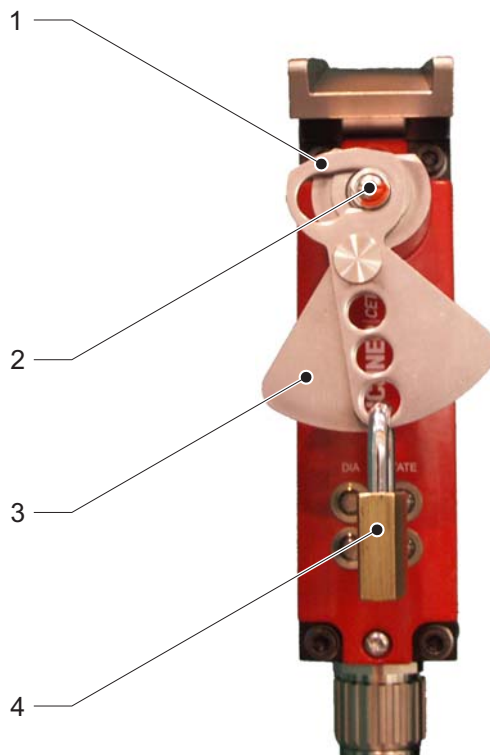
4.2 Special safety measures



4.2.1 - 5 Maintenance area safety door

- 1 Maintenance area safety door
- 2 Safety switch with escape release
- 3 Casement fastener
- 4 Master switch

- Unlock maintenance area safety door by twisting the casement fastener.
- Unlock safety switch and open maintenance area safety door.



4.2.1 - 6 Safety switch with lock insert

- 1 Lock insert
- 2 Pushbutton
- 3 Lever
- 4 Padlock

- Press the push button and line up the holes in the two levers.
- Hook padlock into lock insert and lock.
- The tumbler is not activated. Do not remove padlock before the end of work and before the work area is vacated.
- On completion of work:
 - Remove padlock.
 - Move lock insert to the home position (cutting position).
- Do not remove padlock before the end of work and before the maintenance area is vacated.

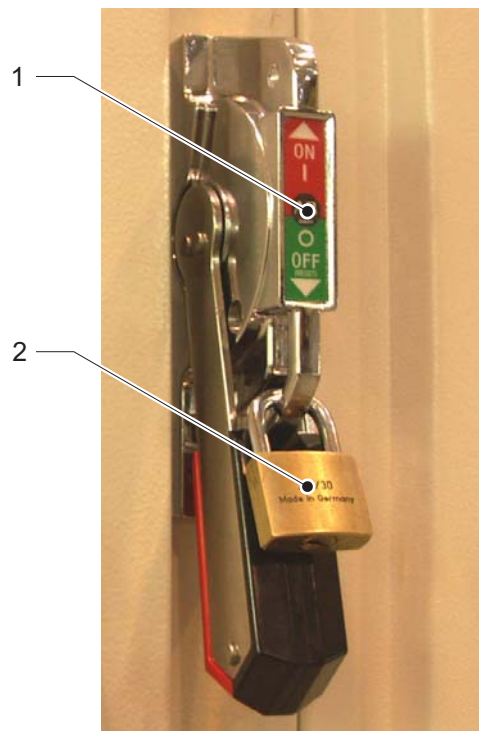
4.2.2 Securing main switch to prevent it being activated



Maintenance openings that can be opened using a tool, are not electrically monitored. Moving machine components are released when maintenance openings are opened. Persons in the danger zone may be seriously injured by moving machine components.

Before the maintenance opening is opened, the main switch must be switched off and secured to prevent being re-activated. It must be impossible to switch on the machine while persons are in the hazard area.

Procedure



4.2.2 - 1 Machine main switch secured by padlock

- 1 Master switch
- 2 Padlock

- Turn off machine at the main switch.
- Hook padlock into main switch and close.

- Do not remove padlock until all maintenance openings are closed.

4.2.3 Opening of maintenance openings

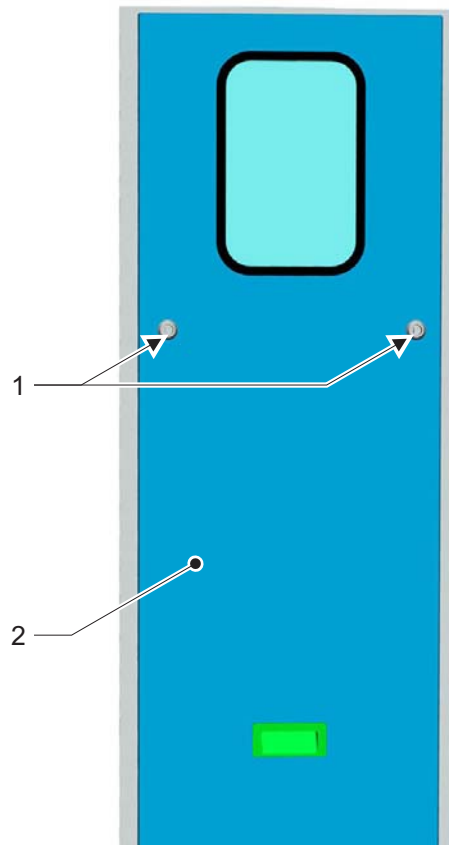


Maintenance openings are not electrically monitored. Moving machine components are exposed when maintenance opening is opened. Persons in the danger zone may be seriously injured by moving machine components.

Before the maintenance opening is opened, the main switch must be switched off and secured to prevent being re-activated. It must be impossible to switch on the machine while persons are in the hazard area.

Procedure

Opening of maintenance openings



4.2.3 - 1 Example: Maintenance opening

- 1 Casement fastener
- 2 Maintenance opening

- Switch off machine at main switch and secure against being switched on again.
- Unlock maintenance by twisting the casement fastener.
- Lift the maintenance opening slightly and remove it.
- After the end of work and before leaving the maintenance area, close and lock maintenance opening.
- Do not remove padlock from master switch before maintenance opening is closed.

4.2.4 Opening workpiece setting station safety door (front door)



After the workpiece setting station safety door (front door) is unlocked and opened, the machine main switch must be turned off and secured to prevent restart. It must be impossible to switch on the machine while persons are in the hazard area.

Procedure

Opening workpiece setting station safety door (front door)

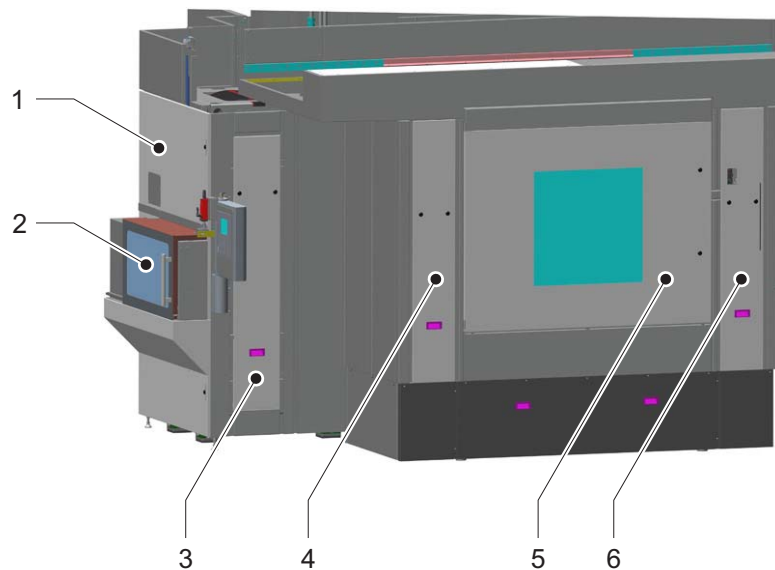


As long as the safety switch of the workpiece setting station safety door (front door) is not locked, the motors cannot be switched on.

- Machine switched on at main switch.
- Ensure that the loading hatch in the work area hood is closed.

4 Inspection and maintenance

4.2 Special safety measures



4.2.4 - 1 Maintenance openings and safety doors on the front side

- 1 Chain magazine maintenance door
- 2 Tool setting station safety door
- 3 Maintenance opening D
- 4 Maintenance opening 1 at workpiece setting station
- 5 Workpiece setting station safety door (front door)
- 6 Maintenance opening 2 at workpiece setting station, safety switch behind

- Open maintenance opening 2 at workpiece setting station.
- Unlock the workpiece setting station safety door (front door) by rotating the casement fasteners.
- Unlock safety switch and open workpiece setting station safety door (front door).
- Switch off machine at main switch and secure against being switched on again.
- When the work is complete and the maintenance area has been vacated, close and lock the workpiece setting station safety door (front door).
- Do not remove padlock at the main switch before maintenance area safety door is closed.

4.2.5 Securing machining unit to prevent it from falling



The Y-axis drive is not self-locking. Persons in the traversing range of the machining unit may be seriously injured if the drive motor holding break fails.

In the event of a collision, the Y-axis can drop down further even if it is in the lower end position of the traversing range.

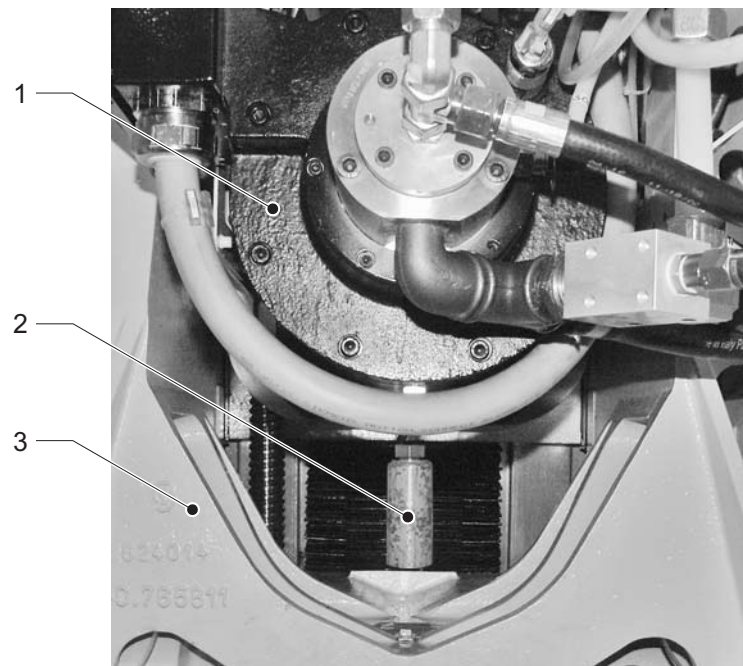
The machining unit must be supported before work is carried out in the danger zone.

Aids

Screw chock of suitable size

Procedure

Before starting work



4.2.5 - 1 Machining unit supported in column with screw chock

- 1 Machining unit
- 2 Screw chock
- 3 Column

The machine is ready for production.

4 Inspection and maintenance

4.2 Special safety measures

- Move machining unit to a suitable height.
- Open maintenance area safety door and secure to prevent closing.
- Switch off machine at main switch and secure against being switched on again.
- Support machining unit in column with the aid of screw chock.

On completion of work

- Remove screw chock.
- Before closing the maintenance safety door, ensure that nobody is behind the guard panels. Close and lock maintenance area safety door.

4.2.6 Securing tool change door to prevent it from falling



Work being carried out near the tool changer may result in injury if the lifting device of the tool change door should fail.

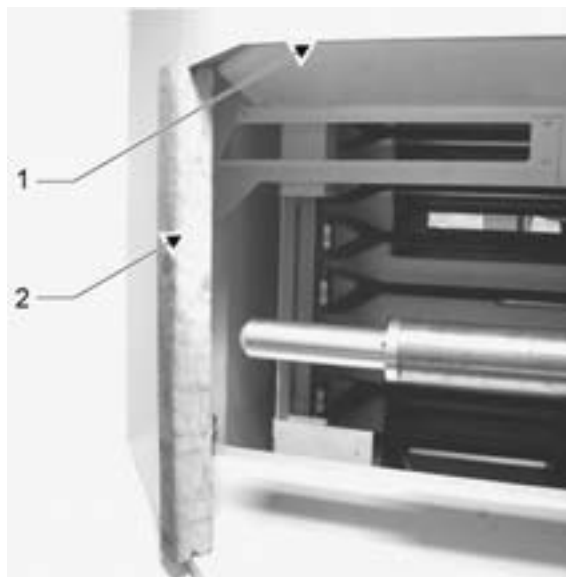
The tool change door must be supported before work is carried out in the danger zone.

Aids

Suitable lengths of stable timber beam.

Procedure

Before starting work



4.2.6 - 1 Tool change door secured with wooden block

- 1 Tool change door
- 2 Notched wooden block

- The machine is ready for production.
- Access right for "Individual functions" main menu granted.
- Select the "Tool change individual functions" main menu.
- Open tool change door using the "tool change door" individual function.
- Ensure that the loading hatch in the work area hood is closed.
- Open work area safety door and secure to prevent closing.
- Switch off machine at main switch and secure against being switched on again.
- Firmly clamp the wooden block below the tool change door.

On completion of work

- Remove support from the tool change door.

4 Inspection and maintenance

4.2 Special safety measures

- Before closing the work area safety door, ensure that nobody is behind the guard panels.
Close work area safety door.
- Turn on machine on at the main switch.
- Switch on motors.
- Close tool change door using the "tool change door" individual function.
- Revoke access rights.
- Switch off motors.

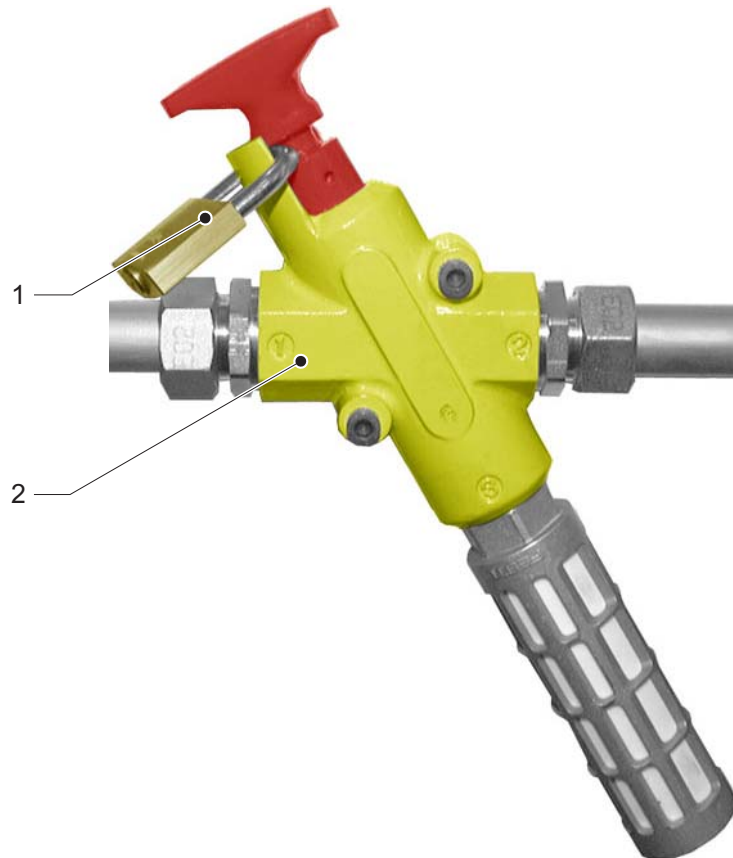
4.2.7 Securing compressed air shut-off valve to prevent opening



Risk of injury when working on pressurised components.

Before commencing work on pneumatic equipment or pneumatically controlled components, close shut-off valve and secure to prevent it from opening.

Procedure



4.2.7 - 1 Pneumatic shut-off valve secured with padlock

- 1 Padlock
- 2 Shut-off valve

- Close shut-off valve.
- Insert padlock into shut-off valve and lock.
- Do not remove padlock before work is complete.

4.2.8 Securing work area against suspended load

The machine is loaded and unloaded by a gantry loader. The hood in the work area is fitted with an automatically actuated loading hatch for this purpose. The loading hatch is closed in normal status.

4 Inspection and maintenance

4.2 Special safety measures

When the loading hatch is closed, you may enter the work area without having to switch off the gantry loader. The following measures protect against suspended loads:

- The safety devices on the gantry loader and the loading hatch are designed in such a way as to prevent a workpiece from falling into the loading area in the event of gantry loader malfunction.
- The loading hatch cannot be opened while ever the work area safety door remains open.



A suspended load can fatally injure persons standing under the open loading hatch when the gantry loader is switched on and able to move.

Before entering the work area you must:

- Either: ensure that the loading hatch is closed.
- Or: move the gantry loader into the parking position, switch off and secure to prevent restart.

Persons are not allowed in the work area during activity that can only be carried out when the gantry loader is in setup mode and the work area safety door and loading hatch are open at the same time!

Presence in the work area with closed loading hatch

Procedure

Before starting work

- Ensure that the loading hatch is closed.
- Open work area safety door and secure to prevent closing.
- The loading hatch cannot be opened. The gantry loader can be moved past the machine to load and unload other machines.
- Do not remove work area safety door padlock before the end of work or before the work area is vacated.

On completion of work

- Before closing the safety door, ensure that nobody is behind the guard panels. Close and lock the work area safety door.

Presence in the work area with open loading hatch

Procedure

Before starting work

- Move the gantry loader into the parking position and secure to prevent it being switched on again.
- Open work area safety door and secure to prevent closing.
- Do not remove gantry loader interlock before the end of work and before the work area is vacated.

On completion of work

- Before closing the safety door, ensure that nobody is behind the guard panels. Close and lock the work area safety door.
- Remove gantry loader padlock.

4.2.9 Moving the gantry loader to its parking position before climbing on the machine

The machine is loaded and unloaded by a gantry loader. The gantry loader can then pass the machine to load and unload other machines even if linked mode is deselected on the machine.



Danger to life within the traversing range of the gantry loader.

Before climbing onto the machine, always move the portal loader to its parking position, switch off and secure to prevent it being switched on again.

Do not remove gantry loader padlock before end of work or before removing the ladder.

4.2.10 Do not enter unsecured safety areas of the machining system



To enable the machining system to continue operating, for example in the event of a machine malfunction, several safety areas are defined for the machining system.

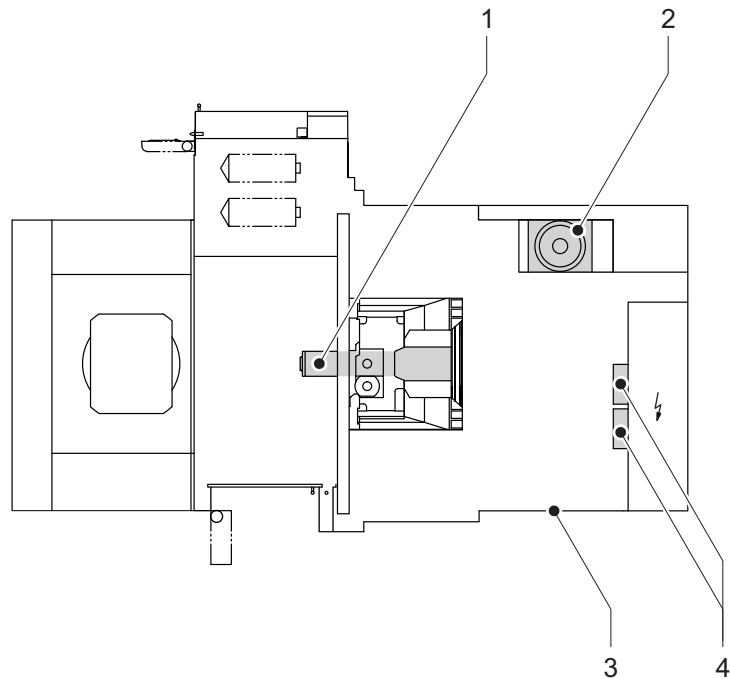
Never step from one secured safety area into another safety area without further checking.

For example:

- Never step from the work area of a machine into the linked system!
- Never step from the linked system into the work area of a machine!

Only step from a secured safety area into another if both safety areas are secured. Areas are secured by switching off the machine and securing to prevent the machine and the linked system from being switched on again.

4.3 Spindle and control cabinet cooling

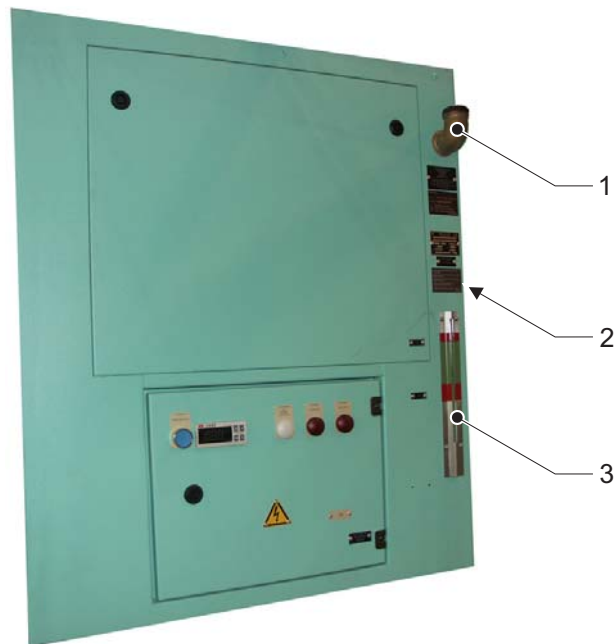


4.3 - 1 Schematic representation of the machine

- 1 spindle
- 2 Cooling unit
- 3 Maintenance area safety door
- 4 Control cabinet cooling unit

4.3.1 Check filling level in cooling unit

Interval	200 Hours Operating time
Component	Cooling unit



4.3.1 - 1 Cooling unit
 1 Filler opening
 2 Side wall (right side)
 3 Fill level display

Inspection

i

Small quantities of cooling water can be lost from the cooling circuit through evaporation. Losses amounting to several litres per week, however, indicate leaks.

Further documents



For manufacturer's documentation on the cooling unit, see Subsuppliers' Information (ZI) from "BKW".



For structure of the cooling unit, see the media diagram (MP).

Procedure

- Check level at the filling level indicator.
- If the filling level has decreased substantially since the last inspection, the hydraulic equipment must be checked for leakages.



For procedure, see:
 "Inspection of fluid equipment" **page 272**

- If the cooling water level is below the centre of the min-max range, top up cooling water.



For procedure, see:
 "Replenishing cooling water" **page 98**

Replenishing cooling water

Consumable

Cooling water

Only a mixture of the following components may be used as cooling water:

Demineralised water	According to DIN ISO 3696, Quality 3 (or better).	
Antifrogen N	Anti-freeze with anti-corrosive action	
	Manufacturer	Clariant GmbH D-65840 Sulzbach Tel.: 06196/757-8807 www.antifrogen.de
Mixing ratio water:Antifrogen N	65:35 Percent by volume = 62:38 Percent by weight This is equivalent to frost protection down to -22 °C.	



The proportion of **Antifrogen N** in the cooling circuit must **never drop below 20%**! Below 20%, the anti-bacterial effect is reversed and bacteria can multiply extensively in the cooling circuit. Always keep the mixing ratio within the following limits:

	Minimum of Antifrogen N	Target value	Maximum of Antifrogen N
Water: Antifrogen N in percentage by volume	70:30	65:35	60:40
Water:Antifrogen N in percentage by weight	67:33	62:38	57:43

4 Inspection and maintenance

4.3 Spindle and control cabinet cooling

	Minimum of Antifrogen N	Target value	Maximum of Antifrogen N
Frost protection	-17 °C	-22 °C	-26 °C

Determine the mixture ratio in the cooling circuit using a frost protection tester before topping up the cooling water and depending on the test result, add pure Antifrogen N, a mixture or pure water. This procedure is described below.

i

Handling demineralised water and auxiliary materials:

- Store demineralised water only for a few days and only in plastic containers.
- To prevent contamination, demineralised water must not come into contact with the skin or soiled objects.
- Pumps, hoses, containers and other auxiliary materials, that are used for handling demineralised water or Antifrogen N may not come into contact with other media such as oil or cooling lubricant.



Safety precautions for Antifrogen N:

- Antifrogen N is harmful to the health if swallowed. If swallowed accidentally, seek medical treatment!
- Do not inhale fumes.
- Avoid any contact with eyes, skin or clothing. Wear solvent-resistant gloves and tight-fitting safety goggles.
- Remove contaminated clothing immediately. For First Aid measures following contact with the body or inhalation, see Safety Datasheet.
- Do not allow undiluted or large volumes of Antifrogen N to penetrate ground water, running water or sewerage systems.

Furthermore, observe the safety instructions on the product packaging.

Aids

Ladder

Clean glass for collecting cooling water sample

Clean anti-freeze tester for Antifrogen N, HELLER No. 01.019174

Clean vessel for preparing the mixture

Clean equipment for filling (jug, funnel)

Further documents



For safety data sheet on anti-corrosion agents, see Subsuppliers' Information (ZI) from "Clariant".

Procedure

Taking cooling water sample

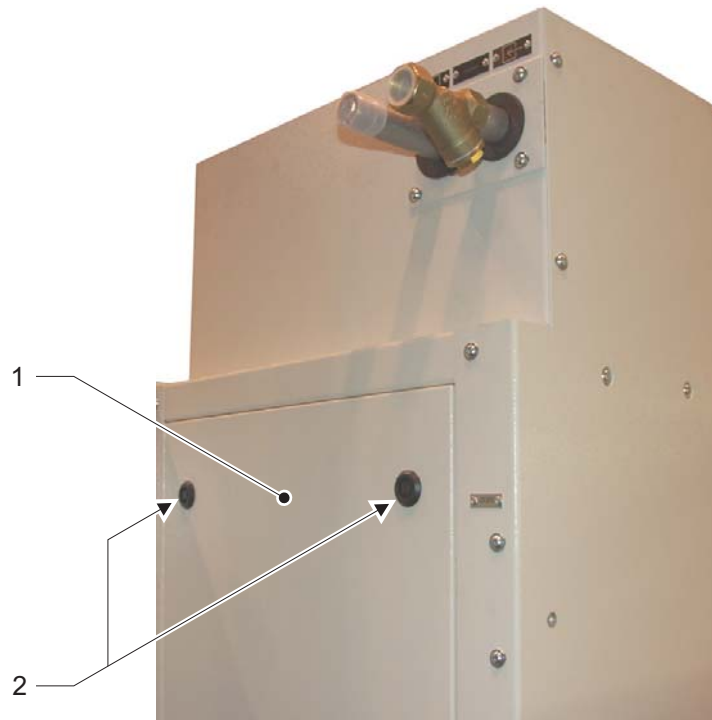


4.3.1 - 2 Cooling unit

- 1 Filler opening
- 2 Side wall (right side)
- 3 Fill level display

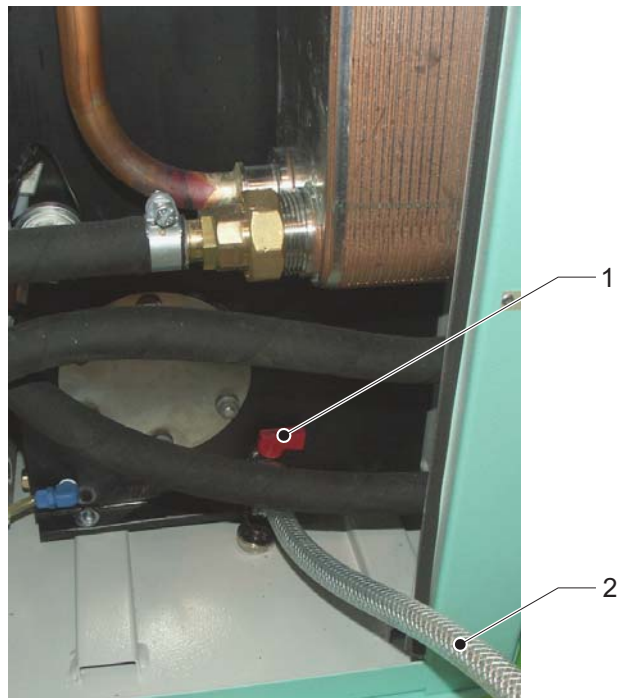
- Maintenance area safety door opened and secured to prevent closing.
- Machine switched off at main switch and secured against being switched on again. This switches off the cooling unit.
- Unscrew cover on filling opening.

4 Inspection and maintenance
4.3 Spindle and control cabinet cooling



4.3.1 - 3 Cooling unit
1 Side panel
2 Casement fastener

- Unlock and take out side panel of the cooling unit by twisting the casement fastener.

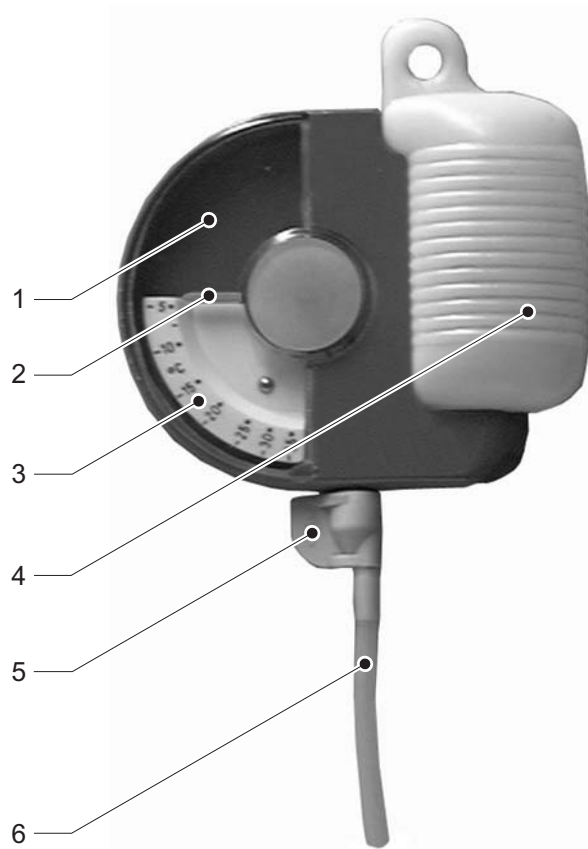


4.3.1 - 4 View into cooling unit with side panel open

- 1 Drain cock
- 2 HOSE

- Guide the hose into a glass beaker. Open the drain cock and remove approx. 100 ml cooling water.
- Close the drain tap. Place the hose inside the cooling unit. Attach side panel of the cooling unit.

Determining mixture ratio



4.3.1 - 5 Anti-freeze tester

- 1 Measuring chamber
- 2 POINTER
- 3 Scale
- 4 Suction bulb
- 5 Valve in opened position
- 6 HOSE

Fill anti-freeze tester:

- Open valve.
- Hold anti-freeze tester with tube in the cooling water sample.
- Fully compress suction bulb.
- Hold the anti-freeze tester in a vertical position and extract cooling water: Release the suction bulb slowly at first to prevent the formation of air bubbles. Air bubbles result in inaccurate measurements. When measuring chamber is approx. 1/3 full, you can release the suction bulb.
- Close the valve.

- ☒ Any air bubbles that have formed can be removed by tapping your finger lightly against the measuring chamber.
- ☒ Read off measuring result.
 - Hold the anti-freeze tester vertically.
 - The scale value at the level of the pointer indicates the anti-freeze rating in °C.
- ☒ Drain the anti-freeze tester into the glass:
 - Open valve.
 - Repeatedly compress the suction bulb until the measuring chamber is completely empty.
- ☒ Clean the anti-freeze tester by repeatedly sucking up and pumping out warm water.
- ☒ Empty glass and clean with warm water.

Replenishing cooling water

i

Depending on the measuring result, add either Antifrogen N, a mixture or water:

Measured anti-freeze	Replenish
Less than -17 °C	Pure Antifrogen N
-17 °C to -26 °C	Mixture in reference ratio 65:35 percent by volume. Do not add the constituents separately, prepare the mixture beforehand.
More than -26 °C	Pure demineralised water

- ☒ Fill with cooling water through the filling opening up to the maximum mark on the filling level indicator.
- ☒ Screw on filling opening cover.
- ☒ Before closing the maintenance safety door, ensure that nobody is behind the guard panels. Close maintenance area safety door.
- ☒ Operate the machine for 1 hour to mix the cooling water.
- ☒ Check the mixing ratio again and adjust as necessary.

- 4** **Inspection and maintenance**
 - 4.3** **Spindle and control cabinet cooling**
-

4.3.2 Changing cooling water in cooling unit

Interval 1 Year(s) Real time
 Component Cooling unit



4.3.2 - 1 Cooling unit
 1 Filler opening
 2 Side wall (right side)
 3 Fill level display

Consumable Cooling water
 Only a mixture of the following components may be used as cooling water:

Demineralised water	According to DIN ISO 3696, Quality 3 (or better).	
Antifrogen N	Anti-freeze with anti-corrosive action	
	Manufacturer	Clariant GmbH D-65840 Sulzbach Tel.: 06196/757-8807 www.antifrogen.de

4 Inspection and maintenance

4.3 Spindle and control cabinet cooling

Mixing ratio water:Antifrogen N	65:35 Percent by volume = 62:38 Percent by weight This is equivalent to frost protection down to -22 °C.
------------------------------------	--

The container in the cooling unit holds 42 l. You therefore require approx. 27 litres of water and 15 litres of Antifrogen N.

HELLER item number 49.200333 will give you coolant water as a prepared mixture.

i

Handling demineralised water and auxiliary materials:

- Store demineralised water only for a few days and only in plastic containers.
- To prevent contamination, demineralised water must not come into contact with the skin or soiled objects.
- Pumps, hoses, containers and other auxiliary materials, that are used for handling demineralised water or Antifrogen N may not come into contact with other media such as oil or cooling lubricant.



Safety precautions for Antifrogen N:

- Antifrogen N is harmful to the health if swallowed. If swallowed accidentally, seek medical treatment!
- Do not inhale fumes.
- Avoid any contact with eyes, skin or clothing. Wear solvent-resistant gloves and tight-fitting safety goggles.
- Remove contaminated clothing immediately. For First Aid measures following contact with the body or inhalation, see Safety Datasheet.
- Do not allow undiluted or large volumes of Antifrogen N to penetrate ground water, running water or sewerage systems.

Furthermore, observe the safety instructions on the product packaging.

Aids

Ladder

Container for collecting used cooling and rinsing water

Drinking water for rinsing the cooling circuit

Clean vessel for preparing the mixture

Clean equipment for filling (jug, funnel)

Further documents



For manufacturer's documentation on the cooling unit, see Subsuppliers' Information (ZI) from "BKW".
For safety data sheet on anti-corrosion agents, see Subsuppliers' Information (ZI) from "Clariant".



For structure of the cooling unit, see the media diagram (MP).

Procedure

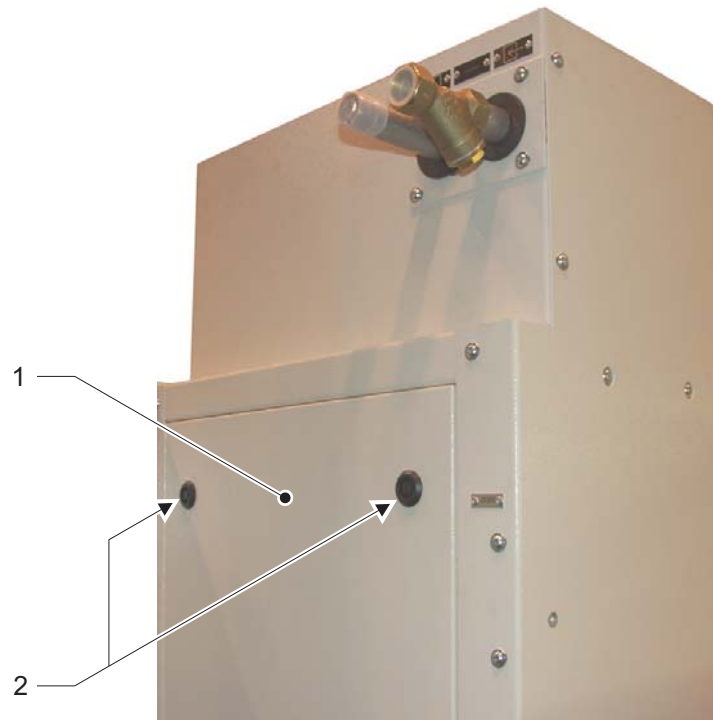
Draining cooling water



Dispose of the used cooling water according to the locally applicable regulations.

- Maintenance area safety door opened and secured to prevent closing.
- Machine switched off at main switch and secured against being switched on again. This switches off the cooling unit.
- Unscrew cover on filling opening.

