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Maintenance Instructions

G200.3 G220.3

DIE248EN - 15.08.2022
2022-08-15/Sp/Wartungsanleitung/20222366

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Preface

General notes

The maintenance activities described in this document essentially pertain only to the machine. Maintenance activities of auxiliary units (e.g., bar loading magazines, extraction systems) are described in the documentation of the specific manufacturer.

The maintenance and servicing activities must absolutely be observed. Failure to conduct maintenance and servicing in accordance with these instructions (especially not at the respective intervals) rules out any claims for damages. This does not apply if it is proved that the non-compliance with the maintenance and servicing activities is unrelated to the defect. Normal wear and tear, especially of components such as bearings and seals, is not a defect. These components are therefore excluded from the warranty. It is recommended to keep a written log of all maintenance activities carried out.

Maintenance intervals

The maintenance intervals are given based on the operating hours counter / “Hydraulic system On” operating condition.

Maintenance intervals displayed on the controller (iXpanel)

Depending on the respective machine type and the different controller types, a corresponding message is issued on the controller when a maintenance interval is reached. The maintenance instructions stored on the respective controller provide information (maintenance log) explaining the service and maintenance activities to be performed.

Cleaning of the machine

Do not clean the machine with compressed air

- Raised dirt particles may cause breathing difficulty or injury (especially of the sensory organs). Furthermore, raised dirt particles or chips may reach spots where they cause technical problems.

Do not use cotton waste for cleaning

- When cleaning with cotton waste, fibers or thread can get loose causing safety problems.

Solvents

- Do not use highly volatile solvents such as petroleum spirit, trichloroethylene or similar cleaning agents. These cleaners may damage the seals, which can lead to safety problems.

Pressure washers

- Do not clean the machine with a pressure washer. Cleaning with a pressure washer results in strong corrosion. Furthermore, bearings may be degreased and seals may become leaking, which can lead to safety problems.

Cleaning of tool mountings

A suitable cleaning tool must be used to clean the hole in the tool mounting.

Ordering spare parts

Always specify the machine type and machine number when ordering spare parts. This and other information about the machine are located on the nameplate under the main switch of the control cabinet.

Operating material

For all work in connection with operating materials, the information in the data sheets of the respective manufacturers and the information in the document **Notes on Operating Materials**.

Pressure accumulators ≤ 1 L

Pressure accumulators with a volume of ≤ 1 L are **not** subject to testing and labeling according to the current issue of the pressure equipment directive. The guidelines and regulations applicable in the country of use must be followed.

Safety Instructions

Safety Instructions and Technical Details

The user documentation and, in particular, the document **"Safety Instructions and Technical Details"** must be observed.

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Carrying out maintenance work

Authorized and trained personnel

- Maintenance is to be performed only by authorized and trained personnel. This applies particularly to work on motors (spindle motors) or other electrical assemblies. The instructions in the respective manufacturer documentation must be followed for such work.

Allow the machine to cool down

- Prior to working on the machine, it must be allowed to cool down, as hot parts may be located under the covers.

Maintenance work on machine being switched off

- In general, maintenance is to be carried out with the machine switched off. The main switch must be locked out. Even when the main switch is switched off, parts of the machine (e.g., the control cabinet light) may still carry electricity. These parts are labeled. In a few cases, maintenance work needs to be performed with the machine turned on (e.g., replacement of backup batteries). These maintenance activities must be carried out with special care.

Required tools

- For removing machine parts, suitable lifting gears and a variety of tools must be used. Removed machine parts must be placed in a safe position and secured against falling over.
- All maintenance work on the machine must be carried out with utmost care. Fasteners must be loosened carefully and parts must be secured against falling down. When elastic items (springs) are removed/replaced, appropriate devices must be used. Any (non-horizontal) axes that pose a risk of falling down must be moved to their end positions or secured against falling down. Pedal switches must be put aside to avoid inadvertent actuation.

Performing maintenance, repair or service work

- The currently valid safety regulations, as well as the specific manufacturer's information for the intended use must be observed for these activities.

Use of climbing aids (ladders or steps)

- In addition, appropriate climbing aids may be required to carry out these activities. When working on climbing aids at great heights, e.g. on the control cabinet, these must always be secured or fastened (depending on the machine, eyelets are also provided for this purpose).

Procurement/use of spare parts

We recommend the use of original spare parts and accessories. For damages caused by the use of parts from third-party providers, liability and warranty are excluded. The use of such products may change the structural characteristics of the machine and negatively affect the active or passive safety.

Cellular and cordless phones

When the control cabinet is open or the machine covers are open or removed, no cellular or cordless phones may be used within a 2 m radius.

Handling hydraulic and hose lines

Damaged hydraulic hose lines must be replaced immediately. Typical types of damage include chafing, kinks, cracks, deformations, or visible leaks.

Flexible, pressurized hydraulic hose lines of **INDEX** equipment are generally designed as thermoplastics or metallic hydraulic hose lines.

The machine operator/owner is responsible for compliance with the laws and regulations of the country of use with regard to the use of hydraulic hoses.

We recommend inspection and documentation of the hydraulic hose lines installed inside the machine and not directly visible every 12 months. For hydraulic hose lines visible in the work area or mounted outside the machine and connecting components to the machine, we recommend inspection and documentation every 6 months.

For the flexible, pressurized hydraulic hose lines used by **INDEX** , empirical values are available for very different periods of use, some of which exceed 10 years.

Maintenance work on fluid systems (hydraulic, lubrication, and pneumatic systems)

When carrying out maintenance work on fluid systems (hydraulic, lubrication, and pneumatic systems), make sure **before** starting the work that the respective system **has been depressurized** (accumulator drain valve / manual slide valve).

Dry run or functional test

After all maintenance work and work on electrical assemblies, a dry run or functional test must be performed.

Service Interval - Care activities

Maintenance Summary - Care activities

It is recommended to document the maintenance activities carried out by using the appropriate maintenance log. The maintenance log has the document number DIE249EN - 15.08.2022.

The maintenance interval is highly dependent on the production and environmental conditions of the machine. The determination of the appropriate interval must be made by the operator.

The maintenance interval should be between once per shift and once a week!

A010 - Check the work area door and window pane

A024 - Check hydraulic system (visual inspection)

A027 - Replace the breathing filter at the filler neck of the hydraulic fluid tank.

A042 - Check pneumatic system (visual inspection)

A049 - Check the lubrication system (visual inspection)

A065 - Lubricate turret steady rest SR2 or SLU X1 (by SMW)

A075 - Check fill levels of the fluid tanks

A080 - Clean and lubricate clamping device

A090 - Check electrical lines (visual inspection)

A095 - Visual inspection of all fluid lines and electrical cables

A103 - Clean cooling lubricant outlet on clamping cylinder

A120 - Check cooling lubricant (visual inspection)

A126 - Check the cooling unit and the coolant

A132 - Check work area light (visual inspection)

A140 - Check HSK clamping set and, if necessary, lubricate (Ott-Jakob)

A145 - Maintenance of HSK clamping sets (from Berg)

A180 - Clean the work area

A215 - Check slat/shingle cover on the telescopes (visual inspection)

A255 - Clean the chip conveyor

A320 - Wassermann tool change system

A010 - Check the work area door and window pane

Orientation

Inspection and maintenance of the work area door includes several steps:

- Inspection of the window pane for damage.
- Checking the safety label on the window pane (replacement interval 8 years).
- Checking/adjusting or replacing, if necessary, the wipers.
- Check the work area door for smooth opening/closing.
- Automatic work area door (optional). Hydraulic valves and motor, control panel, rack and spur gear. (for hydraulic door drive)
- Automatic work area door (optional – electric door drive – follow the manufacturer's documentation).

The window pane consists of three panes. The inner pane made of tempered glass, the central pane made of polycarbonate, and the outer pane also made of polycarbonate. The inner pane is relatively resistant. It can be cleaned with any commercially available cleaning agents. Only the center pane is essential for the impact resistance of the window pane.

The polycarbonate panes are subject to **natural** aging and therefore must be subjected to regular visual inspection. Through contact with cooling lubricant, the aging process is accelerated even further

If the window pane is damaged, it must be replaced. This is necessary regardless of the extent of damage. Even with minimal damage, the impact resistance of the pane can no longer be guaranteed.

Heavily soiled or damaged wipers may cause damage to the inner pane. Moreover, it may be possible that the work area door can be moved only with considerable effort due to heavy soiling or chip deposits in the wipers.

Check the guide rails of the work area door. The guide bars must be checked and cleaned regularly so that the work area door can be moved without much effort.

Procedure

1. Check window pane for damage.
2. 

   Clean the outer pane with a soft cloth or sponge and glass cleaner or soap and water. Do not use abrasive or alkaline cleaners (e.g., benzene, acetone or carbon tetrachloride) and no sharp tools or sharp objects (such as razor blades or screwdrivers).

   Clean outer pane.
3. Clean inner pane.
4. Check wipers. Remove and clean the wipers. If the wipers are severely deformed or damaged, they must be replaced. To clean the door panels evenly, be sure to reinstall the wipers after their removal aligned in parallel and ensure that they snugly contact the work area door.

5. Check the work area door for ease of movement. To do so, open and close the work area door. If the work area door can be moved only with effort, determine the cause. Possible causes include – depending on the work area door – defective or improperly adjusted wipers. Chips on the guide bar or between the door and wiper, or in the guide rollers of work area door.

A024 - Check hydraulic system (visual inspection)

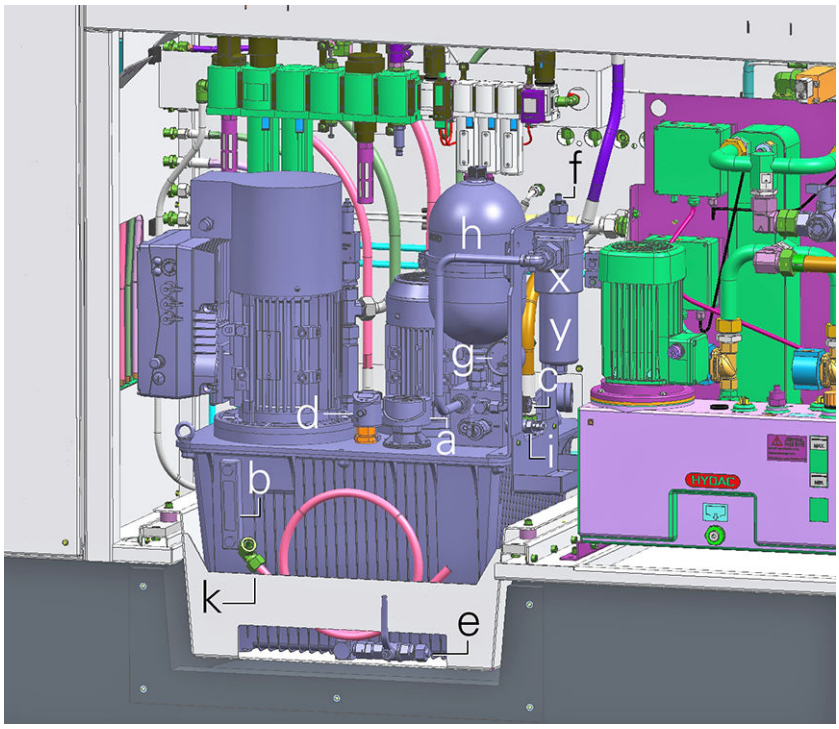
Orientation

To ensure trouble-free operation, periodic checks of the oil level are necessary. The fill level must be between the upper and lower marks on the oil sight glass.

Only use hydraulic fluid grade 15/13/10 in accordance with ISO 4406.

Viscosity other than 32 according to DIN ISO 3448 is not admissible.

For all work in connection with operating materials, the information in the data sheets of the respective manufacturers and the information in the document **Notes on Operating Materials** must be observed.



Example: Hydraulic unit G420

a Filler neck (hydraulic fluid)
b Fill level indicator
c Accumulator drain valve
d Monitoring (level and temperature)
e Oil drain plug
f Electrical monitoring (contamination indicator)
g Pressure gauge (system pressure)
h Pressure accumulator
i Safety valve
j Electrical monitoring (system pressure)
k Drain hose for hydraulic unit
X Hydraulic fluid filter (line filter)
Y Filter bell

Screws on the hydraulic system, the connected components, and the supply lines must be tightened to the manufacturer's specified torques.

Procedure

1. 

   The hydraulic fluid level should always be near the top mark when the machine is switched off. During production, the oil level may drop after several consumers have been connected.

   Check oil level at the oil sight glass.

2. Visual inspection of the hydraulic fluid. The hydraulic fluid may not exhibit any foaming or cloudiness at the oil sight glass. In case of problems of this kind, immediately determine the cause and correct the error. If in doubt, take a sample for analysis and contact the manufacturer of the hydraulic fluid.

3. Check pressure setting on pressure gauge and adjust if necessary. The value to be checked here is specified (see hydraulic diagram) and should be between 70-80 bar.

4. Check supply and fluid lines (damage and leakage). Supply and fluid lines must be checked for damage. Pre-damage such as kinks or abrasions should be logged and replacement should be initiated.

A027 - Replace the breathing filter at the filler neck of the hydraulic fluid tank.

Orientation

The breathing filter on the oil filler neck of the oil tank must be Regular regularly replaced depending on the ambient conditions.

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

Filters are hazardous waste and must be disposed of in a controlled manner.

Requirement

It is essential to keep the filter described here in stock. **It is not permitted to owner the machine without this filling and breathing filter**.

Use only the original filters according to the spare or wear parts list.

Only filters with retained particle sizes described in the fluid plans must be used.

Procedure

1.

Example: Filling and breathing filters of hydraulic and lubrication systems (by ARGO-HYTOS GmbH)

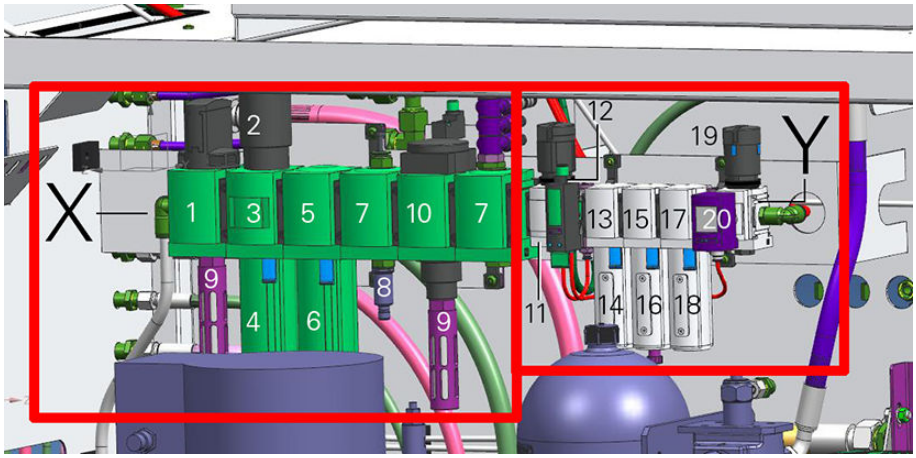
Replace breathing filter.

A042 - Check pneumatic system (visual inspection)

Orientation

To ensure trouble-free operation, periodic checks (visual inspection) of the pneumatic system are necessary.

- Check system pressure and sealing air settings.
- Check supply and fluid lines.
- Check silencers.
- Drain condensate (not applicable to auto-drain).
- Check pressure setting on the pressure differential monitoring pressure gauge.

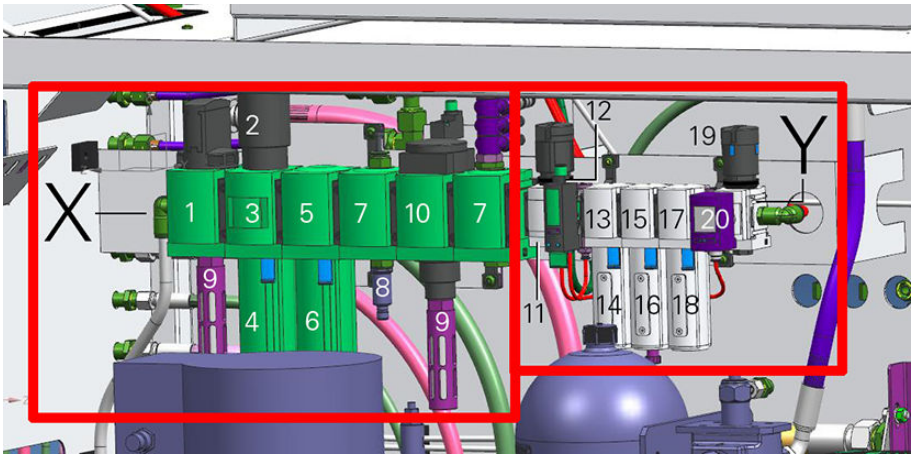


Example: Pneumatic maintenance unit G420 (by FESTO)

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

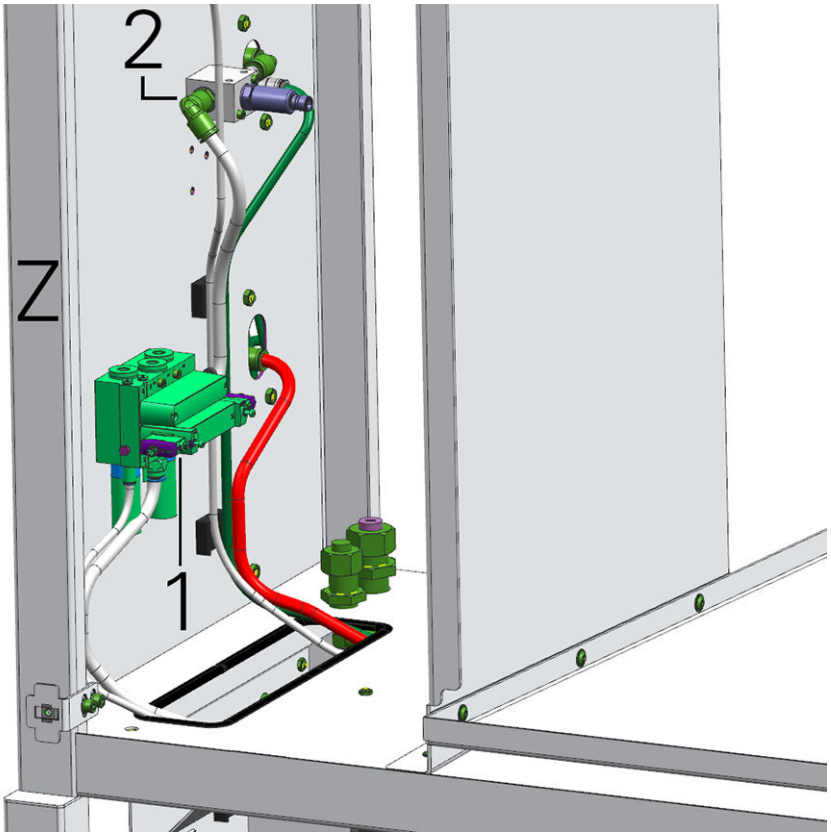
The following components are used on the system maintenance unit **(X)** and the extension for sealing air on the glass scales **(Y)** :

- **X System maintenance unit**
- 1. Switch-on valve (manual)
- 2. Pressure regulating valve (with filter) system pressure 6 bar
- 3. Pressure gauge for system pressure
- 4. Filter insert (filter fineness 40 µm)
- 5. Filter with automatic condensate drain
- 6. Filter insert (filter fineness 5 µm)
- 7. Branch module
- 8. Pressure sensor for system pressure
- 9. Silencer
- 10. Electrically actuated switch-on valve
-
-
-



Example: Pneumatic maintenance unit G420 (by FESTO)

- **Y extension sealing air - “consumer” and sealing air - “glass scale”**
- 11. Pressure regulating valve for “load” sealing air
- 12. Differential pressure sensor
- 13. Filter with automatic condensate drain
- 14. Microfilter insert (filter fineness 1 µm)
- 15. Filter with automatic condensate drain
- 16. Microfilter insert (filter fineness 0.01 µm)
- 17. Filter
- 18. Activated carbon filter **no automatic condensate drain**
- 19. Pressure regulating valve with pressure sensor for glass scales sealing air 1.0 bar
- 20. Display
-
-
-



Z control unit safety

- 1. 3/2-way valve on valve terminal
- 2. Safety pressure sensor

If the differential pressure sensor **(12)** outputs an error message, **all 5 filter elements on the pneumatic system must be replaced.**

Filters are hazardous waste and must be disposed of in a controlled manner.

Requirement

Service and maintenance are to be carried out according to the manufacturer's specifications.

Procedure

1. Check pressure setting on pressure gauge and adjust if necessary. An operating pressure of 6 bar has been set at the factory.

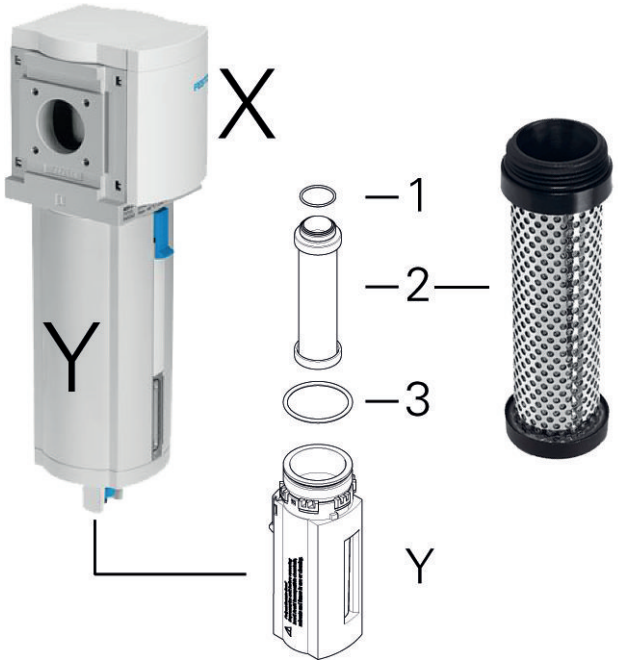
2. Check supply and fluid lines (damage and leakage). Supply and fluid lines must be checked for damage. Pre-damage such as kinks or abrasions should be logged and replacement should be initiated.

3. 

Example: Various silencer versions from FESTO

Check silencer, replace if necessary

4. Drain condensate (not applicable to auto-drain).

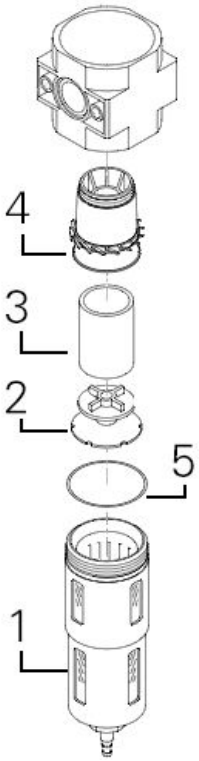
5. 

Replace activated carbon filter (by FESTO)

X Filter base housing
Y Filter bowl
1 Sealing ring
2 Activated carbon filter cartridge
3 O-ring

Check activated carbon filter, replace if necessary. **When disassembling the filter bowl, make sure that sealing rings and O-rings (1 + 3) are also installed.** Unscrew filter bowl **(Y)** from filter base **(X)** and remove activated carbon filter cartridge **(2)**. Check sealing rings and O-rings **(1 + 3)** , replace if necessary. Reinstall all parts in reverse order.

6.



Example: Exploded view of fine filter replacement (by FESTO)

1 Filter bowl
2 Separating disk
3 Filter cartridge (check filter fineness)
4 Filter receptacle
5 O-ring

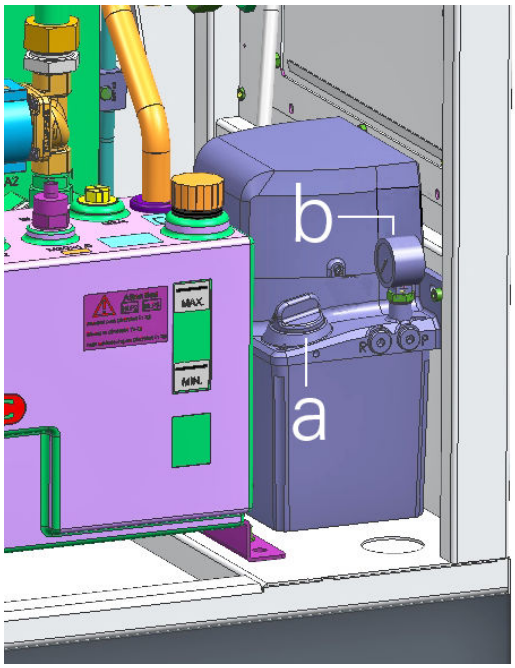
Check fine filter or microfilter, replace if necessary. **When removing the filter bowl, be sure to include the O-ring (5), separating disk (2), and filter receptacle (4).** Unscrew filter bowl **(1)** from filter base body and remove filter cartridge **(3)** , check, and replace if necessary. Check O-ring **(5)** , replace if necessary. Reinstall all parts in reverse order.

A049 - Check the lubrication system (visual inspection)

Orientation

Various components must be checked regularly on the lubrication system.

> Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!



Example: Lubrication system G420

The following components must be checked on the lubrication system:

a) Filler neck
b) Pressure gauge for system pressure (>20 bar)

Procedure

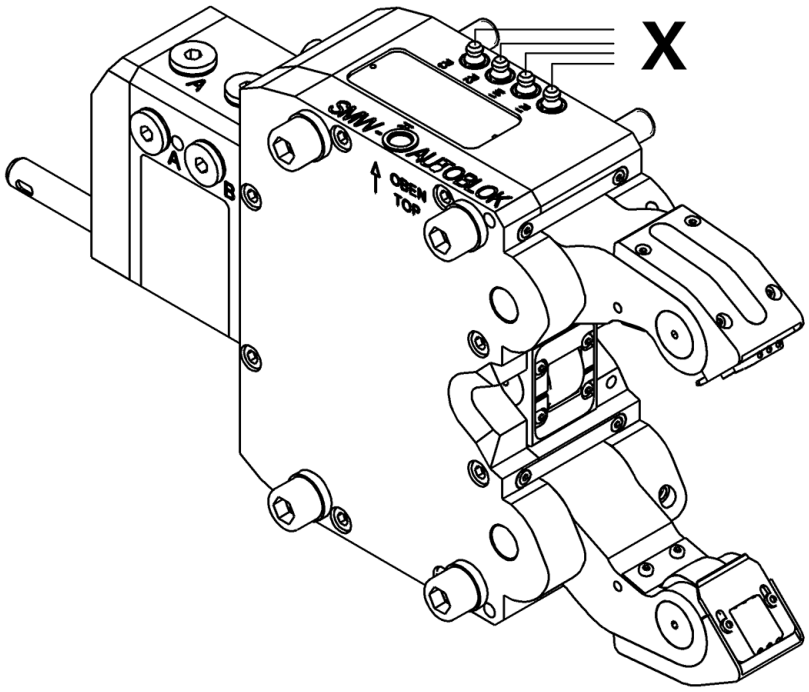
1. Check oil level.
2. Check pressure setting on pressure gauge **(>20 bar)**

A065 - Lubricate turret steady rest SR2 or SLU X1 (by SMW)

Orientation

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

The visual inspections or maintenance activities described in the manufacturer's documentation must be carried out as part of maintenance activities.



Example: Turret_Steady_Rest_SMW_SR2

X Lubrication points

Procedure

1. Service and maintenance are to be carried out according to the manufacturer’s specifications.

   The turret steady rest (type SR2 or SLU X1) used here should be lubricated daily at the points described in accordance with SMW's maintenance instructions.

A075 - Check fill levels of the fluid tanks

Orientation

To ensure the operational safety of the machine, the fill levels of all fluid tanks must be regularly checked, and topped off if necessary.

Operating fluids such as hydraulic fluids, cooling lubricants, lubricating greases/oils are also subject to degradation or aging like the components involved in this process, and must therefore be serviced, refilled or changed at regular intervals. Do not use cotton waste and highly volatile solvents such as petroleum spirit, trichloroethylene or similar cleaning agents. The machine must not be cleaned with compressed air. To ensure trouble-free operation, periodic checks of the oil level are necessary.

The hydraulic fluid and lubricating oil levels should always be near the top mark when the machine is switched off. During production, the oil level may drop after several consumers have been connected.

The interval for this maintenance activity is strongly dependent on the operating profile of the machine. If the machine is used in three-shift operation, this maintenance activity must be carried out much more frequently.

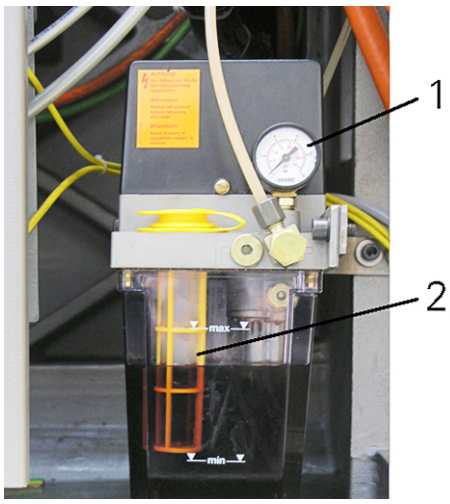
Requirement

For all work in connection with operating materials, the information in the data sheets of the respective manufacturers and the information in the document **Notes on Operating Materials** must be observed.

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

Procedure

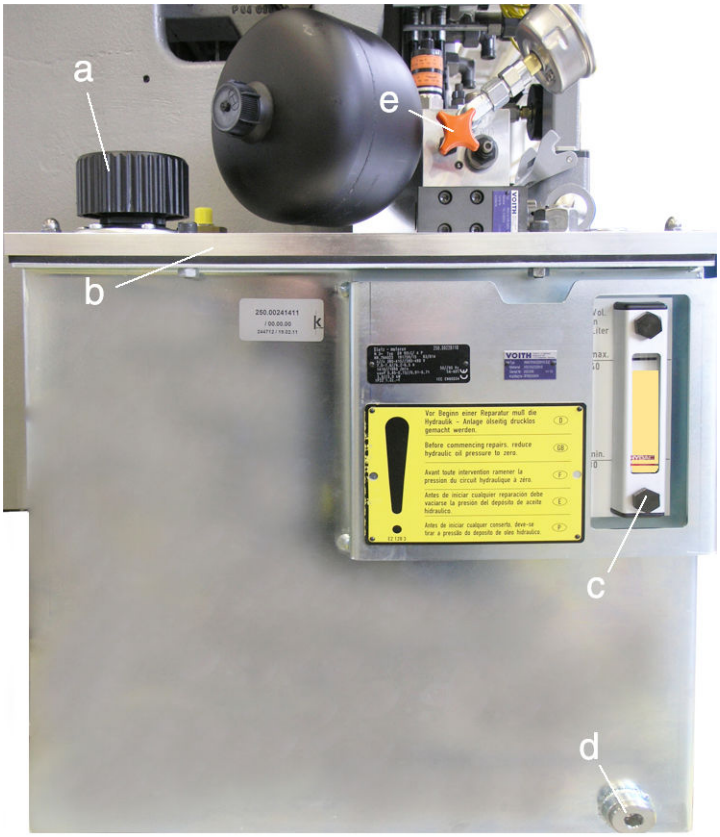
1.



Example: Lubricating oil tank

1 Pressure gauge (lubrication pressure)
2 Filter insert and min./max. indicators

Check fill level at lubricating oil tank.

2. 

Example: Hydraulic unit C100 C200 C200tandem

a Filler neck
b Base plate of hydraulic system
c Fill-level check
d Drain plug
e Accumulator drain valve

Check fill level at hydraulic fluid tank.

3. Check fill level at cooling lubricant tank.

4.

Fill level indicator at a cooling lubricant recycling system (Knoll)

X Fill level indicator

Check the fill level at the cooling lubricant reconditioning system (option).

5. Check fill level of the coolant tank (option).

A080 - Clean and lubricate clamping device

Orientation

To ensure reliability and accuracy of the machine, clamping devices must be subjected to periodic maintenance.

The interval of this maintenance is strongly influenced by the type of material and daily production time. Especially for short chipping materials (e.g., brass or cast iron), these maintenance activities must be performed much more frequently.

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

Depending on the materials to be machined (e.g.: brass, cast iron) and the number of shifts per day, more frequent cleaning of the chuck is necessary.

For this, the clamping device must be removed and completely cleaned. Here, also the labyrinth ring (spindle cover) and the space behind the ring must be cleaned.

Requirement

Example: Three-jaw chuck from different manufacturers.

Do not use cotton waste for cleaning.

When cleaning with cotton waste, fibers or thread can get loose causing safety problems.

Procedure

1.

Caution

Sharp contours on the clamping device

Cuts

Use personal protective equipment (e.g., protective gloves)

Clean clamping devices

Alternatively, the following procedure can be used!

If necessary, unmount clamping devices for cleaning (follow manufacturer's instructions).

2. Lubricate clamping devices according to manufacturer's instructions.
3. Clean labyrinth ring and space behind the labyrinth ring.

A090 - Check electrical lines (visual inspection)

Orientation

Leave the immediate area around the machine and the additional units free; do not use it as storage or warehouse space. This significantly reduces the risk of damage to electrical lines.

Electrical lines routed outside the machine (e.g., lines for cooling lubricant systems, chip conveyor, and pedal switch) must be regularly checked for damage (e.g., pinching or cuts).

Procedure

1. 

Damaged electrical lines.

Electric shock.

Switch off machine and accessory units and arrange for immediate replacement of damaged lines by an electrically trained technician.

Check electrical lines to chip conveyor.

2. Check electrical lines to cooling lubricant system.
3. Check electrical lines to workpiece feeder.
4. Check electrical lines to workpiece removal unit.
5. Electrical leads for the pedal switches.
6. Check electrical lines of the working area light.
7. Check electrical line to sub-panel / handheld control unit (option).
8. Check electrical lines to other optional attachments.

A095 - Visual inspection of all fluid lines and electrical cables

Orientation

Depending on the duration of use, usage profile of the machine and different ambient conditions, it is absolutely necessary to subject all fluid lines and electrical cables to regular visual inspections. This allows that any faults or problems can be detected and eliminated early on.

Damaged fluid lines may cause leakage of fluids under high pressure. Be sure to use personal protective equipment during visual inspection.

Requirement

Should defective points be found on fluid lines or electrical cables during the visual inspection, the machine must be switched off and the damaged lines or cables must be promptly replaced.

Replaced fluid lines must be tightened to the torque specified by the manufacturer.

Procedure

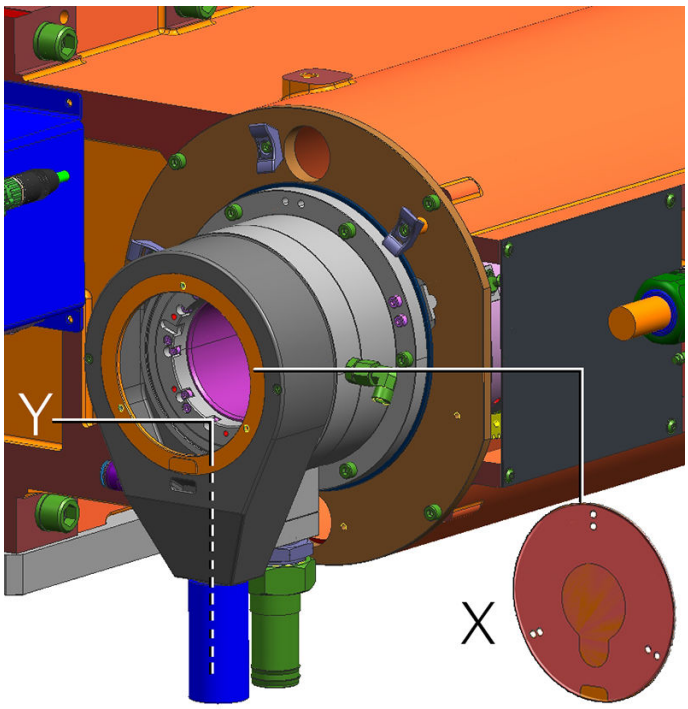
1. Visual inspection of all supply and fluid lines.
2. Visual inspection of all electrical cables.

A103 - Clean cooling lubricant outlet on clamping cylinder

Orientation

During machining, the cooling flow flushes small chips through the spindle in the direction of the clamping cylinder. Therefore, the cooling lubricant outlet on the clamping cylinder must be cleaned at regular intervals.

Procedure

1. Disassemble the machine enclosure in the area ofthe spindles.
2. 

Example: Cooling lubricant outlet, G420

   Remove cover (X) on cooling lubricant tank.
3. Clean cooling lubricant tank and drain hose (Y).
4. For assembly, follow the steps in reverse order. Ensure proper cleanliness during the installation.

A120 - Check cooling lubricant (visual inspection)

Orientation

Follow the user documentation **Notes on Operating Materials** and the documentation of the cooling lubricant manufacturer.

For all work in connection with operating materials, the information in the data sheets of the respective manufacturers and the information in the document **Notes on Operating Materials** must be observed.

The cooling lubricant is subject to wear depending on the material and the generated temperature. Regular inspection is therefore essential.

In case of strong formation of odor, fungus or mold, the cooling lubricant emulsion must be changed at once. The principle of open lubrication may cause a slight commixture between cooling lubricant and hydraulic fluid. If the surface of the cooling lubricant tank is covered with a layer of oil, the cooling lubricant must be replaced. Furthermore, determine the cause of the oil ingression.

Synthetic cooling lubricants or cooling lubricant based on esters are not admissible.

If the type of cooling lubricant or the manufacturer is changed, make sure that the cooling lubricant meets the required specifications.

See the manufacturer's documentation for the fill quantities.

Regularly checking the cooling lubricant is necessary in particular if cooling lubricant emulsions containing mineral oil are used, so that the required properties are ensured.

Requirement

A refractometer is required to determine the concentration.

Procedure

1. Caution

   Biological and chemical changes in the cooling lubricant.

   Skin irritation or respiratory and circulatory problems.

   Wear personal protective equipment (e.g., safety gloves and safety goggles).

   Remove machine enclosure in the area ofthe cooling lubricant tank.
2. Visual and olfactory inspection of the cooling lubricant.
3. Check cooling lubricant emulsion. See document **Notes on Operating Materials**.

4. Check supply and fluid lines. Supply and fluid lines must be checked for damage. Pre-damage such as kinks or abrasions should be logged and replacement should be initiated.

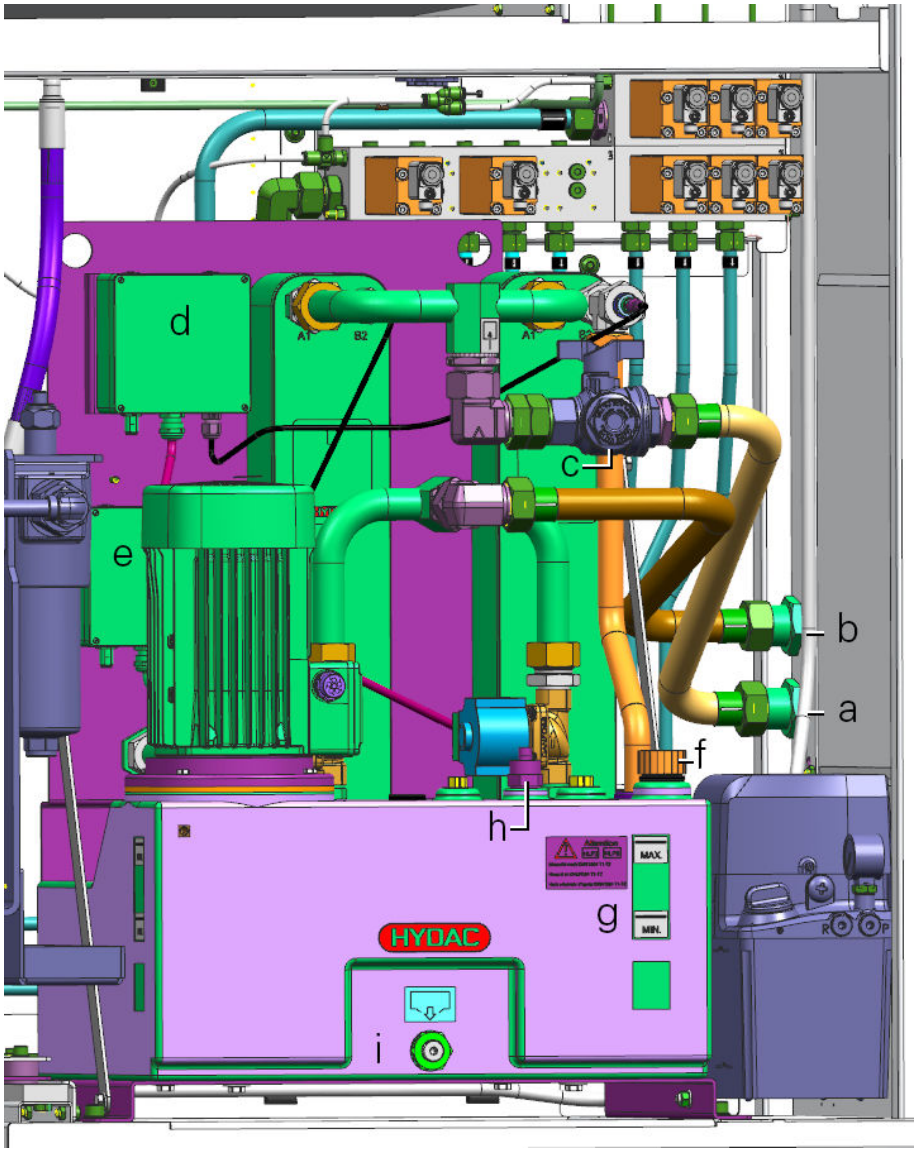
A126 - Check the cooling unit and the coolant

Orientation

For add-on equipment that cannot be cooled conventionally with cooling lubricants or hydraulic fluid due to high temperature development, separate cooling is provided in an independent cooling circuit. The coolant used here must be checked continuously for its condition like other coolants. Also perform a visual inspection of the cooling unit and the supply and fluid lines as part of the servicing and maintenance activities. Check for leaks on the system in general as well as at screw connections, and supply and fluid lines.

This visual inspection or monitoring requires no specific knowledge of refrigeration according to the manufacturer's documentation. These activities can be carried out by instructed individuals with appropriate expertise.

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!



Example: Internal machine cooling FWKS G420

a Inlet flow – cooling compressor
b Return flow - cooling compressor
c Stopcock
d PID controller for 35% water-glycol mixture
e PID controller for hydraulic fluid HLPD 32
f Filler neck
g Sight glass (fill level indicator)
h Level switch
i Drain plug for tank drainage

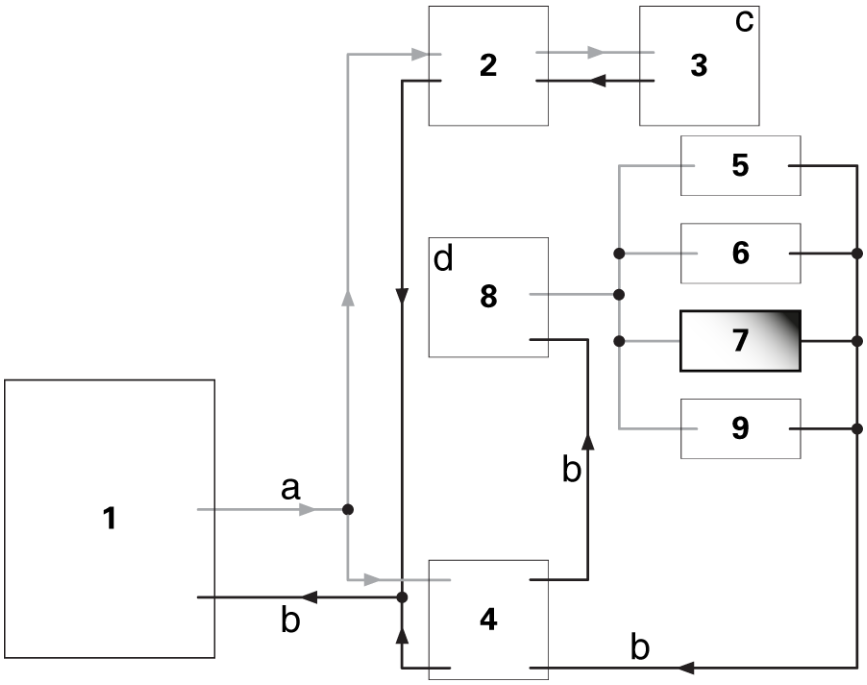


Diagram of cooling system G220.3 G320.2 G4xx/G5xx

1 External cooling unit, or customer-side cooling
2 Heat exchanger (hydraulic unit)
3 Hydraulic unit
4 Heat exchanger (spindles)
5 Main spindle
6 Counter spindle
7 Tool carrier 1 (omitted on G400.2)
8 Internal cooling unit
9 Control cabinet
a Inlet flow (water/water-glycol mixture)
b Return flow (water/water-glycol mixture)
c Hydraulic fluid HLPD32 (VG32)
d FSK35 or Antifrogen N FSK34 (read note)

The following must be observed when servicing the coolant. A water-glycol mixture is filled in at positions 1 and 8. Make sure that a concentration of FSK35 (35% glycol) is used in machines 1-4. From Machine 5, a concentration of Antifrogen N (34% glycol).

For all work in connection with operating materials, the information in the data sheets of the respective manufacturers and the information in the document **Notes on Operating Materials** must be observed.

Requirement

Replenish only coolant of the same manufacturer having the same specification. Mixing different coolants may lead to corrosion of the cooling system, incompatibility and degradation of the coolant. **Be sure to observe the specified concentration of glycol in the respective machine.**

When switching the coolant to another product or changing the manufacturer, the cooling system must be completely flushed and cleaned with this coolant. When preparing the coolant from concentrate and water, be sure to use demineralized water only. Only then the machine may be put back into operation.

External Machine Cooling Water Supply

A	B	C	D	E	F
G220	20°C±2°K	38	4,5	15	8
G220.3/G320.2 G400.2/G420 G500.2/G520	10-20°C	50	2,0	15	8

Technical data of the cooling water supply G220 G220.3 G320.2 G4xx G5xx

A Machine
B Water temperature [°C]
C Cooling water, Qmin / Qmax [l/min]
D Differential pressure P_{inlet} and P_{return} [bar]
E Required cooling capacity [kW]
F Pressure in the cooling system [bar]

The information given in the Technical Data of the cooling water apply at an ambient temperature of max. 40 °C.

The values specified in the table must absolutely be observed! Deviating from these values will not ensure sufficient cooling of the machine.

The maximum operating pressure must not exceed 8 bar!

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

Be sure to replenish with a ready-mix. Mixing different glycol alkalis may trigger chemical reactions causing agglutination or clumping of the coolant.

Procedure

1. Check coolant. Test criteria for this visual inspection are the clarity and transparency of the coolant.
2. Check fill level on the level indicator.

A132 - Check work area light (visual inspection)

Orientation

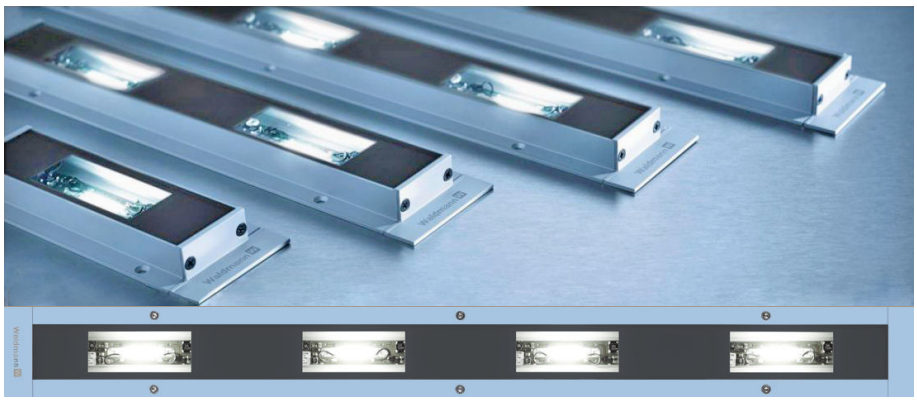
To ensure even illumination of the working areas in the machine, work area lights are installed in the work area.

They enable safe working and should therefore be checked regularly. **Damaged lighting fixtures must be replaced immediately**.

Be sure to follow the manufacturer's documentation.

According to the manufacturer, this lighting fixture is maintenance-free.

Procedure

1. 

Example: Work lamp Waldmann_ MACH_LED_PRO_MUEL_4S (photo: Herbert Waldmann GmbH & Co. KG)

Check all lamps (visual inspection). Check lamp protective glass for damage. If cooling lubricant has already penetrated into the work area light, the lamp must be repaired.

A140 - Check HSK clamping set and, if necessary, lubricate (Ott-Jakob)

Orientation

Ensuring that the tools are properly clamped in the tool carrier requires a high level of cleanliness. Therefore, it is essential to perform various maintenance and service activities more frequently (the manufacturer recommends a weekly inspection interval). The performance and process reliability of the machine are affected to a large degree by the condition of the clamping devices in the multifunction units and motor milling spindles.

This includes the cleaning of surfaces and mounting bores on the tool carrier as well as regular inspection of various wear parts such as O-rings or the like on the HSK clamping set.

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

Example: Clamping sets from Ott-Jakob

When ordering spare parts, always note the make, manufacturer and/or design (latching or non-latching) of the parts currently installed.

The use of tools with shank ISO 12164-1 version before 2001 or DIN 69893-1 version before 2003 (HSK-A) can cause serious damage to the tool magazine during automatic tool change and is therefore not permissible.

