WEISS GMBH

# Operating Instructions

**2SP1 spindle units**

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# 1 WARNING AND SAFETY INFORMATION AND INSTRUCTIONS

## 1.1 GENERAL

Faults at the motor spindle can only be avoided and disturbance-free operation secured by being knowledgeable about the information in these Operation Instructions. This is the reason that it is extremely important that all of the relevant personnel clearly understand these Operating Instructions.
These Operating Instructions address personnel involved with the mounting/installation, operation and monitoring of the equipment. These Instructions include regulations and technical drawings that may neither be completely nor partially copied, communicated or passed-on for competitive purposes. The WEISS company has the exclusive copyrights for these Operating Instructions.
Operators working at and with the spindle unit are responsible in immediately communicating any changes that occur relating to the spindle unit that could have a potential negative impact on the safety.
Users and operating companies are responsible in ensuring that the spindle unit is only operated when it is in a perfect condition.
It is expressly prohibited to make any modifications and changes that could influence the safety of the spindle unit.
The local safety and accident prevention regulations always apply when operating the spindle unit.

## 1.2 EXCLUSION OF LIABILITY

The contents of this document have been checked. However, deviations cannot be completely ruled-out so that we cannot accept any liability for the information contained in the document and that it is absolutely correct. Data in this document is reviewed regularly and any necessary corrections will be included in the following Edition. We are grateful for any recommendations for improvement.

Technical data subject to change.

## 1.3 CORRECT USE

The spindle unit represents state-of-the-art technology and is operationally safe and reliable. However, the spindle unit can represent a hazard if it is not correctly used in-line with the specifications.
The spindle unit has been exclusively designed and constructed to mill metals. This excludes radioactive or combustible metals. If the spindle unit is used to machine any other material, then this is not considered to be correct use. The WEISS company is not liable for any damage incurred due to incorrect use. The company operating the spindle is exclusively responsible for the risk unless this application was explicitly released by WEISS in writing.
Correct use also means that the mounting/installation, disassembly and assembly, commissioning, operating and service/maintenance conditions and specifications specified by WEISS must be maintained.
Cutting values and cutting parameters for both tools and materials cannot be guaranteed as cutting values are very dependent on the structural design of the machine tool and the tools and materials that are being used. The spindle unit has clearly specified technical data such as speed, power and torque.
The machine tool manufacturer is exclusively responsible for the milling process. It is the responsibility of the machinery construction OEM to evaluate the milling results.

## 1.4 ORGANIZATIONAL

Only authorized, appropriately trained personnel who have received the appropriate instructions may operate, service/maintain and repair the spindle unit. These personnel must have received special, in-depth training and instructions about possible hazards and dangers.

The operator/operating company is responsible in ensuring that no unauthorized personnel work on/with the spindle unit. Any person in the operating company's facility that is involved with the mounting, disassembly and re-assembly, commissioning, operating control and service/maintenance of the spindle unit must have read and understood the complete operating instructions and especially this Chapter. We recommend that the operating company has this confirmed in writing.
Responsibilities for mounting/installation, disassembly and re-assembly, commissioning, operation and service/maintenance must be clearly assigned to specific personnel. This allocation of responsibilities must be carefully maintained. This then ensures that from the safety perspective, there is no confusion in understanding who is responsible for what.

## 1.5 WORKING ON THE SYSTEM

### 1.5.1 Basic information

Only appropriately trained specialist personnel may work on and with the spindle unit.
The appropriate Operating Instructions must be carefully observed.

### 1.5.2 Mechanical system

Any work may only be carried-out with the spindle unit at an absolute standstill.
During this work, the following must be absolutely excluded:
That media under pressure are present,
Electrical voltages are present,
The spindle unit can move.
For any work involving the mounting/installation, disassembly and re-assembly, commissioning, operation, changeover, adaptation and service/maintenance, then the power-off and shutdown procedures, specified in the Operation Instructions, must be carefully and precisely observed.

### 1.5.3 Hydraulic/pneumatic systems

All of the systems must be first brought into a no-pressure condition and must be secured so that they cannot be accidentally switched-in again.
For any work involving the mounting/installation, disassembly and re-assembly, commissioning, operation, changeover, adaptation and service/maintenance, then the power-off and shutdown procedures, specified in the Operation Instructions, must be carefully and precisely observed.
Pressure accumulator are equipped with saftey valves. These safety valves are permanently set and sealed. It is absolutely prohibited to change the settings of these valves as this could result in potential death or serious injury!

### 1.5.4 Electrical system

Before carrying-out any electrical work, the machine and peripheral devices must be disconnected from the line supply and must be locked-out to ensure that power is not accidentally re-connected.
If it is absolutely necessary to carry-out work on equipment that is under voltage (live equipment), then a second trained technician must be deployed that can intervene if an emergency situation occurs.
For any work involving the mounting/installation, disassembly and re-assembly, commissioning, operation, changeover, adaptation and service/maintenance, then the power-off and shutdown procedures, specified in the Operation Instructions, must be carefully and precisely observed.

## 1.6 SPECIFIC HAZARDS AND DANGERS

In spite of being correctly used, when a spindle unit is operated, users or third-parties can be exposed to situations which could result in death or severe bodily injury. The subsequent safety and hazard information and instructions must be carefully observed and maintained at all times.
If these information and instructions are not carefully observed, this can result in death or severe personal injury.

### 1.6.1 Hazards due to mechanical energy

Depending on the tool diameter and the speed, extremely high centrifugal forces occur at the tool. This is the reason that only the most precisely balanced tools may be used whose maximum speeds and circumferential velocities lie above the max. spindle speed. For tools with a high mass and/or high extended length (long cantilever length), it is possible that the spindle - tool system can reach its natural frequency therefore destroying the bearings. This could mean that the tool or parts of the tool could be flung-out with an extremely high kinetic energy.
The parts and components mounted and installed in the spindle under spring pressure can be flung-out at a high speed if incorrectly mounted and installed. This is the reason that the spindle may only be opened-up by appropriately trained personnel.
Under no circumstances can the highest spindle unit speed be exceeded.
Under no circumstances may fingers be inserted into the tool interface.

### 1.6.2 Hazards due to hydraulic/pneumatic energy

If damage is identified at pressure hoses and lines as well as glands - such as leaks or worn areas - then the spindle unit must be immediately stopped and powered-down no matter how slight the apparent damage. Operation may only be resumed if the problems and defects have been completely removed.
If media at high pressure escape, then this can result in injury, explosion and fire.

### 1.6.3 Hazards due to electrical energy

When incorrectly handled, electricity can be potentially hazardous resulting in death or severe personal injury!
It is not permissible that the spindle unit is operated with terminal boxes, connectors or electrical cabinets open.
After any electrical installation work or service/maintenance work, the protective measures used must be carefully tested. This also applies for the clamped state displays for the tools. Tools could be flung-out at an extremely high speed if the display indicates an incorrect value.

# 2 DESIGN AND FUNCTION

Detailed technical data on the functions described below are provided in Chapter Technical data.

## 2.1 BEARING DESIGN

High precision spindle bearings are used for the 2SP1 motor spindle shaft. They offer excellent precision and are designed for the loads that occur at high speeds. Hybrid bearings are used for spindle types that operate at even higher speeds. Special significance was placed on the ruggedness of the bearings. They have proven themselves over many years in applications - from JOB-shop environments up to three-shift operations in series production.
The high precision spindle bearings accept the radial and axial forces from the process without any play. Thermal loading of the spindle shaft has no effect on the mechanical tensile forces. The bearings have excellent smoothing running characteristics and the lowest level of roughness.

## 2.2 LUBRICATION

The bearings of 2SP1 motor spindles have a permanent grease lubrication. Re-greasing is not required.

## 2.3 SEAL

The bearings are equipped with an integrated seal. On the spindle drive end, the seal to the operating area is supported using the spindle's own sealing air system.
The sealing air must have been conditioned so that it is clean and dry. The optimum air quantity is obtained at the specified input pressure at the spindle. A pressure switch is necessary in order to check this air flow.
It is not permissible that spray water or other liquids are directly pointed at the sealing gap (labyrinth seal) or openings in the spindle.
In order to prevent foreign bodies from being drawn-through the spindle, it is not permissible that there is a pressure difference between the drive and drive-out sides of the spindle.
**Note:**
In order to achieve the specified bearing lifetime, it is absolutely necessary that the sealing air system is correctly operated.

## 2.4 DRIVE

An integrated build-in motor drives the 2SP1 motor spindle. This build-in motor has a high torque and its rotor is directly mounted onto the tool spindle. This build-in motor is available both as synchronous and induction motor. The electric power is only fed to the stationary outer jacket of the motor. The rotating inner part of the motor does not require any electrical power. Both synchronous and induction motors can be installed. When it comes to designing the machines, in order to graduate the power requirement between the two different diameters, either a long or a short design of the drive package can be selected. These motors are available in various speed classes. The induction motor version has been designed so that the torque can be adapted to the machining situation for both operating modes - star circuit and delta circuit configurations. The operating company can select the most suitable circuit configuration (either star or delta). The motors are designed for high-speed load changes and they quickly follow changing torque demands. In conjunction with the integrated, precise rotary encoder, they are admirably suited for both closed-loop speed and position controlled operation.

## 2.5 MOTOR COOLING

2SP1 motor spindles have integrated ducts to liquid-cool the stationary stator of the drive motor. The stator that draws the electric drive power represents the main source of power loss in the form of heat in the spindle unit. This is the reason that the cooling system is extremely closely coupled to the stator of the drive motor from a thermal standpoint. However, the sources of power losses that are some distance away are also adequately cooled as a result of the integrated cooling ducts. The spindle unit must be supplied with the cooling medium through a feed and return line. The cooling-medium absorbs the power loss of the spindle and as a result its temperature increases. The cooling medium is cooled-down to the original intake temperature outside the spindle using an external cooling or heat exchanger system. The cooling and heat exchanger system is the responsibility of the machinery construction OEM. The necessary cooling-medium pressure in the intake line must be established using an external pump; the user must ensure an adequate cooling quantity by appropriately providing the cooling water.
It is not permissible that the cooling water intake temperature drops below the ambient temperature in order to avoid the formation of condensation water inside the spindle.

## 2.6 TOOLS

The machining result especially depends on the balance quality of the tool being used.
Only suitably balanced tools may be used whose max. speeds and circumferential velocities lie above the max. spindle speed.
Depending on the tool diameter and speed, extremely high centrifugal forces occur at the tool.
For tools with a high mass and/or high extended length (long cantilever length), it is possible that the spindle/tool system reaches its natural frequency therefore destroying the bearings. This could mean that the tool or parts of the tool could be flung-out with an extremely high kinetic energy.
This is the reason that tools should be clamped to ensure that they are kept as short as possible.
Carefully observe the safety information and instructions.

## 2.7 BALANCE REQUIREMENTS

Only precisely balanced tools according to Q 6,3 may be used.

Standards to be carefully observed and fulfilled:
VDI Directive 2056
DIN EN ISO 15641

The system must be balanced after inserting a tool insert in the tool holder. It is not permissible to individually balance the tool insert and tool holder without balancing the complete assembly.

Tool wear can have a noticeable negative impact on the balance quality. If vibration and noise levels increase while the tool is being used, then the tool should be checked for wear and then carefully re-balanced.

## 2.8 TOOL CLAMPING SYSTEM

An integrated clamping system is used to clamp the tool.
The tool is clamped using a spring-loaded column that is part of the clamping system.
The tool is released using a tool release unit in the spindle housing. When it is actuated, it overcomes the pre-tension in the spring-loaded column and the draw bar including tool is pushed-out of the shaft.

## 2.9 TOOL RELEASE UNIT

The tool is released using a tool release unit at the spindle housing. By applying pressure, the unit is shifted forwards against the draw bar and releases the clamping system interlocking and therefore the tool. After it has been released, the tool must be held using a suitable mechanism. When the pressure is reversed, the release unit moves backwards. For the pneumatic version, additional return springs are used.

**Note:**

As a result of the spindle design, the spindle shaft moves slightly in the axial direction while the tool is being changed.

## 2.10 CLAMPING STATE INTERROGATION

Sensors integrated in the spindle are used to interrogate the position of the draw bar and tool release unit. The following sensors can be used for evaluation and monitoring:

**2SP120...**

Sensor S1 for analog data of the draw bar position.
Sensor S4 is adjusted so that when the tool release unit is retracted from the shaft, a signal is output.

**2SP125...**

Sensor S1 (option) is adjusted so that for a tool in compliance with the standard,
it supplies the "Draw bar in the released position" signal.
This cannot be used to safely sense a jammed tool!

Sensor S2 is adjusted so that for a clamped tool, in compliance with the standard,
it supplies the "Tool clamped" signal. It must be ensured that the spindle may only start when the sensor is energized. If this is not the case, then there is a potential danger of personal injury and machine damage due to tool parts that are flung-out at high speed!

Sensor S3 (option) is adjusted so that for an excessively small toolor no tool, it supplies the "no tool or no tool in compliance with the standard" signal.

**For safety reasons, all of the sensors available at the spindle should be connected-up and evaluated.**
**It is not necessary to adjust the sensors - and in fact this is strictly prohibited !**

## 2.11 INTERNAL TOOL COOLING WITH COOLING-LUBRICATING MEDIUM (OPTION)

The 2SP1 motor spindle is optionally available with the inner tool cooling function. In this case, a cooling-lubricating medium (this comprises an emulsion of water and an oil additive) is fed through a rotary gland from the rear shaft end through the spindle shaft to the tool. The user must appropriately condition and provide this cooling-lubricating medium in order to guarantee the service lifetime of the rotary gland.
Cooling-lubricating medium leaks inherent for this mechanical arrangement are drained through a hole in the rotary gland housing.
The rotary gland is suitable for running under dry conditions.
Do not connect any compressed air while the spindle is rotating.
Use flexible hoses/lines. It is not permissible to use rigid pipe connections. Always route hoses and lines in arcs. The hose may not place a strain on the rotary gland neither when it is pressurized or not pressurized.

## 2.12 EXTERNAL TOOL COOLING WITH COOLING-LUBRICATING MEDIUM (OPTION FOR SPINDLE 2SP120...)

The 2SP120... motor spindle is optionally available with the "external tool cooling" function. The cooling-lubricating medium (this comprises an emulsion of water and an oil additive) can be fed to a ring with 6 openings via a connection at the spindle flange. The cooling-lubricating medium is discharged through these openings which, depending on the option selected, are equipped with adjustable nozzles.
Flexible hoses must be used to connect the cooling-lubricating medium. It is not permissible to use rigid pipe connections.
The user must appropriately condition this cooling-lubricating medium so that the nozzles remain free and don't become blocked.

## 2.13 TOOL AIR PURGE SYSTEM

The tool air purge system is available with/without inner tool cooling. Compressed air is used as cleaning medium.
When the tool is changed, the purge air cleans the tool interface in order to ensure that the tool is safely and smoothly guided through the interface.
The purge air must be appropriately conditioned outside the spindle in order to fulfill the cleaning function.
The purge air is fed from the end of the spindle through the draw bar up to the tool taper. The air is fed through a separate connection, or when the inner tool cooling option is used, through the rotary gland. A valve in the intake must be used to ensure that the purge air is only applied while a tool is being changed with the spindle stationary and that the cooling-lubricating medium for the inner tool cooling is not fed-in.

# 3 INSTALLING AND OPERATING THE SPINDLE

The spindle is a precision product. This is the reason that it must be extremely carefully handled and must be kept very clean both when installing as well as in operation.

In order to achieve the required characteristics of the spindle unit also in the machine, the following basic rules must be carefully observed when installing/mounting the spindle:

- Only cranes/lifting equipment with the appropriate load handling capability may be used to transport the spindle unit.
- The spindle unit may only be attached to the lifting equipment using ring bolts located at the threads provided.
- The plugs/caps at the various spindle unit openings (for media etc.) must be removed.
- For horizontal mounting arrangements, the spindle must be mounted so that the relief and drain holes of the spindle are facing downwards.
- Before connecting-up the supply hoses/lines, these must be carefully cleaned. Under no circumstances may foreign bodies and dirt enter the inside of the spindle. We recommend that supply hoses/lines are purged using media of the specified quality.
- Before mounting, it must be carefully ensured that all of the jointing surfaces are clean.
- Force may not be applied to the spindle when it is being mounted in the spindle housing. If force is applied, this could damage the spindle.
- Never use compressed air to clean the spindle and parts of it.
- Do not directly point a jet of cooling medium onto the sealing gap at the spindle nose (labyrinth seal).
- Do not directly point a jet of cooling medium onto the relief hole of the sealing air.
- Before using a tool, check that it is suitable and in a perfect condition (also refer to Tools and Balancing requirements).
- Never raise the spindle unit at the shaft nor place it down on the shaft face or tool interface!
- It is only possible to orientate the spindle for a tool change in the closed-loop controlled mode after passing the reference mark (at least one shaft revolution). This is the reason that it is a critical operation when powering-up and powering-down the spindle in the tool change state.

