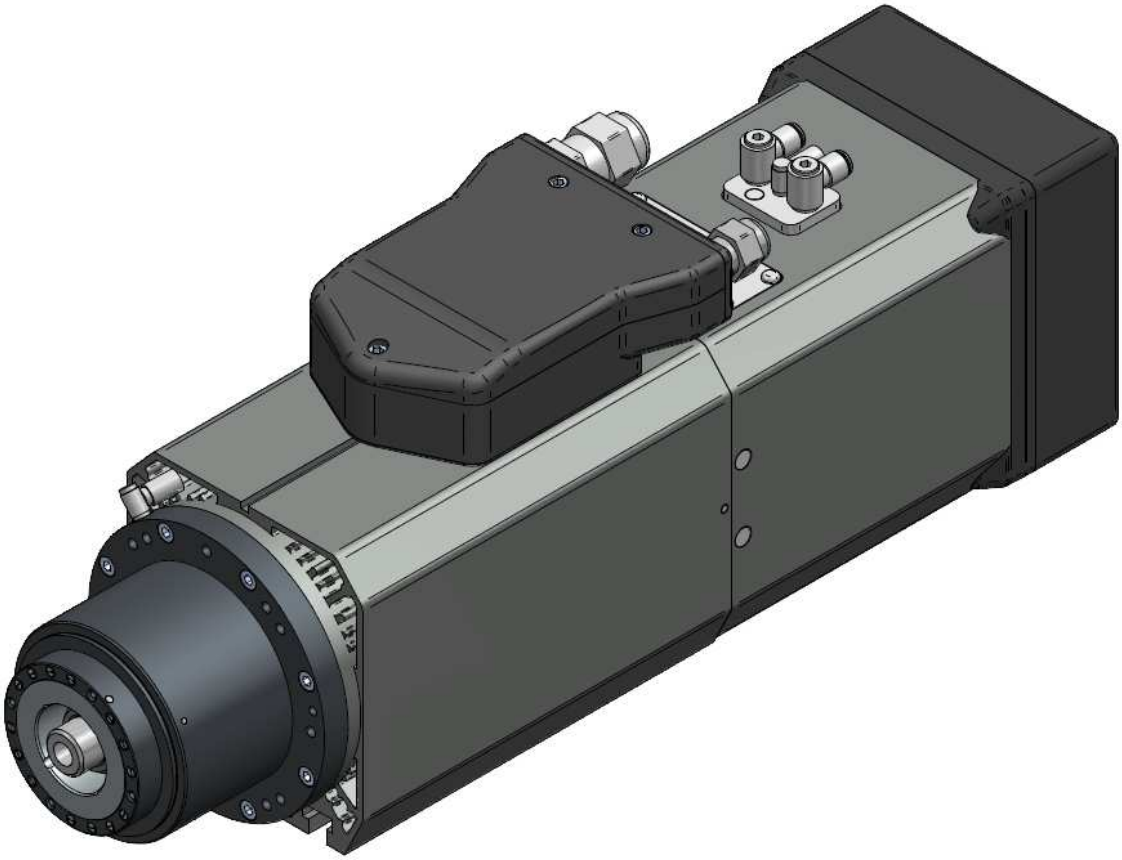
ELECTROSPINDLE

3-PHASE ASYNCHRONOUS MOTOR

MODEL: QE-1F 7.5/6 24 63F NC CB

CODE: 29L0385638C

Rev. 00 (12/18)



- ASSEMBLY INSTRUCTIONS
- USER MANUAL

(TRANSLATION OF THE ORIGINAL INSTRUCTIONS)

HIGH TECHNOLOGY COMPONENTS

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DOCUMENT INFORMATION

MANUFACTURER:	**SCM GROUP Spa HITECO**
ADDRESS:	**SS 258 Marecchia 34**
NAME	**3-PHASE ASYNCHRONOUS MOTOR**
BRAND	**HITECO**
MODEL:	**QE-1F 7.5/6 24 63F NC CB**
CODE:	**29L0385638C**
TYPE OF DOCUMENT:	• **ASSEMBLY INSTRUCTIONS** • **USER MANUAL (ORIGINAL INSTRUCTIONS)**
DOCUMENT CODE:	**90L0505599B**
EDITION	**00 (12/18)**
RELEASED BY:	**HITECO TECHNICAL DEPARTMENT**

DICHIARAZIONE DI INCORPORAZIONE

(AI SENSI DELL'ALL. IIB DELLA DIRETTIVA 2006/42/CE E DI ALTRE DIRETTIVE APPLICABILI)

DECLARATION OF INCORPORATION

(IN ACCORDANCE WITH ANNEX IIB TO DIRECTIVE 2006/42/EC AND OTHER DIRECTIVES APPLICABLE)

IL FABBRICANTE:	***SCM GROUP SPA – VIA EMILIA N° 77***
THE MANUFACTURER:	***I - 47921 RIMINI (RN) - ITALY***

DICHIARA CHE LA

DECLARES THAT THE

QUASI MACCHINA:	***ELETTROMANDRINO PER LA LAVORAZIONE DI LEGHE LEGGERE, LEGNO E DI MATERIE CON CARATTERISTICHE FISICHE SIMILI***		
PARTLY COMPLETED MACHINERY:	***ELECTROSPINDLE FOR WORKING LIGHT ALLOY, WOOD AND MATERIAL WITH SIMILAR PHYSICAL CHARACTERISTICS***		
MARCA: / MAKE:	***HITECO***	N° DI SERIE: / SERIAL N°	
MODELLO: / MODEL:	***QE-1F 8/12 24 63F NL***	ANNO DI COSTRUZIONE: / YEAR OF MANUFACTURE:	

•	E' CONFORME AI REQUISITI ESSENZIALI DI SICUREZZA COMPLIES WITH THE ESSENTIAL SAFETY REQUIREMENTS	**1.1.5, 1.3.2, 1.3.4, 1.3.6, 1.5.1, 1.5.8, 1.5.9, 1.5.10, 1.5.11, 1.7.1, 1.7.2, 1.7.3, 1.7.4, 1.7.4.1, 1.7.4.2, 1.7.4.3**	DELLA DIRETTIVA: OF DIRECTIVE (..)	**2006/42/CE** **2006/42/EC**

•	E' CONFORME ALLE PERTINENTI DISPOSIZIONI DELLE SEGUENTI DIRETTIVE COMPLIES WITH THE RELEVANT PROVISIONS OF THE FOLLOWING DIRECTIVES	
	2006/95/CE	**2004/108/CE**
	2006/95/EC	**2004/108/EC**

•	NON DEVE ESSERE MESSA IN SERVIZIO FINCHE' LA MACCHINA FINALE IN CUI DEVE ESSERE INCORPORATA NON E' STATA DICHIARATA CONFORME ALLE DISPOSIZIONI DELLA DIRETTIVA	**2006/42/CE**
	MUST NOT BE PUT INTO SERVICE UNTIL THE FINAL MACHINERY INTO WHICH IT IS TO BE INCORPORATED HAS BEEN DECLARED IN CONFORMITY WITH THE PROVISIONS OF THE DIRECTIVE	**2006/42/EC**

DICHIARA INOLTRE CHE LA

ALSO DECLARES THAT

•	LA DOCUMENTAZIONE TECNICA PERTINENTE E' STATA COMPILATA IN CONFORMITA' ALL'ALLEGATO VII B DELLA DIRETTIVA	**2006/42/CE**
	THE RELEVANT TECHNICAL DOCUMENTATION WAS COMPILED IN CONFORMITY WITH PART B OF ANNEX VII TO THE DIRECTIVE	**2006/42/EC**

•	SI INPEGNA A TRASMETTERE IN RISPOSTA AD UNA RICHIESTA ADEGUAMENTE MOTIVATA DELLE AUTORITA' NAZIONALI, INFORMAZIONI PERTINENTI SULLA QUASI MACCHINA IT UNDERTAKES TO TRANSMIT, IN RESPONSE TO A REASONED REQUEST BY THE NATIONAL AUTHORITIES, RELEVANT INFORMATION ON THE PARTLY COMPLETED MACHINERY

PERSONA AUTORIZZATA A COSTITUIRE LA DOCUMENTAZIONE TECNICA PERTINENTE PERSON AUTHORIZED TO PRODUCE THE RELEVANT TECHNICAL DOCUMENTATION	**SCM GROUP SPA – VIA EMILIA N° 77** **I - 47921 RIMINI (RN) - ITALY**

IL RAPPRESENTANTE DELEGATO DEL FABBRICANTE

MANUFACTURER'S DELEGATED REPRESENTATIVE

RIMINI,

[IT] LINGUA ORIGINALE DICHIARAZIONE
[EN] TRANSLATION OF THE DECLARATION ORIGINAL LANGUAGE

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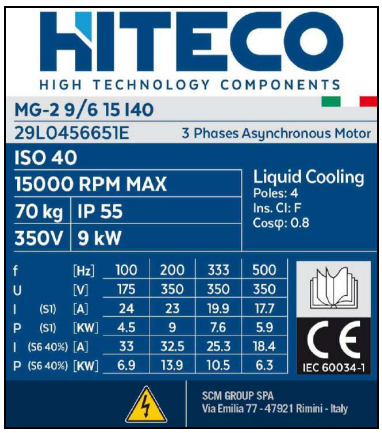
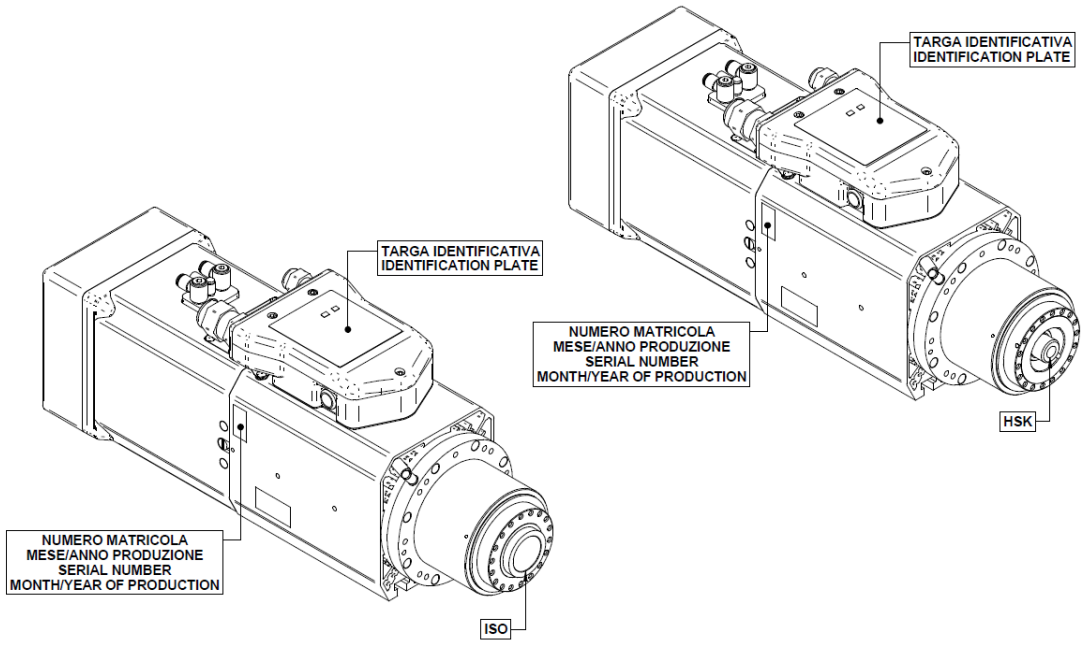
1.1 Machine identification

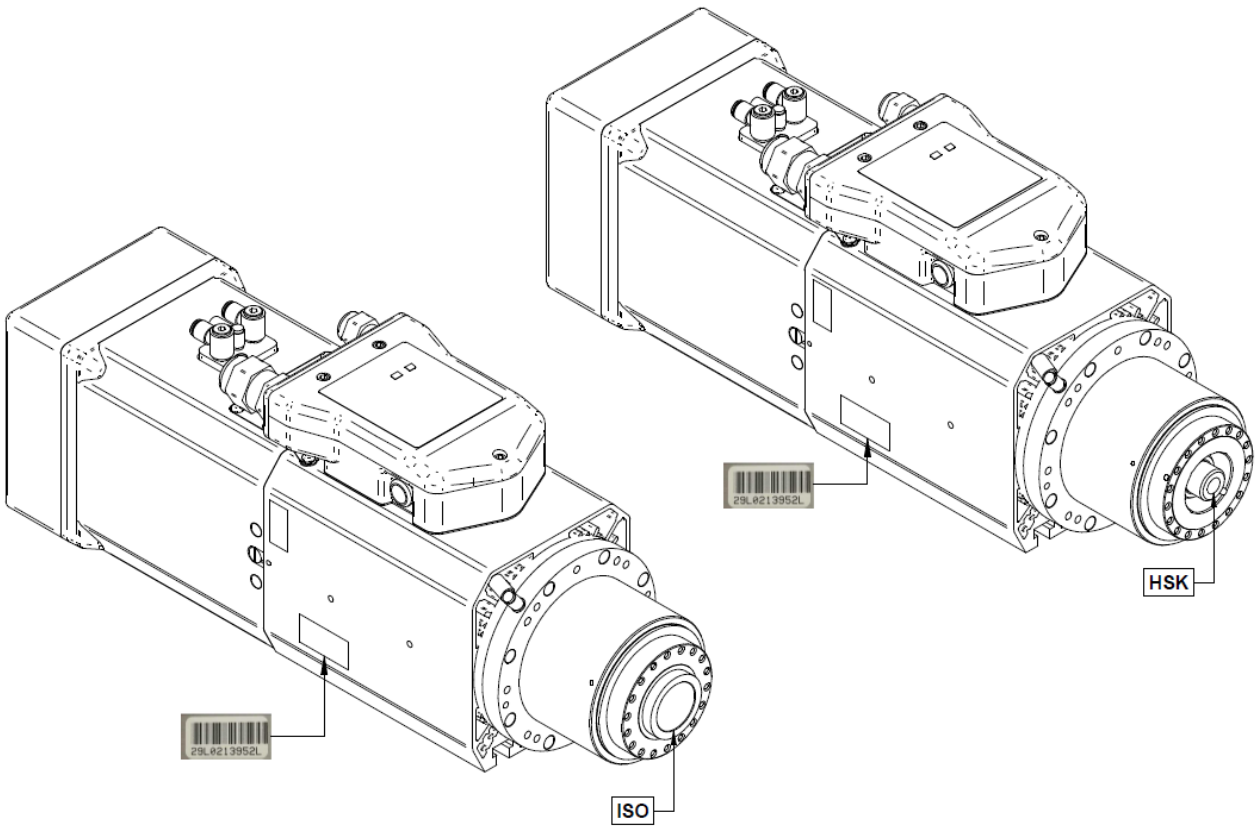
The plate shown in the figure contains the machine ID data: this must be provided every time one of our assistance centres is contacted.
The following information is shown:
Name - ASYNCHRONOUS 3-PHASE MOTOR
Brand - HITECO
Model - for example: ELETM MG-2 9/6 15 I40
Code - for example: 29L0456651E
Kg - WEIGHT (Kg)
Main electromechanical data: frequency (Hz), voltage (V), current (A), power (kW).
The serial number, the month/year of machine production are shown on the electrospindle body, in the point indicated in the figure. The serial number consists of 2 letters, followed by 4 numbers (see example in the figure).

Identification plate (example)	Serial number (example)
	



BARCODE, DO NOT REMOVE.

Barcode (example)



1.2 Intended use

The electrospindle is a partly completed machinery designed to be incorporated in machines for machining light alloys, wood and materials with similar physical specifications and fr professional use.
The electrospindle is not suitable for use in areas classified as potentially explosive atmospheres, according to the Directive 99/92/EC.
The electrospindle:
- must be powered with sinusoidal electricity supplied by a static frequency converter or inverter;
- it must be used only with tool holders and tools balanced in group in grade G2.5 at the maximum operating speed or higher, according to the standard ISO 1940/1;
- it must be fitted exclusively with tool holders:
  - HSK models: HSK tool holders with dimensions and tolerance according to DIN 69893;
  - ISO models: ISO tool holders with dimensions and tolerance according to DIN 69871-1;
  - meet all the specifications set out in chap. 2 paragraph 2.7;

The operator must select the rotation speed of the electrospindle so that it is LOWER :
- than the maximum rotation speed permitted for the tool;
- than the maximum rotation speed permitted for the tool holder;
- than the maximum speed of the electrospindle;
- than the maximum rotation speed permitted for the electrospindle set out in the table in chap. 2 paragraph 2.8.2 based on the material and size of the tool used.

The machine:
- must have an interlock between the electrospindle start function and the safety of the tool change performed;
- must have an interlock between the tool change function and the actual braking of the rotating unit;
- must cut off the electrospindle power supply in case of alarm or emergency; the power supply must be restored manually.

The manufacturer will in no way be responsible for faults caused to the electrospindle or the machine that it is installed in, due to incorrect application or design choices.

1.3 Risks connected to using the product

HITECO does not know and cannot know the product installation methods, therefore the installer or the final customer must carry out a risk assessment specifically for the installation method and type.
In any case the installer must guarantee that there is an adequate degree of protection against the risk of accidental contacts with moving parts.
The installer and the user must also bear in mind other types of risk, in particular, those due to the entrance of foreign bodies and conveying explosive, flammable or toxic gases at high temperature.
Moreover the risk inherent the maintenance operations must be considered, as the operations mus be carried out in maximum safety conditions, with the product cut off and the certainty that the tool is stopped.
At the end of the choices made and based on the product installation method defined and applied by the installer and/or customer, the definitive machine can be considered a finished machine, according to the machinery directive. An overall risk assessment must be carried out a declaration of conformity must be drawn up, according to attachment IIA of directive 2006/42/EC.

1.4 UNINTENDED USE REASONABLY EXPECTABLE

- Use exclusively tool holders that comply with the standards indicated in this manual.
- Check that the conical surfaces of the tool holder engage with the electrospindle, are clean and are not damaged. In fact dirt and dents can compromise the perfect coupling between the tool holder and the electrospindle spindle. Clean the tool holder as indicated in chap. 7 paragraph 7.1. If there are any dents replace the tool holder.
- Always use perfectly sharp tools.
- Tighten the tool correctly in the tool holder.
- Do not damaged and/or imbalanced tools. The specifications on the balancing grade of the tool unit (tool holder taper+tool+fixing parts) are indicated in chap. 2 paragraph 2.8.

When using ting nuts and elastic collets to fix the tool in the tool holder, check that all the coupling surfaces are clean and without dents.

- The operator must select the rotation speed of the electrospindle so that it is LOWER :
  - than the maximum rotation speed permitted for the tool;
  - than the maximum rotation speed permitted for the tool holder;
  - than the maximum speed of the electrospindle;
  - than the maximum rotation speed permitted for the electrospindle set out in the table in chap. 2 paragraph 2.8.2 based on the material and size of the tool used.
- Before starting and using the electrospindle check that the rotation speed is the one selected previously.
- Never rotate the electrospindles with ISO or HSK tool taper without the tool inserted!

The feed speed of the machine axes on which the electrospindle is installed must be selected so that:

- it is suitable for the power available to the electrospindle;
- it is suitable for the requested degree of finish;
- doe not trigger dangerous vibrations on the machine and/or piece being machined.
- The compressed air circuit that feeds the electrospindle must be the one specified in chap. 4 paragraph 4.4.3. Make sure that the solenoid valves have single outlets and not shared with other solenoid valves. The outlet fitted on the solenoid valves must be able to guarantee a fast compressed air outlet and it be must be sized to ensure that it is not blocked due to dirt buildup.
- Check that the pipes of the compressed air circuit are nit crushed.
- Do not place the electrospindle in areas classified as potentially explosive atmospheres as defined by directive 99/92/EC.
- It is absolutely forbidden to neutralise, remove, change or render inefficient any safety, protection or control device of the individual parts and of the entire product.
- Do not insert hands, arms or any part of the body close to the moving parts.
- The product must not be used in potentially explosive atmospheres.
- Unauthorised operators must not eliminate any defects or faults in the operation of the product and/or alter the type of operation and installation.
- At at end of any unscheduled intervention that required the removal of guards, barriers or other protection, restore their operation before restarting the product, making sure that they are positioned correctly and that they are effective.
- All the protection and safety devices must be maintained in perfect and efficient conditions. The recommendation and danger warning plates must be kept fully operational and must not be removed.
- When troubleshooting any faults on the product adopt all the precautions described in the Instruction Manual, designed to prevent injuries to people or damaging property.
- Remember to tighten every screw, nut or fixing ring nut of each mechanical part subject to adjustments or setup.
- Before starting the product check that all the safety devices are installed and perfectly operational. If they are not it must not be started and the internal safety manager or the head of department must be informed immediately.
- The operator must be supplied with the legally required Personal Protection Equipment (PPE).

1.5 Specific risks with electrospindle in maintenance

To operate in safety on an Hiteco product installed on a machine refer to the machine's manual.
- Before proceeding with any maintenance operation make sure that the electrospindle spindle has stopped completely.
- Before proceeding with any maintenance operation disconnect the power cable and the signal cable from the power supply.

1.6 Aim of the manual

This manual is an integral part of the product and must remain with the product. If it is not the product is missing one of its essential safety requirements.
- This instruction manual is aimed at the following subjects:
  - Transport, handling and unpacking personnel
  - Personnel assigned to setting up the systems and installation site
  - Installers
  - Machine operators
  - Maintenance personnel
  - Personnel assigned to installing or using the equipment must be qualified and therefore have the necessary technical knowledge to correctly interpret the safety standards and the use methods set out in this manual.

