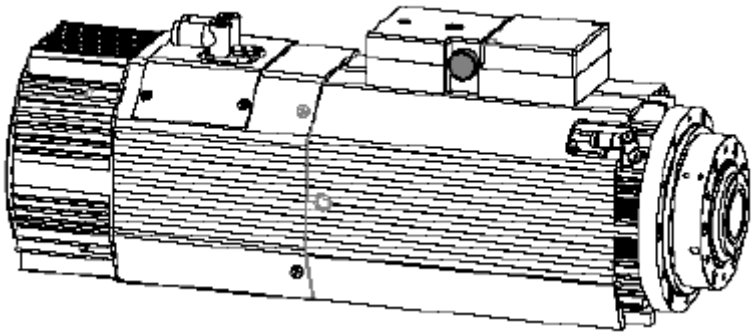
FSE/FSD Series ATC



Instruction Manual

C C M O T O R
TEL/FAX：0535-3205189/3205186
http://www.ccmotor.com

1 PREFACE

First of all, thank you for your support of our products.

The automatic tool changing motor is one of the products of our company according to the market demand. It has the characteristics of small size, compact structure, high speed, and high power, easy to use and so on.

The purpose of this manual is to instruct the motor transportation, installation, debugging, maintenance. The instructions provide tips on the proper behavior for the correct use of the product, as intended by the manufacturer. The manual must be handled with care, distributed and made available to all persons concerned.

In order to avoid incorrect operations that could cause danger for people, it is important to read and understand all the documentation supplied with the electrospindle.

2 IMPORTANT STATEMENT

CCMOTOR accepts no liability for faults in the conformity of the electrospindle caused by a failure to observe the standards of the instruction manual or the incorrect operation or handling of the electrospindle. The buyer shall therefore have a right to replacement of parts found to be defective only if the faults have not been caused by tampering, namely by installing non-original CCMOTOR spare parts and/or replacing components not provided for and not authorized in this manual and, in any case, without the prior written approval of CCMOTOR.

CCMOTOR guarantees that the electrospindle has been inspected at its plant with a positive result. The warranty does not cover faults due to normal wear of those parts which, by their nature, are subject to rapid and continuous wear (e.g. gaskets, belts, bearings, etc.). In particular, CCMOTOR gives no guarantee as to the working life of the bearings, as this depends on various factors including: the degree of balancing of the tools, the types of machining operation, collisions and/or mechanical stresses beyond the values indicated by the manufacturer.

On no account shall CCMOTOR or its suppliers be responsible for damage (including but not limited to damage to the physical integrity of the product or damages due to loss or reduced earnings, stoppages in production, loss of information or other economic losses) resulting from the use of CCMOTOR products, even in cases where CCMOTOR has been warned of the possibility of such damage.

Measured drawings and photographs are provided purely as reference examples for a simpler understanding of the text.

In line with its policy of continuous development and advancement of the product, CCMOTOR reserves the right to modify both its functional and aesthetic characteristics, to vary the design of any functional element or accessory, or to suspend production and delivery; this without undertaking to give notice to anyone and without incurring any other obligation. Furthermore, CCMOTOR reserves the right to make any structural or functional modifications, as well as the modification of the supplied spare parts and accessories, without the obligation of communicating these changes to anyone or assuming any other obligation.

3 WARNINGS AND SAFETY PRECAUTIONS

3.1 THE PURPOSE OF THIS MANUAL

This manual contains important instructions and preventive measures, so the operating safety of the spindle is very important, must be supplied with the electrospindle. The manual is an integral part of the electrospindle and must compulsorily accompany it, otherwise the electrospindle would be without one of its essential safety requirements.

Please keep this manual, and to ensure that all personnel associated with the electrospindle are known to the manual, and are able to obtain this manual.

The safety precautions in this specification are intended to ensure that all personnel are protected against the potential risks of electrical spindles.

The instructions in this manual provides the necessary information relevant to the correct operation of the electrospindle.

If you find that the information provided in this specification is inconsistent with applicable safety regulations, please contact the Company and ask for necessary corrections or modifications.

Ensure that you have read and fully understand all the files supplied with electrospindle, in order to avoid incorrect operation and unnecessary injury. To save this manual in a place close to the machine so that the operator can access at any time.

Important note: this manual provides the basic information to ensure the safety and proper installation and use of the electrical spindle.

3.2 GENERAL SAFETY SYMBOLS

In this specification, important instructions or warnings will be marked as follows:

Warning：Indicate a procedure, practice or any other similar mearsure that, if not observed or correctly followed, may cause personal injuries.

Warning: mobile electrical components

Important prompt: indicate the especially important formation

3.3 THE RISK OF ELECTROSPINDLE

CCMOTOR does not know, and cannot know, the conditions of installation of the product, so the installer or end user must carry out an analysis of the risks, relating specifically to the method and typology of installation.

The installer and the operator must also be aware of the risks associated with other types of risk, especially with foreign bodies, explosions, flammable substances, toxic substances or high temperature gases.

Risks associated with maintenance operations must also be prevented. Maintenance must be carried out when electospindle is completely stationary and shut off.

3.4 THE RISK OF INCORRECT USE AND OPERATION

- It is absolutely forbidden to disconnect, remove, modify or in any other way deactivate any safety, protection or monitoring device, both relating to individual devices and to the electrospindle as a whole.
- Do not place your hands, arms or any other parts of the body in the vicinity of moving parts.
- The use of the electrospindle in atmospheres or environments with the risk of explosion is forbidden.
- It is forbidden for an unauthorized operator to eliminate possible defects or faults in the functioning of the electrospindle and/or to change the type of operation and installation.
- After carrying out any special operations involving the removal of guards, barriers or other protective devices, install these again before restarting the electrospindle and check that they are correctly positioned and functioning efficiently.
- All the protective and safety devices must be maintained in a perfect and efficient condition at all times. The plates with indications, recommendations and danger warnings must be kept in place and fully efficient.
- When looking for the cause of any fault or malfunction of the electrospindle, take all the precautions described in the manual in order to avoid personal injury or damage to equipment.
- Remember to tighten all screws, bolts or ring nuts of all mechanical control or adjustment elements.
- Before starting up the electrospindle, ensure that all the safety devices are installed and in proper functional order; if this is not the case, it is absolutely forbidden to start it up, and the person responsible for internal safety or the section head must be informed immediately.
- The operator must be equipped with Personal Protective Equipment (PPE) in accordance with the provisions of the laws in force; wearing loose clothes and various accessories (ties, wide sleeves, etc.) is forbidden.
- It is absolutely forbidden to use types of tool holder that do not correspond to the models defined in the manual; this would cause the risk of breakage or imperfect hook-up of the tool holder cone.

3.5 SPECIFIC RISKS DURING ELECTROSPINDLE MAINTENANCE

Disconnect the product from the main power supply before carrying out any maintenance operations!

Even when the product is disconnected from the power supply, the rotating parts (and moving parts in general) can nevertheless move, due to their inertia; before carrying out maintenance operations therefore, check that the moving parts of the product are at a standstill.

Warning: do not:

Start any maintenance work before the cutting tool in the electrospindle is completely stationary.

No maintenance work has been started before the electrospindle is disconnected from the main power supply.

Try to clean it when the electrospindle is running.

4 GENERAL INFORMATION

4.1 CORRECT USAGE OF ELECTROSPINDLE

Electrospindle is used as a component of a machine.

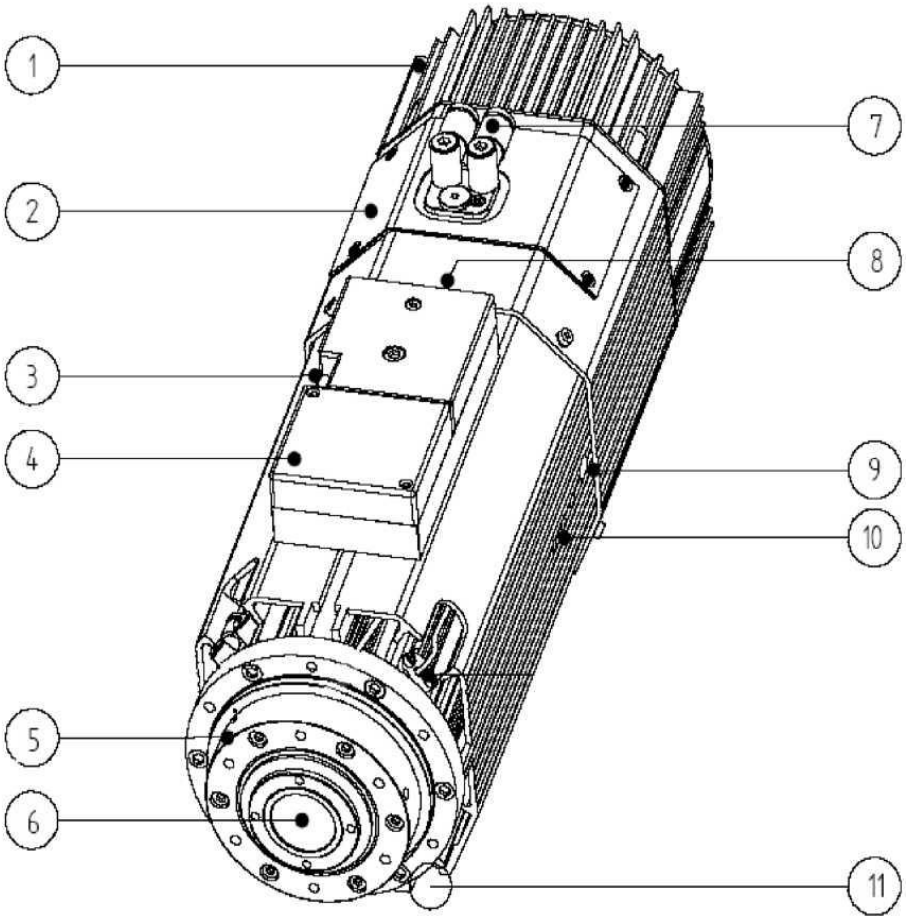
The machine structure must be stable and rigid enough to support the weight of the electrospindle and can withstand subsequent processing operations.

The electrospindle described in this manual is designed to be used for drilling wood, plastics, aluminum and fiber boards，and light machining operations on other metals

These electrical spindles are designed to be used for the duty type of the S. In the seventh section, the different technical specifications will be introduced in detail.

In order to avoid damage to the precision bearing, the electrospindle is installed with a mechanical reaction system, which can offset the axial force exerted by the piston in the tool changing process.