## 3.1 POWER-ON CONDITIONS

The control and monitoring of the power-on and power-off operations at the spindle and its supply equipment is realized via the central machine control. The power-on and operating conditions for safe spindle operation are listed in the following.

**Motor**

| | |
|---|---|
| Cooling | ON |
| Motor temperature | < Maximum value |

**Sealing air**

| | |
|---|---|
| Supply pressure | In the setpoint range |

**2SP120...**
**Clamping state interrogation**

| | |
|---|---|
| Analog sensor | S1 |
| Enable for | |
| Spindle start | 2 - 4 V |
| Tool change [1)] | 9 - 10 V |

1) An enable signal for a tool change means that the draw bar is in the "tool released position".

The specified values of the analog sensor are nominal values.
When setting, the actual values should be taken from the spindle acceptance certificate! In order to ensure safe spindle operation, the various conditions should be monitored during operation using the sensor. After the power-on conditions are present, delay times must be maintained before the spindle is allowed to rotate (refer to the Engineering Guide).

**Tool release unit interrogation**

| | |
|---|---|
| Digital sensor | S4 |
| Spindle start | 1 |

Do not maintain the release pressure at the tool release unit.

**2SP125...**
**Clamping state interrogation**

| | S1 | S2 | S3 |
|---|---|---|---|
| Enable for | | | |
| Spindle start [1)] | 0 | 1 | 0 |
| Tool change [2)] | 1 | 0 | 0 |

1) Do not maintain the release pressure at the tool release unit.
2) An enable signal for a tool change means that the draw bar is in the "tool released position".

In order to ensure safe spindle operation, the various conditions should be monitored during operation using the sensor. After the power-on conditions are present, delay times must be maintained before the spindle is allowed to rotate (refer to the Planning Guide).

## 3.2 POWER-ON PROCEDURE

| | |
|---|---|
| Motor cooling | ON |
| Sealing air | ON |
| Spindle motor | ON |

A new, shorter run-in period is required after the spindle has not been used for more than a week.

This must be carried-out according to the following guidelines:

| | |
|---|---|
| 25% maximum speed | 5 min. operating time |
| 50% maximum speed | 5 min. operating time |
| 75% maximum speed | 5 min. operating time, ready to operate |

Refer to Storing the spindle in the magazine

## 3.3 POWER-OFF PROCEDURE

| | |
|---|---|
| Spindle speed | Braking down to standstill |
| Motor cooling | OFF after 3 minutes |
| Sealing air | OFF |

# 4 FAULTS IN OPERATION

If faults occur during operation, then the spindle unit should be handled according to the following priorities.

**Priority 1:**
A critical situation involving death or severe injury has occurred.
Immediately stop the spindle!

**Priority 2:**
A situation has occurred that means that the spindle can no longer be operated in a non-critical situation.
Power-down the spindle unit.

## Motor

| | |
|---|---|
| Shutdown temperature<br>Thermo-sensor responds | Priority 1 |
| Pre-warning temperature<br>Thermo-sensor responds | Priority 2 |
| Cooling not on | Priority 2 |

## Clamping state interrogation

| | |
|---|---|
| No tool clamped | Priority 1 |

## Tool release unit interrogation

| | |
|---|---|
| Release unit not retracted | Priority 1 |
| Release pressure present at the release unit | Priority 1 |

## For sealing air

| | |
|---|---|
| Pressure too low | Priority 2 |

# 5 SERVICE/MAINTENANCE INFORMATION AND INSTRUCTIONS

## 5.1 SERVICE/MAINTENANCE SCHEDULE

**Weekly**
Clean the spindle unit. Do not point jets of steam, compressed air directly at the seals.
Visually check that glands, plugs/caps are tight and are not leaking.
Visually check the tool gripper for damage, accumulated dirt and ensure that it is adequately lubricated.

**Monthly**
Refer under the Point "Service/maintenance" in the Chapter "Clamping systems".

**Annually**
Ensure that the motor cooling system is free and not blocked
Replace the anti-corrosion agent.
The optional rotary gland is maintenance-free. However, in order to secure a high degree of availability we recommend that the rotary gland is replaced at the latest after three years.

## 5.2 PARTS SUBJECT TO WEAR

Parts that are subject to natural wear include:
- Spindle bearings,
- Tool clamping system,
- Rotary gland,
- Hydraulic and/or pneumatic cylinders.

## 5.3 STORING THE SPINDLE IN THE MAGAZINE

The spindle must be stored in the original packaging. The storage location must be dry and free of dust and dirt. The temperature should be between 10 and 35°C. Conservation agents must be carefully applied so that they don't enter into the bearings.

For storage times over a year, the quality of the lubricant can deteriorate due to ambient effects. We recommend that the spindle is checked in one of our service workshops.

When removed from storage, the spindle may not be immediately operated at its full operational speed. A new run-procedure is required (also refer to "Power-on procedure" in the Chapter "Mounting and operating the spindle")

# 6 TECHNICAL DATA

## 6.1 POWER CONNECTION

### 6.1.1 Synchronous spindle (2SP120...; 2SP125.-1...)

| Phase | Designation at the spindle | Conductor designation |
|---|---|---|
| U1 | U | 1 |
| V1 | V | 2 |
| W1 | W | 3 |
| PE | PE | Gn/Ye |

### 6.1.2 Induction spindle (2SP125.-8...)

| Phase | Designation at the spindle | Conductor designation |
|---|---|---|
| U1 | A1 / UVW | 1 |
| V1 | | 2 |
| W1 | | 3 |
| PE | | Gn/Ye |
| U2 | A2 / UVW | 1 |
| V2 | | 2 |
| W2 | | 3 |
| PE | | Gn/Ye |

When commissioning the spindle unit, it must be carefully ensured that the individual phases are correctly connected. The direction of rotation of the spindle should be checked.

## 6.2 SEALING AIR

| Sealing air input | Connection V |
|---|---|
| | G1/8“ (5 mm diameter) |
| Pressure | 2.5 - 3 bar |
| Filtration grade | 8 µm |
| Min. sealing air temperature | Ambient |
| Max. sealing air temperature | 35° C |
| Max. residual water content | 0.12 g/m$^3$ |
| Max. residual oil content | 0.01 g/m$^3$ |
| Max. residual dust | 0.1 mg/m$^3$ |

## 6.3 MOTOR COOLING

| | 2SP120... | 2SP125... |
|---|---|---|
| Water inlet | Connector I | Connector I |
| | Connector for hose 12/10 mm | G1/2'' (9 mm diam.) |
| Water outlet | Connector II | Connector II |
| | Connector for hose 12/10 mm | G1/2'' (9 mm diam.) |
| Cooling medium | Water with max. 25 % anti-corrosion agent | |
| Pressure | Max. 5 bar | |
| Flow rate | 10 l/min | |
| Filtration grade | 100 µm | |
| Anti-corrosion agent | CLARIANT Antifrogen N,<br>Tyfocor,<br>or comparable anti-corrosion agent | |

For the connectors of the 2SP120... spindle, only use connecting hoses in a PU/PA quality!!

## 6.4 TOOL RELEASE UNIT

| 2SP120... | | |
|---|---|---|
| Design | Pneumatic | Hydraulic |
| Pressure input, to release | Connector VIIa / VIIb | Connector VII |
| | 2 x G1/4'' | G1/4'' |
| Pressure input, to clamp | Connector VIIIa / VIIIb | Connector VIII |
| | 2 x G1/8'' | G1/4'' |
| Release pressure | 5-6 bar | 50 - 80 bar |
| Clamping pressure | 5-6 bar | 50 - 80 bar |

| 2SP125... | | |
|---|---|---|
| Design | Pneumatic | |
| Pressure input, to release | Connector X | |
| | 1 x M16x1.5 | |
| Pressure input, to clamp | Connector XI | |
| | 1 x G1/8'' | |
| Release pressure | 5-6 bar | |
| Clamping pressure | 5-6 bar | |

## 6.5 INNER TOOL COOLING USING A COOLING-LUBRICATING MEDIUM (OPTION)

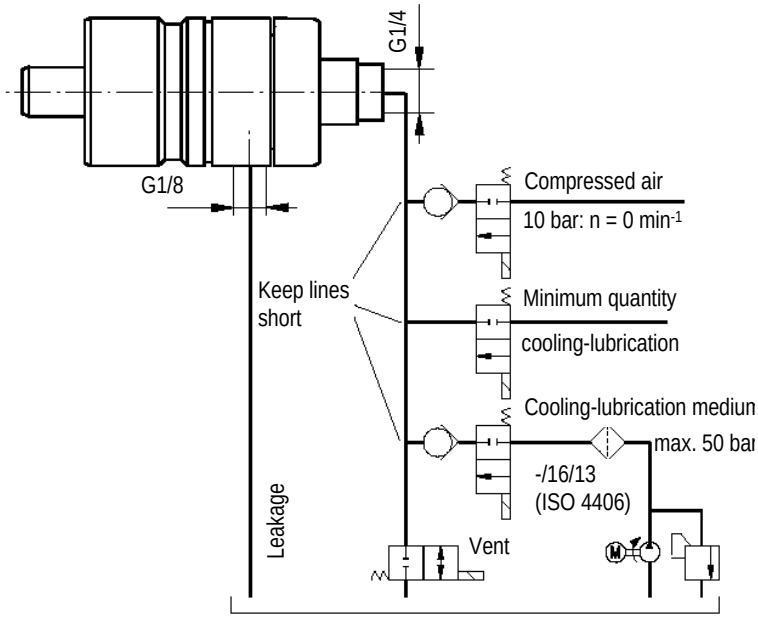
| | 2SP120... | 2SP125... |
|---|---|---|
| Cooling-lubricating medium inlet | Connector X | Connector IXb |
| | G1/4'' | G1/4'' |
| Leakage | Connector IV | |
| | G1/8'' | |
| Suitable for cooling-lubricating medium | Emulsion of water and oil additive | |
| Filtration grade according to ISO 4406 | -/16/13, 50 µm | |
| Cooling-lubricating medium pressure | Max. 50 bar | |
| Cooling-lubricating medium temperature | Max. 40 °C | |
| Flow quantity | 54 l/min | |

## 6.6 EXTERNAL TOOL COOLING WITH COOLING-LUBRICATING MEDIUM (OPTION FOR 2SP120...)

| | 2SP120... |
|---|---|
| Cooling-lubricating medium intake | Connector XI |
| | G1/4'' (radial) or,<br>8.8 mm diameter (axial) for O ring 11x2 |
| Suitable for cooling-lubricating medium | Emulsion of water and oil additive |
| Cooling-lubricating medium pressure | 5 bar |
| Cooling-lubricating medium temperature | Max. 40 °C |

## 6.7 TOOL AIR PURGE SYSTEM

| | 2SP120... | 2SP125... |
|---|---|---|
| | Connector IX | Connector IXa |
| | G1/4'' | |
| Pressure | 5-6 bar | |
| Filtration grade | 50 µm | |
| Max. residual water content | 0.12 g/m$^3$ | |
| Max. residual oil content | 0.01 g/m$^3$ | |
| Max. residual dust | 0.1 mg/m$^3$ | |



## 6.8 CLAMPING STATE INTERROGATION

### 2SP120... analog draw bar interrogation

| | |
|---|---|
| Sensor S1 | Balluff<br>BAW M18ME-UAC50B-BP03 |
| Draw bar in the released position | 9-10V |
| Tool clamped | 2-4V |
| Tool too small | 1 -2 V |
| No tool | <1V |

Those values are nominal values only.
The actual values should be taken from the particular spindle acceptance certificate!
Sensor S1 is adjusted so that for tools in compiliance with the standard, it supplies the "draw bar in released position" signal. This cannot be used to safety detect jammed tools!
Supply voltage, 24V DC +/-20%

### Digital tool release unit interrogation

| | |
|---|---|
| Sensor S4 | Balluff<br>BES M08MI-PSC15B-BP03 |

Sensor S4 is adjusted so that it supplies a signal if there is a safe clearance between the release unit and the spindle shaft.
Supply voltage, 24V DC +/-20%

### 2SP125... Digital draw bar interrogation

| | |
|---|---|
| Sensor S1 (optional) | SIEMENS 3RG4012-3AG33<br>BES 516-325-E5-C-S4 |

Sensor S1 is adjusted so that for tools in compliance with the standard it supplies the "draw bar in the released position" signal.
This cannot be used to safety detect jammed tools!
Supply voltage, 24V DC +/-20%

| | |
|---|---|
| Sensor S2 | SIEMENS 3RG4012-3AG33<br>BES 516-325-E5-C-S4 |

Sensor S2 is adjusted so that for clamped tools in compliance with the standard, it supplies a correct signal. It must be guaranteed that the spindle can only start when the sensor has switched. If this is not the case, then there is a potential danger of personal injury and machine damage due to tool parts that are flung-out at high speed!
Supply voltage, 24V DC +/-20%

| | |
|---|---|
| Sensor S3 (optional) | SIEMENS 3RG4012-3AG33<br>BES 516-325-E5-C-S4 |

Sensor S3 is adjusted so that it supplies a signal if either a tool is being used that is too small or no tool at all.
Supply voltage, 24V DC +/-20%

## 6.9 ROTARY ENCODER, MOTOR MEASURING SYSTEM

The spindle is equipped with a hollow-shaft incremental encoder

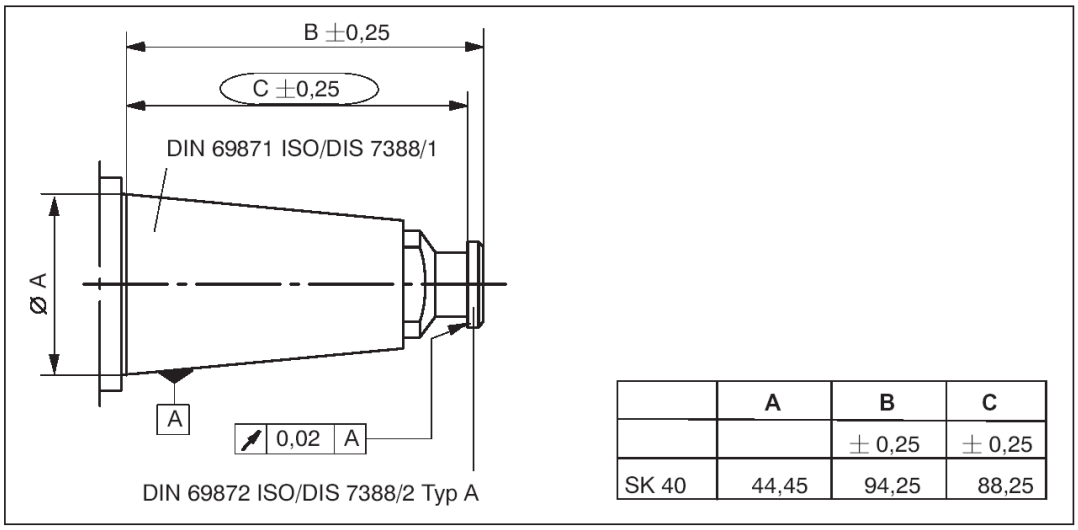
| | |
|---|---|
| Signals | Sin-Cos signal (A+, A-, B+, B-)<br>1 reference signal per revolution (R+, R-) |
| Signal level | 1 Vpp (difference signal) |
| Pulse number | 256 signals / revolution |
| Connecting cable | Siemens 6FX8002-2CA31-1..0 or<br>Siemens 6FX5002-2CA31-1..0 |

The sin-cos signal is suitable for fine interpolation. The reference signal supplies one pulse at each shaft revolution and allows the shaft angle to be referenced. For a synchronous motor, the reference pulse indicates the positive zero crossover of phase U (with a clockwise rotating field). The encoder interface is electrically and functionally compatible to SIEMENS SIMODRIVE 611 drive converters.
The encoder is connected through a 17-pin flange-mounted socket. Pre-assembled cables should be used to connect the encoder to the drive converter (refer to the Planning Guide).