The warnings in this manual are designed to safeguard the safety of people exposed, against residual risks.
The instructions provide the indications on the most suitable behaviour for the correct use of the product, as indicated by the manufacturer.
In order to prevent incorrect operations that could cause danger to people and/or damage the product it is important to read an understand all the document ion supplied with the product.
The instruction manual indicates the manufacturer's intended use.
The instruction manual must be stored with utmost care and always be made available for consultation. If necessary, make copies of the pages that will be used directly on the machine.
Even though the instructions in this manual are detailed, a certain knowledge of the machining procedure is required to obtain the maximum performance.
HITECO reserves the right to make all changes it deems necessary, without warning or replacement.

1.7 General warnings

- Do not perform operations or manoeuvres unless you are completely certain of their effect.
  If you have any doubts contact the closest technical support service or the manufacturer directly.
- The manufacturer shall not be responsible for any damage caused to the machine or property, in the following cases:
  - improper use
  - use of unsuitable personnel
  - incorrect assembly and installation
  - defects in the system
  - unauthorised changes or interventions on the machine
  - use of non-original spare parts
  - non compliance with the regulations set out in this manual
  - exceptional events.

1.8 Carrier and handling warnings

Always check that the handling and transport equipment and machinery is suitable. Check the weight of the electrospindle on the identification plate (see chap. 1 paragraph 1.1).

1.9 Preparation for Installation

- The installation must be carried out by qualified personnel.
- The parts of the control system, inverter and all the electrical, hydraulic and compressed air connections are the responsibility of the installer. They must check the perfect operation of the whole system before starting the equipment. If there are any doubts contact HITECO directly or an authorised support centre.
- The systems must be executed correctly before installing the machine.
- The electrospindle is a device designed to be inserted in other machinery, after having carried out the necessary interventions and protections to remove the risks that can arise during the machining.
- When preparing the installation location take into account the space and work conditions in order to reduce as much as possible noise, fatigue, discomfort and anything else that could affect the assigned personnel negatively.
- When deciding the installation location leave sufficient space for the control, maintenance, cleaning and removal of material residue from machining waste.
- Place effective warning close to the machine to ensure that unauthorised personnel cannot operate close to the work area necessary for the machining cycle.
- Provide adequate lighting of the work station to ensure the best working conditions for the assigned personnel.

1.10 Warnings for the assigned personnel

- The machine must be used with the adequate personal protection equipment.
- The machine must be used exclusively as described in this manual.
- The machine can only be used by personnel who have read the regulations described in this manual.
- Check the process phases often and avoid at all cases, during machining, contact with the sharp parts and moving parts.
- When disassembling and replacing tools, used adequate personal protection equipment (gloves.
- During the operation there are live parts. The incorrect access to these parts or the non-compliance with the safety recommendations could generate a danger for people or the machine.

N.B.: The use of certain personal protection equipment may be necessary based on the type of material and work conditions.

1.11 Instructions for maintenance

- Any maintenance operation must be carried out by qualified personnel, with the machine stopped and disconnected from the electrical and compressed air supply.
- Always close all the cut off valves upstream of the machine.
- When cleaning painted parts do not use solvents or alcohol, as they could damage the surface.

1.12 Meaning of the symbols

GENERIC DANGER ***It indicates a procedure, activity or action that, if not carried out correctly or complied with, can cause injuries to people.***

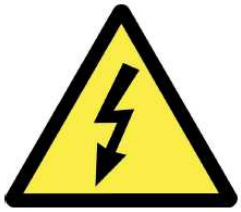
WARNING! ***It indicates a procedure, activity or action that, if not carried out correctly or complied with, can damage or destroy completely the product.***

INFORMATION ***It indicates general information that must not be ignored.***

1.13 Description of the safety signals and their location

INFORMATION REQUIRED

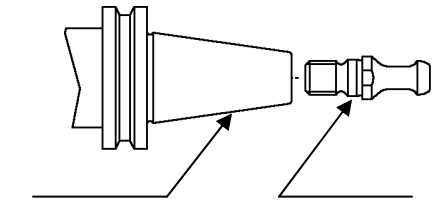
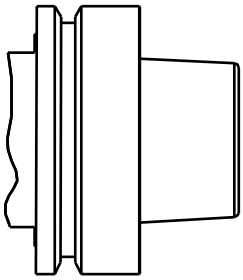
Indicates that before using the machine, you must read the instruction manual and understand all its parts. Symbol position: on the electrospindle identification plate.



DANGEROUS ELECTRICAL CURRENT

Set the main electrical switch to zero and padlock it before performing operations on the parts with this symbol.
Symbol position: on the electrospindle electrical connection

1.14 Glossary

ISO30		System used to clamp the tool to the spindle of the electrospindle described in standard DIN69871-1.
HSK	 **HSK taper – DIN 69893**	System used to clamp the tool to the spindle of the electrospindle described in standard DIN69893. The main specification of this type of clamping is that the tool is held with a gripper with petals that when they rotate increase the clamping force of the tool due to the centrifugal force. The presence of the clamping flange guarantees greater rigidity and positioning precision.
Dynamic balancing grade or class	Balancing quality value of a rotating object according to the standard ISO 1940/1, indicated by the letter G. Low G values indicate good balancing: the best balancing quality is G=0.4. Along with the balancing grade of the rotating object, the speed at which this performance is guaranteed must always be indicated.	
Operating frequency	Frequency of the fundamental component of the power supply current of the motor generated by the drive. Unit of measurement: Hz. It is linked to the empty rotation speed of the motor from the ratio n=60*f/p n= rotation speed in RPM f= operating frequency p= pairs of poles	
Nominal voltage	Maximum supply voltage expressed in V.	
Nominal frequency	Frequency at which the nominal voltage value is reached.	
Nominal specifications	Set of performance levels reached at the nominal frequency.	
Service S1	Operation at constant power of a sufficient duration to allow the motor to reach the thermal balance (see standard CEI EN 60034-1). Abbreviation: S1.	
Service S6	Value of the power produced by the motor that in a sequence of identical cycles including an operating time at constant load and an empty operating time without	

	load, allows the thermal balance to be reached. There are no breaks. Next to the S6 abbreviation there must be a percentage value of the operation under load percentage in relation to the cycle duration. Example: S6 60% indicates that for an operation cycle of 100, 60 is the percentage of operation under load at the power indicated, whilst for the remaining 40 the motor rotates empty, without load. See also standard CEI EN 60034-1.
Cooling liquid	Mixture consisting of water, anti-corrosion additive, anti-freeze and other components suitable to circulate inside the electrospindle, in order to remove the heat generated during its operation.
Planned maintenance	Set of operations to be planned in advance to maintain the ideal operating conditions of the product as indicated by the manufacturer. They are carried out as set out in this manual.
Inverter	Electrical power device that converts a fixed frequency and fixed voltage current in input in a variable frequency and voltage current in output with continuity. It is used to drive asynchronous motors.

1.15 Warranty conditions

1.15.1

For any faults in the supply, the warranty for manufacturing defects of the components with a duration of 12 months, and in any case not greater than 1,800 work hours, applies.

1.15.2

The warranty begins from the component registration date with Hiteco.
The life of the component is calculated from the registration date to the date it returns to the Hiteco plant (with ref. ddt).
After the aforementioned period the warranty will no longer be provided in any form and for any reason and without Hiteco having to provide any explanation.
The warranty consists, at Hiteco's unquestionable discretion and judgement, of repairing or replacing the components, at Hiteco's care and expense, that are broken or faulty, at the Hiteco plant, exclusively for product manufacturing defects and taking into account the correct use of the product. The eventual repair/replacement in warranty will be carried out without Hiteco recognising any charges undertaken by the purchaser for any technical support activities. The return of parts delivered in replacement will be Ex Works (Incoterms 2010).

1.15.3

Hiteco may require the purchaser to return the faulty components replaced for a check and eventual acknowledgement of the warranty.

1.15.4

Faults due to normal wear and tear of those parts that, due to their nature, are subject to a quick and continuous wear are not covered by the warranty (e.g.: seals, belts, bearings, etc.). In particular Hiteco does not guarantee a fixed duration in hours of the bearings, as this depends on various factors such as: the balancing grade of the tools, the type of machining, collisions and/or mechanical stresses greater than the values indicated by the manufacturer or that depend on the specific application. Damage caused by chemical influences or following the transport or storage at the purchaser or the final user is not covered by the warranty.
Moreover Hiteco is not responsible for damage or deterioration of any nature caused by the unintended use or use not indicated in the Use and Maintenance Manual and in any case due to an incorrect use or treatment of the Hiteco product, due to the continued use of the components when there are operational problems or in any case due to any cause not attributable to Hiteco, including the non-compliance by the purchaser, with the regulations for storing the components according to the standard: see chap. 3 paragraph 3.6.

1.15.5

The warranty is declared void when equipment or spare parts not supplied by Hiteco are installed on the components and in any case, when parts have been changed or replaced without Hiteco's written approval or if interventions and/or tampering has been carried out by unauthorised personnel.

1.15.6

Hiteco is not responsible for any type of damage (including but not limited to damage to the physical integrity, as well as damage due to losses or lost earnings, interruption of the activity, loss of information or any other economic losses) that could be due to the use of Hiteco products, even if Hiteco has been warned of the possibility of such damages. The purchaser is exclusively responsible for guaranteeing that the products machined with components supplied by Hiteco comply with the applicable safety standards and in any case is responsible for any claims for any damages and will indemnify Hiteco.

1.15.7

The warranty is subject, under penalty of withdrawal, to the fault or the lack of quality being reported in writing by the purchaser to Hiteco within 8 days from the moment the purchaser discovers it, as well as the express written request to Hiteco for the intervention under warranty. Moreover the purchaser will no longer be eligible for the warranty if he does not allow Hiteco to perform every control requested or if, when the supplier requests the faulty part, the purchaser does not return it within two weeks from the request, or if he carries out any repair not expressly authorised by Hiteco.

1.15.8

This warranty does not cover any further damages, including those due to a lost or reduced production, as well as any indirect and consequential damages, and the rescission of the contract, also if Hiteco has been warned of the possibility of such damages.

1.15.9

Dimensioned drawings and photographs are supplied only by way of example, as reference for an easier understanding of the text. The company, due to its policy of constant development and update of the product, reserves the right to change the functional and aesthetic specifications, make changes to the drawing of any functional and accessory part, or suspend the production and supply, without having to provide any type of notice or incurring any obligation. Moreover Hiteco reserves the right to many any structural or functional change, as well as change the supply of spare parts and accessories, without having to provide any type of notice for any reason.

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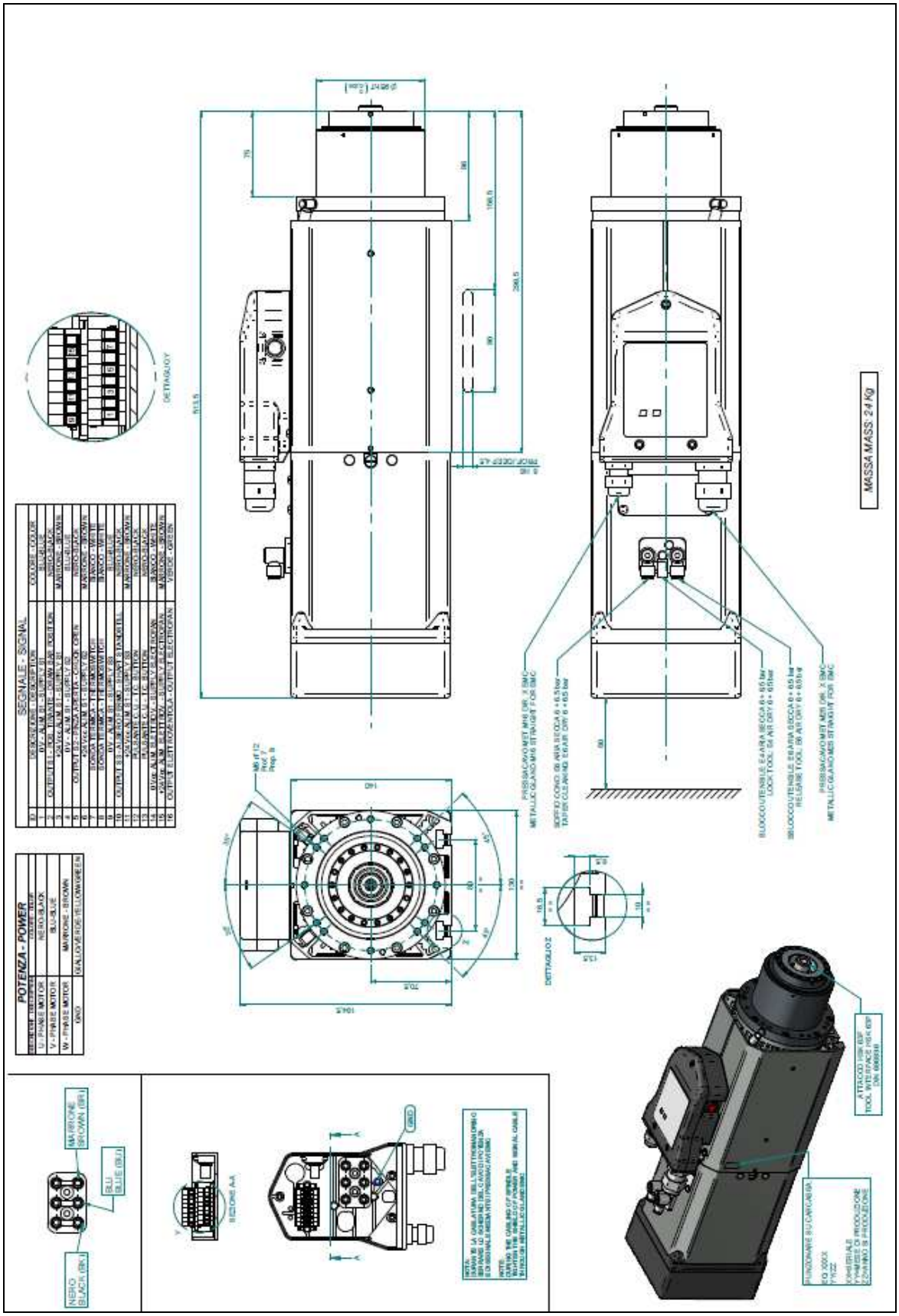
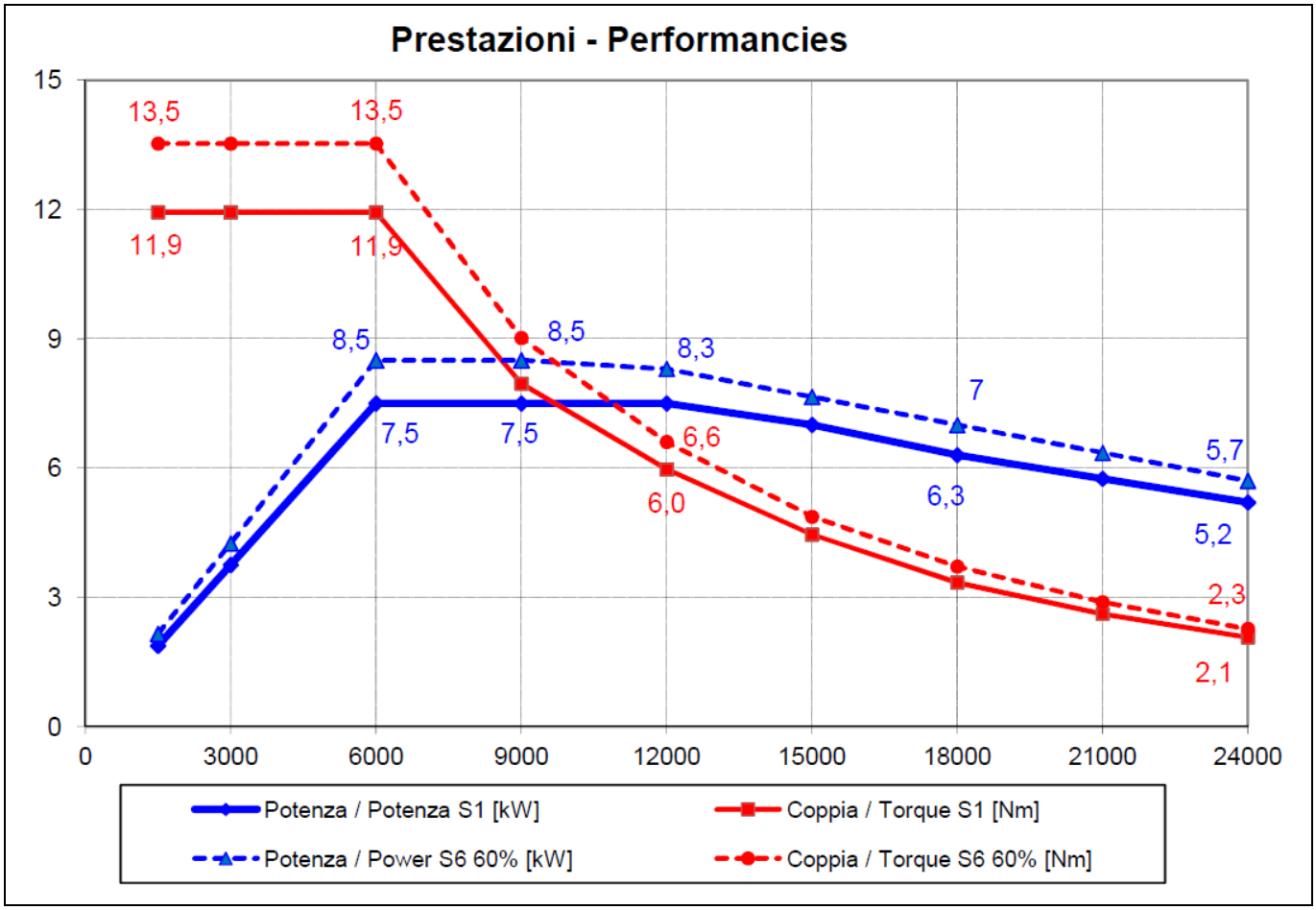
2.1 Electrospindle lay-out



2.2 Mechanical specifications and electrospindle performance



Tensione / Tension	[V]	190	380	380	380
Numero giri / Nominal speed	[RPM]	3000	6000	12000	24000
Frequenza / Frequency	[Hz]	100	200	400	800
Servizio S1 / Service S1					
Potenza S1 / Power S1	[kW]	3.8	7.5	7.5	5.2
Coppia S1 / Torque S1	[Nm]	11.9	11.9	6.0	2.1
Assorbimento S1 / Current S1	[A]	19	19.5	14.2	13
Servizio S6 (60%) / Service S6 (60%)					
Potenza S6 60% / Power S6 60%	[kW]	4.3	8.5	8.3	5.7
Coppia S6 60% / Torque S6 60%	[Nm]	13.5	13.5	6.6	2.3
Assorbimento S6 60% / Current S6 60%	[A]	21.5	21	16	13
Numero di poli / number of poles	4				
Cosφ	0.89				
Classe di isolamento / Insulation class	F				
Raffreddamento / cooling	Aria /Air Ta=20°C				

The motor power supply voltage must be supplied by an inverter with frequency PWM minimum of 8 kHz. Check that the actual power supply voltage is within the range ± 5% in relation to the indicated values.

The wave shape PWM of the power supply voltage must have values of dV/dt<2 kW/[u]s.
If not an an inductance-filter must be inserted between the inverter and the electrospindle that can flatten such voltage peaks that are harmful for the stator windings.
The inductance must be sized as follows:
- Impedance value: 0.045 mH on the 3 phases.
- Operating voltage: 400V
- Maximum operating frequency: 1000 Hz
- PWM switching frequency: 8 kHz
- Flow value in current: higher than the maximum operating current considering the most demanding service (S1 or S6).
- Maximum length of the wiring cables: 40 m

The inverter must be programmed so that the value of the maximum continuative current is the same as the maximum current value between the aforementioned values in the "Current" line, based on the type of service selected.

In order to prevent dangerous overloads, set the values of the maximum current or the maximum torque that can be generated by the inverter at no more than 140% of the nominal current or nominal torque values. This means allowing a maximum overload of 40% beyond the nominal values.

2.3 Inverter speed parameter setting

For this type of electrospindle the main parameters for the inverter setting are described below.

29L0385638C ELETM electrospindle. QE-1F 7.5/6 24 63F NC CB

Parameters	Unit of measurement	Default
Number of poles	(-)	4
Nominal voltage	(V)	380
Nominal frequency	(Hz) (V)	200Hz 380 V
Nominal supply current for S1	(A)	19.5
Power for S1	(kW)	7.5
Nominal supply current S6	(A)	21
Power for S6	(kW)	8.5
Current peak	(A)	27.3
Maximum frequency	(Hz)	800
Power factor	(-)	0.89

In order to prevent dangerous overloads, set the values of the maximum current or the maximum torque that can be generated by the inverter at no more than 140% of the nominal current or nominal torque values. This means allowing a maximum overload of 40% beyond the nominal values.