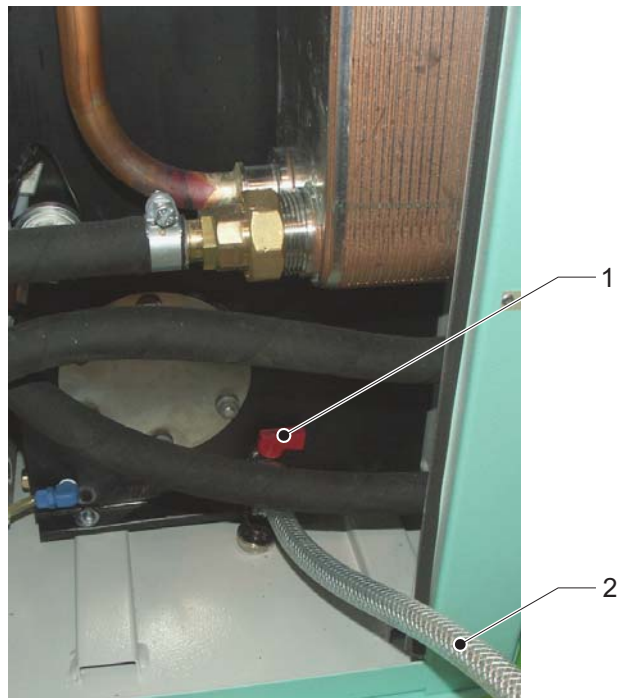
4 Inspection and maintenance
4.3 Spindle and control cabinet cooling



4.3.2 - 2 Cooling unit (right side)

- 1 Side panel
- 2 Casement fastener

- Unlock and take out side panel of the cooling unit by twisting the casement fastener.



4.3.2 - 3 View into the cooling unit after removing the side panel

- 1 HOSE
- 2 Drain cock

- Guide the hose into a container. Open drain cock and allow the water to flow into the container.
- Close the drain tap. Place the hose inside the cooling unit. Attach side panel of the cooling unit.
- Before closing the maintenance safety door, ensure that nobody is behind the guard panels. Close maintenance area safety door.

Filling with flushing water and purging cooling circuit

Use pure drinking water as flushing water.

- Fill with flushing water through the filling opening up to the maximum mark on the filling level indicator.
- Switch on machine at main switch and wait approx. 5 minutes.
 - ↻ The cooling unit is running, the cooling circuit is vented.
- Check level at the filling level indicator. Top up flushing water to maximum mark.
- Screw on filling opening cover.

- Run the machine for around 2 hours to flush out the cooling circuit.

Draining flushing water

- Maintenance area safety door opened and secured to prevent closing.
- Machine switched off at main switch and secured against being switched on again. This switches off the cooling unit.
- Unscrew cover on filling opening.
- Unlock and take out side panel of the cooling unit by twisting the casement fastener.
- Guide the hose into a container. Open drain cock and allow the water to flow into the container.
- Close the drain tap. Place the hose inside the cooling unit. Attach side panel of the cooling unit.
- Before closing the maintenance safety door, ensure that nobody is behind the guard panels. Close maintenance area safety door.

Filling with cooling water

i

Do not allow the machine to stand empty after flushing, refill with cooling water immediately.

Use only freshly prepared mixtures with reference ratio 65:35 percent by volume. Do not add the constituents separately, prepare the mixture beforehand.

- Fill with cooling water through the filling opening up to the maximum mark on the filling level indicator.
- Switch on machine at main switch and wait approx. 5 minutes.
 - The cooling unit is running, the cooling circuit is vented.
- Check level at the filling level indicator. Top up with cooling water to maximum mark.
- Screw on filling opening cover.

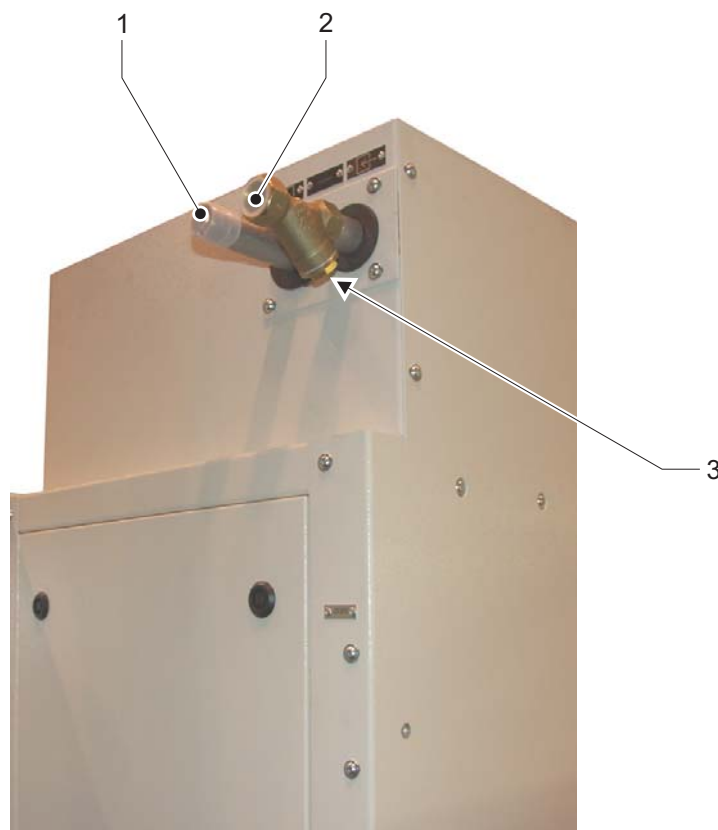
4.3.3 Clean splash guard in the cooling water supply line

Interval 1000 Hours Operating time



Reduce this interval in case of increased contamination level of the customer-provided cooling water.

Component Cooling unit



4.3.3 - 1 Cooling unit (right side)

- 1 Coolant water return to the works network
- 2 Coolant water inlet from the works network
- 3 Dirt trap

Aids Ladder
Container for collecting the leaking cooling water

4 Inspection and maintenance

4.3 Spindle and control cabinet cooling

Further documents



For manufacturer's documentation on the cooling unit, see Subsuppliers' Information (ZI) from "BKW".

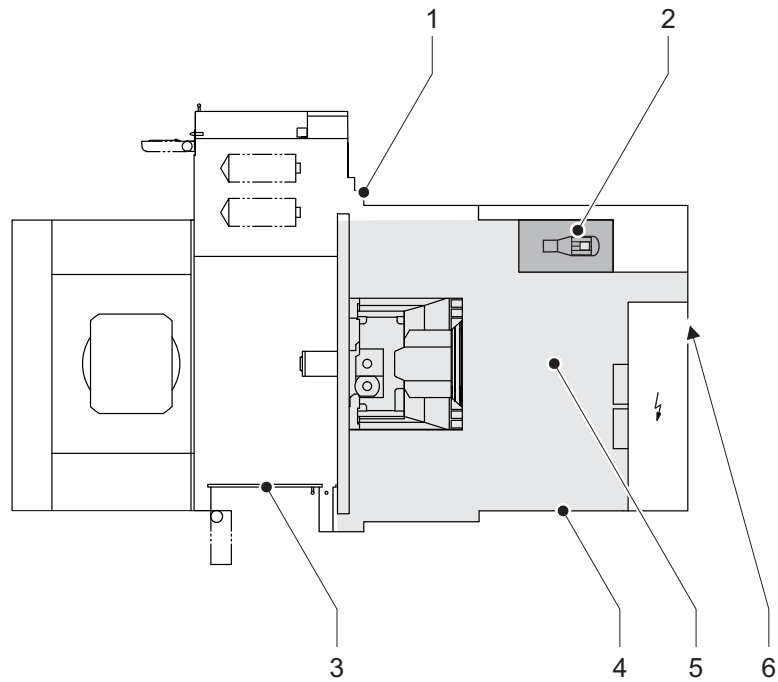


For structure of the cooling unit, see the media diagram (MP).

Procedure

- Maintenance area safety door opened and secured to prevent closing.
- Machine switched off at main switch and secured against being switched on again. This switches off the cooling unit.
- Close shut-off valves provided by the customer within the cooling water supply and return lines.
- Hold container ready to collect leaking cooling water.
- Screw off sealing cap of the mud flap.
- Remove the wire screen and blow out with clean compressed air
- Insert wire screen.
- Screw in sealing cap and tighten.
- Open shut-off valves provided by the customer.
- Before closing the maintenance safety door, ensure that nobody is behind the guard panels. Close maintenance area safety door.
- Turn on machine on at the main switch.
- Cooling unit is switched on.
- Check sealing cap for leakage.

4.4 Hydraulic system

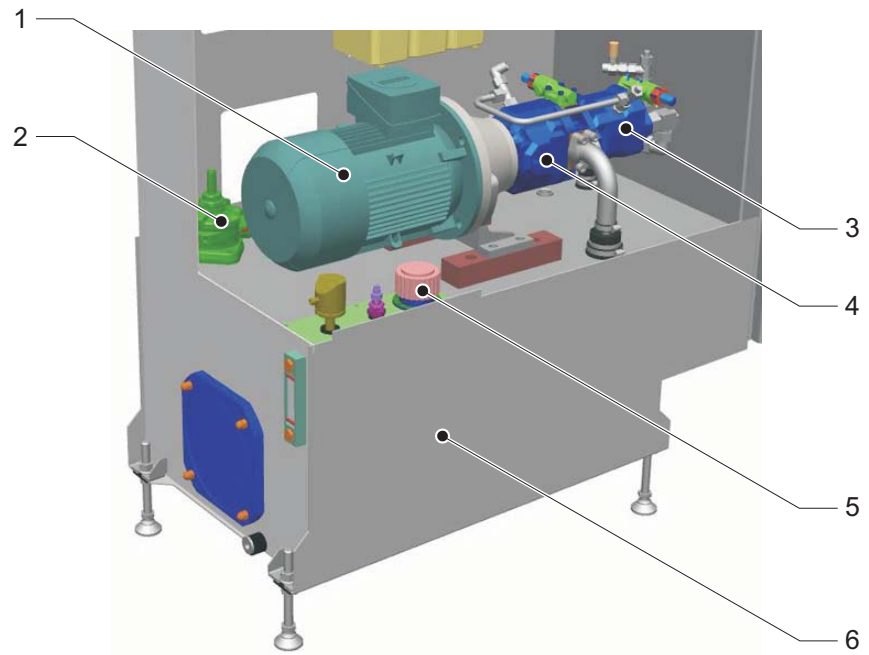


4.4 - 1 Schematic representation of the machine

- 1 Maintenance opening B
- 2 Hydraulic unit
- 3 Work area safety door
- 4 Maintenance area safety door
- 5 Maintenance area
- 6 Master switch

4 Inspection and maintenance

4.4 Hydraulic system



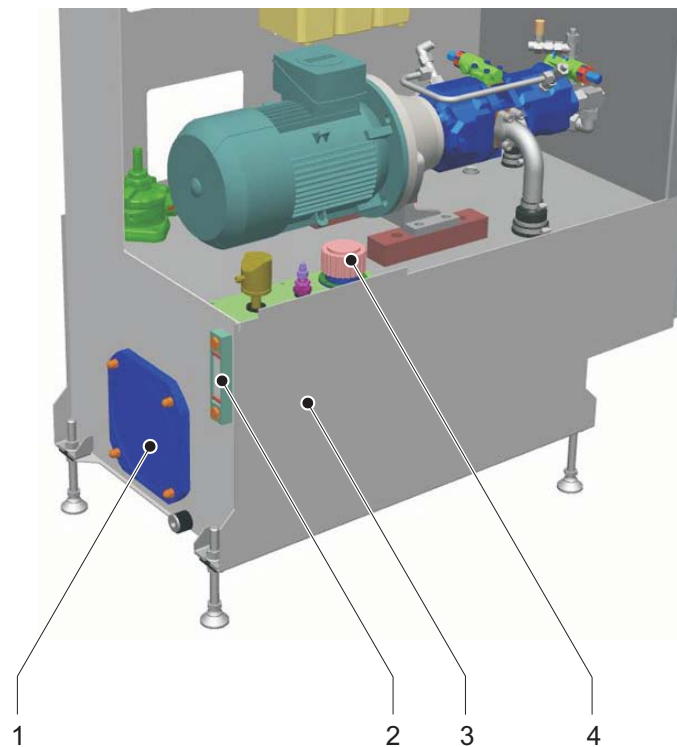
4.4 - 2 Hydraulic unit on the fluid module(HELP 1)

- 1 Three-phase motor and pump mounting
- 2 Return line filter
- 3 Second axial piston pump for high-pressure (optional)
- 4 Axial piston pump for low pressure
- 5 Filling strainer
- 6 Hydraulic reservoir

4.4.1 Oil change in hydraulic reservoir

Interval 1 Year(s) Real time

Component Hydraulic unit



- 4.4.1 - 1 Hydraulic unit
- 1 Cleaning cover
 - 2 Oil level indicator
 - 3 Hydraulic reservoir
 - 4 Filling strainer

4 Inspection and maintenance

4.4 Hydraulic system

Consumable

Hydraulic oil HLP 46 to DIN 51524, Part 2 (ISO-L-HM 46 to ISO 6743, Part 4)

Purity class ISO 4406-18/16/13

For tank capacity, see hydraulic circuit diagram (HP)



Disimilar lubricants can contain various additives that might not be compatible. To rule out incompatibility between the lubricants, disimilar lubricants must not be mixed.

If you have any questions, please contact your lubricant supplier.



Used oil must be regarded as hazardous waste and be disposed of according to the locally applicable regulations.

Spare part

Cleaning cover seal 01.102524

Filling strainer



See Hydraulic Diagram (HP).



Contaminated filter elements must be regarded as hazardous waste and disposed of according to the locally applicable regulations.

Aids

Oil extractor

Hose with a diameter of 8 x 1.25 mm to ventilate the hydraulic unit

Torque wrench for 10 Nm

Further documents



For structure of the hydraulic system, see the Hydraulic Diagram (HP).

Procedure

Emptying hydraulic reservoir

- Machine switched off at main switch and secured against being switched on again.
- Screw off filling strainer cap.
- Remove the fixing screws on the filling filter filling sieve. Remove filling sieve. Dispose of the used filling strainer.
- Exhaust oil through filling opening in filling filter.

Cleaning the hydraulic reservoir

- Remove cleaning cover.
- Exhaust residue.
- Remove dirt and deposits from hydraulic reservoir using lint-free cloths. Do not use any solvents.
- Check the cleaning cover seal for damage. Replace damaged seal. Fit cleaning covers.
- Insert filling sieve of the new filling strainer and screw down.

Filling oil

- Fill with oil through filling opening in filler filter up to the max. mark on the oil level indicator.
- Screw down the filter cap of the filling strainer.

Checking filling level in axial piston pump

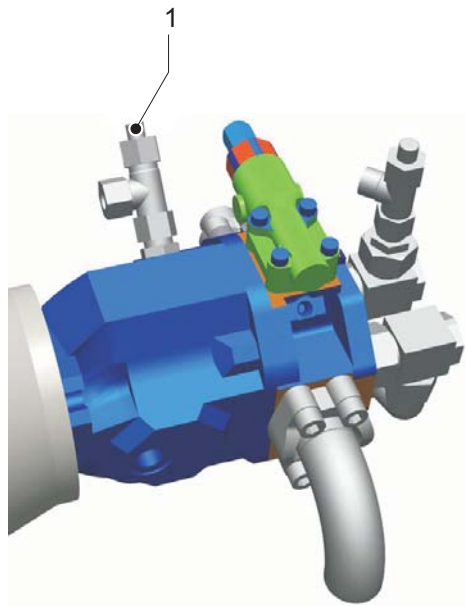
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Depending on the piston position, the axial piston pump may run out via the suction line after you have emptied the hydraulic reservoir. Check and refill as described in the following in order to avoid that the pump runs dry on start-up and seizes.

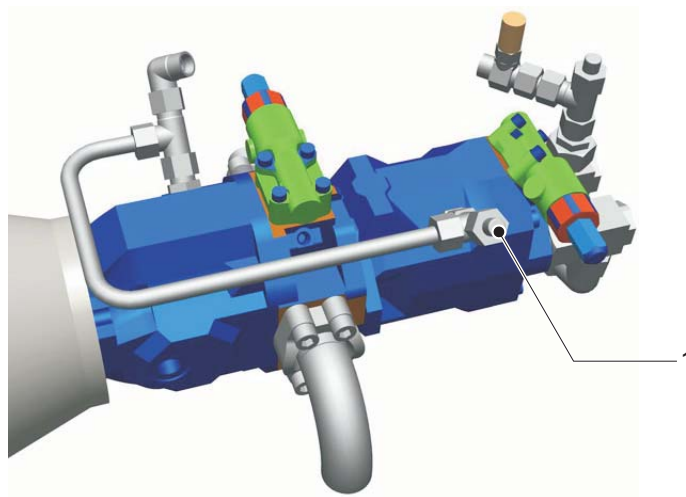
Note that, depending on the design of your machine, the filler plug may be in a different position.

4 Inspection and maintenance

4.4 Hydraulic system



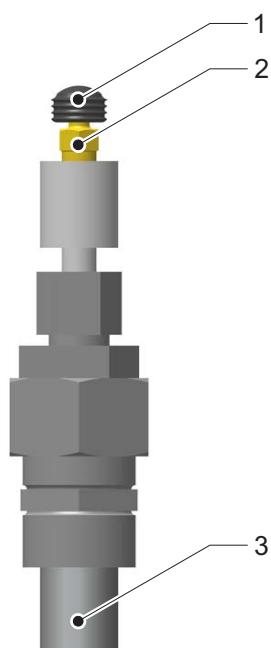
4.4.1 - 2 Axial piston pump (low pressure)
1 Plug for filling the axial piston pump



4.4.1 - 3 Double axial piston pump (option "high pressure")
1 Plug for filling the two axial piston pumps

- ☒ Check and top up filling level in axial piston pump:
 - Remove plug.
 - Check fill level. If oil is missing, top up oil until no more bubbles rise to the surface.
 - Insert plug.

Vent hydraulic unit



4.4.1 - 4 Vent device

- 1 Safety cap
- 2 Vent valve
- 3 Vent pipe of hydraulic unit

- ☒ Vent hydraulic unit:
 - Remove safety cap.
 - Attach hose to vent valve and take a firm hold.
 - Open the vent valve on the vent pipe by half a rotation.
 - Turn on machine on at the main switch.
 - Switch on motors.
 - The hydraulic unit will run.
 - Drain approx. 5 litres of hydraulic oil into a container and close the valve while pressurised.
 - Tighten the vent valve to a torque of 10 Nm.
 - Attach safety cap.

4 Inspection and maintenance

4.4 Hydraulic system

- Run machine for a few minutes.
- Check screw plug and cleaning cover for leakages.
- Check oil level at the oil level indicator. Fill with oil up to maximum mark.

4.4.2 Replacing hydraulic hose lines

Interval 4 Year(s) Real time

Component All hydraulic hose lines



According to the Main Association of Industrial Associations of Germany, hydraulic hose lines must not be used for more than six years, including a maximum two-year storage period.

Hydraulic hose lines are marked with the following information:

- Manufacturer's code
- Date of manufacture (month and year)
- Maximum dynamic operating pressure

We recommend that all hose lines are replaced every four years.

Combine the changing of the hose lines with the oil change. Proceed as follows:

- Empty and clean hydraulic reservoir.
- Replace hose lines.
- Top up oil in the hydraulic reservoir.
- Running in and vent the oil consumers.

Consumable Hydraulic oil HLP 46 to DIN 51524, Part 2 (ISO-L-HM 46 to ISO 6743, Part 4)
Purity class ISO 4406-18/16/13



Disimilar lubricants can contain various additives that might not be compatible. To rule out incompatibility between the lubricants, disimilar lubricants must not be mixed.

If you have any questions, please contact your lubricant supplier.

Spare part



For hose lines with ordering data, see the media diagram (MP).



Used oil and oily hose line should be regarded as hazardous waste. Dispose of these materials and components according to the locally applicable regulations.

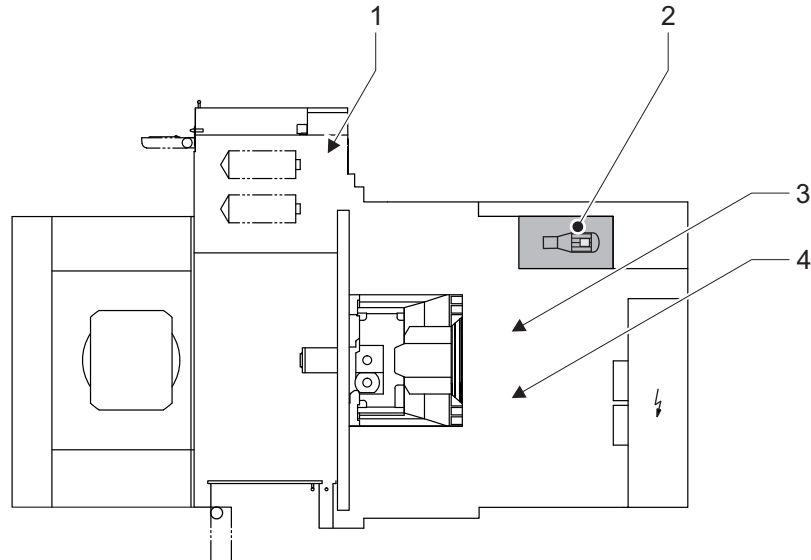
Aids 15 litre container

4 Inspection and maintenance

4.4 Hydraulic system

Procedure

Making hose lines accessible



4.4.2 - 1 Schematic representation of the machine
Installation locations of the hydraulic hose lines

- 1 Tool magazine (tool cartridge)
- 2 Hydraulic unit
- 3 Power supply chain X/Y-axis and machining unit
- 4 Z-axis power supply chain



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.

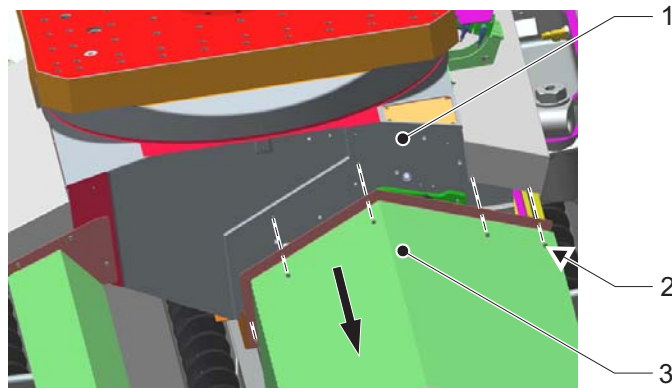
Danger to life within the traversing range of the gantry loader.

Before climbing onto the machine, always move the portal loader to its parking position, switch off and secure to prevent it being switched on again.

Do not remove gantry loader padlock before end of work or before removing the ladder.

- There should be no tool in the tool spindle.
- Machining unit traversed into support position.
- Z-axis (rotary table) moved away from the machining unit.
- Work area safety door open and secured to prevent closing.

- Loading hatch closed.
- Machine switched off at main switch and secured against being switched on again.
- Compressed air shut-off valve closed and secured to prevent opening.
- Maintenance area safety door opened and secured to prevent closing.
- Machining unit protected from falling by supports.
- Maintenance opening B open.
- Gantry loader in parking position, switched off and secured against being switched on again.



4.4.2 - 2 Z-cover in work area

- 1 Rotary table
- 2 Screws (5 x)
- 3 Z-axis concertina cover

- Unscrew Z-concertina cover from rotary table and push onto the XY cover in the direction of the arrow.
- ↪ The connections of the hose lines become accessible.

Replacing hose lines

i

When the hydraulic unit is switched off, various levels of pressure remain inside different sections of the line.

Do not use the manual trigger of directional control valves to release residual pressure from the line. Do not readjust the directional control valves to ensure that upon restart, pressure is initially applied to the same side of the hydraulic cylinders as before. The cylinder will then be filled without piston movement. Otherwise, the piston will not be cushioned when travelling in the opposite direction against the end stop due to lacking counter-pressure.

Lines containing residual pressure may be unscrewed carefully; pressure will be relieved quickly with the first drops escaping from the line. You must only continue to carefully drain the nominal volume of accumulator before completely releasing the hoses if the machine is fitted with an accumulator option. Use the media diagram to check whether this applies to your machine.

- Per hose line:
 - Remove all fixings.
 - Use a container to collect the oil from the line.
 - Carefully loosen the duct union on the hose line until oil drips from the line. Carefully allow the oil to drain until the hose is relieved.
 - Unscrew hose line, drain the oil.
 - Clean the thread with a lint-free cloth.
 - Screw tight new hose line.
 - Fit all fixings.
- Open compressed air shut-off valve.

Running in and venting the oil consumers

i

After the hose line has been replaced, the system contains air. This will make hydraulic movements jerky. To vent the system, all parts must be moved back and forth several times without a workpiece or tool. As a result, the air is evacuated via the tank line.

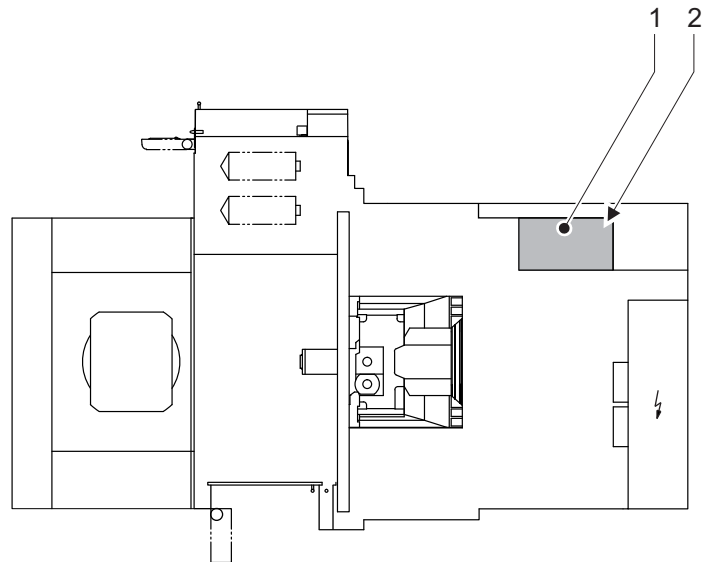
- Oil in the hydraulic reservoir filled to maximum mark on oil level indicator.
- Axial piston pump filled.
- Remove support from the machining unit.

- Before closing the safety doors and maintenance openings, ensure that nobody is behind the guard panels. Close the work area safety door and the maintenance area safety door.
Close maintenance opening B.
- Turn on machine on at the main switch.
- Switch on motors.
 - ↪ The hydraulic unit will run.
- Repeatedly enable all hydraulic movements with individual functions backwards and forwards.

Checking for leaks and preparing machine for operation

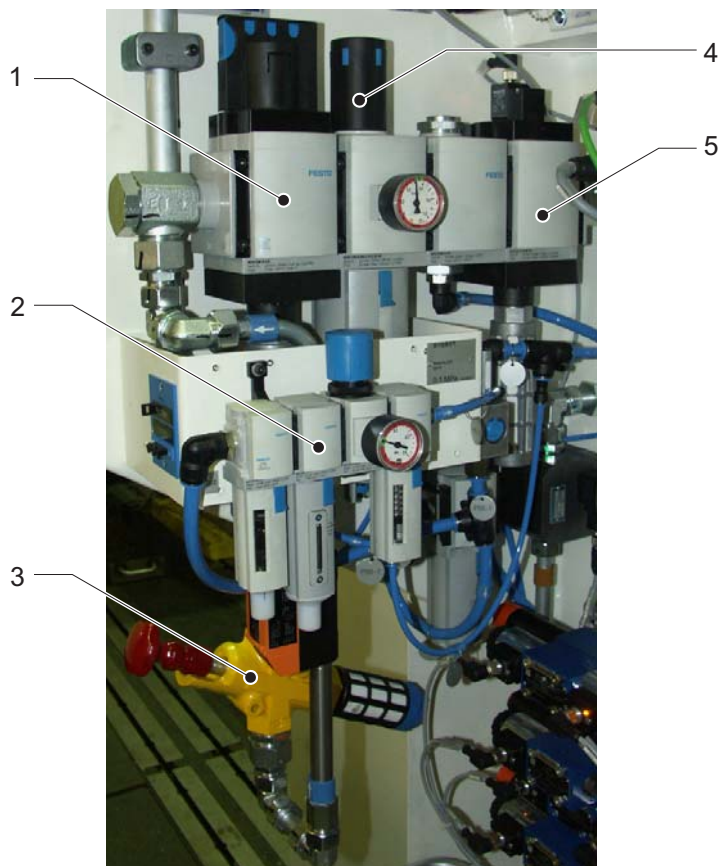
- Make hose lines accessible again:
 - Open work area safety door and secure to prevent closing.
 - Open maintenance area safety door and secure to prevent closing.
 - Switch off machine and secure to prevent restart.
 - Support machining unit.
 - Open maintenance opening B.
- Check the duct unions of the hydraulic hose lines for leaks.
- Check the oil level inside the hydraulic reservoir on the oil level indicator. Fill with oil up to maximum mark.
- Screw Z-axis concertina cover to the rotary table.
- Remove support from the machining unit.
- Before closing the safety doors and maintenance openings, ensure that nobody is behind the guard panels. Close the work area safety door and the maintenance area safety door.
Close maintenance opening B.
- Switch the machine on.
- Place a tool in the tool spindle to protect the tool spindle from the ingress of dirt.
- Switch off motors.
- Remove gantry loader padlock.

4.5 Pneumatics



4.5 - 1 Schematic representation of the machine

- 1 Components of the pneumatic system
- 2 Compressed air shut-off valve



4.5 - 2 Compressed air supply on fluid module 1 (HELP 1)

- 1 Compressed air shut-off valve
- 2 Maintenance unit
- 3 Shut-off valve
- 4 Filter pressure regulator
- 5 Compressed air filter

On machines with pneumatically actuated options, other instruments can be fitted to the assembly plate and the arrangement may deviate from the illustration above. Observe the signs on the machine as they always contain the binding details.

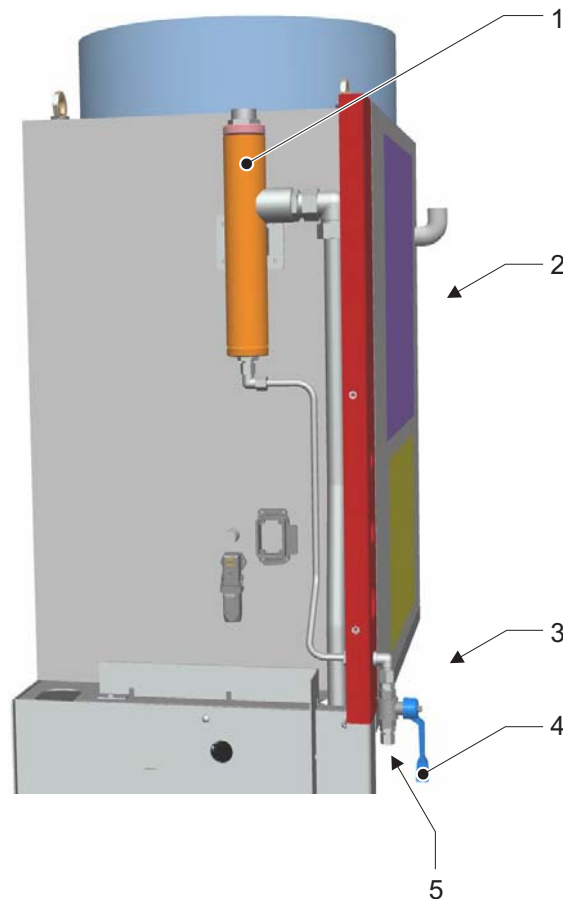
4 Inspection and maintenance

4.5 Pneumatics

4.5.1 Draining water separator

Interval 50 Hours Operating time

Component WATER SEPARATOR



4.5.1 - 1 WATER SEPARATOR

- 1 Water separator (pipe)
- 2 Cooling unit
- 3 Fluid module 1 (HELP 1)
- 4 Ball valve
- 5 End of drain pipe

Aids Container for collecting the compressed air condensate



Compressed air condensation is hazardous waste and should be disposed of according to the locally applicable regulations.

Further documents



For structure of the pneumatic system, see media diagram (MP).

Procedure

- Motors switched off.
- Air supply to machine before the water separator is disabled.
- Hold container below the end of the drain pipe to collect the condensed air condensate.
- Open ball valve and let the compressed air condensate flow into the container .
- Close ball valve.
- Open air supply to machine.

4 Inspection and maintenance

4.5 Pneumatics

4.5.2 Checking automatic drain of filter pressure regulator

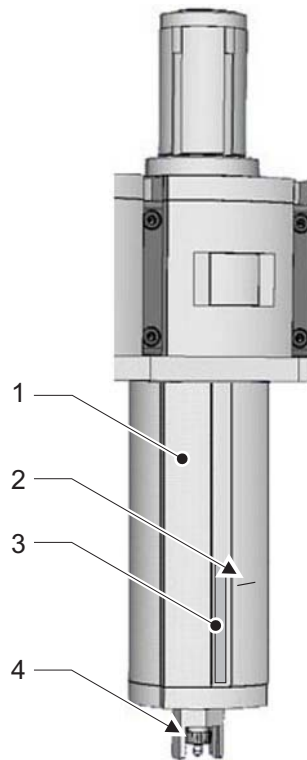
Interval 3 Month(s) Real time



The compressed air supply must correspond to the quality class according to DIN ISO 8573-1 specified in the media diagram.

In case of malfunctions, reduce the maintenance interval. HELLER recommends a 50 h interval in operating time.

Component Filter pressure regulator



4.5.2 - 1 Filter pressure regulator

- 1 Filter container
- 2 Maximum mark
- 3 Fill level display
- 4 Condensate drain

Inspection

Further documents



For manufacturer's documentation on the pre-filter and filter pressure regulator, see Subsuppliers' Information (ZI) from "Festo".



For structure of the pneumatic system, see media diagram (MP).

Procedure



With a fully automatic condensate drain, the valve opens automatically as soon as the float reaches its highest level and closes again when reaching the lowest level.
To switch to automatic mode, fully open up the drain screw by turning clockwise (l.h. thread).

- Check filling level of the condensate in the filter holder. The filling level must not exceed the marked limit.
- If the filling level exceeds the maximum mark, check whether the drain screw is open.
Clean the clogged automatic draining mechanism, clean filter holder with soapy water and blow out with compressed air.

4.5.3 Replacing the filter pressure regulator element

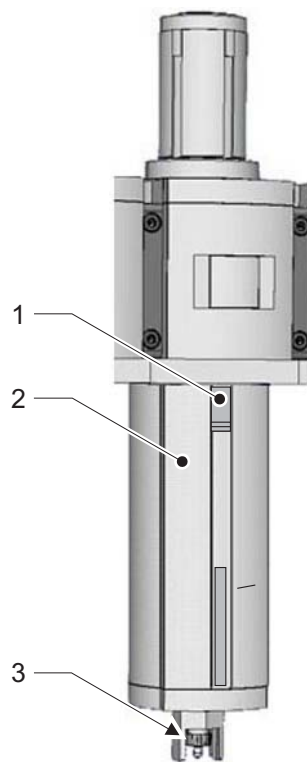
Interval 3 Month(s) Real time



The compressed air supply must correspond to the quality class according to DIN ISO 8573-1 specified in the media diagram.

In case of malfunctions, reduce the maintenance interval.

Component Filter pressure regulator



4.5.3 - 1 Filter pressure regulator

- 1 Unlocking slider
- 2 Filter container
- 3 Condensate drain with drain pipe

4 Inspection and maintenance

4.5 Pneumatics

Spare part

Filter element



See wearing and spare parts list (VS).



Contaminated filter elements must be regarded as hazardous waste and disposed of according to the locally applicable regulations.

Aids

Vessel with soapy water for cleaning the filter container

Container for collecting the compressed air condensate



Compressed air condensation is hazardous waste and should be disposed of according to the locally applicable regulations.

Further documents



For manufacturer's documentation on the filter pressure regulator, see Subsuppliers' Information (ZI) from "Festo".



For structure of the pneumatic system, see media diagram (MP).

Procedure

- Drives and media switched off.
- Compressed air shut-off valve closed and secured to prevent opening.
- Pull off drain pipe from filter container.
- Keep ready container for collecting the compressed air condensate.
- Push unlocking slider downwards and unscrew filter container.
- Empty filter container.
- Clean the filter container with soapy water and blow out with clean compressed air.
- Unscrew filter element.
- Hold the new filter element at the bottom end only. Insert new filter element, screw on filter element and tighten carefully.
- Screw on filter container.
- Push up unlocking slider.
- Screw on drain pipe.
- Open compressed air shut-off valve.