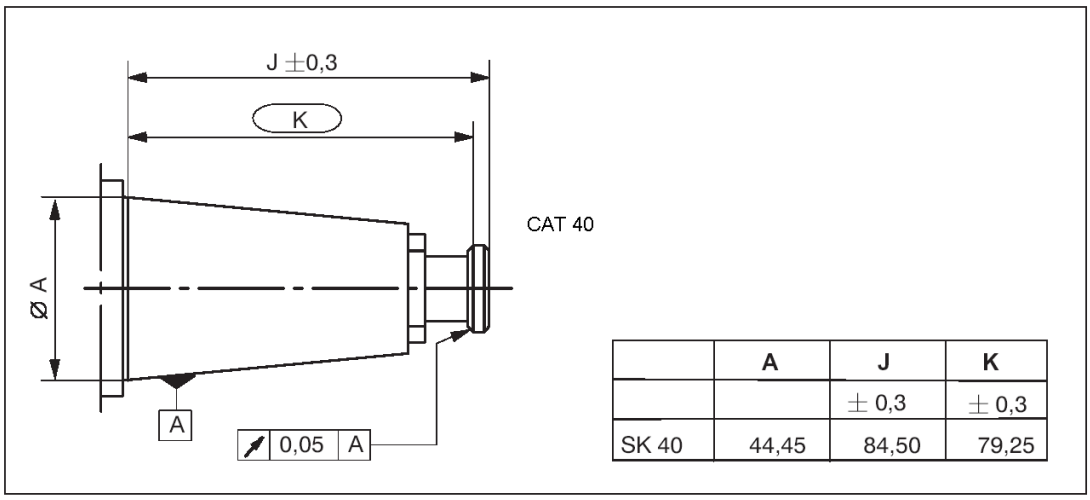
## 6.10 TOOL INTERFACES

| | HSKA63 | SK40 / CAT40 / BT40 |
|---|---|---|
| Relevant standards | DIN 69893-1 Form A<br>ISO 12164-1/2 style A | SK40 asymmetrical<br>DIN 69871/69872<br>ISO 7388/1/2 Type A<br><br>CAT40 asymmetrical<br>ANSI B5.50-78<br>ISO 7388/1/2 Type B<br><br>BT40 asymmetrical<br>BT40, 30°<br>MAS 403-1982,BT/PT30°<br>Version E1<br><br>BT40 asymmetrical<br>BT40, 45°<br>MAS 403-1982,BT/PT45°<br>Version F1 |
| Pull-in force | 18.000 +5.4/-1.9 N | 8,000 +1.6/-0.8 N |
| Reference gauge | 10.5 +/- 0.1 mm | 93.6 +/- 0.1 mm |
| Reference gauge BT 40 | - | 99.7 +/- 0.1 mm |
| Reference gauge CAT 40 | - | 82.9 +/- 0.1 mm |

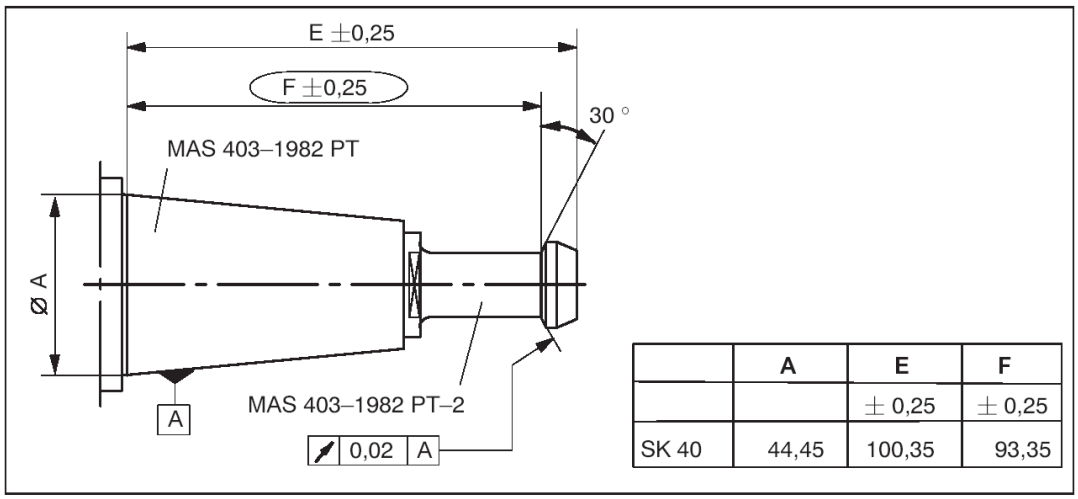
## 6.11 TOOL INTERFACEN



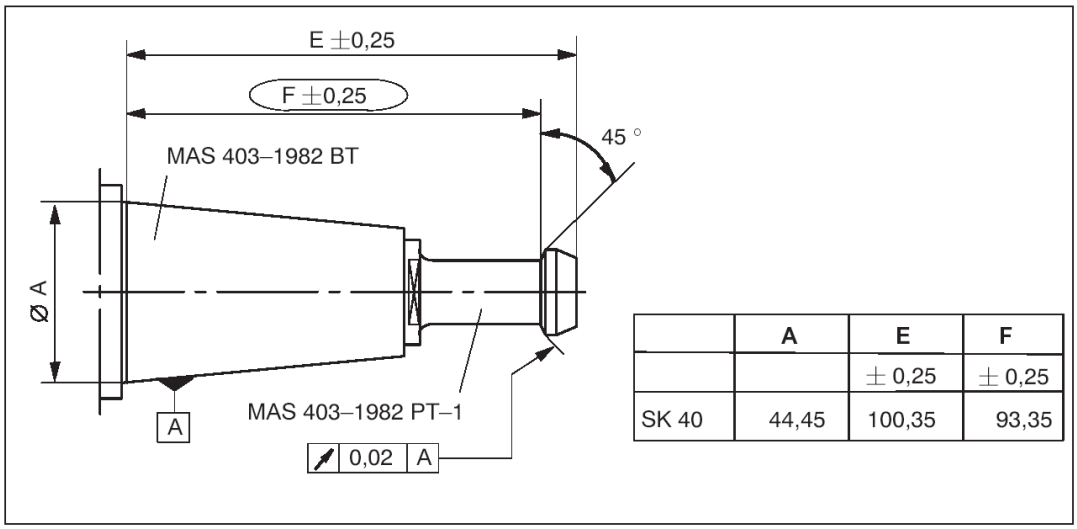

| | A | B | C |
|---|---|---|---|
| | | ± 0,25 | ± 0,25 |
| SK 40 | 44,45 | 94,25 | 88,25 |



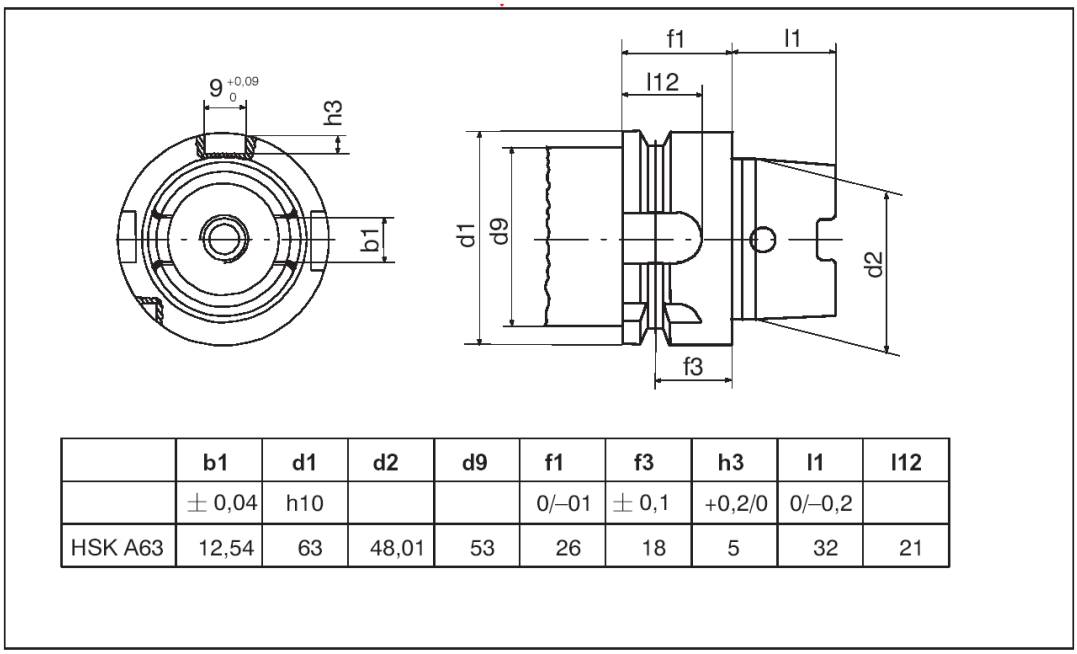

| | A | J | K |
|---|---|---|---|
| | | ± 0,3 | ± 0,3 |
| SK 40 | 44,45 | 84,50 | 79,25 |




| | A | E | F |
|---|---|---|---|
| | | ± 0,25 | ± 0,25 |
| SK 40 | 44,45 | 100,35 | 93,35 |




| | A | E | F |
|---|---|---|---|
| | | ± 0,25 | ± 0,25 |
| SK 40 | 44,45 | 100,35 | 93,35 |




| | b1 | d1 | d2 | d9 | f1 | f3 | h3 | l1 | l12 |
|---|---|---|---|---|---|---|---|---|---|
| | ± 0,04 | h10 | | | 0/–01 | ± 0,1 | +0,2/0 | 0/–0,2 | |
| HSK A63 | 12,54 | 63 | 48,01 | 53 | 26 | 18 | 5 | 32 | 21 |

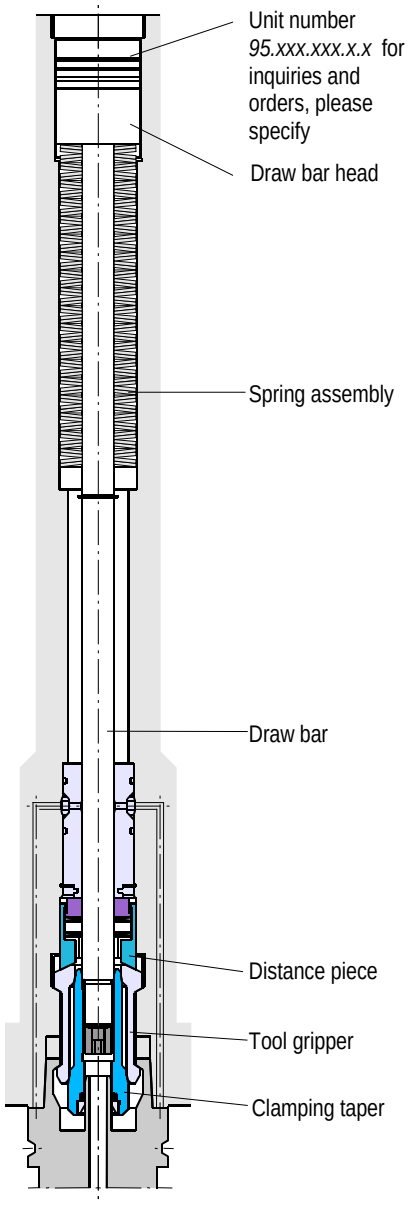
# 7 TOOL CLAMPING SYSTEMS

## 7.1 SAFETY INFORMATION AND INSTRUCTIONS

- The following points must always be carefully observed:
- It is not permissible that the spindle rotates without having a clamped tool!
- Only use tools that are in a perfect operating condition!
- Only use tools that are designed and intended for this tool clamping system (carefully observe the standard companion dimension drawing)!
- Tools may only be inserted when the drive spindle is at an absolute standstill!
- Observe the service/maintenance intervals!

## 7.2 PRODUCT DESCRIPTION, TOOL CLAMPING SYSTEM HSK-A63

### 7.2.1 Function




A spring assembly draws the draw bar together with the clamping taper into the spindle. In so doing, the clamping taper spreads the clamp outwards until this is in contact with the tool and clamps the tool with the spindle.
When clamping, the spring force is increased 300% using the two gripper retaining cones (10° and 30°) therefore applying a clamping force to the tool.
The tool will only become loose after it has been subject to a massive overload (400% clamping force). The tool is only released after tool breakage due to the mechanical interlocking. If pressure is applied to the release unit, the draw bar moves in the opposite direction and the clamp opens. The tool is ejected towards the end of the release stroke.
The tool clamping system can now accept a new tool.

## 7.2.2 Mounting the clamping unit

- Mounting tools required

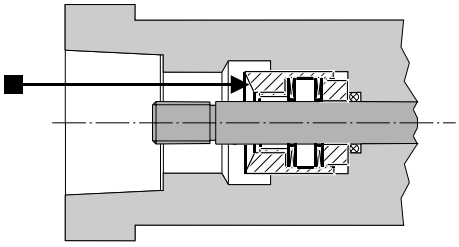
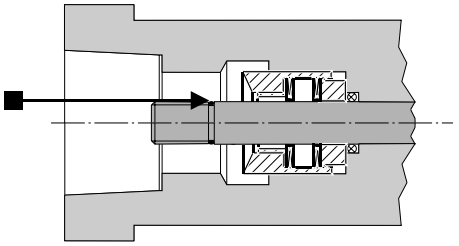
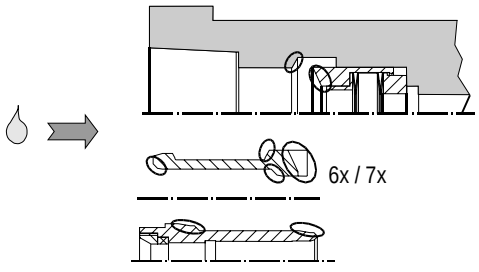
  Mounting tools for the HSK clamping unit to facilitate mounting the HSK clamps 95.601.114.3.1.

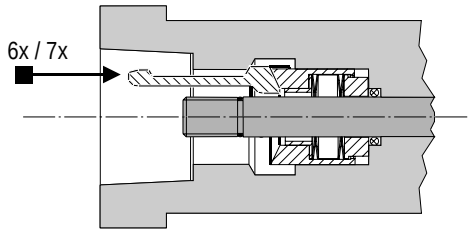
- Spare parts, clamping unit

  Table under Paragraph 7.2.6 "O rings and lip seal"
  Table under Paragraph 7.2.7 "HSK tool gripper"

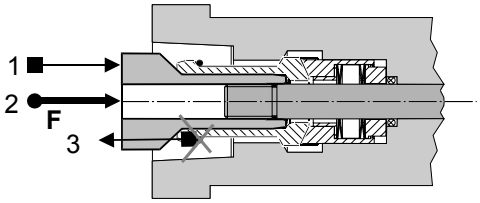
- Checking

  Are the spindle and parts to be mounted/installed clean?
  Are all of the parts in perfect condition and not damaged?
  Has grease been applied to the clamping unit, draw bar head and spring assembly?

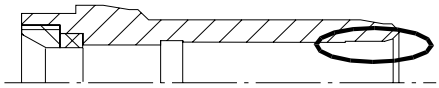
| | |
|---|---|
| | Clean the inner spindle contour, check whether all of the edges are appropriately rounded-off, apply grease to the O rings |
|  | Introduce the spacer ring into the spindle bore; check to ensure that it can move freely |
|  | Assemble the O ring on the draw bar, protective sleeve is optionally available: HSK A 63: 95.601.169.4.1 |
|  | Apply grease to the contact surfaces<br>- METAFLUX paste 70-8508<br>or<br>- KLÜBER paste ME 31-52<br>Never mix/combine different grease types! |



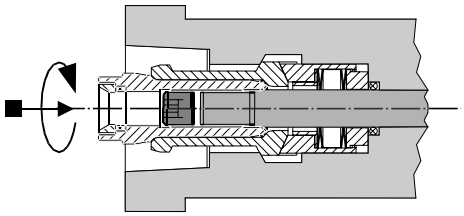

Latch/engage the tool gripper segments into the spacer ring and gripper retaining cone surfaces (ensure the same number!)



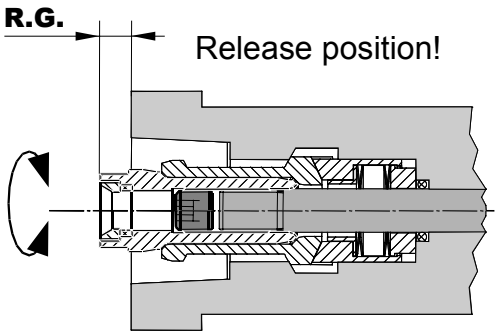

When using the assembly device:
Locate the tool gripper segments on the device and retain using a rubber ring; introduce the complete unit; apply a blow to the auxiliary dowel and locate the gripper; remove the rubber ring



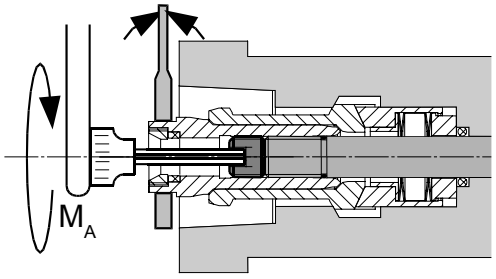
Apply assembly grease to the clamping taper



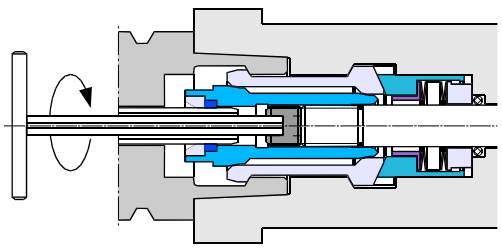
Screw the clamping taper, pre-assembled with seal, protective ring and lock nut onto the draw bar up to the maximum reference gauge; do not screw any further as this will damage the O ring on the draw bar!