4.2 MAIN PARTS OF THE ELECTROSPINDLE

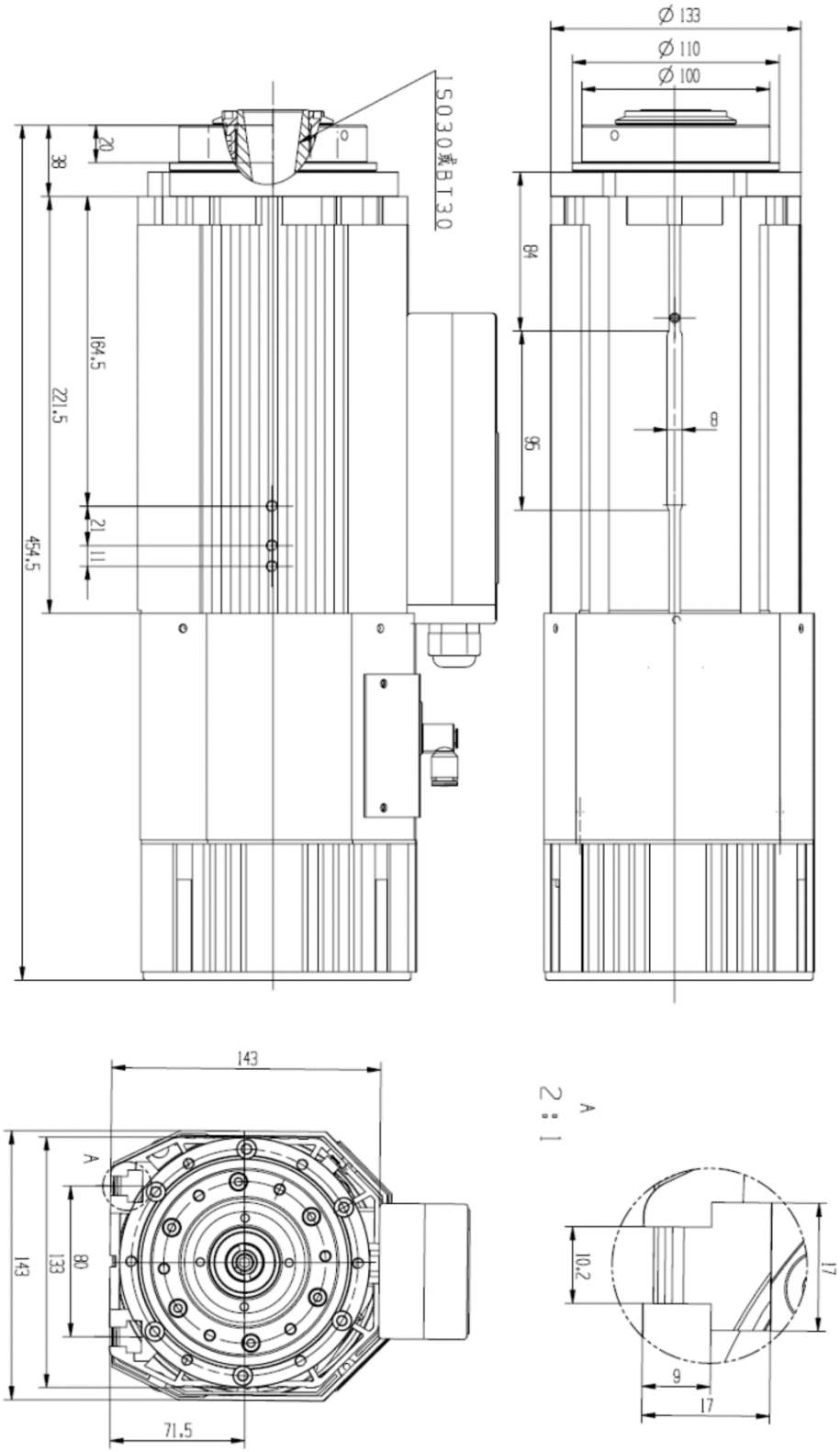


1	Cooling fan	7	Pneumatic connectors
2	Sensor chamber	8	Electric terminal
3	Manual tool holder unlock key	9	Exhaust silencer (one on each side)
4	Electrical box	10	Thread maintenance hole
5	Nose	11	"T" slot for installation
6	Tool hooking system		

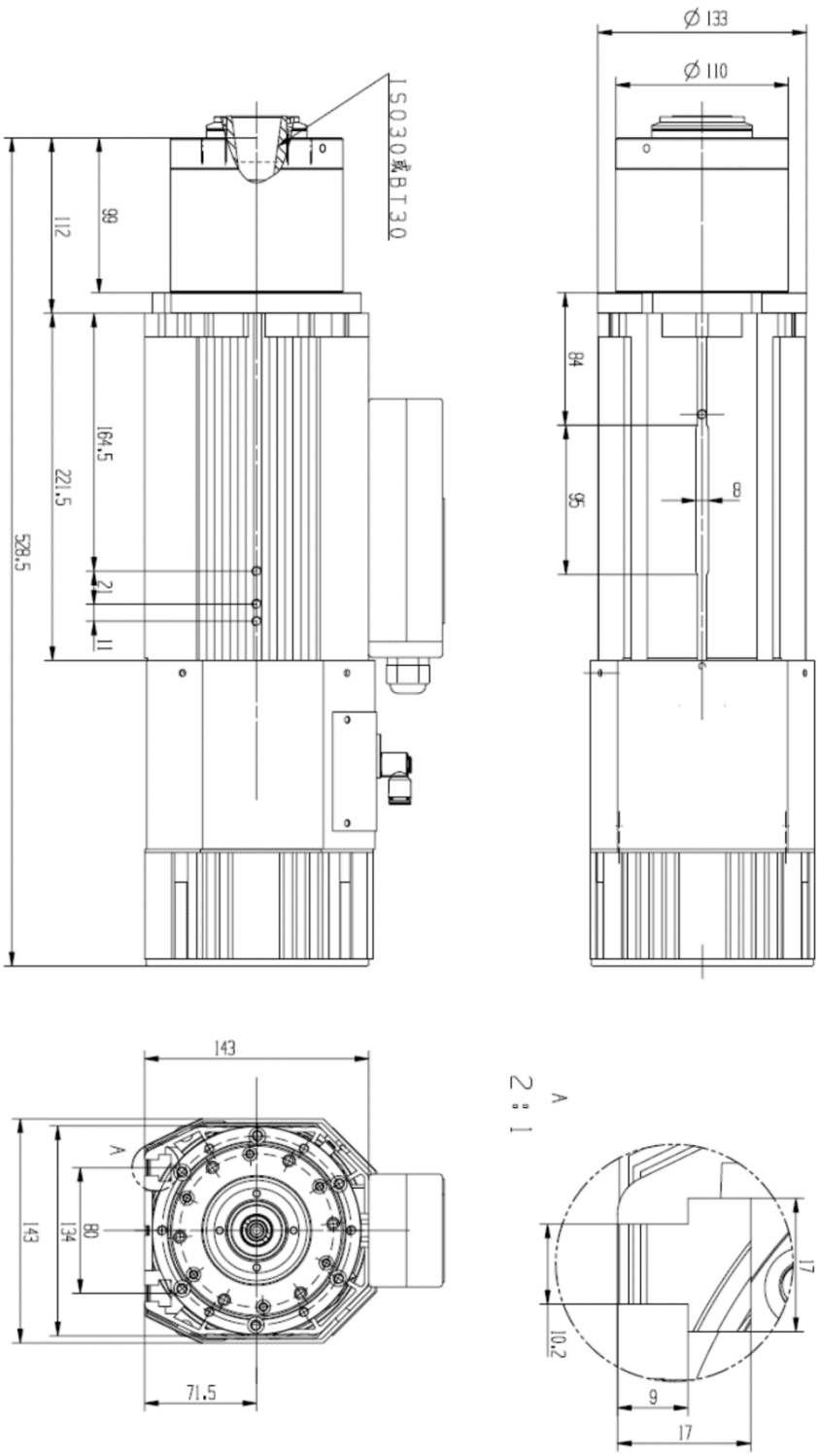
5 TECHNICAL SPECIFICATIONS

5.1 OUTLINE DRAWING

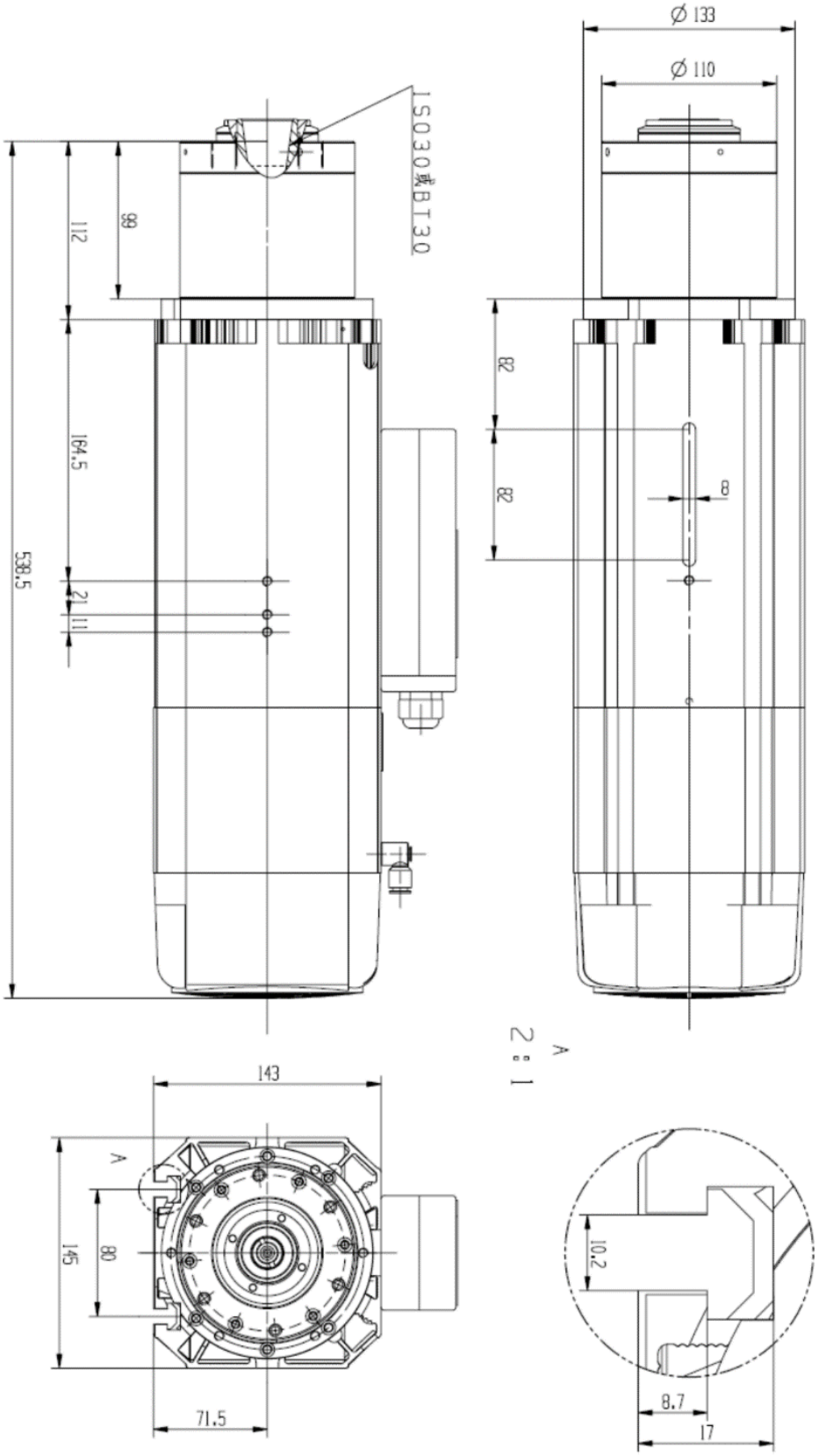
The installation size of the FSE SI-7.5KW short nose



The installation size of the FSE SI-7.5KW long nose



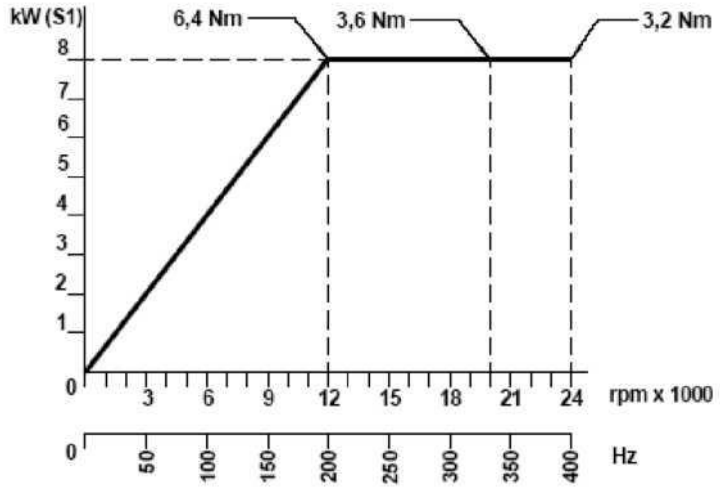
The installation size of the FSD SI-7.5KW long nose



5.2 PERFORMANCE PARAMETER

Terminal connection type	Star	Triangle
Rated voltage(*)	380 v ±10%	220 v ±10%
Rated current	18A	32A
Rated speed	12000 rpm (400Hz)	
Rated power	S1 7.5KW/S6 9KW	
Duty type	S1/S6	
Rated torque	6.4Nm	
Rated efficiency	0.8	
The power factor.	0.8	
Pole	4	
Insulation grade	H	
Cooling mode	Cooling fan	
weight	~26Kg	

(*) from the inverter



Check whether the power terminal is properly connected before installing the electrospindle.

5.3 TECHNICAL SPECIFICATIONS OF PARTS

5.3.1 BEARING

The electrospindle uses a pair of radial angular contact ball bearings on front, the bearing diameter is 40mm.

Bearings have been permanently lubricated and require no the addition of lubricants.

5.3.2 TOOL HOLDER LOCKING AND RELEASING DEVICE

The tool-holder is mechanically blocked with elastic springs. The axial force for tool holder is 3500N + 10%.

The blocking and expulsion of the tool-holder is carried out by the single-acting movement of a pneumatic piston, activated with compressed air. The pneumatic piston works under the pressure of 7bar (100PSI).