2.3.1 Installation Parameters

PARAMETRI INSTALLAZIONE AC / INSTALL PARAMETER AC / EINSTELL PARAMETER AC

Electrospindle: 29L0385638C

Data / date / datum: 18/12/2018 rev. 00

Descrizione	Simbolo	Unità misura	Valore	SINAMICS	SIMODRIVE 611 D/U	SIMODRIVE 611 A
Potenza nominale / rated power / nennleistung (S1)	P_N	kW	7,5	P0307	P1130	P160
Corrente nominale / rated current / nennstrom (S1)	I_N	A	17	P0305	P1103	P161
Tensione nominale concatenata / rated line voltage / nennspannung	U_N	V	380	P0304	P1132	P162
Velocità nominale al carico nominale / rated speed at rated load / nenndrehzahl bei nennlast	n_N	RPM	7020	P0311	P1400	P163
Frequenza nominale / rated frequency / nennfrequenz	f_N	Hz	240	P0310	P1134	P164
Fattore di potenza / power factor / leistungsfaktor	$\cos\phi$	-	0,80	P0308	1129	-
Tensione a vuoto concatenata / no load line voltage / leerlaufspannung bei nennflussu	U_0	V	360	-	P1135	P165
Corrente a vuoto / no load current / leerlaufstrom	I_0	A	9,5	P0320	P1136	P166
Resistenza dello statore / stator resistance / standerwiderstand kalt (20°C)	R_1	Ω	0,224	P0350	P1137	P167
Resistenza del rotore / rotor resistance / lauferwiderstand kalt (20°C)	R_2'	Ω	0,252	P0354	P1138	P168
Reattanza di dispersione dello statore / stator leakage reactance / standerstreureaktanz	$X_{1\sigma}$	Ω	0,805	-	P1139	P169
Induttanza di dispersione dello statore / stator leakage inductance / Standersteuinduktivitat	$L_{1\sigma}$	mH	0,533	P0356	-	-
Reattanza di dispersione del rotore / rotor leakage reactance / Lauferstreureaktanz	$X_{2\sigma}'$	Ω	0,861	-	1140	P170
Induttanza di dispersione del rotore / rotor leakage inductance / Laufersteuinduktivitat	$L_{2\sigma}'$	mH	0,57	P0358	-	-
Reattanza del campo principale / main field reactance / hauptfeld reaktanz	X_h	Ω	23,5	-	P1141	P171
Induttanza del campo principale / main field inductance / hauptfeld induktivitat	L_h	mH	15,5	P0360	-	-
Velocità di desaturazione / upper speed Xh-characteristic / Entsattigungsdrehzahl	n_s	RPM	13000	-	1143	-
Velocità di inizio indebolimento del campo / start of field weakening speed Einsatzdrehzahl feldschwachung	n_{fs}	RPM	7000	P0348	P1142	P173
Velocità massima del motore / maximum speed / maximaldrehzahl	n_{max}	RPM	24000	P0322	P1146	P174
Grado di saturazione / gain factor Xh-characteristic / entsattigungsgrad	K_2	%	142	-	1144	-
Fattore di riduzione della coppia di inversione / stall torque reduction factor / Kippmomentreduktionsfaktor	K_M	%	100	-	1145	-
Momento di inerzia del rotore / moment of inertia	J	Kg m^2	2,06E-03	P0341	P1117	P59
Collegamento / circuit connection / schaltungsart	Y or D	-	Y	-	-	-

Dati motore / motor data / motordaten

Velocità / speed / drehzahl	n	RPM	7020
Frequenza / frequency / frequenz	f	Hz	240
Potenza / power / leistung S1	P	kW	7,5
Corrente / current / strom S1	I	A	17
Potenza di picco / peak power / spitzenleistung	Ppeak	kW	18

_ In according to Siemens requirement all the parameters are given for a motor with star connection Y even if the motor circuit connection is triangle D.
_The moment of inertia is related to the electrospindle only, without any tool.

2.4 Noise emission level

(2.4 45f ce)

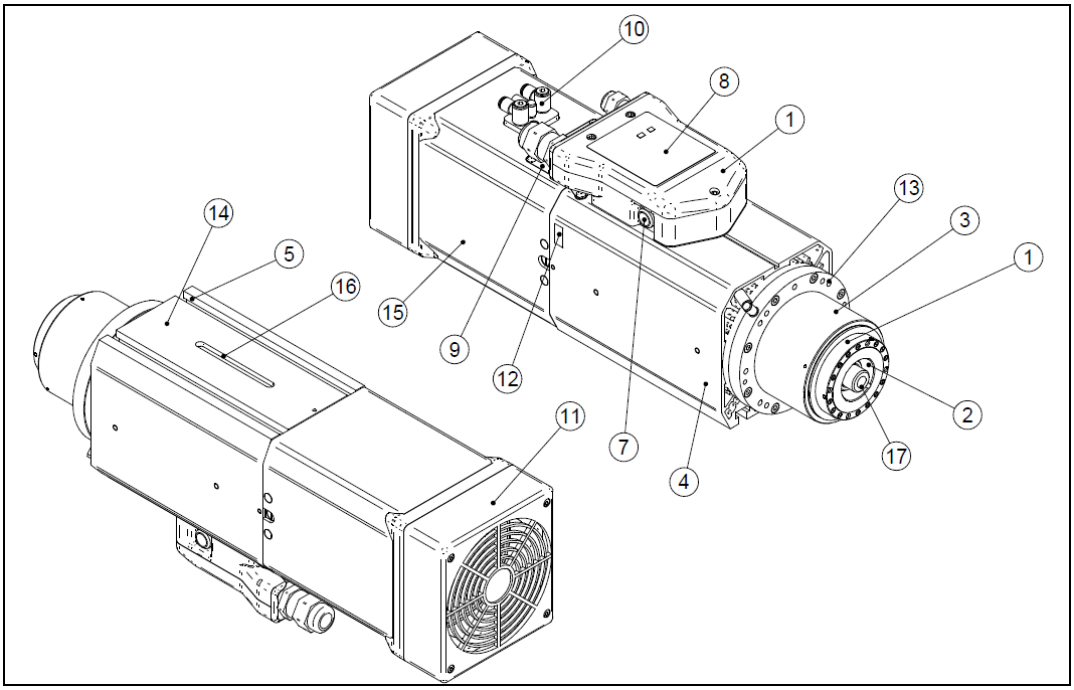
Hiteco, manufacturer of the electrospindle, declares:

Electrospindle model	Series	Noise emission level
QE-1F 7.5/6 24 63F NC CB	Powertech 400	73.6 dB(A) at 24000 RPM

The noise emission level declared above has been measured in semi-anechoic chamber in compliance with standard ISO 3744 2010, in the operating conditions UNI EN ISO 1680:2001.

The noise emission values above refer to the electrospindle when new at the state it is delivered.

2.5 Main parts



Pos.	Description
1	Electrospindle
2	HSK tool taper mounting
3	Nose
4	Casing
5	“T” shaped grooves for clamping
6	Electrical connection
7	Manual release pushbutton
8	Identification plate
9	Sensors compartment
10	Pneumatic connectors
11	Electrofan
12	Electrospindle serial number
13	Aggregates clamping threaded holes
14	Electrospindle clamping table
15	Block/release cylinder
16	Tab groove
17	HSK toolholder

2.6 Device for locking and toolholder expulsion

The electric spindle is equipped with HSK 63F collet to grip the toolholder.
During the working the collet is hold open by a pack of cup springs

Electrospindle model	Axial force on tool	Axial force on coil springs	Toolholder disengagement
HSK 63F	11 kN	3100 N	10,8±0,1 mm

During the electrospindle life the efficiency of the disc washer stack can decrease due to the degradation of the frictional behaviour (vibrations, heat) and to the mechanical wear of the springs. As a consequence the pull-in force generated on the tool decreases. It is required to check the pull-in force generated on the tool afther 500000 tool change cycle. The inspection has to be made afther clieaning and lubricating the collet in according to the procedure showed on chap.7 "Planned maintenance" If the pull-in force is lower than 8 kN AFTHER cleaning and lubrication of the collet the electrospindle as to be send to the service for inspection. The inspection have to be performed by a trained technician designated by Hiteco.
Passed the 500000 tool change cycles the pull-in inspection have to be performed each 150000 cycles.

IF THE PULL-IN FORCE INSPECTIONS AREN'T COMPLY WITH SERIOUS ACCIDENTS OR ELECTROSPINDLES MALFUNCTIONS MAY OCCOUR.

To get the optimal axial force to hold the tool, keep the instructions for cleaning and lubricating the electric spindle collet and all toolholder tapers see Chapter 7 "Programmed maintenance".
The toolholder loosening occurs by a pneumatic cylinder with double effect with double loosening hamber and single return chamber. During the working the cylinder stem is lifted by the rotating part of the electric spindle, so the tool is hold by the springs pack above mentioned.

2.7 Tool

(6.5 21e ce)
The balancing degree of the tools must meet the requirements indicated in par.2.8 when they are fitted as a unit to the toolholder.

The dynamic balancing degree of the tools must be G=1 mm/s (Norm ISO 1940) at the highest speed indicated by the manufacturer on the tool according to Norm 847-1.

The total mass of the tool (taper+tool+fastening elements) can't exceed 10 Kg.

Keep the following prescriptions:
- always use sharp tools;
- clamp the tool in the relative toolholder in the proper way;
- do not use damaged and/or unbalanced tools ;
- if ring nuts and elastic collets areused to clamp the tool in the toolholder, make sure that all coupling surfaces are clean and free from dents.

For selecting the tool form:
- reduce the tool length as much as possible;
- reduce the distance of the cutting edges from the rotation axis;
- use tools with body made of light alloy when possible, to reduce the mass.

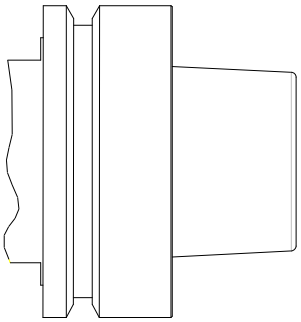
Select the tool speed according to its dimensions by using the tables in par.

IF THE ABOVE REQUIREMENTS REGARDING THE ROTATIONAL SPEED SETTING AREN'T COMPLY WITH SERIOUS ACCIDENTS OR ELECTROSPINDLES MALFUNCTIONS MAY OCCOUR.

Select the feed speed so that:
- it is proper for the power available for the electric spindle;
- it is proper for the required finishing degree;
- no dangerous vibrations rise on the machine and/or on the workpiece during the working.

2.8 Toolholder unit (taper + tool + fastening elements)

(6.6 21e ce)



- HSK toolholder taper shall comply with the Norm DIN69893.
- The balancing is to be carried out with assembled toolholder unit (toolholder taper + fastening elements).
- At the highest tool use speed, the dynamic balancing degree of the toolholder unit shall be G 6.3 mm/s or better (see Norm ISO 1940).
- At the max speed of the tool the Value of the dynamic balancing of the toolholder group has to be less than G 2,5 mm/s or better (see standard ISO 1940).

⚠

It is forbidden to use toolholder units which do not comply with the conditions above mentioned: if these instructions are not kept, the tool rupture and ejection with dangerous risks for the user are possible.

- Keep the conic surfaces of the toolholder and of its seat on the shaft del lean and lubricated to enable the safe fitting (see Chapter 7 - "Programmed maintenance").
- Avoid the contact of the non-cutting rotating parts with the workpiece being processed and/or present equipment.
- The inside part of the toolholder taper in the sfaft of the electric spindle shall always be protected against impurities. Eventually use an empty toolholder taper (see chapter 7 paragraph 7.1).
- After the work shift always remove the toolholder taper of the electric spindle and replace it with a toolholder taper at room temperature to protect the conic seat on the shaft from the external environment (see previous item).

⚠

Do not start HSK electric spindles if the the toolholder is not fitted. If these prescription is not kept, the collet for tool gripping may be damaged.

⚠

The use of tools clamped with ring nut and elastic collets for rotation speed over 24000 Rpm is not permitted.

2.8.1 Max. working speed according to the tool size

(6.7 21e ce)

Always use rotation and feed speed as well as tool diameter and length proper for the working.

The operator shall select the electric spindle speed in order that it is LOWER than:
- the max. permitted speed of the tool;
- the max. permitted speed of the toolholder;
- the max. electric spindle speed;
- the max. permitted speed of the electric spindle selected according to the tool type and dimensions.
This last value is obtained from the tables indicated in the following pages at cross of corresponding lines and columns according to:
- tool form (disk cutter - shank cutter);
- material of the tool body (steel or aluminium only in case of disk cutter);
- tool length;
- tool diameter.

The tables indicated below refer to the electric spindle performance and have been calculated with reference to NORMALIZED TOOLS.
The balancement tool requirements are presented in chapter 2 paragraph 2.7 and 2.8

IF THE ABOVE REQUIREMENTS REGARDING THE ROTATIONAL SPEED SETTING AREN'T COMPLY WITH SERIOUS ACCIDENTS OR ELECTROSPINDLES MALFUNCTIONS MAY OCCOUR.

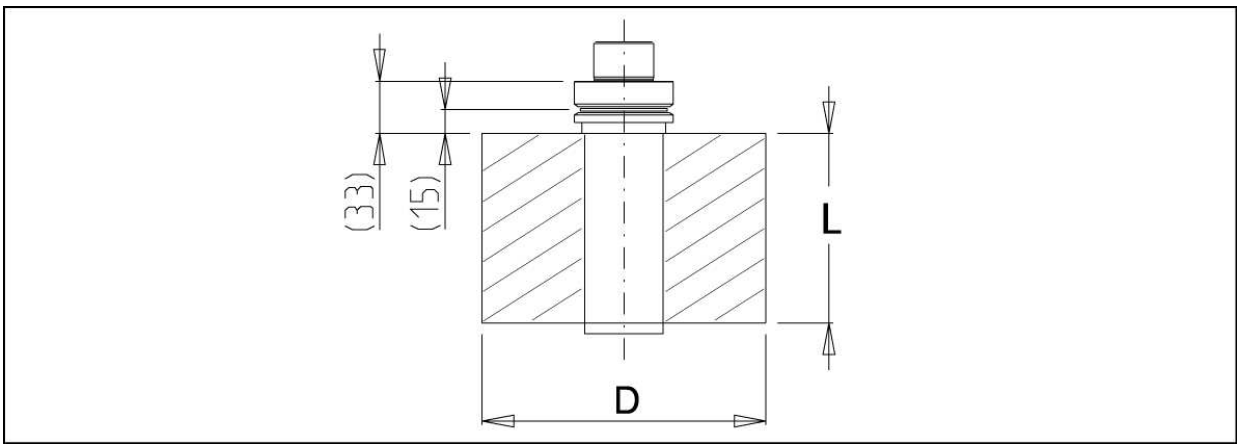
For calculation requirements the tables may indicate speed values exceeding the max. electric spindle speed. The rotation speed shall never exceed the max. electric spindle speed indicated on the identification plate.

The total mass of the tool (taper+tool+fastening elements) can't exceed 10 Kg.

The tables indicated below give the max. working speed of the electric spindle with tool to be compared wth the max.
permitted peed for th tool and for the electric spindle.
These values have been calculated by considering a safety coefficient.
Before beginning the working, preset the working by gradually increasing the rotation speed up to the value set and obtained according to the instructions already described.
After optimizing the rotation speed, you can gradually increase the feed speed to obtain the proper value by considering the required finishing degree, the power available for the electric spindle etc.

The values indicated in the tables are approximate: the user shall evaluate the highest speed which permits the safe working.

TOOL TYPE "A": DISK CUTTER



Steel cylindrical cutter, diameter tool holder d=30 mm, max. working speed [rpm] :

TABELLA T1 / TABLE T1

	90	100	110	120	130	140	150	160	170	180	190	200	210	220	D[mm]
40	21372	20148	18982	17883	16853	15891	14995	14161	13384	12662	11988	11359	10772	10223	
50	19844	18500	17262	16128	15091	14143	13275	12480	11750	11078	10458	9884	9353	8859	
60	18385	16976	15714	14584	13571	12659	11836	11090	10412	9793	9225	8704	8224	7780	
70	17008	15575	14321	13220	12247	11383	10610	9917	9291	8723	8205	7732	7298	6898	
80	15715	14289	13066	12008	11085	10273	9554	8912	8336	7816	7345	6915	6522	6161	
90	12767	11782	10903	10117	9414	8781	8212	7696	7227	6800	6409	6051	5720	5415	
100	11952	10958	10086	9320	8642	8039	7500	7015	6578	6182	5820	5490	5187	4908	
110	11170	10180	9328	8587	7939	7368	6862	6409	6002	5635	5301	4997	4719	4464	
120	10425	9452	8626	7917	7302	6764	6289	5867	5489	5150	4842	4563	4307	4073	
130	9722	8774	7979	7304	6723	6217	5774	5381	5032	4718	4434	4177	3943	3728	
140	8126	7445	6851	6330	5871	5463	5100	4774	4480	4214	3972	3751	3548	3362	
150	7658	6983	6401	5897	5456	5068	4724	4417	4141	3893	3667	3462	3274	3101	
160	7211	6545	5980	5494	5073	4705	4380	4092	3834	3602	3392	3201	3027	2867	
170	6785	6134	5588	5122	4722	4373	4067	3797	3555	3338	3143	2966	2804	2656	
180	6381	5749	5223	4779	4399	4070	3782	3528	3302	3100	2918	2753	2603	2465	
190	5906	5321	4834	4423	4071	3767	3501	3267	3059	2872	2704	2552	2414	2287	
200	5293	4798	4380	4023	3714	3446	3209	3000	2813	2645	2493	2356	2230	2115	
210	5011	4527	4122	3779	3484	3229	3004	2807	2630	2473	2330	2201	2084	1977	
220	4743	4272	3882	3552	3271	3028	2816	2629	2463	2315	2182	2061	1951	1850	
L[mm]															

TABELLA T1 / TABLE T1

	230	*240*	*250*	*260*	*270*	*280*	*290*	*300*	*310*	*320*	*330*	*340*	*350*	*D[mm]*
40	9709	9227	8775	8350	7951	7576	7223	6891	6578	6282	6004	5742	5494	
50	8400	7972	7572	7198	6848	6520	6212	5923	5651	5396	5155	4928	4715	
60	7368	6986	6631	6299	5990	5700	5429	5175	4936	4712	4502	4303	4117	
70	6528	6186	5868	5573	5298	5040	4800	4575	4364	4166	3980	3805	3640	
80	5828	5521	5236	4972	4726	4496	4282	4081	3893	3717	3551	3396	3249	
90	5133	4871	4627	4400	4188	3990	3804	3630	3467	3313	3169	3032	2904	
100	4650	4411	4189	3983	3791	3612	3444	3286	3139	3000	2870	2747	2632	
110	4228	4010	3809	3621	3447	3284	3132	2989	2856	2730	2612	2501	2397	
120	3858	3659	3475	3305	3146	2998	2859	2730	2609	2495	2388	2287	2192	
130	3531	3350	3182	3026	2881	2746	2620	2502	2392	2288	2191	2099	2013	
140	3190	3031	2883	2746	2618	2499	2387	2282	2184	2091	2004	1922	1845	
150	2943	2796	2660	2533	2416	2306	2203	2107	2017	1932	1852	1777	1706	
160	2720	2585	2459	2343	2234	2133	2039	1950	1867	1789	1716	1647	1582	
170	2520	2395	2279	2171	2071	1978	1891	1810	1733	1661	1594	1530	1470	
180	2339	2223	2116	2017	1924	1838	1758	1683	1612	1546	1484	1425	1369	
190	2171	2064	1966	1874	1789	1710	1636	1566	1501	1440	1383	1329	1277	
200	2010	1912	1822	1739	1661	1588	1521	1457	1397	1341	1289	1239	1192	
210	1878	1787	1703	1626	1553	1486	1423	1364	1308	1256	1207	1161	1117	
220	1758	1673	1595	1523	1455	1392	1333	1278	1227	1178	1133	1090	1049	
L[mm]														

Aluminium cylindrical cutter, tool holder diameter d=30 mm, max working speed [rpm]:

TABELLA T2 / TABLE T2

	90	100	110	120	130	140	150	160	170	180	190	200	210	220	D[mm]
40	25240	24514	23756	22977	22186	21391	20599	19816	19047	18294	17560	16848	16158	15492	
50	24480	23561	22630	21700	20781	19881	19007	18161	17347	16566	15818	15104	14422	13772	
60	23652	22554	21472	20421	19408	18439	17517	16642	15815	15033	14294	13598	12941	12321	
70	22770	21509	20302	19159	18083	17074	16132	15253	14432	13667	12953	12285	11661	11077	
80	21843	20442	19136	17929	16816	15792	14850	13983	13184	12447	11765	11133	10546	10001	
90	16478	15694	14927	14185	13473	12795	12152	11544	10969	10428	9918	9438	8986	8560	
100	15941	15064	14228	13436	12692	11994	11343	10734	10167	9638	9143	8682	8250	7846	
110	15374	14416	13523	12695	11930	11225	10574	9975	9421	8908	8434	7994	7585	7204	
120	14785	13757	12821	11969	11195	10491	9850	9265	8729	8238	7786	7369	6983	6626	
130	14181	13097	12129	11265	10492	9797	9171	8605	8091	7622	7194	6800	6438	6104	
140	10889	10281	9704	9160	8650	8174	7731	7319	6935	6578	6246	5936	5647	5377	
150	10546	9891	9281	8717	8196	7717	7276	6869	6494	6148	5828	5531	5256	4999	
160	10191	9495	8859	8281	7756	7278	6842	6445	6081	5747	5440	5157	4896	4653	
170	9828	9097	8443	7857	7332	6859	6432	6046	5695	5375	5082	4813	4565	4336	
180	9461	8702	8035	7447	6926	6461	6046	5672	5335	5029	4750	4495	4261	4045	
190	8772	8066	7446	6900	6416	5986	5602	5256	4944	4661	4404	4169	3953	3754	
200	7571	7035	6550	6113	5719	5363	5041	4747	4480	4236	4012	3806	3616	3441	
210	7323	6765	6270	5830	5437	5085	4769	4484	4225	3990	3776	3579	3398	3231	
220	7074	6499	5997	5555	5166	4820	4512	4236	3986	3761	3555	3368	3196	3038	
L[mm]															