Adjust the clamping taper to the reference gauge
R.G. = 10.5 +/- 0.1 mm




Tighten the lock nut
Tightening torque:
A63: 30 Nm

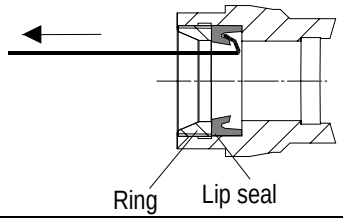
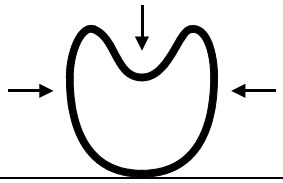
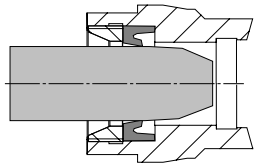


Check the lock nut using the clamped tool.
Check the following after the first approx. 100 clamping operations:

- Check the reference gauge
- Check that the clamping unit is locked using a clamped tool.

## 7.2.3 Changing the lip seal in the clamping unit 0.926030.103

The ring does not have to be removed to disassemble the lip seal; it only has to be replaced if damaged.

| | |
|---|---|
|  | Remove the defective lip seal from the clamping unit using either a suitable hook or pliers |
|  | Press the lip seal into a kidney shape and install; carefully observe the mounting position |
|  | Using a blunt object, press the seal against the surface<br>and using a dowel, bring into the final position |

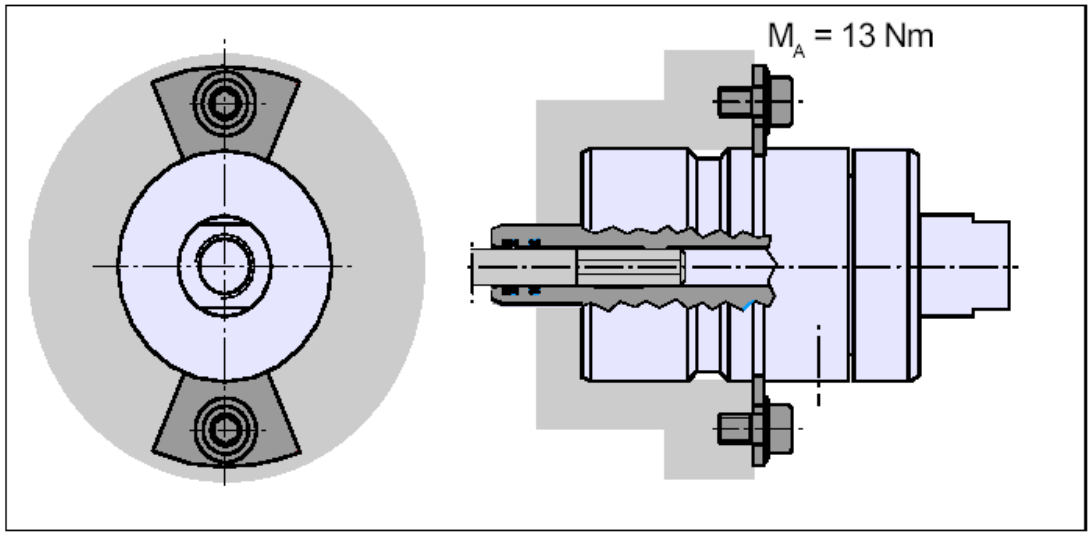
## 7.2.4 Replacing the rotary gland (optional)

Extreme cleanliness must be ensured while disassembling/assembling. This prevents dirt from entering the cooling-medium feeder lines!

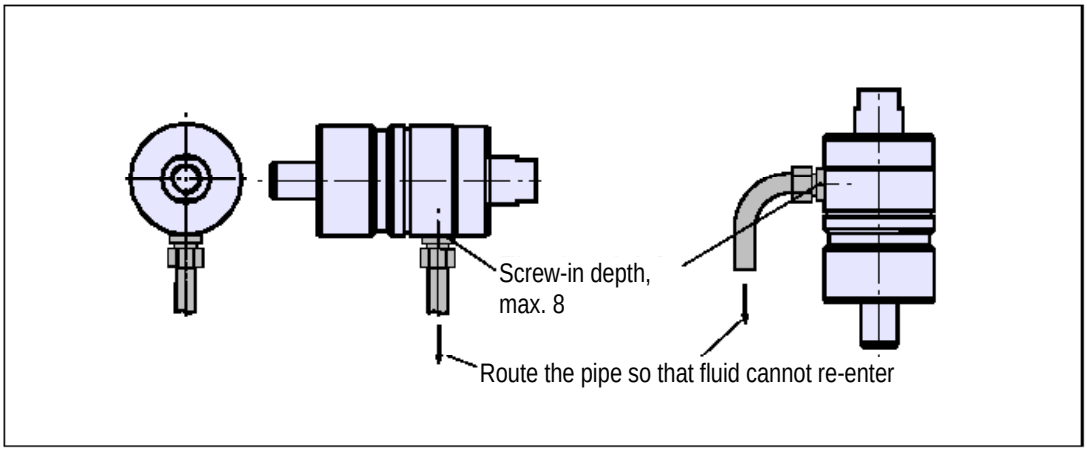
Removing the rotary gland.
Ensure that all of the cooling-medium lines are in a no-pressure condition. Remove any water from the lines.
Remove the connecting lines for the cooling-lubricating medium feed and leakage drain holes.
Release the clamping elements of the rotary gland and carefully withdraw the rotary gland from its bore.

Installing the rotary gland
Carefully insert the new rotary gland into its bore. In so doing, carefully observe the position of the octagon at the connecting element! It may only be inserted by hand! Never apply any hammer blows to the rotary gland! This would certainly damage the rotary gland.
Then, insert the clamping element into the groove and clamp using screws ($M_A$ = 13 Nm).
Re-attach the lines for the cooling-medium feed and leakage drain.
After powering-up the cooling-lubricating medium supply, visually check all the connections to ensure that they are tight and there are no leaks.

Installing the rotary gland




Connecting the leakage drain pipe



### 7.2.5 Service/maintenance

- Service/maintenance intervals

The following checks and work must be carried-out at the specified intervals to allow smooth disturbance-free operation of the tool clamping system and for checking purposes:

- Weekly

Check the lip seal in the clamping taper

Check the clamping taper for damage, accumulated dirt and ensure that it is adequately lubricated

The following should be carefully noted:
The re-lubrication interval depends on how much grease is being removed from the clamping unit.
Reason why grease could be removed:
Defective seal in the clamping taper
Medium that dissolves grease
A jet of cleaning fluid was applied directly to the clamping unit etc.
We recommend METAFLUX Moly-Spray No. 70-82 for quickly re-greasing the clamping set without having to disassemble the clamp

- Monthly

In the released position: Check the reference gauge

Counter-lock using a clamped tool

Check the pull-in force (our recommendation: Use the power check)
If the pull-in force is less than 70% of the nominal value, then the following measures should be taken in the subsequent sequence:
Re-lubricate and re-check the pull-in force
Replace the gripper and re-check
Completely replace the tool clamping system

- Every three months

Replace the lip seal

- Rotary gland (option)

The rotary gland is service/maintenance-free within the service interval.
However, if media is used with hard and fine-grained contaminants (e.g. silicone), then it can be assumed that there will be an increased level of seal wear.

The bearings of the rotary gland are greased. For applications where a high degree of availability is necessary, we recommend a service interval of 4,000 hours. The rotary gland should be replaced, at the latest, after 3 years use. It this is not done, unpredictable failures cannot be completely excluded.

### 7.2.6 Lubricants for the HSK clamping unit

| Description | Quantity | Order No. |
|---|---|---|
| * METAFLUX grease paste No. 70-8508 | 4 g | 0.929100.012 |
| METAFLUX-Moly-Spray No. 70-82 | 400 ml | 06.21001.010 |
| KLÜBER grease paste ME 31-52 | 10 g | 06.21001.014 |
| KLÜBER-Spray ALTEMP Q NB 50 | 400 ml | 06.21001.015 |

* Greased for the first time and when first equipped

Please note: Only use grease/lubricant from the same company; it is not permissible to mix greases/lubricants!

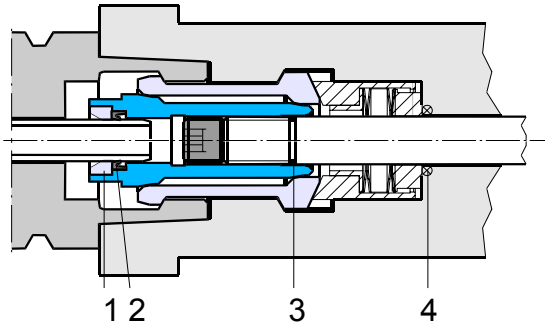
METAFLUX
Metaflux AG
Industriestraße 11
CH-4313 Möhlin
Tel.: +41-61-851 08 00
Fax: +41-61-851 08 08

TECHNO-SERVICE GmbH
Detmolder Straße 515
D-33605 Bielefeld
Tel.: (05 21) 9 24 44 –0
Fax: (05 21) 20 74 32

KLÜBER
Klüber Lubrication München KG
P.O. Box 701047
D-81310 München
Tel.: (0 89) 78 76 –0
Fax: (0 89) 78 76 -333

## 7.2.7 Spare parts list

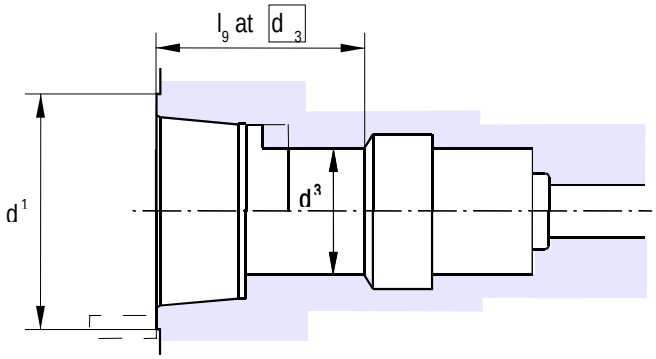
### 7.2.7.1 O rings and lip seal parts




| | | | Lip seal | O rings | |
|---|---|---|---|---|---|
| Clamping unit | | 1 | 2 | 3 | 4 |
| A63 | 95.600.001.3.6 | 95.600.850.4.1 | 0.926030.103 | 0.926010.156 | 0.926010.164 |
| | | | 12 x 18.5 x 4.5 | 12.0 x 1.5 | 13.87 x 3.53 |
| | | | | Material: Viton, hardness 80 SHORE A | |

### 7.2.7.2 HSK tool grippers

We recommend that the clamping unit is completely replaced! Repaired grippers are available if it is necessary to re-work the spindle contour.




| Nominal Size | Clamping set, complete | Gripper HS | | Repair clamping unit, complete | Repair gripper HS-E1 | |
|---|---|---|---|---|---|---|
| | | | l9 | | | l9 |
| A63 | 95.600.001.3.6 | 95.600.283.31 | 52 | 95.600.105.9.6 | 95.600.358.3.1 | 51.7 |

### 7.2.7.3 Rotary gland

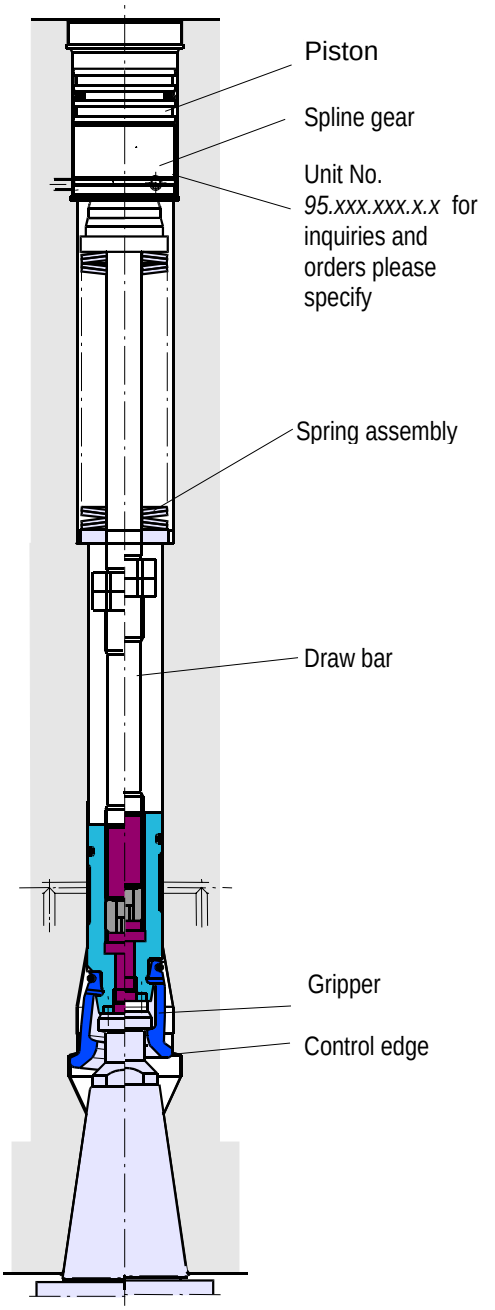
| | | | | |
|---|---|---|---|---|
| | | Rotary gland (optional) | 95.250.037.2.0 | |

### 7.2.8 Troubleshooting HSK-A63

| Fault | Cause |
|---|---|
| Tool has not been correctly clamped | Incorrect reference gauge |
| | Lock nut has become loose (released) |
| | Faulty inner tool contour |
| | Broken spring (the stroke is too short) |
| | Worn clamping unit |
| | Tool is inadequately fed |
| | Purge air presses the tool out of the tool change position |
| Tool isn't released | Defective tool release unit seal |
| | Leaky rotary gland |
| | Insufficient release pressure |
| | Micro-corrosion at the centering |
| | Spring chamber full of oil |
| Tool is either released or becomes loose during machining | Broken gripper, clamping taper or draw bar |
| | Broken tool shaft |
| | Broken springs |
| | Pull-in force too low |
| Loss of tension force | Clamping unit is operating in a dry state |
| | We recommd that the clamping force is measured. |

## 7.3 PRODUCT DESCRIPTION, TOOL CLAMPING SYSTEM SK 40

### 7.3.1 Function

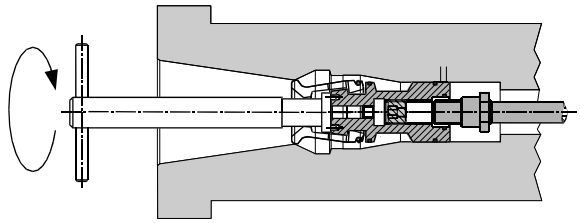
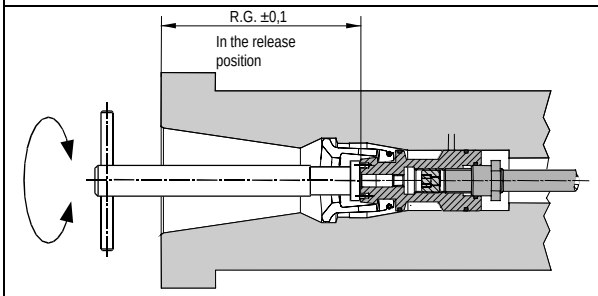
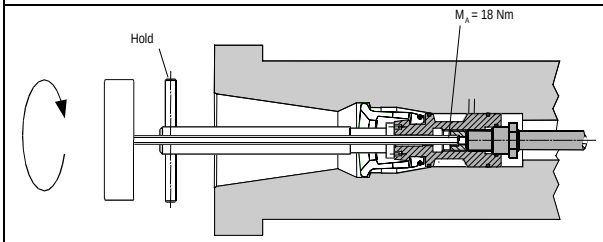
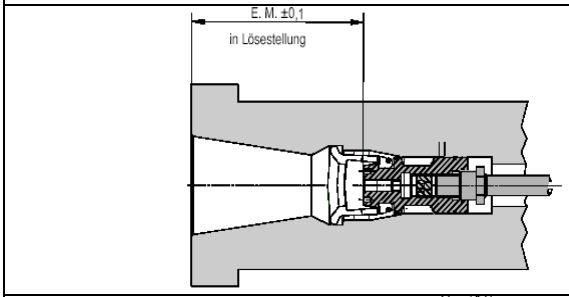
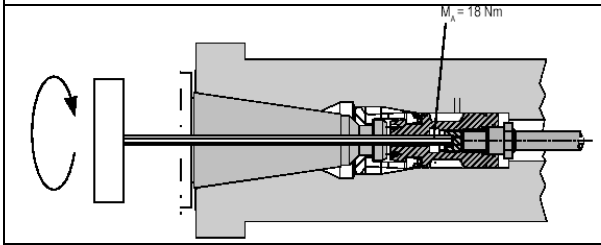



A spring assembly draws the tool into the working spindle through a spline gear, a draw bar and a gripper. As a result of the spline gear, the holding force is a multiple number of times higher than the pull-in force when the tool is drawn in. The tool is firmly clamped even if the power fails. The tool is released using the release unit. Pressure is applied to the tool release and compresses the spring assembly through studs. The draw bar is pushed in the direction of the steep-angle taper. As soon as the control edge has been passed, the gripper automatically opens. The tool is automatically ejected by the draw bar.
The tool clamping system can now accept a new tool.