The axial force exerted on the tool-holder by the blocking system is guaranteed constant for a minimum duration of 2,000,000 cycles of tool change
One time of tool cycle = tool lock / tool release / tool lock

5.3.3 CLEANING THE TOOL-HOLDER CONE AND INTERNAL PRESSURISATION

The air jet for cleaning the cone is automatically activated during the tool change phase. This procedure protects the coupling surfaces against deposits of contaminants. The condition of the connecting surfaces and their degree of cleanliness must be checked at regular intervals

The pneumatic circuit of internal pressurisation prevents harmful particles from entering the electrospindle. The air introduced finds an outlet through the gaps of the front labyrinth in the area of the electrospindle nose. The required air pressure is 4bar.

Pressurization air must always be present, even when the electrospindle is stopped and the machine switched on. It must also be present during machine maintenance and cleaning operations, to prevent dust from getting inside.

5.3.4 PROXIMITY SWITCH

Output type: PNP; NO; voltage 10 V -30 (DC); maximum load 200mA; no load consumption; 10mA; rated sensing distance 0.8MM

5.3.5 MANUAL TOOL RELEASE BUTTON

Button characteristics:

Rated voltage (DC) 24 V; maximum current 100mA

Lamp characteristic: rated voltage (DC) 24 V; rated power 0.7W; rated current 29mA

5.3.6 THERMAL PROTECTION SWITCH

The stator is provided with a normally closed bimetallic metal switch to provide protection to the coil of the stator, and the other bimetallic switch is used for protecting the cooling fan motor.

The two switches are connected in series, and must be connected in series to the machine's safety stop system.

If the temperature is up to the level that can cause damage, these switches are automatically disconnected, and if the temperature is reduced to a general level of work, these switches will automatically connect.

Bimetallic switch characteristics:

DC power supply: Max 48 V_{DC}

AC power supply: Max 230 V_{AC}

Current: Max 1.6A

5.3.7 COOLING FAN

The electrospindle is cooled by a fan mounted at the end, and the fan should always be turned on, even if the electrospindle is not working.

If the motor of the fan is overheated, the thermal control switch of the fan in series with the main switch of the electrospindle can close the unit.

If the temperature of the fan motor is reduced to a safe operating temperature, the operation will be restarted.

Fan characteristics:

Voltage: 230 100/V_{AC}

Power: 45W (50Hz); 39W (60Hz)

Thermal control switch: Bimetallic switch

The thermal control switch for cooling fan heat can detect motor overheating. It cannot detect the fan stops working, unless this causes overheating. Therefore, please regularly check the fan.

Even if the electrospindle is not working, the cooling fan should be working at any time when the machine is running.

6 STORAGE AND TRANSPORTATION

Lifting and moving electrospindles may pose danger to the surrounding personnel. Always comply with the instructions provided, and use the correct lifting device. Only professional and technical personnel can carry out installation and assembly work.

Be careful when lifting and moving the electrospindle and its parts, avoid striking the electrospindle, which

The customer has the responsibility to ensure that the use of lifting device, cable, sling and chain can withstand the spindle weight.

can lead to failure.

6.1 STORAGE

If the electrospindle will be kept for a period of time, make sure it is not affected by the natural environment, especially moisture, dust and other forms of damage to the air or storage environment.

Regularly check the general condition of the electrospindle to avoid performance degradation. Once a month manual rotation of the electrospindle to ensure that the bearing can move freely.

Storage temperature: from -5 ℃ (23 ℉) to 55 ℃ (131 ℉)

Non condensing relative humidity: from 5% to 90%

6.2 LIFT THE ELECTROSPINDLE MOUNTED IN THE CRATE.

The electrospindle is packed in a wooden crates filled with polystyrene foam for shipment. The electrospindle is in a plastic bag and coated with protective grease to prevent abrasion. Please use a piece of clean cloth to wipe off the protective grease.

Note: the polystyrene foam and the plastic bag are all plastic and must be treated in accordance with the plastic disposal method.

Do not lift the electrospindle by pulling the cooling fan cover. This cover may break and the electrospindle will fall and harm the operator.

7 INSTALLATION

7.1 CHECK

Before carrying out any operations, CHECK:

- That no part of the electrospindle has been damaged during transport and/or handling;
- That connectors are not damaged.

7.2 PREPARATION OF THE AUXILIARY SYSTEMS OF THE PLANT

The preparatory work (e.g. providing electricity, air systems etc.) is the responsibility of the customer. The electric power lead of the electrospindle must have the necessary transmission power. The connection to the electricity mains supply must be carried out by qualified personnel. You are reminded that the customer is responsible for all the electricity supply as far as the connectors of the electrospindle.

The customer is also reminded of the need to provide all the safety conditions necessary for the “earthing” of the electrospindle.

The earthing system must conform to the standards in force in the country of installation and must be inspected at regular intervals by qualified personnel.

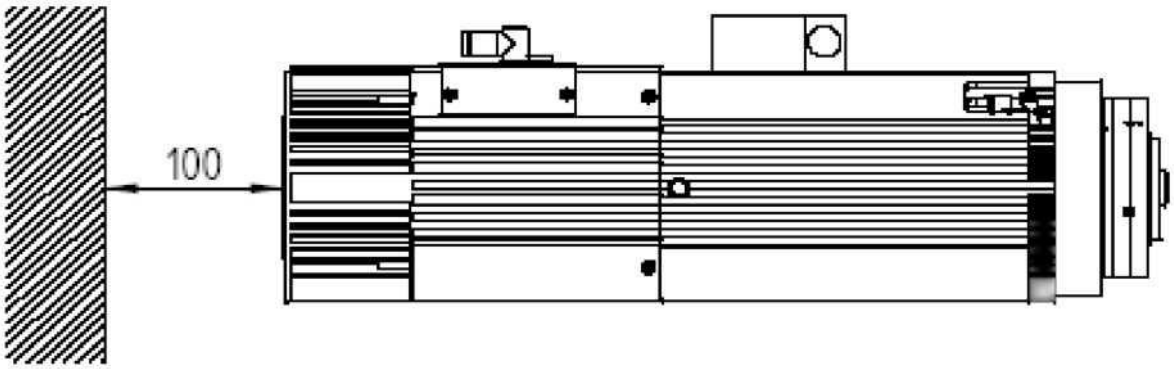
For installation layout and connection diagram, see below sections.

7.3 MECHANICAL INSTALLATION

7.3.1 RESTING SURFACE

i The resting surface where the electrospindle is fixed must have a planarity of less than 0.02mm.	▱ 0,02

7.3.2 POSITIONING OF ELECTROSPINDLE



When choosing the location for the electrospindle, ensure a clearance of at least 100mm from the grille of the electric fan, so as not to obstruct the flow of cooling air.

7.3.3 FIXING OF ELECTROSPINDLE

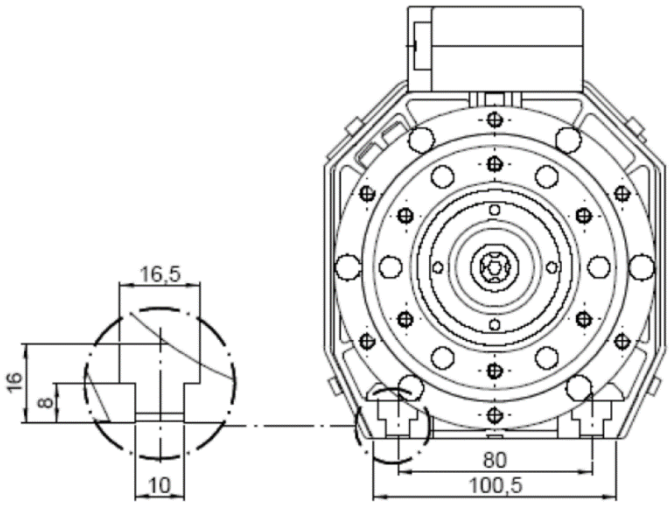


Figure 7.1 T-slot for anchoring the electrospindle

The electrospindle should be fixed to the slide or the spindle holder support (if present), using M8 screws and T-slot nuts with a tightening torque of 20Nm. The maximum protrusion allowed for the fixing screw is 15mm, as shown in Figure7. 2; greater protrusions can deform the framework of the electrospindle and produce incorrect blocking, with negative consequences for the precision of the machining operation and the safety.

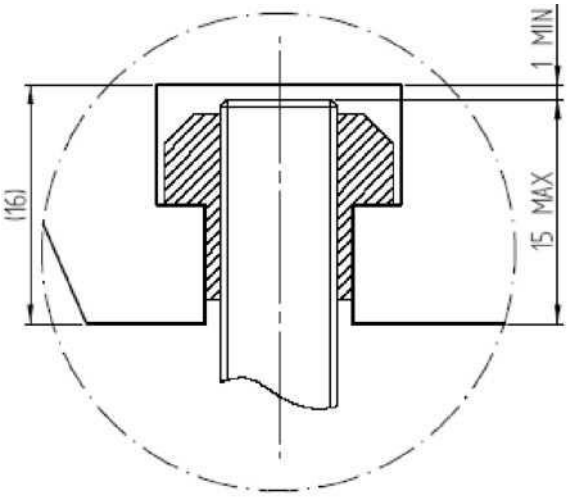


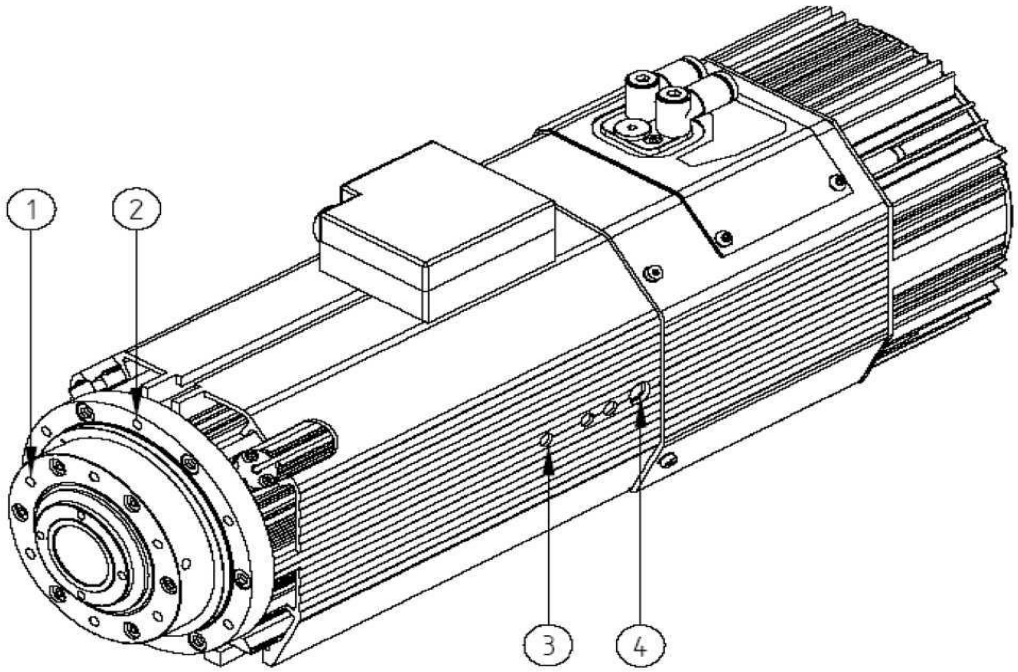
Figure 7.2 Maximum protrusion of the screw in the T-slot

Maximum protrusion of the screw: 15mm.
Ensure a gap of at least 1mm.
Greater protrusions deform the framework of the electrospindle, compromising the precision of the machining operation and also the safety.

7.3.4 THREAD HOLE MAINTENANCE

There are several M6 thread holes on the electrospindle, as shown in the figure.

> ⚠ Note: Do not block the exhaust silencer hole (Hole3).