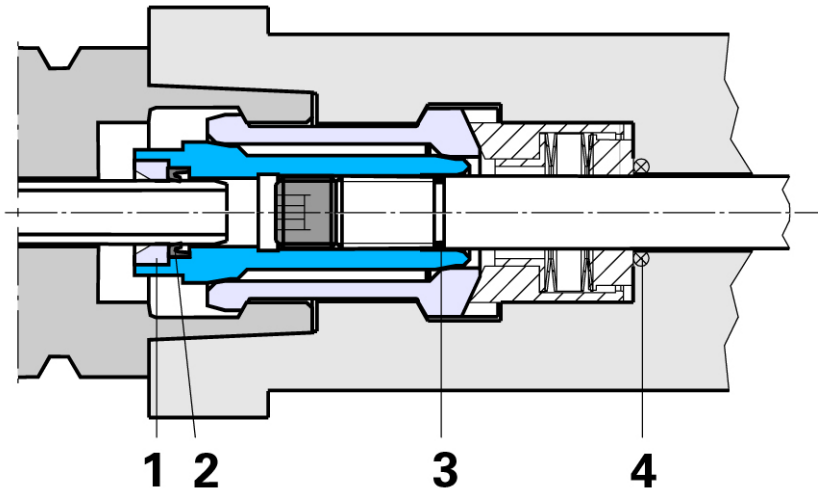
Requirement

Specification and quantity of hydraulic fluid or lubricating oil and grease in accordance with information in the technical data.

The spare parts and utilities as well as operating fluids required for repair or maintenance should already be available in sufficient quantities.

This is especially true for necessary special tools, without which the maintenance or repair would not be possible.

Procedure

1. 

Example: Illustration of HSK clamping set

1 Brass ring
2 Grooved ring
3 O-ring
4 O-ring

Check grooved ring (2) in clamping taper.

2. Replace grooved ring, if necessary.
3. Check collet according to the manufacturer's instructions. Here, check in particular the level of pollution **(clean if necessary)** and that sufficient lubrication is present **(relubricate If necessary)**. Relubricate only after cleaning.
4. Degreasing of the collets may cause technical problems.

   Possible causes:

   - A faulty seal in the clamping taper.
   - A cleaning spray directed immediately at the collet.
   - Use of a degreasing medium.

   Determine the causes of rapid defatting of the collet. If in doubt, always contact the respective manufacturer.

A145 - Maintenance of HSK clamping sets (from Berg)

Orientation

Ensuring that the tools are properly clamped in the tool carrier requires a high level of cleanliness. The performance and process reliability of the machine are affected to a large degree by the condition of the clamping devices in the multifunction units and motor milling spindles.

This includes the cleaning of surfaces and mounting bores on the tool carrier as well as regular inspection of various wear parts such as O-rings or the like on the HSK clamping set.

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

When ordering spare parts, always note the make, manufacturer and/or design (latching or non-latching) of the parts currently installed.

The use of tools with shank ISO 12164-1 version before 2001 or DIN 69893-1 version before 2003 (HSK-A) can cause serious damage to the tool magazine during automatic tool change and is therefore not permissible.

Example: HSK clamping sets from Berg

Procedure

1. Clamping sets from Berg are maintenance-free.

A180 - Clean the work area

Orientation

To ensure consistent quality, high availability and value retention, the machine must be regularly cleaned, depending on the operating conditions.

Of course, this is influenced by various factors. The use of emulsion as a cooling lubricant requires a more frequent and intensive cleaning.

Compared to machining producing long chips, machining producing short chips requires a considerably higher maintenance effort. Short chips, such as in the machining of brass or cast iron, form chip accumulations or become deposited in small cracks and corners. These positions must be cleaned regularly to avoid damage to the respective components.

Areas such as telescopic covers, rubber seals, sealing lips or wipers are particularly affected points. Frequent cleaning of these areas is particularly important.

Requirement

Only the agents described in the documentation may be used for the cleaning and after-treatment of the machine.

Always use the proper tool to remove chips.

The following tools are required for cleaning:

- chip hooks,
- chip brushes,
- spray bottles of cleaners or cooling lubricant,
- a sufficient quantity of rags,
- oil to apply to the telescopic plates and all other bare parts by spaying or by brushes.

Procedure

1. 
Caution

Chips and projecting tools in the work area.

Cuts.

Use of personal protective equipment such as safety goggles and gloves, and appropriate tools.

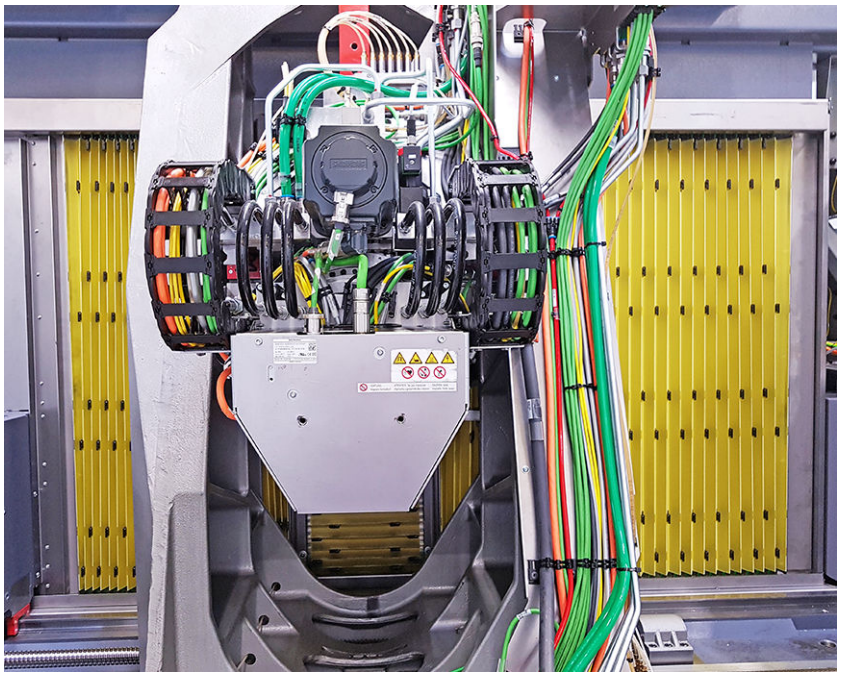
   Remove chips from the work area.
2. Chip accumulation particularly in the area of thetool carriers and the work area door.
3. Flush work area with cooling lubricant.
4. Wipe clean with rags.
5. Apply an oil film to bare metal plates and telescopic covers.
6. Examine any visible damage, and repair or replace, if necessary.

A215 - Check slat/shingle cover on the telescopes (visual inspection)

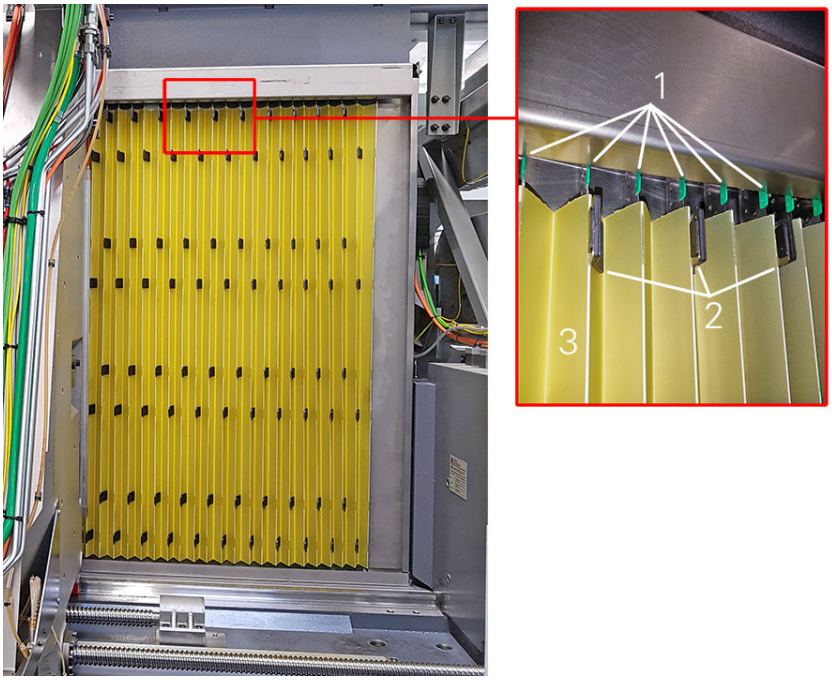
Carrying out the maintenance activities described below requires special knowledge. For this reason, these maintenance activities must only be carried out by staff that has received adequate training by the machine manufacturer!

Orientation

The telescopic plates are additionally fitted with a slat/shingle cover. **View of tool carrier 1**



Example: General view of slat/shingle cover (STRAPANO - Arnold) G420



Slat/shingle cover (STRAPANO - Arnold) G420

1 Slider
2 Holder (two-piece)
3 Slat/shingle cover (carrier material)

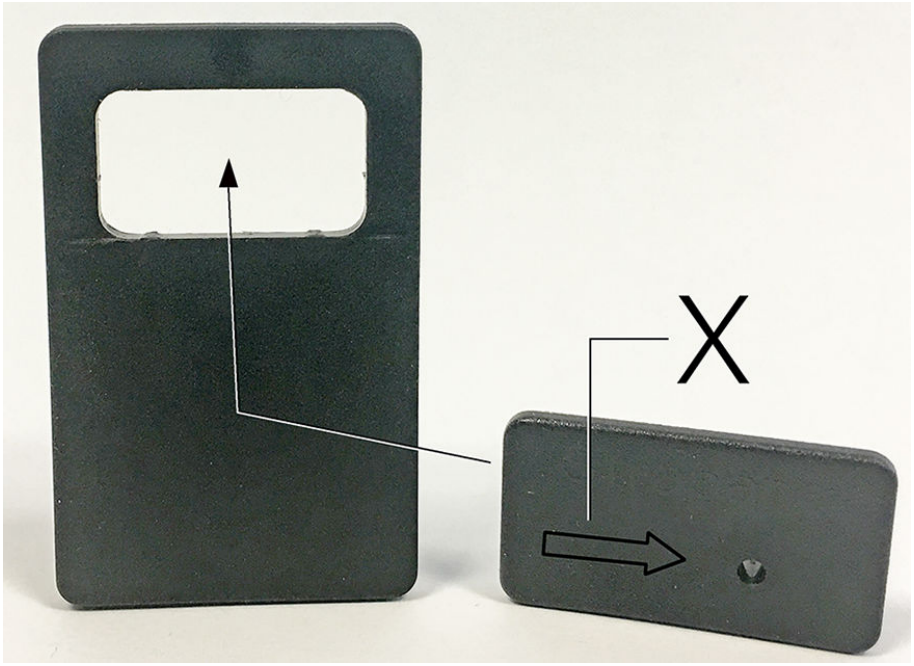
This additional cover consists of three components. During visual inspection, check only the condition of the substrate, the slider and the holder.

Procedure

1. Check the overall condition of the substrate. Assess wear. If individual parts such as sliders, holders or carrier material are destroyed, it is imperative that they be replaced.
2. **Caution**

   Cutting injury due to sharp-edged sheet metal parts.

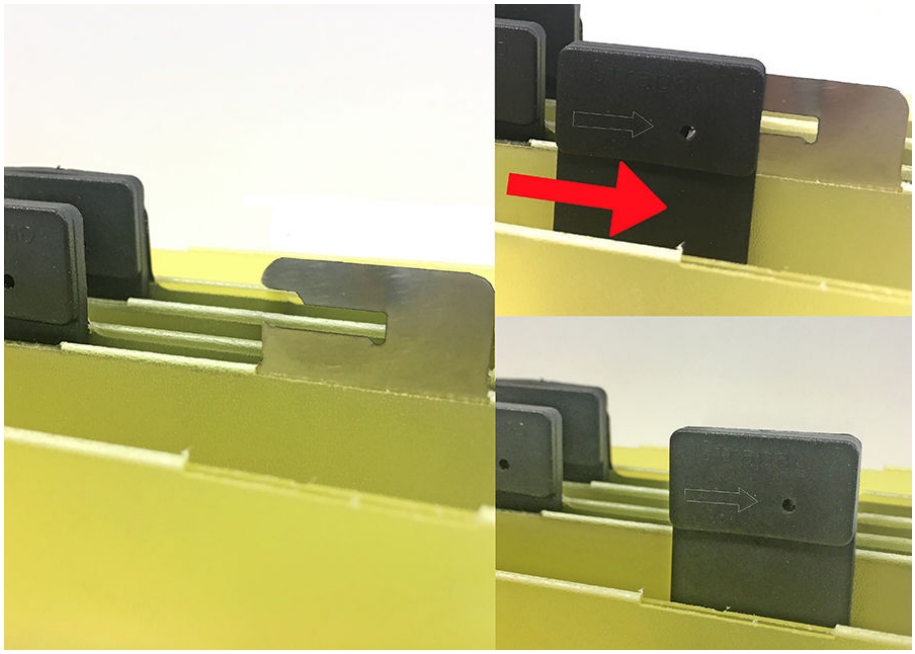
   Always wear suitable protective gloves.



Example: Holder, two-piece (STRAPANO - by Arnold)

X Before mounting on the bellows, join both parts together and observe the direction of the arrow.

Example: Holder, two-piece (STRAPANO - by Arnold)



Example: Mounting of holders (STRAPANO - Arnold company)

Check holder.

3. Check slider.

A255 - Clean the chip conveyor

Orientation

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

To ensure a smooth production process, the chip conveyor should be cleaned and serviced regularly.

With regular cleaning, any defects can be detected and corrected early. Thus, prolonged downtime due to repair work can be reduced to a minimum.

The chip conveyor is used for removal of swarf from the work area and is also a reservoir for the cooling lubricant. The cooling lubricant is filtered in the chip conveyor. For this purpose, various filters and filter plates are built into the chip conveyor. These filters must be cleaned regularly. In particular, make sure that the area around the cooling lubricant pump(s) is always free of chips or dirt.

For all work in connection with operating materials, the information in the data sheets of the respective manufacturers and the information in the document **Notes on Operating Materials** must be observed.

Requirement

Be sure to interrupt the motion of the conveyor belt by opening the work area door or switching off the chip conveyor before commencing cleaning work around the discharge chute!

The conveyor belt can only move when the chip conveyor is switched on and the work area door is closed.

Procedure

1. Service and maintenance are to be carried out according to the manufacturer’s specifications.

   Clean the chip conveyor.
2. Clean the discharge chute. **Pay particular attention to chip build-up and remove them around the discharge chute.** Chip build-up can accumulate in the area of the drive roller so that it can become compacted, causing damage to the conveyor belt including the drive shaft.
3. Check the wipers at the discharge chute and the inlet port.
4. Visual inspection of brush-off device (option).

5.

Example: Chip conveyor G420

Clean strainer basket and magnetic filter plates (option).

6. Remove and clean pre-filters (option) on the cooling lubricant pump.

7. If the supply of cooling lubricant is insufficient, the strainer basket on the cooling lubricant pump must be cleaned.

   Remove cooling lubricant pump. Remove and clean strainer basket on the cooling lubricant pump.

   Alternatively, the following procedure can be used!

   Extract cooling lubricant, remove screen directly from the cooling lubricant pump and clean it.

A320 - Wassermann tool change system

Orientation

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

The visual inspections described in the manufacturer's documentation must be carried out as part of maintenance activities.

Procedure

1. Perform visual inspections according to manufacturer's instructions.

Service Interval - 1.000 Operating hours

Maintenance Summary - 1.000 Operating hours

It is recommended to document the maintenance activities carried out by using the appropriate maintenance log. The maintenance log has the document number DIE249EN - 15.08.2022.

B010 - Customer area

B010 - Customer area

Orientation

This area of the maintenance **B** for **1000h** is generally empty when the machine is delivered. This area is freely editable and is used by the customer to create their own maintenance activities/intervals or work.

For example:

- Interval for cleaning the work area and chip conveyor due to heavy contamination/chip accumulation from short-chipping materials.
- Interval for a filter change.
- Interval for testing the cooling lubricant.

Maintenance contents from the user documentation of additionally purchased peripheral devices that were **not** obtained from **INDEX** can also be transferred to this area.

The procedure for creating your own individual maintenance intervals/contents is described in the **iXpanel** document. This document is both the contents of the user documentation (in paper form) and can be found on the supplied data carriers in Chapter 1 “Instructions”.

Procedure

1. Acknowledgment of maintenance activities **B 1000h**.

Service Interval - 2.000 Operating hours

Maintenance Summary - 2.000 Operating hours

It is recommended to document the maintenance activities carried out by using the appropriate maintenance log. The maintenance log has the document number DIE249EN - 15.08.2022.

C010 - Check maintenance logs of servicing activities

C023 - Clean and check wipers of the work area door

C025 - Check work area door (with electr. drive) and window pane

C040 - Check and lubricate HSK clamping set (from Ott-Jakob)

C047 - Check tool clamping sets of the milling spindles

C050 - Check and potentially replace the cooling lubricant adapter (HSK tool mountings)

C065 - Check telescopic covers and wipers

C070 - Check outer wipers of linear guides

C080 - Check all electrical connections and drive belts of the drive motors

C095 - Check slat/shingle cover on the telescopes (visual inspection)

C130 - Replace filter on air conditioner cooling fan

C140 - Check cooling unit for cooling lubricant

C165 - Check coolant

C190 - Clean labyrinth rings of spindles

C510 - Check backup data carrier

C525 - Check control cabinet

C545 - Check cable and hose clamps for tight seating

C555 - Replace hydraulic fluid filters

C570 - Wassermann tool change system

C590 - Maintenance of turret steady rest SR2 or SLU X1 (by SMW)

C010 - Check maintenance logs of servicing activities

Orientation

The maintenance logs on the performed maintenance activities allow you to review the maintenance activities carried out between two maintenance intervals. The logs may contain important indications as to work that may be necessary beyond the maintenance activities. Similarly, the logs can be used for determining the cause of malfunctions due to incorrect or inadequate maintenance activities carried out.

Procedure

1. Check maintenance or inspection logs.

C023 - Clean and check wipers of the work area door

Orientation

Regular inspection of the wipers prevents damage to the wipers themselves and to the work area door.

If the work area door can be opened and/or closed only with increased effort, it can be expected that the wipers are already destroyed by accumulation of chips and swarf compaction.

Requirement

Example: Chip hook and chip brush

Use appropriate tools to remove coarse chips, chip nests and other debris.

Procedure

1. 

Example: Removing chip nest using appropriate tools (e.g., chip hooks)

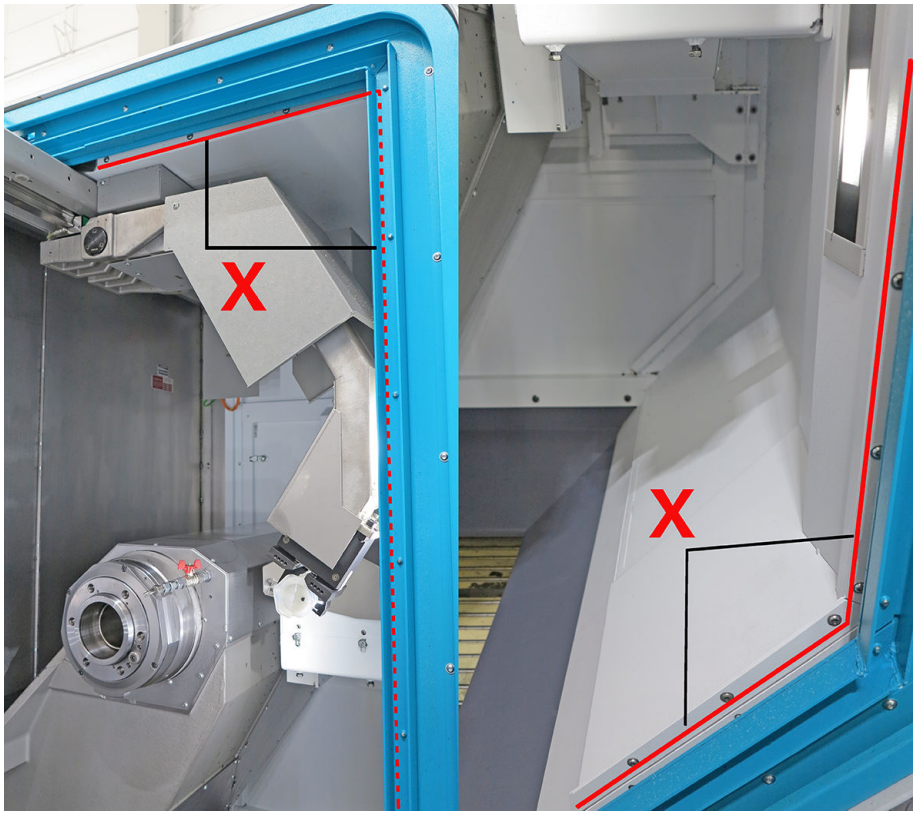
Remove large chips on the inside of the work area door from top to bottom. Use a chip hook for this purpose.

2. 

Example: Sweep small chips and other debris from top to bottom using chip brooms or brushes.

Remove small chips and chip accumulations on the inside of the work area door from top to bottom. Use a chip brush for this purpose.

3. Make sure that the wipers evenly contact the work area door before tightening the screws.



Example: Wipers on work area door top and sides, G220

Clean wipers.

Alternatively, the following procedure can be used!

In case of heavy soling or adhesion of chips to the wipers, the wipers and associated cover plates should at any rate be completely removed and cleaned. **In this case, also clean the area behind the wipers**

4. Check the wipers for proper seating. After the work area door has been cleaned, it should open and close again without much effort as usual

C025 - Check work area door (with electr. drive) and window pane

Orientation

Inspection and maintenance of the work area door includes several steps:

- Inspection of the window pane for damage.
- Checking the safety label on the window pane (replacement interval 8 years).
- Checking/adjusting or replacing, if necessary, the wipers.
- Check the work area door for smooth opening/closing.
- Check functions of the work area door – (**follow manufacturer's documentation from Langer & Laumann**).

The window pane consists of three panes. The inner pane made of tempered glass, the central pane made of polycarbonate, and the outer pane also made of polycarbonate. The inner pane is relatively resistant. It can be cleaned with any commercially available cleaning agents. Only the center pane is essential for the impact resistance of the window pane.

The polycarbonate panes are subject to **natural** aging and therefore must be subjected to regular visual inspection. Through contact with cooling lubricant, the aging process is accelerated even further.

If the window pane is damaged, it must be replaced. This is necessary regardless of the extent of damage. Even with minimal damage, the impact resistance of the pane can no longer be guaranteed.

Heavily soiled or damaged wipers may cause damage to the inner pane. Moreover, it may be possible that the work area door can be moved only with considerable effort due to heavy soiling or chip deposits in the wipers.

Regularly check and clean the guide rails of the work area door.

Check function of the automatic work area door with electric drive (option like open/close) with different speeds with or without obstacle detection check.

Requirement

The automatic work area door can be tested only when the machine is switched on and fully functional.

Be sure that the wipers have been checked before testing the automatic work area door. Be sure to remove any chip nests and make sure that the wipers have been cleaned and attached to the plates.

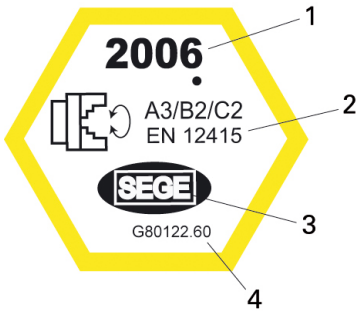
Procedure

1. Check window pane for damage.

2. Clean the outer pane with a soft cloth or sponge and glass cleaner or soap and water. Do not use abrasive or alkaline cleaners (e.g., benzene, acetone or carbon tetrachloride) and no sharp tools or sharp objects (such as razor blades or screwdrivers).

   Clean outer pane.

3. Clean inner pane.

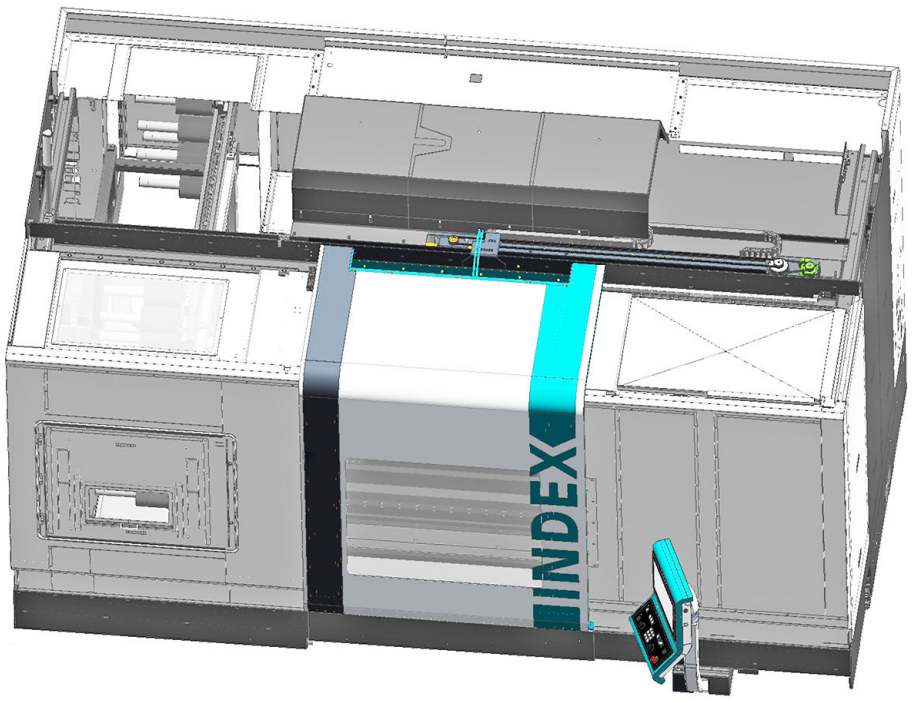
4. 