	230	240	250	260	270	280	290	300	310	320	330	340	350	D[mm]
40	14850	14232	13638	13068	12522	11998	11498	11019	10563	10127	9711	9315	8938	
50	13154	12565	12004	11472	10965	10484	10027	9594	9182	8791	8420	8067	7733	
60	11735	11183	10662	10169	9704	9265	8849	8457	8085	7734	7402	7088	6790	
70	10530	10017	9535	9083	8657	8257	7880	7525	7190	6874	6576	6294	6028	
80	9493	9019	8576	8161	7773	7408	7066	6745	6442	6157	5889	5636	5397	
90	8159	7781	7424	7088	6770	6470	6186	5919	5665	5426	5199	4984	4780	
100	7468	7113	6780	6467	6172	5895	5634	5388	5155	4936	4729	4533	4347	
110	6849	6518	6208	5917	5645	5389	5149	4922	4709	4508	4319	4140	3970	
120	6294	5985	5697	5428	5177	4941	4720	4512	4316	4132	3959	3795	3640	
130	5795	5508	5241	4992	4760	4542	4339	4148	3968	3799	3640	3490	3349	
140	5124	4887	4665	4456	4260	4076	3902	3738	3583	3437	3299	3168	3044	
150	4761	4538	4329	4134	3951	3779	3617	3465	3321	3186	3058	2937	2822	
160	4428	4219	4023	3841	3670	3510	3359	3218	3085	2959	2840	2728	2622	
170	4124	3928	3745	3574	3415	3265	3125	2994	2870	2754	2644	2540	2442	
180	3846	3662	3490	3331	3182	3043	2913	2791	2676	2568	2466	2369	2278	
190	3570	3400	3242	3095	2958	2830	2710	2597	2492	2392	2298	2209	2125	
200	3278	3126	2985	2854	2731	2615	2507	2405	2310	2219	2134	2053	1977	
210	3077	2934	2801	2678	2562	2454	2352	2257	2167	2082	2003	1927	1856	
220	2892	2757	2632	2515	2407	2305	2210	2120	2036	1957	1882	1812	1745	
L[mm]														

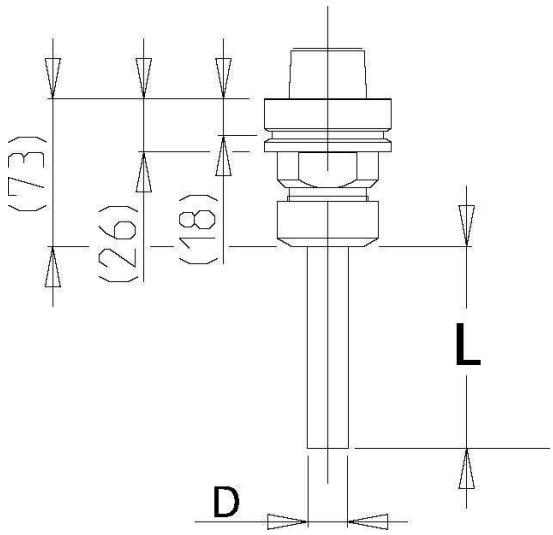
Cylindrical cutter made of steel+ aluminium , max. working speed [rpm] :

TABELLA T3 / TABLE T3

	90	100	110	120	130	140	150	160	170	180	190	200	210	220	D[mm]
40	22708	21610	20535	19494	18496	17545	16643	15791	14986	14228	13514	12841	12207	11610	
50	21372	20113	18921	17802	16758	15787	14885	14048	13270	12547	11875	11248	10664	10118	
60	20044	18674	17414	16262	15211	14251	13373	12570	11833	11155	10529	9952	9416	8919	
70	18745	17305	16016	14863	13828	12899	12059	11299	10608	9978	9400	8870	8381	7930	
80	17487	16013	14724	13591	12590	11702	10908	10195	9552	8969	8438	7953	7507	7097	
90	13919	12957	12077	11275	10544	9878	9270	8715	8206	7738	7308	6911	6543	6203	
100	13145	12147	11254	10454	9736	9089	8506	7977	7496	7058	6656	6287	5947	5633	
110	12383	11366	10474	9686	8989	8368	7812	7312	6860	6450	6077	5735	5421	5132	
120	11641	10621	9739	8973	8301	7709	7182	6712	6289	5907	5560	5244	4955	4689	
130	10926	9913	9052	8312	7670	7108	6612	6171	5776	5421	5100	4807	4541	4296	
140	8939	8254	7644	7099	6611	6174	5780	5424	5101	4807	4538	4291	4064	3855	
150	8482	7788	7179	6643	6169	5747	5371	5032	4727	4450	4197	3967	3755	3561	
160	8036	7340	6739	6215	5757	5353	4994	4673	4385	4125	3888	3673	3476	3295	
170	7604	6912	6323	5815	5375	4989	4648	4344	4073	3829	3608	3407	3223	3055	
180	7189	6506	5932	5442	5020	4653	4330	4044	3789	3560	3353	3165	2994	2838	
190	6655	6022	5490	5037	4646	4307	4008	3744	3509	3298	3107	2934	2777	2632	
200	5911	5389	4942	4555	4217	3921	3659	3426	3216	3028	2857	2702	2560	2430	
210	5623	5106	4667	4292	3966	3682	3432	3211	3013	2835	2674	2528	2394	2272	
220	5346	4836	4408	4045	3732	3461	3223	3012	2825	2657	2505	2368	2243	2128	
L[mm]															

	230	240	250	260	270	280	290	300	310	320	330	340	350	D[mm]
40	11048	10517	10017	9544	9099	8678	8281	7906	7551	7217	6900	6601	6318	
50	9607	9129	8681	8260	7865	7494	7145	6816	6507	6215	5940	5681	5436	
60	8457	8026	7624	7248	6897	6567	6258	5967	5694	5438	5196	4968	4754	
70	7511	7123	6762	6425	6110	5816	5541	5283	5040	4813	4599	4397	4208	
80	6718	6367	6042	5739	5457	5194	4947	4717	4500	4298	4107	3927	3759	
90	5886	5591	5316	5059	4819	4594	4382	4184	3997	3822	3656	3500	3353	
100	5342	5072	4820	4586	4367	4163	3971	3791	3622	3464	3314	3173	3041	
110	4865	4617	4387	4174	3974	3788	3614	3451	3297	3154	3018	2891	2770	
120	4444	4217	4007	3812	3630	3460	3302	3153	3014	2883	2760	2644	2535	
130	4071	3863	3671	3492	3326	3171	3026	2891	2764	2645	2533	2427	2328	
140	3661	3481	3314	3158	3013	2877	2749	2630	2517	2412	2312	2218	2129	
150	3381	3214	3060	2916	2782	2657	2539	2429	2326	2229	2137	2051	1970	
160	3128	2974	2831	2698	2575	2459	2351	2250	2154	2065	1981	1901	1827	
170	2900	2757	2625	2502	2388	2281	2181	2088	2000	1918	1840	1767	1698	
180	2694	2561	2439	2325	2219	2120	2028	1942	1861	1785	1713	1646	1582	
190	2500	2378	2265	2160	2062	1971	1887	1807	1732	1662	1596	1534	1475	
200	2310	2199	2096	2001	1912	1829	1752	1679	1611	1547	1486	1429	1375	
210	2160	2057	1961	1872	1789	1712	1640	1572	1508	1449	1392	1339	1289	
220	2023	1926	1837	1754	1676	1604	1537	1474	1415	1359	1307	1257	1211	
L[mm]														

TOOL TYPE "B": SHANK CUTTER



Max. speed according to the shank cutter dimensions

TABELLA T4 / TABLE T4

	10	12	14	16	18	20	22	24	26	28	30	D[mm]
30	32000	32000	32000	32000	32000	31000	31000	31000	31000	31000	30000	
35	32000	32000	32000	32000	31000	31000	31000	31000	30000	30000	30000	
40	32000	32000	32000	31000	31000	31000	31000	30000	30000	30000	29000	
45	32000	32000	32000	31000	31000	31000	30000	30000	30000	29000	29000	
50	32000	32000	31000	31000	31000	31000	30000	30000	29000	29000	29000	
55	32000	32000	31000	31000	31000	30000	30000	30000	29000	29000	28000	
60	32000	31000	31000	31000	30000	30000	30000	29000	29000	28000	28000	
65	32000	31000	31000	31000	30000	30000	29000	29000	28000	28000	27000	
70	31000	31000	31000	30000	30000	30000	29000	28000	28000	27000	27000	
75	31000	31000	31000	30000	30000	29000	29000	28000	27000	27000	26000	
80	31000	31000	30000	30000	29000	29000	28000	28000	27000	26000	26000	
85	31000	31000	30000	30000	29000	29000	28000	27000	27000	26000	25000	
90	30000	30000	30000	29000	29000	28000	27000	27000	26000	25000	25000	
95	30000	30000	29000	29000	28000	28000	27000	26000	26000	25000	24000	
100	28000	29000	29000	28000	28000	27000	27000	26000	25000	24000	24000	
105	27000	28000	28000	28000	27000	27000	26000	25000	25000	24000	23000	**Legenda**
110	25000	27000	28000	27000	27000	26000	26000	25000	24000	23000	22000	
115	23000	26000	27000	27000	26000	26000	25000	24000	23000	23000	22000	>24000rpm
120	22000	24000	26000	26000	26000	25000	24000	24000	23000	22000	21000	< 24000 rpm

L[mm]

2.8.2 Examples to determine the max. working speed

(6.7.1 21e ce)

Example 1. Steel cylinfrical cutter Ø125 L100 with max. speed of 10000 rpm.

With these data use table T1 "Shank cutter Ø90-210" by taking as a length the value 100 mm and as a diameter the value 130 mm to ensure safety, obtaining 8642 rpm as max. working speed.
Considering that:
the max. speed of the electric spindle is 24000 rpm;
the max. tool speed is 10000 rpm;
it is possible to set the rotation speed to max 8642 rpm for the required working.

Example 2. Shank cutter Ø14 L60 with max. speed of 25000 rpm.

With these data use table T4 "Shank cutter Ø10-30" by taking as a length the value 60 mm and as a diameter the value 14 mm, obtaining 31000 rpm as max. working speed.
Considering that:
the max. speed of the electric spindle is 24000 rpm;
the max. tool speed is 25000 rpm;
it is possible to set the rotation speed to max 24000 rpm for the required working.

Example 3. Aluminium profiling cutter Ø max.180, Ø min.110, L 68, body made of light alloy, mass 3 kg and max. speed 8000 rpm.

If the shaped cutter has more diameters, carry out a preliminary calculation by consering the tool as a aluminium cylindrical cutter of the same length.
For this purpose it is necessry to know the mass of tool +toolholder unit.

As the tool is made of light alloy, the density may be considered equal to the aluminium one [p]=2700 Kg/m3.

S=M/([p]*L)=3/(2700*68/1000)=0,01634 m2=16340 mm2

d=[v](4*S/π)=[v](4*16340/3,14)=144 mm

Note that the diameter obtained is intermediate between the max. value Ø180 and min. value Ø110.

With these data use table T2 "Aluminium cylindrical cutter Ø90-210" by taking as a length 70 mm and as a diameter 150 mm to ensure the safety, obtaining 16132 rpm as max. working speed.
Considering that:
the max. speed of the electric spindle is 24000 rpm;
the max. tool speed is 8000 rpm;
it is possible to set the rotation speed to max 8000 rpm for the required working.

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3.1 Warnings

Hoisting and handling the product are potentially hazardous operations.
Follow the indications given in this manual.
The installation and assembly must always be performed by specialised technicians.

3.2 Packaging

The machine is shipped in a cardboard package or wooden crate.
Inside the packaging the product is protected with bubble wrap sheets or secured with wooden supports.

3.3 Dimensions and weights

The weight of the product can be found on the electrospindle identification plate (see chap. 1 paragraph 1.1).
The linear dimensions of the package can be found in the accompanying documents.

3.4 Handling

The user is responsible for selected the most suitable lifting equipment (ropes, bands or chains, etc.) in terms of function and lifting capacity, for the mass indicated on the package and the plate.

The packed machine must be handled and hoisted manually by at least two people.

The lifting equipment used must be compatible with the mass being handled.
If handling with a pallet truck, make sure that the forks lift the crate at the ends, so that the centre line of the package is in the middle.

Avoid collisions that could compromise the correct operation of the product. Hoist and handle the product with utmost care.

3.5 Unpacking

Check the integrity and closure of the package before opening.

If the product is packed in a cardboard box, remove the adhesive tape taking care not to damage the package or the contents.
If the package is a wooden crate, open the cover with clippers to cut the metal strip. Once the crate is open, lift the electrospindle and unwrap the bubble wrap.
Keep the original packaging and any supports, so that they can be reused in case of shipping due to unscheduled maintenance that cannot be carried out in the installation location.

3.6 Storage

If the product needs to be stored, leave it in its packing, which will protect it from the weather, damp, dust and atmospheric and environmental agents.

Manually rotate the electrospindle spindle at least once every 2 months to maintain the optimal greasing of the bearings.

MAXIMUM STORAGE TEMPERATURE: +55°C (+131 °F) maximum.

We strongly suggest that the product is not stored for more than 12 months.

If the electrospindle remains in storage for more than 6 months after the installation, the following run-in procedure must be performed in steps before switching on the electrospindle and starting to work.

Both Vmax = maximum speed of the electrospindle;

Step	Speed %	Speed [Rpm]	Duration [min.]
1	6.3	0.063 * Vmax	15
2	Electrospindle stopped		5
3	12	0.12 * Vmax	15
4	Electrospindle stopped		5
5	19	0.19 * Vmax	15
6	Electrospindle stopped		5
7	25	0.25 * Vmax	15
8	Electrospindle stopped		5
9	38	0.38 * Vmax	10
10	Electrospindle stopped		5
11	50	0.50 * Vmax	10
12	Electrospindle stopped		5
13	67	0.67 * Vmax	10

The run-in procedure in steps lasts 2 hours.

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4.1 Preliminary checks

Before performing any operation, CHECK that the electrospindle has not been knocked (with particular attention to the front ring nut) and that the contacts of the electrical connection have not been damaged.

4.2 Availability of auxiliary systems in the factory

The customer is responsible for the preparatory works (e.g. electrical system, air system, etc.).
The electrical power supply line must be of an adequate power.
The customer must ensure all the safety conditions necessary to setup the electrospindle.
The grounding system must comply with the applicable standards in the country of installation and checked by qualified personnel.

4.3 Mechanical connections

4.3.1 Electrospindle support table

The electrospindle must be secured on an aluminium table. The planarity of the support table must be less than 0.02 mm and the surface finish must be less than Ra 1.6.

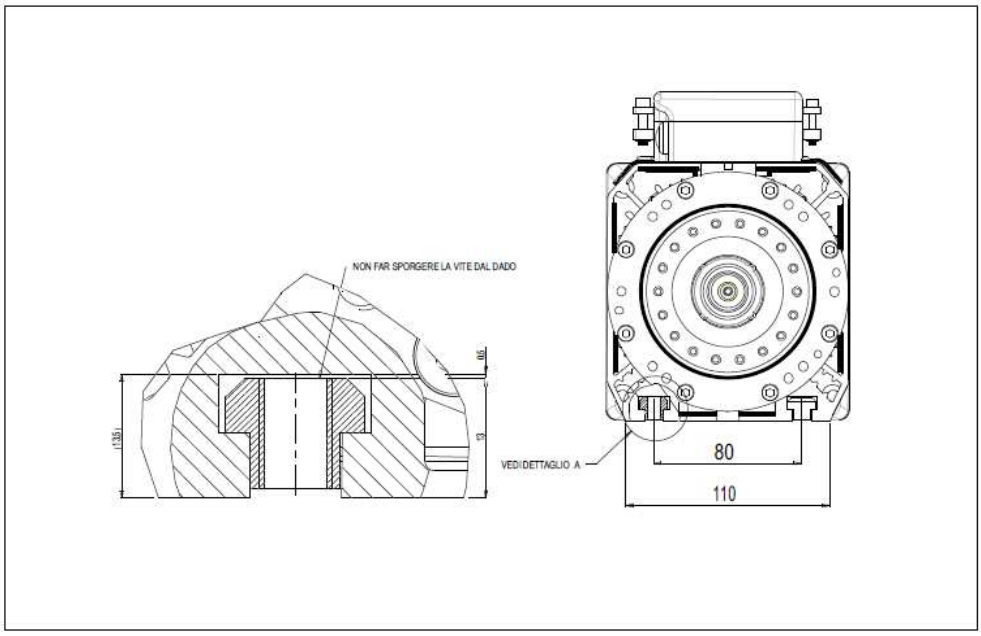
We strongly recommend not securing the electrospindle casing along its whole length: secure only the length indicated by the dotted line in the electrospindle layout.

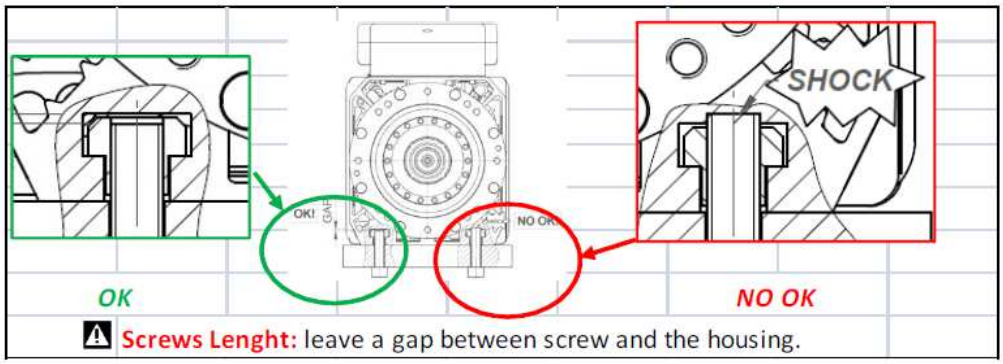
4.3.2 Securing the electrospindle

The electrospindle must be secured to the support plate with M8 nuts for T-shaped slot with a tightening torque of 10 Nm.
Alternatively to the nuts, wedges with the same profile can be used and supplied on request (contact the technical support service).

The maximum projection of the fixing screw is 12 mm. Greater projections deform the electrospindle casing, compromising the life and machining precision.

For a correct alignment during the assembly, use the slot for the tab found on the casing.

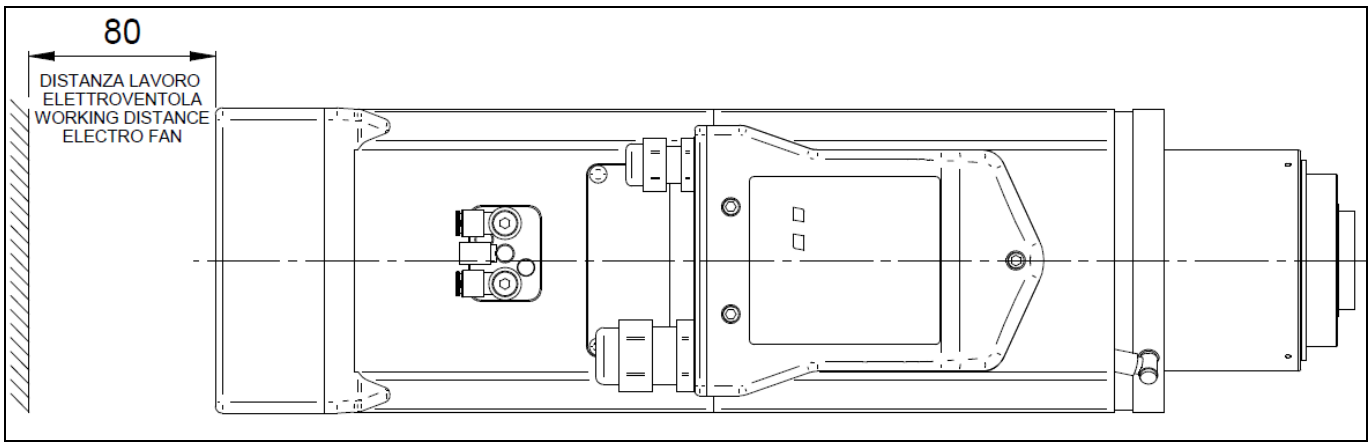




4.3.3 Positioning with electric fan air cooling

(4.3.3 45f ce)

If the air cooling is performed with the electric fan, position the electrospindle so that there are at least 80 mm from the electric fan grill.
This maximises the performance of the electric fan.



Electric can IP grade: IP 20. The air that flows inside the electric fan for the cooling must comply with the cleaning grade.

The cooling air comes out of the front slots in the electrospindle casing.
To maximum the cooling capacity, ensure that around the outlet channels there are no obstructions for the air, placing hoods, aggregate units, etc. present at a suitable distance.