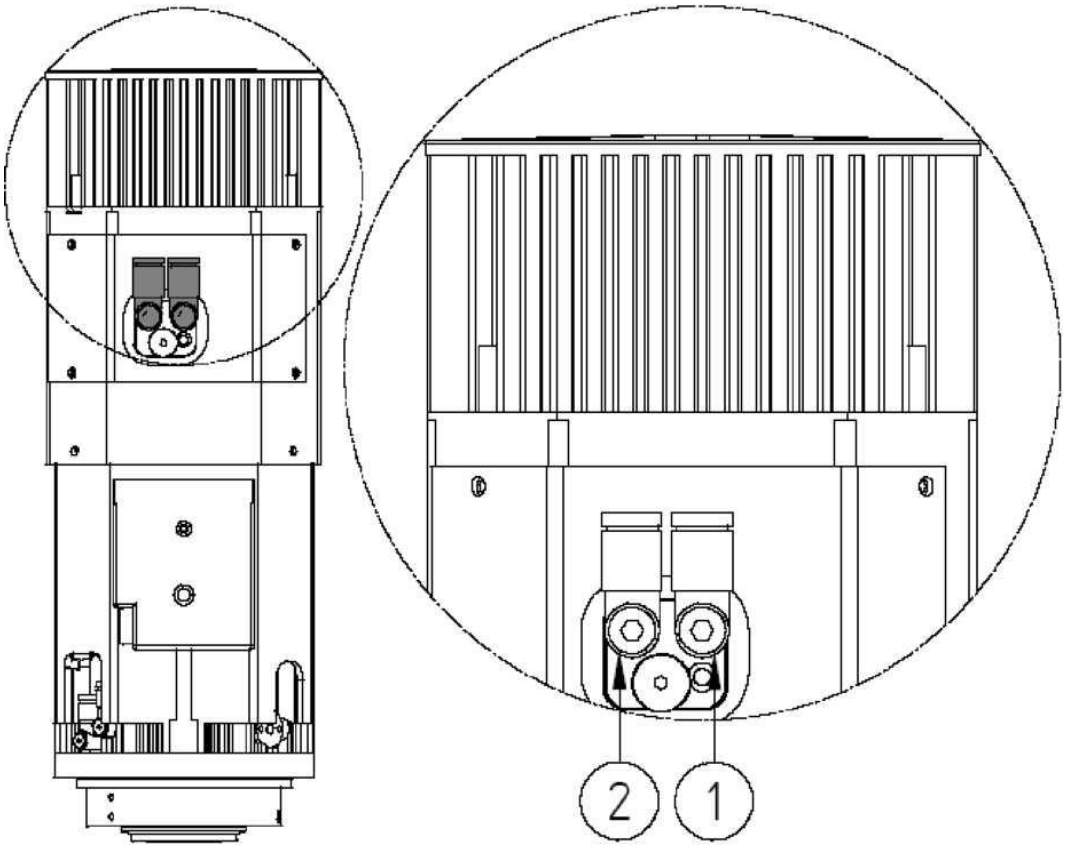


1	Front maintenance hole	6
2	Side thread maintenance hole	3 per side
3	Exhaust silencer hole	1 per side

7.4 PNEUMATIC CONNECTION

7.4.1 PNEUMATIC CONNECTOR

The pneumatic connector is a quick fitting joint. The position is shown in the below figure.

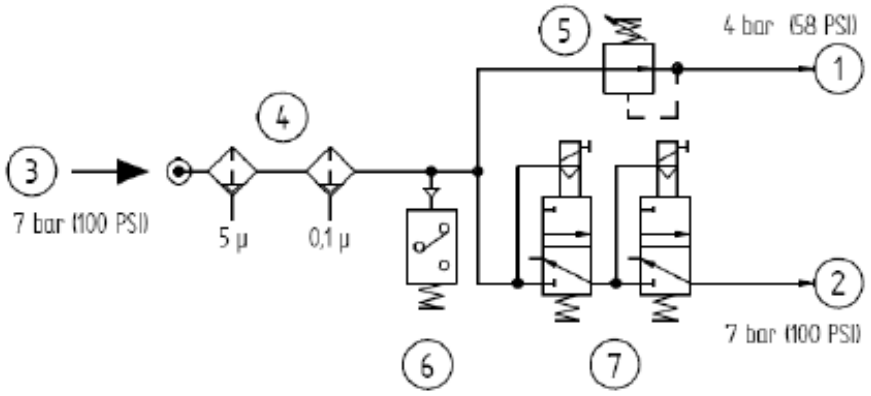


Description		Pressure (bar/PSI)	Tube diameter(mm)
1	Pressurization and cone cleaning	4/58	8
2	Releasing tool holder	7/100	8

7.4.2 LAYOUT FOR THE PNEUMATIC CIRCUIT

As shown in the bellowed figure, it is the pneumatic system circuit which must be arranged by the customer.

The use of two electric valves in series instead of just one reduces the possibility of malfunctioning. Although such malfunctioning is very rare, it may cause serious results. Therefore the application of the redundancy is suggested.



1	Cone cleaning and pressurization air inlet
2	The tool release air inlet
3	Factory air supply
4	Compressed air filtration and drying with automatic condensed water discharge: the first filter 5μm, the second filter 0.1μm
5	4 bar (58PSI) pressure regulator.
6	Pressure switch
7	A pair of two position three way solenoid valves

Two separate loops are used to connect the solenoid valve (position 7 in the figure) to the control unit or the manual control system.

Important note: The air source in the pneumatic loop must be dry and filtered.

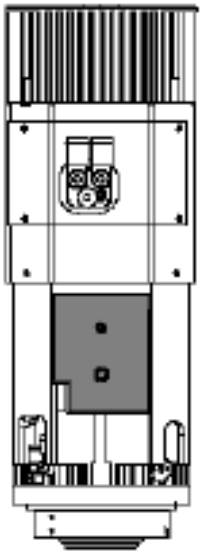
When the machine is running, even if the electrospindle stops, the compressed air should be provided at any time to prevent dust and dirt from entering the electrospindle.

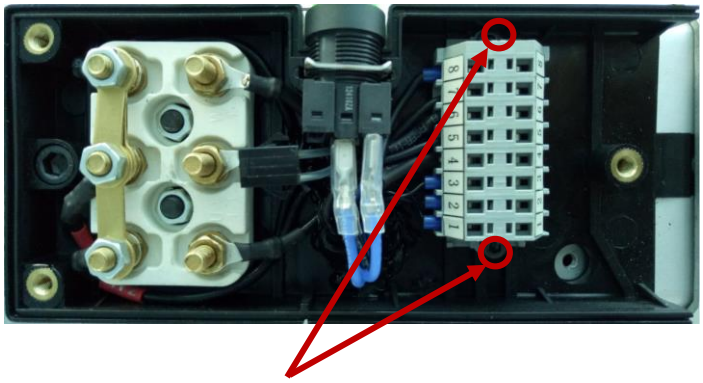
When the electrospindle stops, make sure that there is a steady flow of air around the electrospindle. Otherwise, check the pneumatic circuit and connection.

7.5 ELECTRICAL CONNECTION

7.5.1 TERMINAL

The electrospindle is equipped with two terminals, one of which is used for connecting the power supply, the other is used for connecting the signal and the fan and the heat protector.

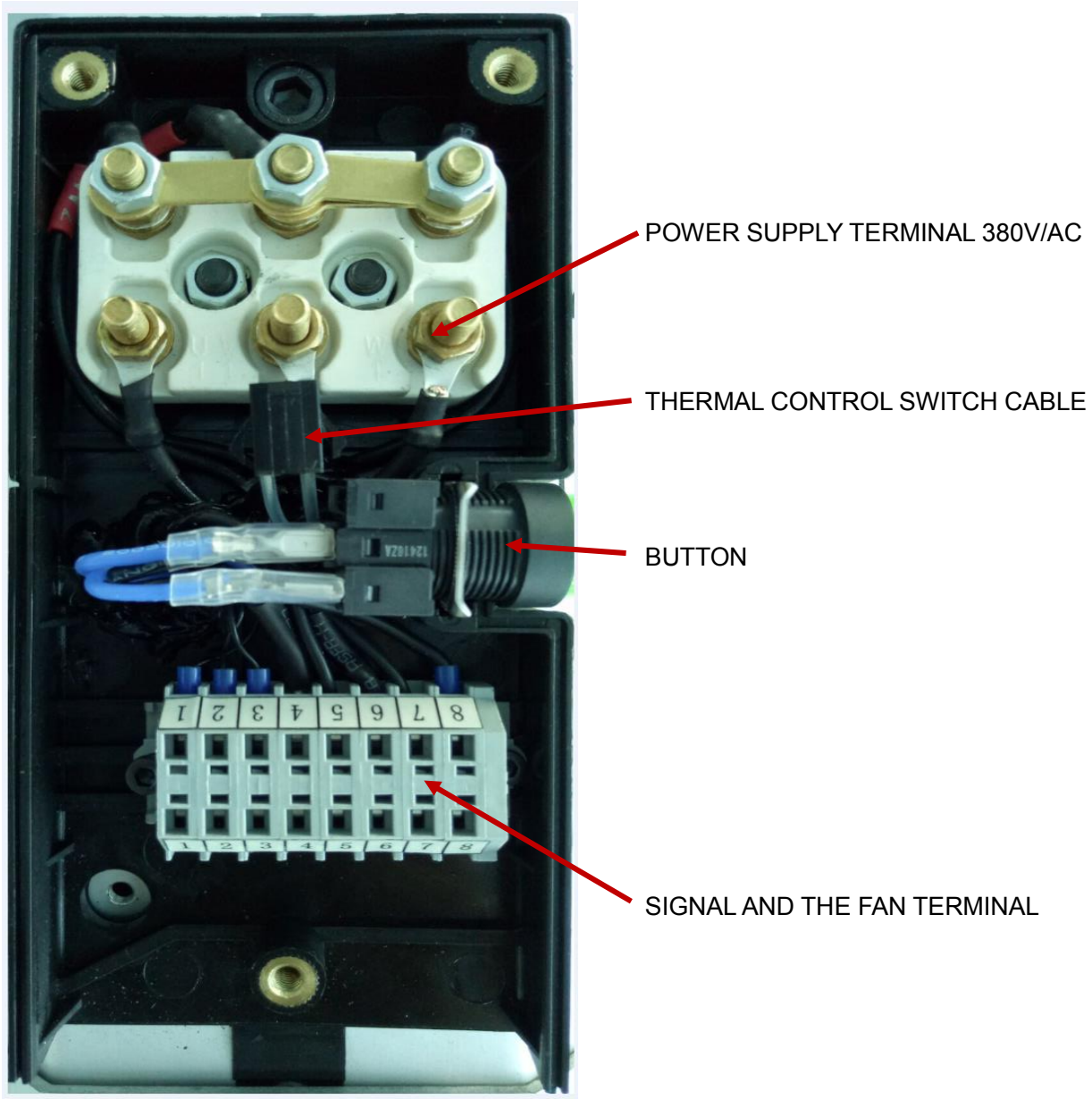




For convenient wiring, remove the two screws before connecting.

7.5.2 SIGNAL TERMINAL FOR FIXED SIGNAL AND FAN MOTOR AND THERMAL CONTROL SWITCH WIRING ARE SHOWN AS BELOW.

7.5.2.1 **FSE model**



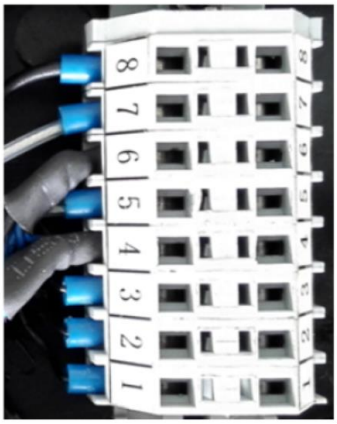
i	Using AWG22 cable

Label	Description
1	sensor S2 (tool release) output
2	sensor S1 (tool lock) output
3	sensor S3 (shaft stop) output
4	Provide 24V DC power supply to S1, S2, S3, button and button light
5	0V power supply to S1, S2, S3, button and button light
6	button output
7	230VAC 50/60Hz cooling fan
8	230VAC 50/60Hz cooling fan

Thermal control switch cable

Normally closed, double metal switch should be connected in series to the machine safety stop system. 230V/AC MAX.