   Example: Safety label – window pane 2006

   1 Year of manufacture
   2 Protection class and EN standard
   3 Manufacturer
   4 INDEX part number

   Check safety label (replacement interval every 8 years).

5. Check wipers. Remove and clean the wipers. If the wipers are severely deformed or damaged, they must be replaced. To clean the door panels evenly, be sure to reinstall the wipers after their removal aligned in parallel and ensure that they snugly contact the work area door.

6. 

   Example: View of the automatic work area door with drive

Check the work area door for ease of movement. To do this, press the emergency stop button and manually open and close the work area door. If the work area door can be moved only with effort, determine the cause. Possible causes are defective or improperly adjusted wipers, or chips on the guide bar or in the guide rollers of the work area door.

7.

Danger

Pinching of limbs due to faulty obstacle detection on the work area door

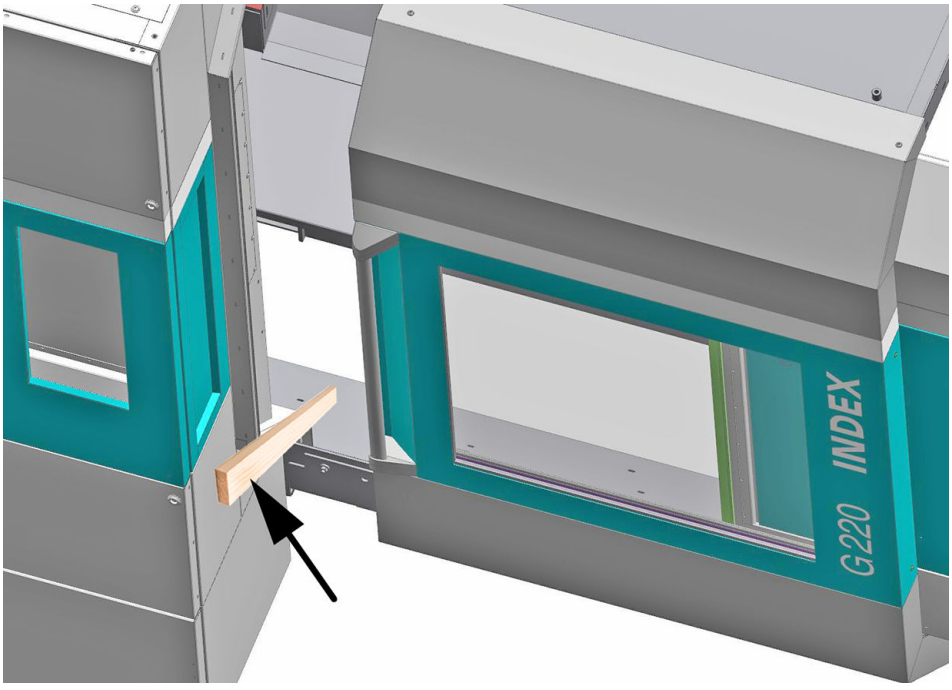
Check obstacle detection.

INDEX recommends an annual check of the obstacle detection function of the automatic work area door.

The test should only be carried out with a suitable aid, such as a rectangular strip or a softwood squared timber.

INDEX recommends documenting the results of the inspection and keeping them at the workplace.

The machine must be switched on and fully functional for this test.



Example: Checking the obstacle detection

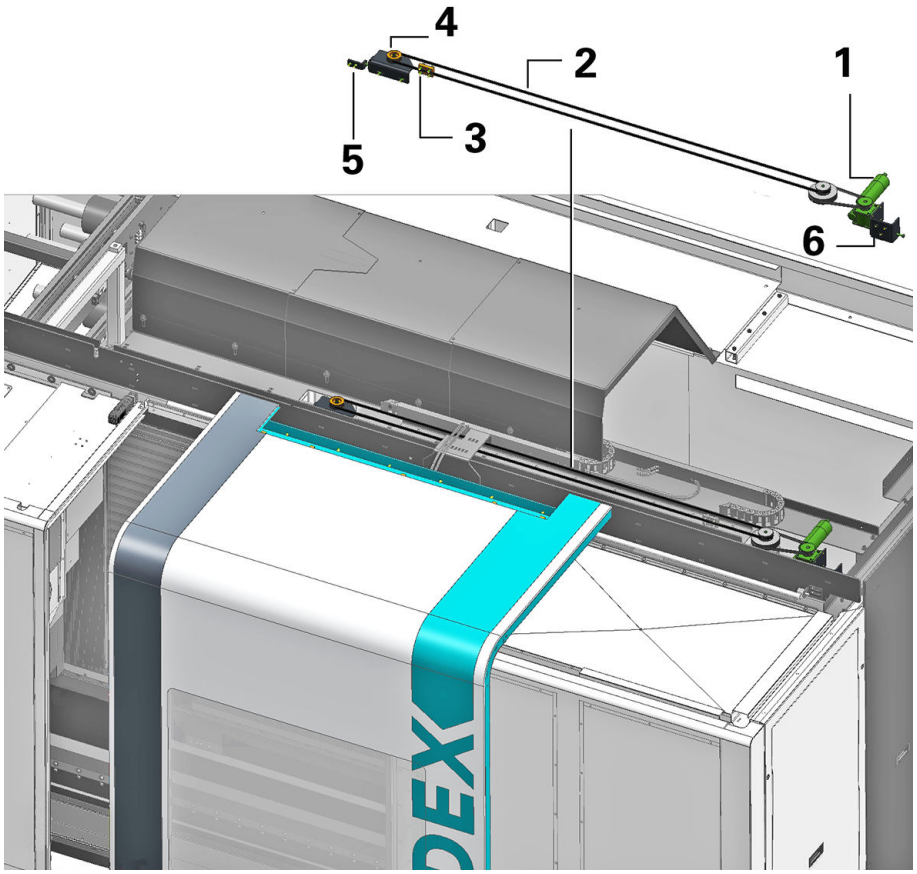
Check obstacle detection of the automatic work area door. During the obstacle detection test, a rectangular strip or softwood squared lumber, for example, is held in the travel path of the work area door during the closing process. If the rectangular strip or squared timber comes into contact with the work area door

in the closing area, the obstacle detection is triggered and the closing movement must be reversed.

If the obstacle detection does not immediately lead to reversal of the moving direction, the complete work area door must be checked immediately. **The machine must not be operated any further.**

8. Be sure to contact the **INDEX** service department or an **INDEX** representative.

9.



Example: View of the automatic work area door G420 with drive

1 Drive/deflection pulley
2 Belt
3 Driver
4 Deflection pulley

Visual inspection of the drive of the automatic work area door. This is in particular an assessment of the toothed belt **(2)** – condition, tension. Also the condition of the two deflection pulleys **(1+4)** and the actuator **(3)**.

C040 - Check and lubricate HSK clamping set (from Ott-Jakob)

Orientation

Ensuring that the tools are properly clamped in the tool carrier requires a high level of cleanliness. Therefore, it is also essential to carry out various maintenance and servicing activities at shorter time intervals. The performance and process reliability of the machine are affected to a large degree by the condition of the clamping devices in the multifunction units and motor milling spindles.

This includes the cleaning of surfaces and mounting bores on the tool carrier as well as regular inspection of various wear parts such as O-rings or the like on the HSK clamping set.

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

Example: Clamping sets from Ott-Jakob

When ordering spare parts, always note the make, manufacturer and/or design (latching or non-latching) of the parts currently installed.

The use of tools with shank ISO 12164-1 version before 2001 or DIN 69893-1 version before 2003 (HSK-A) can cause serious damage to the tool magazine during automatic tool change and is therefore not permissible.

Requirement

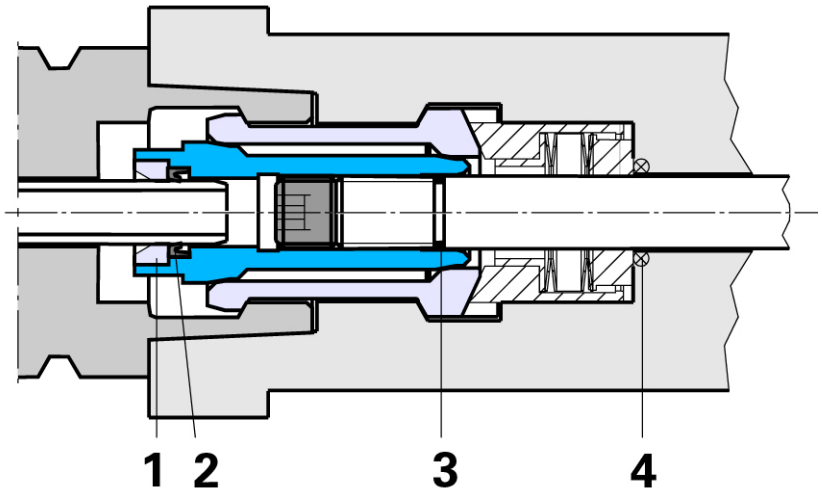
Specification and quantity of hydraulic fluid or lubricating oil and grease in accordance with information in the technical data.

The spare parts and utilities as well as operating fluids required for repair or maintenance should already be available in sufficient quantities.

This is especially true for necessary special tools, without which the maintenance or repair would not be possible.

Procedure

1. Check the adjustment in the “Released” position – lock with a clamped tool.
2. A measuring device required to measure the clamping force can be sourced through **INDEX** , a representative or the tool manufacturer.

   Check the retraction force. **If the retraction force is less than 70% of the nominal value, take the following measures in the order given** : Regrease and recheck retraction force – replace collet and recheck – completely replace tool clamp.
3. 

   Example: HSK clamping set

   1 Brass ring
   2 Grooved ring
   3 O-ring
   4 O-ring

   Check grooved ring (2) in clamping taper
4. Remove and check clamping set. Remove clamping set, clean it according to manufacturer’s instructions, check it for wear (replace if necessary), and lubricate it. After lubricating, re-check the retraction force. If the retraction force is still less than 70% of the nominal value, the collet or the complete tool clamping system must be replaced.

C047 - Check tool clamping sets of the milling spindles

Carrying out the maintenance activities described below requires special knowledge. For this reason, these maintenance activities must only be carried out by staff that has received adequate training by the machine manufacturer!

Orientation

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

The clamping sets (HSK and Capto) installed in the tool or milling spindles should be checked regularly. Regular checks ensure continuous and trouble-free operation. Based on manufacturer's instructions, we recommend replacement of the clamping sets when the clamping force falls below the following values **(see Table F_{min})** .

		F_1 (kN)	F_{min} (kN)
R200	HSK-T40	10	7
R300	HSK-T63 PSC 63	24 30	17 21
G220	HSK-T40 HSK-T63	10 24	7 17
G220.3	HSK40 HSK63	12 24	10 20
G320.2	HSK63	24	20
G200.2	HSK-A40	11	8
G420 G520	HSK-T63 PSC 63	24 30	17 21

Table for testing the clamping force of clamping systems

F_1 = nominal clamping force in kN (manufacturer data)
F_{min} = manufacturer recommendation in kN

The values for F_1 listed in the table are based on **DIN 69063-1** for HSK and **ISO 26623-2** for PSC - CAPTO

Example: HSK clamping sets from Berg

New or manufacturer-reconditioned clamping sets must **not** be relubricated. Improper lubrication of the clamping sets may cause damage to the clamping set or failure of the entire clamping system.

Requirement

A measuring device required to measure the clamping force can be sourced through **INDEX** , a representative or the tool manufacturer.

Example: Clamping force measuring system from Berg

The Berg clamping force measuring system for tool mountings is designed for force measurement with a stationary spindle. Clamping force measurements can be performed on HSK, SK and Capto tool mountings.

Procedure

1. Check clamping sets of the tool spindles. This procedure depends on the measuring device. **Therefore be sure to follow the manufacturer's documentation of the measuring device**.

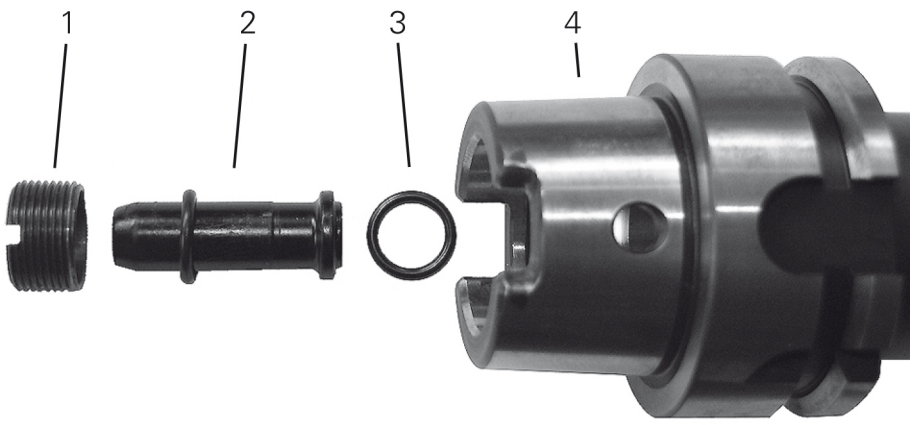
C050 - Check and potentially replace the cooling lubricant adapter (HSK tool mountings)

Carrying out the maintenance activities described below requires special knowledge. For this reason, these maintenance activities must only be carried out by staff that has received adequate training by the machine manufacturer!

Orientation

HSK tool mountings feature a so-called internal cooling lubricant supply. in which the cooling lubricant is fed through the tool to the tool's cutting edge. To ensure a tight connection between the tool spindle and the HSK shank when a tool is changed (automatically or manually), there is a cooling lubricant adapter inside the HSK shank. This adapter is spring-mounted using O-rings so it can move to some extent, which provides for a safe tool change. As this O-ring is subjected to natural wear, it must be checked and replaced if necessary at regular intervals.

Procedure

1. Check and potentially replace the cooling lubricant adapter (also for tools inside the tool magazine). Check the correct seating of the cooling lubricant adapter, and replace the sealing ring at the cooling lubricant adapter.
2. Remove the tool including the HSK tool mounting.
3. Check the centric position of the cooling lubricant pipe. It should be possible to shift the pipe approximately 1 mm from the center, after which it centers again automatically (resilient). Otherwise the cooling lubricant pipe has to be removed and the O-ring has to be replaced. The following steps must be performed.
4. 

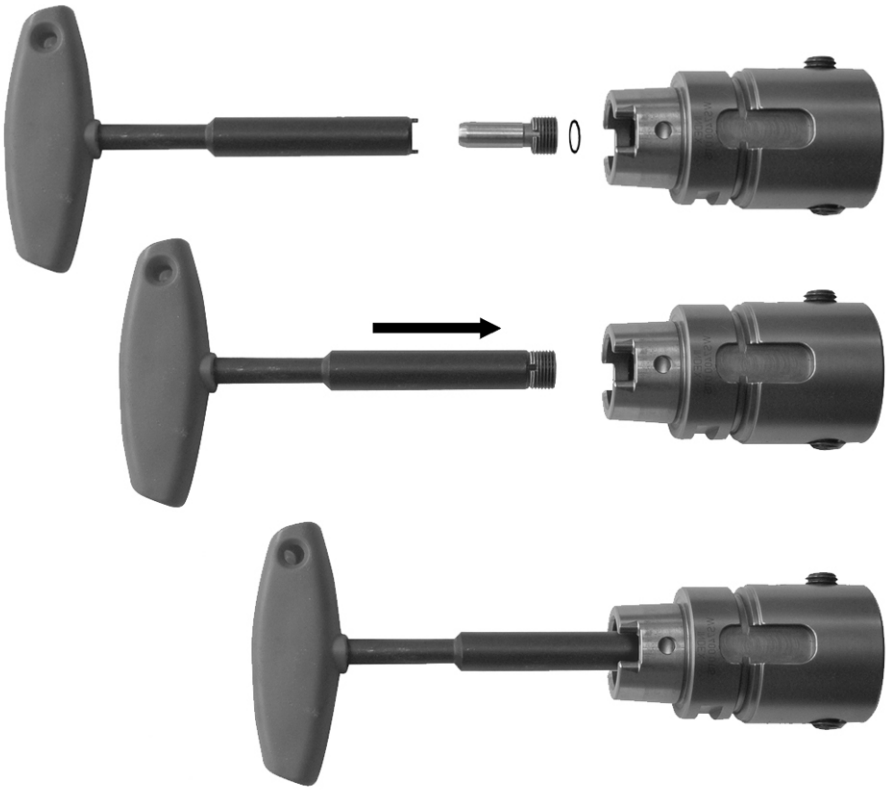
Example: Seal at the cooling lubricant adapter

1 Groove nut
2 Cooling lubricant tube
3 O-ring
4 HSK tool mounting

Clean the tool including the HSK tool mounting before the removal.

5. Loosen and remove groove nut **(1)** inside the HSK tool mounting **(4)** using the supplied special tool.
6. Remove cooling lubricant pipe **(2)** and replace O-ring **(3)**.

7. For assembly, follow the steps in reverse order. Ensure proper cleanliness during the installation.

8. 

After assembly, check again the central position of the pipe. See item 3.

C065 - Check telescopic covers and wipers

Orientation

Depending on the material used and the machining process, the telescopic covers and wipers must be cleaned and checked regularly. In particular, before any prolonged shutdown of the machine (e.g., during weekends).

Dirty telescopic covers and wipers affect the accuracy of the machine and its service life.

Contamination of the telescopic covers and wipers results in increased friction (stiffness) of the plates. This may damage the telescopic covers and wipers so that contaminants can get into the area behind the telescopic cover. This in turn may cause damage to other machine parts, requiring expensive repair. In the event of damage, determine the cause of the damage and immediately notify the machine manufacturer or its representative company.

After cleaning, the telescopic covers and wipers must be coated with low-viscosity oil.

The oil must not resinify and sediments must not form when exposed to other fluids or machining residues (e.g., metallic dust). Otherwise, the service life of the wipers would be considerably impaired.

Requirement

Before starting the cleaning, move the tool slides to positions that are more convenient for the cleaning process.

Power off the machine and secure it against power on.

Procedure

1. Clean telescopic plates. Remove chips with a suitable chip hook or hand-held broom. Afterwards rub with a cloth.
2. Check telescopic and guide plates for damage. Look for deep scoring or abrasion.
3. Oil the telescopic covers.
4. Switch the machine on and move the tool slides until an even film of oil is visible over the whole traversing range of the telescopic cover. If relubrication is required, first stop the travel movement and set feed rate override to “zero” position.

C070 - Check outer wipers of linear guides

Carrying out the maintenance activities described below requires special knowledge. For this reason, these maintenance activities must only be carried out by staff that has received adequate training by the machine manufacturer!

Orientation

Regularly checking wipers of the roller guides prevents accelerated wear of the linear guides. This test is a visual inspection. But if the wiper is destroyed and no longer snugly contacts the contour of the guide, it must be replaced. **It is essential to ensure absolute cleanliness when removing and installing the wiper.**

Requirement

Move the tool carriers to a suitable position. For checking the outer wipers, parts of the machine enclosure must be removed from the machine. In most cases, access to the wipers is best in the end positions of the respective axes. To move to the positions in which the wipers can be checked, it may be necessary to switch the machine on/off several times.

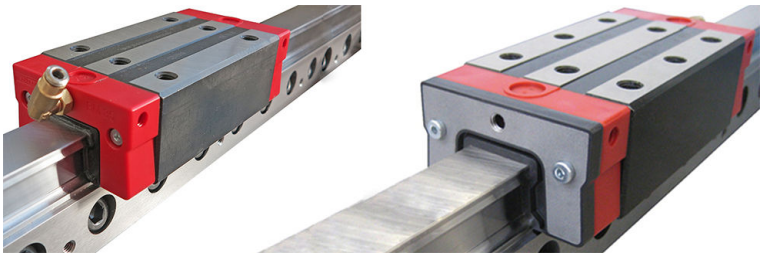
Procedure

1. Move the tool carrier to the position required for checking.
2. Caution

   Moving tool carriers, spindles, or belt drives.

   Risk of bruising and lacerations.

   Switch off the machine via the main switch or shut down with the emergency stop.

   Remove relevant machine enclosure.
3. 

   Example: Wiper on the trolley of the linear guide (view from the preassembly).

   Check wipers.
4. Replace wipers. Loosen and remove the mounting screws of the wiper on the trolley. Push the wiper from the guide bar. Clean the guide bar and push a new wiper onto the guide bar. Finally lightly oil the guideway.

C080 - Check all electrical connections and drive belts of the drive motors

> Carrying out the maintenance activities described below requires special knowledge. For this reason, these maintenance activities must only be carried out by staff that has received adequate training by the machine manufacturer!

Orientation

This activity is merely a test to check the power and encoder connections for proper seating and tightness. Simultaneously, all drive belts are subjected to a visual inspection.

Requirement

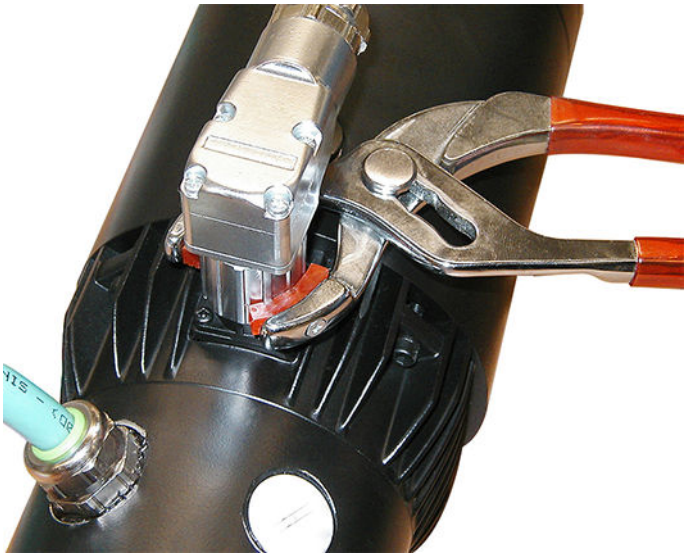
Move the tool carriers to a suitable position.

It may also be necessary to remove various covers or plates for carrying out a visual inspection. Furthermore, a special pair of pliers is needed for tightening the power and encoder connections.

Example: Special pliers for tightening power and encoder connections on the motors

Procedure

1. Loosen connector and check for corrosion and leaks.
2.
> If traces of corrosion or moisture are visible, they must be eliminated and their causes must be determined. If the connectors cannot be cleaned, they must be replaced.



Example: Tighten motor connector

When done checking, reconnect plugs and tighten with special pliers (see the example).

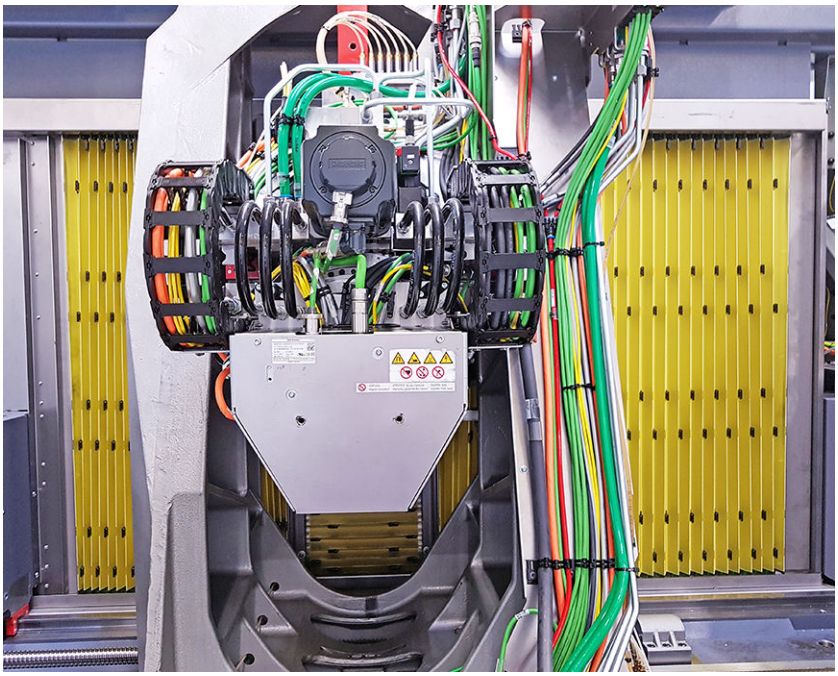
3. Check belt on drive motors for any damage or wear.