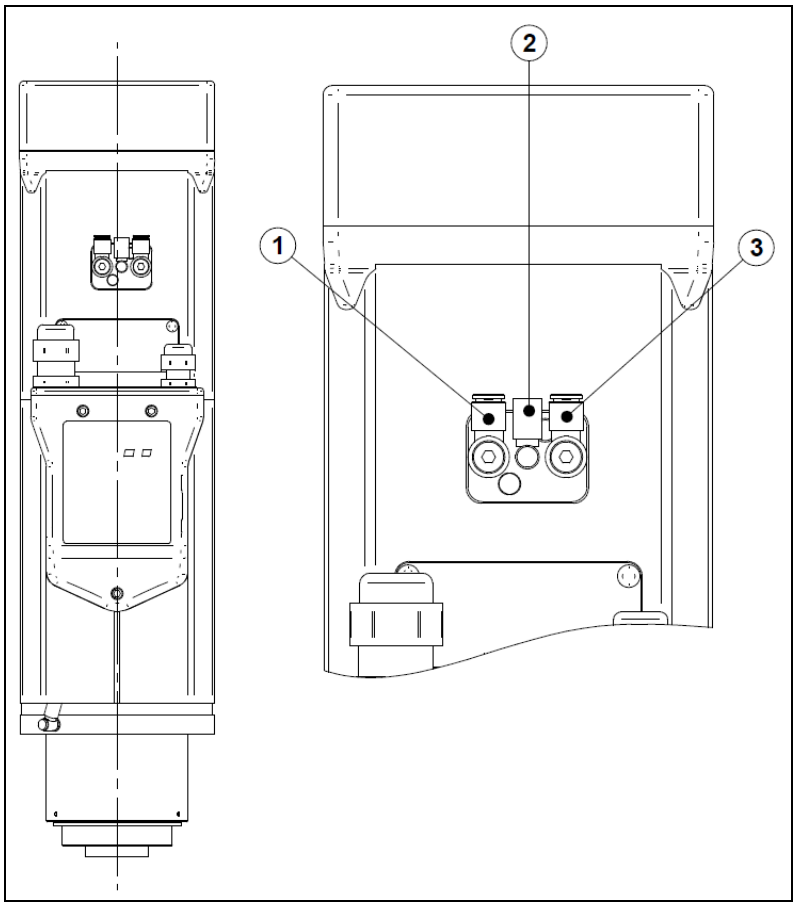
4.4 Compressed air connections

4.4.1 Air purity of the compressed air circuit

The compressed air that must be fed in the electrospindle must be DRY.
The purity of the air should satisfy the 2 4 3 classes indicated in the standard ISO8573-1
- Class 2: solid particles < 1 micron
- Class 4: humidity - dew point < 3 °C (37.4 °F)
- Class 3: oil - concentration < 1 mg/m3
Feeding dry air into the device that does not comply with the specifications indicated above may seriously damage the product
and cause it to malfunction.

4.4.2 Compressed air connection points on the electrospindle

The compressed air connections are shown in the figure.

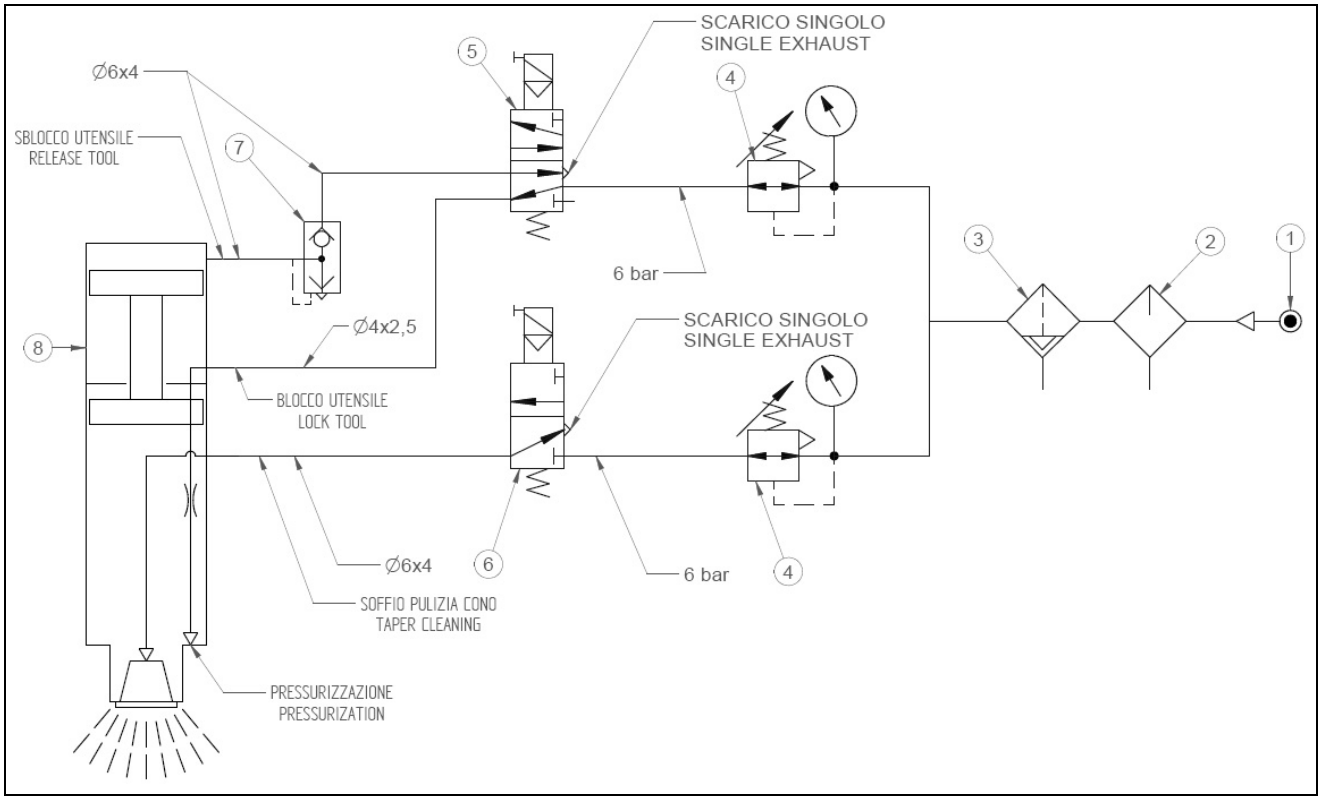


REF.	Name	Function	Pressure	Ø Pipe
1	**RELEASE**	Tool release	6 – 6.5 bar	Ø6x4
2	**CLAMP**	Tool clamp + pressurization	6 – 6.5 bar	Ø4x2.5
3	**TAPER BLOW**	Tool holder cleaning blow	6 – 6.5 bar	Ø6x4

Pressure values lower than the ones indicated in the previous table can cause malfunctions, such as not releasing the tool from the electrospindle.

The electrospindle inlet pressure value must be measured with a pressure gauge AT THE HEAD (as close as possible) of the electrospindle. Check that during the tool change phases the pressure does not drop below the values indicated in all the operating conditions of the machine that the electrospindle wil be installed in.

4.4.3 Compressed air circuit



1	Mains supply
2	Pre-filter 5 µm
3	Oil separator filter 0.1 µm
4	Pressure regulator
5	Monostable 5/2 solenoid valve
6	Monostable 3V/2P solenoid valve
7	Quick discharge valve
8	Electrospindle

Only use solenoid valves with the following specifications:

- MONOSTABLE

- FOR DRY AIR

- MAXIMUM OPERATING PRESSURE 10 bar

- MINIMUM AIR FLOW AT 6 bar DELTA P=1 bar 800 Nl/min.

Position the control solenoid valves as close as possible to the electrospindle.

The solenoid valves discharges that operate the clamp/release and the taper blow must have independent discharges and NOT SHARED with other solenoid valves of the machine, otherwise there may be serious malfunctions when operating the electrospindle. This must be complied with even if the solenoid valves are part of a pack that performs other different functions.

	
OK!	*NO!*

For the solenoid valves discharges use silencers with a flow greater than or equal to 1400 Nl/min, in order to avoid flow reductions or blockages of the discharge over time due to dust or dirt. Avoid using silencers in sintered bronze.

At the end of the installation check that the pneumatic pipes connected to the electrospindle are not crushed or any narrowing.

The non-compliance with the above can cause serious accidents or malfunctions of the electrospindle.

Position the control solenoid valves close to the electrospindle.

4.4.4 Pressurisation

The pressurisation is a continuous air jet that seals the mechanical seals between the front ring nut and the electrospindle nose. It comes from the electrospindle clamping air automatically.

Seeing as the hot air contained inside the electrospindle that has machined, when it cools, allows external air contaminated with dust to enter, we recommend closing the compressed air that feeds the machine 10-15 minutes after switching off the machine. Throughout this period of them the pressurisation will be active, preventing dust from entering during the cooling down of the electrospindle.

Check that with the electrospindle stopped air comes out of the front ring nut. If it does not check the compressed air circuit and the compressed air connections of the electrospindle.

4.4.5 Cleaning air blow of the tool holder taper

The taper cleaning air blow must be activated to clean the tool holder taper during the tool change phase to protect the conical seatings of the spindle and the tool holder and the support plane.

The machine logic must ensure that the taper blow is activated ONLY after the tool holder taper is released. Wait for the S2 sensor "Collet open" is on before activating the taper blow.

The tool holder taper cleaning blow must be active throughout the time that the collet remains open.
If the tool changer moves down, causing difficulties in gripping the taper during the tool change, due to the pneumatic thrust generated by the taper blow, the blow can be disabled when the taper is at a distance of about 20 mm from the spindle of the electrospindle.

In order to guarantee an optimal cleaning of the tool holder taper and its conical seating on the spindle perform the scheduled maintenance operations set out in chap. 7.

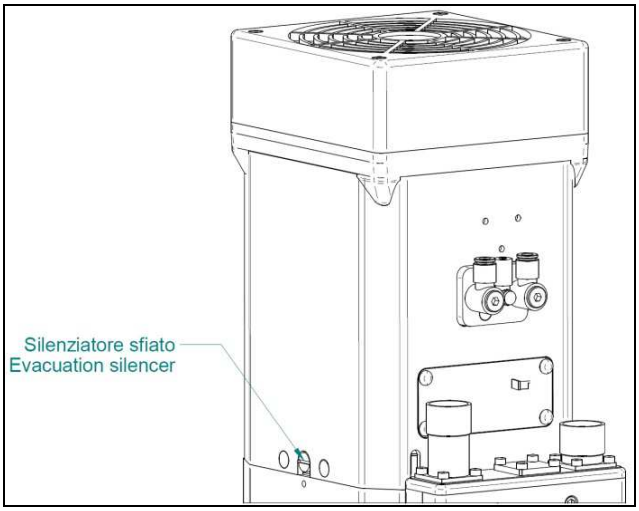
4.4.6 Tool with air flow (option)

The spindles with this option can supply an air flow to the tool during machining.

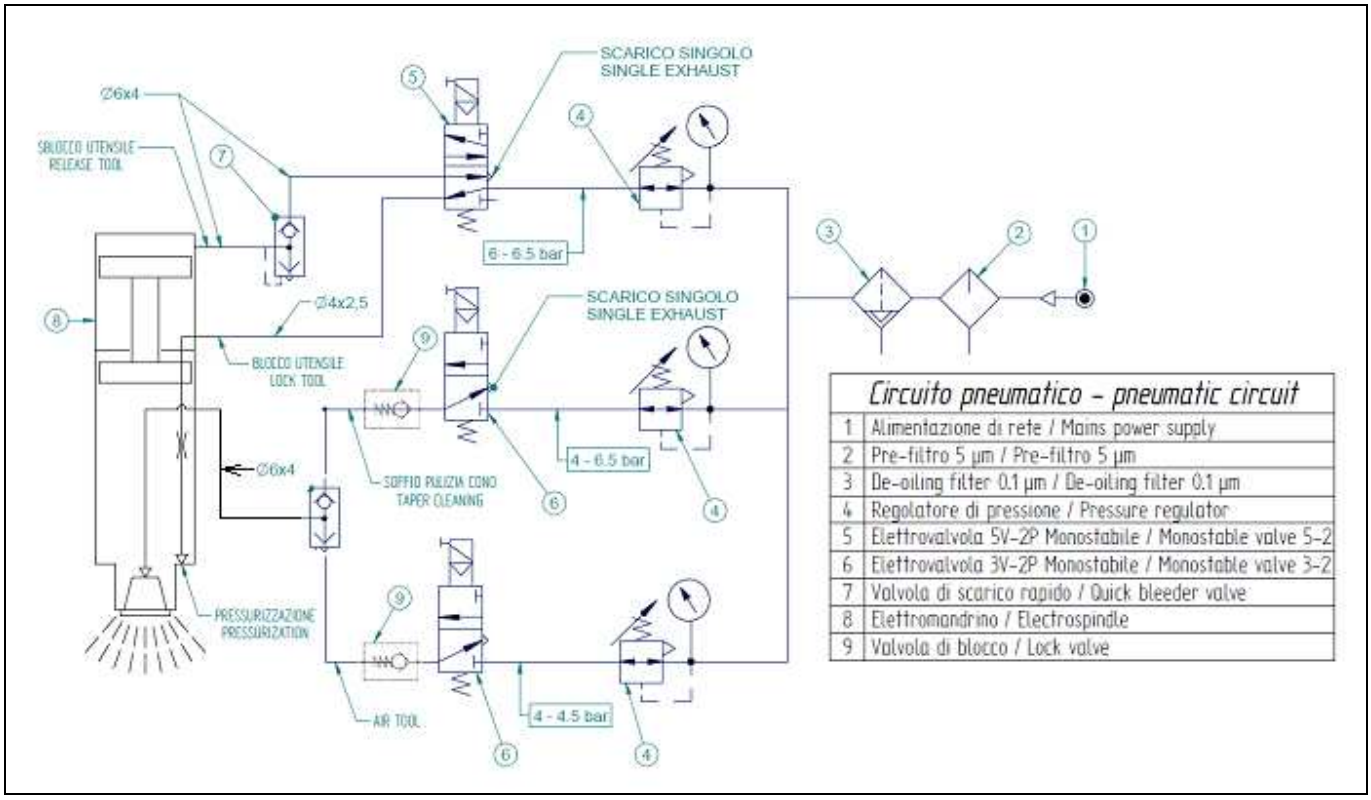
The air flow requires that the tool or the tool holders have holes to allow that air to flow to the cutting edges. Moreover, the tool holders must have an internal channel to let the air arrive directly from the spindle to the tool, avoding air leaks through the internal collet of the spindle.

The non-compliance with the indications above could cause a malfunction of the spindle.
The spindle use the same compressed air connection of the taper cleaning.
The latter is performed with a rotating joint between the spindle and the tool change cylinder of the spindle.

The rotating joint inside the spindle is a "controlled loss" joint. This means that there is always a very small air flow in the joint. Consequently it is normal to hear or see a small air blow from the ejection silencers on the spindle body.



The maximum pressure for the optional "central air flow" is 4-4.5 bar; do not supply a higher pressure to this circuit to prevent excessive air leaks during the spindle operation.
If a higher pressure level is required to clean the taper, an additional solenoid valve can be added to perform the cleaning of the taper and tool with the air flow, with two different pressure levels.



Circuito pneumatico - pneumatic circuit

1	Alimentazione di rete / Mains power supply
2	Pre-filtro 5 µm / Pre-filtro 5 µm
3	De-oiling filter 0.1 µm / De-oiling filter 0.1 µm
4	Regolatore di pressione / Pressure regulator
5	Elettrovalvola 5V-2P Monostabile / Monostable valve 5-2
6	Elettrovalvola 3V-2P Monostabile / Monostable valve 3-2
7	Valvola di scarico rapido / Quick bleeder valve
8	Elettromandrino / Electrospindle
9	Valvola di blocco / Lock valve

Two additional uni-directional valves are required, see diagram above.

To supply the tool air flow, the machine logic must comply with the following requirements:
- Start the tool air flow after 300 ms from the spindle start.
- Interrupt the tool air flow after 300 ms from the start of the spindle deceleration.
The tool air flow must be cut off before performing any tool change operation.
During the tool change you must clean the taper with the same requirements set out in paragraph 4.4.5.
The spindle can also work as a standard spindle, without supplying air to the tool.
Always check that the tool allows this operating mode.

The non-compliance with the indications above could cause a malfunction of the spindle.

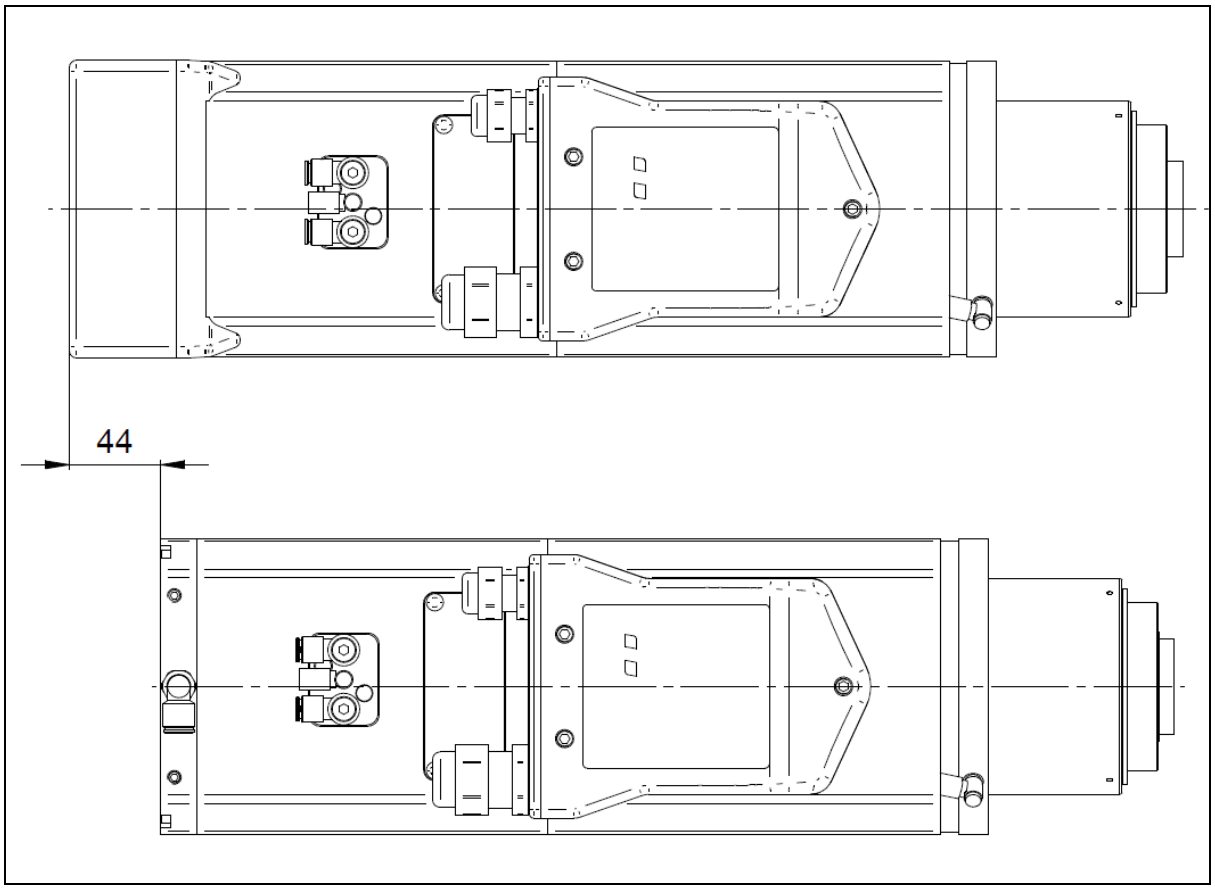
For tools with a transversal section of the internal holes larger than 8 mm2 (generally a tool with a tang with diameter > Ø10 mm) sealed collets must be used (see bottom left figure). These collets have internal seals to guarantee the seal with the ring nut.
For tools with a transversal section of the internal holes smaller than 8 mm2 (generally a tool with a stem with diameter > Ø10 mm) externally cooled collets must be used (see bottom right figure). These collets have a series of holes around the tool to wrap it with the air flow.
For tools without internal holes, use only externally cooled collets.

	
Sealed collet – Pinza sigillata	***Externally cooled collet – Pinza raffreddata esternamente***

If the aforementioned tool requirements do not comply the spindle and/or the tool could be seriously damaged.

4.5 Compressed air cooling

Certain models are cooled with compressed air. This solution reduces the length of the spindle by 44 mm compared to the version with fan. Moreover the minimum installation distance required for the fan could be avoided (see chap. 4.3.3).



To cool the spindle the air must comply with the requirements set out in chap. 4.4.1.

Cooling air flow.

Description	Default
Diameter of tube	E8x1
Pressure interval	3.0 – 4.0 bar / 45 – 58 psi
Air flow	310 – 410 Nl/min.

The pressure grade must be measured with the air flow active (spindle operating condition), by placing a pressure gauge on the spindle head (directly between the spindle and pipe). They are valid for the service in S1.

If this air flow is not compatible with the spindle, it could work at reduced power.

4.6 Hydraulic cooling circuit

The hydraulic cooling circuit is found only on liquid cooled models.

4.6.1 Hydraulic connections

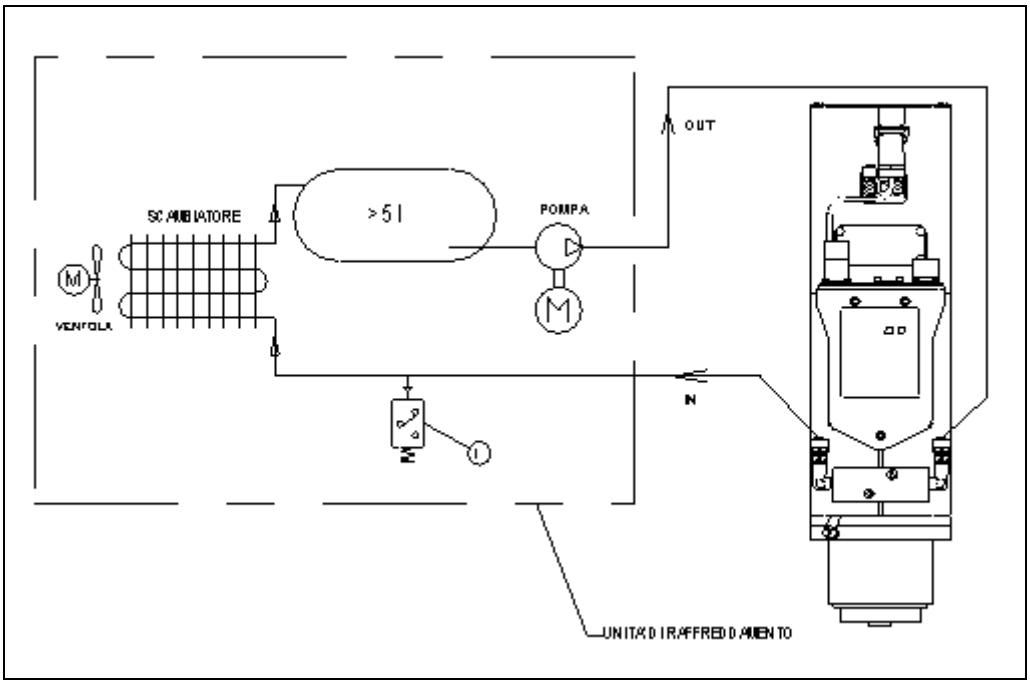
Identify the fittings for the hydraulic connections on the electrospindle layout.