- Switch on drives and media.
- Check filter pressure regulator for leakage.

4 Inspection and maintenance

4.5 Pneumatics

4.5.4 Checking automatic drain of compressed air filter

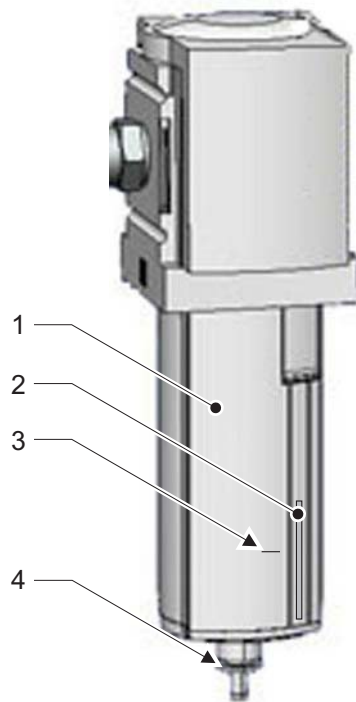
Interval 3 Month(s) Real time



The compressed air supply must correspond to the quality class according to DIN ISO 8573-1 specified in the media diagram.

In case of malfunctions, reduce the maintenance interval. HELLER recommends a 50 h interval in operating time.

Component Compressed air filter



4.5.4 - 1 Compressed air filter

- 1 Filter container
- 2 Fill level display
- 3 Maximum mark
- 4 Condensate drain

Inspection

Further documents



For manufacturer's documentation on the compressed air filter, see Subsuppliers' Information (ZI) from "Festo".



For structure of the pneumatic system, see media diagram (MP).

Procedure



With a fully automatic condensate drain, the valve opens automatically as soon as the float reaches its highest level and closes again when reaching the lowest level.
To switch to automatic mode, fully open up the drain screw by turning clockwise (l.h. thread).

- Check filling level of the condensate in the filter holder. The filling level must not exceed the marked limit.
- If the filling level exceeds the maximum mark, check whether the drain screw is open.
Clean the clogged automatic draining mechanism, clean filter holder with soapy water and blow out with compressed air.

4.5.5 Replace filter element of the compressed air filter.

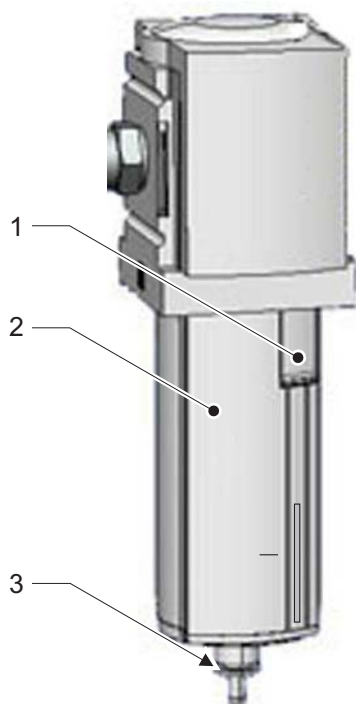
Interval 3 Month(s) Real time



The compressed air supply must correspond to the quality class according to DIN ISO 8573-1 specified in the media diagram.

In case of malfunctions, reduce the maintenance interval.

Component Compressed air filter



4.5.5 - 1 Compressed air filter

- 1 Unlocking slider
- 2 Filter container
- 3 Condensate drain with drain pipe



Check the automatic drain before replacing the filter element so that all work on the compressed air filter can be carried out at the same time.



For procedure, see:
"Checking automatic drain of compressed air filter" **page 138**

4 Inspection and maintenance

4.5 Pneumatics

Spare part

Filter element



See wearing and spare parts list (VS).



Contaminated filter elements must be regarded as hazardous waste and disposed of according to the locally applicable regulations.

Aids

Vessel with soapy water for cleaning the filter container

Container for collecting the compressed air condensate



Compressed air condensation is hazardous waste and should be disposed of according to the locally applicable regulations.

Further documents



For manufacturer's documentation on the compressed air filter, see Subsuppliers' Information (ZI) from "Festo".



For structure of the pneumatic system, see media diagram (MP).

Procedure

- Drives and media switched off.
- Compressed air shut-off valve closed and secured to prevent opening.
- Pull off drain pipe from filter container.
- Keep ready container for collecting the compressed air condensate.
- Push unlocking slider downwards and unscrew filter container.
- Empty filter container.
- Clean the filter container with soapy water and blow out with clean compressed air.
- Unscrew filter element.
- Hold the new filter element at the bottom end only. Insert new filter element, screw on filter element and tighten carefully.
- Screw on filter container.
- Push up unlocking slider.
- Screw on drain pipe.
- Open compressed air shut-off valve.

- Switch on drives and media.
- Check compressed air filter for leakage.

4 Inspection and maintenance

4.5 Pneumatics

4.5.6 Checking automatic drain of the maintenance unit for the measuring scale sealing air

Interval 3 Month(s) Real time



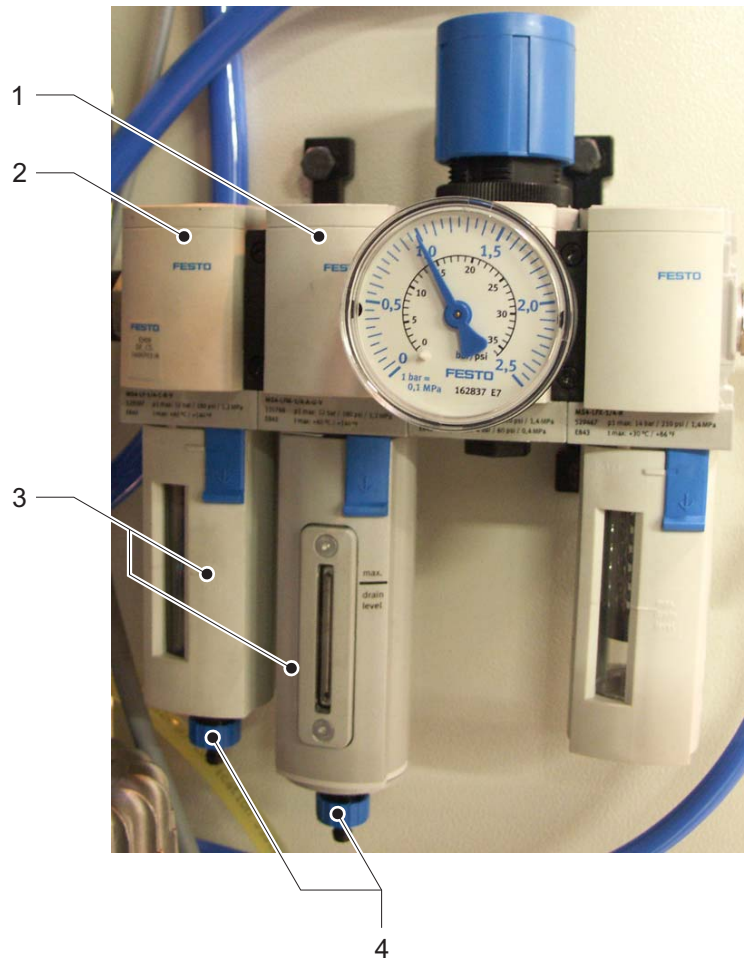
The compressed air supply must correspond to the quality class according to DIN ISO 8573-1 specified in the media diagram.

In case of malfunctions, reduce the maintenance interval.

Component Compressed air filter (2 pc.)

4 Inspection and maintenance

4.5 Pneumatics



4.5.6 - 1 Pneumatic maintenance unit for measuring scale sealing air

- 1 Housing for compressed air filter
- 2 Housing for superfine air filter
- 3 Filter container with automatic drain (2 pieces)
- 4 Condensate drain screw with drain pipe (2 pieces)

Inspection

Further documents



For manufacturer's documentation on the compressed air filter, see Subsuppliers' Information (ZI) from "Festo".



For structure of the pneumatic system, see media diagram (MP).

Procedure

i

With a fully automatic condensate drain, the valve opens automatically as soon as the float reaches its highest level and closes again when reaching the lowest level.

To switch to automatic mode, fully open up the drain screw by turning clockwise (l.h. thread).

- Check filling level of the condensate in the filter holder. The filling level must not exceed the marked limit.
- If the filling level exceeds the maximum mark, check whether the drain screw is open.
Clean the clogged automatic draining mechanism, clean filter holder with soapy water and blow out with compressed air.
Replace defective automatic drain.

4 Inspection and maintenance

4.5 Pneumatics

4.5.7 Replacing filter elements of the maintenance unit for the measuring scale sealing air

Interval 3 Month(s) Real time

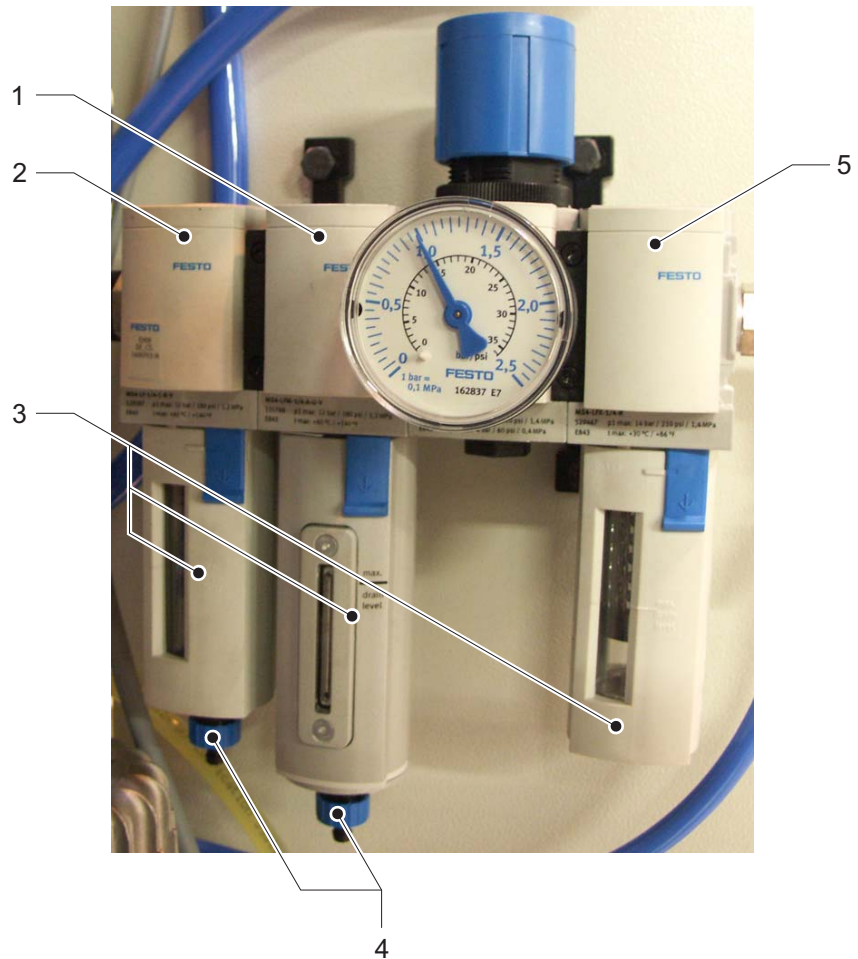


The compressed air supply must correspond to the quality class according to DIN ISO 8573-1 specified in the media diagram.

In case of malfunctions, reduce the maintenance interval.

Component Compressed air filter (3 pc.)

4 Inspection and maintenance
4.5 Pneumatics



4.5.7 - 1 Pneumatic maintenance unit for measuring scale sealing air

- 1 Housing for compressed air filter
- 2 Housing for superfine air filter
- 3 Filter container (3 pieces)
- 4 Condensate drain screw with drain pipe (2 pieces)
- 5 Housing for active carbon filter

i

Check the automatic drain before replacing the filter element so that all work on the compressed air filter can be carried out at the same time.



For procedure, see:
"Checking automatic drain of the maintenance unit for the measuring scale sealing air" **page 144**

Spare part

Compressed air filter element

Superfine air filter element

Active carbon filter element



See wearing and spare parts list (VS).



Contaminated filter elements must be regarded as hazardous waste and disposed of according to the locally applicable regulations.

Aids

Vessel with soapy water for cleaning the filter container

Container for collecting the compressed air condensate



Compressed air condensation is hazardous waste and should be disposed of according to the locally applicable regulations.

Further documents



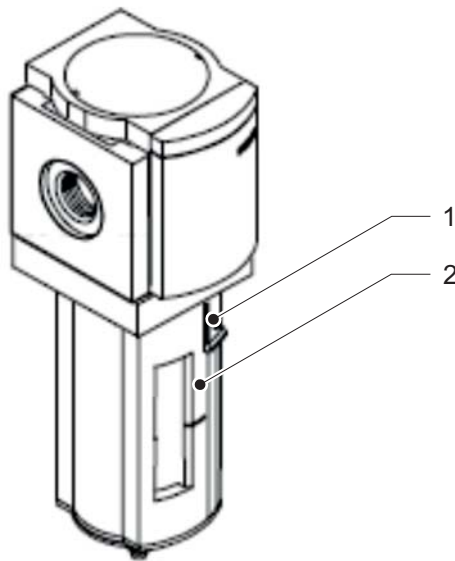
For manufacturer's documentation on the compressed air filter, see Subsuppliers' Information (ZI) from "Festo".



For structure of the pneumatic system, see media diagram (MP).

Procedure

- Motors switched off.
- Shut-off valve closed and secured to prevent opening.
- Unscrew drain pipe from filter container.

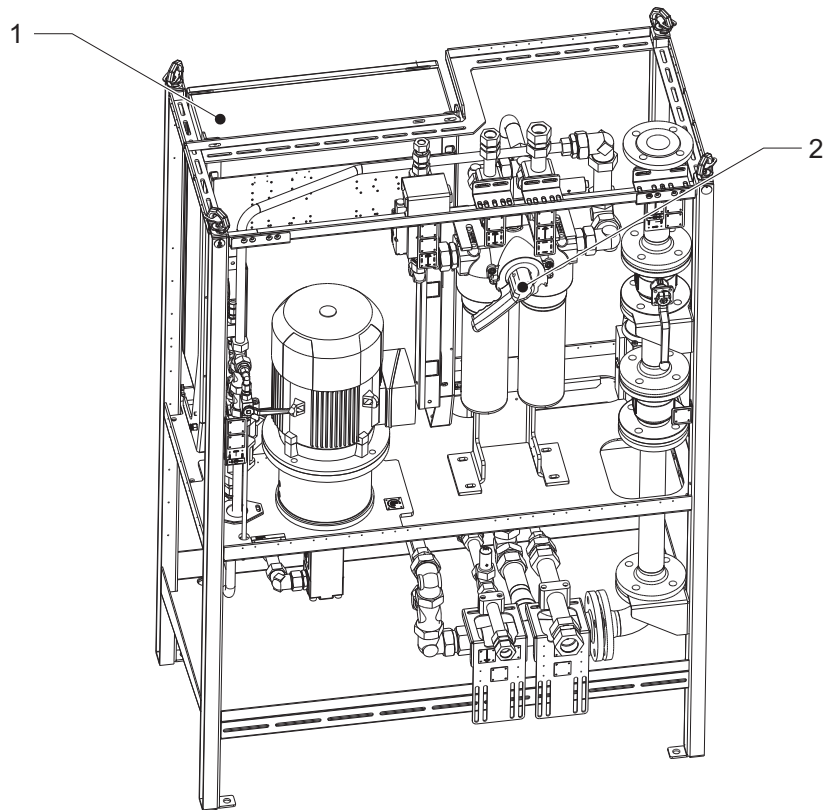


4.5.7 - 2 Compressed air filter/superfine air filter/active carbon filter

- 1 Unlocking slide
- 2 Filter container

- Remove filter container:
 - Push unlocking slide down.
 - Rotate filter container anti-clockwise.
 - Pull filter container away downwards.
- Empty filter container.
- Clean the filter container with soapy water and blow out with compressed air.
- Unscrew filter plate and remove filter element.
- Hold the new filter element at the bottom end only. Insert new filter element, screw on filter plate and tighten carefully.
- Mount filter container in the reverse order.
- Open shut-off valve.
- Check compressed air filter for leakage.
- Mount the drain pipe on the filter container.

4.6 Cooling lubricant system



4.6 - 1 Pressure boosting system

- 1 Control box
- 2 Double filter

Cooling lubricant requirements

The cooling lubricant must fulfil the following conditions:

- The cooling lubricant must be mixable with water.
- No explosive mixtures must be allowed to form.
- The cooling lubricant must be compatible with the lubricants used.
- The cooling lubricant must be compatible with unvulcanised rubber seals.

Further selection depends on the conditions of use.

Important information on consumables and auxiliary materials:
The procurement, use and consumption of all consumables and auxiliary materials for the offered machine lie exclusively in the risk sphere of the purchaser. We therefore highly recommend obtaining information on suitability from the manufacturer concerned prior to selecting and using the consumable or auxiliary material. All

instructions in the operation manual must be observed while the machine is in operation. We accept no liability whatsoever for consumables or auxiliary materials (e.g. oils, greases, filter inserts, coolants etc.) or for the damage caused thereby (e.g. bright spots on guide rails) or the consequential loss thereof.



Cooling lubricants can damage your health and the environment.

Observe the applicable safety regulations. In Germany, the Trade Association regulations for Occupational Health & Safety apply BGR 143.

i

Deposit formation on machine components

Boronic water-mixed cooling lubricant may form deposits on machine components. Hard mixing water may also cause deposits.

Deposits may lead to severely increased wearing of machine components, particularly when hard particles reach the cooling lubricant during machining, for example silicon particles resulting from aluminium alloy. If the particle size is below the cooling lubricant unit's degree of filtration, the residual contamination level in the cooling lubricant may increase continuously and form abrasive sludge easily sticking to deposits.

Observe the following instructions if you find deposits:

- Consult your cooling lubricant supplier. Choosing a boron-reduced or boron-free cooling lubricant may solve the problem.
- Remove deposits before continuing to operate the machine.
- If the residual contamination level in the recycled cooling lubricant causes problems, contact our sales department for improved or different filtration.

HELLER shall not be responsible for machine damage resulting from deposits or from residual contamination level in the cooling lubricant beneath the nominal degree of filtration of the cooling lubricant unit.

4.6.1 Check condition of the cooling lubricant

Interval 8 Hours Operating time



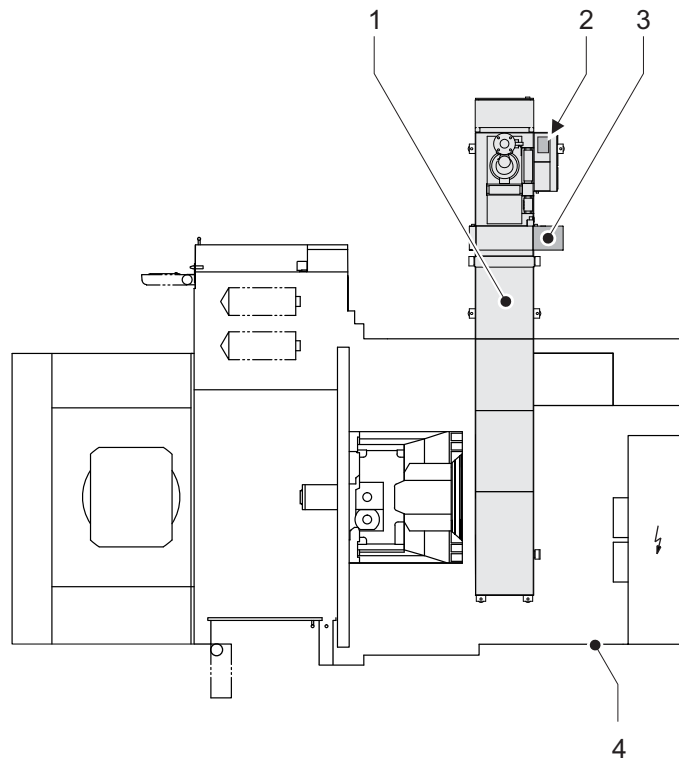
In Germany, cooling lubricants and their handling are governed by the Health & Safety Regulations on hazardous substances TRGS 611 and the Trade Association Regulations for Occupational Health & Safety BGR 143. These regulations specify various regular tests. BGR 143 also contains information on conducting these tests.

In other countries, compliance with the locally applicable instructions is required.

Component Cooling lubricant system

Procedure Carry out checks on the cooling lubricant in accordance with the instructions issued by the relevant supplier or manufacture and the valid regulations.

4.7 Chip disposal

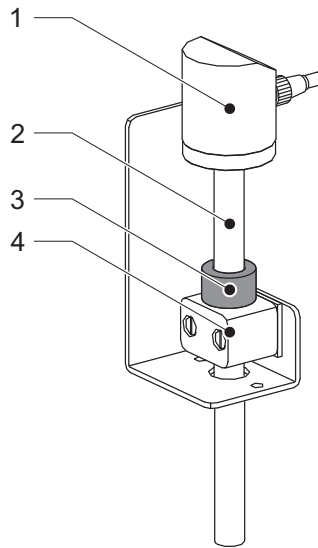


4.7 - 1 Schematic representation of the machine

- 1 Chip conveyor
- 2 Level sensor
- 3 Conveyor drive
- 4 Maintenance area safety door

4.7.1 Cleaning and checking fill level sensor

Interval 1500 Hours Operating time
Component Fill level sensor, mounted to the chip conveyor



4.7.1 - 1 Installation position of level sensor

- 1 Level sensor
- 2 Sensor rod
- 3 Marking clamp
- 4 Pipe clamp

Further documents



For manufacturer's documentation on the fill level sensor, see subsupplier's information (ZI) from "Knoll", documents from IFM.

Procedure

Cleaning



The fill level sensor is removed from the container for maintenance and cleaning work. During reinstallation, the fill level sensor must be mounted at the exact same position and installation height as before. Prior to removal, fix the set installation height with the enclosed marking clamp.



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.
Exercise extreme caution when working in the maintenance area with unsecured machining unit! Avoid working below the machining unit!

- The machining unit is positioned so that you can work safely on the chip conveyor:
 - X-axis (Frame) to the tool changer.
 - Y-axis (Machining unit) down.
- Machine switched off at main switch and secured against being switched on again.
- Disconnect the fill level sensor from the power supply.
- Fix the marking clamp to the sensor rod of the fill level sensor using the pipe clamp.
- Installation position is marked.
- Loosen the screws on the pipe clamp of the fill level sensor. Take the fill level sensor from the housing.
- Clean the sensor rod of the fill level sensor.

Check overflow safety mechanism

- Test the overflow safety mechanism in accordance with the installation instructions from "Knoll", documents from IFM.

Prepare machine for operation

- Insert fill level sensor into the housing until the marking clamp is in contact with the pipe clamp.
- Tighten the screws on the pipe clamp.
- Connect the fill level sensor to the power supply.

4.7.2 Checking the scraper belt

Interval 1500 Hours Operating time

Component Chip conveyor scraper belt

Inspection



Two people are required for this work: An assistant deactivates and activates the chip conveyor on the machine control box, whilst you inspect the chip conveyor.

Further documents



For manufacturer's documentation on the chip conveyor and on the cooling lubricant unit, see Subsuppliers' Information (ZI) from "Knoll".

Procedure

Preparation

- Work area safety door closed and locked.
- Machine switched off at main switch and secured against being switched on again.
- Chip conveyor switched to 0.
- Remove the cover at the discharge of the chip conveyor.
- Affix a cable binder to a tapping rail to identify start of checking.
- Switch the machine on. Switch on motors.

Check



WARNING

Danger to hands and arms if scraper conveyor is approaching!
Do not reach into chip conveyor!

- Check visible section of scraper conveyor:
 - Check tapping rails and chains for damage.
- Move scraper conveyor forwards step by step and check each section, until the initial test mark appears.
- Switch chip conveyor to 0.
- Replace worn or damaged components.



For procedure, see:
"Replacing the scraper conveyor or scraper conveyor components"
page 159

Close

- Switch off machine at main switch and secure against being switched on again.
- Remove the initial test mark.
- Attach the cover to the discharge of the chip conveyor.
- Switch chip conveyor to "forwards".

Replacing the scraper conveyor or scraper conveyor components

Spare part



For spare parts, see Subsupplier's Information (ZI) from "Knoll"

Procedure

- Machine switched off at main switch and secured against being switched on again.
- If you have to change the scraper conveyor, check also the lateral guide rails and the scraper conveyor drive for wearing.

- Replace worn or damaged parts according to the manufacturer's instructions.
- Switch chip conveyor to "forwards".

4 Inspection and maintenance

4.7 Chip disposal

4.7.3 Tensioning scraper conveyor

Interval 1 Year(s) Real time

Component Chip conveyor scraper belt

Further documents



For manufacturer's documentation on the chip conveyor, see Subsuppliers' Information (ZI) from "Knoll".

- Procedure**
- Machine switched off at main switch and secured against being switched on again.
 - Tension scraper conveyor according to manufacturer's instructions.

4 Inspection and maintenance

4.7 Chip disposal

4.7.4 Clean and check chip conveyor

Interval 1 Year(s) Real time



Reduce this interval depending on the contamination of the machine.

Component

Chip conveyor

Aids

Exhauster unit to exhaust cooling lubricant and sludge

Further documents



For manufacturer's documentation on the chip conveyor, see Subsuppliers' Information (ZI) from "Knoll".

Procedure



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.

- Machining unit traversed into support position.
- Maintenance area safety door opened and secured to prevent closing.
- Machine switched off at main switch and secured against being switched on again.
- Machining unit protected from falling by supports.
- Check chip conveyor, fitted accessories and pipes for leakages and visible external damage.
- Repair leakages and damage immediately. Do not operate machine with damaged equipment!
- Remove covers from the chip conveyor.
- Exhaust cooling lubricant from the chip conveyor. Remove chips.
- Clean inside the chip conveyor and check for damage and corrosion. Replace damaged components.
- Refit covers onto the chip conveyor.

4 Inspection and maintenance

4.7 Chip disposal

- Remove support from the machining unit.
- Before closing the maintenance safety door, ensure that nobody is behind the guard panels. Close and lock maintenance area safety door.

4.7.5 Oil change on the belt drive gear unit

Interval 3 Year(s) Real time

Component Gear motor for driving the conveyor belt

Consumable Synthetic lube oil CLP PG 220 according to DIN 51502
Purity class ISO 4406-18/16/13
Container capacity 0.42 l



Disimilar lubricants can contain various additives that might not be compatible. To rule out incompatibility between the lubricants, disimilar lubricants must not be mixed.

If you have any questions, please contact your lubricant supplier.



Used oil must be regarded as hazardous waste and be disposed of according to the locally applicable regulations.

Aids Container for collecting the used lubrication oil

Further documents



For manufacturer's documentation on the gear motor, see Subsuppliers' Information (ZI) from "Knoll", documentation from Danfoss Bauer.

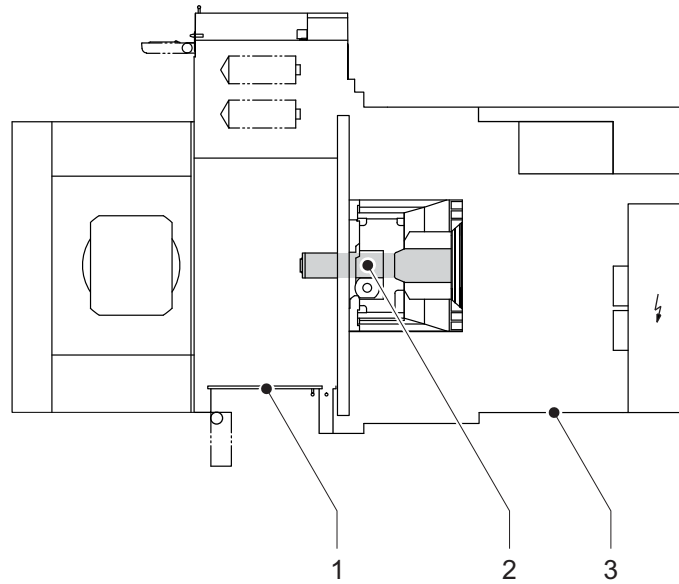
- Procedure**
- The gear motor is warm to the touch.
 - Machine switched off at main switch and secured against being switched on again.
 - Have cable disconnected by a qualified electrician.
 - Unscrew guards.
 - Mark the position of the gear motor in the slots.
Unscrew gear motor.
 - Pull off gear motor from the mounting and set down.
 - Drain-off oil:
 - Keep ready a collector bin.
 - Disconnect three-phase motor from gear unit.
 - Collect draining oil.

4 Inspection and maintenance

4.7 Chip disposal

- Flush gear unit with fresh oil and refill.
- Assemble gear motor.
- Insert the gear motor and fasten loosely:
 - The gear wheels of the gear unit and the friction clutch must engage correctly.
 - Screw on plate. Insert hexagon screws initially to the stop.
- Adjust and fasten gear motor:
 - The gear wheels must line up. Use your markings as guidance.
 - The toothed wheels should have slight flank play. Raise the gear motor maximum 1 mm from its play-free position.
 - Fasten gear motor in the correct position using the hexagon screws.
- Screw on guards.
- Have cable connected by a qualified electrician.

4.8 Machining unit

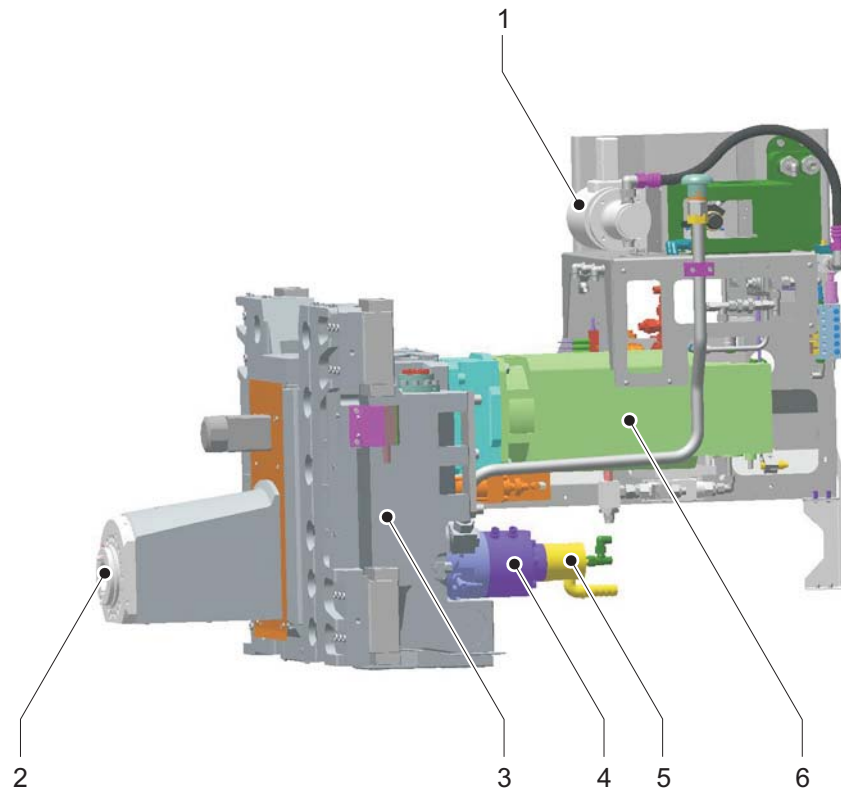


4.8 - 1 Schematic representation of the machine

- 1 Work area safety door
- 2 Machining unit
- 3 Maintenance area safety door

4 Inspection and maintenance

4.8 Machining unit



4.8 - 2

Machining unit components

- 1 Gear ring pump unit for gearbox lubrication
- 2 Spindle taper
- 3 Guide slide
- 4 Unclamp device
- 5 Rotary distributor
- 6 Main spindle motor

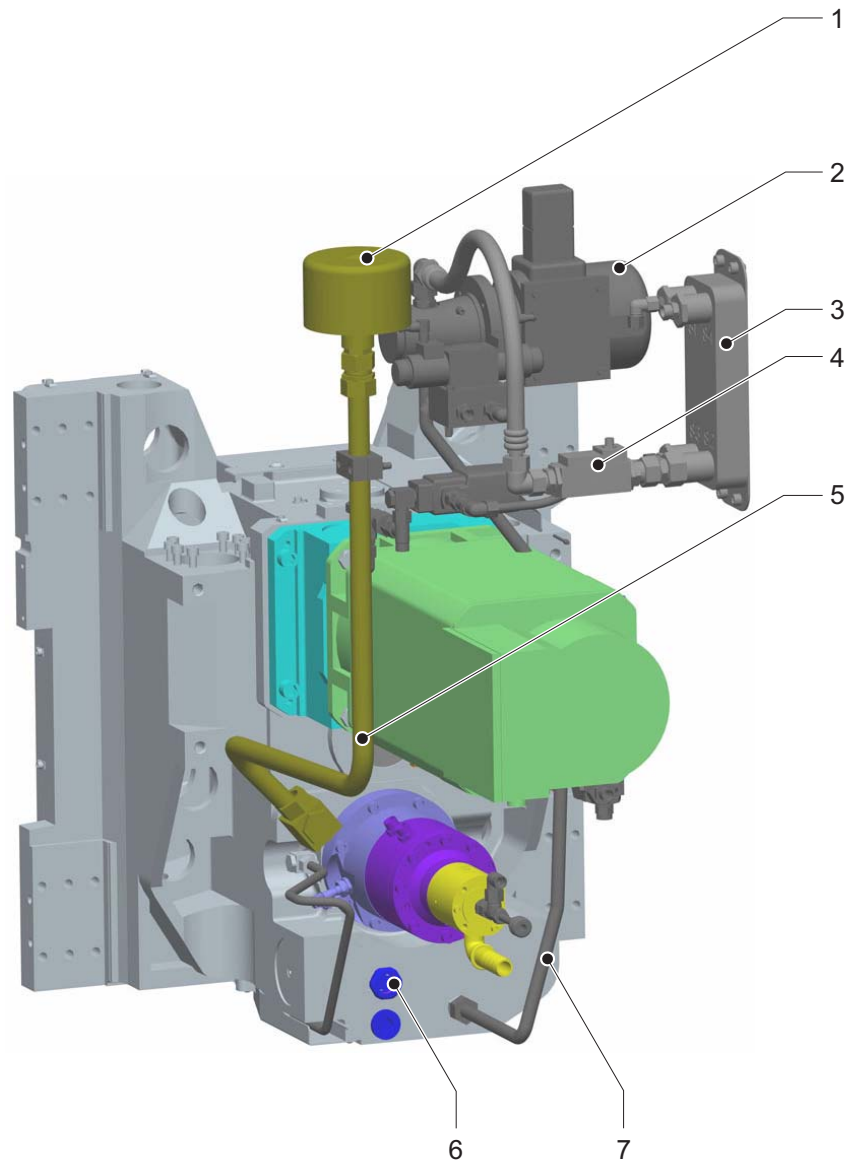
4.8.1 Check oil level in the gear lubrication

Interval 500 Hours Operating time

Component Guide slides of the machining unit

4 Inspection and maintenance

4.8 Machining unit



4.8.1 - 1 Machining unit, rear side

- 1 Ventilation filter
- 2 Gear ring pump unit for gearbox lubrication
- 3 Plate heat exchanger
- 4 Flow monitor
- 5 Oil filler tube
- 6 Oil sight glass
- 7 Hose line

Inspection

Procedure



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.

If you enter the machine without securing the machining unit, do not linger around the danger zone!

- Machining unit traversed into support position.
- Maintenance area safety door opened and secured to prevent closing.
- Machine switched off at main switch and secured against being switched on again.
- Check oil level through oil sight glass. The oil level must reach the centre of the sight glass.
- If the oil level is too low, support machining unit, check for leaks and top up oil.



For procedure, see:
"Check for leaks and top up oil" **page 172**

- Before closing the maintenance safety door, ensure that nobody is behind the guard panels. Close maintenance area safety door.

Check for leaks and top up oil

Consumable

Lubrication oil CLP 46 acc. to DIN 51517, part 3 (ISO-L-CKC 46 acc. to ISO 6743, part 6)
Purity class ISO 4406-18/16/13



Disimilar lubricants can contain various additives that might not be compatible. To rule out incompatibility between the lubricants, disimilar lubricants must not be mixed.
If you have any questions, please contact your lubricant supplier.