7.5.2.2 FSD model



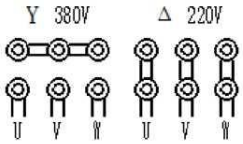
Label	Description
1	sensor S2 (tool release) output
2	sensor S1 (tool lock) output
3	sensor S3 (shaft stop) output
4	Provide 24V DC power supply to S1, S2, S3

	Provide 24V DC power supply to the button light
	Provide 24V DC power supply to the button
	Provide 24V DC power supply to the cooling fan
5	0V DC power supply to for S1,S2,S3
	0V DC power supply to the button and button light
	0V DC power supply to the cooling fan
6	button output
7	Thermal control switch: normally closed, double metal switch should be connected in series to the machine safety stop system. 230VAC MAX
8	Thermal control switch

7.5.3 THE FIXED POWER TERMINAL AS SHOWN IN THE FIGURE

380 V star connection method

220 V delta connection method

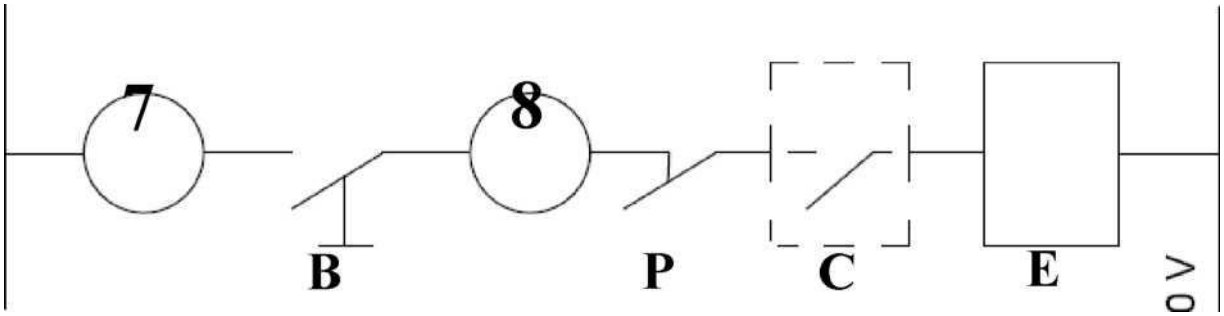


Use AWG10 cable

7.5.4 ELECTRICAL LAYOUT FOR TOOL-HOLDER MANUAL RELEASE CIRCUIT

When the spindle is rotating, a control system must deactivate the command arriving from the button.

- The activation of the button must only be possible with the spindle idle.
- The tool block/release operation via the button must only be carried out with the machine in MANUAL working mode (not AUTOMATIC).
- The tool could be ejected at high speed if the safety conditions described above are not respected.



7-8	Signal terminal position 7 and 8
B	Manual Tool release button
P	Pressure switch that, in the event of low pressure, does not allow the release of the tool holder
C	Safety check (device at null speed)
E	Tool release solenoid valve

- When the "B" button is pressed, the solenoid valve "E" of the coil can be electrified, and the tool was released.
- Press the button "B" button to release tool holder.

8 GENERAL INSPECTION AFTER INSTALLATION

8.1 CHECK THE ELECTROSPINDLE BEFORE START UP

Positioning

- There should be at least 100 mm space behind the cooling fan cover.

Pneumatic connection

- Check the correctness of the pneumatic connections, the pressure levels used and the purity of the compressed air.
- With the spindle at standstill and the tool holder inserted, check there is a uniform, continuous outlet of air from the area of the spindle nose around the shaft.
- The air jet for cleaning the cone must be present during the tool change phase.
- The pressurization air must always be present, even when the electrospindle is stopped.
- The diameter of tube for tool change must be 8mm and the air pressure is 7bar (100psi); the diameter of tube for pressurization and cleaning the cone must be 8mm and the air pressure is 4bar (58psi).

i	Tool release cylinder is single-acted electrical connection

Electrical connection

- The earthing wire of the electrospindle must be connected to this (shown in the below fighure)

i

Inverter programming

- The maximum voltage set on the inverter must correspond to the rated value indicated on the motor rating plate;
- The frequency value at which the maximum voltage (rated frequency) is to be attained must correspond to the value indicated on the motor rating plate;
- The maximum speed set on the inverter must correspond to the value indicated on the motor rating plate;
- The maximum direct current supplied to the inverter must correspond to the rated current indicated on the motor rating plate;
- If it is considered necessary to check the other parameters of the inverter, please contact CCMOTOR.

8.2 START-UP CHECKS.

- Briefly run the electrospindle to warm up.
- Ensure that the compressed air comes out from the front end of the electrospindle.
- **Compressed air should be provided at any time even when the electrospindle is not running.**
- Check the airflow from the fan to the nose end.
- **Even when the electrospindle is not running, the fan should be turned on.**
- Check the cone cleaning airflow when changing the tool.
- Check the clearance (at least 1 mm) between the compressed air hose and the electrical cable or machine parts.
- Check whether the electrospindle control sensor meets the use requirements.
- The tool holder must be ejected by 0.5-0.9mm when release the tool holder.
- **It is only when the electrospindle and the machine are standstill that the tool can be changed. (The sensor 2 is on and the sensor 1 is off)**
- Button on the terminal box must be able to do manually tool change.
- **This button must only be used when the electrospindle and the machine are standstill.**
- The direction of the spindle rotation must comply with the setting of the digital controller.

9 USE AND ADJUSTMENT

9.1 ENVIRONMENTAL CONDITIONS

- According to the Company's design and test, the electrospindle should work under the following conditions:
- The elevation is above sea level is less than1000m.
- The maximum ambient air temperature does not exceed 40 ℃ (104 ℉)
- The minimum ambient air temperature is higher than -15 ℃Celsius (5 ℉)
- The coolant temperature at the entrance of the electrospindle (if there is) is between 23 ℃(73 ℉) and 27 ℃ (81 ℉) .
- In addition to the above limitations, there are other limitations in the table and figures of section 7.

If your specific working condition is not included in this manual, please contact the CCMOTOR to obtain information about installation.

9.2 RUNNING-IN

Before being packed, the product was subjected to an automatic running-in cycle to guarantee the correct distribution of the lubricant (long-life grease) on the races of the bearings, and to run in the spheres and races of the bearings themselves. The running-in cycle also includes a strict inspection of all the command and signaling elements, simulating various types of operating cycle on the test bench.

9.3 WARM UP

CCMOTOR uses high-precision angular contact bearing pairs, pre-loaded and lubricated for life with special grease for high speeds. When the machine is switched on for the first time every day, allow the electrospindle to perform a brief preheating cycle in order to allow the bearings to gradually attain a uniform operating temperature, and hence to obtain a uniform expansion of the bearing races and the correct preload and rigidity.

The following cycle is recommended, without machining operations:

50 % of the maximum rated speed for 2 minutes.
75 % of the maximum rated speed for 2 minutes.
100 % of the maximum rated speed for 1 minute.

The preheating cycle should also be performed every time that the machine is inoperative long enough for the electrospindle to cool down to room temperature.

9.4 TOOL HOLDER

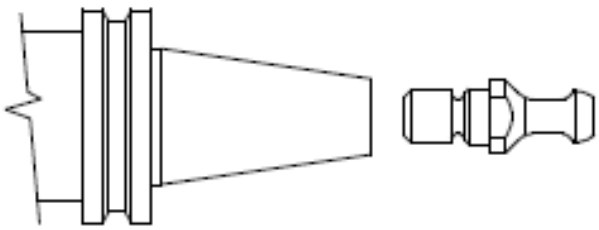
9.4.1 ISO30 TOOL HOLDER

When you choose tool holders, you must consider the following conditions:

- The cone geometry must conform to the DIN 69871.
- The tool-holder cone ISO30 must have an AT3 precision rating.
- Avoid the presence of plugs, slots, or other forms affecting the dynamic balancing of the toolholder;
- At the maximum rated speed of the electrospindle, the level of dynamic balancing must be G =2.5 or better (ISO1940 standard).
- The balancing must be carried out with the tool-holder assembled (cone, mill collet, ring nut, tool);
- Use only qualified tie-rod.

Install the tie rod in the ISO 30 cone in the following manner:

- Carefully clean the tie-rod and the tie-rod housing in the cone ISO30.
- Cover the thread of the tie-rod with high resistance, thread-blocking liquid (LOCTITE 270 or another equivalent product).
- Tighten the tie-rod to the cone with a torque of 62 Nm.
- Leave the cone to rest, to allow the thread-blocking liquid to adhere (12 hours with LOCTITE 270, or depending on the manufacturer's indications if using an alternative, equivalent threadblocker).



ISO cone Tie-rod

Warning: The use of not qualified tie-rods, or incorrect installation, may cause the tool-holder cone to fly off

9.4.2 GENERAL RECOMMENDATIONS FOR THE TOOL-HOLDER CONES

The correct choice of the tool holder is very important for the safety purpose. Please carefully follow the instructions provided.

The conical surfaces of the tool-holder and its housing on the spindle shaft must be kept thoroughly clean in order to permit secure hooking-up

During machining operations, be sure to avoid any contact between the non-cutting rotating parts and the piece being machined.

The seat of the tool-holder cone must always be protected against any impurity that may come in: use a closing device or a tool-holder cone.

At the end of the working day, always remove the tool-holder cone from the electrospindle, to avoid any problem of it sticking. Replace it with a clean tool-holder cone at room temperature, to protect the inside of the electrospindle from the outer

9.4.3 TOOL SELECTION

The tools must have a degree of dynamic balancing of G = 2.5 or better (standard ISO1940) at the maximum rated speed of the electrospindle.

Please pay attention to the following conditions when selecting the tool:

- Always use properly sharpened tools, locking them correctly in the respective tool-holder.
- Never use deformed or damaged tools, tools with missing parts or tools that are not perfectly balanced.
- Before inserting the tool in the respective collet, always check that all the surfaces are free from damage and thoroughly cleaned.

- The essential requirements for using a tool at high speed are:
  - a compact, short, lightweight tool
  - precise, and with any inserts blocked with a high degree of safety
  - balanced and coupled symmetrically with the tool-holder
  - with bits near the rotation axis

OBSERVE THE MAXIMUM ROTATIONAL SPEED (rpm) SPECIFIED BY THE TOOL MANUFACTURER.

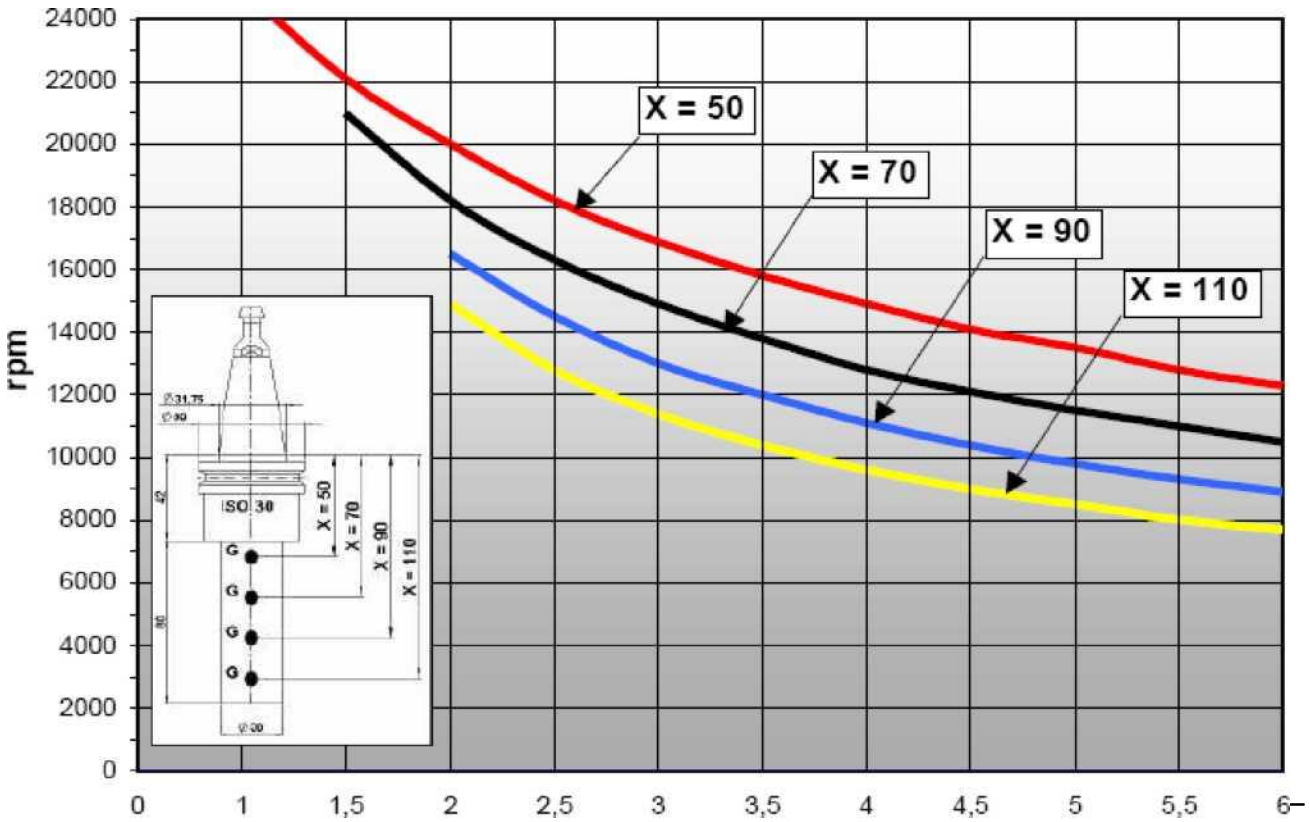
9.5 SPEED LIMITS

Under no circumstances must the maximum speed indicated by the tool manufacturer be exceeded.