## 7.3.2 Mounting the clamping unit

- Mounting tools required: Mounting tool for SK tool grippers 95.102.388.9.2
- Checking

  Are the spindles and parts to be mounted/installed clean?
  Are all of the parts in perfect condition and not damaged?
  Gripper and clamping head greased?

| | |
|---|---|
|  | Screw the gripper with holder onto the draw bar |
|  | Adjust the gripper with holder to the reference gauge |
|  | Attach the gripper with holder using the lock nut.<br>Tightening torque 18 Nm |
|  | Check after the first 100 clamping operations:<br><br>Check the reference gauge |
|  | Check after the first 100 clamping operations:<br><br>Check that the lock nut is tight using a clamped tool |

- Reference gauges

| Code | Standards | R.G. +/- 0.10 |
|---|---|---|
| A1 | DIN 69 871 / 69 872 | 93.6 |
| B1 | DIN 2080 | 91.4 |
| C1 | ANSI B 5.50 | 82.9 |
| E1 | MAS 403-1982 P40T-2 | 99.7 |
| F1 | MAS 403-1982 P40T-1 | 99.7 |

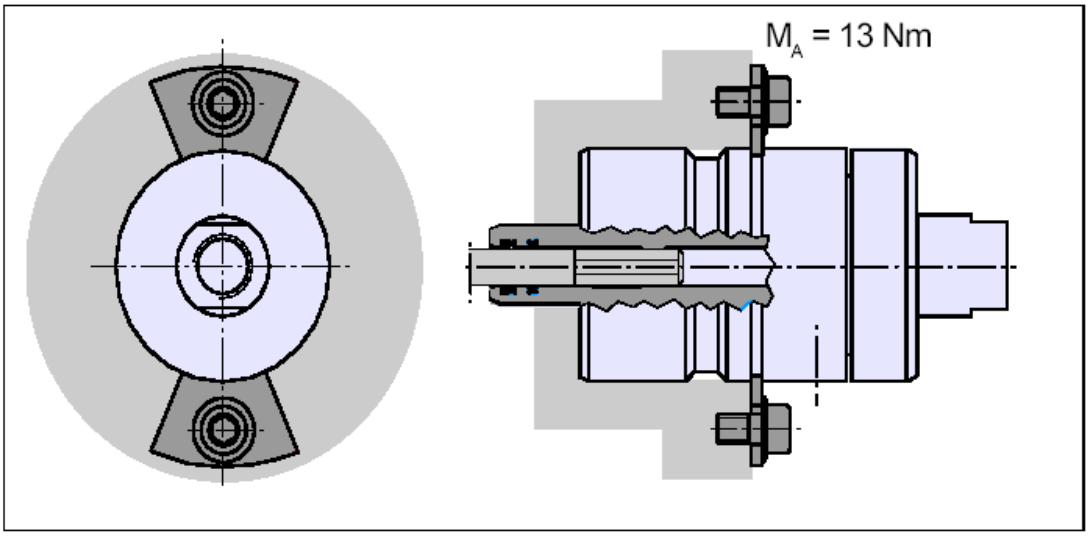
### 7.3.3 Replacing the rotary gland (optional)

Extreme cleanliness must be ensured while disassembling/assembling. This prevents dirt from entering the cooling-medium feeder lines!

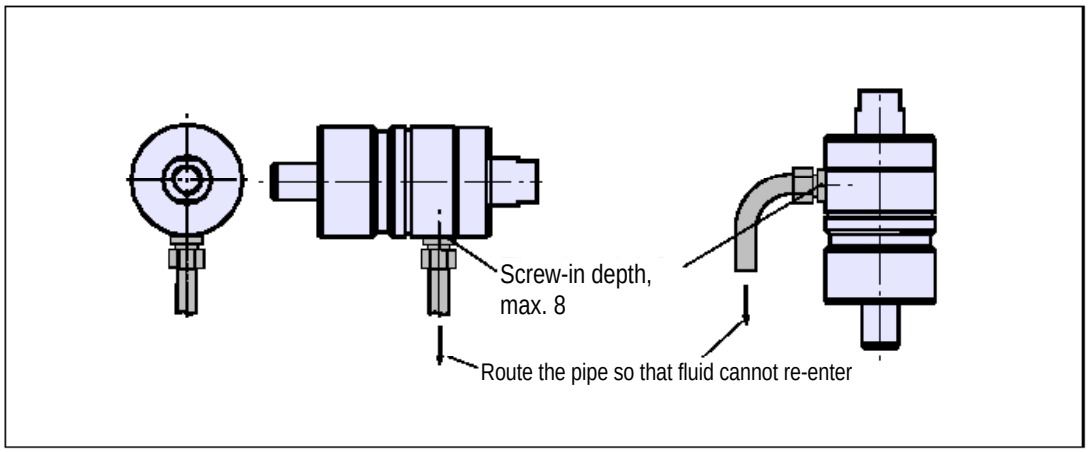
Removing the rotary gland.
Ensure that all of the cooling-medium lines are in a no-pressure condition. Remove any water from the lines.
Remove the connecting lines for the cooling-lubricating medium feed and leakage drain holes.
Release the clamping elements of the rotary gland and carefully withdraw the rotary gland from its bore.

Installing the rotary gland
Carefully insert the new rotary gland into its bore. In so doing, carefully observe the position of the octagon at the connecting element! It may only be inserted by hand! Never apply any hammer blows to the rotary gland! This would certainly damage the rotary gland.
Then, insert the clamping element into the groove and clamp using screws ($M_A$ = 13 Nm).
Re-attach the lines for the cooling-medium feed and leakage.
After powering-up the cooling-lubricating medium supply, visually check all the connections to ensure that they are tight and there are no leaks.

Installing the rotary gland




Connecting the leakage drain pipe




## 7.3.4 Servicing and maintenance

➢ Service/maintenance intervals

The following checks and work must be carried-out at the specified intervals to allow smooth disturbance-free operation of the tool clamping system and to fulfill the warranty conditions:

➢ Weekly

Check the tool gripper for damage, accumulated dirt and that it is adequately lubricated

The following should be carefully noted:
If a gripper segment breaks, then the complete clamping unit must be replaced. Ensure the correct sequence of the segments.
The re-lubrication interval depends on how much grease is being removed from the clamping set.
Reason why grease could be removed:
Defective seal in the clamping taper
Medium that dissolves grease
A jet of cleaning fluid is applied directly to the clamping unit etc.
We recommend METAFLUX Moly-Spray No. 70-82 for quickly re-greasing the clamping unit without having to disassemble the gripper.

➢ Monthly

In the released position: Check the reference gauge

Counter-lock using a clamped tool
Check the pull-in force (our recommendation: Use the power check)
If the pull-in force is less than 70% of the nominal value, then the following measures should be taken in the subsequent sequence:
Re-lubricate and re-check the pull-in force
Replace the gripper and re-check
Completely replace the tool clamping system

➢ Rotary gland (option)

The rotary gland is service/maintenance-free within the service interval.
However, if media is used with hard and fine-grained contaminants (e.g. silicone), then it can be assumed that there will be an increased level of seal wear.

The bearings of the rotary gland are greased. For applications where a high degree of availability is necessary, we recommend a service interval of 4,000 hours. The rotary gland should be replaced, at the latest, after 3 years use, as otherwise, unpredictable failures cannot be completely excluded.

### 7.3.5 Lubricants for the SK clamping set

| Description | Quantity | Order No. |
|---|---|---|
| * METAFLUX grease paste No. 70-8508 | 4 g | 0.929100.012 |
| METAFLUX-Moly-Spray No. 70-82 | 400 ml | 06.21001.010 |
| KLÜBER grease paste ME 31-52 | 10 g | 06.21001.014 |
| KLÜBER-Spray ALTEMP Q NB 50 | 400 ml | 06.21001.015 |

* Greased for the first time and when first equipped

Please note: Only use grease/lubricant from the same company; it is not permissible to mix greases/lubricants!

METAFLUX
Metaflux AG
Industriestraße 11
CH-4313 Möhlin
Tel.: +41-61-851 08 00
Fax: +41-61-851 08 08

TECHNO-SERVICE GmbH
Detmolder Straße 515
D-33605 Bielefeld
Tel.: (05 21) 9 24 44 –0
Fax: (05 21) 20 74 32

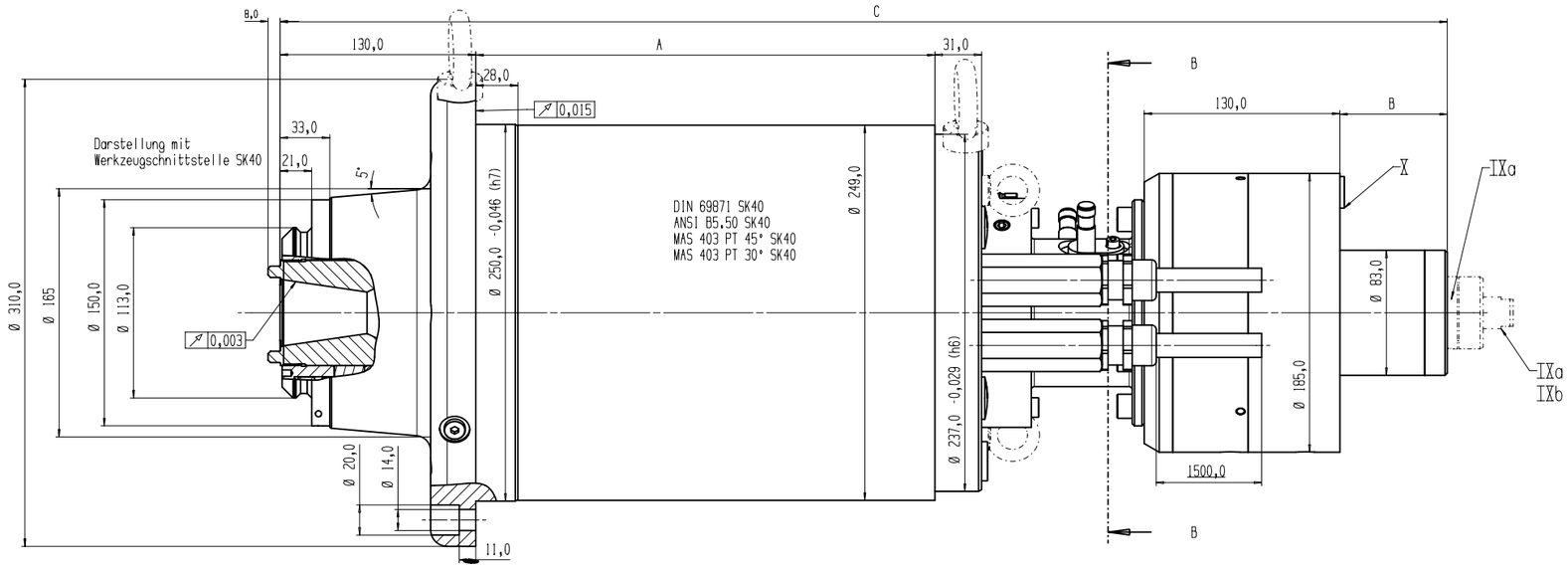
KLÜBER
Klüber Lubrication München KG
P.O. Box 701047
D-81310 München
Tel.: (0 89) 78 76 –0
Fax: (0 89) 78 76 -333

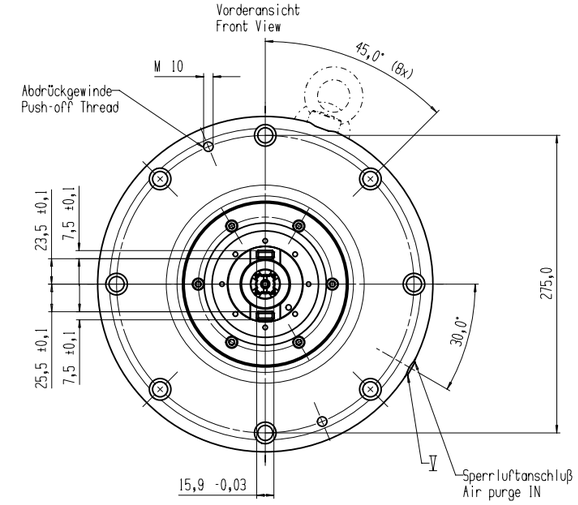
### 7.3.6 Spare parts list

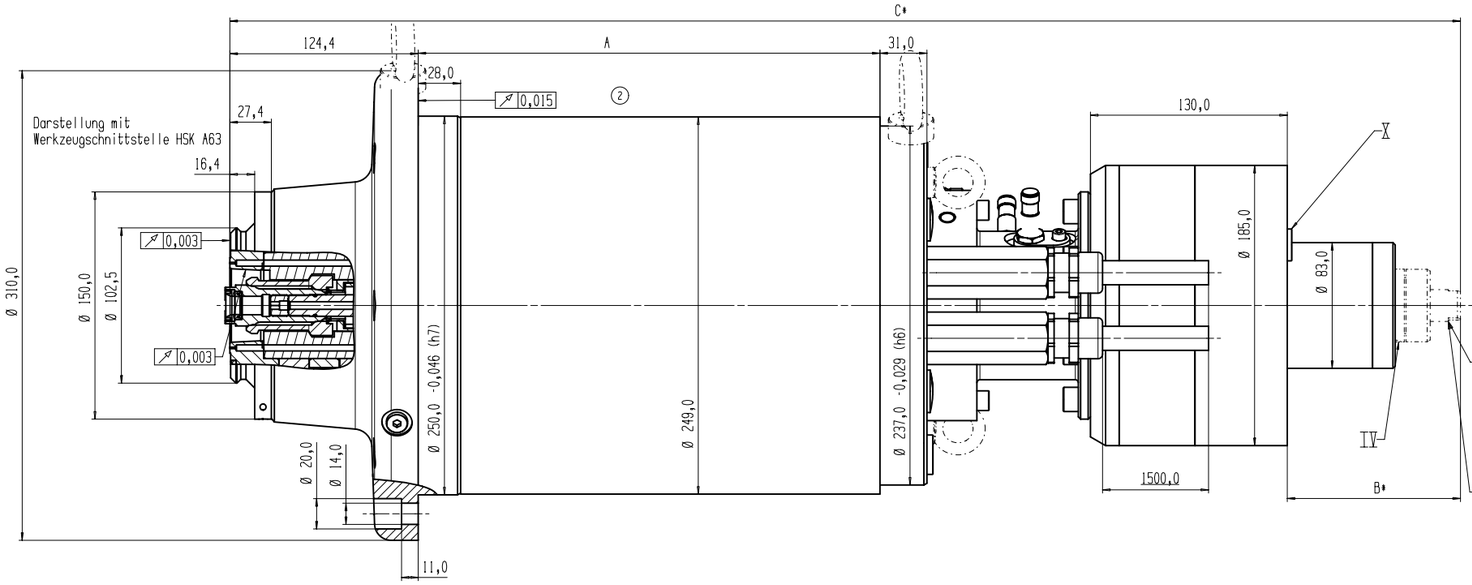
| SK 40 | Code | Standards | Order No. | Code No. |
|---|---|---|---|---|
| | A | DIN 69871 / 69872 ISO 7388/1/2 Type A | 95.102.437.2.1 | 36 |
| | B | DIN 2080 - OTT-Rille | 95.102.432.2.1 | 32 |
| | C | ANSI B5.50 - 78 ISO 7388/1/2 Type B | 95.102.436.2.1 | 35 |
| | I | MAS 403-1982 BT/PT 2 (30°) | 95.103.514.2.1 | 38 |
| | F | MAS 403-1982 BT/PT 1 (45°) | 95.103.513.2.1 | 37 |
| | | Rotary gland (optional) | 95.250.037.2.0 | |