Aids

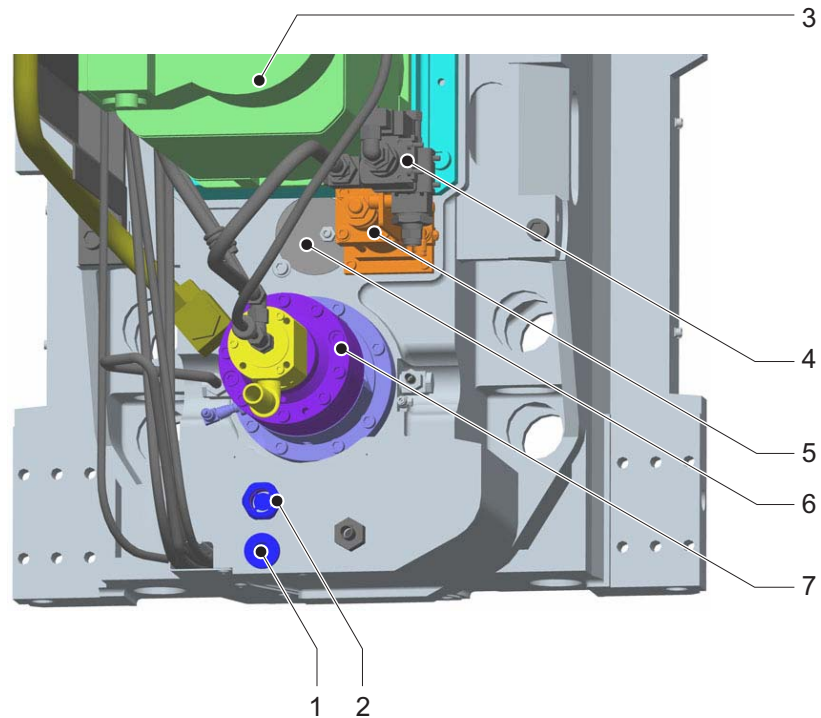
Can with narrow neck or funnel
Fine filter

4 Inspection and maintenance**4.8** Machining unit

Ladder

Procedure**Checking for leaks**

- Machining unit protected from falling by supports.



4.8.1 - 2 Components on the rear side of the machining unit

- 1 Oil drain screw
- 2 Oil sight glass
- 3 Main spindle motor
- 4 Valve for extracting the cooling lubricant
- 5 Gear switch cylinder
- 6 Cover
- 7 Unclamp device

- Check machining unit for escaping oil. Possible leakages:
- Oil filler tube, oil inspection glass and oil drain screw
 - Cover.
 - Bore on the underside of the unclamp device
 - Flange between main spindle motor and guide slide.
 - Gear switch cylinder.
 - Valve for extracting the cooling lubricant fed through the spindle.
 - External components and lines for gearbox lubrication (see Fig. 1). The lubricating oil flows through the hose line to the gear ring pump unit mounted to the console and from there via the flow monitor and the plate-type heat exchanger to the top of the guide slide.

Oil continually escapes from the drain holes of the spindle bearings. This oil is from the oil/air lubrication of the spindle bearings and does not indicate that the gear lubrication system is leaking.

- ☒ You can replace defective hose lines or mounting parts yourself. Leakages in the guide blocks (cover, unclamp device, gear change mechanism, motor flange) indicate defective sealing rings or bushes inside the machining unit. Have this damage repaired by customer services.
Do not operate machine with damaged machining unit!

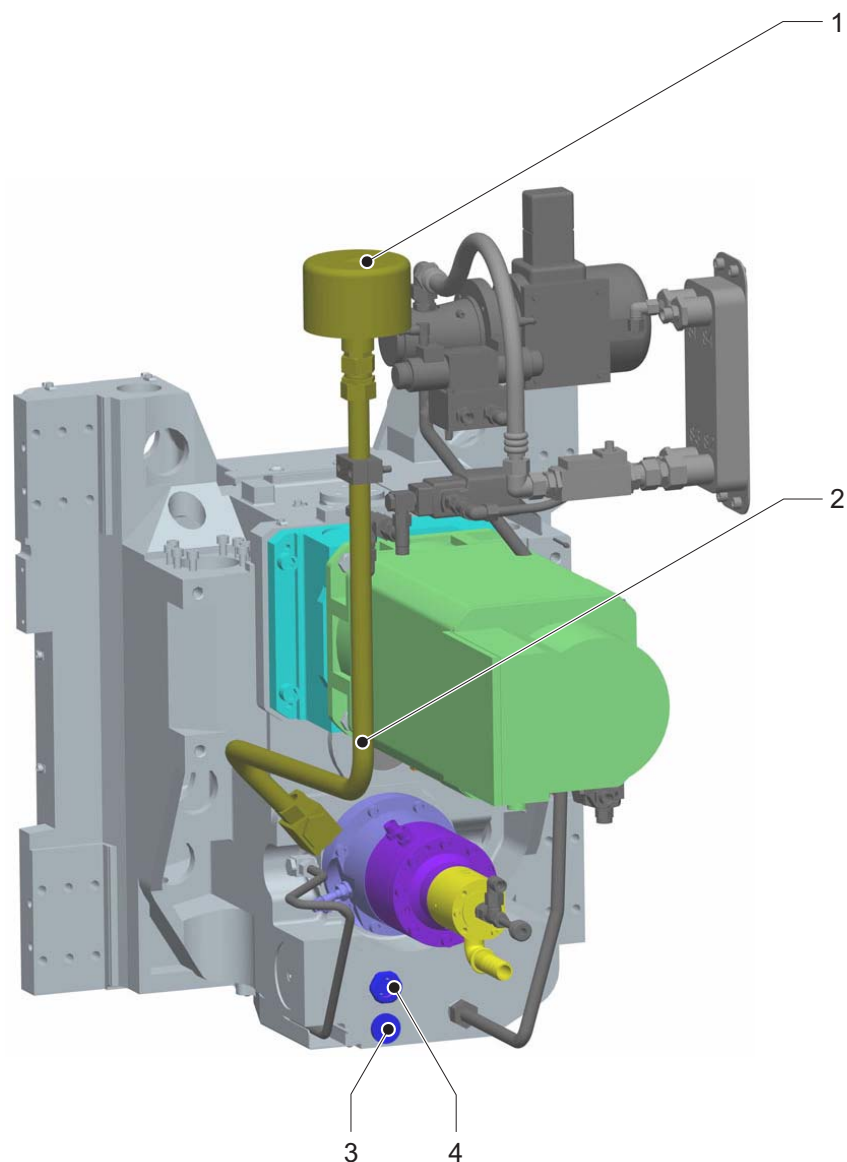
Top up oil

- ☒ Remove the ventilation filter.
- ☒ Fill with oil through oil filler tube up to the centre of the inspection glass.
- ☒ Mount ventilation filter.
- ☒ Remove support from the machining unit.
- ☒ Before closing the maintenance safety door, ensure that nobody is behind the guard panels. Close maintenance area safety door.

4.8.2 Oil change in the guide slides

Interval 1 Year(s) Real time

Component Guide slides of the machining unit



4.8.2 - 1 Machining unit, rear side

- 1 Ventilation filter
- 2 Oil filler tube
- 3 Oil drain screw
- 4 Oil sight glass

4 Inspection and maintenance

4.8 Machining unit

Consumable

Lubrication oil CLP 46 acc. to DIN 51517, part 3 (ISO-L-CKC 46 acc. to ISO 6743, part 6)
Purity class ISO 4406-18/16/13
Container capacity 5 l



Disimilar lubricants can contain various additives that might not be compatible. To rule out incompatibility between the lubricants, disimilar lubricants must not be mixed.

If you have any questions, please contact your lubricant supplier.



Used oil must be regarded as hazardous waste and be disposed of according to the locally applicable regulations.

Spare part

Oil filter screw with seal: screw plug

Aids

Container with 10 litre capacity

Can with narrow neck or funnel

Fine filter

Ladder

Procedure



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.

- The machining unit is warm to the touch.
- Machining unit traversed into support position.
- Maintenance area safety door opened and secured to prevent closing.
- Machine switched off at main switch and secured against being switched on again.
- Machining unit protected from falling by supports.
- Remove the ventilation filter.
- Position a suitable container under the oil drain screw.
- Remove oil drain screw. Allow oil to drain into the container.
- Insert oil drain screw with sealing ring and tighten.

- Fill with oil through oil filler tube until the level reaches the centre of the sight glass.
- Mount ventilation filter.
- Remove support from the machining unit.
- Before closing the maintenance safety door, ensure that nobody is behind the guard panels. Close maintenance area safety door.

4 Inspection and maintenance

4.8 Machining unit

4.8.3 Checking tool holder blow-off procedure

Interval 50 Hours Operating time

Component Tool spindle



The tool holding fixture is cleaned in two stages during the tool change operation:

- The internal cooling lubricant is extracted before the change operation.
- During the tool change, the spindle taper is blown off.

A malfunctioning extraction device is indicated by an increased volume of cooling lubricant being drawn into the tool magazine. Problems with clamping the tool into the tool spindle or reduced machining accuracy indicate inadequate blow-off.

Procedure

- The machining program runs in automatic mode.
- Check whether the tool holding fixture is effectively blown off during a tool change cycle.
 - Can the air flow be heard?
 - Do the contact surfaces of the tool and the tool spindle appear to have been blown free of adhesive cooling lubricant?
- In the absence of an air-flow, check air supply to the tool spindle.



For procedure, see:
"Inspection of fluid equipment" **page 272**

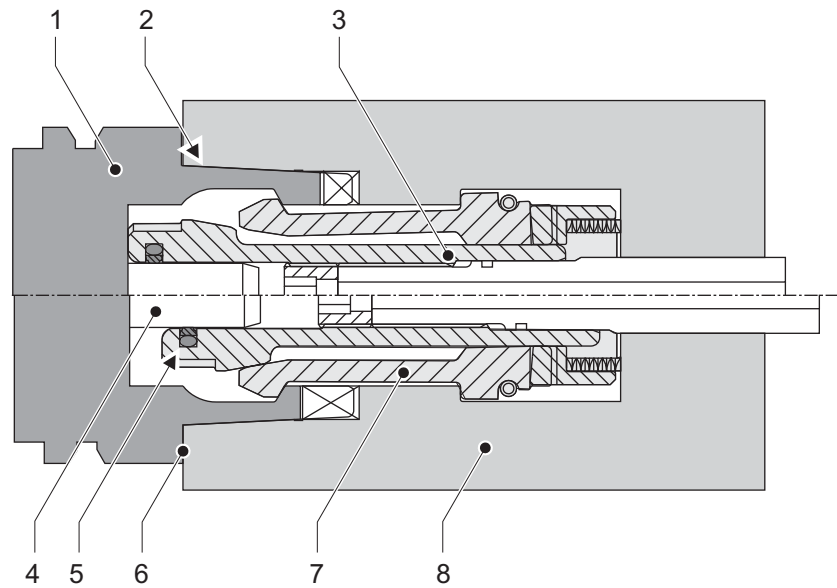
4 Inspection and maintenance

4.8 Machining unit

4.8.4 Cleaning and checking tool holding fixture

Interval 500 Hours Operating time

Component Tool spindle



4.8.4 - 1 HSK tool holding fixture
Hatched: Collet

- 1 Tool
- 2 Spindle internal contour
- 3 Draw bolt
- 4 Cooling lubricant pipe
- 5 Bar seal
- 6 Flat location
- 7 Clamping segment
- 8 Tool spindle

Inspection

Aids
Depth gauge
Torque wrench for 50 Nm
Soft brush

Procedure

Preparation

- There should be no tool in the tool spindle.
- The machining unit is positioned such that you can work on the tool spindle without entering the work area.
 - Z-axis moved away from the machining unit.
 - X-axis (Frame) moved towards the work area safety door.
 - Y axis (Machining unit) at shoulder height.
- Motors are switched on.
- Open collet with individual function.
- Open work area safety door.

Cleaning and checking tool holding fixture

- Clean the planar support with a cloth and check for wear and damage, such as scoring and scratches.

**CAUTION**

Crushing hazard on open collet.
If the power supply fails, the collet closes automatically.
Use a suitable brush to clean the inside contour of the spindle.
Do not reach into the open collet.

- Clean the inside contour of the spindle with a soft brush and check for wear and damage, such as scoring and scratches.
- If the tool holding fixture is damaged, have the tool spindle replaced by customer services.
Do not operate machine with damaged tool holding fixture!

Checking collet

- Check collet for wear and damage.

- Replace worn or damaged collet.



For procedure, see:
"Replacing the collet " **page 184**

Checking adjustment setting

- Check the adjustment setting of the collet against manufacturer's data and correct if necessary.



For manufacturer's documentation on the collet, see Subsuppliers' Information (ZI) from "Berg".

Checking bar seal

- Check condition of the clamping seal.
- Replace damaged bar seal so that no high-pressure cooling lubricant can penetrate the tool clamping system and flood the tool spindle.



For procedure, see:
"Replace bar seal" **page 186**

Close

- Before closing the safety doors, ensure that nobody is behind the guard panels.
Close and lock the work area safety door.
- Close collet with individual functions.
- Place a tool in the tool spindle to protect the tool spindle from the ingress of dirt.
- Switch off motors.

Replacing the collet

Spare part

Collet



See wearing and spare parts list (VS).

Aids

Assembly aid number 786.15090.007.0 by Messrs. Berg (supplied with the collet)

4 Inspection and maintenance

4.8 Machining unit

Depth gauge
Torque wrench for 50 Nm

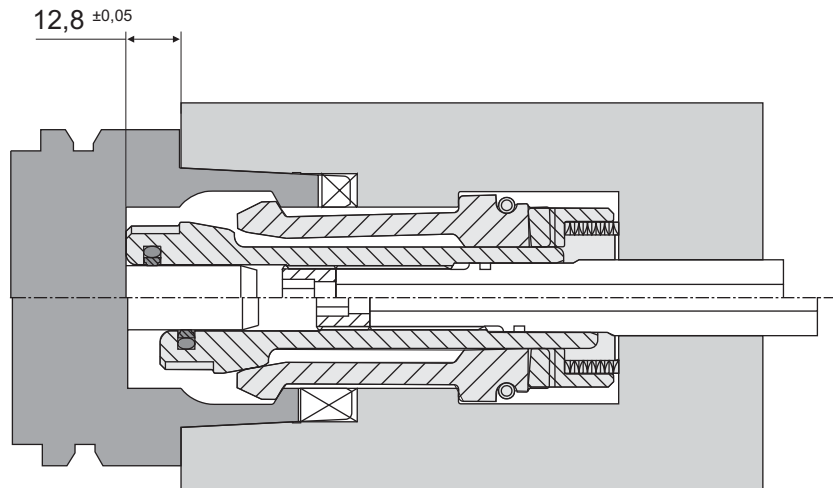
Further documents



For manufacturer's documentation on the collet, see Subsuppliers' Information (ZI) from "Berg".

Procedure

- Collet opened.
- Work area safety door opened
- Loading hatch closed.



4.8.4 - 2 Adjustment setting

- Replace collet according to the installation instructions of Messrs. Berg and set to adjustment setting.
- Close and lock the work area safety door.
- Close collet with individual functions.
- Place a tool in the tool spindle to protect the tool spindle from the ingress of dirt.
- Switch off motors.

Replace bar seal

Spare part

Bar seal



See wearing and spare parts list (VS).

Aids

A tool with mounted cooling lubricant pipe
Slot-type screwdriver, width 5.5 mm

Procedure



A new bar seal must be calibrated. To do this, you must insert a tool into the collet.

The collet features a latch which holds the tool even in the "unclamped" position. The collet engages easily, but it has a high retaining force, so you need a screwdriver as leverage to remove the tool.

- Remove bar seal from the ring groove carefully using a scribing tool.
- Oil new bar seal and inset inside the ring groove.



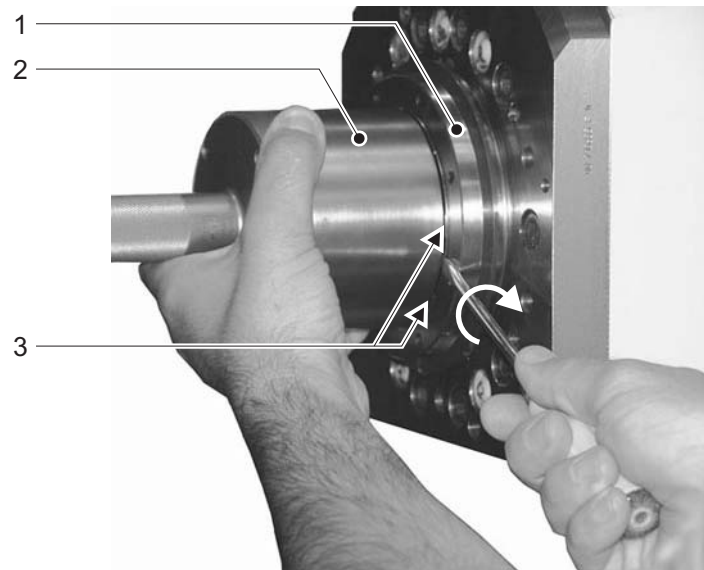
WARNING

Danger of becoming trapped when the tool engages in the collet.
Hold the tool in such way that your hand cannot be trapped between tool and tool spindle.

- Calibrate bar seal:
 - Insert a tool with mounted cooling lubricant pipe into the collet and let engage. Exercise caution when inserting the cooling lubricant pipe into the new bar seal.
 - Allow tool to rest for 3 minutes.

4 Inspection and maintenance

4.8 Machining unit



4.8.4 - 3 Pressing the tool off from the collet

- 1 Tool spindle
- 2 Tool
- 3 Location segments of the tool spindle

- Remove the tool:
 - Hold tool in place.
 - Place screwdriver between two location segments.
 - Press off tool with a rotational movement.
- Before closing the safety doors, ensure that nobody is behind the guard panels.
Close and lock the work area safety door.
- Close collet with individual functions.
- Place a tool in the tool spindle to protect the tool spindle from the ingress of dirt.
- Switch off motors.

4.8.5 Check tool pull-in force.

Interval 1000 Hours Operating time

Component Tool spindle

Inspection

Aids Measuring device, for example model "Power-Check" by Ott-Jakob
Slot-type screwdriver, width 5.5 mm

Procedure

Preparation

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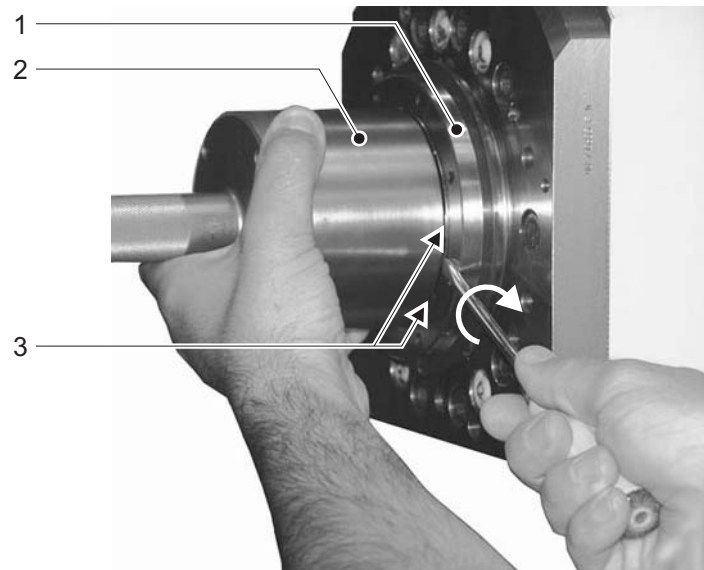
The collet features a latch which holds the measuring device even in the "unclamped" position. For safety reasons, it is nonetheless advisable to hold the measuring device in place during opening the collet.

The collet engages easily, but it has a high retaining force, so you need a screwdriver as leverage to remove the measuring device.

- A tool is placed in the tool spindle.
- The machining unit is positioned such that you can work on the tool spindle and read-off the measuring device display without entering the work area.
 - Z-axis moved away from the machining unit.
 - X-axis (Frame) moved towards the work area safety door.
 - Y axis (Machining unit) at shoulder height.
- Motors are switched on.
- Open work area safety door.
- Take hold of the tool inserted into the tool spindle. Unclamp tool. You can use individual functions to open and close the collet.

4 Inspection and maintenance

4.8 Machining unit



4.8.5 - 1 Pressing the tool off from the collet

- 1 Tool spindle
- 2 Tool
- 3 Location segments of the tool spindle

- Remove the tool:
 - Hold tool in place.
 - Place screwdriver between two location segments.
 - Press off tool with a rotational movement.

Measuring tool pull-in force



WARNING

Danger of becoming trapped when the measuring device engages in the collet.

Hold the measuring device in such way that your hand cannot be trapped between measuring device and tool spindle.

- Insert measuring device into collet and let engage.
- Close collet.
- Read tool pull-in force off the measuring device display. The minimum value is 30000 N.

- Take several measurements. Hold the measuring in place during opening the collet.
- Hold measuring device in place. Open collet.
- Remove measuring device.
- If the tool pull-in force has not reached the minimum value, remove the collet and clean or replace.



For procedure, see:
"Repairing the collet" **page 190**

Close

- Insert and clamp the removed tool into the tool spindle.
- Close and lock the work area safety door.
- Switch off motors.

Repairing the collet

Spare part

Collet



See wearing and spare parts list (VS).

Aids

Assembly aid number 786.15090.007.0 by Messrs. Berg (supplied with the collet)

Depth gauge

Torque wrench for 50 Nm

Further documents

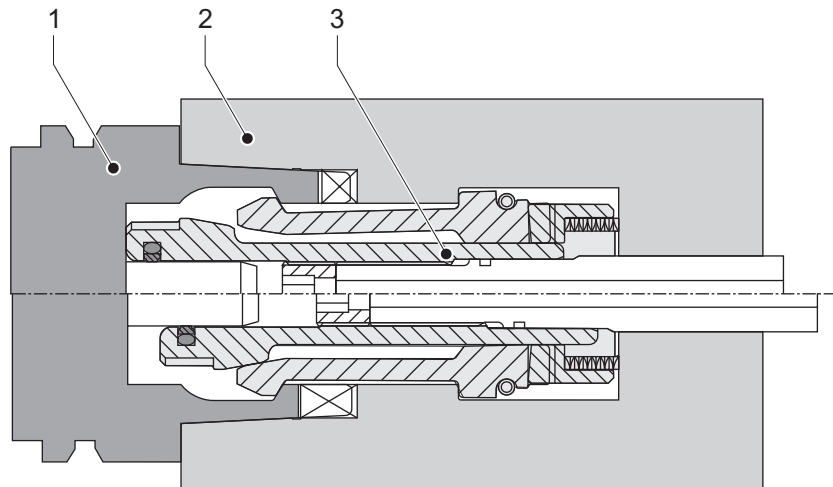


For manufacturer's documentation on the collet, see Subsuppliers' Information (ZI) from "Berg".

Procedure

- Measuring device removed. Collet opened.
- Work area safety door opened.
- Loading hatch closed.

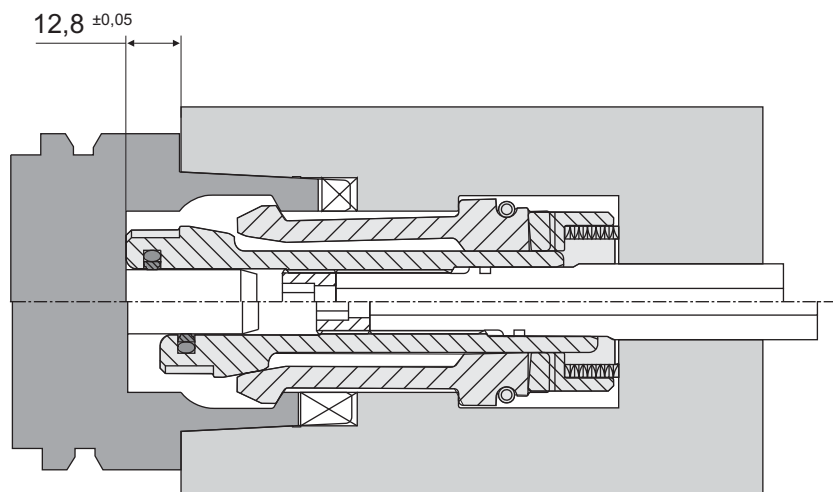
4 Inspection and maintenance
4.8 Machining unit



4.8.5 - 2 HSK tool holding fixture
Hatched grey: Collet

- 1 Tool
- 2 Tool spindle
- 3 Draw bolt

- Unscrew collet using the face pair (width across flats 36) of draw bolt.
- Clean collet . Check condition of the collet. Replace worn collet.
- Prepare collet for installation:
 - Oil degreased components.



4.8.5 - 3 Adjustment setting

- Install collet according to the installation instructions of Messrs. Berg and set to adjustment setting.

- Re-measure tool pull-in force after the collet has been cleaned.

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If the tool pull-in force has not reach the minimum value despite the collet having been cleaned, the collet may be defective even if there is no visible external wear.

- Replace collet.
-

- Re-measure tool pull-in force after the collet has been replaced.

?

If the tool pull-in force has not reached the minimum value despite the collet having been replaced, the tool clamping system is probably defective.

- Call customer service. Do not operate machine with damaged tool clamping system!
-

- Insert and clamp the removed tool into the tool spindle.

- Close and lock the work area safety door.

- Switch off motors.

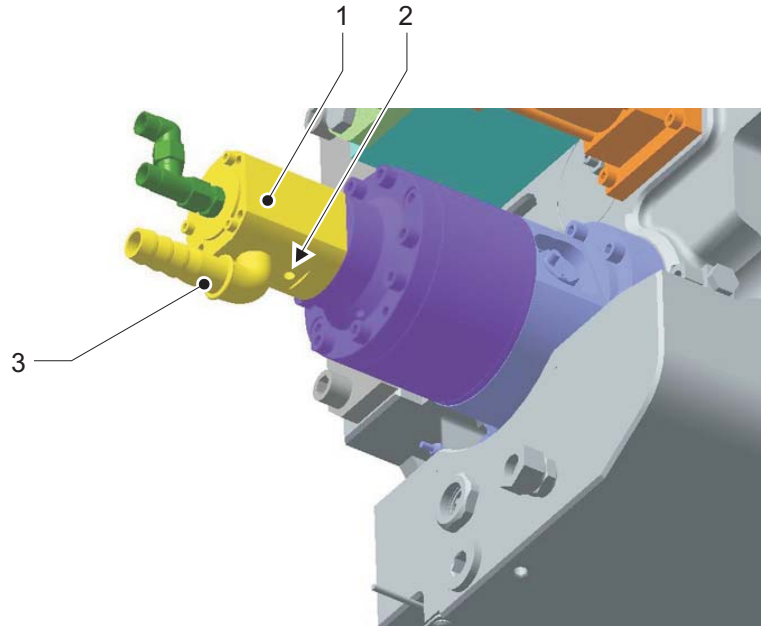
4 Inspection and maintenance

4.8 Machining unit

4.8.6 Checking leakage discharge of the rotary distributor

Interval 500 Hours Operating time

Component Rotary distributor



4.8.6 - 1 Leakage discharge of the rotary distributor

- 1 Rotary distributor
- 2 Bore
- 3 Connection for hose



When the coolant supply is switched on, cooling lubricant continually flows through the connected hose. Only single drips should escape from the bore.

Procedure



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.

- Machining unit traversed into support position.
- Maintenance area safety door opened and secured to prevent closing.

4 Inspection and maintenance

4.8 Machining unit

- Machine switched off at main switch and secured against being switched on again.
- Machining unit protected from falling by supports.
- Check leakage on the rotary distributor. Only single drips should escape from the bore.

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Increased leakage occurs on the bore of the rotary distributor.

- This indicates missing seal air. Check air supply to the rotary feed.

For procedure, see:

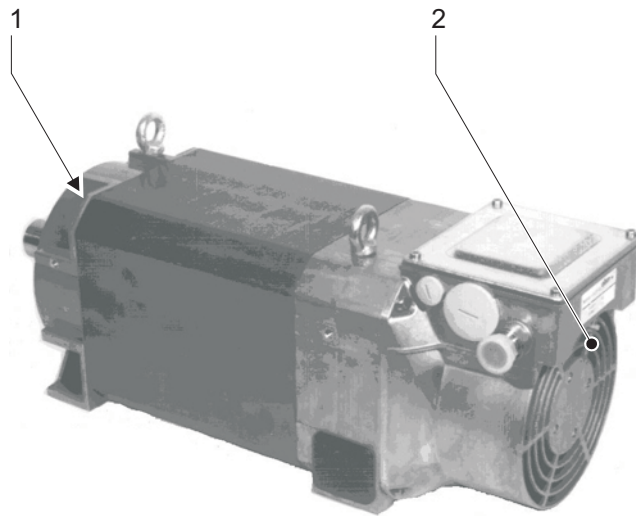
"Inspection of fluid equipment" **page 272**

- In case of continuously increased leakage on the bore of the rotary distributor, seals inside the rotary distributor are defective. Have the rotary distributor replaced by the customer service.
Do not operate the machine with a defective rotary distributor.
- Remove support from the machining unit.
- Before closing the maintenance safety door, ensure that nobody is behind the guard panels. Close maintenance area safety door.

4.8.7 Check cooling air paths of the main spindle motor for contamination

Interval 1000 Hours Operating time

Component Main spindle motor



4.8.7 - 1 Main spindle motor

- 1 Cooling air inlet
- 2 Lattice, fan behind

Inspection

Procedure



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.

If you enter the machine without securing the machining unit, do not linger around the danger zone!

- Machining unit traversed into support position.
- Maintenance area safety door opened and secured to prevent closing.

4 Inspection and maintenance

4.8 Machining unit

- Machine switched off at main switch and secured against being switched on again.
- Check from outside whether the lattice of the fan is contaminated.
- If the lattice is visibly contaminated, support the machining unit and clean the cooling air paths of the main spindle motor.



For procedure, see:
"Clean cooling air paths of the main spindle motor" **page 197**

- Before closing the maintenance safety door, ensure that nobody is behind the guard panels. Close maintenance area safety door.

Clean cooling air paths of the main spindle motor

Aids

Detergents

Use a water-soluble cleaning concentrate with a fat-dissolving action. Organic cleaning agents may corrode cables and must not be used.

Further documents

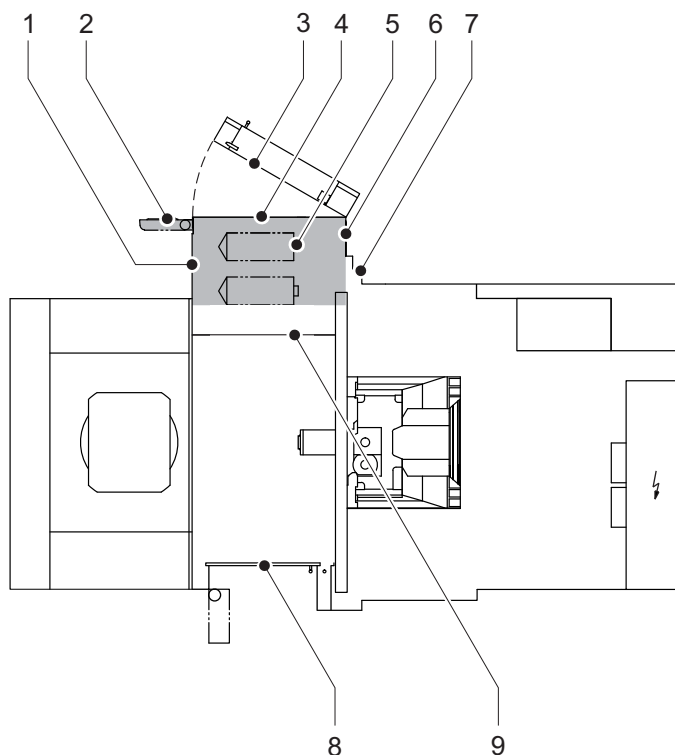


For manufacturer's documentation on the main spindle motor, see Subsuppliers' Information (ZI) from "Siemens".

Procedure

- Machining unit protected from falling by supports.
- Unscrew lattice from the fan.
- Have a cloth ready when blowing out the cooling pipes to catch the dirt and prevent it being blown into the machine.
Blow out the cooling pipes of the main spindle motor in both directions - from cooling air inlet and from the fan.
- Clean fan and lattice with a damp but not dripping cloth. Remove incrustations with a brush.
Ensure that you do not bend the fan vanes.
Rub the fan dry after cleaning.
- Screw on the lattice.
- Remove support from the machining unit.
- Before closing the maintenance safety door, ensure that nobody is behind the guard panels. Close maintenance area safety door.

4.9 Tool magazine

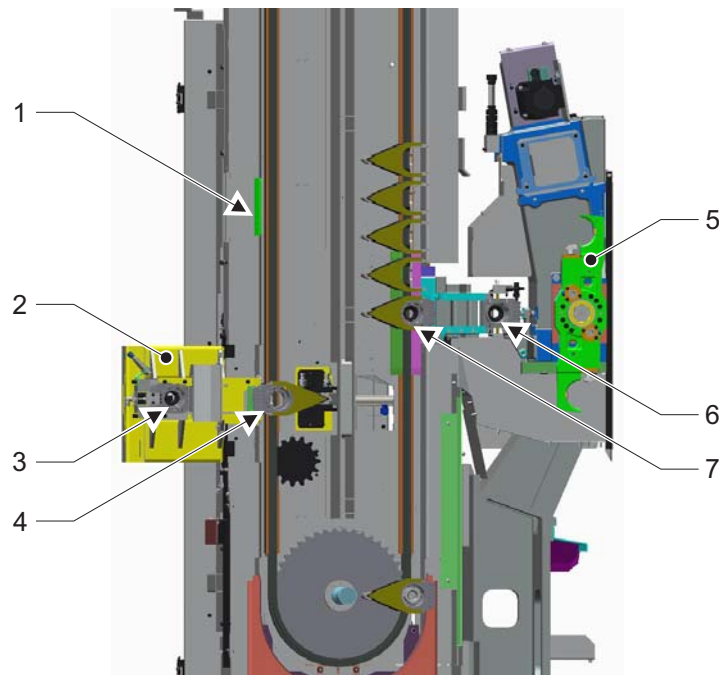


4.9 - 1 Schematic representation of the machine
Access to the tool magazine

- 1 Maintenance opening D
- 2 Control unit, tool setting station
- 3 Maintenance door with tool setting station safety door
- 4 Intermediate door
- 5 Position of the tools in the magazine places
- 6 Maintenance sheet for tool setting station
- 7 Maintenance opening B
- 8 Work area safety door
- 9 Tool change door

4 Inspection and maintenance

4.9 Tool magazine



4.9 - 2 Schematic representation of the tool magazine (similar illustration)

- 1 Cartridge removal place
- 2 "Tool loading station" assembly
- 3 Tool loading position (= location where the operator inserts the tool into or removes it from the tool cartridge)
- 4 Conveying station towards tool setting station
- 5 Check tool change arm of the tool changer
- 6 Provisioning place on tool changer (for loading the tool into the tool spindle)
- 7 Conveying station towards tool changer

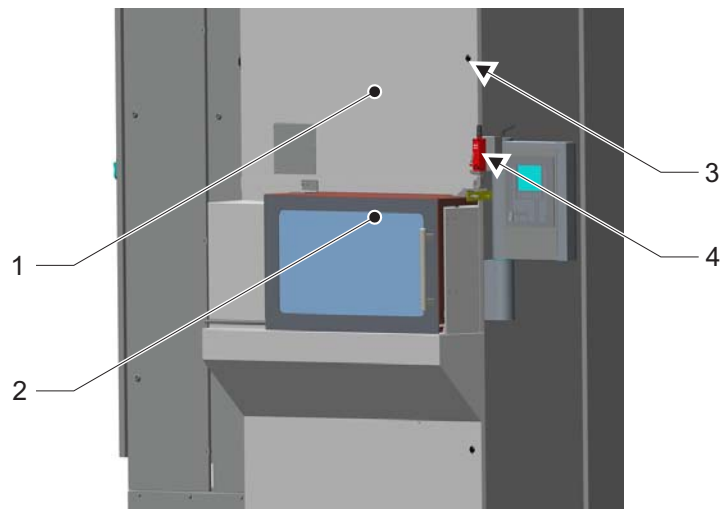
Opening the chain magazine maintenance door



After the workpiece setting station safety door is unlocked and opened, the machine main switch must be turned off and secured to prevent restart. It must be impossible to switch on the machine while persons are in the hazard area.

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As long as the safety switch of the tool setting station safety door is not locked, the motors cannot be switched on.