Depending on the machining operation to be performed, it is the responsibility of the user to decide whether to operate with a lower speed (NEVER HIGHER) than that specified by the tool manufacturer or shown on the following pages.

9.5.1 ROTATION SPEED SELECTION CURVE

As an example, the chart below show the maximum rotation speed of the electrospindle when empty, on the basis of the weight of the TOOL+TOOL HOLDER assembly (including ring nut and mill collet if present), and of the distance between the nose of the electrospindle and the center of gravity “G” of the tool+tool holder assembly. The mass of the tool+tool holder assembly was applied to the center of gravity “G”.



The chart is approximate, in that they do not take into account (because CCMOTOR cannot know this information) of the machining operation parameters, the specific characteristics of the tool used by the customer, or the particular type of material being worked: **it is the user's responsibility to evaluate each time the maximum speed that allows him to work safely.**

9.5.2 PROCEDURE FOR READING THE CHARTS

(1) On the basis of the distance “X” between the spindle nose and the center of gravity “G” of the tool+tool holder assembly, choose one of the curves. If the “X” measured on your electrospindle does not appear on the chart, choose the curve associated with the “X” that is the next measurement bigger (see example).

(2) Corresponding to the weight of the tool+tool holder assembly, read the value of the maximum speed.

EXAMPLE

On ISO 30 SHORT NOSE, you want to use a pack of milling cutters with the distance “X” between the spindle nose and the center of gravity “G” of the tool+tool holder assembly 80mm and overall weight 3.5kg(including ring nut and an elastic collet):

(1) With no specific curve for “X”=80mm, it is necessary to refer higher value curve associated

(2) Corresponding to the weight of 3.5kg, you can read the maximum speed, when empty, of 12000 rpm.

9.6 SENSORS

Note:

The shaft stop sensor of the electrospindle is optional. This section only describes the sensors for basic configuration.

For basic configuration the electrospindle is equipped with two sensors: sensors S2 and S1, they are used for the following functions.

S1	S1 is used to detect if tool holder is attached providing safe signal for shaft rotation.

Condition	Output S1
The tool holder is locked	+ 24V
No tool holder	0V
The tool holder has ejected (open collet)	0V

Monitor the S1 signal any time the electrospindle is rotating. If the S1 is reduced to 0V, stop rotating.

Monitor the S1 signal any time the electrospindle is rotating. If the S1 is reduced to 0V, stop rotating.

i	S1 signal can be ignored between the period of the tool ejection command and the next tool lock command.

S2	S2 is very important in tool change process. It checks whether the tool holder has ejected, allowing for next step of tool change cycle.

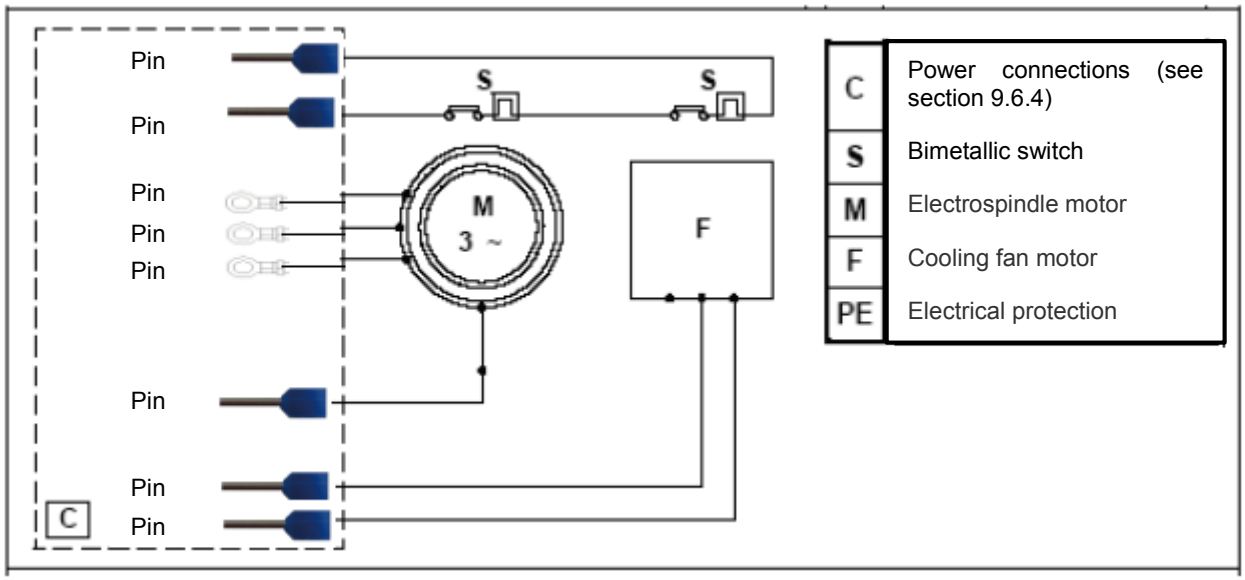
Condition	Output S2
The tool holder is locked	0V
No tool holder	0V
The tool holder has pop-up (open collet)	┼ 24V

9.7 THERMAL CONTROL SWITCH

The electrospindle is protected by two normally closed, bimetallic switches, which protects an electrospindle motor and cooling fan motor respectively.

The thermal switch must be connected to the numerical control, which in turn must stop the machining operations as quickly as possible and stop the rotation of the shaft of the electrospindle, if the switch opens.

The switch opens when a temperature that is harmful for the electric coils is reached; the contact closes automatically when the temperature drops and returns to safe values.



i	The thermal control switch of the fan only detects the overheating of the fan motor. It cannot detect if the fan is working unless the fan is stopped because of

The fan must be turned on at any time the machine is running, even if the electrospindle does not work.

10MAINTENANCE

Read this chapter carefully before carrying out maintenance operations on the electrospindle. This section includes important information about the safety and reliability for the maintenance personnel.

The safety regulations during the maintenance of the electrospindle must take into account that:

- the maintenance operations must only be carried out by trained and qualified personnel, purposely authorised by the technical management of the plant, in accordance with the safety directives and standards in force, using tools, instruments and products suitable for this work;
- During the maintenance work it is obligatory to wear suitable clothing, such as close-fitting work overalls, safety shoes, strictly avoiding wide items or with protruding parts.
- During the maintenance of the machine, please indicate that the machine is in maintenance, and prevent unauthorized personnel to assess.

During any maintenance operations, the electrospindle must be:

- **Disconnected and isolated from the electric power supply;**
- **Compulsorily with the tool at a standstill (not in rotation).**

Maintenance administrator must ensure that the team has been trained, in order to ensure the best coordination and safety. All maintenance personnel must be within the vision of their colleagues at any time in order to ask others to provide assistance.

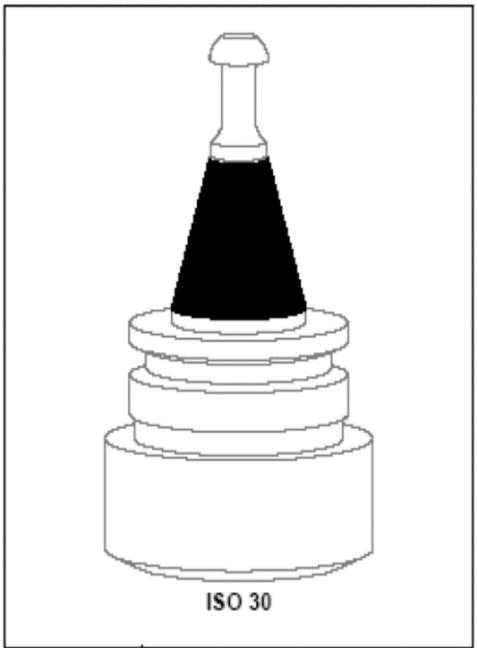
The maintenance of electrospindle generally does not require special tools.

10.1 SCHEDULED MAINTENANCE

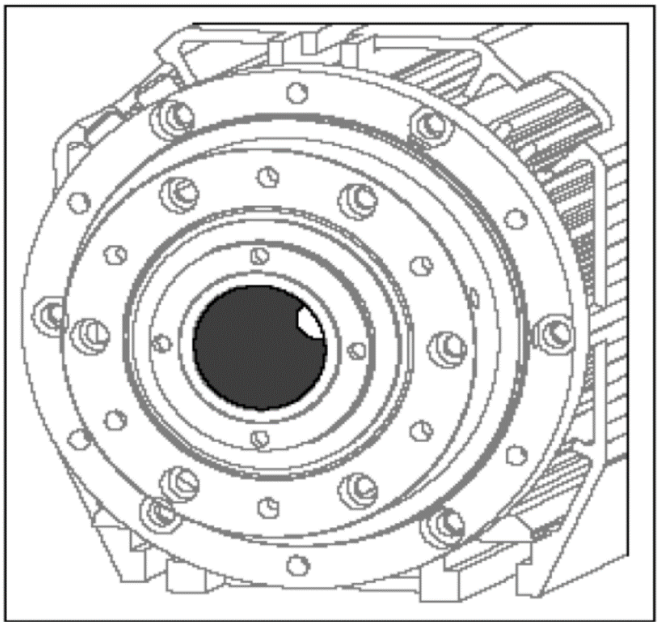
The punctual respect of the scheduled maintenance is essential in order to maintain the conditions of use and working.

The frequency has been calculated on the basis of a working week of 5 days, each of 8 working hours, under normal ambient working conditions.

10.1.1 CHECKING THE CLEANING OF THE TOOL-HOLDER CONE AND THE CONICAL HOUSING THE SPINDLE SHAFT.



ISO 30 conical surface of the tool holder (highlightened in black)

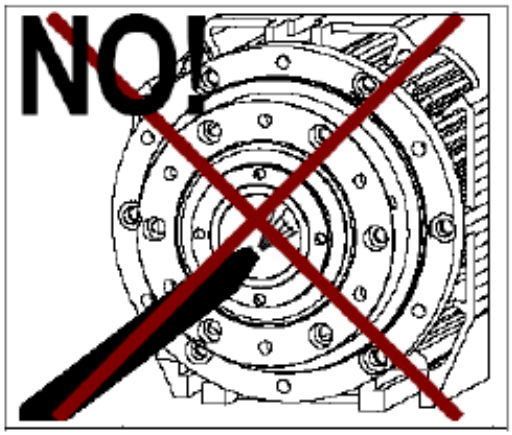


Conical surface of ISO30 electrospindle (highlightened in black)

Before using the electrospindle, ensure that the conical surfaces of the tool-holders (highlighted in black) and the conical surface of the tool-holder housing in the spindle shaft (highlighted in black) are thoroughly clean, with no traces of dust, grease, cooling liquid, oil or metallic particles, nor traces of oxide or scale;

Daily cleaning is recommended, at the end of the working day, using a clean, soft cloth.

DO NOT DIRECT JETS OF COMPRESSED AIR INTO THE SPINDLE SHAFT WHEN THE TOOL-HOLDER CONE IS ABSENT.



TO CLEAN THE SURFACES HIGHLIGHTED IN THE FIGURE, USE CLEAN, SOFT CLOTHS; NEVER USE ABRASIVE INSTRUMENTS SUCH AS WIRE WOOL, METAL SCRAPERS, EMERY CLOTH, ACIDS OR OTHER AGGRESSIVE MEDIA.

IMPERFECT CLEANING PREVENTS THE CORRECT POSITIONING OF THE TOOL-HOLDER, WITH SERIOUS CONSEQUENCES FOR THE SAFETY OF THE OPERATOR, THE WEAR AND TEAR OF THE ELECTROSPINDLE AND TOOLHOLDER, THE PRECISION AND EFFICIENCY OF THE MACHINING OPERATION.

10.1.2 CLEANING TOOL HOLDER CONE

EVERY TWO WEEKS carefully clean the conical surfaces of the tool-holders (highlighted in black in Figure above) with a clean soft cloth impregnated with ethyl alcohol.

10.1.3 PROTECTING THE CONICAL SEAT IN THE SPINDLE SHAFT

THE SEAT OF THE TOOL-HOLDER CONE IN THE SPINDLE SHAFT MUST ALWAYS BE PROTECTED FROM IMPURITIES: USE A CLOSING DEVICE OR A TOOL-HOLDER CONE.