4.6.2 Cooling fluid

To prevent rust from forming inside the electrospindle, that could compromise the efficiency of the hydraulic circuit, the cooling fluid must contain sufficient anti-corrosion additives.
Use a mixture in volume consisting of:
- Double-distilled water 60 - 65%
- Car anti-freeze fluid 35 - 40%.
  The antifreeze fluid used must contain at least 10% of anti-corrosion additives.
  The ready to use and mixed cooling fluid can be supplied on request.

The seals used inside the electrospindles are in NBR: make sure not to use additives that attack this material. It can cause leaks of liquid inside the electrospindle.

4.6.3 Hydraulic circuit



The cooling circuit shown in the figure is purely indicative.
Note that the dotted part represents the cooling control unit that can be:
- a heat exchanger (cooling core + pump)
- a chiller

The cooling control unit must comply with the following specifications:

Cooling capacity	Electrospindle	Cooling power
	13 kW	2700 W
	9.0 kW	1800 W
Minimum flow		4 litres/minute with the circuit operational
Type of cooling fluid		See paragraph: 4.6.2

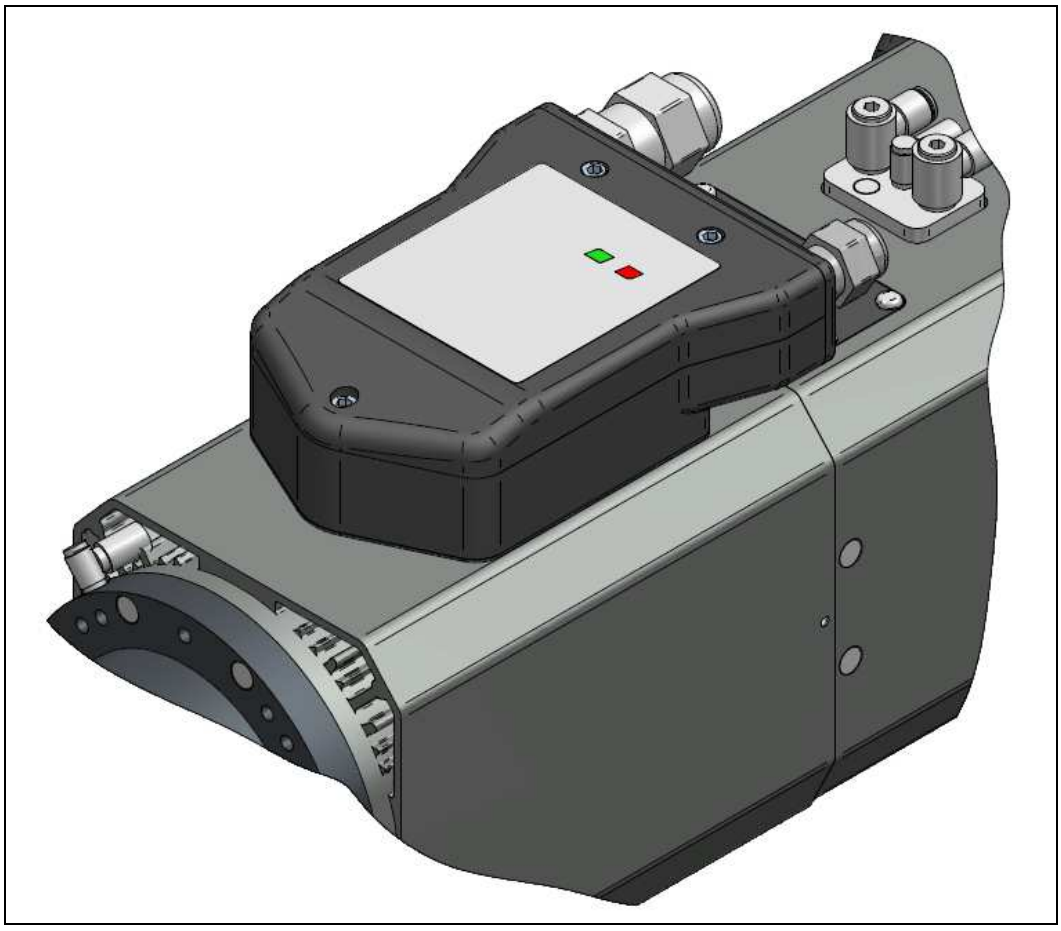
If using chiller units the minimum intervention temperature must not be less than +23°C (+75°F).

The pressure of the fluid entering the electrospindle must not exceed 6 bar at the top of the electrospindle.

4.7 Electrical circuit

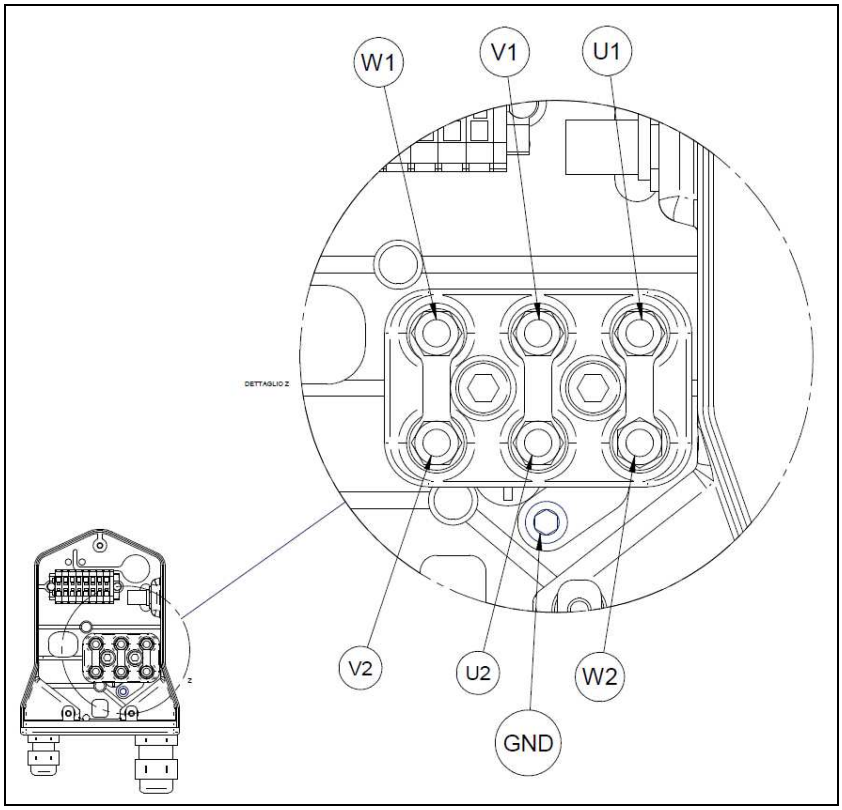
4.7.1 Basic Connection (CB)

On the electrospindle there is a quick electrical connection, positioned on the electrospindle casing. On the cover of the electrical box there is a plate indicating the type of electrospindle and the main mechanical and electrical specifications (power, absorbed current, rotation current).



WARNING! High voltage present. Before accessing the electrical connections check that the electrical power supply of the machine where the electrospindle has been installed has been cut off otherwise THERE CAN BE SERIOUS ACCIDENTS OR MALFUNCTIONS OF THE ELECTROSPINDLE.

4.7.2 Power contacts layout



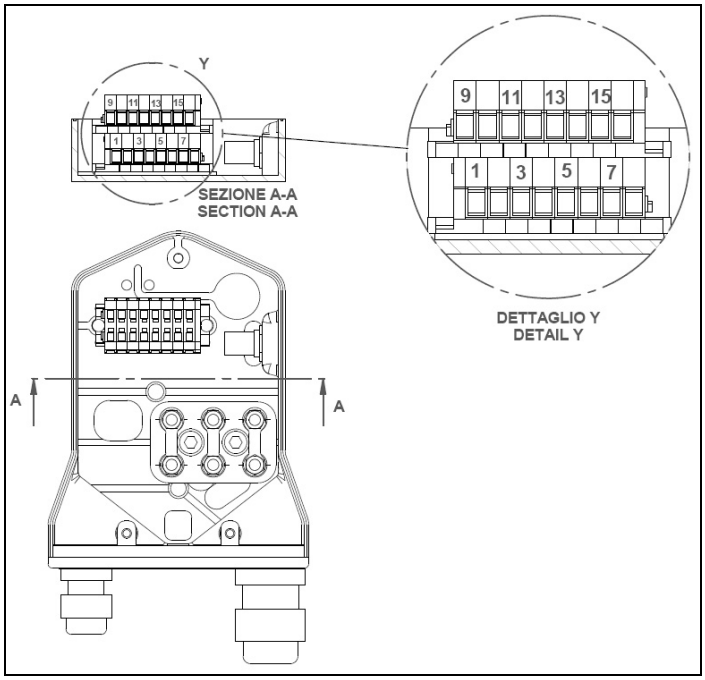
POTENZA - POWER		
PIN	DESCRIZIONE / DESCRIPTION	COLORE / COLOR
1	U1 - FASE MOTORE	Marrone-Brown
2	V1 - FASE MOTORE	Blu-Blue
3	W1 - FASE MOTORE	Nero-Black
4	GND	Giallo-Verde - Yallow-Green

For the power supply of the phases inside the power wiring, use cables with a section of 6 mm2 (AWG 10) with a current density suitable for the electrospindle absorption indicated on the identification plate.

The electrospindle power supply MUST be through an adequately sized and parametrised inverter, in compliance with the electrical specifications of the motor, indicated on the electrospindle plate and in point 2.2 of this manual.

The wave shape PWM of the power supply voltage must have values of dV/dt<2 kV/micros.
If not an an inductance-filter must be inserted between the inverter and the electrospindle that can flatten such voltage peaks that are harmful for the stator windings.
The inductance must be sized as follows:
- Impedance value: 0.045 mH on the 3 phases.
- Operating voltage: 400V
- Maximum operating frequency: 1000 Hz
- PWM switching frequency: 8 kHz
- Flow value in current: higher than the maximum operating current considering the most demanding service (S1 or S6).
- Maximum length of the wiring cables: 40 m

4.7.3 Signal contacts layout

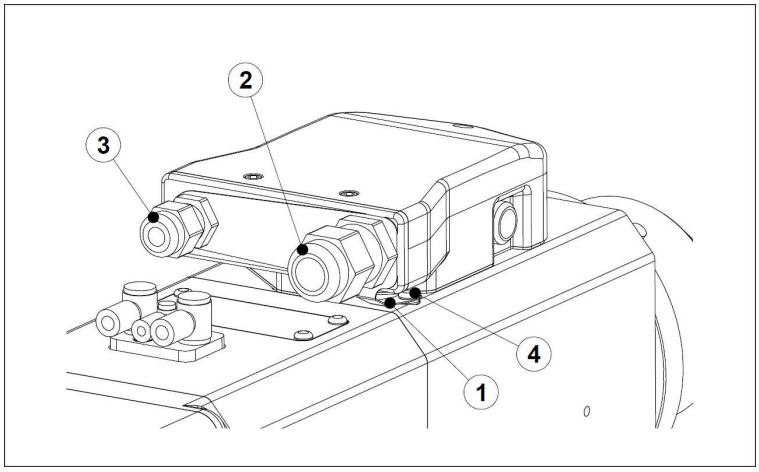


SEGNALE - SIGNAL		
PIN	DESCRIZIONE - DESCRIPTION	COLORE - COLOR
1	0 V - ALIM. S1 - SUPPLY S1	BLU - BLUE
2	OUTPUT S1 - POS. TIRANTE - DRAW BAR POSITION	NERO - BLACK
3	+24 Vcc ALIM. S1 - SUPPLY S1	MARRONE - BROWN
4	0 V - ALIM. S1 - SUPPLY S2	BLU - BLUE
5	OUTPUT S2 - PINZA APERTA - CHUCK OPEN	NERO - BLACK
6	+24 Vcc ALIM. S1 - SUPPLY S2	MARRONE - BROWN
7	SONDA TERMICA - THERMOSWITCH	BIANCO - WHITE
8	SONDA TERMICA - THERMOSWITCH	BIANCO - WHITE
9	0 V - ALIM. S1 - SUPPLY S3	BLU - BLUE
10	OUTPUT S3 - ALBERO FERMO - SHAFT STANDSTILL	NERO - BLACK
11	+24 Vcc ALIM. S1 - SUPPLY S3	MARRONE - BROWN
12	PULSANTE C.U. - T.C. BUTTON	NERO - BLACK
13	PULSANTE C.U. - T.C. BUTTON	NERO - BLACK
14	0 Vcc ALIM. ELETTROV. - SUPPLY ELECTROFAN	BIANCO - WHITE
15	+24 Vcc ALIM. ELETTROV. - SUPPLY ELECTROFAN	MARRONE - BROWN
16	OUTPUT ELETTROVENTOLA - OUTPUT ELECTROFAN	VERDE - GREEN

Meaning of the following elements:
- S1 sensor – Tool clamped correctly
- S2 sensor – Collet open
- S3 sensor – Spindle rotation
- Tool change pushbutton
- Stator heat probe

For further information see Chapter 6.

4.7.4 Electrospindle wiring



Pos.	Description
1	Motor side shielding
2	Power cable gland
3	Signal cable gland
4	Sheet metal fixing screw

The wiring cables are secured to the electrospindle with cable glands 2 and 3.
The power connections (cable gland 2) must be connected to the internal screw terminal board.
The signal connections (cable gland 3) must be connected to the internal spring terminals.
The connections is fitted with a motor side shielding (1 in figure), to guarantee the maximum level of EMC immunity of the signals from external disturbances from highly automated machine tools, such as brushless drives, solenoid valves, etc.

Diameters allowed for the signal and power cables	
Power cable	**13 ÷ 18 mm**
Signal cable	**5 ÷ 10 mm**

Requiring cable glands with shielding in the plug wiring guarantees the correct continuity with the shielding sheath of the power cable and signal cable.

The power cable, the signal cable and encoder cable, when present, must guarantee a shielding grade of 85%.

Never disconnect the sheet metal 1 from the casing by loosening the fixing screw 4.

4.7.5 Tool release manual command pushbutton for BASIC connection (CB)

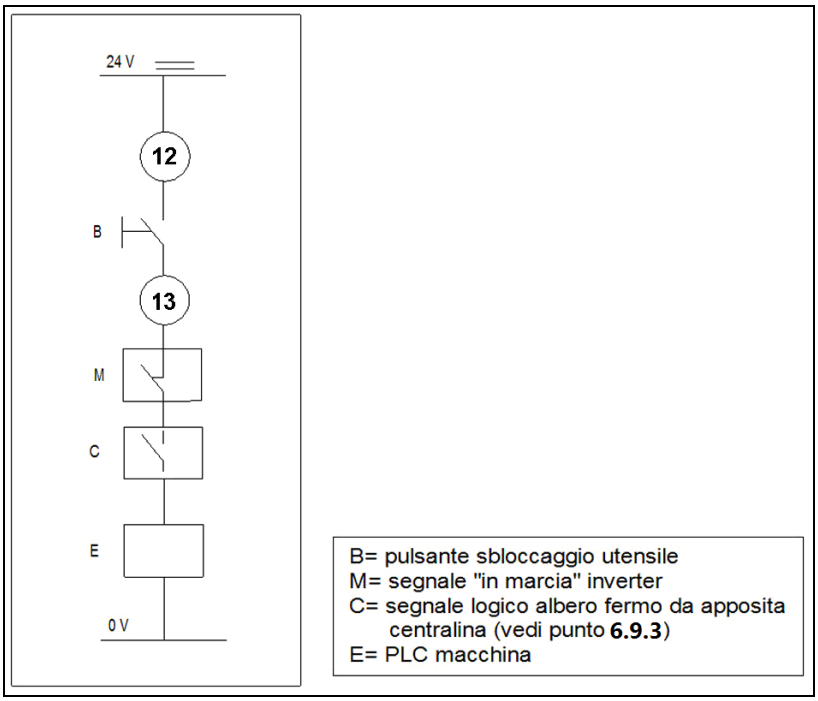
The position of the tool release manual command pushbutton is indicated in paragraph 2.5 "Main parts of the electrospindle".
The pushbutton can be included in the consents chain to manually control the release of the tool holder. The user presses the button to release the tool holder and the clamping collet remains open until the button is released.

If the button is used to control the manual tool changer, the machine logic must ensure that:

- ***when the electrospindle is in rotation, the control MUST disable the command from the pushbutton***
- ***the pushbutton is enabled ONLY when the electrospindle is stopped***
- ***the manual release command must be performed with the machine in MANUAL mode***

The non-compliance with the points above can cause the ejection of the rotating tool, with a risk of fatal injuries for people!

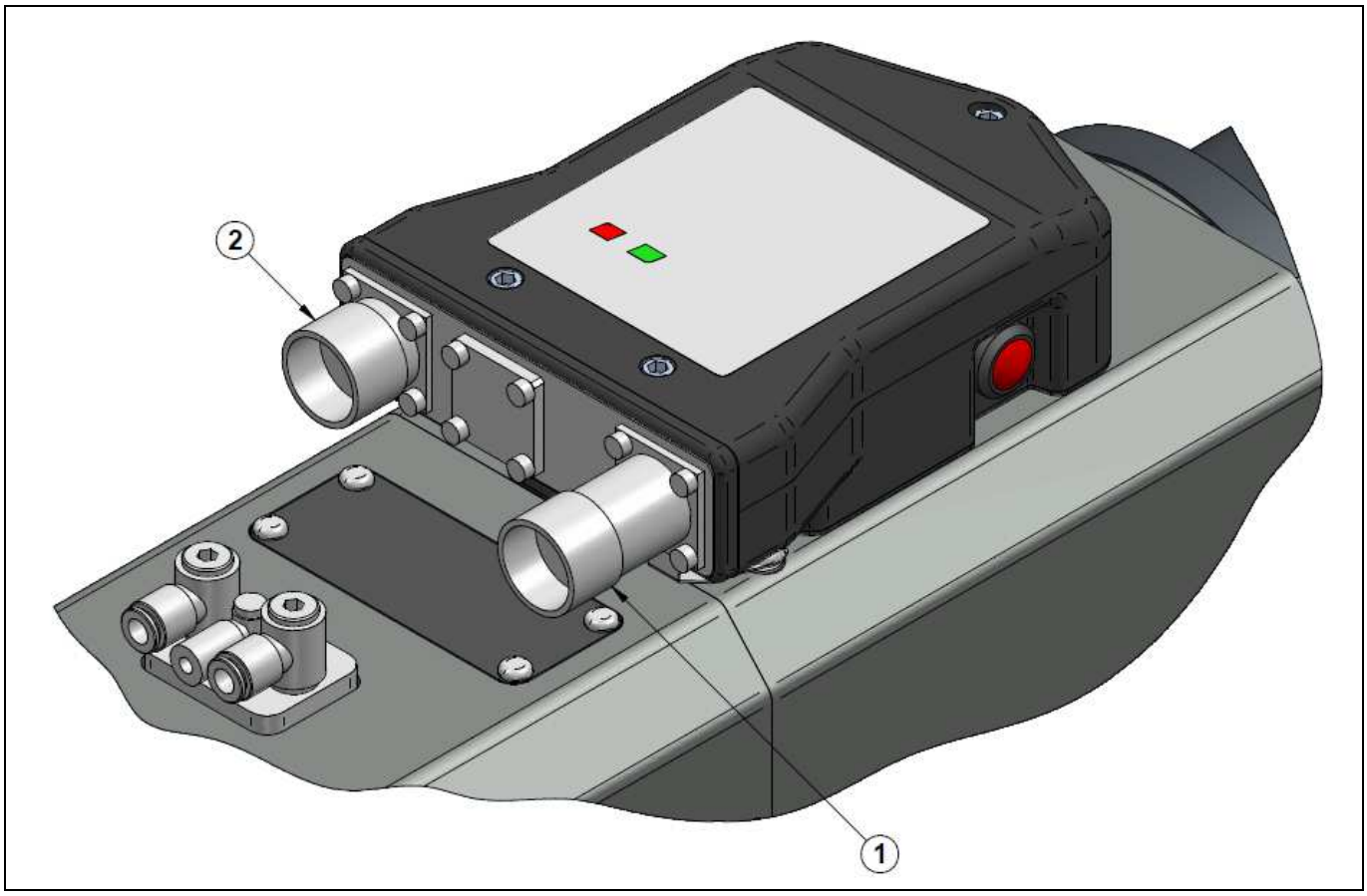
The diagram below shows an example of an electrical diagram that can be used to manage the manual release pushbutton.



PUSHBUTTON SPECIFICATIONS	
Nominal voltage (CC)	24V DC
Maximum current	100 mA

4.8 Circular connectors connection (CC)

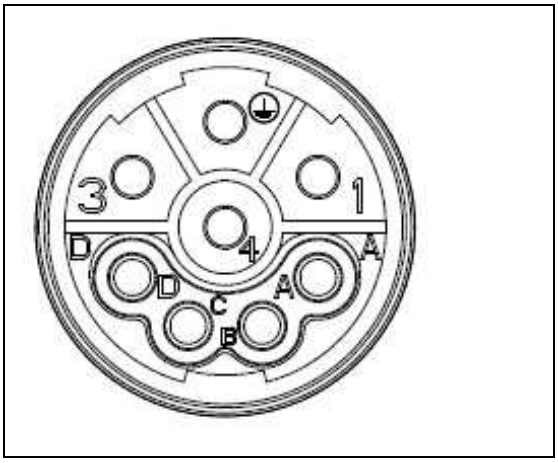
On the electrospindle there is a quick electrical connection, positioned on the electrospindle casing.
On the cover of the electrical box there is a plate indicating the type of electrospindle and the main mechanical and electrical specifications (power, absorbed current, rotation current).