4.9 - 3 Opening the maintenance door

- 1 Chain magazine maintenance door
- 2 Tool setting station safety door
- 3 Casement fastener (2 components)
- 4 Safety switch

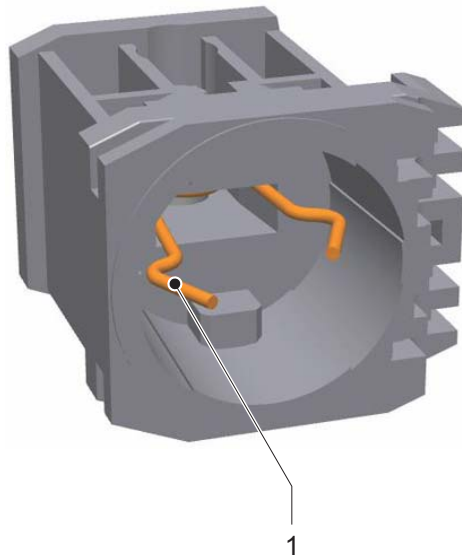
Opening the maintenance door:

1. Unlock tool loading station safety door.
2. Push the tool setting station safety door approx. 100 mm to the left.
3. Switch off machine at main switch and secure against being switched on again.
4. Unlock casement fastener of the maintenance door. Swivel out maintenance door.

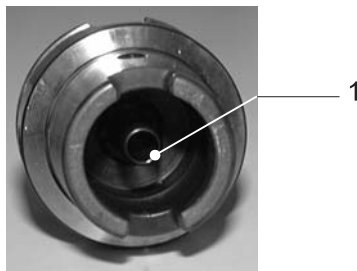
4.9.1 Cleaning and checking tool holders, tool cartridges and tools

Interval 1000 Hours Operating time

Component All tool holders, tool cartridges and tools



4.9.1 - 1 Tool cartridge for HSK tool
1 Retaining spring



4.9.1 - 2 HSK tool
1 Cooling lubricant pipe

Inspection

- Procedure**
- Motors are switched on.
 - Run tool cartridge from the conveying station to the tool loading position.

- Tool loading station safety door unlocked and open.
- Remove tool from the tool cartridge.
- Clean tool and check for wearing:
 - Clean hollow shaft and flat location, remove swarf. Check hollow shaft and flat location for grooves, scratches and rust spots.
 - Check that the cooling lubricant pipe is securely mounted. Tighten cap nut.
 - With coded tools: Check codechip is faultless.
 - Replace worn components.
- Clean tool cartridge and check for wearing.
- Remove tool cartridge if damaged.



For procedure, see:
"Replacing tool cartridge or tool holder" **page 203**

- Clean and check tool holders:
 - Close tool loading station safety door.
 - Assign access right for the "individual functions" main menu.
 - Select the "Tool change manual mode" main menu. Open intermediate door via individual function "Tool setting station/tool magazine safety door".
 - Select "Additional functions manual mode" main menu. Unlock tool setting station safety door via individual function "Tool setting station safety doors/safety door".
 - Open tool loading station safety door.
 - Switch off machine at main switch and secure against being switched on again.
 - Secure the intermediate door to prevent it from lowering.
 - Clean empty tool holder and check for faultless condition.
 - Remove support from intermediate door.
 - Close tool loading station safety door.
 - Turn on machine on at the main switch.
 - Switch on motors.
 - Close intermediate door via individual function "Tool setting station/tool magazine safety door".
 - Revoke granted access right.
- Remove tool holder if damaged.



For procedure, see:
"Replacing tool cartridge or tool holder" **page 203**

4 Inspection and maintenance

4.9 Tool magazine

- Insert tool into tool cartridge. The retaining spring must engage and sit tight.
- Run tool back tool to the conveying station.
- Check all other magazine places in the same way.
- On completion of the maintenance work, close and lock the tool loading station safety door.

Replacing tool cartridge or tool holder

Spare part

Tool cartridge

Tool holder



See wearing and spare parts list (VS).

Aids

Ladder

Procedure

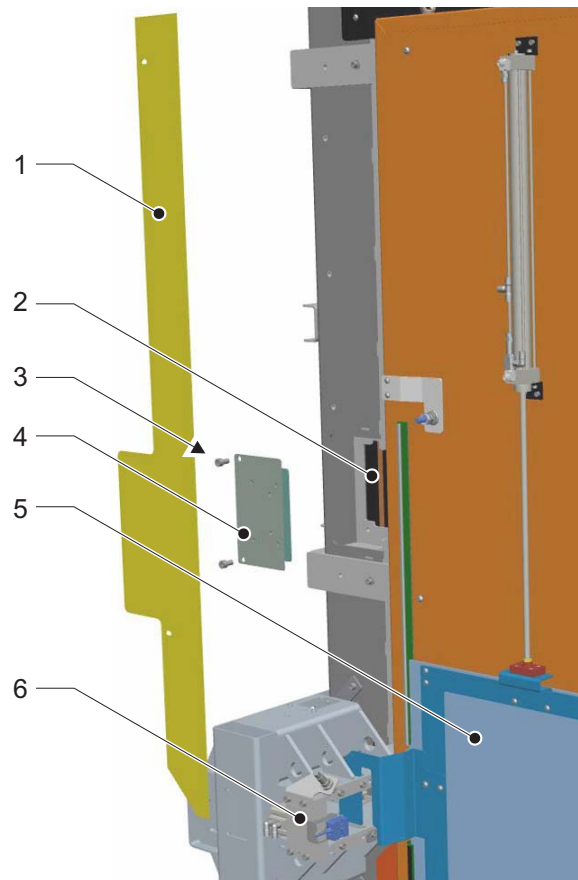


Observe Section 4.2 "Special safety measures" before opening the tool magazine maintenance door.

- Close and lock the tool loading station safety door.
- Run the empty tool cartridge back to the conveying station.
- Move magazine place with defective tool cartridge or defective tool holder to the cartridge unloading position.
The cartridge unloading position is 5 locations above the conveying station to the tool setting station.
- Unlock and open the tool loading station safety door
- Switch off machine at main switch and secure against being switched on again.
- Open maintenance door of the tool magazine.



For more information on how to open the maintenance door see:
"Opening the chain magazine maintenance door" **page 199**



4.9.1 - 3 Access to cartridge removal place

- 1 Safety guard
- 2 Cartridge removal place
- 3 Hexagon socket screw (2 components)
- 4 Cover
- 5 Intermediate door
- 6 Tool Loading Station

- Position the ladder so that you can safely reach the cartridge unloading position.
- Remove guard panel.
- Remove cover (2 hexagon socket screws).
- Remove tool cartridge.

4 Inspection and maintenance

4.9 Tool magazine



4.9.1 - 4 Tool holder

- 1 Screw
- 2 Chain bolts (2 x)

- If the tool holder is defective:
 - Loosen screw. A link stone on the rear of the tool holder forms the counter-piece. Remove fixing screw and link stone.
 - Remove tool holder.
 - Position the new tool holder onto the two chain bolts and secure with link stone and screw.
- Insert tool cartridge into the tool holder.
- Fit the cover.
- Attach safety guard.
- Before closing the maintenance door, ensure that nobody is behind the guard panels.
Close the maintenance door of the tool magazine.
- Close tool loading station safety door.

4.9.2 Cleaning drip pan

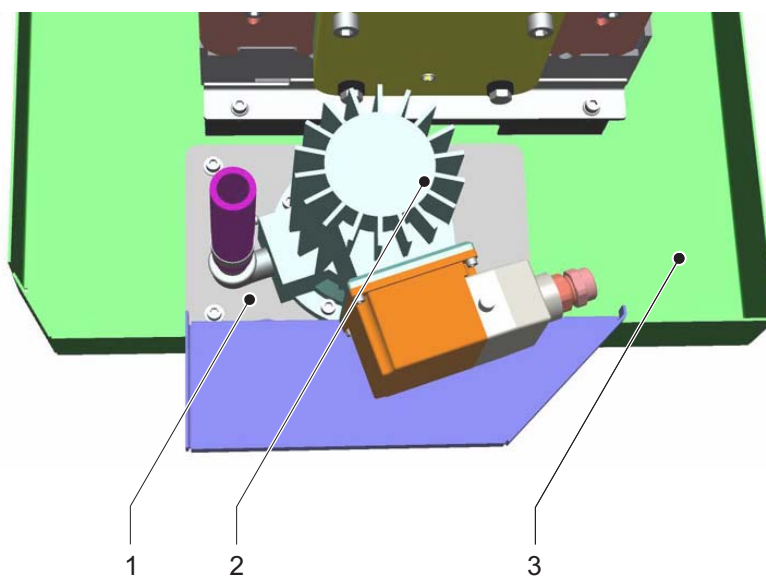
Interval 1 Year(s) Real time



Reduce this interval depending on the contamination of the machine.

Component

Drip pan below the tool magazine

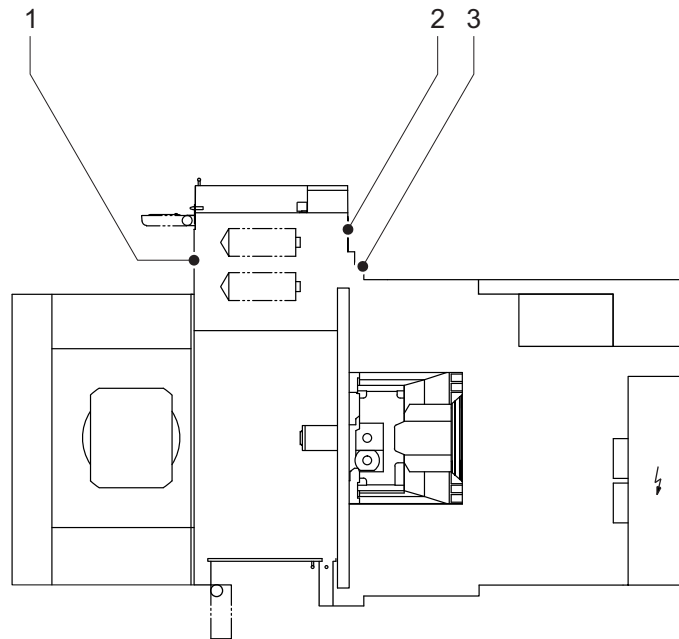


4.9.2 - 1 Drip pan below the tool magazine

- 1 Retaining plate
- 2 Immersion pump
- 3 Drip pan

4 Inspection and maintenance

4.9 Tool magazine



4.9.2 - 2 Access to drip pan

- 1 Maintenance opening D
- 2 Maintenance sheet for tool setting station
- 3 Maintenance opening B



This work should be carried out as part of the basic machine cleaning operation.



For basic cleaning of the machine, please refer to:
"Cleaning the machine" **page 268**

Aids

Exhauster unit

Procedure



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.
Exercise extreme caution when working in the maintenance area with unsecured machining unit! Avoid working below the machining unit!

- X and Y-axis positioned so that the drip pan is safely accessible:
 - X-axis (Frame) moved towards the work area safety door.
 - Y-axis (Machining unit) down.
- Machine switched off at main switch and secured against being switched on again.
- Maintenance openings B, C and D opened.
- Unscrew retaining plate with immersion pump from drip pan, lift out and set down.
- Exhaust sludge and chips from the drip pan.
- Insert retaining plate with immersion pump into the drip tray and screw down.
- Before closing the maintenance openings, ensure that nobody is behind the guard panels. Close maintenance openings B, C and D.

4 Inspection and maintenance

4.9 Tool magazine

4.9.3 Tensioning magazine chains

Interval 5000 Hours Operating time

Component Magazine chains



To readjust the conveying station towards the tool changer place after clamping operation, the machine data has to be modified. You must hold the relevant access right.



The control system accepts machine data input without confirmation. Overwritten data will be lost. Incorrect values can result in severe damage to the machine. Inputs take effect at different times according to level of effectiveness.

Machine data must only be changed by specially trained personnel.

Proceed as follows:

- Before amending the machine data, save the NCK data with a "Series commissioning".
- Check the cursor position before entering anything to avoid accidentally overwriting any data.
- After adjusting the data, save the new NCK data with "Series commissioning" to two separate data carriers.
- Check what effect the modified machine data has before reverting to automatic mode.

Aids

Oil can

Precision torque wrench (width across flats 18 mm)

Further documents



For control functions, see machine operating instructions (BD). You will require the following functions:

- Control of tool magazine
- Inserting and removing tools, tool data management
- Ifct



Refer to the "SINUMERIK 840D sl - Operating Manual".

Procedure

Data backup

Only choose a Siemens stick when using a USB stick as data memory.

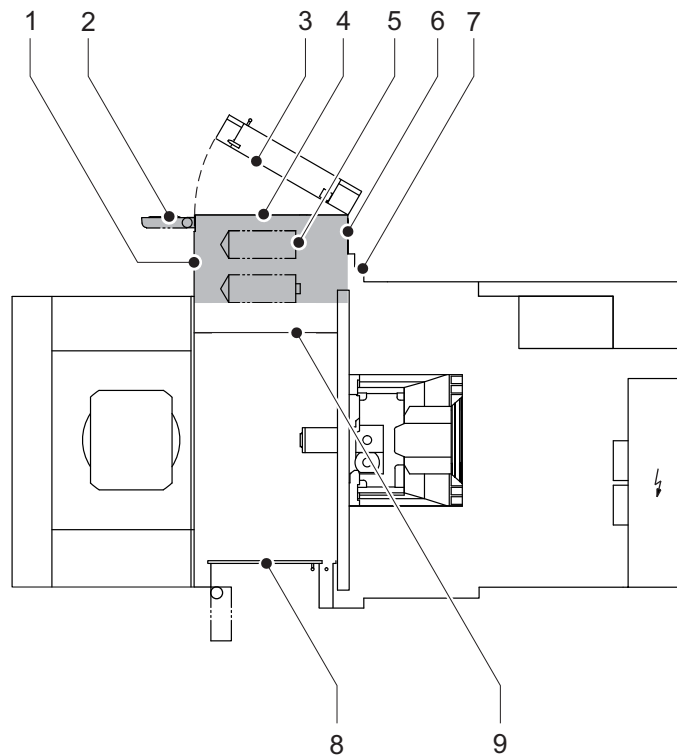
- Select the "Commissioning" main menu.
- Press upgrade key > .
- Press *Series IBN* softkey.
 - ↪ A dialogue window appears.
- Select menu item "Perform series commissioning".
- Confirm input with *OK* softkey.
- Follow the prompts.



For additional information on data security, see the Operator's Manual for the Machine (BD), chapter entitled "Data security of the machine manufacturer's data".

Unloading tool magazine

Observe Chapter 4.2 "Special safety measures" before opening the guard panels and when entering or leaving the machine. Exercise extreme caution when working in the maintenance area with unsecured machining unit! Avoid working below the machining unit!



4.9.3 - 1 Schematic representation of the machine
Access to the tool magazine

- 1 Maintenance opening D
- 2 Control unit, tool setting station
- 3 Maintenance door with tool setting station safety door
- 4 Intermediate door
- 5 Position of the tools in the magazine places
- 6 Maintenance sheet for tool setting station
- 7 Maintenance opening B
- 8 Work area safety door
- 9 Tool change door

- X-axis (frame) moved towards the work area safety door, so that the clamping device is accessible later.
- There should be no tool in the tool spindle.
- Remove all tools from the tool magazine.
- Move magazine place 1 to the cartridge unloading position.
- Depending on the magazine size, the following magazine place is located at the tool setting station:
 - Magazine size 50: magazine place 46
- Unlock and open the tool loading station safety door

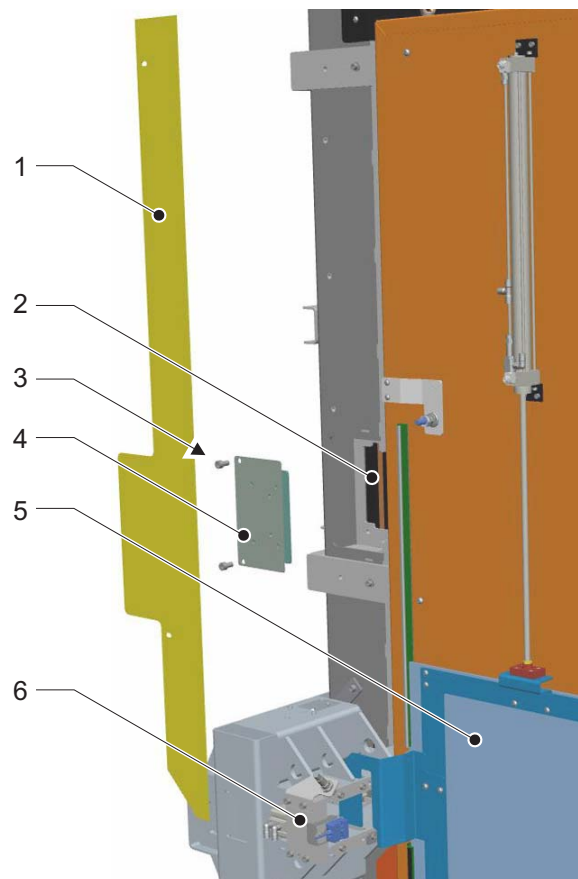
4 Inspection and maintenance

4.9 Tool magazine

- Switch off machine at main switch and secure against being switched on again.
- Open maintenance door of the tool magazine.



For more information on how to open the maintenance door see:
 "Opening the chain magazine maintenance door" **page 199**



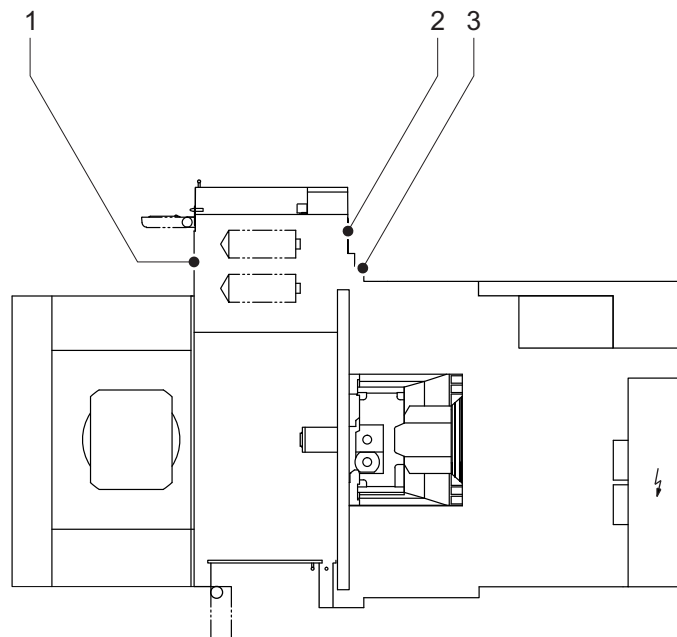
4.9.3 - 2 Cartridge removal place

- 1 Safety guard
- 2 Cartridge removal place
- 3 Hexagon socket screw (2 components)
- 4 Cover
- 5 Intermediate door
- 6 Tool Loading Station

- Position the ladder so that you can safely reach the cartridge unloading position.
- Remove guard panel.

- ☒ Remove cover (2 hexagon socket screws).
- ☒ Remove tool cartridge.

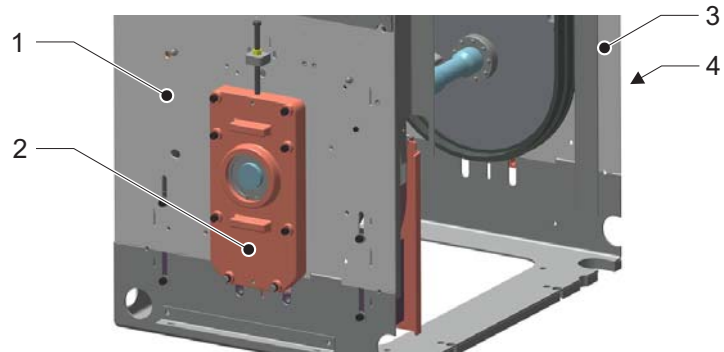
Make clamping devices accessible



4.9.3 - 3 Access to the clamping fixtures

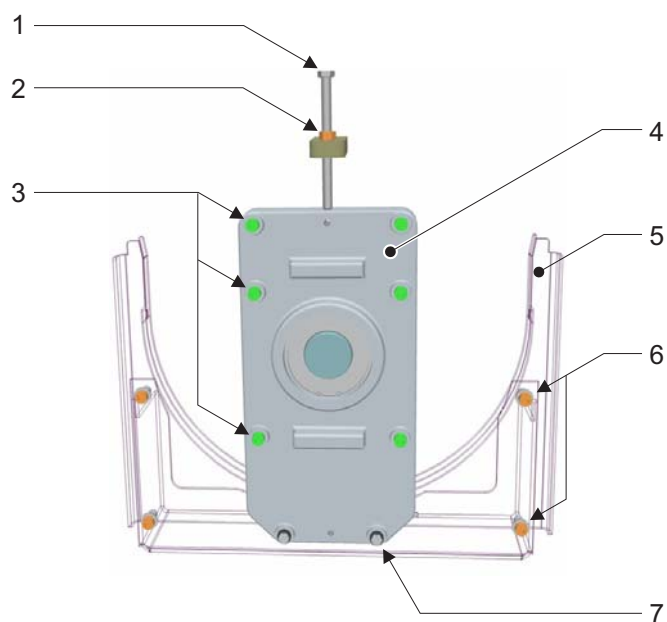
- 1 Maintenance opening D
- 2 Maintenance sheet for tool setting station
- 3 Maintenance opening B

- ☒ Open maintenance opening B and D.

Tensioning procedure:

4.9.3 - 4 Side identification on chain magazine and position of tensioning fixtures

- 1 Drive side
- 2 Clamping fixture at drive side
- 3 Non-drive end
- 4 Clamping fixture at non-drive end



4.9.3 - 5 Clamping fixture at drive side
The concealed guide frame is represented as wire frame model.

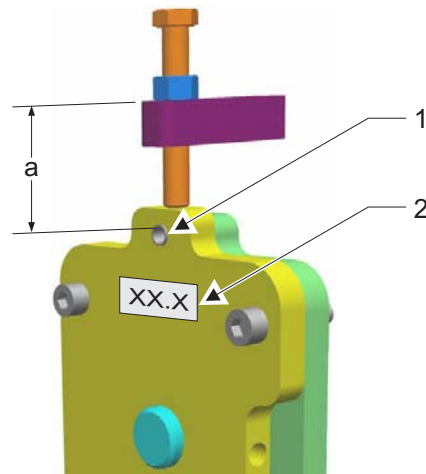
- 1 Setscrew
- 2 Locknut
- 3 Plate fastening to magazine carrier (6 screws)
- 4 Plate
- 5 Guide frame on inside of magazine carrier (drive side only)
- 6 Guide frame fastening to magazine carrier (4 screws)
- 7 Guide frame fastening to plate (2 screws, do not loosen)

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Two screws fasten the guide frame to the plate. This ensures that the distance between the guide frame and the tool cartridges remains the same even after the magazine chains are tensioned. Do not slacken these two screws !

4 Inspection and maintenance

4.9 Tool magazine



4.9.3 - 6 Determining the clamping distance:
Tensioning distance = $a - XX.X$

- 1 Gauging hole
- 2 Stamped original distance $XX.X$

i

The tensioning device at both the drive side and the non-drive end must be adjusted by the same amount in order to preserve the alignment of the transmission shaft and the sprocket shaft. By the same token:

- The tensioning distances must be identical, the tightening torques for the two setscrews are different.
- To check the tensioning distances, measure the value of a . The deviation " a less the original distance stamped on the plate" must be the same at both ends.

Magazine size	Tightening torques for tensioning the magazine chains			
	Drive side		Non-drive end	
	Nominal value	Max value	Nominal value	Max value
50	12 Nm	12 Nm	12 ± 5 Nm	12 ± 5 Nm

- ☒ Prepare both ends for tensioning:
 - Turn back the locking nut of the adjusting screw.
 - Apply ample oil to adjusting screw.
 - Check adjusting screw for ease of movement.
 - Place adjusting screw against plate but do not tighten.
 - Loosen plate fixing screws but leave them at end-stop so that the plate does not tilt from the magazine carrier.
 - At the drive side, also loosen the guide frame fixing screws at the magazine carrier.

Ensure that the two guide frame fixing screws do not detach from the plate.

- ☒ Using a torque wrench, tighten the two setscrews at the drive and non-drive ends:
 - Both sides always alternately.
 - In small steps.
 - Both sides by the same strokes each.
 - Until the torques on both sides are within the tolerance range.
- ☒ Ensure that the two tensioning distances are identical:
 - Determine tensioning distances as per Fig. -6.
 - Tighten the end that has the smaller tensioning distance until both tensioning distances are identical. An accuracy of ± 0.5 mm is sufficient.
- ☒ Secure the clamping fixtures:
 - Tighten fixing screws on the plate.
 - At the drive side, also tighten the guide frame fixing screws.
 - Tighten adjusting screw locking nut.
- ☒ Before closing the maintenance opening, ensure that nobody is behind the guard panels. Close maintenance openings C and D.
- ☒ Close tool magazine maintenance door.
- ☒ Close tool loading station safety door.

Running in magazine chains

- ☒ Turn on machine on at the main switch.
- ☒ Switch on motors.
- ☒ Run the tool magazine through its complete cycle at least twice in both directions.

Align conveying station with tool changer

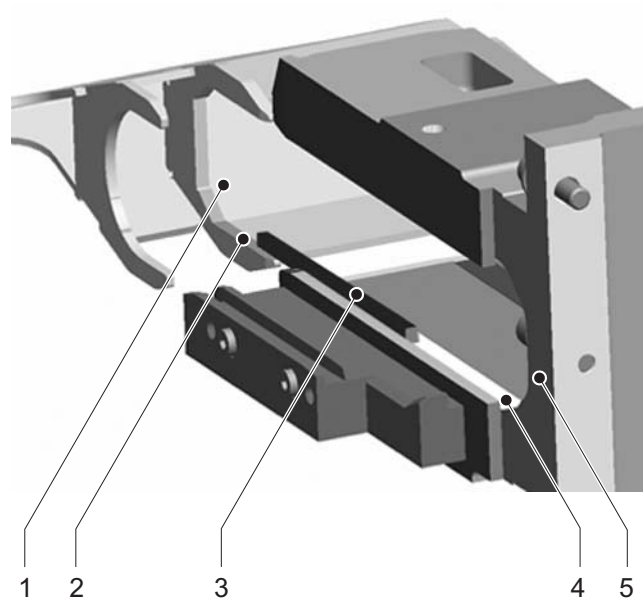
i

There is a structural offset of several millimetres between the two conveyor stations on the chain-type magazine (conveyor station to tool changer and conveyor station to tool setting station). The tool magazine is therefore fitted with two measuring systems: measuring system 1 is the motor encoder of the drive motor. This encoder synchronises the chain-type magazine with the tool changer. Measuring system 2 is a rotary encoder located above the tool setting station in the chain area. This encoder synchronises the chain-type magazine with the tool setting station.

Normally, the control polls measuring system 1, so that the chain-type magazine is synchronised with the tool changer. The control switches to measuring system 2 only for transport of the cartridge between the tool loading position and conveying station. During switchover, the chain-type magazine moves up by the offset between the two conveying stations. In normal mode, this process is coupled to the activation of the alignment device, which fixes the tool holder on the conveying station to the tool setting station while the cartridge is being transported. For commissioning and service, chain synchronisation is provided as a separate individual function.

- Magazine chains are retracted.
- Loading hatch closed.
- Move magazine place 1 (empty location without tool cartridge) to the conveying station towards tool changer.
- Because the control is unaware that the chains have elongated, magazine place 1 is no longer at the reference position.
- Position the linear axes such that the tool changer door is easily accessible:
 - Z-axis (rotary table) away from the machining unit.
 - Y-axis (Machining unit) down.
 - X-axis (frame) away from the tool changer door.
- Grant access rights for "Individual functions" operating area.
- Check measuring system position display:
 - Select the "Service axis/spindle" window. Softkey sequence from the basic menu: *Diagnostics - Axis diagnostics - Service axis*.
 - Select axis 9 M_CM.
 - Read off the "Position actual value measuring system 1" parameter. The measuring system 1 must report 0 degrees.

- Select the "Tool change individual functions" main menu.
- Open tool change door using the "tool change door" individual function.
- Switch off motors.
- Open work area safety door and secure to prevent closing.
- Switch off machine at main switch and secure against being switched on again.
- Secure tool change door to prevent it from falling.



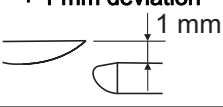
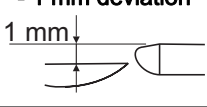
4.9.3 - 7

Determine the difference between "tool changer conveying station" and "tool changer provisioning place"

- 1 Tool holder
- 2 Locating face of the tool holder
- 3 Linear
- 4 Locating face of the provisioning place
- 5 Provisioning place for tool changer

- Determine deviation between target and actual position.
 - Set position:
 - Theoretically, the locating face of tool holder should be at the same height as the locating face of provisioning place. A difference of ± 0.3 mm is permissible.
 - In practice, the tool holder should be somewhat higher, to a level so that the cartridge continues to run evenly during the next function test. This gives you some reserve, should the chains give under heavier tools and expand further over the course of time.
 - Measure deviation in accordance with Fig. -7. Ensure that the two locating faces are parallel for measurement.

- Converting the deviation to angular degrees.
Observe positive and negative values according to the following tables:

Magazine size	Correction values	
	+ 1 mm deviation	- 1 mm deviation
50		
	+0.056°	-0.056°

- Remove support from the tool change door.
- Before closing the safety door, ensure that nobody is in the work area.
Close work area safety door.
- Turn on machine on at the main switch.
- Switch on motors.
- Close tool change door using the individual function.



CAUTION

Incorrect entries in the machine data can cause serious machine damage.

Exercise extreme caution when changing machine data!

- Select the "Commissioning" main menu.
- Grant access rights for "Commission" main menu.
- Enter adjustment value:
 - Select "Commissioning" - "Machine Data" - "Axis-machine data" menu.
 - Select the tool magazine using the softkeys *Axis+* and *Axis-* (axis 9, M-CM).
 - Select machine datum MD 34090[0].
 - Add the adjustment value to the previous contents of MD 34090[0]: Subtract negative correction values. Key sequence:

Key sequence for addition	Key sequence for subtraction	Remarks	Example
=	=	An input window appears showing the previous contents of the machine datum:	360.0000000

4 Inspection and maintenance

4.9 Tool magazine

Key sequence for addition	Key sequence for subtraction	Remarks	Example
+adjustment value	-adjustment value	The typed in value is appended to the value in the input window:	360.00000000-0.15
<i>Input</i>	<i>Input</i>	The input window is closed. The result is displayed in the machine data listing.	359.85000000

- Turn the main switch off and on again.
- The actual position of the tool magazine is displayed in the actual value display of the main operator panel.

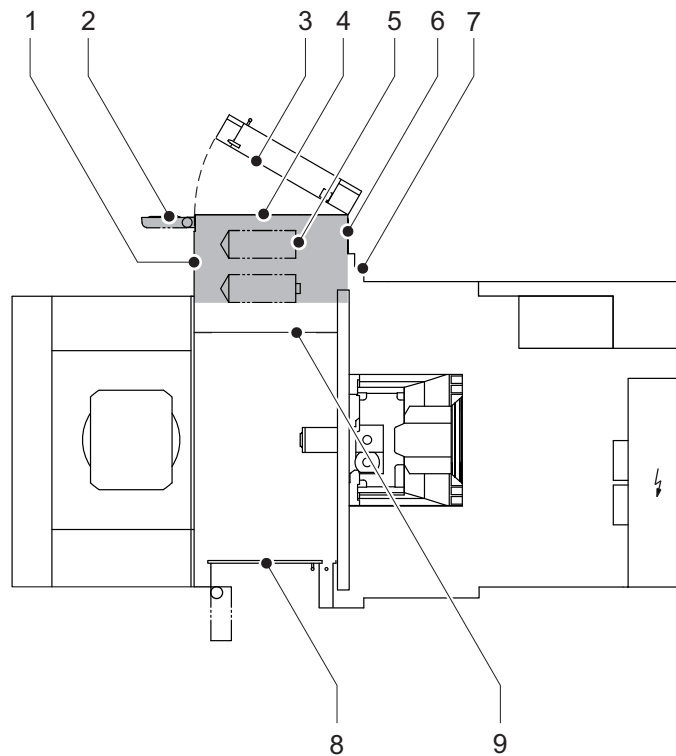
Checking adjustment and readjust if necessary

- Run the tool magazine through its complete cycle again in both directions.
- Check height of the conveying station. Readjust deviations. Proceed as previously with the first adjustment.

Checking cartridge transport between conveying station and tool changer provisioning place

- You have checked the adjustment and not found any deviations.
- Machine switched on.
- Work area safety door is locked.
- Motors are switched on.
- Tool change door closed.
- Move a magazine place with tool cartridge to the conveying station towards the tool changer.
- Open tool change door with individual functions.
- Use the "Tool traverse attachment" individual function to move the tool cartridge to and fro between conveying station and tool changer provisioning place. At the same time, observe the tool cartridge movement. The tool cartridge must move back and forth without jerking.
- Close tool change door with individual functions.
- If the tool cartridge transport was not perfect, readjust the conveying station and repeat all checks.

Checking conveying station towards the tool setting station and calibrate



4.9.3 - 8 Schematic representation of the machine
Access to the tool magazine

- 1 Maintenance opening D
- 2 Control unit, tool setting station
- 3 Maintenance door with tool setting station safety door
- 4 Intermediate door
- 5 Position of the tools in the magazine places
- 6 Maintenance sheet for tool setting station
- 7 Maintenance opening B
- 8 Work area safety door
- 9 Tool change door

i

Because measuring system 2 sits flush over the tool setting station, tensioning has only a slight effect on this side. After repeated tensioning however, the deviation may exceed tolerance permitted here.

- The cartridge transport between conveying station and tool changer provisioning place is smooth.

4 Inspection and maintenance

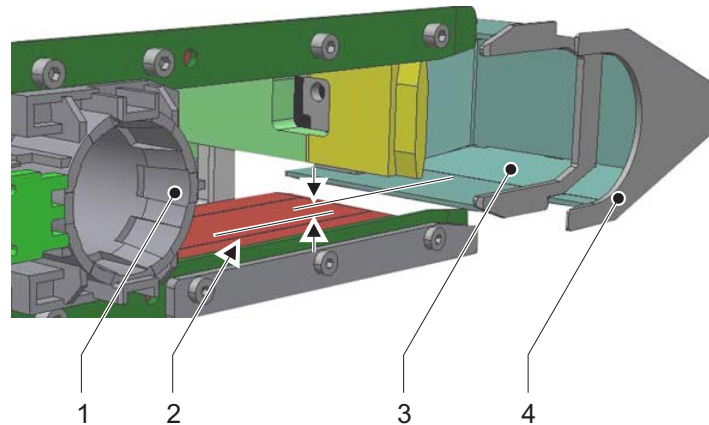
4.9 Tool magazine

- ☒ Move magazine place 33 on the conveying station towards the tool changer.
- ↪ Magazine place 1 (empty location without tool cartridge) is located on the conveying station towards the tool setting station.
- ☒ Issue access authorisation for the "Commissioning" main menu.
- ☒ Select the "Commissioning" main menu.
- ☒ Open intermediate door:
 - Select the "Tool change manual mode" main menu.
 - Open intermediate door via individual function "Tool setting station/tool magazine safety door".
- ☒ Synchronise chain-type magazine with the tool setting station via individual function "chain synchronisation".
- ↪ The control switches over to measuring system 2. The chain-type magazine moves up by the offset between the two measuring systems.
- ☒ Unlock tool setting station safety door with intermediate door open:
 - Select "Additional functions manual mode" main menu.
 - Unlock tool setting station safety door via individual function "Tool setting station safety doors/safety door".
- ☒ Open maintenance door of the tool magazine.



For more information on how to open the maintenance door see:
"Opening the chain magazine maintenance door" **page 199**

- ☒ Switch off machine at main switch and secure against being switched on again.
- ☒ Secure the intermediate door to prevent it from lowering.

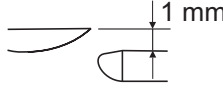
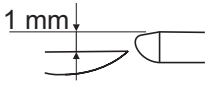


4.9.3 - 9 Determine the difference between conveying station and tool setting station

- 1 Tool Loading Station
- 2 Locating face of the tool setting station
- 3 Locating face of the tool holder
- 4 Tool holder

- ☒ Determine deviation between target and actual position.
 - Set position:
 - Theoretically, the locating face of the tool holder should be at the same height as the locating face of the tool setting station. A difference of ± 0.3 mm is permissible.
 - In practice, the tool holder should be somewhat higher, to a level so that the cartridge continues to run evenly during the next function test. This gives you some reserve, should the chains give under heavier tools and expand further over the course of time.
 - Measure deviation in accordance with Fig. -9. Ensure that the two locating faces are parallel for measurement.