AT THE END OF THE MACHINING OPERATIONS, ALWAYS REMOVE THE TOOLHOLDER CONE FROM THE ELECTROSPINDLE, TO AVOID ANY PROBLEM OF IT STICKING. REPLACE IT WITH A CLEAN TOOL-HOLDER CONE AT ROOM TEMPERATURE, TO PROTECT THE INSIDE OF THE ELECTROSPINDLE FROM THE OUTSIDE ENVIRONMENT.

10.1.4 BEARING

THE BEARINGS HAVE BEEN LUBRICATED FOR LIFE AND DO NOT REQUIRE RECURRENT ADDITIONS OF GREASE.

10.2 REPLACING COMPONENTS

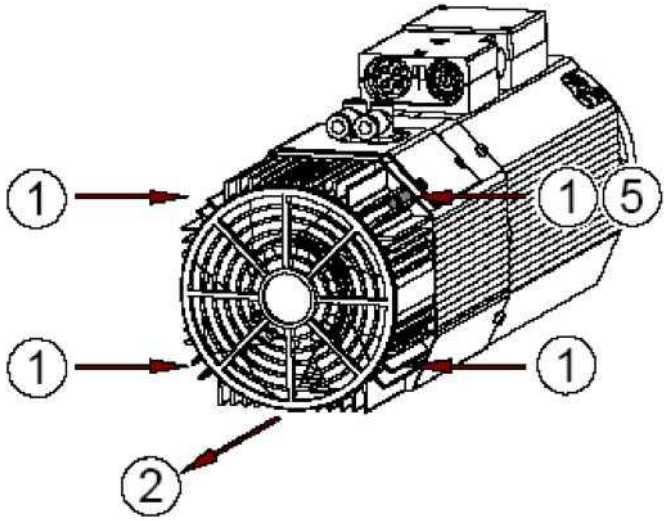
Only qualified and authorized personnel can take off and replace the components.

Potential Danger	Inside the electrospindle there is a pre-loaded spring with a force of several hundred kilograms. This spring is attached to a tie-rod that may fly out violently if the electrospindle is dismantled by personnel who have not been sufficiently trained. Carry out only the operations described in this manual, paying close attention to the instructions given; if in doubt, contact the Assistance

All removal and reload operations must be carried out under the following conditions:
Absolutely ensure that the machine has stopped, the power switch control board has been disconnected, the switch has been locked, and the maintenance manager has key in the hand. Make sure that the tool has completely stopped rotating.
Replace with all the necessary tools and equipment. Make sure there is no potential danger. All spare parts have been cleaned, and the grease and lubricant has been removed in accordance with the requirements.

Use only original spare parts and replace according to the instructions in this manual. No other adjustment should be done on the electrospindle, which will result in the failure of our guarantee.

10.2.1 REPLACING THE COOLING FAN



1	Remove the four fixing screws of the electric fan unit.
2	Move the electric fan unit in an axial direction.
3	Disconnect the electrical connector of the electric fan.
4	Connect the electrical connector of the new electric fan.
5	Insert the earth cable of the new electric fan in the appropriate space (5), so that it is blocked by the screw in the next point (6).
6	Fix the new electric fan with the four screws, paying attention to the earth connection.

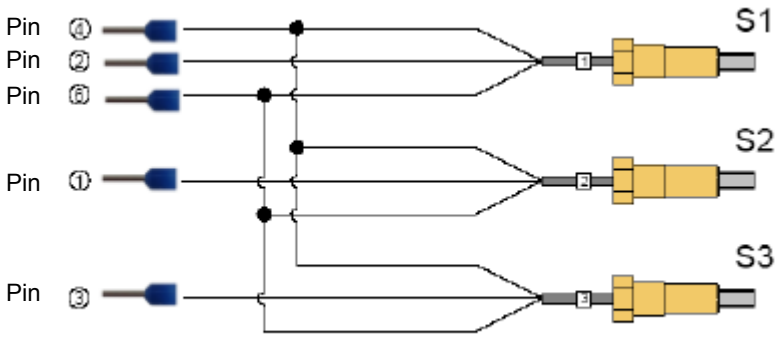
10.2.2 CHANGE TOOL BUTTON

1	Remove two screws from the terminal box.
2	Remove the box cover
3	Disconnect the change tool button cable
4	Slowly push the button out from inside, and pull it out from outside.
5	Put on the new button
6	Connect the button cable.
7	Fit the box cover on
8	Fix the terminal box with two screws.
9	Check if the button works

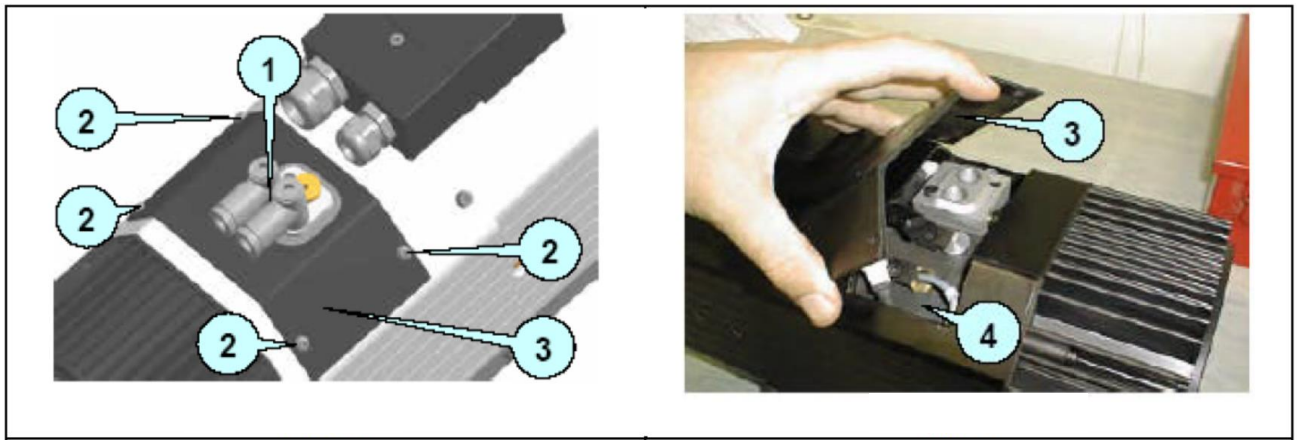
It is absolutely not allowed to replace the cables in the terminal box.

10.2.3 REPLACING THE SENSORS S1, S2, S3

10.2.3.1 Wiring of the sensors



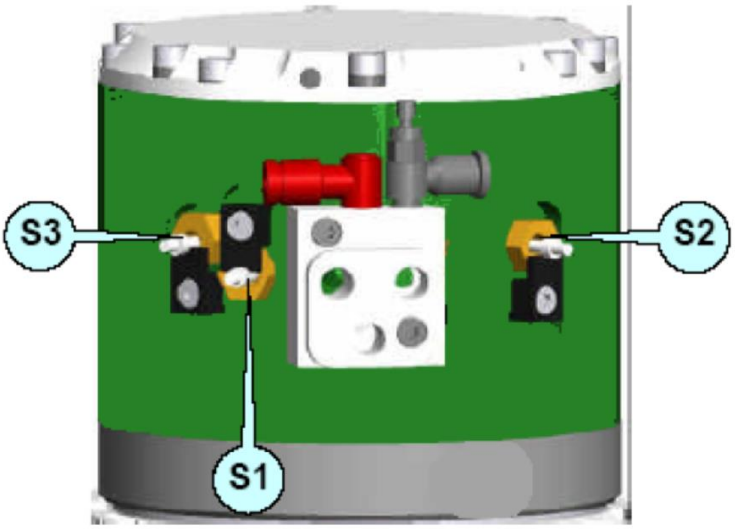
10.2.3.2 **Accessing the sensors**



1. pair of quick connectors	3. sensor area cover
2. screws	4. sensor area

- Disconnect the quick connectors 1 from the tubes and rotate them towards the spindle nose.
- Loosen the screws 2 to free the cover 3.
- Lift up the cover 3 to access the area 4, being careful not to damage the interposed gasket.

10.2.3.3 Position of the sensors

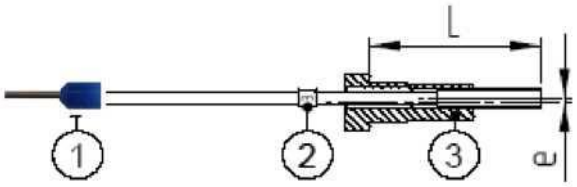


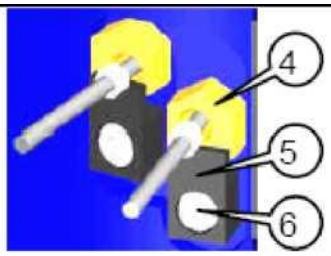
10.2.3.4 The sensor unit

> **The various sensors are identified by the number shown on the cable marking label; danger of damage to moving parts if sensors are swapped over.**

The sensors are pre-assembled in calibrated bushes to allow simple insertion to the right depth in the electrospindle.

It is therefore important to correctly identify the sensor to be replaced: for this reason, both the sensors installed on the electrospindle and those supplied as spare parts bear a numbered cable marking hose clamp.





Sensor Unit

1	Electrical connector	e	Eccentricity for adjustment
2	Cable marking label	4	sensor
3	Bush and sensor	5	Sensor blocking bracket
L	Calibrated position	6	Embedded hexagon screw

10.2.3.5 Replacing the sensor unit

1) Remove the screw (6) that blocks the bracket (5) of the sensor to be replaced (4).

2) Unthread the faulty sensor unit from its seat, and disconnect its electrical connector (1).

3) Connect the electrical connector of the new sensor unit. Position the replacement sensor in the empty seat.

4) Reposition the bracket (5) and tighten the screw (6) without blocking it completely, so that the sensor can rotate, allowing the calibration operations described in the following paragraphs.

5) After calibration, tighten the screw, blocking the sensor with an open-end spanner so as to maintain the calibration carried out.

To check the effectiveness of the adjustment, perform the maximum possible number of tests with all the tool-holders available.

Warning: an incorrect calibration of the sensors can cause irregularities in the functioning of the electrospindle.

10.2.3.6 Calibration of the sensors S1, S2 and S3

After replacing the sensor in accordance with section 10.2.3.5, calibrate it as the following steps:

1) Check whether the signal output of the sensor meets the requirements.

2) if not, please rotation sensor bush 4) until it reaches the required output. Keep the sensor in this position and tighten the screw 6).

10.2.3.6.1 Calibration for S1

When you have replaced the sensor in accordance with section 10.2.3.5, follow these steps to calibrate:

1. Insert the tool-holder cone and ensure that the output of S1 is "ON" if the output is “OFF”, rotate the sensor unit until it becomes “ON”;

2. Rotate the bush slowly in the direction that takes the sensor away from the tool-holder; stop immediately when the output of the sensor becomes ”OFF”;

3. Carefully rotate the bush back by about 15° - 20°, so that the output of the sensor returns to “ON”;

4. Rotate the shaft manually, and check that the signal remains “ON” for the whole rotation;

5. Tighten the screw (3);

6. Unhook the tool-holder by powering the cylinder, and check that in this condition (collet open) the output of S1 is “OFF”;

7. by means of the cylinder, let the collet close without a tool-holder: in this condition, the output of S1 must be "OFF" for the whole rotation of the shaft;

8. If points [6] and [7] are not satisfied, repeat the procedure from the start, making an even slighter rotation movement at point [3];

9. If points [6] and [7] are satisfied, make a cycle of 10 tool changes;

10. At the end of the cycle, check that the conditions in the following table are satisfied;

11. If the conditions of the table are not satisfied, repeat the procedure from the start;

12. If the conditions of the table are satisfied, perform a cycle of 100 tool changes with the machine, using the maximum possible number of different tool-holders;

13. At the end of the cycle, check that the condition of the table at point [10] is satisfied. If this is the case, the adjustment procedure for S1 is completed; if this is not the case, repeat the procedure from the beginning.

Condition	Output S1
The tool holder locked	+ 24V
No tool holder	0V
The tool holder ejected (open collet)	0V

10.2.3.6.2 Calibration for S2

When you have replaced the sensor in accordance with section 10.2.3.5, follow these steps to calibrate.