CIRCULAR CONNECTORS	
Pos.	**Description**
1	Power connector
2	Signal connector

WARNING! High voltage present. Before accessing the electrical connections check that the electrical power supply of the machine where the electrospindle has been installed has been cut off otherwise THERE CAN BE SERIOUS ACCIDENTS OR MALFUNCTIONS OF THE ELECTROSPINDLE.

4.8.1 Power contacts layout



PIN	DESCRIZIONE / DESCRIPTION	COLORE / COLOR
1	U1 - Fase Motore / Motor phase	Marrone / Brown
2	GND	Giallo / Verde – Yellow / Green
3	W1 - Fase Motore / Motor phase	Nero / Black
4	V1 - Fase Motore / Motor phase	Blu / Blue
A	N.C.	-
B	N.C.	-
C	N.C.	-
D	N.C.	-

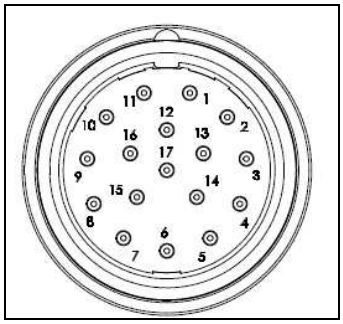
N.C. = NON COLLEGATO / NOT CONNECTED

For the power supply of the phases inside the power wiring, use cables with a section of 4 mm2 (AWG 10) with a current density suitable for the electrospindle absorption indicated on the identification plate.

The electrospindle power supply MUST be through an adequately sized and parametrised inverter, in compliance with the electrical specifications of the motor, indicated on the electrospindle plate and in point 2.2 of this manual.

The wave shape PWM of the power supply voltage must have values of dV/dt<2 kV/micros.
If not an an inductance-filter must be inserted between the inverter and the electrospindle that can flatten such voltage peaks that are harmful for the stator windings.
The inductance must be sized as follows:
- Impedance value: 0.045 mH on the 3 phases.
- Operating voltage: 400V
- Maximum operating frequency: 1000 Hz
- PWM switching frequency: 8 kHz
- Flow value in current: higher than the maximum operating current considering the most demanding service (S1 or S6).
- Maximum length of the wiring cables: 40 m

4.8.2 Signal contacts layout



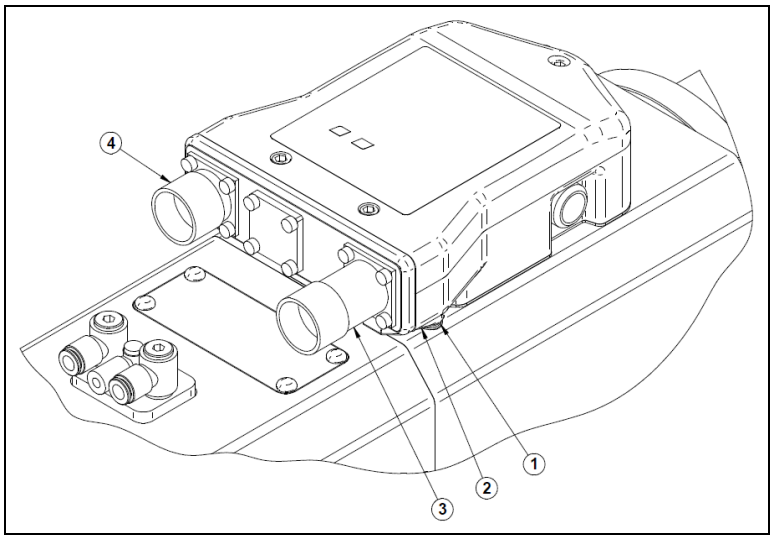
CAVO DI SEGNALE		
PIN	**DESCRIZIONE / DESCRIPTION**	**COLORE / COLOR**
1	OUTPUT ELETTROVENTOLA - OUTPUT ELECTROFAN	VERDE / GREEN
2	+24 Vcc - ALIM. ELETTROVENTOLA - SUPPLY ELECTROFAN	MARRONE / BROWN
3	+24 Vcc - ALIM. S3 - SUPPLY S3	BLU / BLUE
4	0 Vcc - ALIM. S3 - SUPPLY S3	NERO / BLACK
5	OUTPUT S1 - UTENSILE AFFERRATO - TOOL LOCKED	MARRONE / BROWN
6	OUTPUT S2 - UTENSILE SBLOCCATO - TOOL RELEASED	GRIGIO / GREY
7	OUTPUT S3 - ROTAZIONE ALBERO - SHAFT ROTATION	ROSSO / RED
8	0 Vcc - ALIM. S1 + S2 - SUPPLY S1 + S2	ROSA / PINK
	0 Vcc - ALIM. S1 + S2 - SUPPLY S1 + S2	VERDE / GREEN
9	+24 Vcc - ALIM. S1 + S2 - SUPPLY S1 + S2	GIALLO / YELLOW
	+24 Vcc - ALIM. S1 + S2 - SUPPLY S1 + S2	BIANCO / WHITE
10	N.C.	-
11	OUTPUT SONDA TERMICA - THERMAL ALLARM	BIANCO / WHITE
12	0 Vcc - ALIM. ELETTROVENTOLA - SUPPLY ELECTROFAN	BIANCO / WHITE
13	+24 Vcc - SONDA TERMICA - THERMAL ALLARM	BIANCO / WHITE
	+24 Vcc - PULSANTE C.U. - T.C. BUTTON	NERO / BLACK
14	OUTPUT - PULSANTE C.U. - T.C. BUTTON	NERO / BLACK
15	N.C.	-
16	N.C.	-
17	N.C.	-

CONNECT THE ELECTRIC FAN ONLY IF PRESENT
(SERVO-VENTILATED AIR COOLING)
N.C. = NON COLLEGATO / NOT CONNECTED

Meaning of the following elements:
- S1 sensor – Tool clamped correctly
- S2 sensor – Collet open
- S3 sensor – Spindle rotation
- Tool change pushbutton
- Stator heat probe

For further information see Chapter 6.

4.8.3 Electrospindle wiring



Pos.	Description
1	Motor side shielding
2	Sheet metal fixing screw
3	Power connector
4	Signal connector

The power connector is a standard M23 circular connector with 4 +4 contacts, in a metal housing.
The signal connector and the encoder connector are standard M23 circular connectors with 17 contacts, with a metal housing.
Use the suitable M23 circular connector to connect the spindle.
Check the M23 circular power connector is correctly sized for the maximum motor current, as indicated in chap. 2.
The connectors must comply with the EMC directive.
The housing must be metal and the shielding of the power, signal and encoder cable must be connected to the housing of the connector, to create a connection in compliance with the EMC directive.
The connections is fitted with a motor side shielding (ref. 1 in figure), to guarantee the maximum level of immunity of the signals, in compliance with the EMC directive, from external disturbances from highly automated machine tools, such as brushless drives, solenoid valves, etc.

Diameters allowed for the signal and power cables	
Power cable	**13 ÷ 18 mm**
Signal cable	**5 ÷ 10 mm**

In the electrospindle wiring the circular connectors that are connected to the spindle must be connected to the shielding of the respective cables

The power cable, the signal cable and encoder cable, when present, must guarantee a shielding grade of 85%.

The power cable and the signal cable must have the shielding connected to the grounding of the electrical panel with low impedance connections (wide contact surface) NO PIGTAIL.

Never disconnect the sheet metal 1 from the casing by loosening the fixing screw 4.

4.8.4 Tool release manual command pushbutton for circular connectors connection (CC)

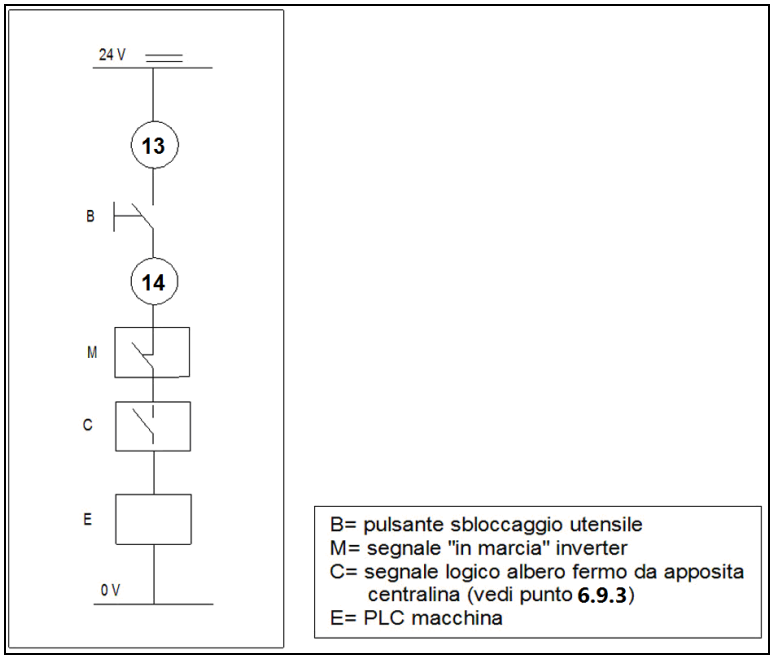
The position of the tool release manual command pushbutton is indicated in paragraph 2.5 "Main parts of the electrospindle".
The pushbutton can be included in the consents chain to manually control the release of the tool holder. The user presses the button to release the tool holder and the clamping collet remains open until the button is released.

If the button is used to control the manual tool changer, the machine logic must ensure that:

- ***when the electrospindle is in rotation, the control MUST disable the command from the pushbutton***
- ***the pushbutton is enabled ONLY when the electrospindle is stopped***
- ***the manual release command must be performed with the machine in MANUAL mode***

The non-compliance with the points above can cause the ejection of the rotating tool, with a risk of fatal injuries for people!

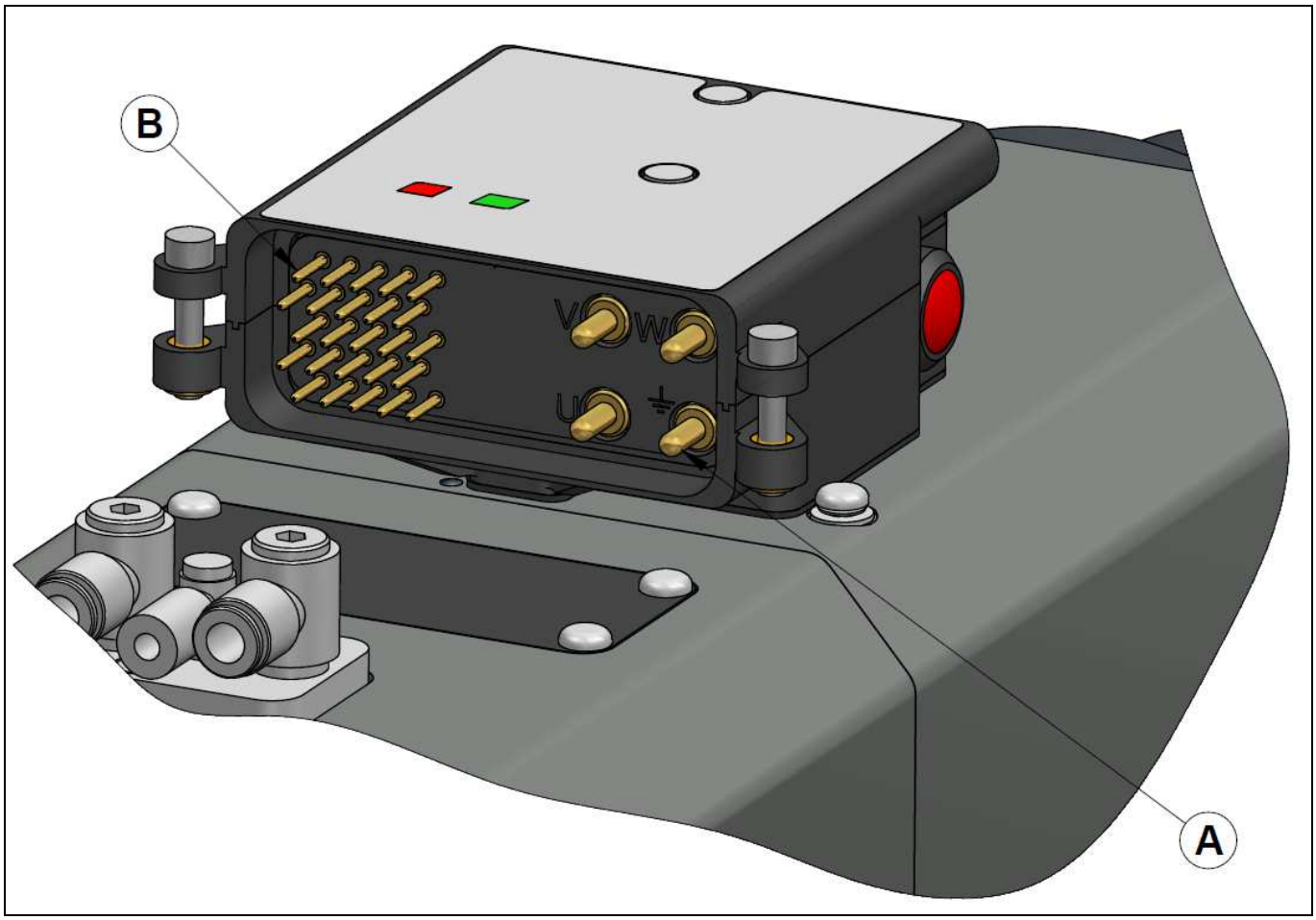
The diagram below shows an example of an electrical diagram that can be used to manage the manual release pushbutton.



PUSHBUTTON SPECIFICATIONS	
Nominal voltage (CC)	24V DC
Maximum current	100 mA

4.9 PLUG connection (PP)

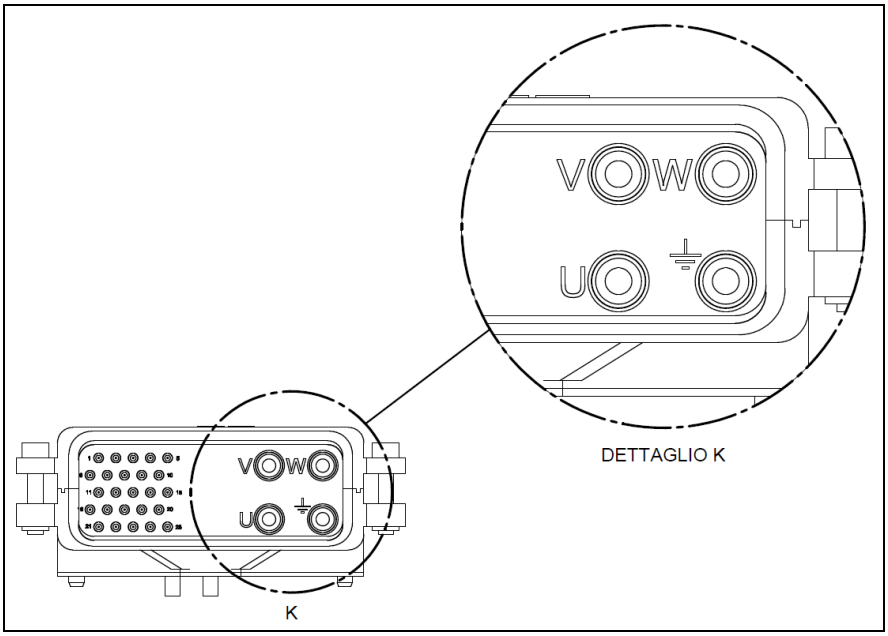
On the electrospindle there is a quick electrical connection, positioned on the electrospindle casing.
On the cover of the electrical box there is a plate indicating the type of electrospindle and the main mechanical and electrical specifications (power, absorbed current, rotation current).



Inside the electrical connection there are two different areas:
- power contacts (Ø 3.5 mm), (A)
- signal contacts (Ø 1 mm), (B)

WARNING! High voltage present. Before accessing the electrical connections check that the electrical power supply of the machine where the electrospindle has been installed has been cut off otherwise THERE CAN BE SERIOUS ACCIDENTS OR MALFUNCTIONS OF THE ELECTROSPINDLE.

4.9.1 Power contacts layout



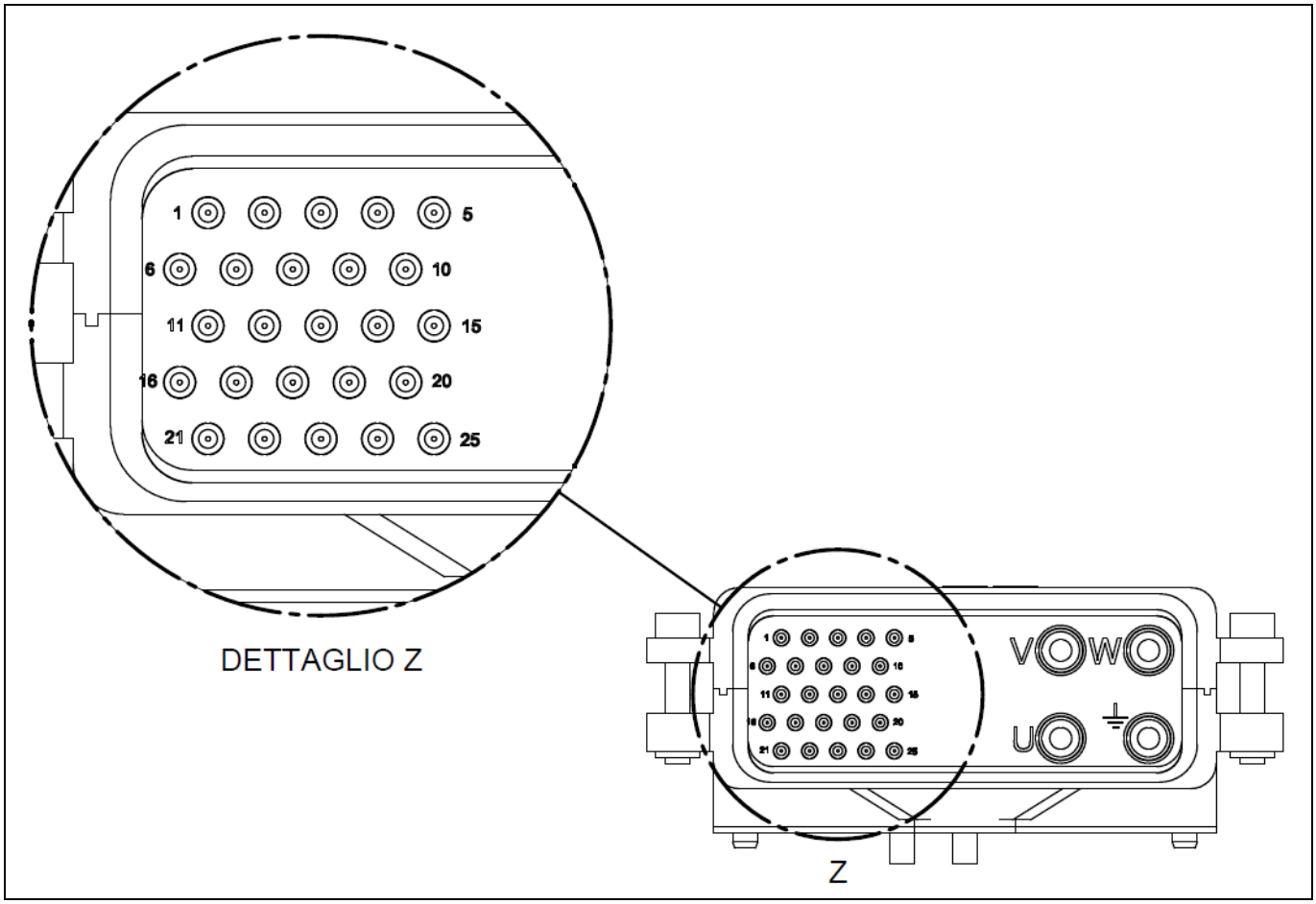
POTENZA - POWER		
PIN	DESCRIZIONE / DESCRIPTION	COLORE / COLOR
1	U1 - FASE MOTORE	Marrone-Brown
2	V1 - FASE MOTORE	Blu-Blue
3	W1 - FASE MOTORE	Nero-Black
4	GND	Giallo-Verde - Yallow-Green

For the power supply of the phases inside the power wiring, use cables with a section of 6 mm2 (AWG 10) with a current density suitable for the electrospindle absorption indicated on the identification plate.

The electrospindle power supply MUST be through an adequately sized and parametrised inverter, in compliance with the electrical specifications of the motor, indicated on the electrospindle plate and in point 2.2 of this manual.

The wave shape PWM of the power supply voltage must have values of dV/dt<2 kV/micros.
If not an an inductance-filter must be inserted between the inverter and the electrospindle that can flatten such voltage peaks that are harmful for the stator windings.
The inductance must be sized as follows:
- Impedance value: 0.045 mH on the 3 phases.
- Operating voltage: 400V
- Maximum operating frequency: 1000 Hz
- PWM switching frequency: 8 kHz
- Flow value in current: higher than the maximum operating current considering the most demanding service (S1 or S6).
- Maximum length of the wiring cables: 40 m

4.9.2 Signal contacts layout



n. u. = not used. If the position is not used, the contact is not assembled for economical reasons.