- ☒ Converting the deviation to angular degrees. Observe positive and negative values according to the following tables:

Magazine size	Correction values	
	+ 1 mm deviation 	- 1 mm deviation 
50	+0.056°	-0.056°

- ☒ Remove support from intermediate door.

4 Inspection and maintenance

4.9 Tool magazine

- Before closing the maintenance door, ensure that nobody is behind the guard panels.
Close the maintenance door of the tool magazine.
- Close tool loading station safety door.
- Turn on machine on at the main switch.
- Switch on motors.
- Close intermediate door via individual function "Tool setting station/ tool magazine safety door".

**CAUTION**

Incorrect entries in the machine data can cause serious machine damage.

Exercise extreme caution when changing machine data!

- Issue access authorisation for the "Commissioning" main menu.
- Select the "Commissioning" main menu.
- Enter adjustment value:
 - Select "Commissioning" - "Machine Data" - "Axis-machine data" menu.
 - Select the tool magazine using the softkeys *Axis+* and *Axis-* (axis 9, M-CM).
 - Select machine datum MD 34090[1].
 - Add the adjustment value to the previous contents of MD 34090[1]: Subtract negative correction values. Key sequence:

Key sequence for addition	Key sequence for subtraction	Remarks	Example
=	=	An input window appears showing the previous contents of the machine datum.	360.00000000
+adjustment value	-adjustment value	The typed in value is appended to the value in the input window:	360.00000000+0.05
<i>Input</i>	<i>Input</i>	The input window is closed. The result is displayed in the machine data listing.	360.05000000

- Turn the main switch off and on again.
- ↗ The actual position of the tool magazine is displayed in the actual value display of the main operator panel.
- Select the "Tool change individual functions" main menu.

- ☒ Synchronise chain-type magazine with the tool setting station via individual function "chain synchronisation".
- ↻ The control switches over to measuring system 1. The chain-type magazine moves up by the offset between the two measuring systems.

Checking adjustment and readjust if necessary

- ☒ Run the tool magazine through its complete cycle again in both directions.
- ☒ Check height of the conveying station. Readjust deviations. Proceed as previously with the first adjustment.

Checking tool cartridge transport between magazine place and provisioning place

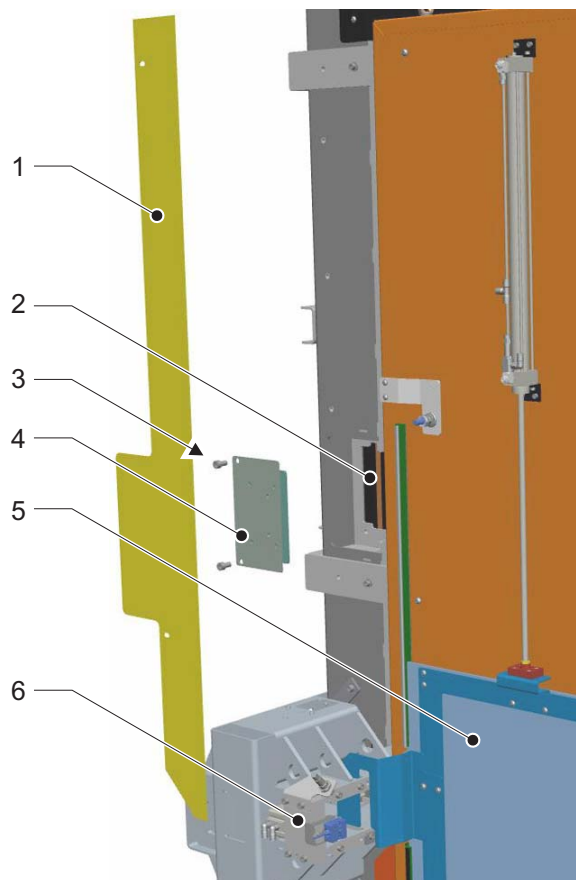
- ☒ You have checked the adjustment and not found any deviations.
- ☒ Maintenance door of the tool magazine closed
- ☒ Machine switched on.
- ☒ Tool loading station safety door locked.
- ☒ Work area safety door is locked.
- ☒ Motors are switched on.
- ☒ Intermediate door closed.
- ☒ Move one magazine place with tool cartridge on the conveying station towards tool setting station.
- ☒ Individual function "Tool holder" to "Align".
 - ↻ The chain synchronisation is switched over to the tool setting station.
- ☒ Use the "Tool cartridge on tool setting station" individual function to move the tool cartridge to and fro between conveying station and tool loading position. At the same time, observe the tool cartridge movement. The tool cartridge must move back and forth without jerking.
- ☒ Individual function "Tool holder" to "swivel back".
 - ↻ The chain synchronisation is switched over to the tool changer.
- ☒ If the tool cartridge transport was not perfect, readjust the conveying station and repeat all checks.

Loading the tool magazine

- Move magazine place 1 to the cartridge unloading position.
- Depending on the magazine size, the following magazine place is located at the tool setting station:
 - Magazine size 50: magazine place 46
- Unlock and open the tool loading station safety door
- Switch off machine at main switch and secure against being switched on again.
- Open maintenance door of the tool magazine.



For more information on how to open the maintenance door see:
"Opening the chain magazine maintenance door" **page 199**



4.9.3 - 10 Cartridge removal place

- 1 Safety guard
- 2 Cartridge removal place
- 3 Hexagon socket screw (2 components)
- 4 Cover
- 5 Intermediate door
- 6 Tool Loading Station

- Reinsert the removed tool cartridge into tool holder 1.
- Fit the cover.
- Attach safety guard.
- Before closing the maintenance door, ensure that nobody is behind the guard panels.
Close the maintenance door of the tool magazine.
- Close tool loading station safety door.
- Switch the machine on.
- Replace the tools from the tool magazine in the tool magazine.

Check tool transport between conveying station and tool changer provisioning place

- Check movement between conveying station and tool changer provisioning place again using different tools. Proceed as described earlier when checking an empty tool cartridge.

Close

- Revoke granted access rights.
- Save the new NCK data with "Series commissioning". Make two copies on separate data carriers.
- Place a tool in the tool spindle to protect the tool spindle from the ingress of dirt.
- Switch off motors.

4.9.4 Lubricate traverse attachment and guide of the tool setting station

Interval 2 Year(s) Real time

Component Traverse attachment for tool transport between tool magazine and tool changer provisioning place, guideway of the slide for tool transport between tool magazine and tool setting station



This work should be carried out as part of the basic machine cleaning operation.



For basic cleaning of the machine, please refer to:
"Cleaning the machine" **page 268**

Consumable

Lubricating grease K2K-20 to DIN 51825, Part 2

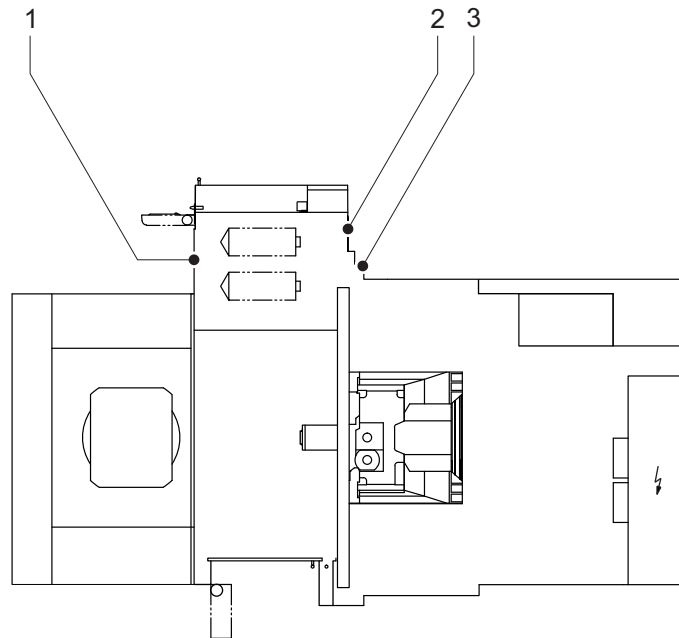


Used greases and dirty cloths should be regarded as hazardous waste and must be disposed of according to the locally applicable regulations.

4 Inspection and maintenance

4.9 Tool magazine

Procedure



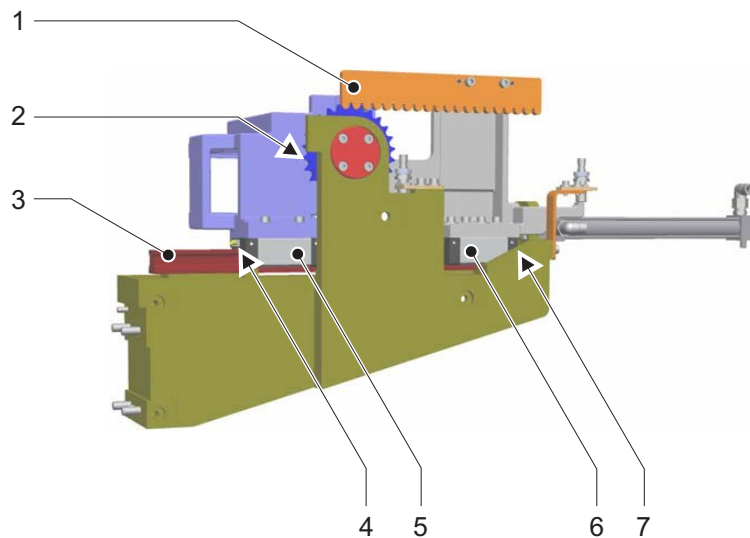
4.9.4 - 1 Access to the traverse attachments

- 1 Maintenance opening D
- 2 Maintenance sheet for tool setting station
- 3 Maintenance opening B



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.
Exercise caution when working inside the machine with the machining unit not secured!

- Switch off machine at main switch and secure against being switched on again.
- Open maintenance opening B.



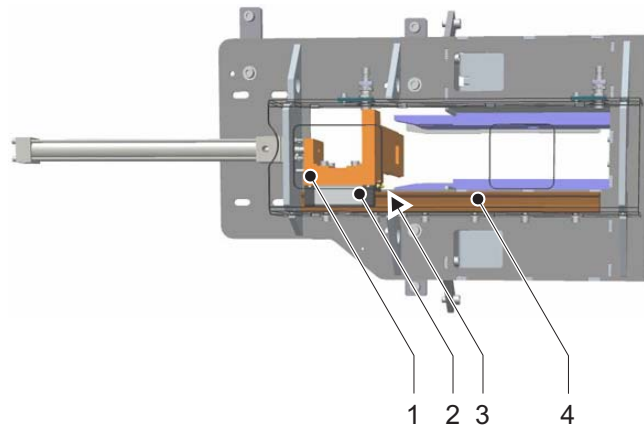
4.9.4 - 2 Traverse attachment

- 1 Toothed rack
- 2 Chain wheel
- 3 Guide rail
- 4 Lube nipples of runner block 1
- 5 Runner block 1
- 6 Runner block 2
- 7 Lube nipples of runner block 2

- Clean traverse attachment guide rail.
- Clean and lubricate toothed rack and chain wheel.
- Relubricate the two runner blocks with the grease press until clean grease escapes from inside the runner block. Remove the used grease.
- Screw off maintenance sheet for tool setting station.

4 Inspection and maintenance

4.9 Tool magazine



4.9.4 - 3 Slide of the tool setting station

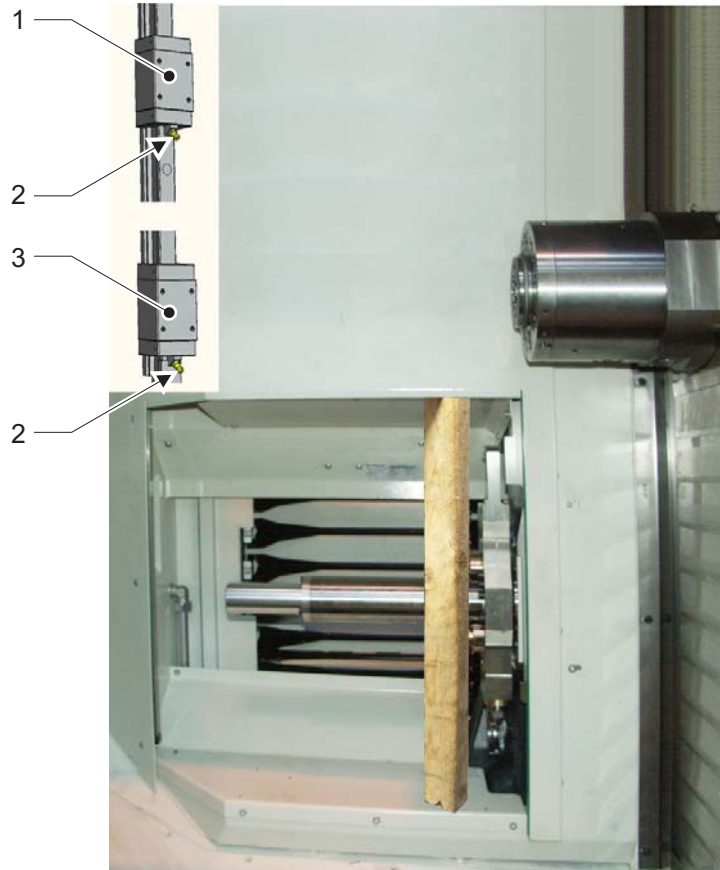
- 1 Slide
- 2 Runner block
- 3 Lube nipple
- 4 Guide rail

- Clean slide guide rail.
- Re-lubricate the runner blocks with the grease press until clean grease escapes from inside the runner block. Remove the used grease.
- Screw on maintenance sheet for tool setting station.
- Close maintenance opening B.
- Place a tool in the tool spindle to protect the tool spindle from the ingress of dirt.
- Switch off motors.

4.9.5 Lubricate guideways of the tool change door.

Interval 2 Year(s) Real time

Component Guide of tool change door



4.9.5 - 1 Tool change door opened.

- 1 Upper carriage of the tool change door
- 2 Lube nipple of the runner block
- 3 Lower carriage of the tool change door

Consumable Lubricating grease K2K-20 to DIN 51825, Part 2.



Used greases and dirty cloths should be regarded as hazardous waste and must be disposed of according to the locally applicable regulations.

Aids Ladder

Procedure

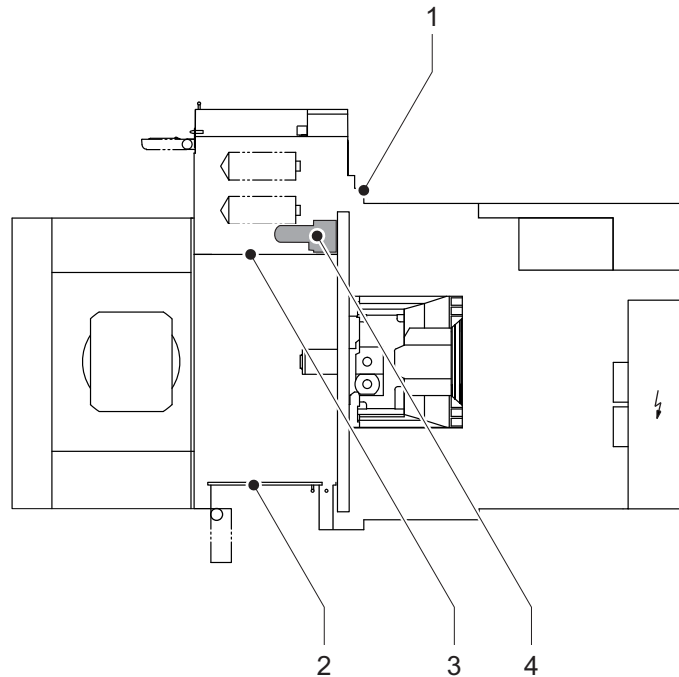


Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.
Exercise extreme caution when working in the work area with unsecured machining unit. Avoid working below the machining unit!

- There should be no tool in the tool spindle.
- The X, Y and Z-axes are positioned such that you can work safely on the lift door tool changer:
 - Z-axis (rotary table) to the pallet changer.
 - X axis (Frame) in centre of travel.
 - Y-axis (Machining unit) down.
- Loading hatch closed.
- Grant access rights for "Individual functions" operating area.
- Select the "Tool change individual functions" main menu.
- Open tool change door using the "tool change door" individual function.
- Open work area safety door and secure to prevent closing.
- Switch off machine at main switch and secure against being switched on again.
- Secure tool change door to prevent it from falling.
- Relubricate the carriage on the lube nipple using the grease press until clean grease escapes from inside the carriage. Remove the used grease.
- Attach the ladder so that the upper carriage of the opened tool change door can be accessed safely.
- Relubricate the carriage on the lube nipple using the grease press until clean grease escapes from inside the carriage. Remove the used grease.
- Remove ladder.
- Remove support from the tool change door.
- Before closing the safety door, ensure that nobody is behind the guard panels. Close work area safety door.

- Turn on machine on at the main switch.
- Switch on motors.
- Close tool change door using the "tool change door" individual function.
- Revoke access rights.
- Place a tool in the tool spindle to protect the tool spindle from the ingress of dirt.
- Switch off motors.

4.10 Tool changer



4.10 - 1 Schematic representation of the machine

- 1 Maintenance opening B
- 2 Work area safety door
- 3 Tool change door
- 4 Tool changer

4.10.1 Replacing timing belt of tool changer

Interval 10000 Hours Operating time

Component Tool changer

Procedure



The timing belt must be replaced at regular intervals in order to avoid fatigue break.

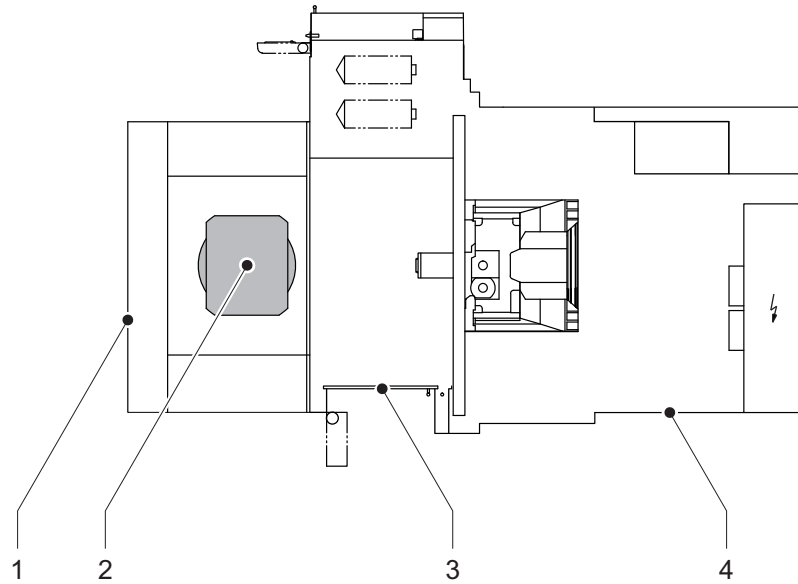
This activity must only be carried out by specially trained personnel.



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.

- Compressed air shut-off valve closed and secured to prevent opening.
- Open safety doors and maintenance openings to make tool changer accessible.
- Switch off machine at main switch and secure against being switched on again.
- Have the timing belt replaced by customer service.
- Before closing the safety doors and maintenance openings, ensure that nobody is behind the guard panels.
Close safety doors and maintenance openings.
- Open compressed air shut-off valve.

4.11 Rotary feed table



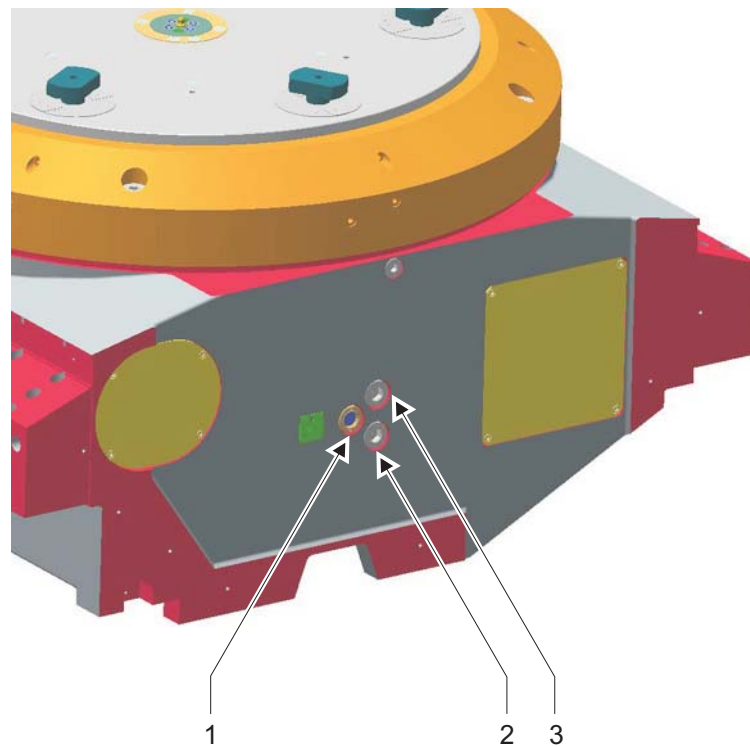
4.11 - 1 Schematic representation of the machine

- 1 Workpiece setting station safety door (front door)
- 2 Rotary feed table
- 3 Work area safety door
- 4 Maintenance area safety door

4.11.1 Checking oil level in rotary feed table

Interval 200 Hours Operating time

Component Rotary feed table



4.11.1 - 1 Rotary feed table (orientation for workpiece setting station safety door (front door))

- 1 Oil sight glass
- 2 Oil drain screw
- 3 Oil filler screw

4 Inspection and maintenance

4.11 Rotary feed table

Inspection

Procedure



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.

Exercise caution when working inside the machine with the machining unit not secured!

- The linear axes are positioned so as to make the oil sight glass on the rotary table accessible.
 - Y-axis (Machining unit) outside of workpiece collision area.
 - X-axis (Frame) to the tool change door.
 - Z-axis (rotary table) to the machining unit.
- Loading hatch closed.
- Work area safety door open and secured to prevent closing.
- Workpiece setting station safety door (front door) opened.
- Check oil level through oil sight glass. The oil level must reach the centre of the sight glass.
- If the oil level is too low, check rotary feed table for leaks and top up oil.



For procedure, see:
"Check for leaks and top up oil" **page 243**

- Before closing the safety doors, ensure that nobody is behind the guard panels. Close the work area safety door and the workpiece setting station safety door (front door).

Check for leaks and top up oil

Consumable

Lube oil SAE 80W GL-4 according to DIN 51502
Purity class ISO 4406-18/16/13



Disimilar lubricants can contain various additives that might not be compatible. To rule out incompatibility between the lubricants, disimilar lubricants must not be mixed.
If you have any questions, please contact your lubricant supplier.

Spare part

Oil filler screw or oil drain screw with seal: screw plug



See wearing and spare parts list.

Aids

Torch

Can with narrow neck or funnel

Fine filter

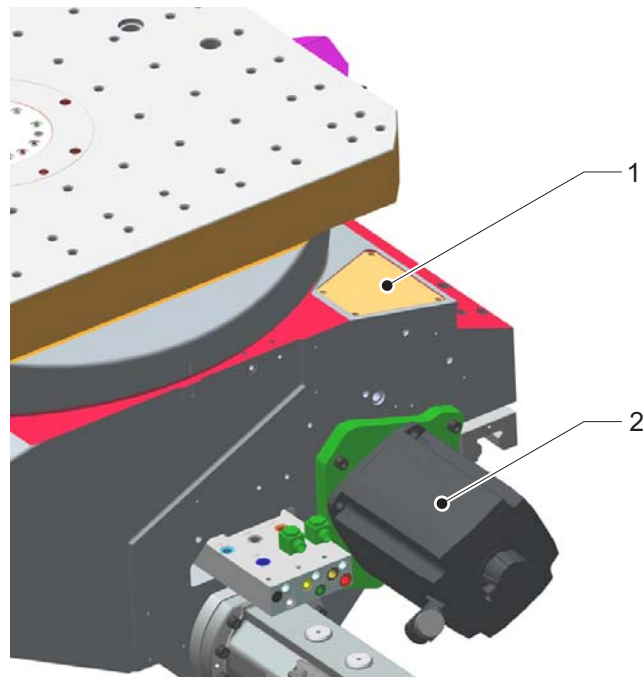
Procedure

Check rotary table for leakage

- Adequate freedom of movement in work area.
Remove the bulky workpieces and clamping fixtures.
- There should be no tool in the tool spindle.
- Z-axis (rotary table) in centre of travel.
- Machining unit traversed into support position.
- Loading hatch closed.
- Work area safety door open and secured to prevent closing.
- Workpiece setting station safety door (front door) opened.
- Maintenance area safety door opened and secured to prevent closing.
- Compressed air shut-off valve closed and secured to prevent opening.
- Machine switched off at main switch and secured against being switched on again.
- Machining unit protected from falling by supports.
- Inspect front of rotary table for leaking oil: Possible leak points:
 - Oil sight glass
 - Oil drain screw

4 Inspection and maintenance

4.11 Rotary feed table



4.11.1 - 2 Rear of the rotary feed table (oriented to the machining unit)

- 1 Cover
- 2 B-axis motor

- If the front of the rotary table is leak-proof, also check the drive side of the worm gear:
 - Remove cover and shine torch into the hollow space.
 - Has oil escaped into the timing belt drive area?
- Repair leak yourself or have it repaired by customer services. Do not operate machine with damaged rotary table!
- Insert cover to seal hollow space and tighten with four screws.

Top up oil

- Remove the oil filler screw.
- Fill with oil through opening until the level reaches the centre of the sight glass.
- Insert oil filler screw with sealing ring and tighten.
- Before closing the safety doors, ensure that nobody is behind the guard panels. Close the work area safety door and the workpiece setting station safety door (front door).

- Remove support from the machining unit.
- Before closing the safety door, ensure that nobody is behind the guard panels. Close maintenance area safety door.
- Open compressed air shut-off valve.
- Switch the machine on.
- Place a tool in the tool spindle to protect the tool spindle from the ingress of dirt.
- Switch off motors.

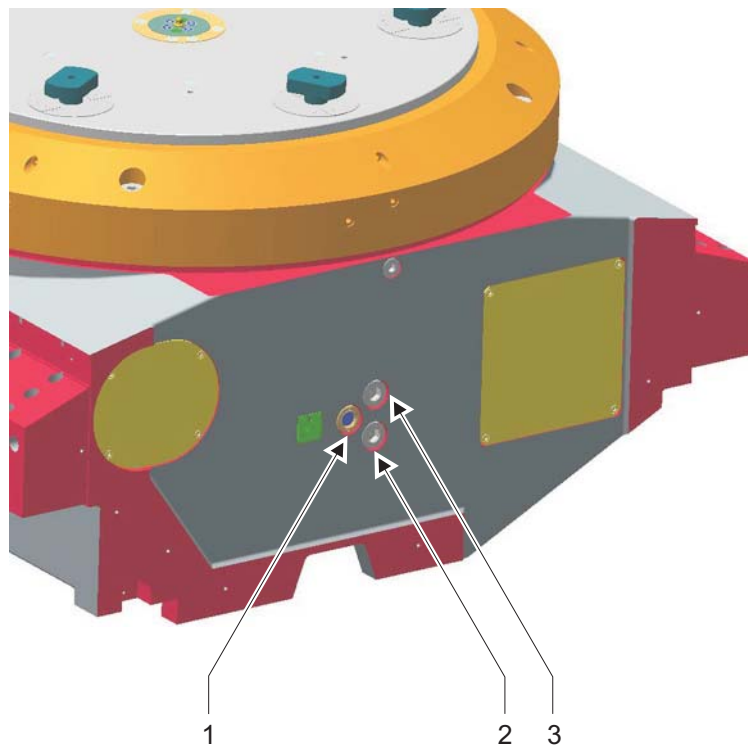
4 Inspection and maintenance

4.11 Rotary feed table

4.11.2 Oil change in rotary feed table

Interval 1 Year(s) Real time

Component Rotary feed table



4.11.2 - 1 Rotary feed table (orientation for workpiece setting station safety door (front door))

- 1 Oil sight glass
- 2 Oil drain screw
- 3 Oil filler screw

4 Inspection and maintenance

4.11 Rotary feed table

Consumable

Lube oil SAE 80W GL-4 according to DIN 51502
 Purity class ISO 4406-18/16/13
 Container capacity 17 l



Disimilar lubricants can contain various additives that might not be compatible. To rule out incompatibility between the lubricants, disimilar lubricants must not be mixed.
 If you have any questions, please contact your lubricant supplier.



Used oil must be regarded as hazardous waste and be disposed of according to the locally applicable regulations.

Spare part

Oil filler screw or oil drain screw with seal: screw plug



See wearing and spare parts list.

Aids

Container with 19 litre capacity
 Can with narrow neck or funnel
 Fine filter

Procedure



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.

Exercise caution when working inside the machine with the machining unit not secured!

- The rotary feed table is warm to the touch.
- There should be no tool in the tool spindle.
- The linear axes are positioned so as to make the rotary table easily accessible.
 - Y-axis (machining unit) traversed into support position.
 - X-axis (Frame) to the tool change door.
 - Z-axis (rotary table) to the machining unit.
- Loading hatch closed.
- Compressed air shut-off valve closed and secured to prevent opening.

- Workpiece setting station safety door (front door) opened.
- Maintenance area safety door opened and secured to prevent closing.
- Machine switched off at main switch and secured against being switched on again.
- Machining unit protected from falling by supports.
- Remove the oil filler screw.
- Position a suitable container under the oil drain screw.
- Remove oil drain screw. Allow oil to drain into the container.
- Insert oil drain screw with sealing ring and tighten.
- Fill with oil through opening until the level reaches the centre of the sight glass.
- Insert oil filler screw with sealing ring and tighten.
- Before closing the safety door, ensure that nobody is behind the guard panels.
Close workpiece setting station safety door (front door).
- Remove support from the machining unit.
- Before closing the safety door, ensure that nobody is behind the guard panels.
Close maintenance area safety door.
- Open compressed air shut-off valve.
- Turn on machine on at the main switch.
- Switch on motors.
- Place a tool in the tool spindle to protect the tool spindle from the ingress of dirt.
- Switch off motors.

4 Inspection and maintenance

4.11 Rotary feed table

4.11.3 Replace timing belt of the rotary table drive

Interval 10000 Hours Operating time

Component Rotary feed table

Procedure

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The timing belt must be replaced at regular intervals in order to avoid fatigue break.

This activity must only be carried out by specially trained personnel.



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.

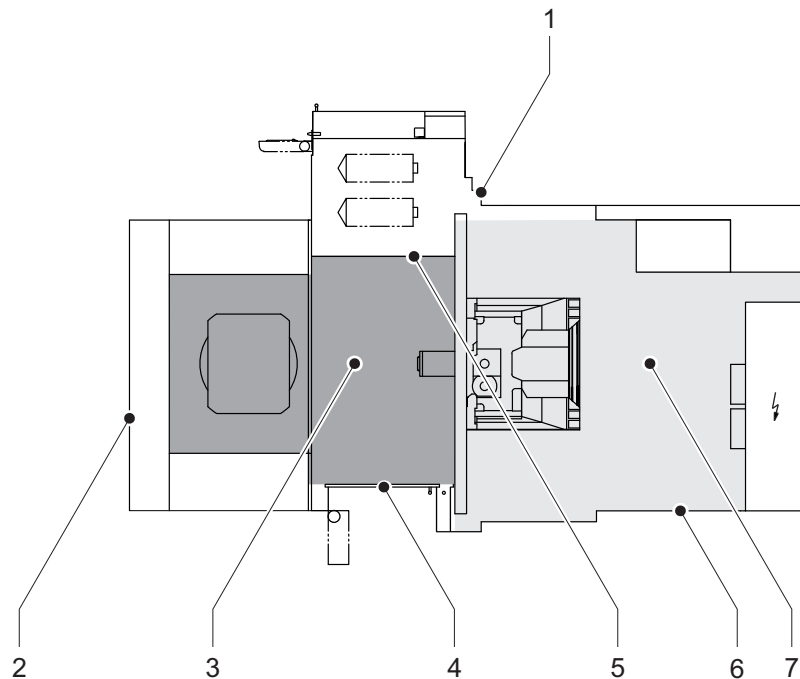
Exercise caution when working inside the machine with the machining unit not secured!

- Loading hatch closed.
- There should be no tool in the tool spindle.
- Z-axis (rotary table) is moved to the workpiece setting station safety door (front door).
- Work area safety door open and secured to prevent closing.
- Maintenance area safety door opened and secured to prevent closing.
- Machine switched off at main switch and secured against being switched on again.
- Machining unit protected from falling by supports.
- Compressed air shut-off valve closed and secured to prevent opening.
- Have the timing belt replaced by customer service.
- Remove support from the machining unit.
- Before closing the safety doors, ensure that nobody is behind the guard panels.
Close and lock the work area safety door and the maintenance area safety door.

4 Inspection and maintenance**4.11** Rotary feed table

- Open compressed air shut-off valve.

4.12 Machine frame



4.12 - 1 Schematic representation of the machine

- 1 Maintenance opening B
- 2 Workpiece setting station safety door (front door)
- 3 Work area
- 4 Work area safety door
- 5 Tool change door
- 6 Maintenance area safety door
- 7 Maintenance area



For location names on the tool magazine see:
"Tool magazine" **page 198**

4.12.1 Removing chips from the work area

Interval 200 Hours Operating time



Reduce this interval depending on the type and quantity of chips.

Component

Work area

Aids

Chip hook, hand broom

Procedure



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.

Exercise caution when working inside the machine with the machining unit not secured!

- A tool is placed in the tool spindle.
- Linear axes suitably positioned:
 - Y-axis (Machining unit) outside of workpiece collision area.
 - X-axis (Frame) to the tool change door.
 - Z-axis (rotary table) to the machining unit.
- Loading hatch closed.
- Work area safety door open and secured to prevent closing.
- Workpiece setting station safety door (front door) opened.
- Maintenance area safety door opened and secured to prevent closing.
- Machine switched off at main switch and secured against being switched on again.
- Remove chips from the workpiece clamping fixture and the work area.
- Before closing the safety doors, ensure that nobody is behind the guard panels. Close the work area safety door and the workpiece setting station safety door (front door).

4.12.2 Checking dirt wipers and concertina covers

Interval 1000 Hours Operating time

Component Concertina covers of Y and Z-axis, wiper for XY cover

- Procedure
- There should be no tool in the tool spindle.
 - The linear axes are positioned so as to make all covers easily accessible.
 - Z-axis (rotary table) in centre of travel.
 - X axis (Frame) in centre of travel.
 - Y axis (Machining unit) in centre of travel.
 - Loading hatch closed.
 - Workpiece setting station safety door (front door) opened.
 - Work area safety door open and secured to prevent closing.
 - Maintenance area safety door opened and secured to prevent closing.
 - Machine switched off at main switch and secured against being switched on again.
 - Machining unit protected from falling by supports.

**CAUTION**

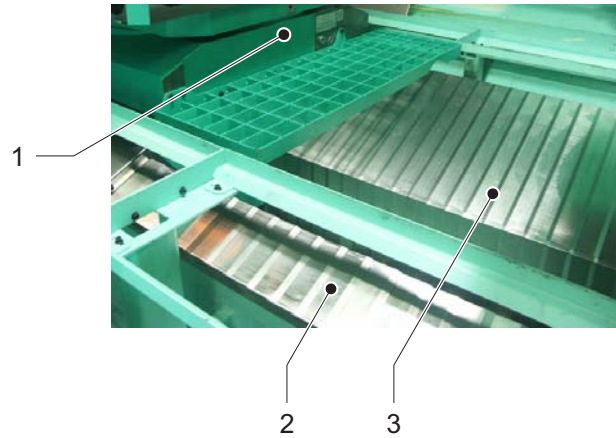
The steel wipers and the concertina covers steel flaps are sharp-edged.

Risk of gashes.

Wear gloves!

- Check all parts for wear and damage. Details are described as follows.
- If a part can no longer guarantee a sound function effect, call customer services.
Do not carry out this work yourself. Customer service ensures that no consequential damage can occur from penetrating chips and dirt and that all covers are resealed after the maintenance activity.