C095 - Check slat/shingle cover on the telescopes (visual inspection)

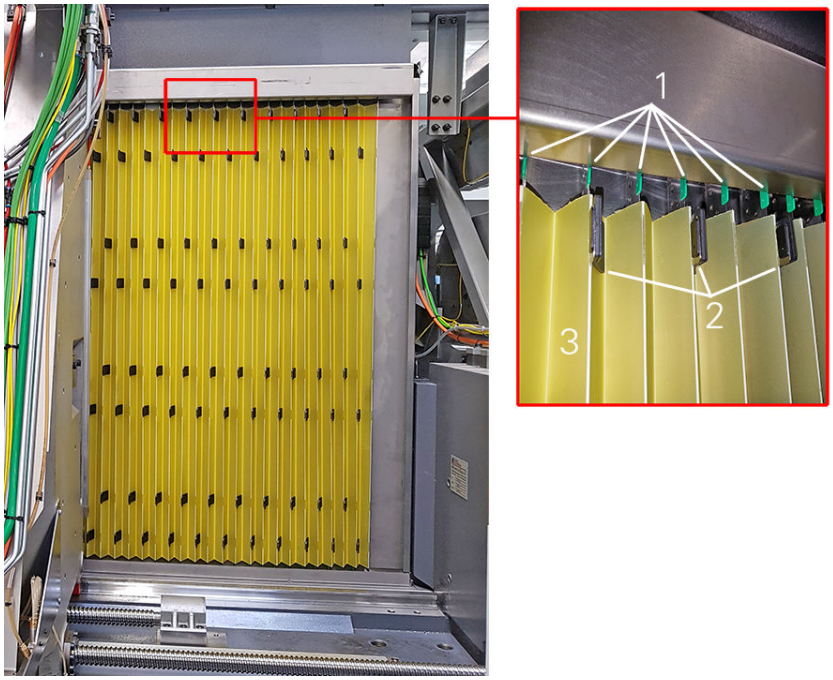
Carrying out the maintenance activities described below requires special knowledge. For this reason, these maintenance activities must only be carried out by staff that has received adequate training by the machine manufacturer!

Orientation

The telescopic plates are additionally fitted with a slat/shingle cover. **View of tool carrier 1**



Example: General view of slat/shingle cover (STRAPANO - Arnold) G420



Slat/shingle cover (STRAPANO - Arnold) G420

1 Slider
2 Holder (two-piece)
3 Slat/shingle cover (carrier material)

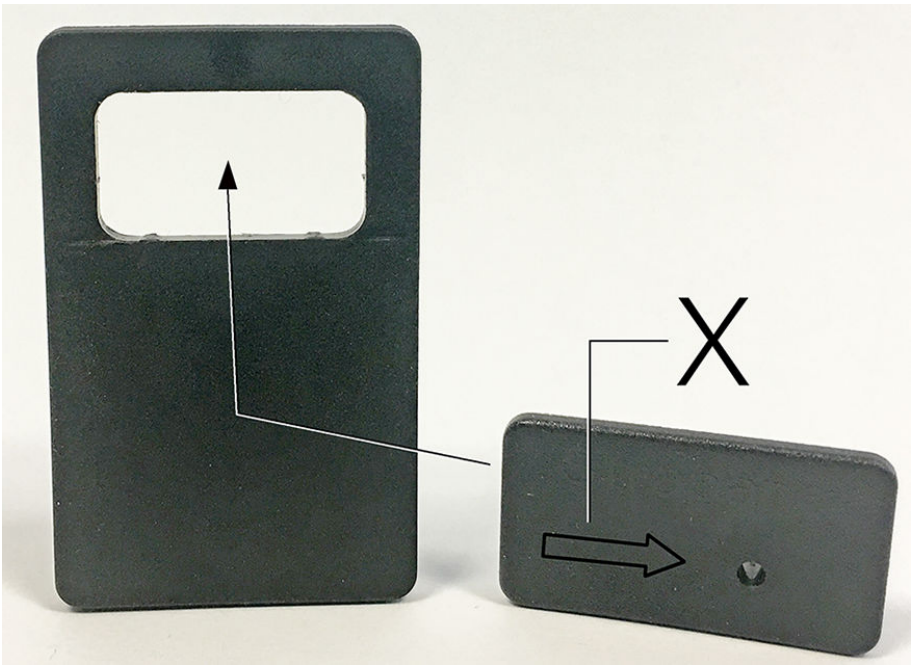
This additional cover consists of three components. During visual inspection, check only the condition of the substrate, the slider and the holder.

Procedure

1. Check the overall condition of the substrate. Assess wear. If individual parts such as sliders, holders or carrier material are destroyed, it is imperative that they be replaced.
2. **Caution**

   Cutting injury due to sharp-edged sheet metal parts.

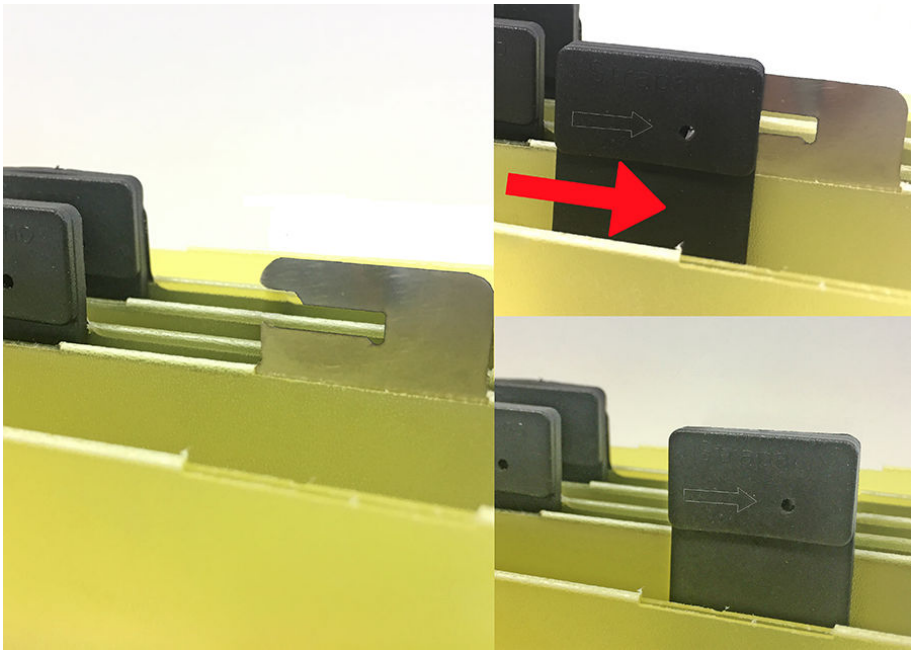
   Always wear suitable protective gloves.



Example: Holder, two-piece (STRAPANO - by Arnold)

X Before mounting on the bellows, join both parts together and observe the direction of the arrow.

Example: Holder, two-piece (STRAPANO - by Arnold)



Example: Mounting of holders (STRAPANO - Arnold company)

Check holder.

3. Check slider.

C130 - Replace filter on air conditioner cooling fan

Orientation

The filters must be replaced regularly depending on the ambient conditions.

Whether air flow exists can quickly and easily be made visible by attaching a thread at the opening of the air outlet.

Use only the original filters according to the spare or wear parts list! Otherwise the machine is at risk of sustaining serious damage due to overheating.

Requirement

A sufficient number of filters must be available.

Procedure

1. 

Example: Filter

   Remove machine covers and/or filter housing cover.

2. Replace filter.
3. Reinstall all covers.

C140 - Check cooling unit for cooling lubricant

Carrying out the maintenance activities described below requires special knowledge. For this reason, these maintenance activities must only be carried out by staff that has received adequate training by the machine manufacturer!

Orientation

Water-cooling equipment maintain the temperature in the cooling lubricant circuit on a previously set value. The heat generated by the machining process is dissipated away from the workpiece by the cooling lubricant and the cooling lubricant is cooled down again to the preset temperate by the water cooling unit(s).

To achieve a constant temperature level in this circuit, it is necessary to include it in the inspection and maintenance operations.

Be sure to observe the third-party manufacturer documentation and the technical data of the respective equipment. If in doubt, contact the manufacturer of the equipment or the cooling lubricant vendor.

Requirement

Prerequisite for effective operation within the cooling circuit is the condition of the cooling lubricant. To check the condition of the cooling lubricant, a refractometer is required. With the help of this instrument, it is possible to determine the concentration of cooling lubricant in water. In addition, the monitoring features available on the cooling unit must be checked or adjusted.

Procedure

1. General visual inspection for tightness.
2. Check condition of coolant.
3. Check fill level glass(es) (option).
4. Check flow rate sensor and record current values.
5. If necessary, readjust flow rate sensor and record new values.
6. Check temperature sensors/thermostats and record current settings.
7. If necessary, readjust temperature sensors/thermostats and record new values.

C165 - Check coolant

Orientation

For add-on equipment that cannot be cooled conventionally with cooling lubricants or hydraulic fluid due to high temperature development, separate cooling is provided in an independent cooling circuit. The coolant used here must be checked continuously for its condition like other coolants.

Apart from this interval, the coolant should generally be replaced once a year.

The system comprises a cooling circuit on the machine side and either

1. a water recooler located next to the machine or
2. an external cooling circuit provided by the machine operator/owner.

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

For all work in connection with operating materials, the information in the data sheets of the respective manufacturers and the information in the document **Notes on Operating Materials** must be observed.

Requirement

Replenish only coolant of the same manufacturer having the same specification. Mixing different coolants may lead to corrosion of the cooling system, incompatibility and degradation of the coolant. Required glycol concentration min. 34-35%.

When switching the coolant to another product or changing the manufacturer, the cooling system must be completely flushed and cleaned with this coolant. When preparing the coolant from concentrate and water, be sure to use demineralized water only. Only then the machine may be put back into operation.

Make sure that a concentration of FSK35 (35% glycol) is used in machines 1-4. From Machine 5, a concentration of Antifrogen N (34% glycol).

When using a water recooler, be sure to follow the manufacturer’s instructions.

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

Procedure

1. Check coolant.
2. Check supply and fluid lines for damage such as buckling and abrasions, and for liquid leaks. Replace supply and fluid lines if necessary. Record the age or date of replacement of supply and fluid lines in the service, testing and maintenance schedules or reports.

C190 - Clean labyrinth rings of spindles

Orientation

When machining short-chipping materials such as brass, cast iron, or in case of residues from the grinding, the work area must be cleaned more frequently due to the special nature of the contamination. Depending on the duration of use, usage profile of the machine and different ambient conditions, it is necessary in particular to remove and clean the labyrinth rings.

Do not clean the machine with compressed air.

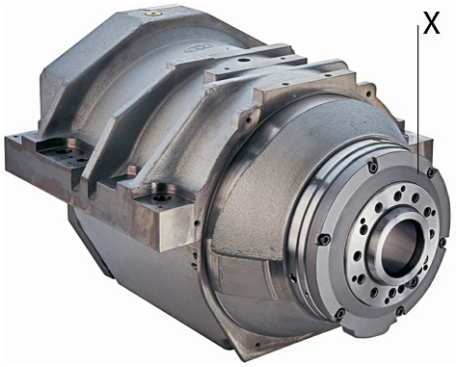
Raised dirt particles may cause breathing difficulties or injuries (especially of the sensory organs).

Furthermore, raised dirt particles or chips may reach spots where they cause technical problems.

Do not use cotton waste for cleaning.

When cleaning with cotton waste, fibers or thread can get loose causing safety problems.

Procedure

1. Loosen and remove the screws on the labyrinth ring (X) of the work spindle. The number of screws that are necessary to fasten the labyrinth ring may differ depending on the type of machine.
2. 

Example: (X) Labyrinth ring on the main spindle G200

   Remove the labyrinth ring.
3. Clean the labyrinth ring. Clean the free space behind the labyrinth ring by hand with a cloth.
4. Reinstall the labyrinth ring and tighten the screws to the proper torque.

C510 - Check backup data carrier

Orientation

If data from the control is lost, the backup CD/DVD always provides the ability to quickly restore the operation of the machine.

Therefore, regularly checking this data carrier is essential.

Procedure

1. Check the existing backup data carrier for readability. Insert the data carrier into the appropriate drive of a standard PC.
2. 

   If the data carrier is not recognized, it is damaged. To create a new backup data carrier, contact the machine manufacturer.

   If the data carrier is recognized, make a copy to the hard disk. Create a folder named “Backup Copy” at a suitable location in the directory tree.
3. Copy the entire contents of the backup data carrier to this folder. If the copying process finished without displaying an error message, the data carrier is fine.
4. Delete the folder on your hard disk.

C525 - Check control cabinet

Orientation

To avoid problems and prevent any resulting system failures, simplified control cabinet checks must be carried out at regular intervals on the cabinet and associated components. Additional built-in air conditioning units ensure a constant temperature in the control cabinet. These air conditioners cannot work efficiently if filters are dirty or doors are not tight.

Procedure

1. 

   Electric shock

   Power off the machine and wait approx. 30 minutes. Check with a meter if there is still voltage applied to the intermediate circuit.

   Check settings of the fuses. For this purpose, review the information in the wiring diagram.

2. Check Sinamics S120 connections, control modules, connectors, bus, device bus and intermediate circuit bus for tight seating.
3. Clean suction port(s).
4. Check door seals.

C545 - Check cable and hose clamps for tight seating

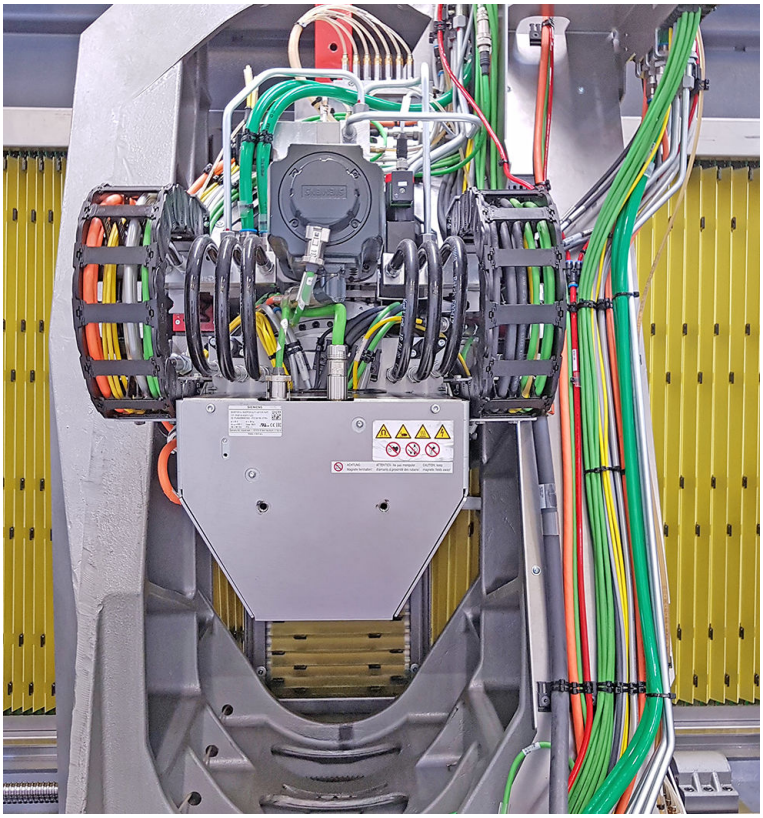
Carrying out the maintenance activities described below requires special knowledge. For this reason, these maintenance activities must only be carried out by staff that has received adequate training by the machine manufacturer!

Orientation

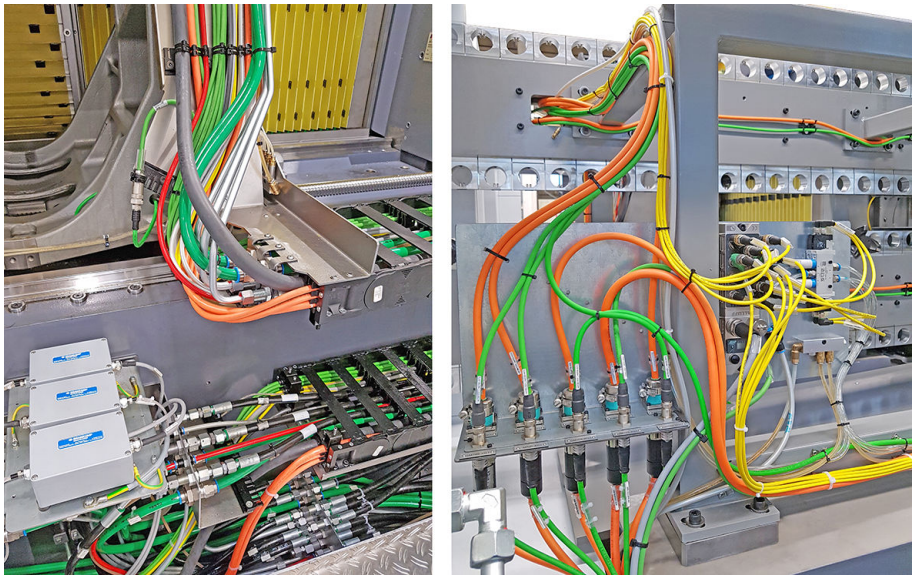
Cable and hose clamps are used to bundle and/or hold the cables and hoses in a certain position.

Loose or faulty clamps can be abrasive to cables or hoses and damage them. Under unfavorable circumstances, defective clamps may lead to “entangling” of the cables/ hoses, which may result in tearing off entire bundles.

Procedure

1. Check cables for chafing and kinks.
2. Check cable and hose clamps for tight seating. In case of moving drags or bundles, check for any movement within the function.
3. 

Example: Power cabling G420



G420_Power_Cabling_Example

Check strain relief. Check the correct position of the boots and adjust the strain reliefs.

4. Record any damages and initiate repair.

C555 - Replace hydraulic fluid filters

Carrying out the maintenance activities described below requires special knowledge. For this reason, these maintenance activities must only be carried out by staff that has received adequate training by the machine manufacturer!

Orientation

One or more hydraulic fluid filters are installed on the machine depending on the product and its equipment. The filters are provided with a sensor that signals malfunction or contamination to the control. If a fault is displayed on the control, the filter unit should be removed or replaced.

For all work in connection with operating materials, the information in the data sheets of the respective manufacturers and the information in the document **Notes on Operating Materials** must be observed.

Requirement

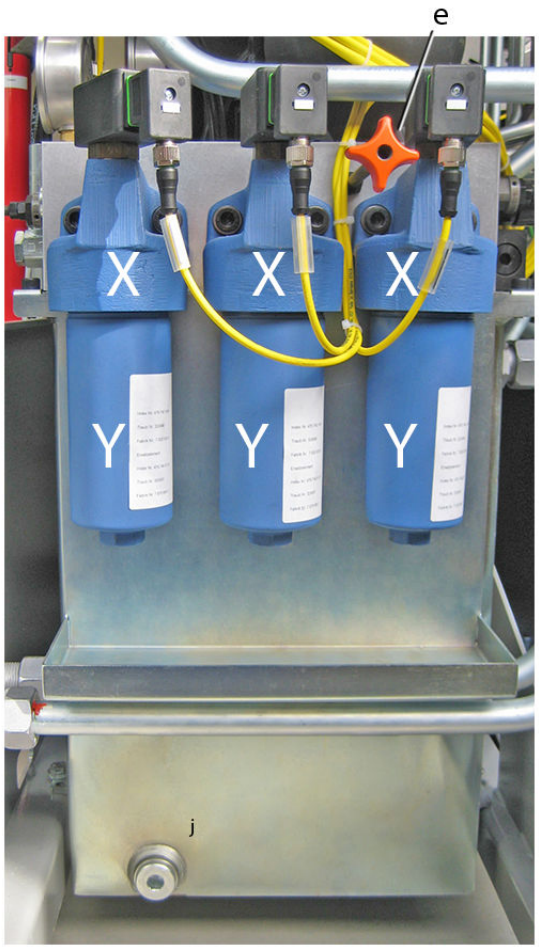
Only filters with retained particle sizes described in the fluid plans must be used.

Use only the original filters according to the spare or wear parts list.

A suitable container should be ready for the disposal of the filter and the residual oil in the filter bowl.

Procedure

1. Power off the machine, depressurize the hydraulic system by opening the accumulator relief valve(s), and protect against accidental power on.



Example: Hydraulic fluid filter G220 G420

e Accumulator drain valve
X Hydraulic filter
Y Filter bowl

Using a wrench, loosen the filter bowl **(Y)** and remove it from the filter unit **(X)**.

2.

Filters are hazardous waste and must be disposed of in a controlled manner.

Example: Filter insert (Z)

Empty filter bowl **(Y)** into prepared container. **Do not fill fluid from the filter bowl (Y) back into the tank!** Remove filter **(Z)**.

3. Clean filter bowl **(Y)** and insert a new filter **(Z)**. Reinstall the filter bowl and tighten **by hand until it stops**. Then back off the filter bowl 1/8 turn.

C570 - Wassermann tool change system

Orientation

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

Procedure

1. Perform 2000 h maintenance according to the manufacturer's documentation.

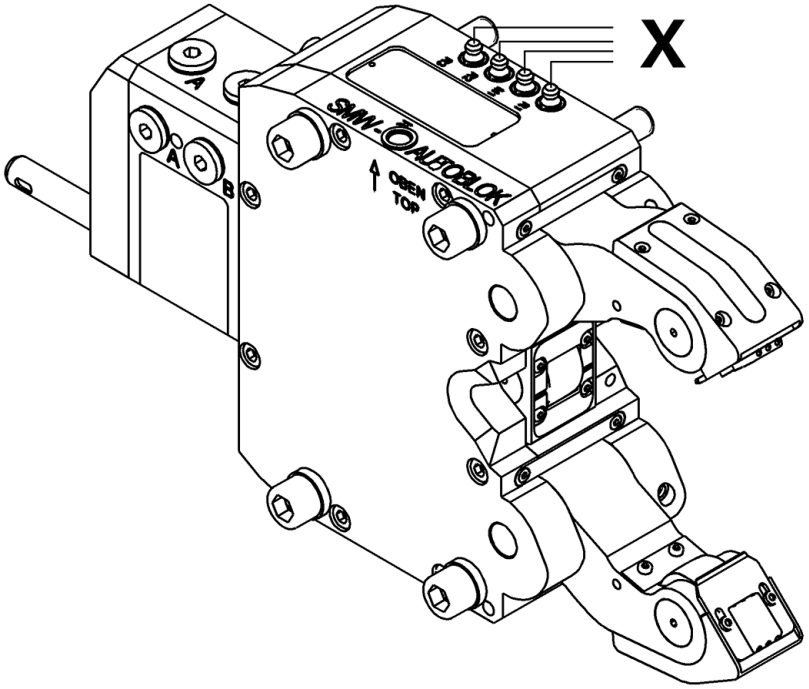
C590 - Maintenance of turret steady rest SR2 or SLU X1 (by SMW)

Orientation

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

Procedure

1.



Example: Turret_Steady_Rest_SMW_SR2

X Lubrication points

Perform 2000 h maintenance according to the manufacturer's documentation.

Service Interval - 4.000 Operating hours

Maintenance Summary - 4.000 Operating hours

It is recommended to document the maintenance activities carried out by using the appropriate maintenance log. The maintenance log has the document number DIE249EN - 15.08.2022.

D010 - Cleaning of the machine

Orientation

To ensure consistent quality, high availability and value retention, the machine must be regularly cleaned, depending on the operating conditions.

Of course, this is influenced by various factors. The use of emulsion as a cooling lubricant requires a more frequent and intensive cleaning.

Compared to machining producing long chips, machining producing short chips requires a considerably higher maintenance effort. Short chips, such as in the machining of brass or cast iron, form chip accumulations or become deposited in small cracks and corners. These positions must be cleaned regularly to avoid damage to the respective components.

Areas such as telescopic covers, rubber seals, sealing lips or wipers are particularly affected points. Frequent cleaning of these areas is particularly important.

Requirement

Only the agents described in the documentation may be used for the cleaning and after-treatment of the machine.

Always use the proper tool to remove chips.

The following tools are required for cleaning:

- chip hooks,
- chip brushes,
- spray bottles of cleaners or cooling lubricant,
- a sufficient quantity of rags,
- oil to apply to the telescopic plates and all other bare parts by spaying or by brushes.

Procedure

1. Caution

   Chips and projecting tools in the work area.

   Cuts.

   Use of personal protective equipment such as safety goggles and gloves, and appropriate tools.

   Remove chips from the work area.
2. Chip accumulation particularly in the area of thetool carriers and the work area door.
3. Flush work area with cooling lubricant.
4. Wipe clean with rags.
5. Apply an oil film to bare metal plates and telescopic covers.
6. Check plates for damage, repair or replace if necessary.

7. When cleaning the drive area, make sure that the dirt does not penetrate directly into the path measuring systems and the ballscrews. The cleaning process must not aggravate the contamination of the components.

   Clean drive area. Spray cooling lubricant onto the drive area around the supports of the guide bars and then sweep off the rough dirt down into the drag of the machine with a hand brush. Afterwards rub with rags.

8. When cleaning the spindle carriers, make sure that the dirt does not penetrate directly into the spindle encoders. The cleaning process must not aggravate the contamination of the components. Follow the manufacturer's documentation.