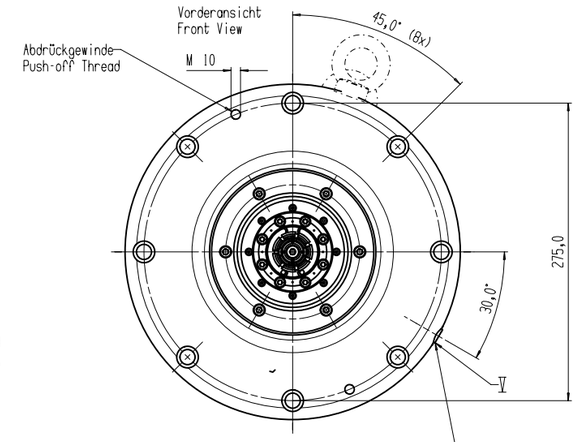
### 7.3.7 Troubleshooting SK40

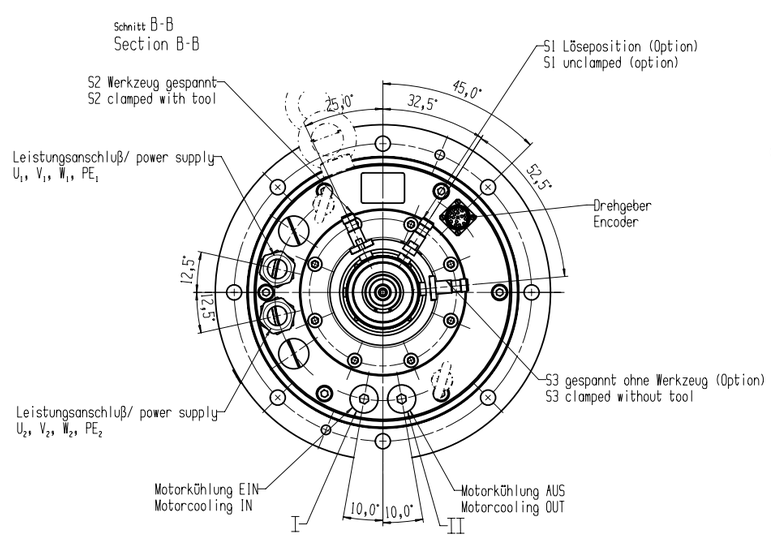
| Fault | Cause |
|---|---|
| Tool has not been correctly clamped | Incorrect reference gauge |
| | Lock nut has become loose (released) |
| | Incorrect gripper used (tool standard) |
| | |
| | Broken spring (the stroke is too short) |
| | Large amount of dirt in the gear |
| | Draw bolts either incorrect or faulty |
| | Tool is inadequately fed |
| | Purge air presses the tool out of the tool change position |
| | Loss of clamping force |
| Tool isn't released | Defective tool release unit seal |
| | Leaky rotary gland |
| | Insufficient release pressure |
| | Micro-corrosion at the steep-angle taper |
| | Spring chamber full of oil |
| Tool is either released or becomes loose during machining | Broken gripper, clamping taper or draw bar |
| | Draw bolts or steep-angle taper shaft broken |
| | Tool too long/too short |
| | Broken springs |
| | Pull-in force too low; gear is not in the working range |
| Loss of tension force | Clamping unit is operating in a dry state |
| | We recommd that the clamping force is measured. |

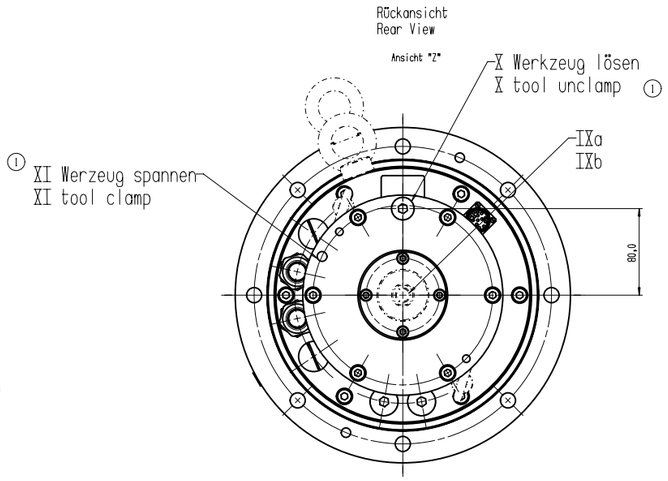



## Asynchron Motor
## Induction Motor

| | 2SP1 253-B | 2SP1 255-B | 2SP1 253-B | 2SP1 255-B |
|---|---|---|---|---|
| tool interface | SK/BT/CAT 40 | SK/BT/CAT 40 | HSK A63 | HSK A63 |
| speed | 10000 min-1 | 10000 min-1 | 15000 min-1 | 15000 min-1 |
| motor type | Asynchron | Asynchron | Asynchron | Asynchron |
| A | 305,0 | 405,0 | 305,0 | 405,0 |
| B | 71.3 | 71.3 | 71.3 | 71.3 |
| B * | 114.3 | 114.3 | 114.3 | 114.3 |
| C | 775.3 | 875.3 | 769.8 | 869.8 |
| C * | 818.3 | 918.3 | 812.8 | 912.8 |


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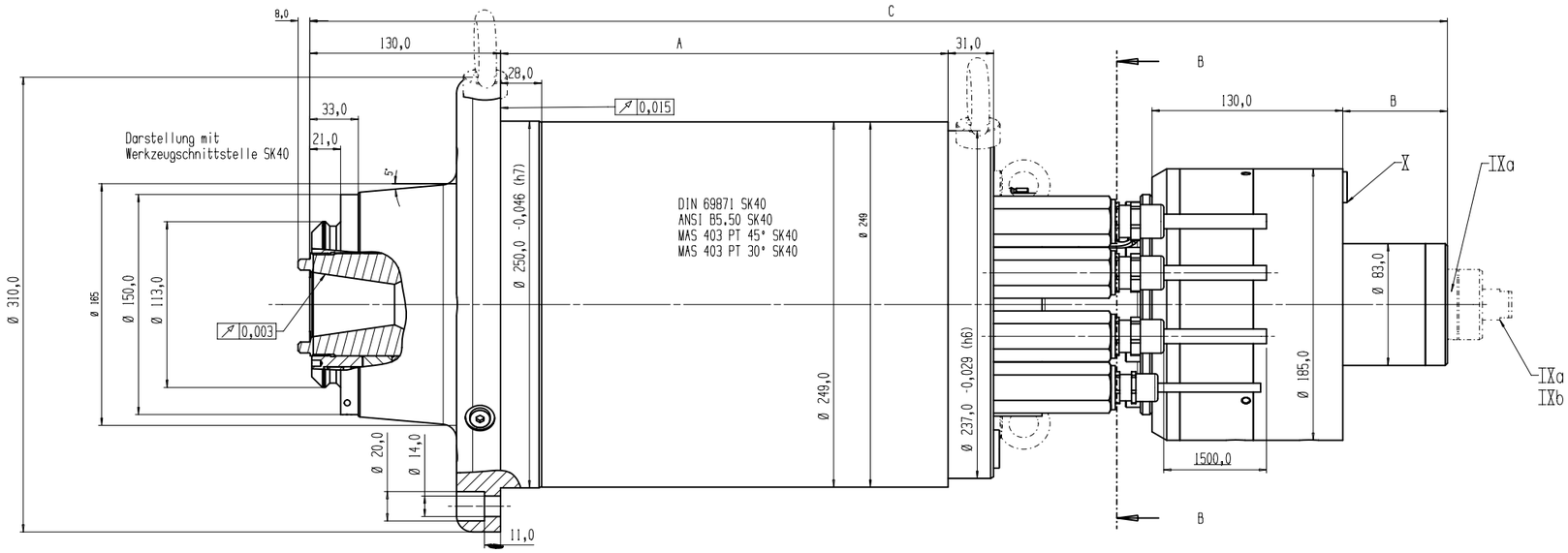


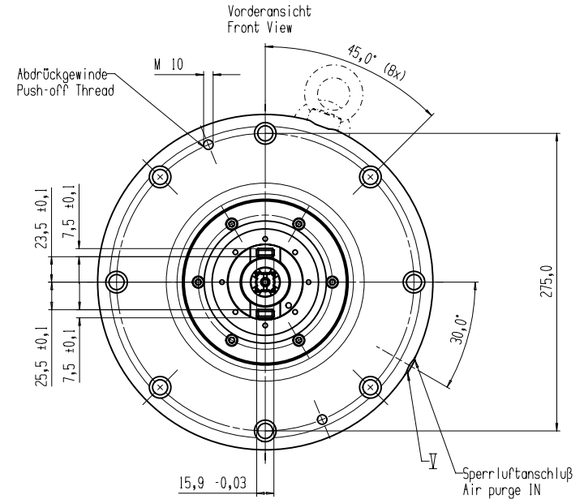
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SPINDELTECHNOLOGIE GMBH
A SIEMENS COMPANY
HITACHI-ZAHNRÄD.-STRASSE 55
97424 SCHWEINFURT

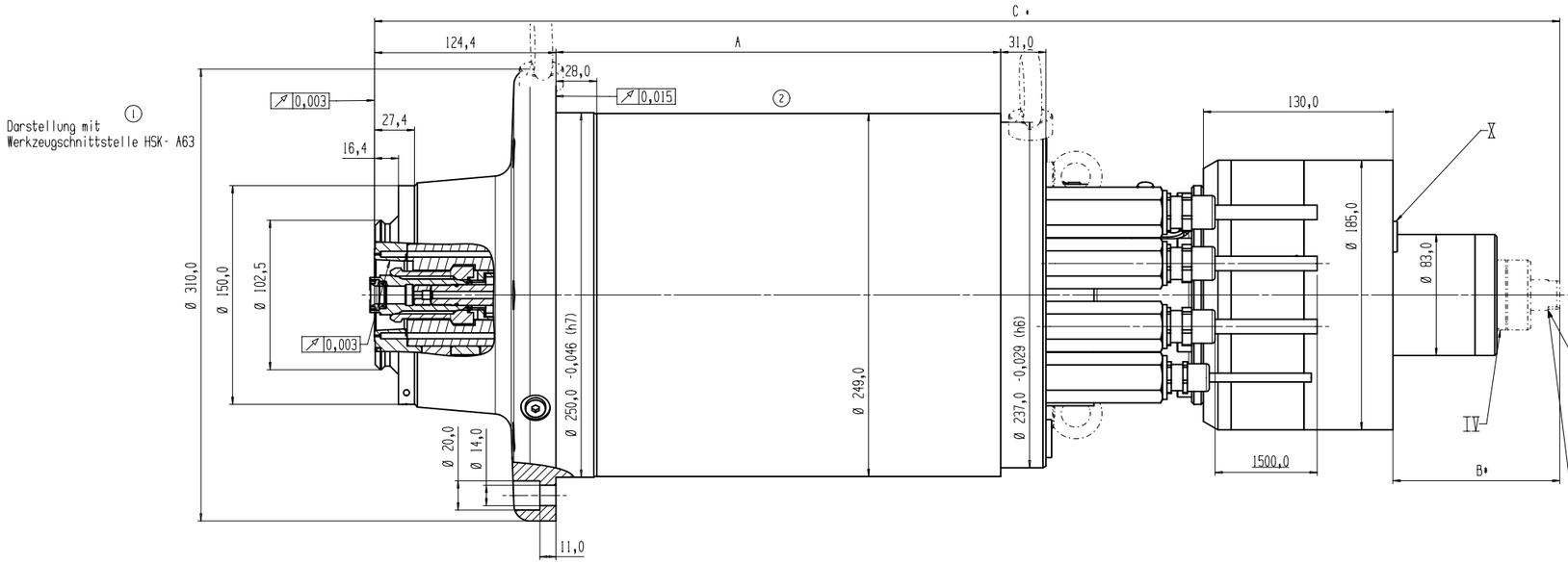

Maßstab 1:1 A0 Gewicht kg
Werkstoff/1
Rohteil Modell
Bearb. 05.08.02 Schneider
Bearb.
Norm
Bemerkung, Zusatzinformation
ECS Maßblatt
Schutzvermerk
ECS_Maßblatt
Blatt 1
von 1
Ers.f. Ers.d.

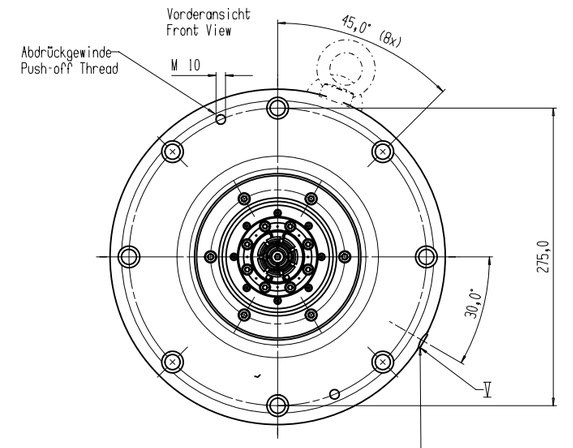
| Zust. | Änderung | Datum | Name |
|---|---|---|---|
| 2 | orgject | 08.01.04 | MS |
| 1 | orgject | 05.10.01 | MS |


User: MS1319 Part: ECS_Massblatt.A_asm Date: 27-Apr-04 Time: 07:17 Message:

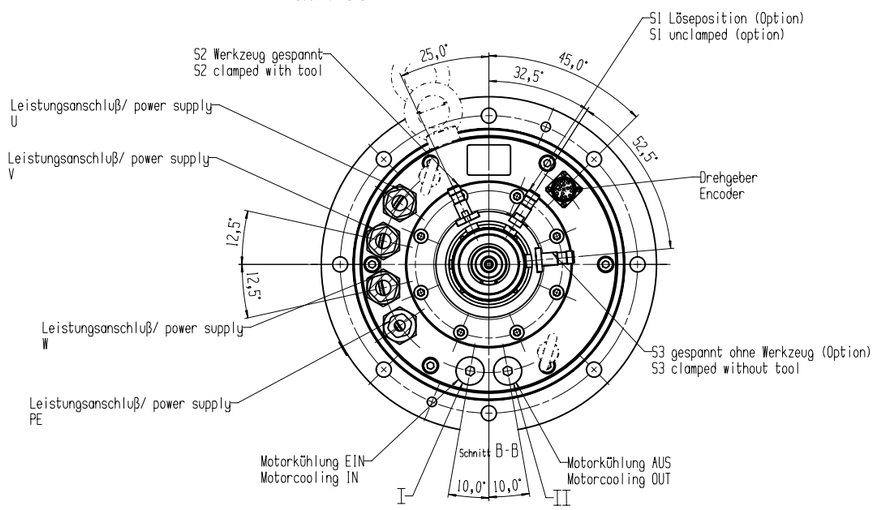


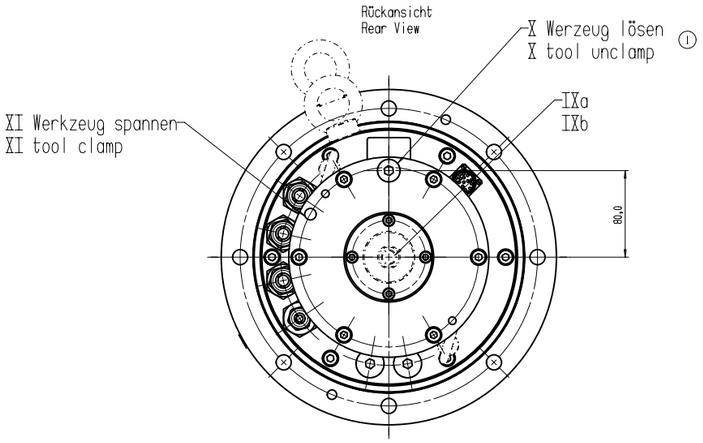




Schnitt B-B
Section B-B




## Synchron Motor
## Permanent Magnet Motor

| | 2SPI 253-1 | 2SPI 255-1 | 2SPI 253-1 | 2SPI 255-1 |
|---|---|---|---|---|
| tool interface | SK/BT/CAT 40 | SK/BT/CAT 40 | HSK A63 | HSK A63 |
| speed | 10000 min-1 | 10000 min-1 | 15000 min-1 | 15000 min-1 |
| motor type | Synchron | Synchron | Synchron | Synchron |
| A | 305,0 | 405,0 | 305,0 | 405,0 |
| B | 71.3 | 71.3 | 71.3 | 71.3 |
| B * | 114.3 | 114.3 | 114.3 | 114.3 |
| C | 775.3 | 875.3 | 769.8 | 869.8 |
| C * | 818.3 | 918.3 | 812.8 | 912.8 |


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| | | | | | |
|---|---|---|---|---|---|
| | | | Bearb. | 06.08.02 | Schneider |
| | | | Gepr. | | |
| | | | Norm | | |
| 2 | engineering | 08.01.04 | MS | | |
| 1 | engineering | 06.10.03 | MS | | |
| Zust. | Änderung | Datum | Name | | |