Check Z-axis concertina cover



4.12.2 - 1 Z-axis concertina cover, spindle side

- 1 Rotary table
- 2 Concertina cover on operating side
- 3 Concertina cover on tool change side

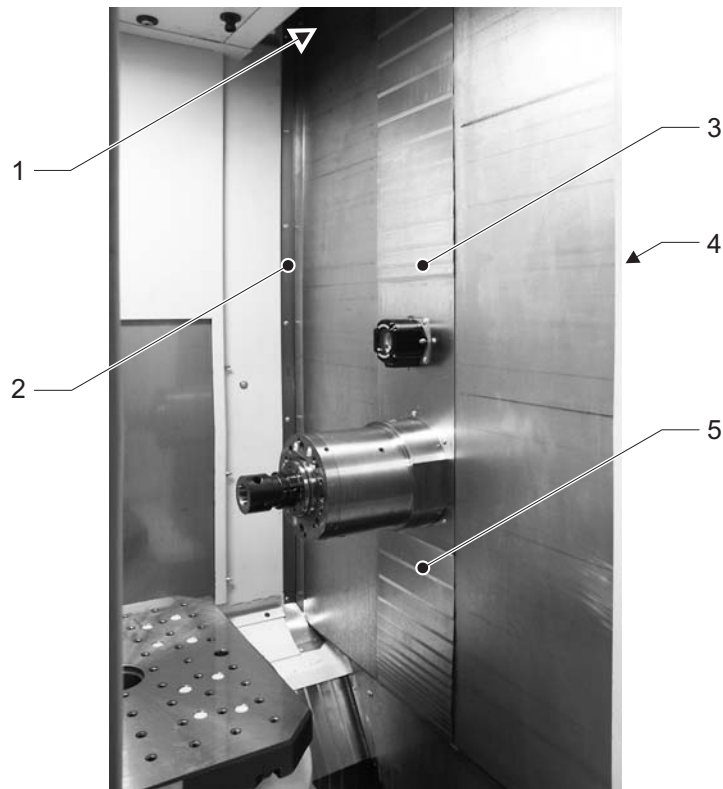


4.12.2 - 2 Z-axis concertina cover, front side

- 1 Concertina cover on tool change side
- 2 Concertina cover on operating side

Check all four concertina covers.

Check X and Y axis dirt wipers



4.12.2 - 3 Check X and Y axis dirt wipers

- 1 Wiper (Y-axis)
- 2 Wiper (X-axis, tool change side)
- 3 Wiper (Y-axis)
- 4 Operating side (X-axis wiper concealed)
- 5 Wiper (Y-axis)

- Check all wipers and concertina covers of the X and Y-axes for wear and damage.

Close

- Before closing the safety doors, ensure that nobody is behind the guard panels. Close the work area safety door and the workpiece setting station safety door (front door).
- Remove support from the machining unit.
- Before closing the safety door, ensure that nobody is behind the guard panels. Close maintenance area safety door.

4 **Inspection and maintenance****4.12** **Machine frame**

- Place a tool in the tool spindle to protect the tool spindle from the ingress of dirt.

4.12.3 Running cleaning stroke of linear axes

Interval	200 Hours Operating time
Component	Guide rails of X, Y and Z axes



Always run the cleaning strokes, regardless of the interval, if you want to shut down the machine for more than 8 hours so that no residues remain on the guide rails. This prevents wear on the dirt wipers and linear roller guides.

Run all three linear axes consecutively.

Procedure



If you move the linear axes by hand, watch out for danger of collision by workpiece, clamping fixture and tool.

- Motors are switched on.
- Run linear axes back and forth once over the entire stroke.
 - The dirt wipers on the runner blocks wipe the guide rails.
- Switch off motors.

4 Inspection and maintenance

4.12 Machine frame

4.12.4 Check emergency stop device

Interval 1000 Hours Operating time

Component EMERGENCY STOP button at all machine control panels

Procedure



Pressing the EMERGENCY STOP device while machining is in progress can cause tool breakage.

Only press EMERGENCY STOP if no tool is engaged.

Check each individual EMERGENCY STOP switch as follows:

- No machining program is running. All drives are stationary.
- Motors are switched on.
- Press the emergency stop button.
 - The motors are switched off.
 - The "Motors start" lamp goes out.
 - The "Emergency Stop" message appears on the main operator panel.

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If after pressing an EMERGENCY STOP key, the aforementioned events do not occur, operation of the machine must stop.

- Have the maintenance personnel check and repair the EMERGENCY STOP key.
-
- Release the emergency stop button.
 - Acknowledge "Emergency stop" message on the control.
 - The "Emergency stop" message disappears.

4 Inspection and maintenance

4.12 Machine frame

4.12.5 Checking quiet running of the machine

Interval 2000 Hours Operating time

Component Machine



Unusual noises indicate defects in machine parts, such as motors, bearings, gearboxes, guideways, tool spindles, ball screws and other components.

The machine operators are obliged to permanently monitor the quiet running of the machine, switch off the machine if unusual noises occur and must not continue to operate, which detects damage early and avoids consequential damage.

Procedure

- The machine is running in Automatic mode.
- Listen to the noises from the machine.
- If you hear unusual noises:
 - Locate the source of the noise.
 - Then switch off machine and secure to prevent being switched on again.
 - Repair damage yourself or have it repaired by customer services.

4 Inspection and maintenance

4.12 Machine frame

4.12.6 Checking completeness and condition of guard panels

Interval 1 Year(s) Real time

Component Guard panels of the machine and the provided units

- Procedure
- Machine switched on.
 - Check all safety doors:
 - Open safety door, reclose and lock.
 - The safety door must not be opened after locking.
 - Check electrically protected doors, if available, in the same way.
 - Rectify damage on the door locking immediately. Do not operate the machine with damaged door locking.
 - Check that the guard panels of the machine and the provided units are complete. All potentially dangerous machine movements must be covered by the guard panels.
 - Replace any missing guard panels components immediately. Contact Customer Services to order any missing components. Do not operate machine with incomplete guard panels.
 - Check the condition of guard panels. Pay particular attention to damage to the moving parts of the of the guard panels, such as safety doors and maintenance openings.
 - Check the work area screening is correctly sealed.
 - Rectify damage on guard panels immediately. Do not operate machine with damaged guard panels.

4 Inspection and maintenance

4.12 Machine frame

4.12.7 Cleaning the machine

Interval 1 Year(s) Real time



Reduce this interval depending on the contamination of the machine.

Component

Machine with all units and fittings

Aids

Recommended cleaning agents:

- Water-soluble cleaning concentrate which dissolves grease, diluted for basic cleaning and undiluted for heavily contaminated areas.
- For protective screens and screens: Glass cleaner.

The cleaning agent must have the following properties:

- No explosive mixtures must be allowed to form.
- They must not attack any of the machine elements, e.g. cables, connectors, seals, hose lines, plastic, paint, screens.
- Use products that least affect health and environment.

Other aids:

- Chip hook, broom, sweeping sheet
- Cloths, sponges, window leather
- Oil extractor

The following are not permissible:

- Compressed air and waste steam fixtures. These aids damage guideways and other machine components.
- Aggressive and scouring agents. These can attack plastic components, protective screens, screens and paint.



Cleaning agents may contaminate the cooling lubricant. Take the following precautions:

- Before cleaning:
 - Completely evacuate chips and circulating cooling lubricant.
 - Ensure that cleaning agent cannot enter the cooling lubricant supply.
- After cleaning: Completely remove cleaning agent collected in the machine bed, in the collection pans of attached components and in the drain channels before restarting up the machine.



Used oil, grease and cooling lubricants, contaminated cleaning solutions and contaminated cloths should be regarded as special waste and disposed of according to the locally applicable regulations.

Procedure



Having made all machine areas accessible, take the opportunity to check all the fluid equipment. Proceed as follows to avoid doubling work:



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.

Danger to life within the traversing range of the gantry loader.

Before climbing onto the machine, always move the portal loader to its parking position, switch off and secure to prevent it being switched on again.

Do not remove gantry loader padlock before end of work or before removing the ladder.

Proceed with caution if a tool is placed in the tool spindle whilst you are working within the work area.

- Adequate clearance in the machine.
Remove the bulky workpieces and clamping fixtures.
- Traverse Z-axis (rotary table) to centre of travel.
- A tool is inserted into the tool spindle to prevent the ingress of dirt.
- Machining unit traversed into support position.
- Tool change door opened using the individual function.
- Loading hatch closed.
- Gantry loader in parking position, switched off and secured against being switched on again.
- All safety doors open and secured to prevent closing.
- Electrically protected doors, if available, open and secured to prevent closing.

- Machine switched off at main switch and secured against being switched on again.
- Compressed air shut-off valve closed and secured to prevent opening.
- Maintenance openings open.
- Machining unit protected from falling by supports.
- Secure tool change door to prevent it from falling.
- Remove chips from the entire machine area using a broom or chip hook.
- Check all housings with oil filling for escaping oil.
 - Depending on the machine version, pay particular attention to the following components:
 - Rotary table lower part
 - Gear motors
 - Gear unit of machining unit
 - If components are not sealed, repair damage yourself or have it repaired by Customer Services. Do not operate machine with damaged equipment!
- Check all fluid equipment components for leakages and visible external damage.



For procedure, see:
"Inspection of fluid equipment" **page 272**

- Clean entire machine using cleaning solution.
- Rub dry blank, metallic surfaces and lightly rub with lubrication oil.
- On machines with "oil pan" option:
 - Exhaust and rub out the oil pan.
 - Check oil pan for leaks.
- Clean vision panels and screens using window cleaning agent.

4 Inspection and maintenance

4.12 Machine frame

- Prepare machine for operation:
 - Remove support from the tool change door.
 - Remove support from the machining unit.
 - Before closing the maintenance openings and safety doors, ensure that nobody is behind the guard panels. Close safety doors and maintenance openings.
 - Open compressed air shut-off valve.
 - Switch the machine on.
 - Close tool change door using the individual function.
 - Remove gantry loader padlock.

4.12.8 Inspection of fluid equipment

Interval	1 Year(s) Real time
Component	All components of the cooling, hydraulic, central lubrication, pneumatic and cooling lubricant equipment

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These tests are best performed as part of the machine's basic cleaning routine, as all machine areas must be made accessible for both activities. This avoids doubling work.



For the best sequence in which to proceed, see:
"Cleaning the machine" **page 268**

Further documents



For structure of the cooling unit, see the media diagram (MP).
For structure of the hydraulic system, see media diagram (MP).
For structure of the central lubrication system, see media diagram (MP).
For structure of the pneumatic system, see media diagram (MP).
For structure of the cooling lubricant system, see the media diagram (MP).

Procedure



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.

Danger to life within the traversing range of the gantry loader.

Before climbing onto the machine, always move the portal loader to its parking position, switch off and secure to prevent it being switched on again.

Do not remove gantry loader padlock before end of work or before removing the ladder.

Proceed with caution if a tool is placed in the tool spindle whilst you are working within the work area.

- Machining unit traversed into support position.
- Loading hatch closed.

4 Inspection and maintenance

4.12 Machine frame

- Gantry loader in parking position, switched off and secured against being switched on again.
- All safety doors open and secured to prevent closing.
- Electrically protected doors, if available, open and secured to prevent closing.
- Machine switched off at main switch and secured against being switched on again.
- Compressed air shut-off valve opened.
- Maintenance openings open.
- Machining unit protected from falling by supports.



4.12.8 - 1 Start-up valve
1 Hand actuator

- To check the pneumatic equipment, open the air supply on the start-up valve (next to the maintenance unit): push in hand actuator using a screwdriver and turn to the right.

- Check all fluid equipment components for leakages and visible external damage:
 - Storage containers
 - Pumps and units
 - Pipes and hoses
 - Duct unions
 - Filters and regulators
 - Flow monitors and pressure switches
 - Cylinders and valves
- Repair leakages and damage immediately. Do not operate machine with damaged equipment!
- Close air supply on the directional control valve: Remove screwdriver.
- Remove support from the machining unit.
- Before closing the safety doors, maintenance doors and maintenance openings, ensure that nobody is behind the guard panels. Close safety doors, maintenance doors and maintenance openings.
- Remove gantry loader padlock.

4 Inspection and maintenance

4.12 Machine frame

4.12.9 Checking linear roller guides and axis drives

Interval 2000 Hours Operating time

Component Linear roller guides and axis drives for the X-, Y- and Z-axes

Spare part Guide carriages of the X, Y and Z-axis with integrated seal and outer seal.



See wearing and spare parts list (VS).
The Wear Parts List contains the factory-mounted cover strips.
These are loose cover strips, tightly fitted and 0.30 mm thick.

Aids For raising and attaching the cover strips of the guide rails: Assembly aid lifting plate according to the installation instructions of Messrs. Bosch Rexroth.

Further documents



For installation instructions on replacing cover strips and wipers, see Subsupplier's Information (ZI) from "Bosch Rexroth".



For lube points, see media diagram (MP).

Procedure

Make axes accessible



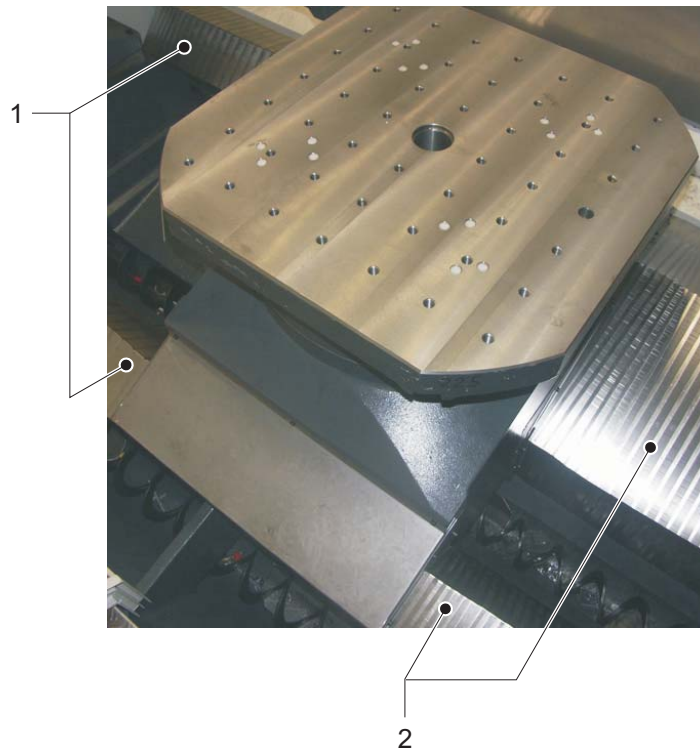
Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.

- Adequate clearance in the machine.
Remove the bulky workpieces and clamping fixtures.
- There should be no tool in the tool spindle.
- Traverse Z-axis (rotary table) to centre of travel.
- Machining unit traversed into support position.
- Loading hatch closed.
- Workpiece setting station safety door (front door) opened.

4 Inspection and maintenance

4.12 Machine frame

- Work area safety door open and secured to prevent closing.
- Maintenance area safety door opened and secured to prevent closing.
- Machine switched off at main switch and secured against being switched on again.
- Compressed air shut-off valve closed and secured to prevent opening.
- Maintenance openings B open. (Only with chain magazine)
- Maintenance door of the tool magazine opened. (Only applicable with rack-type magazine)
- Machining unit protected from falling by supports.



4.12.9 - 1 Z-axis concertina

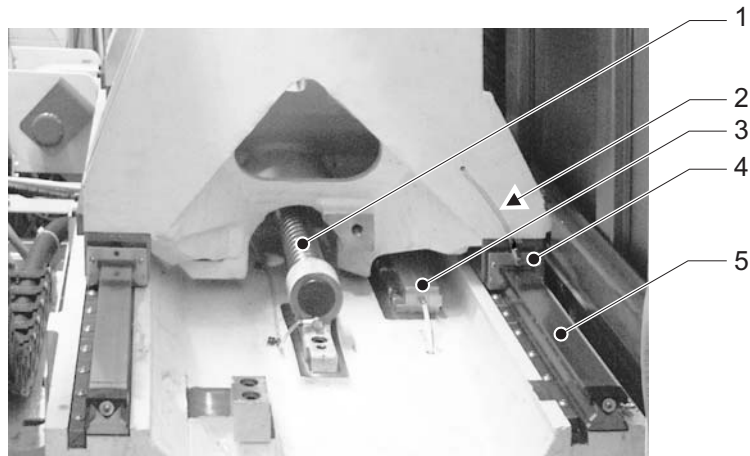
- 1 Concertina covers on the left side of the rotary table
- 2 Concertina covers on the spindle side of the rotary table

- Unscrew all 4 concertina covers of the Z-axis from the rotary table and push away.

Inspections

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Where visible, check the components from all sides. One side of the X-axis is shown here as an example.



4.12.9 - 2 View onto machine bed, column and the X-axis drive and guide element

- 1 Ball screw
- 2 Lubrication line
- 3 Measuring scale
- 4 Runner block
- 5 Guide rail

- Remove chips from around the guide rails, ball screw drives and measuring scales.
- Check lubrication of guideways and ball screw drives:
 - Are the surfaces of the guide rails and the ball screws covered with an oil film?
 - Are the lubrication lines and the connections intact?
 - Check lubrication supply in case of signs of dry running. Replace damaged components or have them replaced by Customer Service.



CAUTION

The edges and ends of the cover strips are sharp.
Risk of gashes.
Wear gloves!

- ☒ Inspect the rails to check that:
 - The cover strip on the top of the guide rail must be engaged into the guide rail groove over the entire length on both sides. The ends must be flush at the top and the front of the guide rail.
 - Check guide rail and cover strip for damage.
- ☒ Align an incorrectly seated cover strip according to the installation instructions of Messrs. Bosch Rexroth.
- ☒ In the event of damage, shut down the machine. Call customer service. Do not operate machine with damaged guide!
Indentations, scoring, scratches and discolouration indicate a faulty runner block. Guide rail/cover strip and both runner blocks must be replaced if any of these appear.
- ☒ Check wipers on runner block for penetrated swarf.
If chips have penetrated or the wiper is damaged, replace the complete sealing set.
- ☒ Clean guide and drive elements. Do not use compressed air! Lightly oil the running surfaces.

Prepare machine for operation

- ☒ Screw concertina cover to rotary table.
- ☒ Remove support from the machining unit.
- ☒ Before closing the safety doors and maintenance openings, ensure that nobody is behind the guard panels.
Close safety doors and maintenance openings.
- ☒ Open compressed air shut-off valve.
- ☒ Switch the machine on.
- ☒ Traverse Z-axis to and fro over the entire stroke and check that the concertina covers are running smoothly.
- ☒ Place a tool in the tool spindle to protect the tool spindle from the ingress of dirt.

Switch off motors.

4 Inspection and maintenance

4.12 Machine frame

4.12.10 Checking safety pane of work area safety door

Interval 200 Hours Operating time



The safety pane consists of polycarbonate, which is protected on the inside by single-layer safety glass and on the outside by blown film. Polycarbonate ages and becomes brittle under the influence of cooling lubricant vapours, cleaning agents and oils, which reduces its impact resistance. It is not possible to see this embrittlement!

In order to protect persons in the machine surroundings, check the safety pane regularly and replace if damaged.

Component Safety pane of work area safety door

Aids Glass cleaner. No aggressive or scouring agents.
Window leather.

Procedure



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.

Exercise caution when working inside the machine with the machining unit not secured!

- The linear axes are positioned so as to make the inside of the work area safety door easily accessible.
 - Z-axis (rotary table) away from the machining unit.
 - Y-axis (Machining unit) down.
 - X-axis (Frame) to the tool change door.
- Loading hatch closed.
- Work area safety door open and secured to prevent closing.

4 Inspection and maintenance

4.12 Machine frame

- Clean the safety pane.
Take the opportunity to check vision panels and screens for contamination. Keep the vision panels and screens of the machine clean to prevent dirt from clinging.
- Check the inside of the safety pane for cracks. Surface scratches are permissible.
- Check whether cooling lubricant has penetrated between the glass and the polycarbonate layer.
- Check the outside of the blown film for cracks and scratches.
- If the inside and outside of the polycarbonate pane are no longer perfectly sealed and protected from aggressive mediums, replace the safety pane.



For procedure, see:
"Replacing safety pane of work area safety door" **page 284**

- Before closing the safety door, ensure that nobody is behind the guard panels.
Close and lock the work area safety door.
- Switch off motors.

4.12.11 Replacing safety pane of work area safety door

Interval 8 Year(s) Real time



The safety pane consists of polycarbonate, which is protected on the inside by single-layer safety glass and on the outside by blown film. Polycarbonate can age and become brittle, which reduces its impact resistance. It is not possible to see this embrittlement!

In order to protect persons in the machine surroundings, we recommend to replace the safety pane after eight years as a precautionary measure.

Component Safety pane of work area safety door

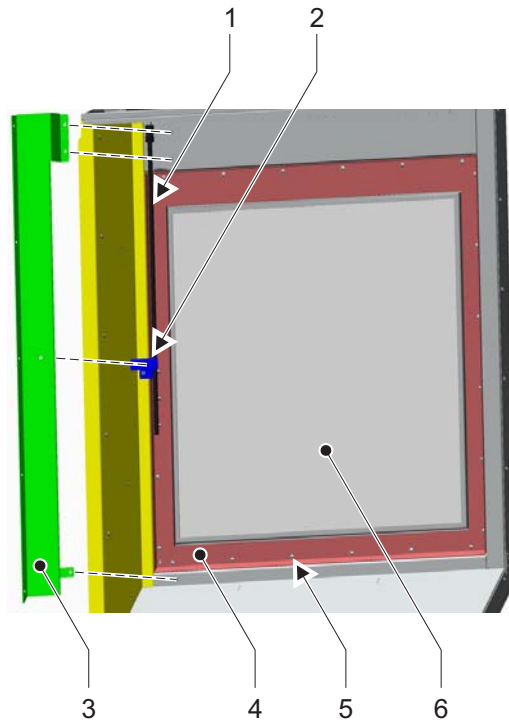
Spare part
Safety pane
Sealing strip
Joint sealant (Polyether to DIN 18545)



See wearing and spare parts list (VS).

Procedure

Removing safety pane



4.12.11 - 1 Inside of work area safety door

- 1 Screen blow-off device (behind the cover plate)
- 2 Retaining angle of screen blow-off device
- 3 Cover plate
- 4 Retaining plate
- 5 Flange head screw
- 6 Safety pane



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.

Exercise caution when working inside the machine with the machining unit not secured!



The work area safety room is monitored by a bi-stable safety switch. With "Main switch off" and "Work area safety door open", the work area safety door will not lock when you close the safety door.

- There should be no tool in the tool spindle.

- The linear axes are positioned so as to make the inside of the work area safety door easily accessible.
 - Z-axis (rotary table) away from the machining unit.
 - Y-axis downwards.
 - X-axis to the tool change door.
- Loading hatch closed.
- Compressed air shut-off valve closed and secured to prevent opening.
- Unlock and open the work area safety door.
- Switch off machine at main switch and secure against being switched on again.
- Check the function of the safety switch by closing and then re-opening the work area safety door.

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If the work area safety door can no longer be opened, the safety switch is faulty.

Do not continue to operate the machine if the safety safety switch is faulty.

- Have the maintenance personnel check and repair the safety switch.
-
- Unscrew cover plate to make the duct union of the air supply and all fixings of screen blow-off device accessible.
 - Unscrew and remove screen blow-off device.
 - Remove flange-head screws from retaining plate.
 - Remove retaining plate carefully to prevent the safety pane from falling out.
 - Push the safety pane out of the door frame towards the work area.
 - Remove used sealing band from retaining plate and joint sealant residues from door frame.

Installing safety pane

- Fit new sealing band to retaining plate.
- Apply joint sealant to the entire door frame. Distance from window opening: 3 to 4 cm.
- Place new safety pane in door frame and press into joint sealant.

4 Inspection and maintenance

4.12 Machine frame

- Mount retaining plate.
- Secure retaining plate with flange-head screws.
- Connect the screen blow-off device to the air supply and fix to the retaining plate using retaining angles.
- Mount cover plate and tighten.

Close

- Before closing the work area safety door, ensure that nobody is behind the guard panels.
Close work area safety door.
- Open compressed air shut-off valve.
- Turn on machine on at the main switch.
- The work area safety door is locked.
- Switch on motors.
- Place a tool in the tool spindle to protect the tool spindle from the ingress of dirt.
- Switch off motors.

4.12.12 Checking safety pane of the workpiece setting station safety door (front door)

Interval 200 Hours Operating time



The safety pane consists of polycarbonate, which is protected on the inside by single-layer safety glass and on the outside by blown film. Polycarbonate ages and becomes brittle under the influence of cooling lubricant vapours, cleaning agents and oils, which reduces its impact resistance. It is not possible to see this embrittlement!

In order to protect persons in the machine surroundings, check the safety pane regularly and replace if damaged.

Component Safety pane of the workpiece setting station safety door (front door)

Aids Glass cleaner. No aggressive or scouring agents.
Window leather.

Procedure



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.

Exercise caution when working inside the machine with the machining unit not secured!

- The linear axes are positioned so as to make the inside of the work area safety door easily accessible.
 - Z-axis (rotary table) away from the machining unit.
 - Y-axis (Machining unit) down.
 - X-axis (Frame) to the tool change door.
- Loading hatch closed.
- Workpiece setting station safety door (front door) opened.

4 Inspection and maintenance

4.12 Machine frame

- Clean the safety pane.
Take the opportunity to check vision panels and screens for contamination. Keep the vision panels and screens of the machine clean to prevent dirt from clinging.
- Check the inside of the safety pane for cracks. Surface scratches are permissible.
- Check whether cooling lubricant has penetrated between the glass and the polycarbonate layer.
- Check the outside of the blown film for cracks and scratches.
- If the inside and outside of the polycarbonate pane are no longer perfectly sealed and protected from aggressive mediums, replace the safety pane.



For procedure, see:

"Replacing safety pane of the workpiece setting station safety door (front door)" **page 290**

- Before closing the safety door, ensure that nobody is behind the guard panels.
Close and lock the workpiece setting station safety door (front door).
- Switch off motors.

4.12.13 Replacing safety pane of the workpiece setting station safety door (front door)

Interval 8 Year(s) Real time



The safety pane consists of polycarbonate, which is protected on the inside by single-layer safety glass and on the outside by blown film. Polycarbonate can age and become brittle, which reduces its impact resistance. It is not possible to see this embrittlement!

In order to protect persons in the machine surroundings, we recommend to replace the safety pane after eight years as a precautionary measure.

Component Safety pane of the workpiece setting station safety door (front door)

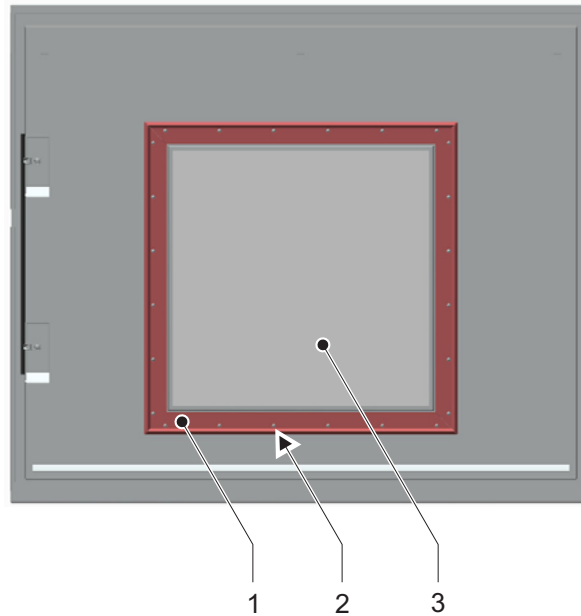
Spare part
Safety pane
Sealing strip
Joint sealant (Polyether to DIN 18545)



See wearing and spare parts list (VS).

Procedure

Removing safety pane



4.12.13 - 1 Inside of workpiece setting station safety door (front door)

- 1 Retaining plate
- 2 Flange head screws
- 3 Safety pane



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.

Exercise caution when working inside the machine with the machining unit not secured!

i

The workpiece setting station safety door (front door) is monitored by a bi-stable safety switch. With "Main switch off" and "Workpiece setting station safety door (front door) open", the workpiece setting station safety door (front door) will not lock when you close the safety door.

- There should be no tool in the tool spindle.
- Loading hatch closed.
- Compressed air shut-off valve closed and secured to prevent opening.

?

- Workpiece setting station safety door (front door) opened.
- Switch off machine at main switch and secure against being switched on again.
- Check the function of the safety switch by closing and then re-opening the workpiece setting station safety door (front door).

If the workpiece setting station safety door (front door) can no longer be opened, the safety switch is faulty.
Do not continue to operate the machine if the safety safety switch is faulty.

- Have the maintenance personnel check and repair the safety switch.
-

- Remove flange-head screws from retaining plate.
- Remove retaining plate carefully to prevent the safety pane from falling out.
- Push the safety pane out of the door frame towards the work area.
- Remove used sealing band from retaining plate and joint sealant residues from door frame.

Installing safety pane

- Fit new sealing band to retaining plate.
- Apply joint sealant to the entire door frame. Distance from window opening: 3 to 4 cm.
- Place new safety pane in door frame and press into joint sealant.
- Mount retaining plate.
- Secure retaining plate with flange-head screws.

Close

- Before closing the safety door, ensure that nobody is in the work area.
Close workpiece setting station safety door (front door).
- Open compressed air shut-off valve.
- Turn on machine on at the main switch.
 The work area safety door is locked.
- Switch on motors.

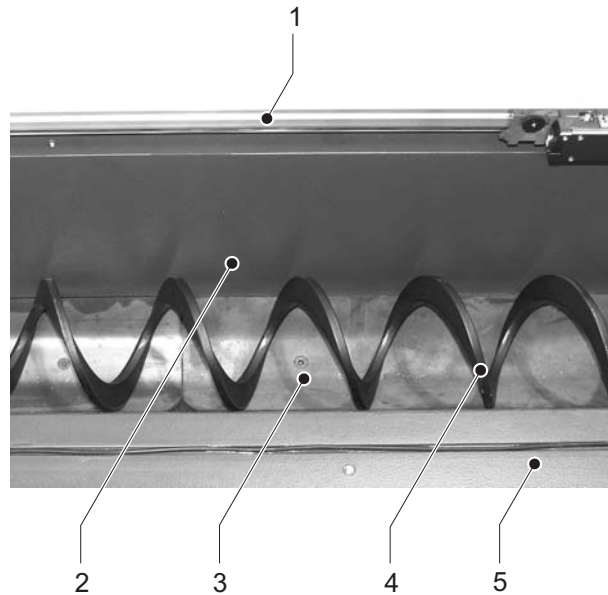
4 **Inspection and maintenance****4.12** **Machine frame**

- Place a tool in the tool spindle to protect the tool spindle from the ingress of dirt.

4.12.14 Check conveyor helixes and slide rails for wear

Interval 2 Year(s) Real time

Component Conveyor helixes and slide rails in machine bed



4.12.14 - 1 View towards the conveyor channel

- 1 Z-axis measuring scale
- 2 Conveyor channel
- 3 Slide rails
- 4 Conveyor helix
- 5 Machine bed

i

The 3 conveyor helices that transport the chips out of the work area are located on slide rails, which are screwed onto the conveyor channel.

Certain types of chips may cause shrinkage of slide rails and conveyor helices over the years, despite of their robust material. Replace the parts in good time. Wear limit is reached at the latest when the thickness of a slide rail decreases to 2 mm at the thinnest point. Always replace the entire set, conveyor helices and slide rails.

The following inspection is best carried out when the machine undergoes its annual basic cleaning.

4 Inspection and maintenance

4.12 Machine frame

Spare part



For slide rails and conveyor helixes, see wear and spare parts list. (VS).

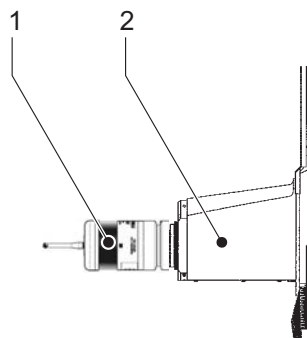
Procedure



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.

- Loading hatch closed.
- There should be no tool in the tool spindle.
- Z-axis moved away from the machining unit into end position.
- Machining unit traversed into support position.
- Work area safety door open and secured to prevent closing.
- Maintenance area safety door opened and secured to prevent closing.
- Machine switched off at main switch and secured against being switched on again.
- Machining unit protected from falling by supports.
- Conveyor channel covers unscrewed.
- Check slide rails and conveyor helixes in the conveyor channels for wear.
- Prepare machine for operation. Move Z-axis to the machining unit, and check the side behind the rotary table in the same way.
- Worn conveyor helixes and slide rails shall be replaced by the customer service.
- Remove support from the machining unit.
- Before closing the safety doors, ensure that nobody is behind the guard panels. Close the work area safety door and the maintenance area safety door
- Switch the machine on.
- Place a tool in the tool spindle to protect the tool spindle from the ingress of dirt.
- Switch off motors.

4.13 Measuring Probe (option)



4.13 - 1 Machining unit with measuring probe

- 1 Measuring probe
- 2 Tool spindle

4 Inspection and maintenance

4.13 Measuring Probe (option)

4.13.1 Cleaning and checking measuring probe

Interval 1000 Hours Operating time

Component Measuring probe



4.13.1 - 1 Measuring probe

1 Cover, outer diaphragm behind

2 Tool shank

Aids Container with caustic sodas

Further documents



For manufacturer's documentation containing spare parts data, see Subsuppliers' Information (ZI) from "Renishaw".

Procedure

- Measuring probe removed from the machine.
- Clean tool shank and check for wearing:
 - Clean hollow shaft and flat location, remove swarf. Check hollow shaft and flat location for grooves, scratches and rust spots.
 - Replace worn components.
- Check outer diaphragm for visual damage. Replace damaged diaphragm in accordance with the manufacturer's instructions.

CHAPTER 5

Maintenance on account of messages

5 Maintenance on account of messages

5.1 Notes to the following Maintenance Instructions

Important supply functions are monitored	Some components of the machine's fluid system are monitored electrically. This is achieved, for example, by float switches in fluid containers or differential pressure measuring devices on filters. If, during operation, a measured value exceeds the set limit value or switching point, an error message appears on the main operator panel.
Error messages	Error messages are messages that cause the machine to be shut down since safe operation can no longer be guaranteed. The error must therefore be eliminated immediately. The machine must not be operated again until the error is eliminated!
Pre-warnings	Pre-warnings are maintenance requests that do not cause the machine to shut-down immediately. Rectify the cause of the message as quickly as possible! This will prevent the next limit being exceeded, an error message being generated and the machine being shut down.
Skilled maintenance is vital	Inadequate or improper maintenance can cause equipment failures and affect the operating safety and durability of the machine. It is recommended that maintenance is carried out only by trained personnel.
Warranty limits	The contractually agreed warranty does not relieve the machine owner of the obligation to rectify errors immediately. HELLER shall not be responsible for damage caused by inadequate maintenance.

5 Maintenance on account of messages
5.1 Notes to the following Maintenance Instructions



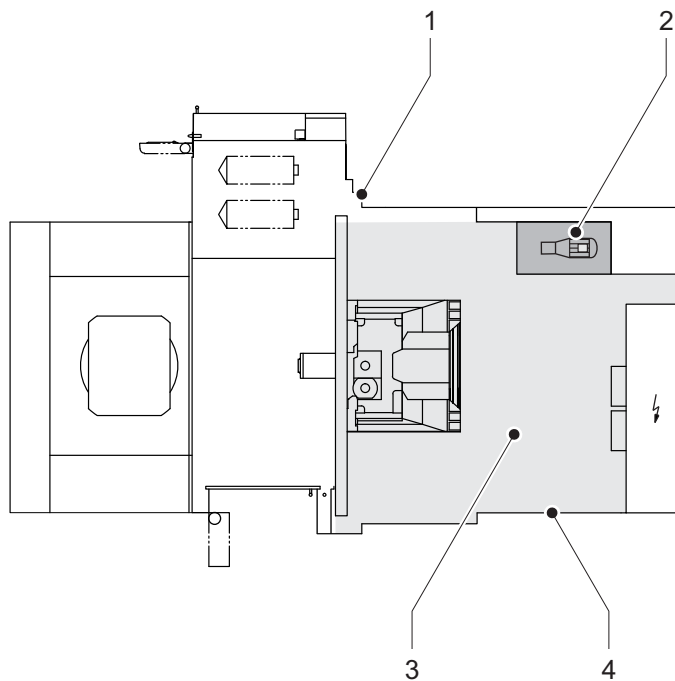
Whenever maintenance work is carried out, the instructions in the Chapter on "Safety" in these Maintenance Instructions and the applicable safety regulations must always be followed and strictly adhered to!

Observe particularly the instructions in Section 4.2. This Chapter describes preparatory and conclusive safety measures for work in the danger zone of movable machine parts and automatically operated devices.

Division of sub-Chapters

The following maintenance instructions are categorised into functional and main assembly groups. The headlines for the individual maintenance items are reflected in the message text.