   Cleaning of the spindle carriers of the main and counter spindles. Remove machine covers in the area of the spindles. Then remove and clean the spindle covers.

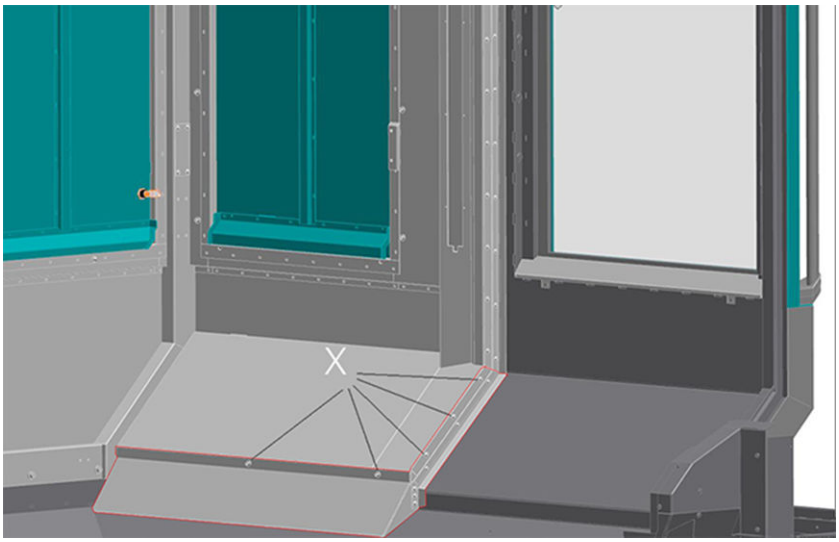
9. Clean the machine base. Remove accumulations of chips, especially in the area of the counter spindle. For this purpose, move the counter spindle towards the main spindle and flush the area with cooling lubricant in the direction of the chip conveyor. Sweep the dirt arising from the cleaning of the drive area also in the direction of the chip conveyor and then flush with cooling lubricant. Afterwards rub with rags.
10. Clean and reinstall machine covers.
11. Clean the collecting tray under the workpiece handling unit.

D015 - Clean the cover at the work area door

Orientation

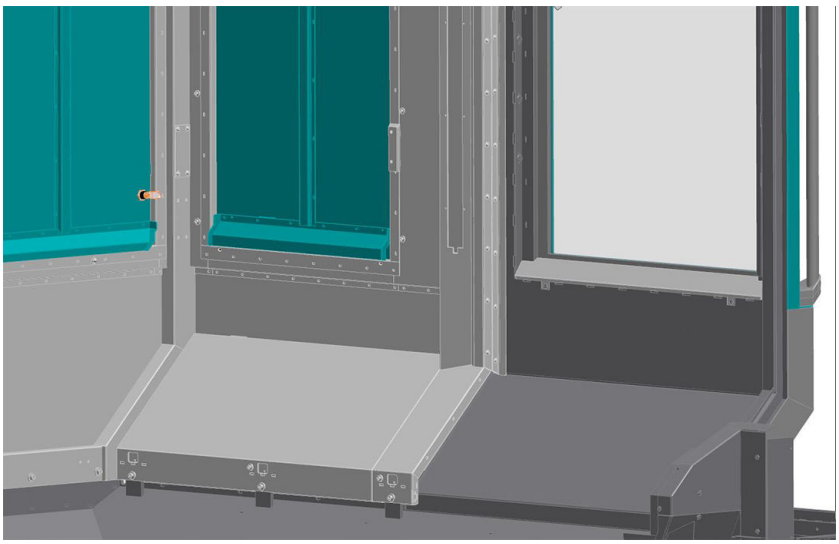
To ensure trouble-free operation of the automatic work area door, the cover in the work area described below must be cleaned. Accumulation of chips (chip nests), depending on the machined material, may cause a compression of chips at this point. This can lead to malfunction and damage to the work area door.

Procedure

1. 

Example: Fig. a G220 G420

After opening the work area door and turn off the hydraulic system, loosen and remove the screws (X) marked in Figure (a). It may be necessary to loosen and remove the screws of the wipers as well.

2. 

Example: Fig. c G220 G420

Example: Tool for removing chips

Clean – after removing the cover – the space behind this cover (Figure (c)). Avoid pushing the chips into the spaces behind the cover by using a suitable tool such as a chip hook and brushes to remove the chips.

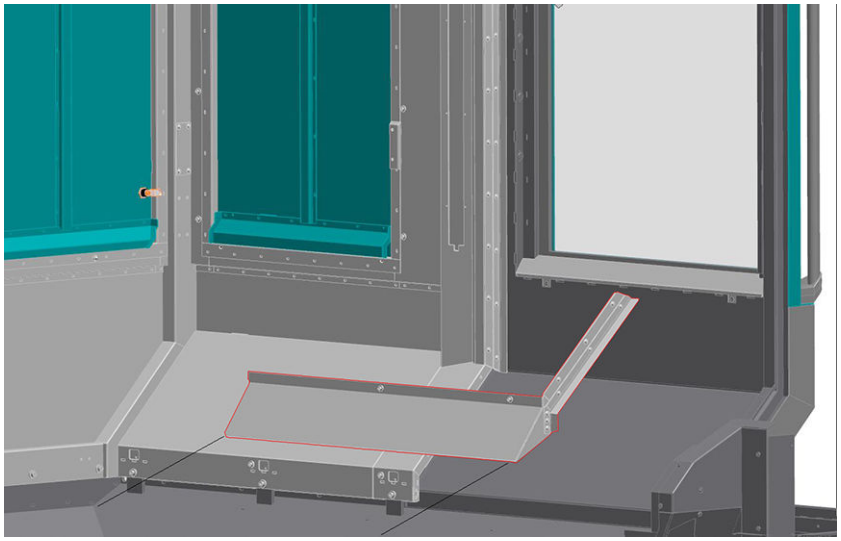
3.

Danger

Deflagration or flames.

Be sure to screw on the cover again.

Operation of the machine without this cover is not allowed.
The cover is part of the machine enclosure and serves also as protection in case of a fire, in particular in case of deflagration or to minimize exit of flames.



Example: Fig. b G220 G420

Then replace the cover (Figure (b)) and reinstall and adjust the wipers that may have been removed.

D020 - Check the pressure accumulator

Orientation

A pressure accumulator consists of two chambers, a liquid and a gas section with a membrane as a separator. The liquid section is connected to the hydraulic circuit, so that the bubble reservoir is filled when the pressure rises, thereby compressing the gas. When the pressure drops, the compressed gas expands and displaces the stored pressurized liquid into the circulation. This ensures that the pressure level is maintained during load changes or temporary higher loads.

Screws on the hydraulic system, the connected components, and the supply lines must be tightened to the manufacturer's specified torques.

Procedure

1. Check the pressure accumulator. With the machine powered on (not during the program or continuous run), slowly open the accumulator drain valve on the hydraulic fluid tank and watch the needle on the system pressure gauge.

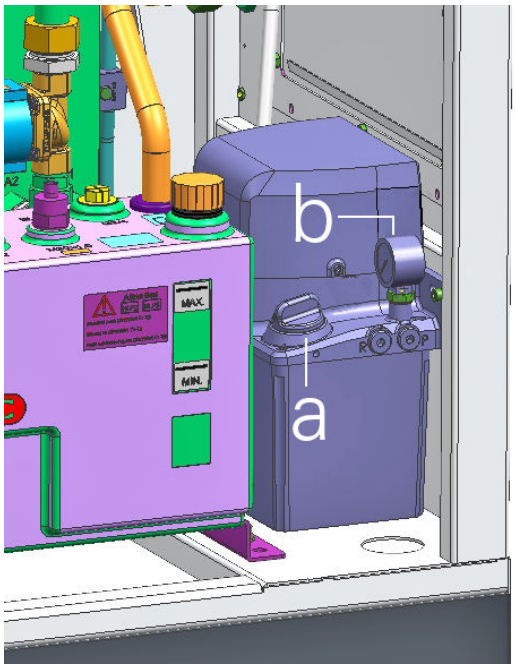
   The pressure gauge needle slowly falls to a point where it quickly drops to zero. This point is the approximate accumulator bias tension. This value is 50 +/-2 bar. **If this value is below 40 bar, the pressure accumulator must be replaced**.

D053 - Check the lubrication system

Orientation

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

The principle of open lubrication requires refilling of lubricating oil.



Example: Lubrication G420

The following components must be checked on the lubrication system:

a) Filler neck
b) Pressure gauge for system pressure (>20 bar)

During maintenance of the lubrication system, first perform a visual inspection of all components involved in lubrication for leaks and their visual condition. The following components must be examined during maintenance of the lubricating oil system:

- Lubricating oil tank
- Oil level in lubricating oil tank
- Lubricating oil pump
- Supply and fluid lines
- Pressure gauges
- Metering valves
- Pressure sensors

For all work in connection with operating materials, the information in the data sheets of the respective manufacturers and the information in the document **Notes on Operating Materials** must be observed.

Screws on the lubrication system, the connected components, and the supply lines must be tightened to the manufacturer's specified torques.

Requirement

The maintenance of the lubricating oil supply requires the following auxiliary or working equipment:

- Use an ample supply of cleaning rags.
- A sufficient amount of lubricating oil for refilling/changing.
- Replacement filters for lubricating oil tank.

Oil type, specification and quantity as specified in the technical data.

Use only the original filters according to the spare or wear parts list!

Service and maintenance are to be carried out according to the manufacturer’s specifications.

Procedure

1. 

Pressurized fluids exiting from damaged or incorrectly installed fluid lines.

General cuts or eye injuries.

Power off the machine and depressurize the hydraulic system before any maintenance activities. Secure the machine against being switched on. Wear personal protective equipment.

Check supply and fluid lines (damage and leakage). Supply and fluid lines must be checked for damage. Pre-damage such as kinks or abrasions should be logged and replacement should be initiated.

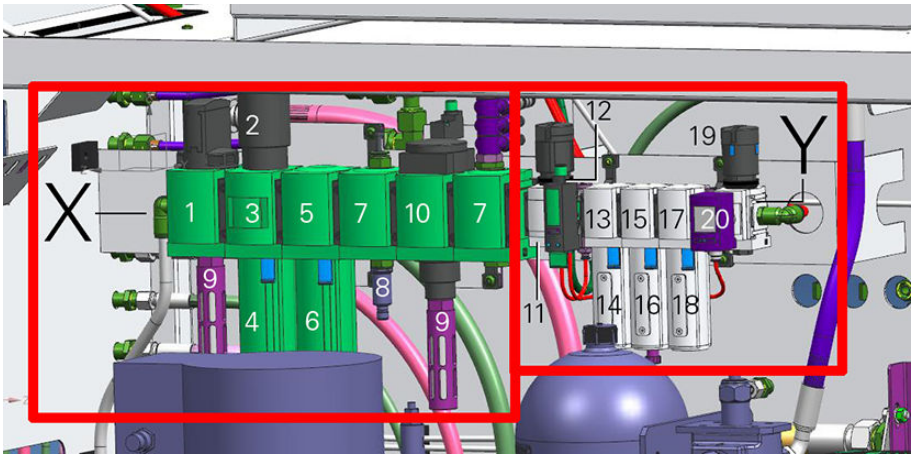
2. Check lubrication pressure and related sensors.
3. Activate lubrication pulse in the control ten times.
4. Monitor the area around the lubricating oil distributor for leakage.

D057 - Check the pneumatic system

Orientation

To ensure trouble-free operation, periodic checks (visual inspection) of the pneumatic system are necessary.

- Check system pressure and sealing air settings.
- Check supply and fluid lines.
- Check silencer, replace if necessary.
- Drain condensate (not applicable to auto-drain).
- Check pressure setting on the pressure differential monitoring pressure gauge.

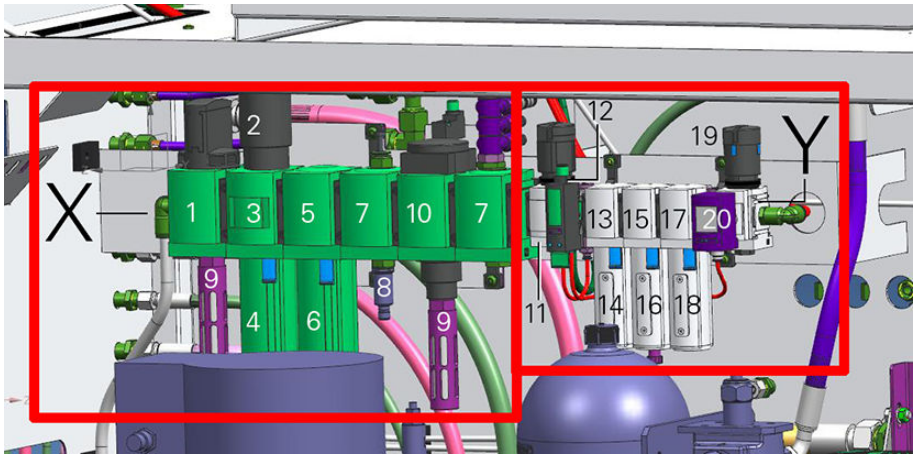


Example: Pneumatic maintenance unit G420 (by FESTO)

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

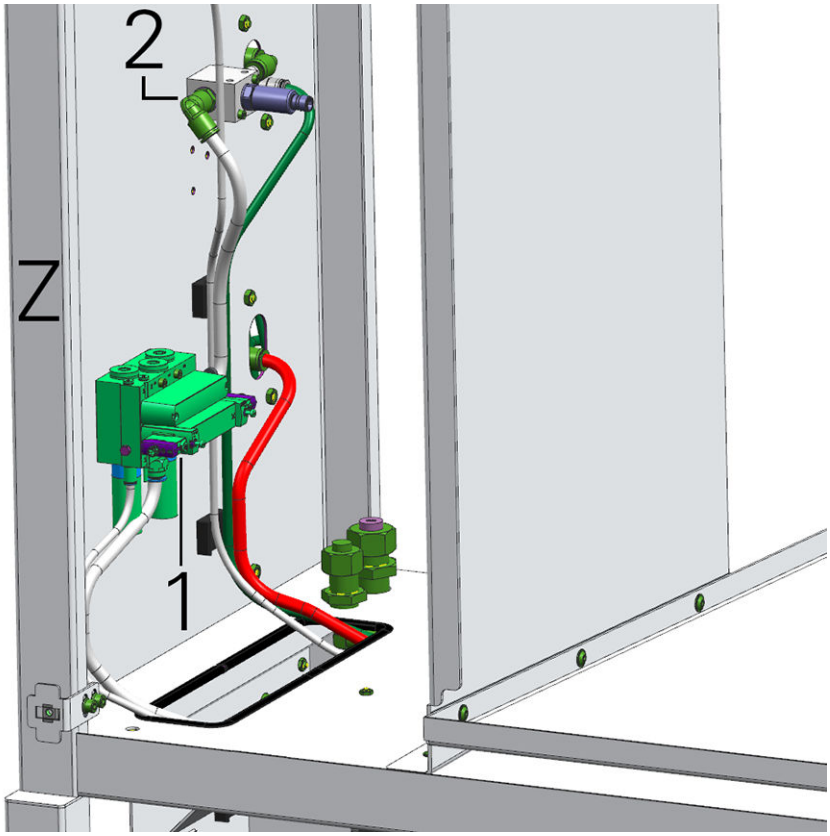
The following components are used on the system maintenance unit **(X)** and the extension for sealing air on the glass scales **(Y)** :

- **X System maintenance unit**
- 1. Switch-on valve (manual)
- 2. Pressure regulating valve (with filter) system pressure 6 bar
- 3. Pressure gauge for system pressure
- 4. Filter insert (filter fineness 40 µm)
- 5. Filter with automatic condensate drain
- 6. Filter insert (filter fineness 5 µm)
- 7. Branch module
- 8. Pressure sensor for system pressure
- 9. Silencer
- 10. Electrically actuated switch-on valve
-
-
-



Example: Pneumatic maintenance unit G420 (by FESTO)

- **Y extension sealing air - “consumer” and sealing air - “glass scale”**
- 11. Pressure regulating valve for “load” sealing air
- 12. Differential pressure sensor
- 13. Filter with automatic condensate drain
- 14. Microfilter insert (filter fineness 1 µm)
- 15. Filter with automatic condensate drain
- 16. Microfilter insert (filter fineness 0.01 µm)
- 17. Filter
- 18. Activated carbon filter **no automatic condensate drain**
- 19. Pressure regulating valve with pressure sensor for glass scales sealing air 1.0 bar
- 20. Display
-
-
-



Z control unit safety

- 1. 3/2-way valve on valve terminal
- 2. Safety pressure sensor

If the differential pressure sensor **(12)** outputs an error message, **all 5 filter elements on the pneumatic system must be replaced.**

Filters are hazardous waste and must be disposed of in a controlled manner.

Requirement

Service and maintenance are to be carried out according to the manufacturer's specifications.

Procedure

1. Check pressure setting on pressure gauge and adjust if necessary. An operating pressure of 6 bar has been set at the factory.

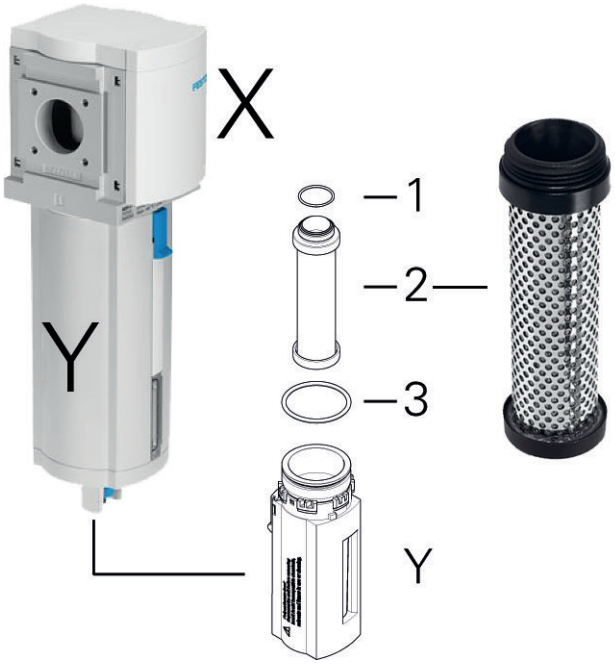
2. Check supply and fluid lines (damage and leakage). Supply and fluid lines must be checked for damage. Pre-damage such as kinks or abrasions should be logged and replacement should be initiated.

3. 

Example: Various silencer versions from FESTO

Check silencer, replace if necessary

4. Drain condensate (not applicable to auto-drain).

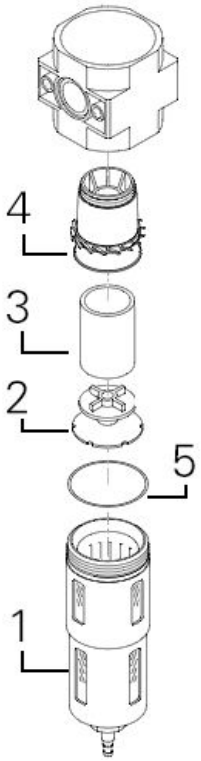
5. 

Replace activated carbon filter (by FESTO)

X Filter base housing
Y Filter bowl
1 Sealing ring
2 Activated carbon filter cartridge
3 O-ring

Check activated carbon filter, replace if necessary. **When disassembling the filter bowl, make sure that sealing rings and O-rings (1 + 3) are also installed.** Unscrew filter bowl **(Y** from filter base **(X)** and remove activated carbon filter cartridge **(2)**. Check sealing rings and O-rings **(1 + 3)** , replace if necessary. Reinstall all parts in reverse order.

6.



Example: Exploded view of fine filter replacement (by FESTO)

1 Filter bowl
2 Separating disk
3 Filter cartridge (check filter fineness)
4 Filter receptacle
5 O-ring

Check fine filter or microfilter, replace if necessary. **When removing the filter bowl, be sure to include the O-ring (5), separating disk (2), and filter receptacle (4).** Unscrew filter bowl **(1)** from filter base body and remove filter cartridge **(3)** , check, and replace if necessary. Check O-ring **(5)** , replace if necessary. Reinstall all parts in reverse order.

D077 - Check tool clamping sets of the milling spindles

Carrying out the maintenance activities described below requires special knowledge. For this reason, these maintenance activities must only be carried out by staff that has received adequate training by the machine manufacturer!

Orientation

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

The clamping sets (HSK and Capto) installed in the tool or milling spindles should be checked regularly. Regular checks ensure continuous and trouble-free operation. Based on manufacturer's instructions, we recommend replacement of the clamping sets when the clamping force falls below the following values **(see Table F_{min})** .

		F_1 (kN)	F_{min} (kN)
R200	HSK-T40	10	7
R300	HSK-T63 PSC 63	24 30	17 21
G220	HSK-T40 HSK-T63	10 24	7 17
G220.3	HSK40 HSK63	12 24	10 20
G320.2	HSK63	24	20
G200.2	HSK-A40	11	8
G420 G520	HSK-T63 PSC 63	24 30	17 21

Table for testing the clamping force of clamping systems

F_1 = nominal clamping force in kN (manufacturer data)
F_{min} = manufacturer recommendation in kN

The values for **F_1** listed in the table are based on **DIN 69063-1** for HSK and **ISO 26623-2** for PSC - CAPTO

Example: HSK clamping sets from Berg

New or manufacturer-reconditioned clamping sets must **not** be relubricated. Improper lubrication of the clamping sets may cause damage to the clamping set or failure of the entire clamping system.

Requirement

A measuring device required to measure the clamping force can be sourced through **INDEX** , a representative or the tool manufacturer.

Example: Clamping force measuring system from Berg

The Berg clamping force measuring system for tool mountings is designed for force measurement with a stationary spindle. Clamping force measurements can be performed on HSK, SK and Capto tool mountings.

Procedure

1. Check clamping sets of the tool spindles. This procedure depends on the measuring device. **Therefore be sure to follow the manufacturer's documentation of the measuring device**.

D087 - Check main and counter spindles

Carrying out the maintenance activities described below requires special knowledge. For this reason, these maintenance activities must only be carried out by staff that has received adequate training by the machine manufacturer!

Orientation

During this maintenance activity, various components in the area of the spindles are checked for leaks on the one hand and for the general condition of the power and encoder connections on the other.

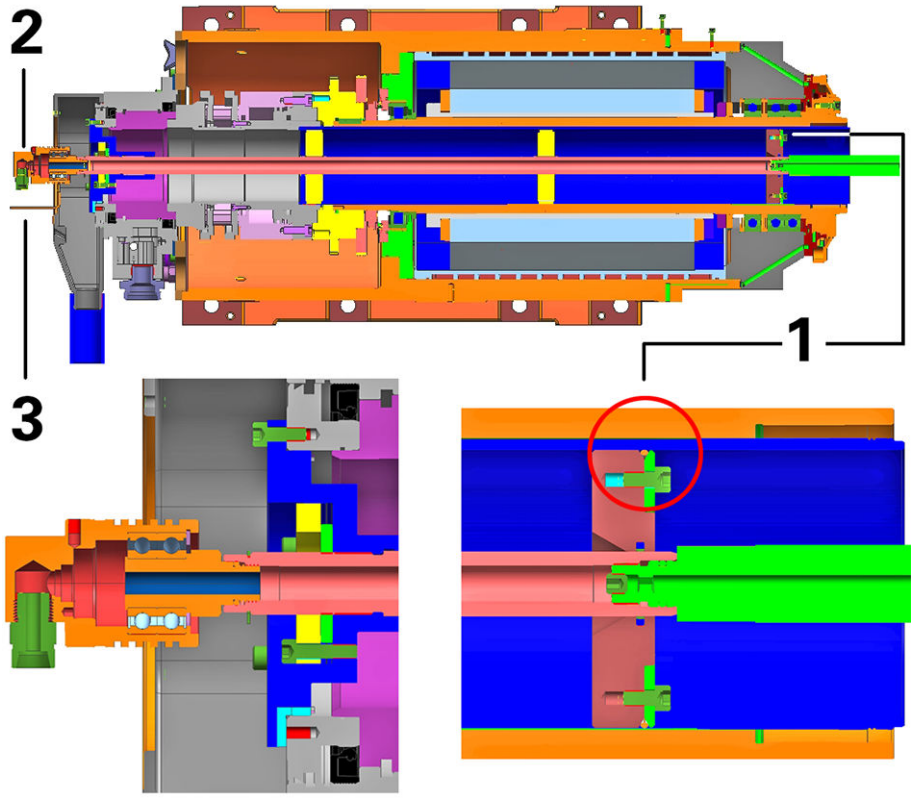
Requirement

The following tools and spare parts are required to carry out this maintenance:

1. Sealing rings or O-rings
2. Supply or fluid lines as necessary

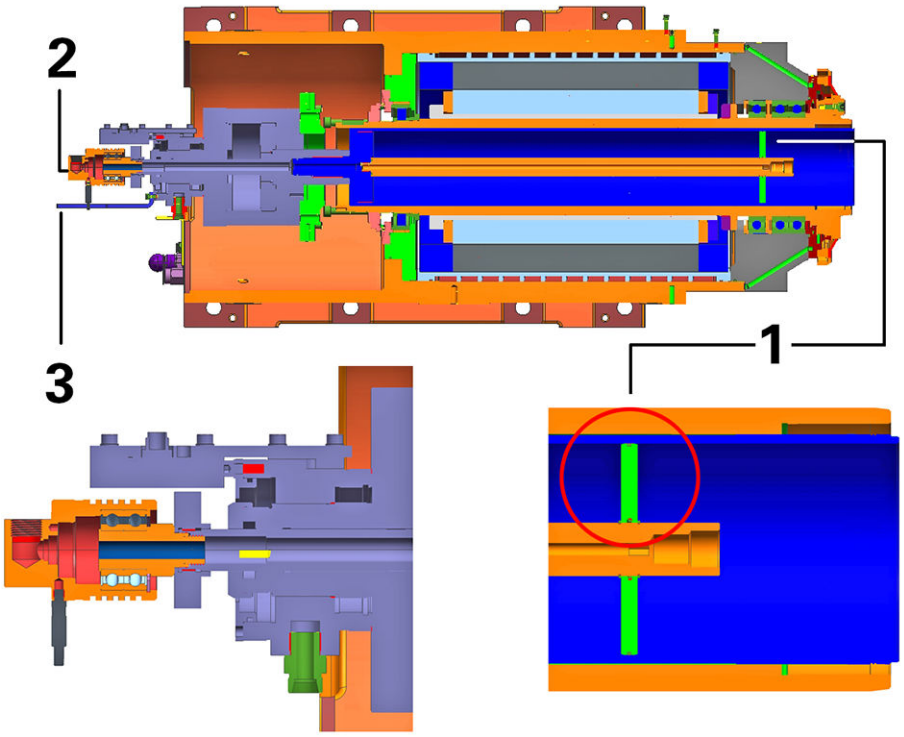
Procedure

1.