1. Correctly attach a tool-holder before beginning the adjustment of the sensor;

2. Check that, in this state, the output of S2 is “OFF”; if the output is “ON”, rotate the sensor unit until it becomes “OFF”;

3. Feed the air input for a tool change of the cylinder, using a one-way pressure regulator initially set at 0 bar;

4. Gradually increase the feed pressure so as to move the piston slowly forward and, at the same time, check that the output of S2 is “OFF”;

5. As long as the tool-holder is firmly blocked, the output of S2 must be “OFF”; if the output changes during the movement of the piston, slightly rotate the sensor unit until the output returns to “OFF”;

6. When the tool-holder begins to slacken (but is not yet free to fall), the output of S2 must still be “OFF” (if necessary, rotate the sensor unit);

7. When you reach the feed pressure at which the tool-holder is finally free to fall, increase the pressure by another 0.2 bar and block the pressure regulator;

8. Rotate the sensor unit so that, in this state, the output of S2 is “ON”, then fix it by tightening the screw (3);

9. Perform a cycle of 10 tool changes;

10. At the end of the cycle, check that the steps from [1] to [8] are satisfied, without the need to ever rotate the sensor;

11. If the outputs requested are not satisfied, repeat the entire procedure from the start;

12. If the outputs requested are satisfied, perform a cycle of 100 tool changes with the machine, using the maximum possible number of different tool-holders;

13. At the end of the cycle, check that the steps from [1] to [8] are satisfied, without the need to ever rotate the sensor;

14. If the outputs requested are not satisfied, repeat the entire procedure from the start;

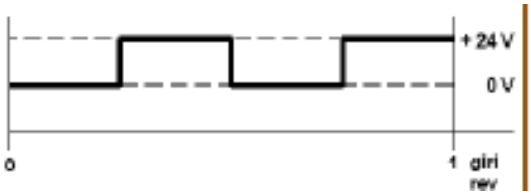
15. If the outputs requested are satisfied, the regulation procedure for S2 is complete.

10.2.3.6.3 Calibration procedure for S3

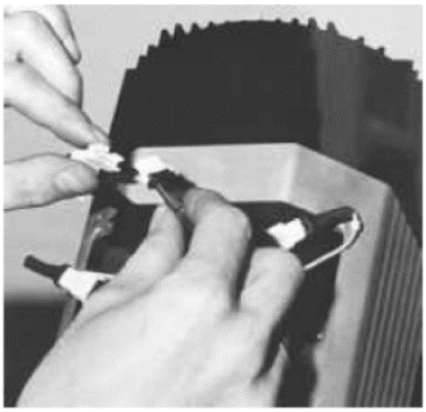
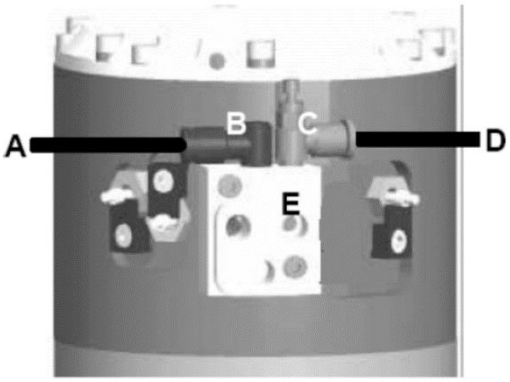
When you have replaced the sensor in accordance with section 10.2.3.5, follow these steps to calibrate.

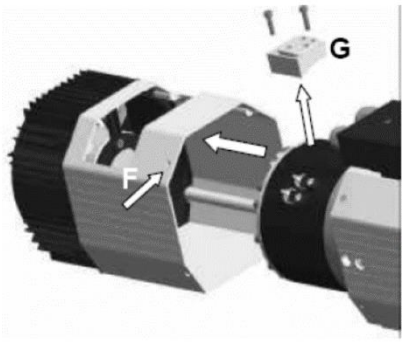
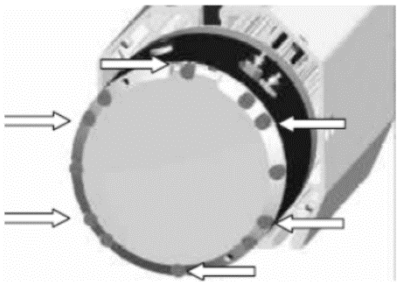
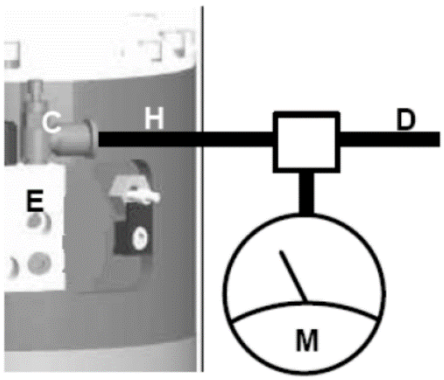
1. Check that the signal from the sensor corresponds to that described in the figure below.

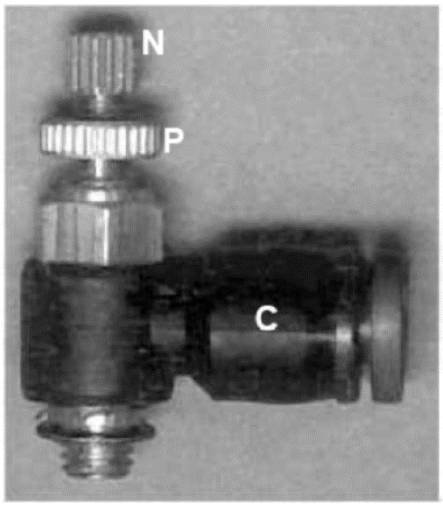
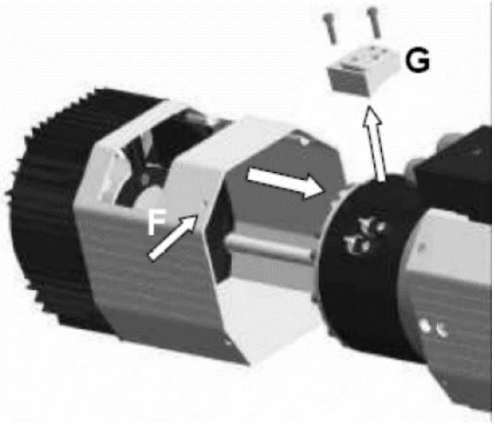
2. If this is not the case, rotate the bush (4) until you find the position that permits you to have the output described in the table, then definitively tighten the screw (6).



10.2.4 REPLACE CYLINDER ASSEMBLY

1		Open the sensor chamber in accordance with section 10.2.3.2
2		Disconnect all electrical connectors.
3	**Important tips:**	use the label to mark hose A and D to identify them later (see Step 4 below) before remove the hose A and D.
4		A. Compressed air B. Quick connectors C. Quick connectors with pressure regulator D. Pressurization air E. Compressed air inlet for conical cleaning and pressurization

5		• As shown in step 3, make a clear mark on the hose A and D. • Remove the hose A and D from the connector B and C. • Remove two screws from the part G. • Take off the part G, take care not to lose or damage the seal. • Remove 4 screws F. • Remove the cooling fan cover along the direction of the arrow.
6		Remove only the 6 screws shown to take off the cylinder.
7		Use the 6 screws from step 6 to install the new cylinder.
8		C. Quick connector with pressure regulator D. Pressurization air E. Compressed air inlet for conical cleaning and pressurization H. Connecting hose M. Pressure gauge

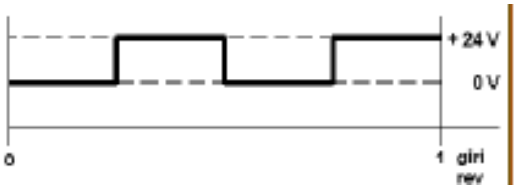
9		C. Quick connector with pressure regulator N. Regulator P. Lock nut • As shown in step 8, install a pressure gauge M to measure the output pressure of C. • Connect E with 4 bar (58 PSI) air source. • Adjust the regulator N until the pressure gauge is 0.8 bar (11.6 PSI). • Tighten the lock nut P to fix it. • Disconnect the pressure gauge M and hose D and H from the connector C
10		• Before installing the cooling fan cover, you must remove the part G. • Remove two screws from the part G. • Take off the part G, take care not to lose or damage the seal. • Install cooling fan cover and use screw F for fixing • Install the part G, pay attention to the correct installation of the seal, and then tighten the two screws. • Connect hose A and B to the quick connector D and C (see Step 4 of the schematic). • Connect the electrical connector of the cooling fan.
11		In accordance with the instructions in section 10.2.3: • Remove the sensor from the cylinder; • Fit it on the new cylinder; • Calibrate sensor; • Close sensor chamber.
12		Use a M6 hexagon angle wrench to remove the external compressed air connector from the old cylinder and install it on the new cylinder.

After replacing the cylinder assembly, calibrate the sensors.

11 OPTIONAL ACCESSORIES

Electrospindle can have optional accessory "electrospindle stop" sensor S3

For each rotation, "electrospindle stop" sensor will output two "ON" and "two" OFF "pulse; at high speed, it will remain" ON".



See section 5.3.4 for electrical specifications of this sensor.

See section 10.2.3 for installation and calibration of sensors to ensure that the output meets the requirements

Ignore the output of S3 in the process of changing the tool.

12 TROUBLE SHOOTING

BEFORE STARTING WORK ON THE ELECTROSPINDLE, READ AND IMPLEMENT ALL THE WARNINGS AND RECOMMENDATIONS RELATED TO SAFETY AND MAINTENANCE.

PROBLEMS	CAUSES	SOLUTIONS
The electrospindle does not rotate	No power supply:	• Check for mains voltage; • Check the connectors; • Check the integrity and continuity of the electric connections.
	The tool-holder is not inserted:	Insert a tool-holder.
	The tool-holder is not inserted correctly:	See the item "The tool-holder is not locked" below.
	The thermal protective device has triggered:	Wait for the electrospindle to cool down: the thermal protective device is reset automatically. If the thermal protective device trips frequently, consult the item "The electrospindle overheats" further on in this same chapter.

	The VFD over-current protection triggered.	Refer to the VFD's manual or contact its manufacturers.
	No electrospindle start signal	Refer to the manual, or contact the manufacturers of the machine, digital controller and VFD.
	Sensor S1 disconnected or faulty	• Check sensor connector. • Check whether the sensor cable is broken. Calibrate the sensor according to the instructions. • Replace any faulty sensors in accordance with the instructions.
The tool-holder is not expelled:	Insufficient air pressure	• Check the required pressure values. • Check the integrity and efficiency of the pneumatic circuit.
	No triggered signal	Refer to the manual, or contact the manufacturers of the machine, digital controller and VFD.
Lack of pressurization:	Insufficient pressure or inefficient pneumatic circuit:	• Check the required pressure values • Check the integrity and efficiency of the pneumatic circuit;
One of the sensors does not provide the required output:	Sensor disconnected or faulty:	• Check the sensor connection. • Check the integrity and continuity of the electrical connectors; • Carry out the adjustment of the sensor as described. • Replace the sensor as described.
The electrospindle overheats:	The cooling fan is not working properly	• Check the electric fan is operational; • Check the electric fan is integral; • Check that the rotation of the electric fan is not obstructed by foreign matter; • Replace the electric fan if it is faulty
	The passages where the cooling air goes through the framework of the electrospindle are obstructed:	• Disassemble the electric fan. • Check and free the passages where the cooling air goes through the framework of the electrospindle;

		• Reassemble the electric fan.
	The machining operation is too heavy:	Reduce the severity of the machining operation.
	Incorrect parameterisation of the inverter:	Check the parameters on the plate of the electrospindle
	Incorrect voltage supply	Check the voltage of electrospindle on the plate.
Bearing noise	Bearings damaged	Replace bearings
Electrospindle vibrations	The tool-holder is not balanced:	Choose a tool-holder according to the indications in above chapters.
	The tool is not balanced:	Choose and use the tool according to the indications in in above chapters.
	Dirt between tool-holder cone and spindle shaft:	Remove the foreign matter and clean the tool-holder cone and shaft cone as described.
	Incorrect parameterization of the inverter:	Check the parameters on the plate of the electrospindle.
	The machining operation is too heavy:	Reduce the severity of the machining operation including cutting depth and feed rate.
	Anchor screws loose:	Tighten the screws
	Incorrect voltage supply	Check the voltage of electrospindle on the plate.

13 DISPOSAL OF SCRAPPED ELECTROSPINDLE

At the end of the electrospindle lifespan, it is the responsibility of the user company to dispose of it.

First of all, the various elements must be cleaned, then the various parts must be separated into components and electrical material. The different materials should be divided, e.g.: electrical motors (copper coils), metallic parts, plastic materials etc., and then disposed of separately, according to the regulations of the current laws in the country of installation.