5.2 Hydraulic system



5.2 - 1 Schematic representation of the machine

- 1 Maintenance opening B
- 2 Fluid module 1 with hydraulic unit(HELP 1)
- 3 Maintenance area
- 4 Maintenance area safety door

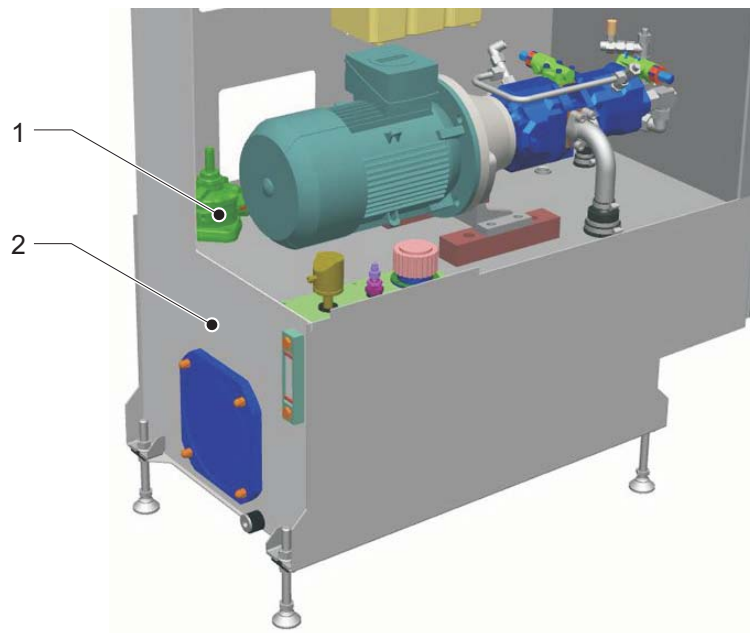
5 Maintenance on account of messages

5.2 Hydraulic system

5.2.1 Hydraulic filter 75% clogged

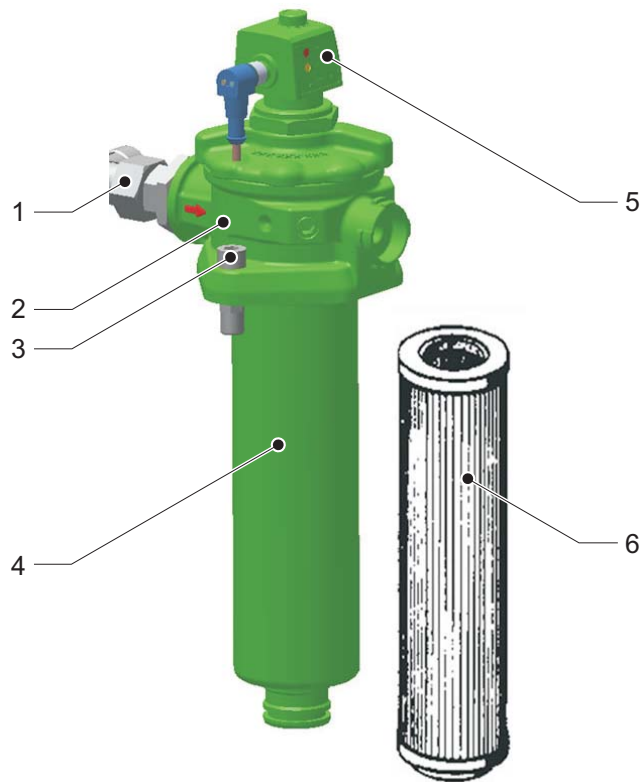
Component Return line filter

Action Replacing return line filter element



5.2.1 - 1 Hydraulic unit on the fluid module (HELP 1)

- 1 Return line filter
- 2 Hydraulic reservoir



5.2.1 - 2 Return line filter

- 1 Feed line connector
- 2 Filter top
- 3 Screws (2 x)
- 4 Filter pot
- 5 Electrical clogging indicator
- 6 Filter element

Spare part

Filter element

Set of seals



See wearing and spare parts list (VS).



Contaminated filter elements must be regarded as hazardous waste and disposed of according to the locally applicable regulations.

Aids

Container with substitute petroleum

5 Maintenance on account of messages

5.2 Hydraulic system

Further documents



For manufacturer's documentation on the return line filter, see Subsuppliers' Information (ZI) from "Bosch Rexroth".



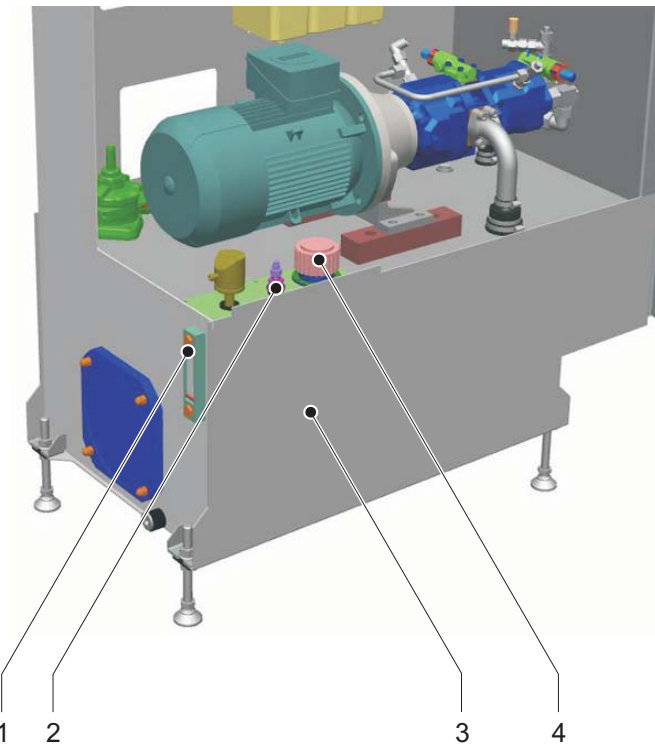
For structure of the hydraulic system, see media diagram (MP).

Procedure

- Machine switched off at main switch and secured against being switched on again.
- Undo the connection on the oil feed line and pull feed line from the return filter.
- Remove the two screws.
- Take filter head with attached filter element out of the filter pot.
- Pull filter element off the filter head by gentle movements to and fro.
- Remove filter pot from the hydraulic reservoir.
- Wash filter pot in substitute petroleum.
- Mount new filter element onto the filter head.
- Check R-ring seal on filter pot for damage. Replace damaged O-ring.
- Insert filter pot and filter head with filter element into the hydraulic reservoir.
- Attach oil line to the return filter and screw tight.
- Insert screws and tighten.
- Switch the machine on.
- Start machining program
- Check return line filter for leakage.

5.2.2 Hydraulic oil fill level pre-warning

Component	Hydraulic unit
Action	Check hydraulic equipment for tightness, replenish oil



5.2.2 - 1 Hydraulic unit

- 1 Oil level indicator
- 2 Filling level switches
- 3 Hydraulic reservoir
- 4 Filling strainer

i

The hydraulic cycle is a closed system where only little of the hydraulic oil may be lost through leakage. Substantial oil loss indicates leakage.



Leakage oil can damage your equipment and the environment.

5 Maintenance on account of messages

5.2 Hydraulic system

Consumable

Hydraulic oil HLP 46 to DIN 51524, Part 2 (ISO-L-HM 46 to ISO 6743, Part 4)
Purity class ISO 4406-18/16/13



Disimilar lubricants can contain various additives that might not be compatible. To rule out incompatibility between the lubricants, disimilar lubricants must not be mixed.

If you have any questions, please contact your lubricant supplier.

Further documents



For structure of the hydraulic system, see media diagram (MP).

Procedure

Inspection of hydraulic equipment



Please observe chapter 4.2 "Special safety measures" when entering or leaving the machine.

Danger to life within the traversing range of the gantry loader.

Before climbing onto the machine, always move the portal loader to its parking position, switch off and secure to prevent it being switched on again.

Do not remove gantry loader padlock before end of work or before removing the ladder.

Proceed with caution if a tool is placed in the tool spindle whilst you are working within the work area.

- Machining unit traversed into support position.
- Loading hatch closed.
- Gantry loader in parking position, switched off and secured against being switched on again.
- Maintenance area safety door opened and secured to prevent closing.
- Work area safety door open and secured to prevent closing.
- Machine switched off at main switch and secured against being switched on again.

- Compressed air shut-off valve closed and secured to prevent opening.
- Machining unit protected from falling by supports.
- Check all equipment components for leakages and visible external damage:
 - Hydraulic reservoir
 - Pipes and hoses
 - Duct unions
 - Pumps
 - Hydraulic blocks
 - Filters
 - Valves
 - Pressure switches
 - Cylinders
- Repair leakages and damage immediately. Do not operate machine with damaged equipment!
- Remove support from the machining unit.
- Before closing the maintenance openings, ensure that nobody is behind the guard panels. Close maintenance openings.
- Before closing the safety doors, ensure that nobody is behind the guard panels.
Close and lock the work area safety door and the maintenance area safety door.
- Open compressed air shut-off valve.

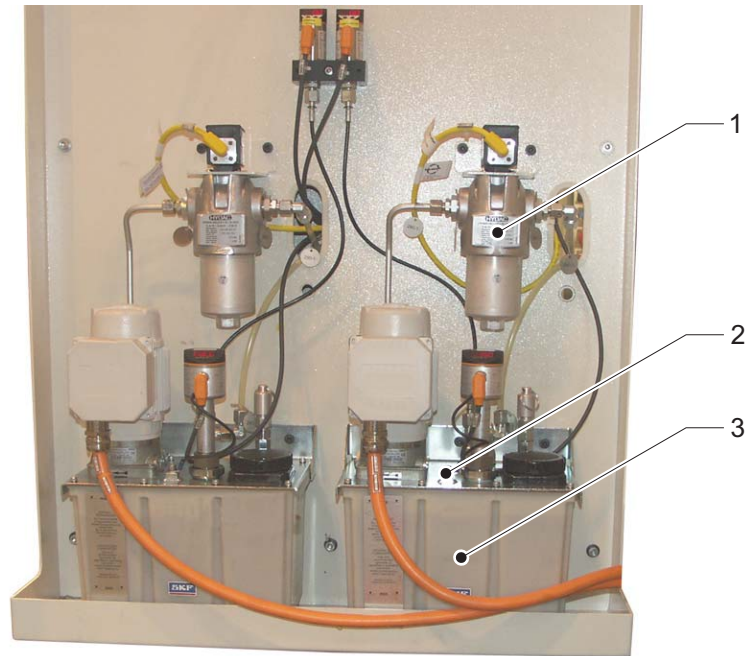
Filling oil

- Screw off filling strainer cap.
- Fill with oil through filling opening in filler filter up to the max. mark on the oil level indicator.
- Screw down the filter cap of the filling strainer.
- Turn on machine on at the main switch.
- Switch on motors.
 - ↻ The hydraulic unit will run.
- Run machine for a few minutes.
- Check hydraulic reservoir for leakage.

5 Maintenance on account of messages**5.2 Hydraulic system**

- Check oil level at the oil level indicator. Fill with oil up to maximum mark.
- Remove gantry loader padlock.

5.3 Central lubrication 1

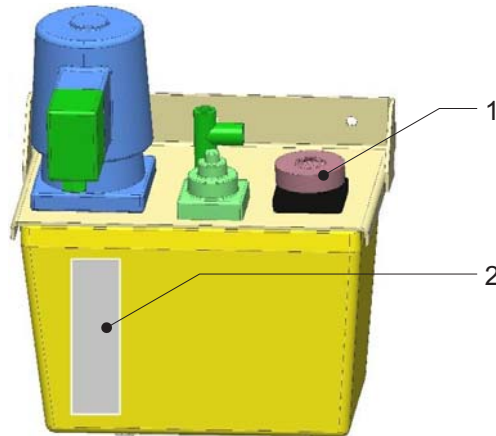


5.3 - 1 Components of central lubrication 1

- 1 Pressure filter
- 2 Lubrication unit 1
- 3 Container of lubrication unit 1

5.3.1 Fill level lubricant tank 1 pre-warning

Component	Lubrication unit
Action	Topping up oil in the lubrication unit tank



5.3.1 - 1 Lubrication unit

1 Locking lid

2 Plate with marks for maximum and minimum oil level

i

The lubrication circuit is an open system. The useable capacity of the lubrication container is adequate for at least 400 operating hours.

Consumable

Lubrication oil CLP 68 acc. to DIN 51517, part 3 (ISO-L-CKC 68 acc. to ISO 6743, part 6)
Purity class ISO 4406-18/16/13
Container capacity 6 l

i

Disimilar lubricants can contain various additives that might not be compatible. To rule out incompatibility between the lubricants, disimilar lubricants must not be mixed.
If you have any questions, please contact your lubricant supplier.

Further documents

For manufacturer's documentation on the lubrication unit, see Subsuppliers' Information (ZI) from "SKF".



For structure of the central lubrication system, see media diagram (MP).

Procedure

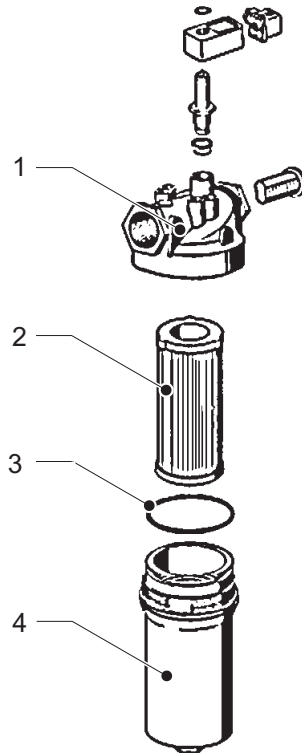
- Unscrew locking lid.
- Check the sieve in the filling opening for contamination and clean if necessary.
- Fill with oil through opening until the level reaches the maximum mark.
- Secure locking lid.

5 Maintenance on account of messages

5.3 Central lubrication 1

5.3.2 Filter lubrication 1 75% clogged

Component	Pressure filter
Action	Replace filter element of the pressure filter



5.3.2 - 1 Pressure filter
 1 Filter top
 2 Filter element
 3 O-ring (sealing set)
 4 Filter pot

Spare part	Filter element Set of seals
-------------------	--------------------------------



See wearing and spare parts list (VS).



Contaminated filter elements must be regarded as hazardous waste and disposed of according to the locally applicable regulations.

Aids	Container for collecting the oil in the pressure filter Container with substitute petroleum for cleaning the filter pot.
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5 Maintenance on account of messages

5.3 Central lubrication 1

Further documents



For manufacturer's documentation on the pressure filter, see Subsuppliers' Information (ZI) from "Bosch Rexroth".

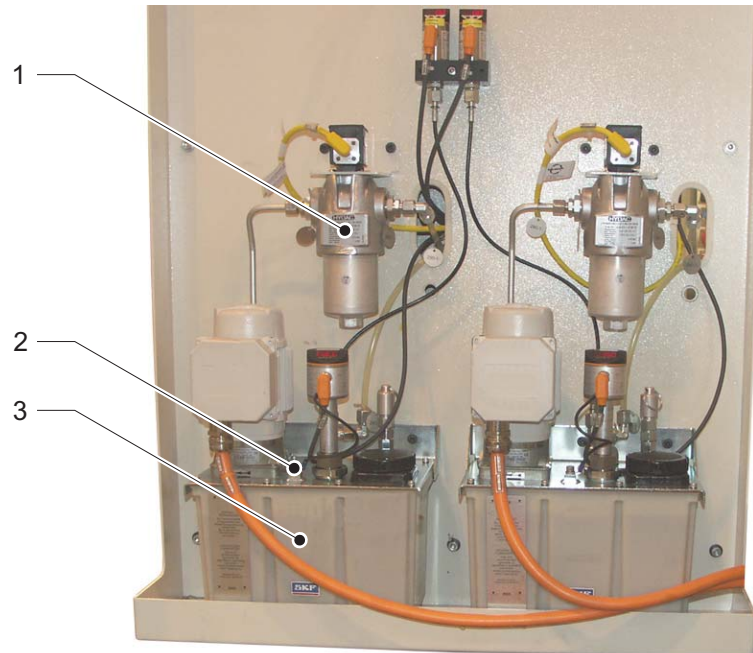


For structure of the central lubrication system, see media diagram (MP).

Procedure

- Machine switched off at main switch and secured against being switched on again.
- Hold ready container for collecting the oil in the pressure filter.
- Unscrew filter pot.
- Wash filter pot in substitute petroleum.
- Pull filter element downwards by slight forwards and backwards movements.
- Check O-ring for damage. Replace damaged components.
- Re-position new filter element at the mounting pin by a gentle rotation movement.
- Moisten thread and O-ring seal of filter pot with clean lubrication oil.
- Screw filter pot into the filter head far as it will go and tighten to 50 Nm of torque.
- Turn on machine on at the main switch.
- Switch on motors.
 - ↪ The lubrication unit will run.
- Check pressure filter for leakage.
- Switch off motors.

5.4 Central lubrication 2

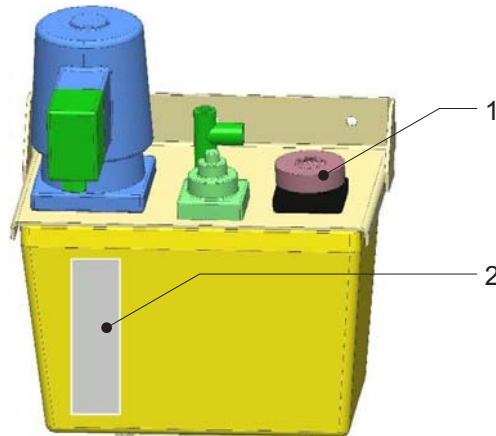


5.4 - 1 Components of central lubrication 2

- 1 Pressure filter
- 2 Lubrication unit 2
- 3 Container of lubrication unit 2

5.4.1 Fill level lubricant tank 2 pre-warning

Component	Lubrication unit
Action	Topping up oil in the lubrication unit tank



5.4.1 - 1 Lubrication unit

1 Locking lid

2 Plate with marks for maximum and minimum oil level

i

The lubrication circuit is an open system. The useable capacity of the lubrication container is adequate for at least 400 operating hours.

Consumable

Lubrication oil CLP 68 acc. to DIN 51517, part 3 (ISO-L-CKC 68 acc. to ISO 6743, part 6)
Purity class ISO 4406-18/16/13
Container capacity 6 l

i

Disimilar lubricants can contain various additives that might not be compatible. To rule out incompatibility between the lubricants, disimilar lubricants must not be mixed.
If you have any questions, please contact your lubricant supplier.

Further documents

For manufacturer's documentation on the lubrication unit, see Subsuppliers' Information (ZI) from "SKF".



For structure of the central lubrication system, see media diagram (MP).

Procedure

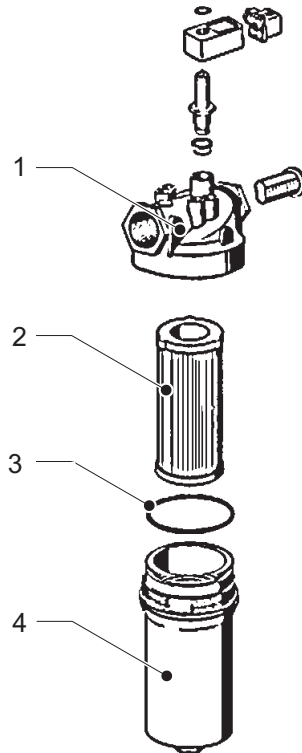
- Unscrew locking lid.
- Check the sieve in the filling opening for contamination and clean if necessary.
- Fill with oil through opening until the level reaches the maximum mark.
- Secure locking lid.

5 Maintenance on account of messages

5.4 Central lubrication 2

5.4.2 Filter lubrication 2 75% clogged

Component	Pressure filter
Action	Replace filter element of the pressure filter



5.4.2 - 1 Pressure filter

- 1 Filter top
- 2 Filter element
- 3 O-ring (sealing set)
- 4 Filter pot

Spare part	Filter element Set of seals
-------------------	--------------------------------



See wearing and spare parts list (VS).



Contaminated filter elements must be regarded as hazardous waste and disposed of according to the locally applicable regulations.

Aids	Container for collecting the oil in the pressure filter Container with substitute petroleum for cleaning the filter pot.
-------------	---

5 Maintenance on account of messages

5.4 Central lubrication 2

Further documents



For manufacturer's documentation on the pressure filter, see Subsuppliers' Information (ZI) from "Bosch Rexroth".

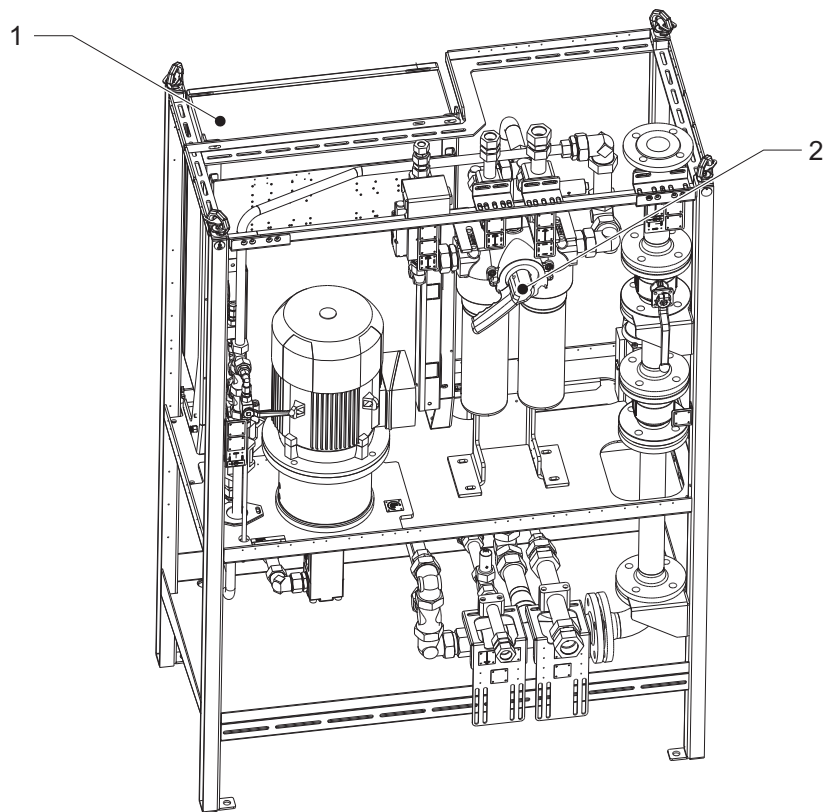


For structure of the central lubrication system, see media diagram (MP).

Procedure

- Machine switched off at main switch and secured against being switched on again.
- Hold ready container for collecting the oil in the pressure filter.
- Unscrew filter pot.
- Wash filter pot in substitute petroleum.
- Pull filter element downwards by slight forwards and backwards movements.
- Check O-ring for damage. Replace damaged components.
- Re-position new filter element at the mounting pin by a gentle rotation movement.
- Moisten thread and O-ring seal of filter pot with clean lubrication oil.
- Screw filter pot into the filter head far as it will go and tighten to 50 Nm of torque.
- Turn on machine on at the main switch.
- Switch on motors.
 - ↪ The lubrication unit will run.
- Check pressure filter for leakage.
- Switch off motors.

5.5 Cooling lubricant system

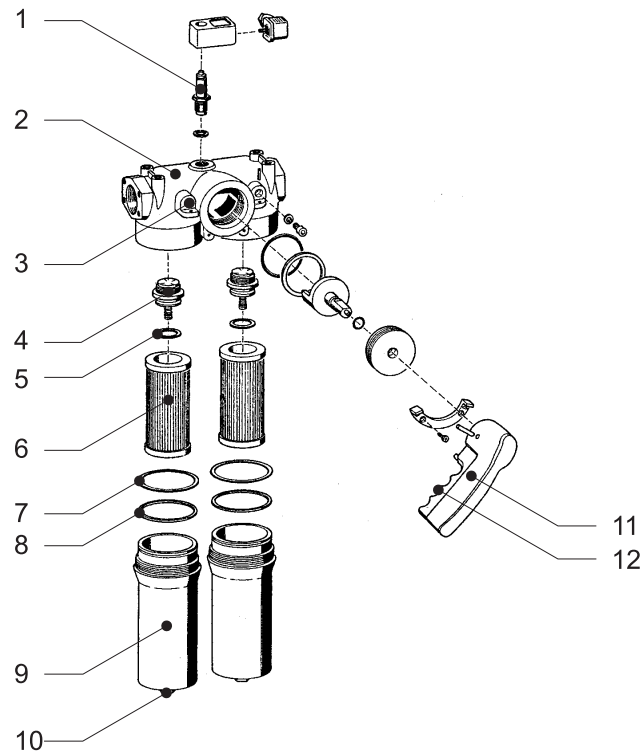


5.5 - 1 Pressure boosting system

- 1 Control box
- 2 Double filter

5.5.1 Double filter clogged

Component	Double filter
Action	Switch double filter to alternative chamber and clean the clogged one



5.5.1 - 1 Double filter. When the switch lever is in this position, the right-hand filter chamber is operating.

- 1 Clogging indicator
- 2 Filter top
- 3 Ventilation screw
- 4 Location piece
- 5 O-ring
- 6 Filter element
- 7 O-ring
- 8 Supporting ring
- 9 Filter housing
- 10 Hexagon
- 11 Switch lever
- 12 Pressure equaliser in the switch lever

Change double filter to alternative chamber



The clogging indicator only monitors the filter chamber that is started up. During operation, you can switch filter chambers and clean the inactive filter chamber.

Further documents




For manufacturer's documentation on the duplex filter, see Subsuppliers' Information (ZI) from "Knoll", documentation from "Mahle".



For structure of the cooling lubricant system, see the media diagram (MP).

Procedure

- Press and hold down pressure equaliser (-1/12) in the switch lever (-1/11).
-  The switch lever locking device is triggered.
- Push out switch lever to limit stop and let locking device engage.
- Push the red button on the clogging indicator (-1/1) back.
- Acknowledge message on the main operator panel.

Clean inactive filter chamber



The fabric filter element is washable. This does however limit the life of the filter element, since the cleaning effect is never one hundred percent. The tool life after several cleaning operations is therefore reduced.

If the cleaning intervals are too short or if the fabric is damaged, you must replace the filter element.

Spare part

For order details of filter element, see nameplate for double filter
For order details of the set of seals, see nameplate for double filter



Contaminated filter elements must be regarded as hazardous waste and disposed of according to the locally applicable regulations.

Aids

Pan with 5 l capacity for collecting the cooling lubricant in the filter housing

5 Maintenance on account of messages

5.5 Cooling lubricant system

Container with substitute petroleum for washing the filter housing and pre-cleaning the filter element

Cleaning equipment for washing the filter element:

- Ultrasonic bath or container with cleaning fluid (cleaning solution, wash thinner or hot water)

Hair brush or paint brush

Procedure

Remove and clean the filter housing



Used cooling lubricant should be regarded as hazardous waste and must be disposed of according to the locally applicable regulations.

- Place pan below the filter chamber to catch the cooling lubricant.
- Release ventilation screw (-1/3) by 2 to 3 rotations.
- For filters size Pi 3745:
 - Remove drain screw in hexagon (-1/10) and allow the cooling lubricant to flow from the filter chamber.
 - Insert drain screw and tighten.
- Position key on the hexagon (-1/10). Unscrew filter housing (-1/9).
- Wash filter housing in substitute petroleum.

Remove and clean the filter element**i**

Instructions for cleaning the fabric filter elements:

- To avoid damaging the fabric, do not use wire brushes or sharp-edged or spiked objects to remove the dirt deposits.
 - We recommend that fine filter elements less than 40 µm are cleaned in an ultrasonic bath.
 - Ensure that dirt does not accumulate on the inside (clean side) of the filter element. Stand the filter element in the cleaning fluid upright rather than horizontal.
 - Thoroughly clean the filter element. Particles smaller than 40 µm are barely visible to the naked eye. Change the cleaning fluid at regular intervals, depending on the level of contamination.
 - Do not apply undue pressure to clean the filter element. The fine fabric may become detached if the pressure applied is too great.
 - Use only clean compressed air for blowing out. The compressed air must not contain solid particles larger than the size of the pores in the filter element.
- Pull filter element (-1/6) downwards by slight forwards and backwards movements.
- Pre-clean filter element.
- To remove coarse, external contaminations, immerse the filter element in substitute petroleum and clean with a brush or paint brush.
- Clean finer filter elements (less than 40 µm) in an ultrasonic bath:
- Immerse filter element in the ultrasonic bath for 90-120 minutes (preferably upright, turning the filter element several times).
 - Allow the filter element to dry naturally.
- Clean coarser filter elements (from 40 µm) or finer if no ultrasonic bath is available, by hand:
- To loosen incrustations, soak filter elements in new cleaning fluid for 20 minutes (preferably upright, turning the filter element several times).
 - Rinse filter element with new cleaning fluid from inside to out.
 - Carefully purge filter element from inside to out with compressed air or allow to dry naturally.

Mount filter housing and filter element

- Check O-ring (-1/7), support ring (-1/8) and O-ring (-1/5) for damage. Replace damaged components.

5 Maintenance on account of messages

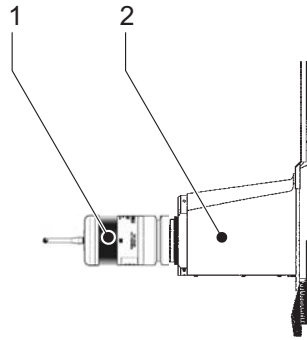
5.5 Cooling lubricant system

- Push the cleaned filter element onto the location piece (-1/4) in the filter top (-1/2).
- Insert filter housing up to limit stop in the filter top and then return by between an eight and a half rotation.

Preparing inactive filter chamber for operation

- Place pan below the filter chamber to catch the cooling lubricant.
- Actuate pressure equaliser.
- The inactive filter chamber is filled.
- Keep pressure equaliser pressed down, until the cooling lubricant flows continuously from the vent hole.
- Tighten ventilation screw (-1/3).
- Actuate pressure equaliser again to check the filter chamber for leaks.
- Ensure that the switch lever is securely engaged.

5.6 Measuring Probe (option)



5.6 - 1 Machining unit with measuring probe

- 1 Measuring probe
- 2 Tool spindle

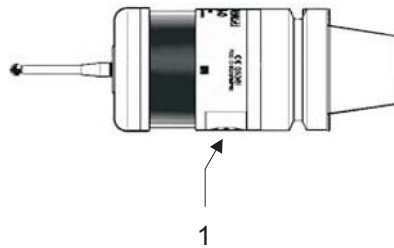
5 Maintenance on account of messages

5.6 Measuring Probe (option)

5.6.1 Measuring device battery flat/faulty

Component Measuring probe

Action Replacing battery



5.6.1 - 1 Measuring probe

1 Battery cover

Spare part 2 identical AA batteries with a voltage between 1.2 and 3.6 V according to manufacturer's recommendation



Used batteries should be regarded as hazardous waste and must be disposed of according to the locally applicable regulations.

Further documents



For manufacturer's documentation, see Subsuppliers' Information (ZI) from "Renishaw".

Procedure

- Measuring probe removed from the machine.
- Replace empty battery according to manufacturer's documentation.

CHAPTER 6

Drawings, plans

6 Drawings, plans

6.1 Technical data on the application field of the machine H 8000 MC (DL) + H 10000 MC (DL)

The following technical data reflect the standard version. Please refer to the General layout (AZ) for order-related modifications of individual data.

			H 8000 MC (DL)	H 10000 MC (DL)
Work area				
	Longitudinal stroke (X-axis)	mm	1 250	1,400
	Vertical stroke (Y-axis)	mm	1 000	1 000
	Transverse stroke (Z-axis)	mm	1 400	1,450
Feed forces				
	X and Y axes at duty cycle S3 - 40%	N	15 000	15 000
	Z axes at duty cycle S3 - 40%	N	20 000	20 000
Speeds				
	Rapid traverse in X, Y and Z-axis.	mm/min	50 000	45,000
	Acceleration X-axis / Y-axis / Z-axis	m/s ²	4.0 / 4.0 / 4.0	4.0 / 4.0 / 4.0
Machining unit				
	Spindle taper	SK HSK BT	50 A100 50	50 A100 50
Power Cutting (PC)				
	Maximum drive power at duty cycle S6 - 40%	kW	43	43
	Maximum drive torque at duty cycle S6 - 40%	Nm	822	822
	Speed range	1/min	5 - 8 000	5 - 8 000
Enforced Power Cutting (EPC)				
	Maximum drive power at duty cycle S6 - 40%	kW	60	60
	Maximum drive torque at duty cycle S6 - 40%	Nm	1 146	1 146
	Speed range	1/min	5 - 8 000	5 - 8 000
High Power Cutting (HPC)				
	Maximum drive power at duty cycle S6 - 40%	kW	60	60
	Maximum drive torque at duty cycle S6 - 40%	Nm	2 292	2 292
	Speed range	1/min	5 - 6 000	5 - 6 000

6 Drawings, plans

6.1 Technical data on the application field of the machine H 8000 MC (DL) + H 10000 MC (DL)

			H 8000 MC (DL)	H 10000 MC (DL)
Speed Cutting (SC)				
	Maximum drive power at duty cycle S6 - 40%		52	52
		Siemens kW		
		Fanuc kW	37	37
	Maximum drive torque at duty cycle S6 - 40%		166	166
		Siemens Nm		
		Fanuc Nm	161	161
	Speed range	1/min	5 - 12 500	5 - 12 500
Power Speed Cutting (PSC)				
	Maximum drive power at duty cycle S6 - 40%	kW	52	52
	Maximum drive torque at duty cycle S6 - 40%	Nm	500	500
	Speed range	1/min	5 - 12 500	5 - 12 500
Extra Power Cutting_PM (XPC_PM)				
	Maximum drive power at duty cycle S6 - 40%	kW	60	60
	Maximum drive torque at duty cycle S6 - 40%	Nm	2 292	2 292
	Speed range	1/min	5 - 5 000	5 - 5 000
Extra Power Cutting_SM (XPC_SM)				
	Maximum drive power at duty cycle S6 - 40%	kW	60	60
	Maximum drive torque at duty cycle S6 - 40%	Nm	2 292	2 292
	Speed range	1/min	5 - 8 000	5 - 8 000
Tool magazine				
	Maximum tool mass	kg	35	35
Chain-type magazine				
	Magazine places	Pieces	50/100/150	50/100/150
	Maximum tool length / option	mm	600 / 800	600 / 800
	Maximum tool diameter	mm	280	280
Rack-type magazine				
	Magazine places	Pieces	265/425	265/425
	Maximum tool length	mm	600	600
	Maximum tool diameter	mm	280	280
Rotary table				
	Indexing	degrees	360 000 x 0,001	360 000 x 0,001
	maximum speed	1/min	10	10
Pallet design				
	Pallet size	mm x mm	750 x 750	1000 x 820

			H 8000 MC (DL)	H 10000 MC (DL)
Workpiece				
	Maximum workpiece collision path	mm	-	-
	Maximum workpiece height	mm	1 350	1 350
	Maximum pallet loading capacity	kg	2 500	4 000
Special cases, see "Loading regulation" in Chapter 5 of the Operator Manual (BD).				
Installation data				
	Footprint (length x width), depends on cooling lubricant system	m	On request	On request
	Machine height	m	4,4	4,4
	Machine mass approx.	kg	On request	On request
	Overall operating power of the machine approx.	kVA	37	37
	Overall operating power of the cooling lubricant unit approx.	kVA	13	13
	Compressed air	bar	5 - 6	5 - 6
	Temperature range	°C	+10 ... +45	+10 ... +45

Subject to technical revisions.

Updated: October 2016

6.2 Drawing overview

The table below shows which drawings and plans are valid for your machine and in which manual which documents can be found. The documents always appear in the Section headed "Drawings, Plans".

	Drawing no.	Page	IA	BD
General layout	AZ.			X
Foundation layout	FZ.			X
Transportation Information	TI.			X
Tool assignment plan	57.			X
Hydraulic Diagram ^{x)}	HP.		X	
Lubrication Diagram ^{x)}	SP.		X	
Pneumatic Diagram ^{x)}	PP.		X	
Coolant diagram ^{x)}	KP.		X	
Coolant diagram ^{x)} shown on:	KP.			
	KP.	50	X	
Lubrication Instructions	SA		X	
Lubrication Chart	BA0124		X	
Wiring Diagram	See electronics documentation			
IA	Maintenance Instructions			
BD	Machine Operator Manual			
x)	with parts list			