Example: Hollow clamping cylinder version

1 O-ring
2 Rotary feeder
3 Anti-twist lock



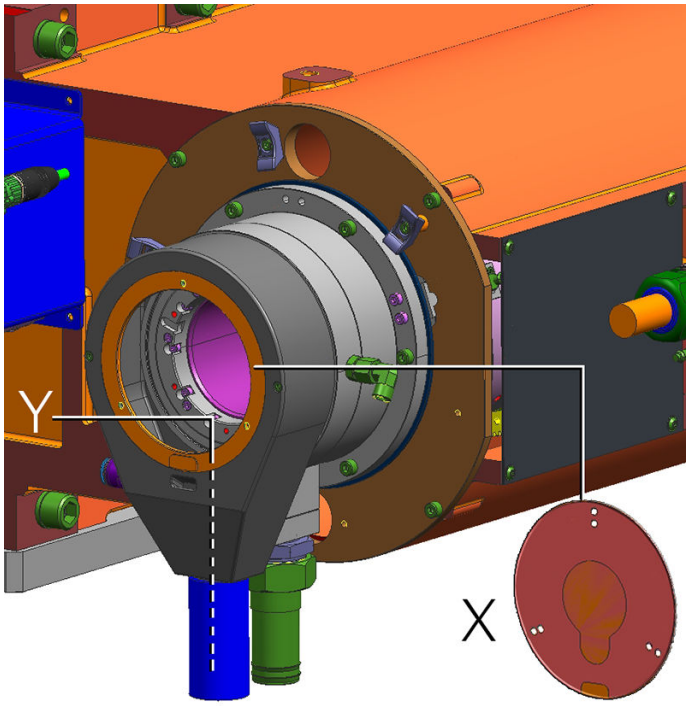
Example: Solid clamping cylinder version

1 O-ring
2 Rotary feeder
3 Anti-twist lock

Check the tightness of the depth stop/flushing unit and the correct seating of the rotary feeder.

2. Tightness of the solid or hollow clamping cylinder.

3.



Example: cooling lubricant outlet on clamping cylinder G420

Check the cooling lubricant drain (X) on the clamping cylinder. Check that the drain is free and contains no chips. Loosen screws and remove cooling lubricant drain of the clamping cylinder. Remove chips or other impurities and ensure that the cooling lubricant can drain off. Then reassemble and tighten the screws.

4.

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

Check and potentially replace O-rings or other seals on the clamping devices. O-rings and other seals on the clamping devices prevent that chips or cooling lubricant penetrate into the hydraulic circuit or even into the mechanical components of the respective assemblies where they can cause significant damage. In any case, make sure that the seals recommended by the manufacturer are used or installed during maintenance or repair work.

5. Check the condition/tightness of the power and encoder connections as well as the fluid lines of the respective components.

D105 - Wassermann tool change system

Orientation

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

For efficiency reasons, we recommend carrying out the 5000 h maintenance interval described in the manufacturer's documentation in the 4000 h maintenance interval.

Procedure

1. Perform 5000 h maintenance according to the manufacturer's documentation.

D110 - Check hydraulic system

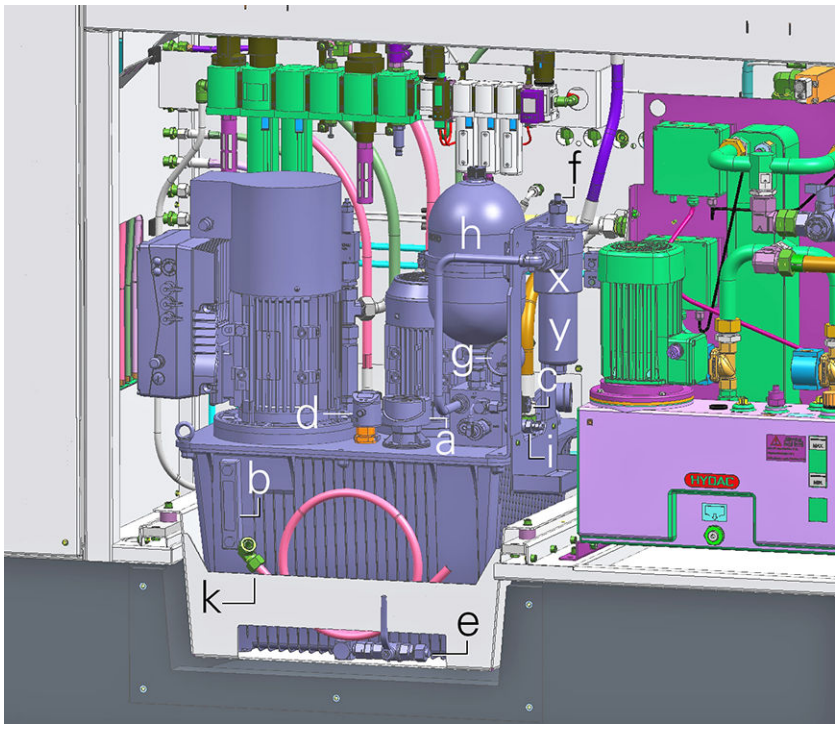
Orientation

To ensure trouble-free operation, periodic checks of the oil level are necessary. The fill level must be between the upper and lower marks on the oil sight glass.

Only use hydraulic fluid grade 15/13/10 in accordance with ISO 4406.

Viscosity other than 32 according to DIN ISO 3448 is not admissible.

For all work in connection with operating materials, the information in the data sheets of the respective manufacturers and the information in the document **Notes on Operating Materials** must be observed.



Example: Hydraulic unit G420

a Filler neck (hydraulic fluid)
b Fill level indicator
c Accumulator drain valve
d Monitoring (level and temperature)
e Oil drain plug
f Electrical monitoring (contamination indicator)
g Pressure gauge (system pressure)
h Pressure accumulator
i Safety valve
j Electrical monitoring (system pressure)
k Drain hose for hydraulic unit
X Hydraulic fluid filter (line filter)
Y Filter bell

Screws on the hydraulic system, the connected components, and the supply lines must be tightened to the manufacturer's specified torques.

Procedure

1. 

   The hydraulic fluid level should always be near the top mark when the machine is switched off. During production, the oil level may drop after several consumers have been connected.

   Check oil level at the oil sight glass.

2. Visual inspection of the hydraulic fluid. The hydraulic fluid may not exhibit any foaming or cloudiness at the oil sight glass. In case of problems of this kind, immediately determine the cause and correct the error. If in doubt, take a sample for analysis and contact the manufacturer of the hydraulic fluid.

3. Check pressure setting on pressure gauge and adjust if necessary. The value to be checked here is specified (see hydraulic diagram) and should be between 70-80 bar.

4. Check supply and fluid lines (damage and leakage). Supply and fluid lines must be checked for damage. Pre-damage such as kinks or abrasions should be logged and replacement should be initiated.

D170 - Check the system for reconditioning the cooling lubricant

Orientation

Cooling and cleaning equipment for cooling lubricants is used where reconditioning of the cooling lubricant is necessary. Here, in order to achieve high availability of the cooling lubricant, the cooling lubricant is filtered (e.g., using edge gap filters or vacuum rotation filters) and also cooled using coolers to a certain preset temperature.

Here, the filters, pressure and temperature sensors, valve functions and fluid lines of the devices must be checked.

Similarly, the supply lines to the machine and the fluid lines in the machine must be checked for damage such as abrasions or kinks or leakage.

For all work in connection with operating materials, the information in the data sheets of the respective manufacturers and the information in the document **Notes on Operating Materials** must be observed.

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

Requirement

To determine the concentration of cooling lubricant in the cooling lubricant, a measuring device (refractometer) is necessary.

Procedure

1. Evaluate the overall impression of the system.
2. Visual inspection for leaks.
3. 

   Filters are hazardous waste and must be disposed of in a controlled manner.

   Replace filter.
4. Check and potentially adjust float switch settings.
5. Check and potentially adjust temperature sensor settings.
6. Check and potentially adjust pressure sensor settings.

D180 - Check fire extinguishing system (visual inspection)

Orientation

An examination of a fire extinguishing system may only be conducted directly by the manufacturer or a person with written authorization by the manufacturer.

Be sure to read the operating instructions of the manufacturer!

Procedure

1. Visual inspection for obvious defects.
2. 

Example: Inspection stickers Kraft & Bauer

   Check sticker for manufacturing date.
3. Check sticker for inspection date.
4. Check sticker for battery replacement.

D220 - Replace belts and check belt tension

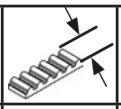
Orientation

Use only the original belts according to the spare or wear parts list.

Requirement

After replacing a drive belt, be sure to observe the values (Hz) specified in the table below for the belt tension of the respective axis. **A frequency meter is required for testing.**

Also the reference point may need to be checked or adjusted.

			X (WT2/3)
G4xx/G5xx	30mm	**Hz**	min. 149 - max. 156
G320.2	30mm	**Hz**	min. 126 - max. 132
G220.3	30mm	**Hz**	min. 177 - max. 186

Setting values in Hertz (Hz) for belt tension

Procedure

1. **Caution**

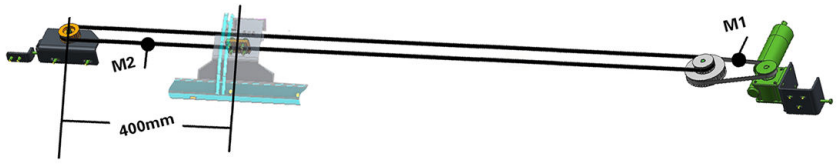
   Uncontrolled movements of axes or machine components.

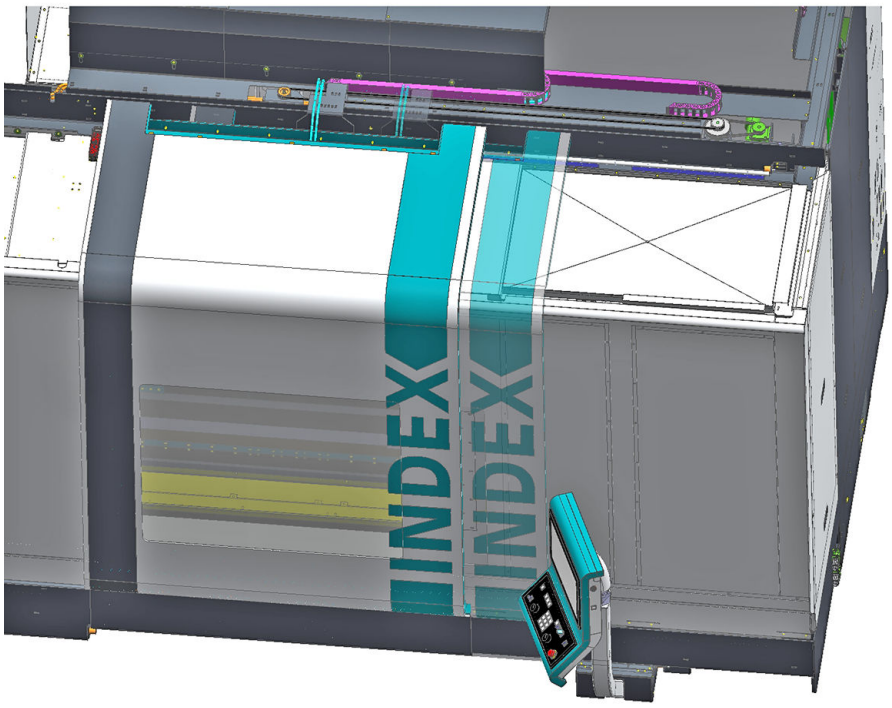
   Severe cut and crush injuries.

   Secure all axes or components against uncontrolled movements during maintenance or repair work.

   Move the tool slides to a suitable position.
2. Replace X2 belt.
3. Replace the belt of the work area door drive.

4.



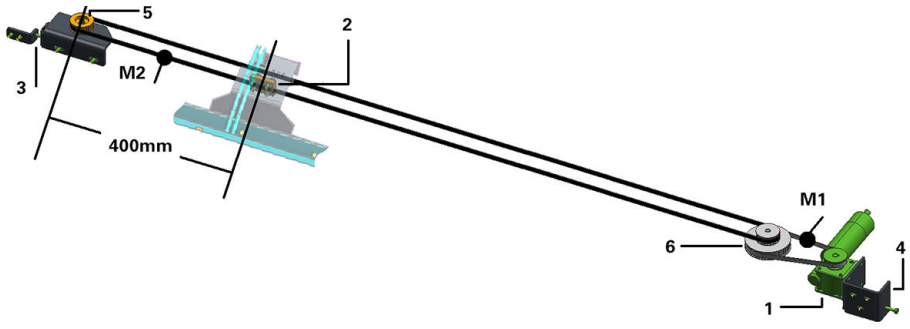


Example: Work area door drive G420

X 400 mm measuring range (M2)

Conditions to measure the belt tension. Open the work area door until there is a 400 mm clearance between the driver **(2)** on the belt and the deflection pulley/ belt tensioner **(5) (see examples of work area door drive G420)**.

5.



Example: Work area door drive G420

1 Drive
2 Driver
3 Belt tensioner (for measuring point M2)
4 Belt tensioner (for measuring point M1)
5 Deflection pulley
6 Deflection pulley
M1 Measuring point (181 Hz)
M2 Measuring point (100–110 Hz)

Adjust belt tension. Using a frequency meter and the belt tensioner **(3+4)** , the belt tension can now be set to the specified value at the marked point **(M1 or M2)**.

D458 - Replacing hydraulic fluid

Orientation

Power off the machine and secure it against power on.

Use only approved hydraulic fluid. Details can be found in the documentation and on the label of the hydraulic fluid tank.

When changing the type of hydraulic fluid, the unit must be flushed with new fluid.

For all work in connection with operating materials, the information in the data sheets of the respective manufacturers and the information in the document **Notes on Operating Materials** must be observed.

Requirement

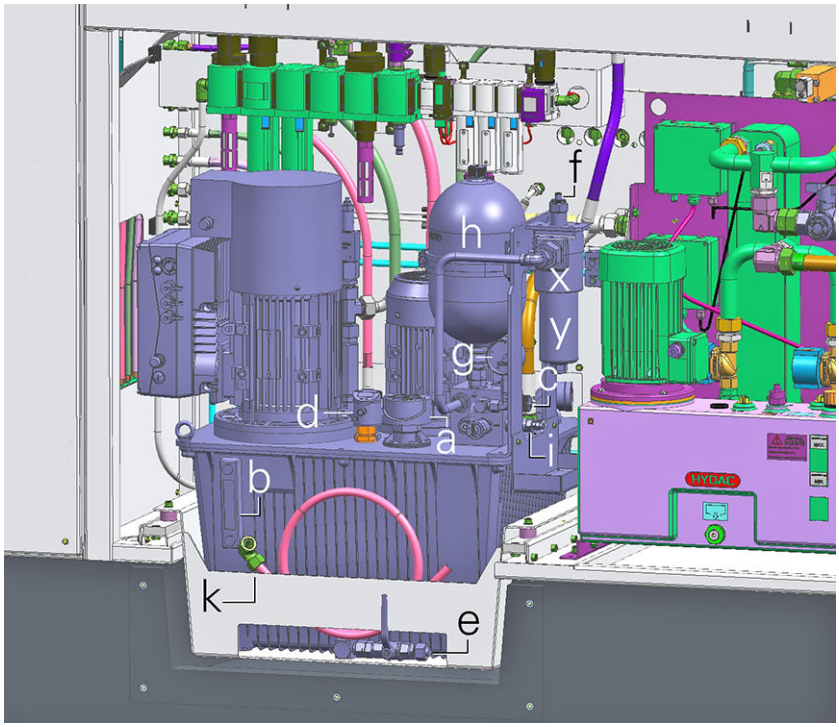
Specification and quantity of hydraulic fluid as specified in the technical data.

Before replacing the hydraulic fluid, make sure that the required spare parts such as seals and filters are available.

Use only the original filters according to the spare or wear parts list.

Procedure

1. Suction off old fluid through the filler neck **(a)** or drain the fluid from the drain plug **(e)**. Use a suitable collection bin for this purpose.
2. Use only lint-free cleaning cloths or a sponge!



Example: Hydraulic unit G420

a Filler neck (hydraulic fluid)
b Fill level indicator
c Accumulator drain valve
d Monitoring (level and temperature)
e Oil drain plug
f Electrical monitoring (contamination indicator)
g Pressure gauge (system pressure)
h Pressure accumulator
i Safety valve
j Electrical monitoring (system pressure)
k Drain hose for hydraulic unit
X Hydraulic fluid filter (line filter)
Y Filter bell

Replace filter.

3. Unscrew the filter bell **(Y)**.

4. Dispose of the fluid in the filter bell **(Y)** ; do **not** return it to the hydraulic tank.

Replace filters **(Z)** of the hydraulic fluid filters **(X)**. A different number of hydraulic filters **(X)** may be installed, depending on the version. Unscrew filter bell **(Y)** , remove contaminated hydraulic fluid (oil sump) and used filter **(Z)** from the filter bell **(Y)** and dispose of them according to environmental regulations.

5. Only filters with retained particle sizes described in the fluid plans must be used.

Example: Filter (Z)

Clean filter bell **(Y)** and insert a new filter **(Z)**. Reinstall the filter bell **(Y)** and tighten **by hand until it stops**. Then back off the filter bell **(Y)** 1/8 turn.

6. To fill in new hydraulic fluid, use a pump with a min. 10 µm micro filter that is exclusively used for hydraulic fluid.
7. Fill in the prescribed amount of new hydraulic fluid.
8. Switch on the machine and hydraulic system.
9. Check and, if necessary, replenish hydraulic fluid level.
10. Vent hydraulic system. To bleed the hydraulic system, open the accumulator drain valve **(c)** for about 10 seconds and then close it again.

D500 - Perform data backup

Carrying out the maintenance activities described below requires special knowledge. For this reason, these maintenance activities must only be carried out by staff that has received adequate training by the machine manufacturer!

Orientation

If data from the control is lost, the backup CD/DVD always provides the ability to quickly restore the operation of the machine. If machine data have been modified as part of maintenance or repair work, a data backup **must** be performed. In this case, a backup of the PLC and NC archives is sufficient. The data can be saved to a floppy disk or USB flash drive, depending on the machine control equipment. In a system recovery, the backup CD/DVD created when the machine was delivered is restored on the machine. Afterwards, the PLC and NC archive files are loaded from the floppy disk or USB flash drive.

Procedure

1. Perform data backup.

D520 - Check control cabinet and cable assemblies (visual inspection)

Carrying out the maintenance activities described below requires special knowledge. For this reason, these maintenance activities must only be carried out by staff that has received adequate training by the machine manufacturer!

Orientation

To avoid problems and prevent any resulting system failures, simplified control cabinet checks must be carried out at regular intervals on the cabinet and associated components. This include a visual inspection of the wire harnesses of the individual modules and the grounding cable. Additional built-in air conditioning units (option) ensure a constant temperature in the control cabinet. These air conditioners cannot work efficiently if filters are dirty or doors are not tight.

Use only the original filters according to the spare or wear parts list!

Filters are hazardous waste and must be disposed of in accordance with environmental guidelines and regulations of the country of operation.

When working in or on the control cabinet, switch off the machine and secure it against power on.

Requirement

Even with the machine powered off, some devices or components in the control cabinet are still energized.

Observe the specific electrical diagrams for this machine.

Procedure

1. Switch off the machine.
2. Have the electrical diagrams for the corresponding machine ready.
3. Replace all filters on the control cabinet and cabinet components.
4. Check that the cabinet doors can be properly closed. If the cabinet doors can not be closed properly, determine the cause and eliminate it. Possible causes could be faulty seals, hinges, or even a damaged cabinet door.
5. Check all cabinet seals. They should be free of oil and condensation.
6. Clean the control cabinet. Use a suitable vacuum cleaner for this purpose.
7. Check the cabinet lighting (optional).

8. Check grounding cable. Grounding cables are located, e.g., between the control cabinet and cabinet doors and between the base and the machine bed.
9. Check cable assemblies for damage, replace if necessary.

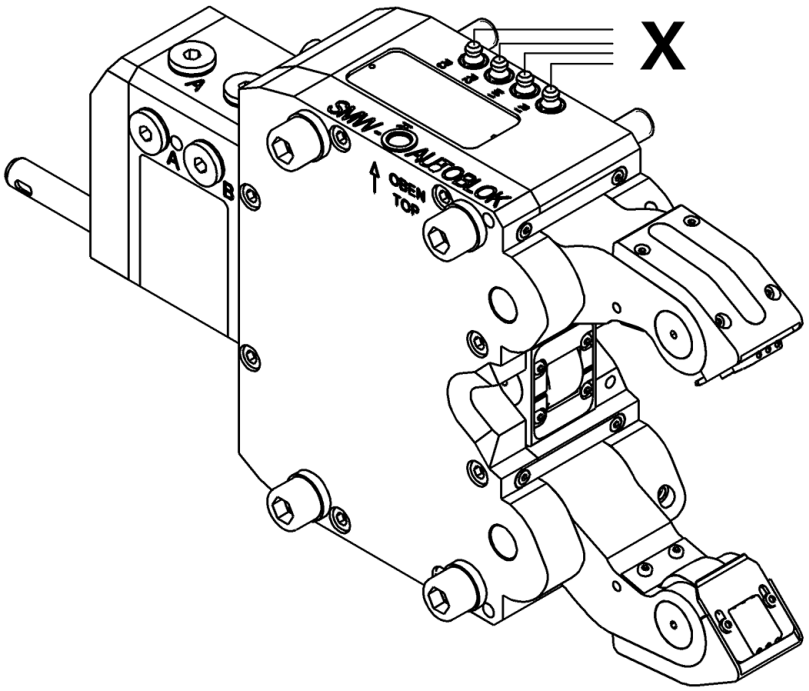
D570 - Maintenance of turret steady rest SR2 or SLU X1 (by SMW)

Orientation

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

Procedure

1.



Example: Turret_Steady_Rest_SMW_SR2

X Lubrication points

Perform 4000 h maintenance according to the manufacturer's documentation.

Service Interval - 8.000 Operating hours

Maintenance Summary - 8.000 Operating hours

It is recommended to document the maintenance activities carried out by using the appropriate maintenance log. The maintenance log has the document number DIE249EN - 15.08.2022.

E010 - Wassermann tool change system

E060 - Maintenance of turret steady rest SR2 or SLU X1 (by SMW)

E010 - Wassermann tool change system

Carrying out the maintenance activities described below requires special knowledge. For this reason, these maintenance activities must only be carried out by staff that has received adequate training by the machine manufacturer!

Orientation

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

For efficiency reasons, we recommend carrying out the 2-year maintenance interval described in the manufacturer's documentation in the 8000 h maintenance interval.