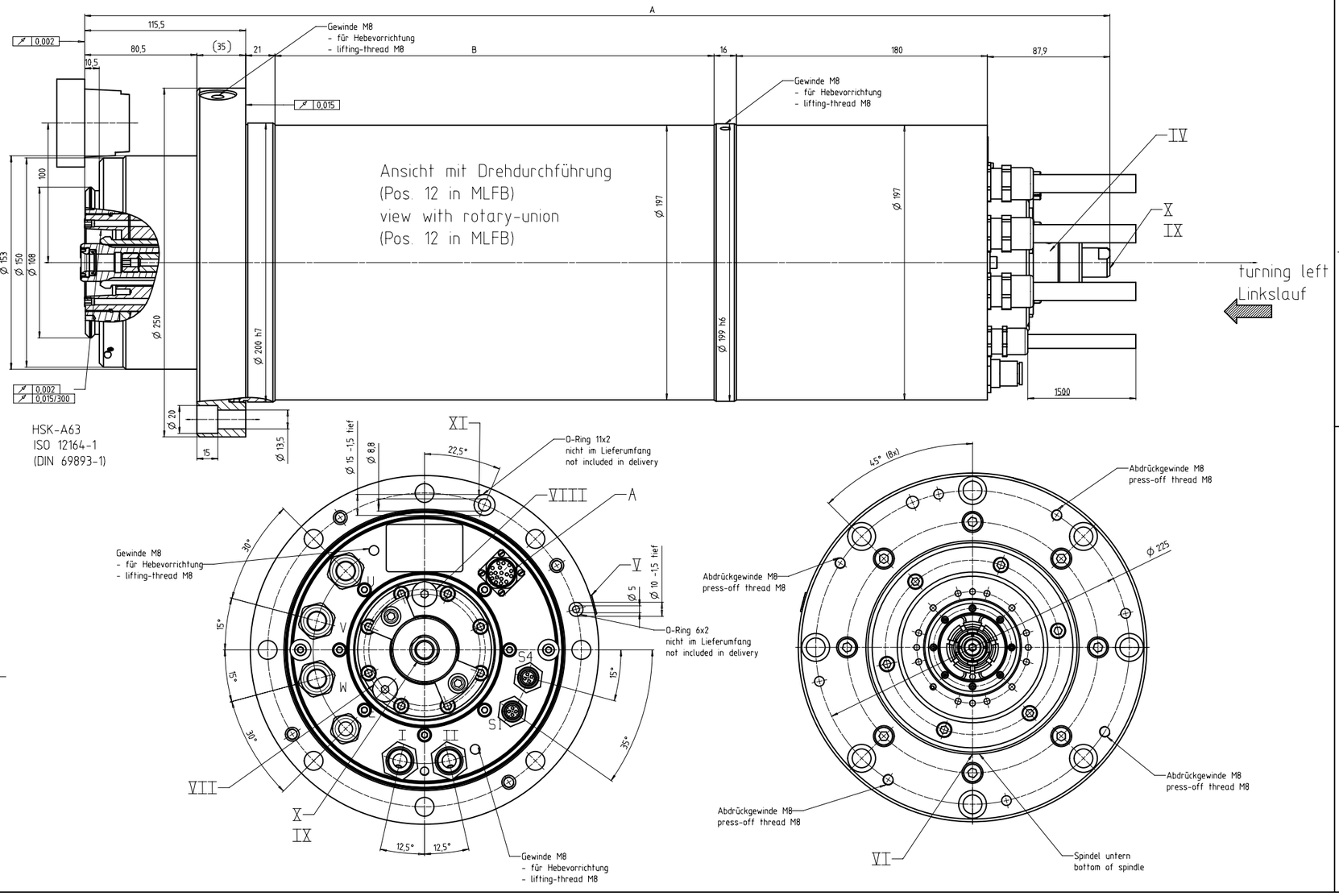

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HITACHI-ZAHNRÄD-STRASSE 55
97424 SCHWEINFURT


Maßstab: 1/1 A0 Gewicht: kg
Werkstoff:
Rohteil: Modell:
Bemerkung, Zusatzinformation:

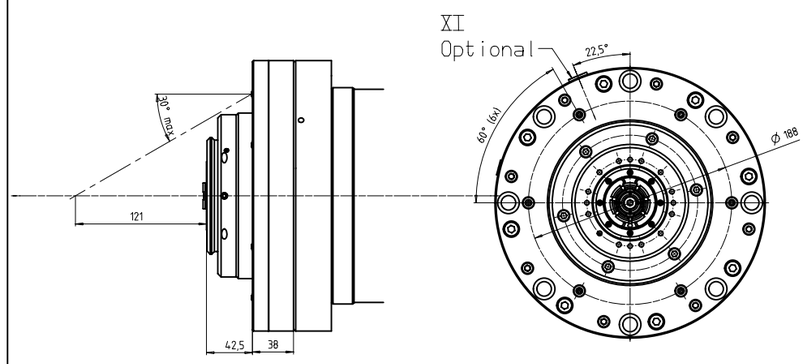
ECS Maßblatt

Sachnummer: ECS_Maßblatt
Blatt von 1
Ers.f: Ers.d:

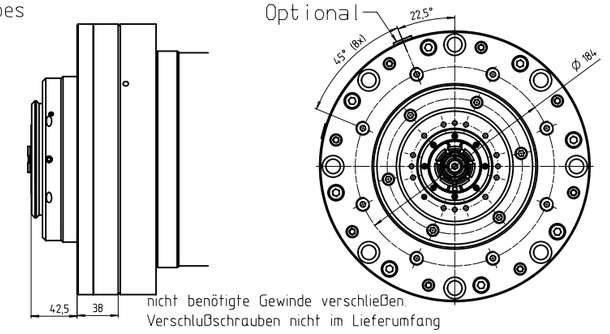

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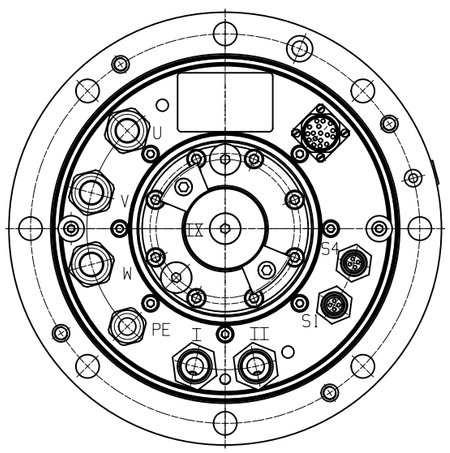

Ansicht mit Ring für externes
Kühlschmiermittel (OPTION, Pos. 12 in MLFB)
Verwendung von Spritzdüsen
view with ring for external
coolant (OPTION, POS. 12 in MLFB)

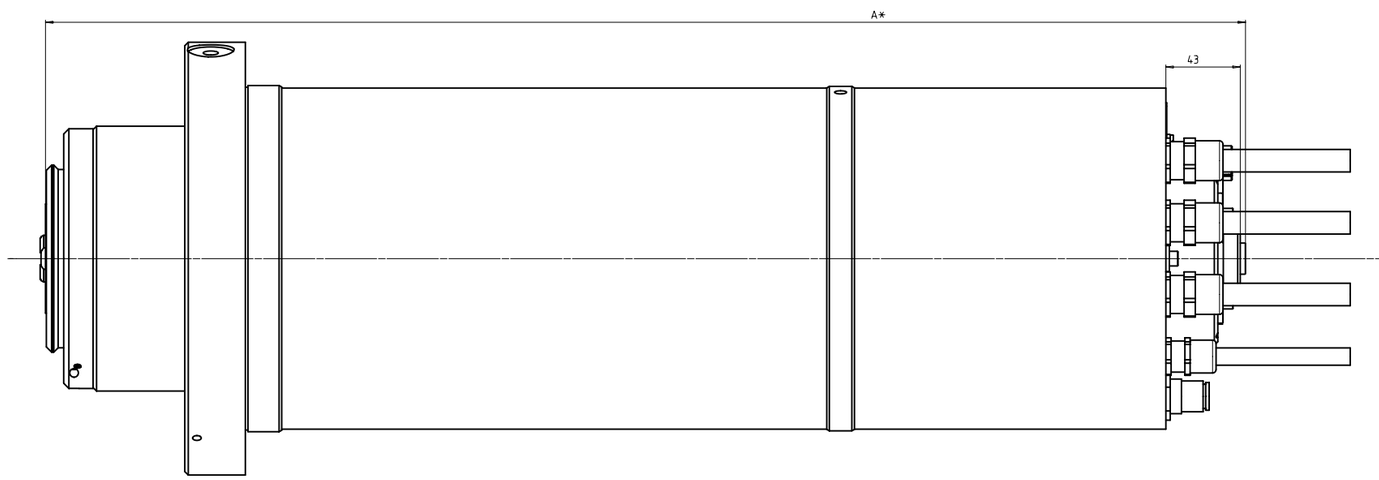



Ansicht mit Ring für externes
Kühlschmiermittel (OPTION, Pos. 12 in MLFB)
mit Gewinde G1/4 für Verwendung von
Gelenkschläuchen
view with ring for external
coolant (OPTION, POS. 12 in MLFB)
with G1/4 connection for use of flexible
spry nozzle tubes




nicht benötigte Gewinde verschließen.
Verschlußschrauben nicht im Lieferumfang
unused connection openings to be closed by screw plugs
screw plugs are not included in delivery




| | 2SP1 202-1HA1. | 2SP1 202-1HB1. | 2SP1 204-1HA1. | 2SP1 204-1HB1. |
|---|---|---|---|---|
| tool interface | HSK-A63 | HSK-A63 | HSK-A63 | HSK-A63 |
| speed | 15000 min-1 | 18000 min-1 | 15000 min-1 | 18000 min-1 |
| motor type | 1FE1082 | 1FE1082 | 1FE1084 | 1FE1084 |
| A | 636 | 636 | 736 | 736 |
| A* | 593 | 593 | 693 | 693 |
| B | 215 | 215 | 315 | 315 |

Hydraulik / hydraulik

Ansicht ohne Drehdurchführung
( OPTION, Pos. 12 in MLFB)
view without rotary-union
( OPTION, Pos. 12 in MLFB)

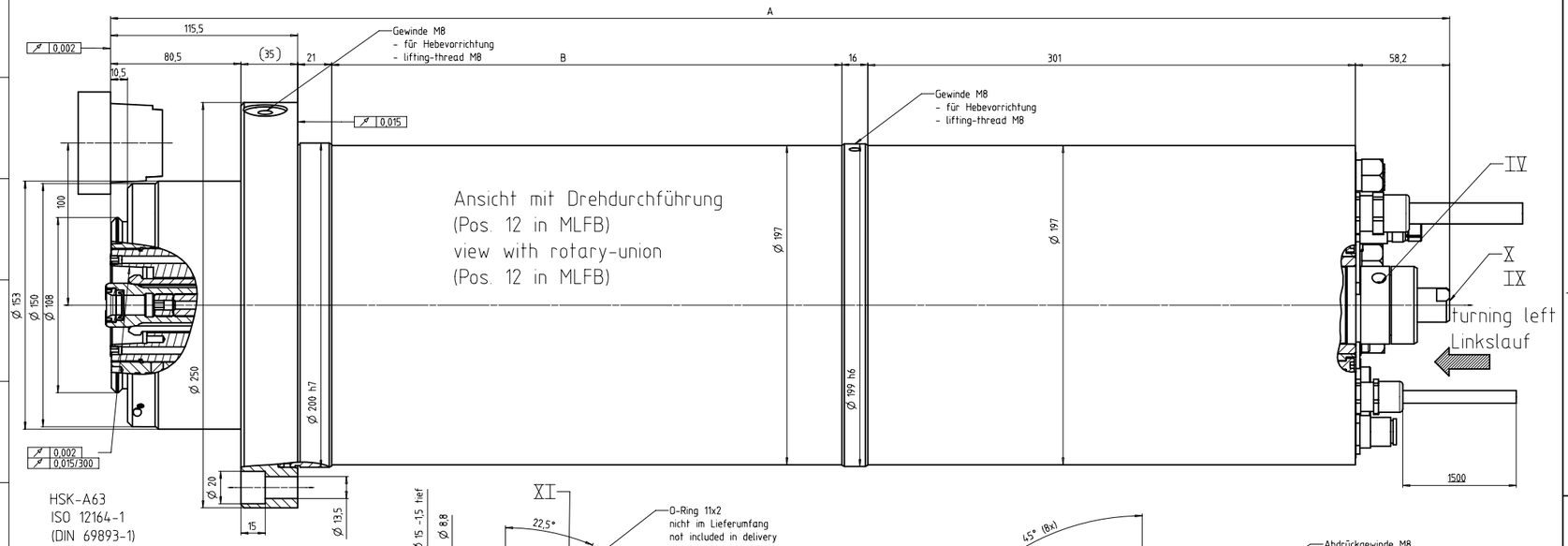
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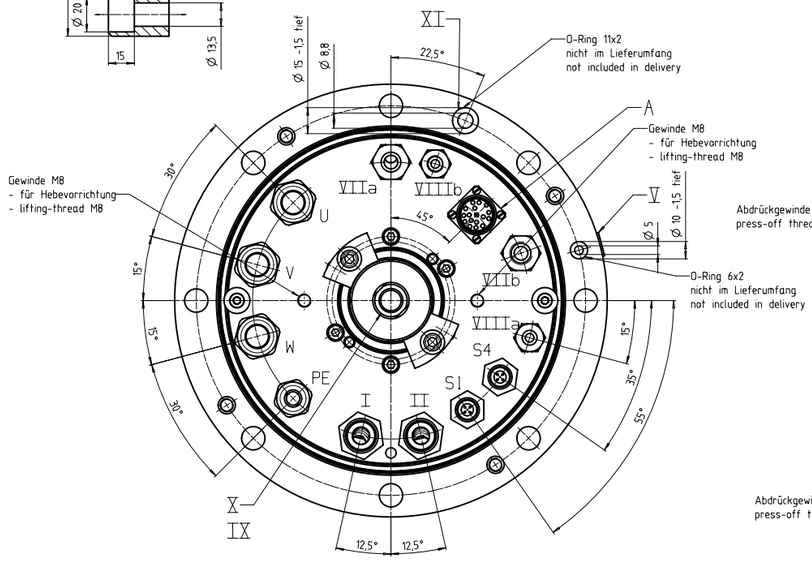
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SPINDELTECHNOLOGIE GMBH
A SIEMENS COMPANY
RUDOLF-DIESEL-STRASSE 25
97424 SCHWEINFURT

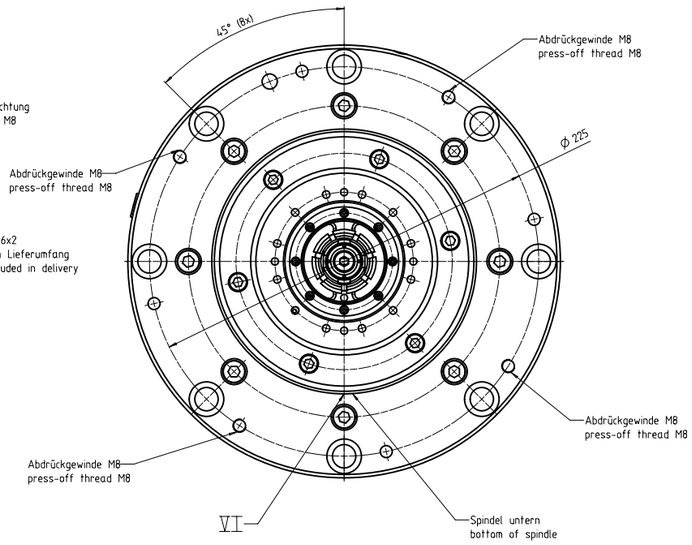
Maßblatt ECS-M
HSK A63
Hydraulische Löseeinheit

ECS_M_MASSBLATT_HYD

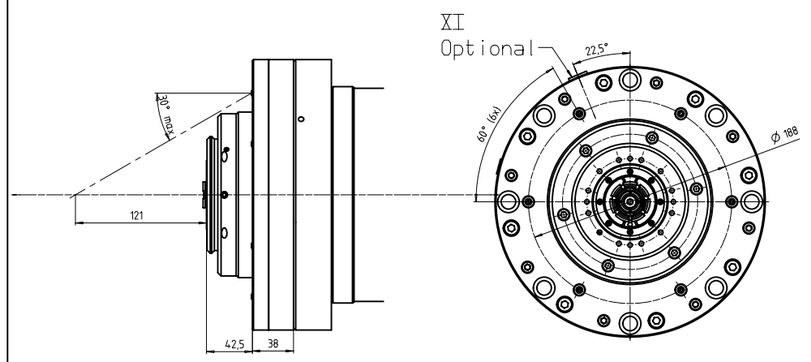
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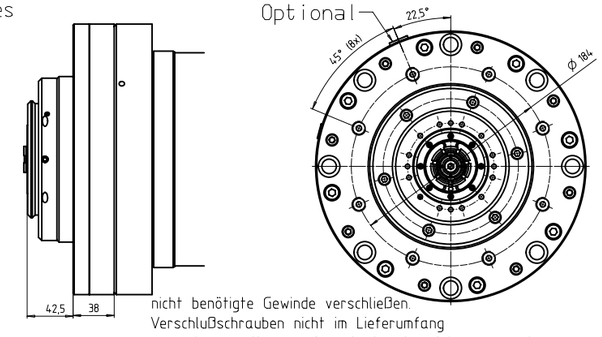



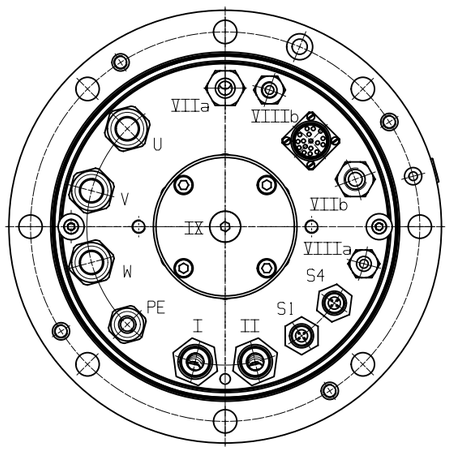

Ansicht mit Ring für externes
Kühlschmiermittel (OPTION, Pos. 12 in MLFB)
Verwendung von Spritzdüsen
view with ring for external
coolant (OPTION, POS. 12 in MLFB)