Procedure

1. Perform 2-year maintenance according to the manufacturer's documentation.

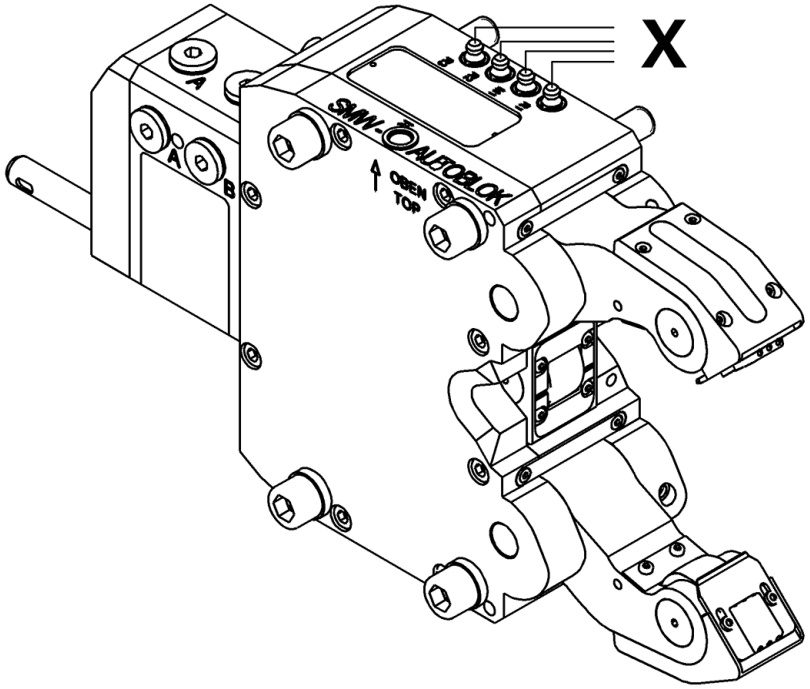
E060 - Maintenance of turret steady rest SR2 or SLU X1 (by SMW)

Orientation

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

Procedure

1.



Example: Turret_Steady_Rest_SMW_SR2

X Lubrication points

Perform 8000 h maintenance according to the manufacturer's documentation.

Service Interval - 5 Years

Maintenance Summary - 5 Years

It is recommended to document the maintenance activities carried out by using the appropriate maintenance log. The maintenance log has the document number DIE249EN - 15.08.2022.

I010 - Renewing the pneumatically pilot-controlled cooling lubricant valves

Orientation

In the course of the machine's operating time, internal wear of the pneumatically pilot-controlled cooling lubricant valves may occur, with the result that cooling lubricant may penetrate the pneumatic control lines. To avoid consequential damage, **INDEX** recommends replacing these valves after 5 years.

Requirement

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

Power off the machine to depressurize the pneumatic system and secure against accidental switching on.

Procedure

1. Renew valves.

I020 - Replace the pressure accumulator

Orientation

According to the pressure equipment directive 97/23/EC, the pressure accumulators built into the machine are of category I/ module A. They are provided with a CE mark by the manufacturer, and a declaration of conformity has been issued. Due to this categorization, the pressure accumulators must be subjected to an external and internal inspection and a strength test by a qualified person after a period of time recommended by the pressure accumulator's manufacturer. For pressure units with gas cushions, an internal inspection is recommended after 10 years at the latest. We recommend to replace the pressure accumulator after 5 years to avoid an internal inspection that is laborious and expensive for this size of pressure accumulator.

Due to different requirements and/or specifications of the respective manufacturers, be sure to review the respective manufacturer's documentation!

The machine operator is obliged to check the pressure accumulator according to applicable rules and directives. Defective pressure accumulators must be disposed of according to applicable rules after they have been depressurized by a qualified technician. The guidelines and regulations applicable in the country of use must be followed.

Screws on the hydraulic system, the connected components, and the supply lines must be tightened to the manufacturer's specified torques.

Procedure

1. Replace the pressure accumulator.

2.

Example: Pressure accumulator

Connect and secure the pressure accumulator. Observe the tightening torque.

Service Interval - 8 Years

Maintenance Summary - 8 Years

It is recommended to document the maintenance activities carried out by using the appropriate maintenance log. The maintenance log has the document number DIE249EN - 15.08.2022.

J005 - Note on replacing the window pane or removing the design pane

J150 - Replace the window pane

J005 - Note on replacing the window pane or removing the design pane

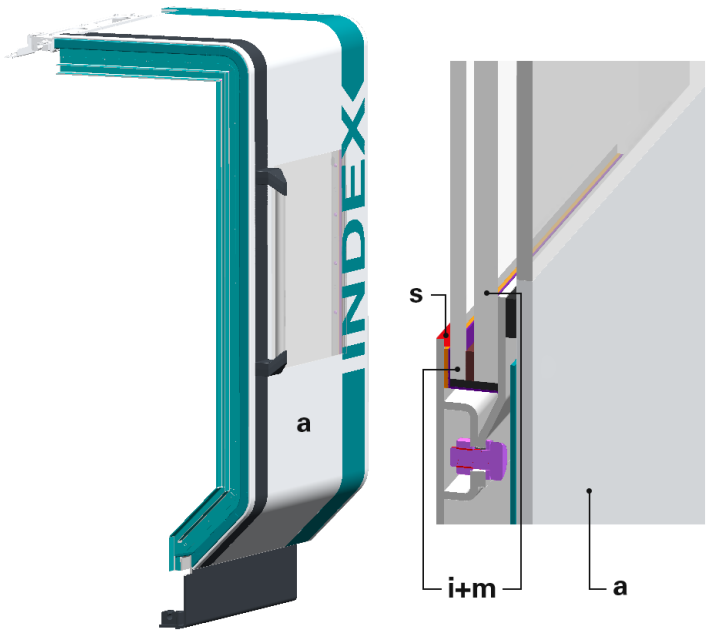
Orientation

The instructions described in this point only serve as information for the subsequent maintenance activity **“replace window pane”** of the respective machines.

If the window pane is damaged, it must be replaced. This is necessary regardless of the extent of damage. Even with minimal damage, the impact resistance of the pane can no longer be guaranteed.

For safety reasons, it is recommended to obtain the window pane directly from the machine manufacturer or its country representative.

The window pane consists of three panes. the inner pane of tempered glass, the central pane of polycarbonate, and the outer pane also made of polycarbonate. The inner pane is relatively resistant. It can be cleaned with any commercially available cleaning agents. Only the center pane is essential for the impact resistance of the window pane. The polycarbonate panes are subject to natural aging and must be replaced at regular intervals.



Example: G200.2 Work area door 01 1

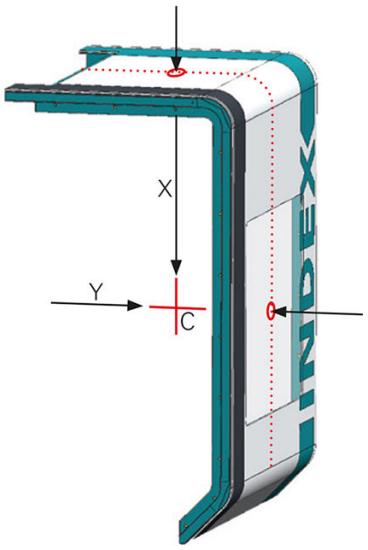
a Outer pane (design pane made of PMMA – polymethyl methacrylate)
m Center pane (polycarbonate)
i Inner pane (glass)
s Silicone gasket

Depending on the machine type, it may be necessary to remove a handle attached here before dismantling the design disks.

Requirement

General information. **The values indicated in the table must be strictly observed**.

			C	
A		B	X	Y
ABC	-	33	444	193
C100	-/+	42	581	68
C200	+	58	663	90
G200.2/.3	+	56	668	118
B400/B500	+	67	603	48
G220/.2	+	84	728	171
G220.3	+	92	707	166
G320.2*2)	+	122	693	210
G400.2/G420*1) G500.2/G520*1)	+	134	776	206
G400.2/G420*3) G500.2/G520*3)	+	164	739	206



Example: Design pane specifications for the respective machines

A Machine designation
B Weight (kg)
C Values for centers of gravity
Y Y-value (mm)
X X-value (mm)
*1 Turning length 1600 mm
*2 Turning length 1400 mm
*3 Turning length 2300 mm

From a weight of approx. 80kg, the use of lifting equipment (cranes, forklifts or similar) is recommended. The machines marked with **+** in the table (**example: design pane specifications ...**) have threaded bushings at the top of the design pane and are therefore crane-compatible.

If the design pane is not removed using a crane or other lifting equipment but by hand using suction lifters, it is imperative that the current **Load Handling Ordinance (LasthandhabV)** be taken into account. When using suction lifters (see example), be sure to select the appropriate size or type according to the table (**example: design pane specifications...**).

The locally valid guide lines and regulations must be taken into consideration.

Example: Bohle suction lifter 60 kg-100 kg

Procedure

1. If you have questions, be sure to contact the **INDEX** service department or an **INDEX** representative.

J150 - Replace the window pane

Carrying out the maintenance activities described below requires special knowledge. For this reason, these maintenance activities must only be carried out by staff that has received adequate training by the machine manufacturer!

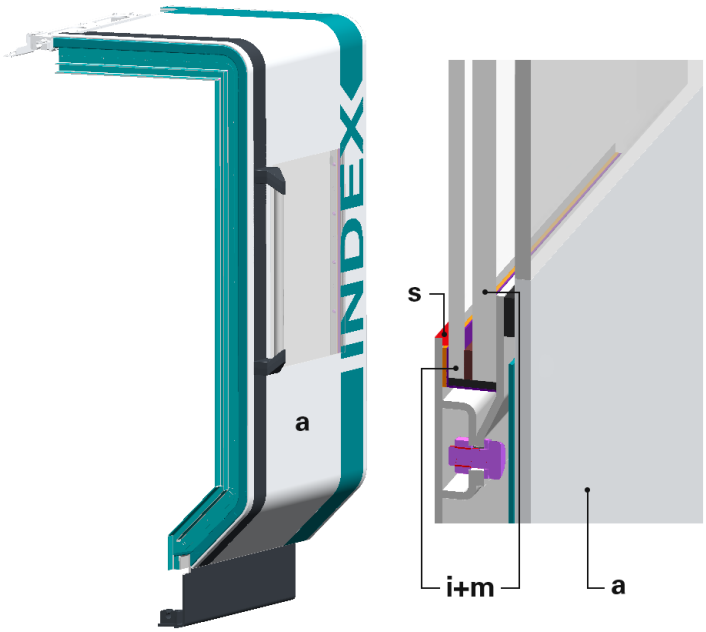
Orientation

If the window pane is damaged, it must be replaced. This is necessary regardless of the extent of damage. Even with minimal damage, the impact resistance of the glass can no longer be guaranteed.

For safety reasons, it is recommended to obtain the window pane directly from the machine manufacturer.

The window pane consists of three panes. the inner pane **(i)** made of tempered glass, the central pane **(m)** made of polycarbonate, and an outer pane **(a)** made of PMMA (polymethyl methacrylate). The inner pane **(i)** is relatively resistant. It can be cleaned with any commercially available cleaning agents. Only the center pane **(m)** is essential for the impact resistance of the window pane. The polycarbonate pane is subject to natural aging and must therefore be replaced at regular intervals.

After replacing the inner window pane and after the installation work is complete, it must be sealed on the inside of the work area door **(s)**. It is necessary to provide a suitable sealant. **The sealant Terostat 930 is used at the factory for this purpose.**



Example: G200.2 Work area door 01 1

a Outer pane (design pane made of PMMA – polymethyl methacrylate)
m Center pane (polycarbonate)
i Inner pane (glass)
s Silicone gasket

If sealing compounds from other manufacturers are used, their equivalence must be guaranteed by the supplier or manufacturer in writing.

When mounting and dismounting the front cover/design pane using a crane, **INDEX** recommends using suitable suction lifters to secure it. To ensure safe handling, both the suction surfaces of the suction lifters used and the corresponding areas of the design pane must be carefully cleaned beforehand.

Personal protective equipment -> Use gloves with rubberized palm/ inside.

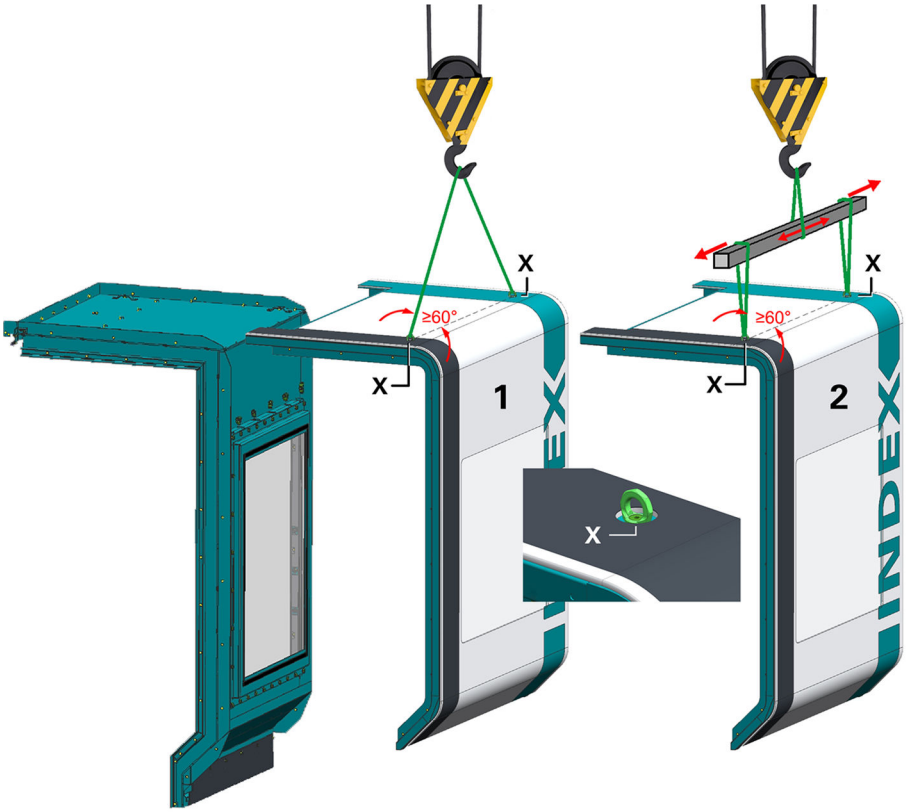
Determine and prepare the storage location for the design pane. To prevent scratching of the design pane, cover the surface at the storage location with suitable tarpaulins, foils, felt mats or similar. Under certain circumstances, the design pane can also remain on the crane near the ground. Shut down and secure the crane and seal off or secure the surrounding area.

Example: Bohle suction lifter (max. 60 kg and max.100 kg)

Requirement

Before disassembling the design pane, observe the following:

1. It may be necessary to remove a door handle (depending on the machine type).
2. Install the eyebolts **(X)**. (included with the delivery)
3. Design pane using round slings (as in 1 and 2 in the **example: Transport design element G420** as described) and lift slightly with a crane. In the case of the variant shown in example 2, it is **essential** to secure the round slings in such a way that they cannot slip.
4. It is essential to ensure that the slinging angle of the slinging ropes/round slings does **not** fall below an angle of 60° in order to prevent diagonal pull and the associated damage to the design pane.

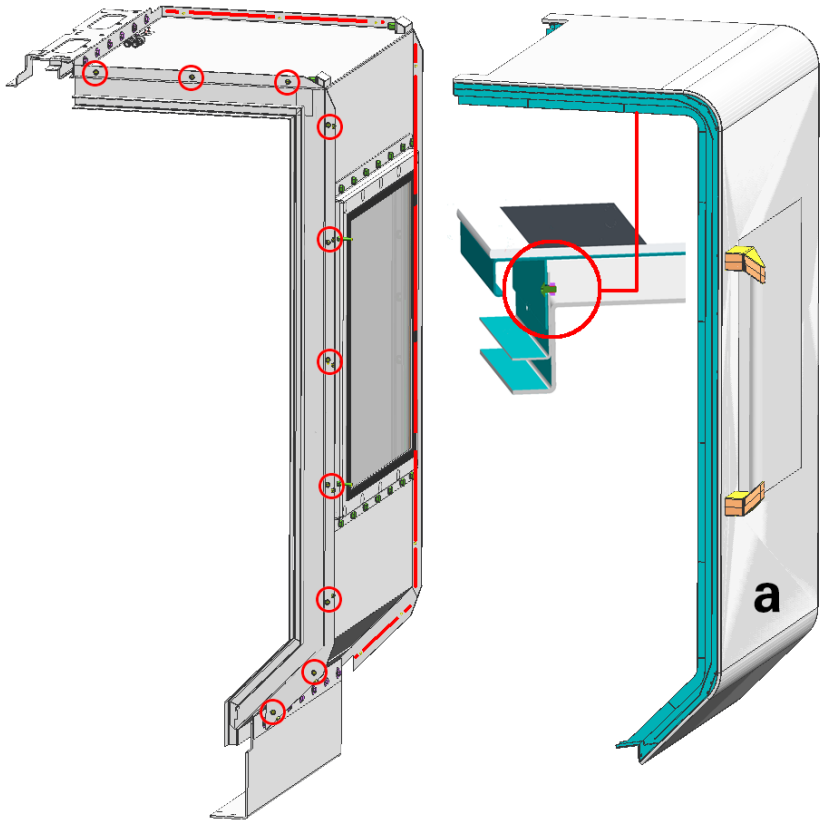


Example: Transport of design element G420

X Install eyebolts
1 Lifting with round slings
2 Lifting with short round slings and small crossbeam

Procedure

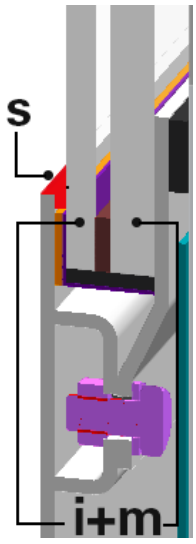
1.



Example: G200.2 Work area door 03 1

The front cover is also the front pane/design pane **(a)**. It is screwed to the work area door. Loosen the screws (M6) along the contour on both sides and remove (Fig. 03 1). Remove front cover/pane, carefully place aside and secure against tipping over.

2.

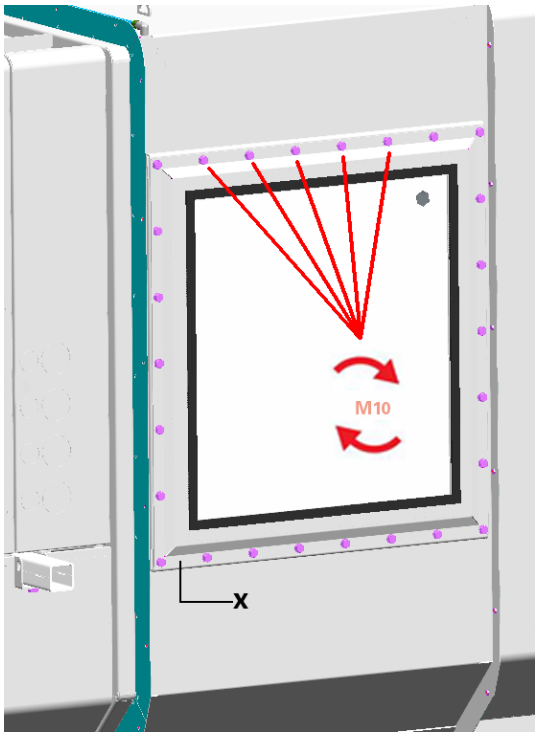


Example: G200.2 Work area door 06

Cut the silicone sealing **(s)** on the inside of the window pane (see Fig._06) with a suitable knife.

3.

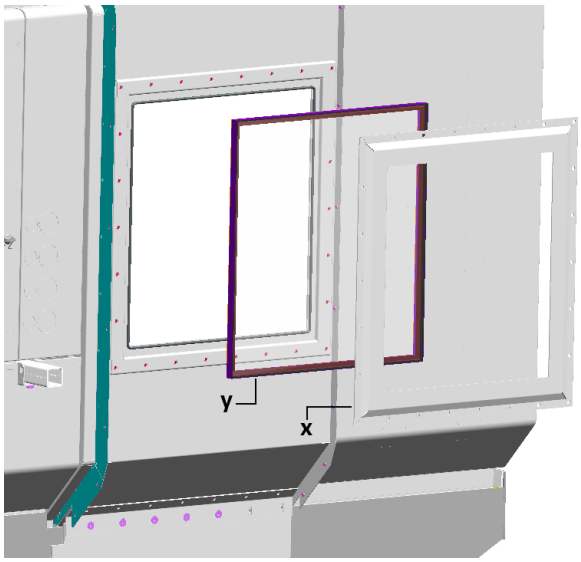
Assistance of a second person to hold the glass is recommended for the activity below. This generally also applies to the installation of the new pane, in particular when sealing and fastening the clamping frame with screws.



Example: G200.2 Work area door 07

Remove the clamping frame **(x)** of the glass package. Loosen and remove all screws from the clamping frame (see Fig_07).

4.

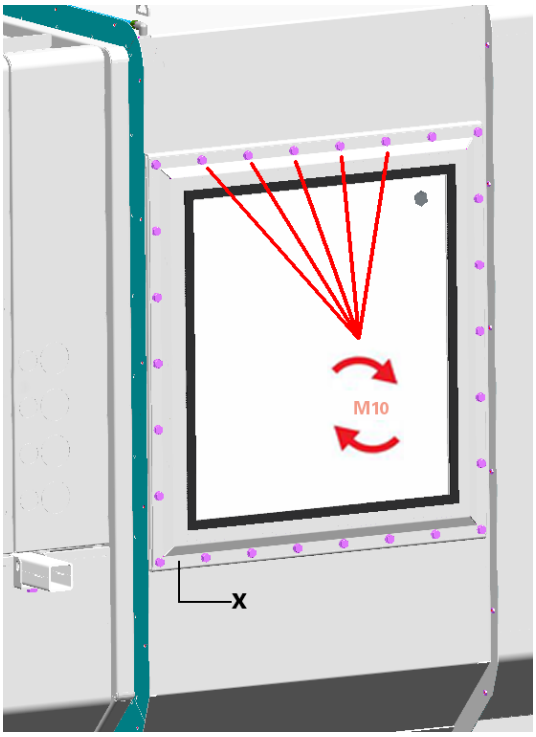


Example: G200.2 Work area door 04

Remove the clamping frame **(x)** and glass package **(y)**. (See Fig._04)

5. For assembly, follow the steps in reverse order. Ensure proper cleanliness during the installation.

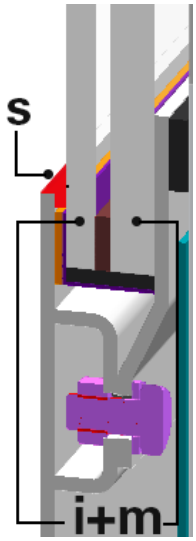
6. Make sure of cleanliness and stress-free installation when mounting the clamping frame into the work area door.



Example: G200.2 Work area door 07

Reinstall the glass package and clamping frame. After installation, tighten all screws (Fig.:_07) to the prescribed torque.

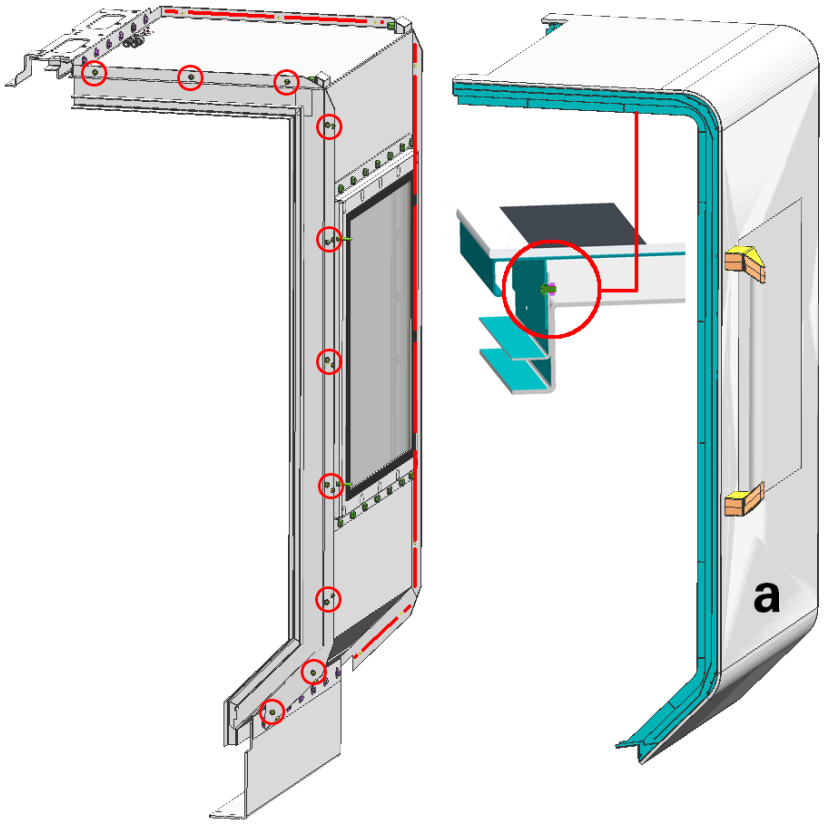
7.



Example: G200.2 Work area door 06

Seal the inner pane in the work area with sealant **(s)** again. After the assembly of the panes and frame parts, the inner pane must be sealed using a sealant (Terostat 930 gray is used at the factory). See Fig.:_06

8.



Example: G200.2 Work area door 03 1

Refit the front cover or front pane/design pane **(a)** and screw it on again on both sides along the contour using the screws (M6 – 11 each).

INDEX
TRAUB

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