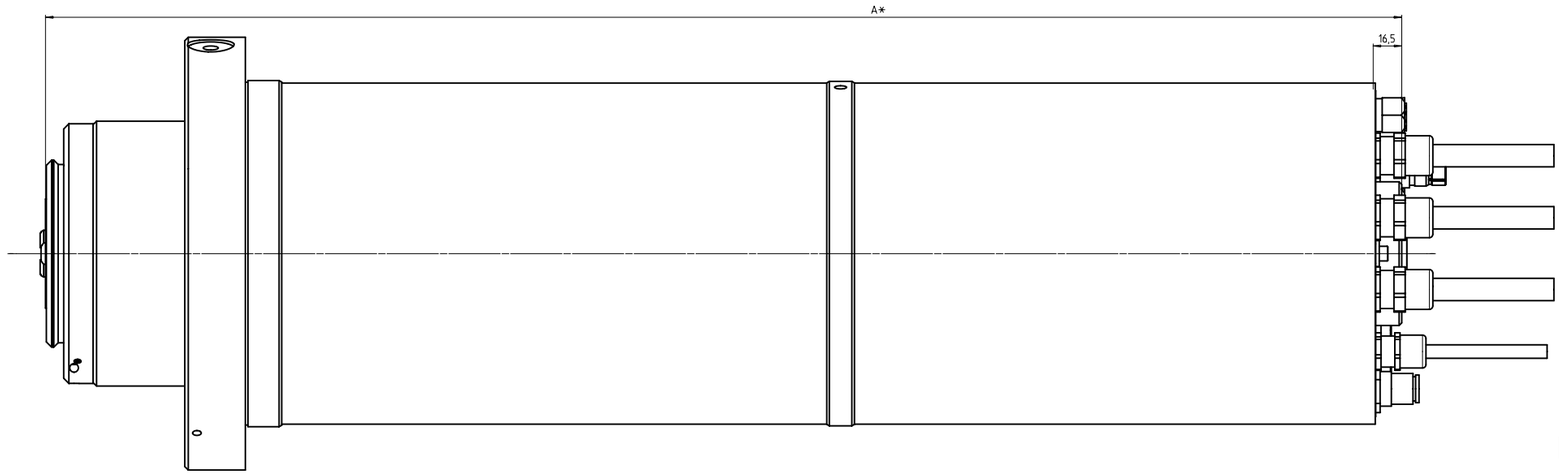



Ansicht mit Ring für externes
Kühlschmiermittel (OPTION, Pos. 12 in MLFB)
mit Gewinde G1/4 für Verwendung von
Gelenkschläuchen
view with ring for external
coolant (OPTION, POS. 12 in MLFB)
with G1/4 connection for use of flexible
spry nozzle tubes




nicht benötigte Gewinde verschließen.
Verschlußschrauben nicht im Lieferumfang
unused connection openings to be closed by screw plugs
screw plugs are not included in delivery




| | 2SP1 202-1HA0 | 2SP1 202-1HB0 | 2SP1 204-1HA0 | 2SP1 204-1HB0 |
|---|---|---|---|---|
| tool interface | HSK-A63 | HSK-A63 | HSK-A63 | HSK-A63 |
| speed | 15000 min-1 | 18000 min-1 | 15000 min-1 | 18000 min-1 |
| motor type | 1FE1082 | 1FE1082 | 1FE1084 | 1FE1084 |
| A | 727 | 727 | 827 | 827 |
| A* | 684 | 684 | 784 | 784 |
| B | 215 | 215 | 315 | 315 |

pneumatik / pneumatic

Ansicht ohne Drehdurchführung
( OPTION, Pos. 12 in MLFB)
view without rotary-union
( OPTION, Pos. 12 in MLFB)


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Schweinfurt



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A SIEMENS COMPANY
GEORG-SCHÄFER-STRASSE 55
97424 SCHWEINFURT


Bearb. 05.03.04 Schneider
Gepr.
Norm

Maßblatt ECS-M
HSK A63
Pneumatische Löseeinheit

Schriftfeld: ECS_M_MASSBLATT_PNEU


User: MS1319 Part: ECS_M_Massblatt_pneu_s.spec Date: 05-Mar-04 Time: 14:54 Message:

| **Drive converter setting data SIMODRIVE 611U/D**<br>Phase-to-phase voltages, otherwise phase values | | | | 2SP1204-1HB__-2DF2 | 2SP1204-1HA__-1DF2 | 2SP1202-1HB__-2DF2 | 2SP1202-1HA__-1DF2 |
|---|---|---|---|---|---|---|---|
| Encoder pulse number, motor measuring system | | Inc/rev | MD 1005 | 256 | 256 | 256 | 256 |
| Activate PD MSD | | | MD 1015 | 1 | 1 | 1 | 1 |
| Current - rotor position identification | | % | MD 1019 | 25 | 25 | 25 | 25 |
| PWM frequency | $f_{PWM}$ | Hz | MD 1100 | 4000 | 3200 | 4000 | 3200 |
| Rated motor current | $I_N$ | A | MD 1103 | 79.0 | 60.0 | 42.0 | 30.0 |
| Max. motor current | $I_{max}$ | A | MD 1104 | 160.0 | 120.0 | 84.0 | 60.0 |
| Pole pair number | | | MD 1112 | 2 | 2 | 2 | 2 |
| Torque constant | $k_t$ | Nm/A | MD 1113 | 0.92 | 1.27 | 0.9 | 1.25 |
| Voltage constant | $k_e$ | V/1000*RPM | MD 1114 | 70 | 97 | 74 | 98 |
| Armature resistance | $R_a$ | Ohm | MD 1115 | 0.085 | 0.165 | 0.255 | 0.46 |
| In-axis inductance | $L_d$ | mH | | 3.00 | 5.80 | 7.00 | 11.60 |
| Armature inductance | $L_q$ | mH | MD 1116 | 3.40 | 6.40 | 7.20 | 12.50 |
| Motor moment of inertia | $J_m$ | kgm² | MD 1117 | 0.023 | 0.023 | 0.015 | 0.015 |
| Motor standstill current | $I_O$ | A | MD 1118 | 79.0 | 60.0 | 42.0 | 30.0 |
| Motor limiting current | $I_{Grenz}$ | A | MD 1122 | 160.0 | 120.0 | 84.0 | 60.0 |
| Optimum load angle | $\alpha_{opt}$ | ° | MD 1128 | 105 | 105 | 105 | 105 |
| Motor short-circuit current | $I_k$ | A | MD 1136 | 64.0 | 46.0 | 29.0 | 23.0 |
| Speed at the start of field weakening | $n_{fs}$ | RPM | MD 1142 | 6,100 | 4,400 | 5,700 | 4,300 |
| Stall torque reduction factor | $k_{red}$ | % | MD 1145 | 80 | 80 | 75 | 75 |
| Max. motor speed | $n_{max}$ | RPM | MD 1146 | 18,000 | 15,000 | 18,000 | 15,000 |
| Reluctance torque factor | $k_{Trelu}$ | mH | MD 1149 | 0.7 | 1.2 | 6.3 | 4.2 |
| Current controller adaptation, lower limit | | % | MD 1180 | 0 | 0 | 0 | 0 |
| Current controller adaptation, upper limit | | % | MD 1181 | 20 | 20 | 20 | 20 |
| Current controller adaptation, reduction factor | | % | MD 1182 | 15 | 15 | 15 | 15 |
| Current controller adaptation, ON | | | MD 1183 | 1 | 1 | 1 | 1 |
| Rated motor speed | $n_n$ | RPM | MD 1400 | 4,300 | 3,000 | 3,500 | 2,700 |
| Motor temperature alarm threshold | | °C | MD 1602 | 150 | 150 | 150 | 150 |
| Shutdown limit, motor temperature | | °C | MD 1607 | 160 | 160 | 160 | 160 |
| Rated motor torque | $M_N$ | Nm | | 78 | 84 | 42 | 42 |
| Rated motor power | $P_N$ | kW | | 35.0 | 26.4 | 15.5 | 12.0 |

| **Drive converter setting data SIMODRIVE 611U/D**<br>Phase-to-phase voltages, otherwise phase values | | | | 2SP1255-1HB__-1__2 | | 2SP1255-1HA__-0__2 | | 2SP1253-1HB__-1__2 | | 2SP1253-1HA__-0__2 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Standard | Reduced | Standard | Reduced | Standard | Reduced | Standard | Reduced |
| Encoder pulse number, motor measuring system | | Inc/rev | MD 1005 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| Activate PD MSD | | | MD 1015 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Current - rotor position identification | | % | MD 1019 | 20 | 20 | 15 | 20 | 15 | 20 | 15 | 20 |
| PWM frequency | $f_{PWM}$ | Hz | MD 1100 | 3200 | 3200 | 3200 | 3200 | 3200 | 3200 | 3200 | 3200 |
| Rated motor current | $I_N$ | A | MD 1103 | 120.0 | 102.0 | 95.0 | 85.0 | 68.0 | 60.0 | 53.0 | 45.0 |
| Max. motor current | $I_{max}$ | A | MD 1104 | 240.0 | 240.0 | 190.0 | 170.0 | 136.0 | 120.0 | 106.0 | 90.0 |
| Pole pair number | | | MD 1112 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Torque constant | $k_t$ | Nm/A | MD 1113 | 1.34 | 1.34 | 1.55 | 1.7 | 1.24 | 1.36 | 1.62 | 1.77 |
| Voltage constant | $k_e$ | V/1000*RPM | MD 1114 | 94 | 94 | 116 | 116 | 93 | 93 | 121 | 121 |
| Armature resistance | $R_a$ | Ohm | MD 1115 | 0.065 | 0.065 | 0.1 | 0.1 | 0.13 | 0.13 | 0.23 | 0.23 |
| In-axis inductance | $L_d$ | mH | | 2.62 | 2.62 | 4.10 | 4.10 | 4.40 | 4.40 | 7.40 | 7.40 |
| Armature inductance | $L_q$ | mH | MD 1116 | 2.62 | 2.62 | 4.70 | 4.10 | 4.90 | 4.40 | 8.40 | 7.40 |
| Motor moment of inertia | $J_m$ | kgm² | MD 1117 | 0.055 | 0.055 | 0.055 | 0.055 | 0.037 | 0.037 | 0.037 | 0.037 |
| Motor standstill current | $I_O$ | A | MD 1118 | 120.0 | 102.0 | 95.0 | 85.0 | 68.0 | 60.0 | 53.0 | 45.0 |
| Motor limiting current | $I_{Grenz}$ | A | MD 1122 | 240.0 | 240.0 | 190.0 | 170.0 | 136.0 | 120.0 | 106.0 | 90.0 |
| Optimum load angle | $\alpha_{opt}$ | ° | MD 1128 | 105 | 105 | 110 | 105 | 110 | 105 | 110 | 105 |
| Motor short-circuit current | $I_k$ | A | MD 1136 | 97.0 | 97.0 | 78.0 | 78.0 | 58.0 | 58.0 | 45.0 | 45.0 |
| Speed at the start of field weakening | $n_{fs}$ | RPM | MD 1142 | 4,600 | 4,600 | 3,600 | 3,600 | 4,500 | 4,500 | 3,500 | 3,500 |
| Stall torque reduction factor | $k_{red}$ | % | MD 1145 | 70 | 70 | 80 | 70 | 80 | 70 | 80 | 70 |
| Max. motor speed | $n_{max}$ | RPM | MD 1146 | 15,000 | 15,000 | 10,000 | 10,000 | 15,000 | 15,000 | 10,000 | 10,000 |
| Reluctance torque factor | $k_{Trelu}$ | mH | MD 1149 | 2.5 | 2.5 | 4.8 | 3.9 | 5.2 | 4.2 | 8.7 | 7.1 |
| Current controller adaptation, lower limit | | % | MD 1180 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Current controller adaptation, upper limit | | % | MD 1181 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Current controller adaptation, reduction factor | | % | MD 1182 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Current controller adaptation, ON | | | MD 1183 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Rated motor speed | $n_n$ | RPM | MD 1400 | 3,000 | 3,000 | 2,600 | 2,560 | 3,300 | 3,600 | 2,500 | 2,700 |
| Motor temperature alarm threshold | | °C | MD 1602 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| Shutdown limit, motor temperature | | °C | MD 1607 | 160 | 160 | 160 | 160 | 160 | 160 | 160 | 160 |
| Rated motor torque<br>Rated motor power | $M_N$<br>$P_N$ | Nm<br>kW | | 170<br>53.4 | 150<br>47.0 | 170<br>46.3 | 150<br>40.0 | 100<br>35.0 | 80<br>30.0 | 100<br>26.0 | 80<br>22.5 |

| **Drive converter setting data SIMODRIVE 611U/D**<br>Phase-to-phase voltages, otherwise phase values | | | Star (Y) | Delta (D) | 2SP1255-8HA__-1__2 | | 2SP1255-8HA__-0__2 | | 2SP1253-8HA__-1__2 | | 2SP1253-8HA__-0__2 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Y | D | Y | D | Y | D | Y | D |
| Encoder pulse number, motor measuring system | | Inc/rev | MD 1005 | MD 2005 | 256 | 256 | 256 | 256 | 256 | 256 | 256 | 256 |
| Rated power | $P_N$ | kW | MD 1130 | MD 2130 | 11.7 | 11.7 | 11.7 | 11.7 | 13.20 | 13.20 | 13.20 | 13.20 |
| Rated current | $I_N$ | A | MD 1103 | MD 2103 | 28.8 | 27.5 | 28.8 | 27.5 | 27.0 | 27.5 | 27.0 | 27.5 |
| Rated voltage | $V_N$ | V | MD 1132 | MD 2132 | 360 | 370 | 360 | 370 | 400 | 400 | 400 | 400 |
| Rated speed | $n_N$ | RPM | MD 1400 | MD 2400 | 800 | 1,800 | 800 | 1,800 | 1,800 | 4,000 | 1,800 | 4,000 |
| Rated frequency | $f_N$ | Hz | MD 1134 | MD 2134 | 29.3 | 61.6 | 29.3 | 61.6 | 64.4 | 136.0 | 64.4 | 136.0 |
| No-load voltage at rated flux | Vo | V | MD 1135 | MD 2135 | 320 | 350 | 320 | 350 | 368 | 380 | 368 | 380 |
| No-load current | Io | A | MD 1136 | MD 2136 | 13.4 | 15.6 | 13.4 | 15.6 | 10.8 | 14.2 | 10.8 | 14.2 |
| Stator resistance (20°C) | $R_{1K}$ | Ohm | MD 1137 | MD 2137 | 0.537 | 0.179 | 0.537 | 0.179 | 0.361 | 0.120 | 0.361 | 0.120 |
| Rotor resistance (20°C) | $R_{2K}$ | Ohm | MD 1138 | MD 2138 | 0.471 | 0.157 | 0.471 | 0.157 | 0.384 | 0.128 | 0.384 | 0.128 |
| Stator leakage resistance | $X_{1leakage}$ | Ohm | MD 1139 | MD 2139 | 0.701 | 0.593 | 0.701 | 0.593 | 0.891 | 0.752 | 0.891 | 0.752 |
| Rotor leakage reactance | $X_{2leakage}$ | Ohm | MD 1140 | MD 2140 | 0.673 | 0.526 | 0.673 | 0.526 | 0.715 | 0.570 | 0.715 | 0.570 |
| Magnetizing reactance, rated operation | $X_{1H}$ | Ohm | MD 1141 | MD 2141 | 13.8 | 12.9 | 13.8 | 12.9 | 20.5 | 15.7 | 20.5 | 15.7 |
| Speed at the start of field weakening | nfe | RPM | MD 1142 | MD 2142 | 970 | 1,980 | 970 | 1,980 | 1,800 | 4,000 | 1,800 | 4,000 |
| Upper speed, Lh characteristic | | RPM | MD 1143 | MD 2143 | 1,600 | 2,600 | 1,600 | 2,600 | 2,700 | 4,900 | 2,700 | 4,900 |
| Gain factor, Lh characteristic | | % | MD 1144 | MD 2144 | 147 | 117 | 147 | 117 | 148 | 112 | 148 | 112 |
| Maximum speed | $n_{max}$ | RPM | MD 1146 | MD 2146 | 15,000 | 15,000 | 10,000 | 10,000 | 15,000 | 15,000 | 10,000 | 10,000 |
| Number of poles | 2*p | | | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Motor moment of inertia | Jo | kgm² | MD 1117 | MD 2117 | 0.055 | 0.055 | 0.055 | 0.055 | 0.037 | 0.037 | 0.037 | 0.037 |
| Motor temperature alarm threshold | | °C | MD 1602 | MD 2602 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| Power factor | cosφ | | | | 0.830 | 0.760 | 0.830 | 0.760 | 0.840 | 0.790 | 0.840 | 0.790 |
| Rated torque | $M_N$ | Nm | | | 140 | 62.1 | 140 | 62.1 | 70 | 31.5 | 70 | 31.5 |
| Stall torque reduction factor | $M_{stall, red}$ | . | MD 1145 | MD 2145 | 80 | 80 | 80 | 80 | 100 | 100 | 100 | 100 |