Meaning of the following elements:
- S1 sensor – Tool clamped correctly
- S2 sensor – Collet open
- S3 sensor – Spindle rotation
- Tool change pushbutton
- Stator heat probe

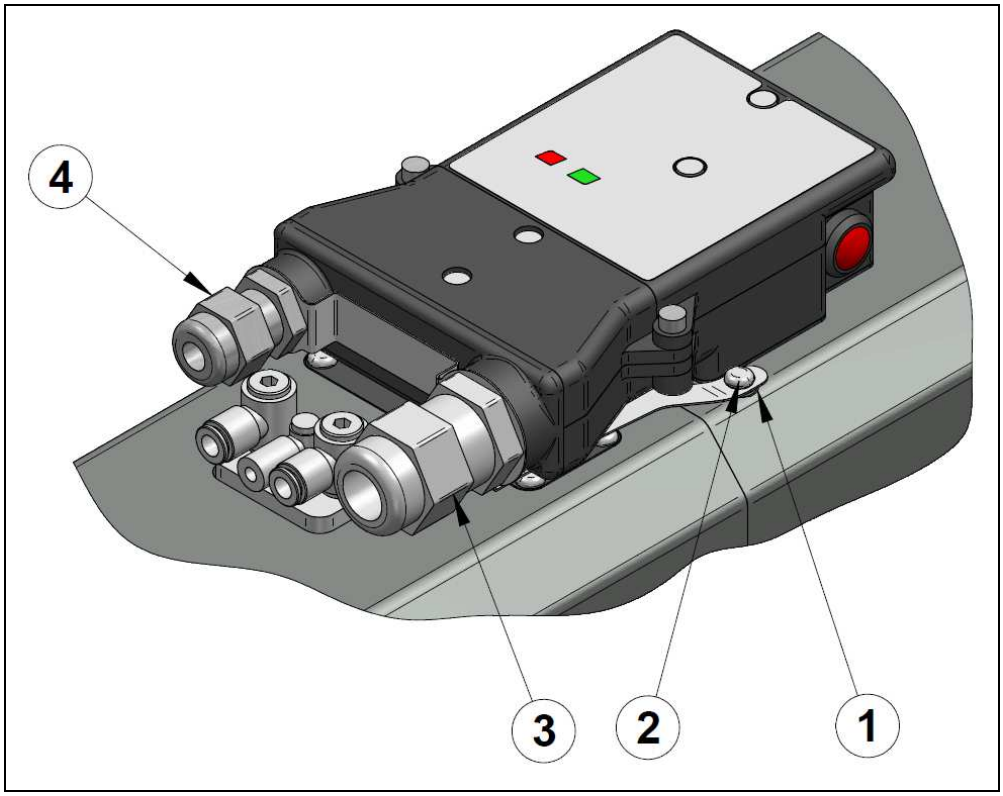
For further information see Chapter 6.

The positions used by the vibration sensor indicated in italics refer to the optional "Vibrations sensor" and must be considered not used if the sensor is not fitted.
Position 1 is used for the S3 sensor output "spindle stopped", standard on all electrospindles.

CAVO DI SEGNALE		
PIN	**DESCRIZIONE / DESCRIPTION**	**COLORE / COLOR**
1	OUTPUT ELETTROVENTOLA - OUTPUT ELECTROFAN	VERDE / GREEN
2	+24 Vcc - ALIM. ELETTROVENTOLA - SUPPLY ELECTROFAN	MARRONE / BROWN
3	+24 Vcc - ALIM. S3 - SUPPLY S3	BLU / BLUE
4	0 Vcc - ALIM. S3 - SUPPLY S3	NERO / BLACK
5	OUTPUT S1 - UTENSILE AFFERRATO - TOOL LOCKED	MARRONE / BROWN
6	OUTPUT S2 - UTENSILE SBLOCCATO - TOOL RELEASED	GRIGIO / GREY
7	OUTPUT S3 - ROTAZIONE ALBERO - SHAFT ROTATION	ROSSO / RED
8	0 Vcc - ALIM. S1 + S2 - SUPPLY S1 + S2	ROSA / PINK
	0 Vcc - ALIM. S1 + S2 - SUPPLY S1 + S2	VERDE / GREEN
9	+24 Vcc - ALIM. S1 + S2 - SUPPLY S1 + S2	GIALLO / YELLOW
	+24 Vcc - ALIM. S1 + S2 - SUPPLY S1 + S2	BIANCO / WHITE
10	N.C.	-
11	OUTPUT SONDA TERMICA - THERMAL ALLARM	BIANCO / WHITE
12	0 Vcc - ALIM. ELETTROVENTOLA - SUPPLY ELECTROFAN	BIANCO / WHITE
13	+24 Vcc - SONDA TERMICA - THERMAL ALLARM	BIANCO / WHITE
	+24 Vcc - PULSANTE C.U. - T.C. BUTTON	NERO / BLACK
14	OUTPUT - PULSANTE C.U. - T.C. BUTTON	NERO / BLACK
15	N.C.	-
16	N.C.	-
17	N.C.	-

4.9.3 Electrospindle wiring

The wiring on the electrospindle is performed with a cable mounted plug available on request.



Pos.	Description
1	Motor side shielding
2	Sheet metal fixing screw
3	Power cable gland
4	Signal cable gland

The plug has a thread to secure the metal shielding with the cable gland M25x1.5, from the cable gland a multipolar power supply cable comes out with an external sheathing of Ø9-16.5 mm (3 in figure).

The plug has a thread to secure the metal shielding with the cable gland M16x1.5, from the cable gland a multipolar signal cable comes out with an external sheathing of Ø4-5.9 mm (4 in figure).

As can be seen in the figure, the plug is fitted with a shielded connection on the motor side (1 in figure). In this way it guarantees the maximum level of EMC immunity from signals originating from external disturbances on machine tools, such as brushless drives, solenoid valves, etc.

In the plug wiring check that the screws are tightened to guarantee continuity between the shielding and the power and signal cables.

The power cable and the signal cable must guarantee a shielding grade of 85%.

When connecting the plug with the electrospindle, with the screws supplied, check that the shielding is secured to the casing of the electrospindle (see photo below).

4.9.4 Tool release manual command pushbutton for PLUG connections (PP)

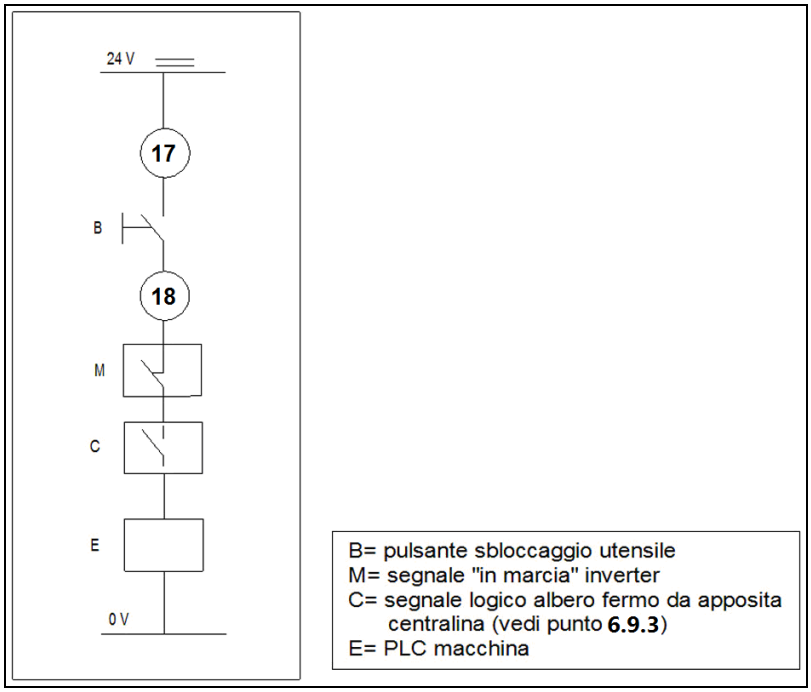
The position of the tool release manual command pushbutton is indicated in paragraph 2.5 "Main parts of the electrospindle".
The pushbutton can be included in the consents chain to manually control the release of the tool holder. The user presses the button to release the tool holder and the clamping collet remains open until the button is released.

If the button is used to control the manual tool changer, the machine logic must ensure that:

- ***when the electrospindle is in rotation, the control MUST disable the command from the pushbutton***
- ***the pushbutton is enabled ONLY when the electrospindle is stopped***
- ***the manual release command must be performed with the machine in MANUAL mode***

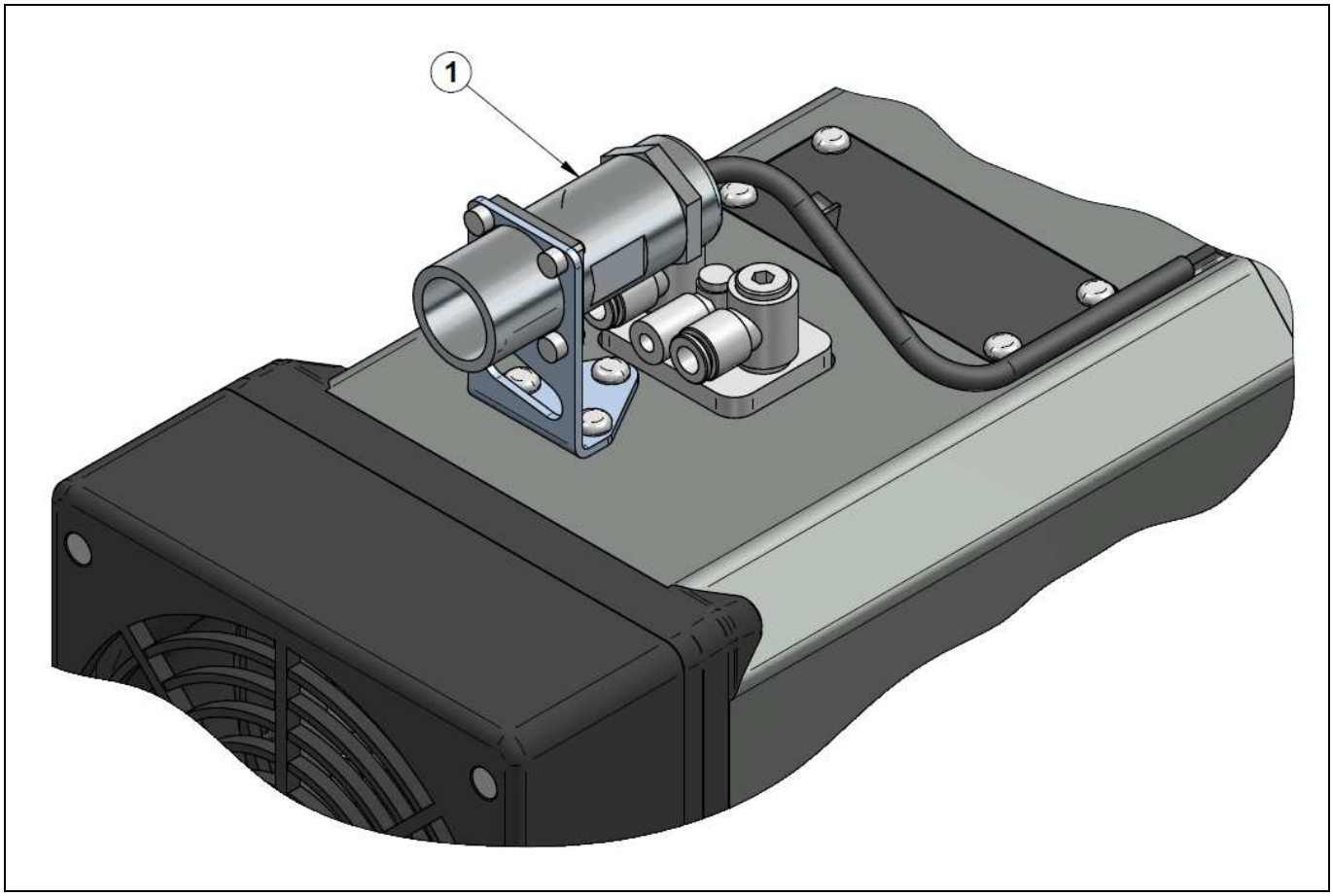
The non-compliance with the points above can cause the ejection of the rotating tool, with a risk of fatal injuries for people!

The diagram below shows an example of an electrical diagram that can be used to manage the manual release pushbutton.



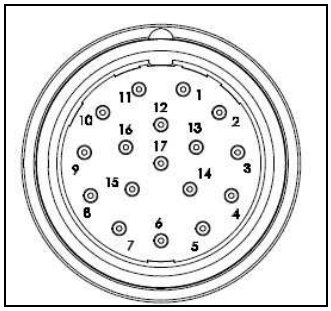
PUSHBUTTON SPECIFICATIONS	
Nominal voltage (CC)	24V DC
Maximum current	100 mA

4.10 Encoder connection



Pos.	Description
1	M23 ENCODER connector

4.10.1 Encoder contacts layout



M23 ENCODER CONNECTOR		
PIN	**DESCRIPTION**	**COLOUR**
1	Ua + ENCODER	WHITE
2	Ua - ENCODER	BROWN
3	Un + ENCODER	GREY
4	N.C.	-
5	N.C.	-
6	N.C.	-
7	+0 Vcc power supply ENCODER	BLUE
8	N.C.	-
9	N.C.	-
10	+5 Vcc power supply ENCODER	RED
11	Ub + ENCODER	PINK
12	Ub - ENCODER	BLACK
13	Un - ENCODER	YELLOW
14	N.C.	-
15	CONNECTED WITH 7	BLUE
16	5V SENSE ENCODER	GREEN
17	N.C.	-

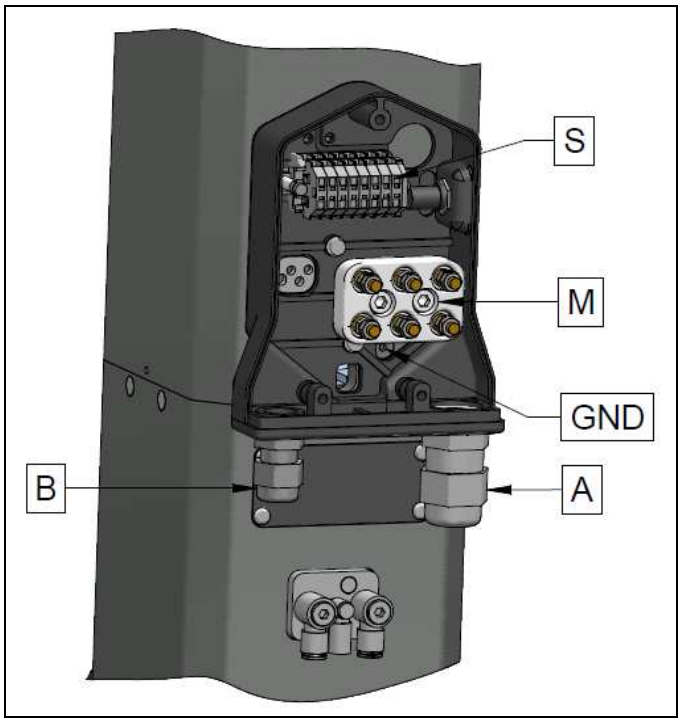
N.C. = NON COLLEGATO / NOT CONNECTED

The power cable, the signal cable and encoder cable, when present, must guarantee a shielding grade of 85%.

The encoder cable must have the pairs of signal cables (a, b, n) twisted with an adequate step for the application. The power supply cables of the encoder must also be twisted. Each pair of cables must be twisted individually.

4.11 Two-voltage electrical connection (BT) Basic

The electrical connection of the electrospindle is performed with a power supply and signal terminal board located in the electrical box secured on the spindle casing.
On the cover of the electrical box there is a plate indicating the type of electrospindle and the mechanical and electrical specifications, such as: power, absorbed current, rotation speed, etc. The power and signal cable for the electrical power supply and the communication between machine and electrospindle is performed with two cable glands (A) and (B) located on the electrical casing. The supply terminal board is used to change the connections of the phases, based on the selected power supply voltage.

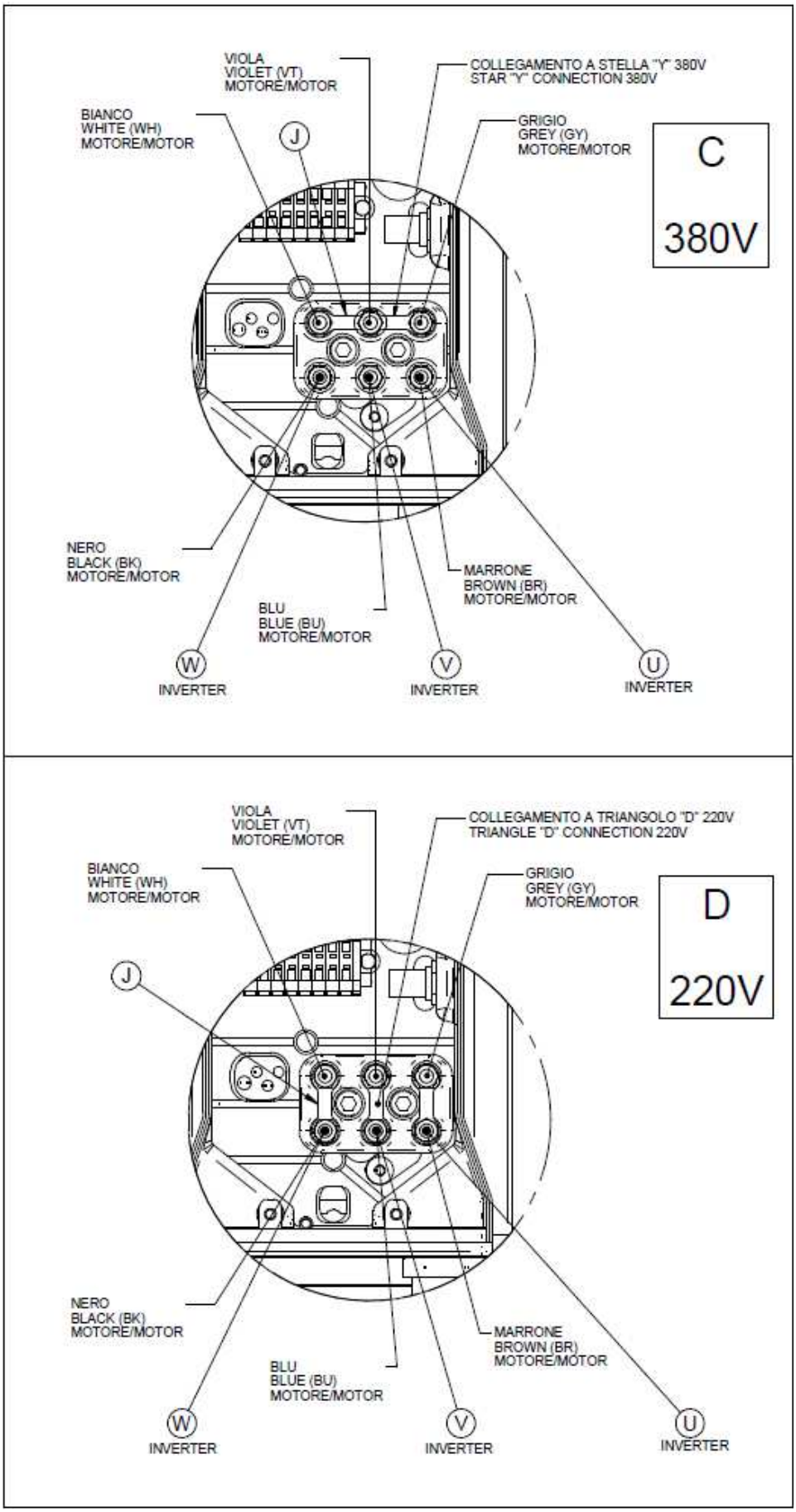


RIF / REF	COLLEGAMENTO / CONNECTOR	SIMBOLI / SYMBOL	TENSIONE / SUPPLY VOLTAGE
C	**STELLA / STAR**	Y	380 V
D	**TRIANGOLO / TRIANGLE**	D	220 V

4.11.1 Terminal board electrical connection

Connect the power supply cables to the terminal board (C) or (D) only with the electrical supply of the machine is cut off. If these indications are not complied with, there may be injuries to people and damage to the electrospindle.

The power supply (M) of the electrospindle is used for the power supply and to select the voltage power supply.
Place the jumpers (J) in the terminals to set a different voltage power supply.
Set the jumpers(J) as shown in the drawing (C) to work with a voltage of 380 V.
Set the jumpers (J) as shown in the drawing (D) to work with a voltage of 220 V.



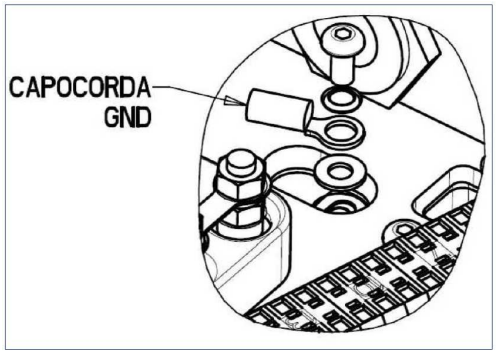
Set the jumpers (J) in the terminal board only in the 2 positions available, see drawing (C) or (D). Different jumper (J) settings can cause injuries to people or damage to the electrospindle.

(C) Position of the jumper (J) for star connection - 380 V
(D) Position of the jumper (J) for triangle connection - 220 V

For the power supply of the phases inside the power wiring, use cables with a section of 6 mm2 (AWG 10) with a current density suitable for the electrospindle absorption indicated on the identification plate.

Always connect the spindle with a grounding wire. Use a terminal and secure it with the M4 screw as shown in figure 1

Figure 1



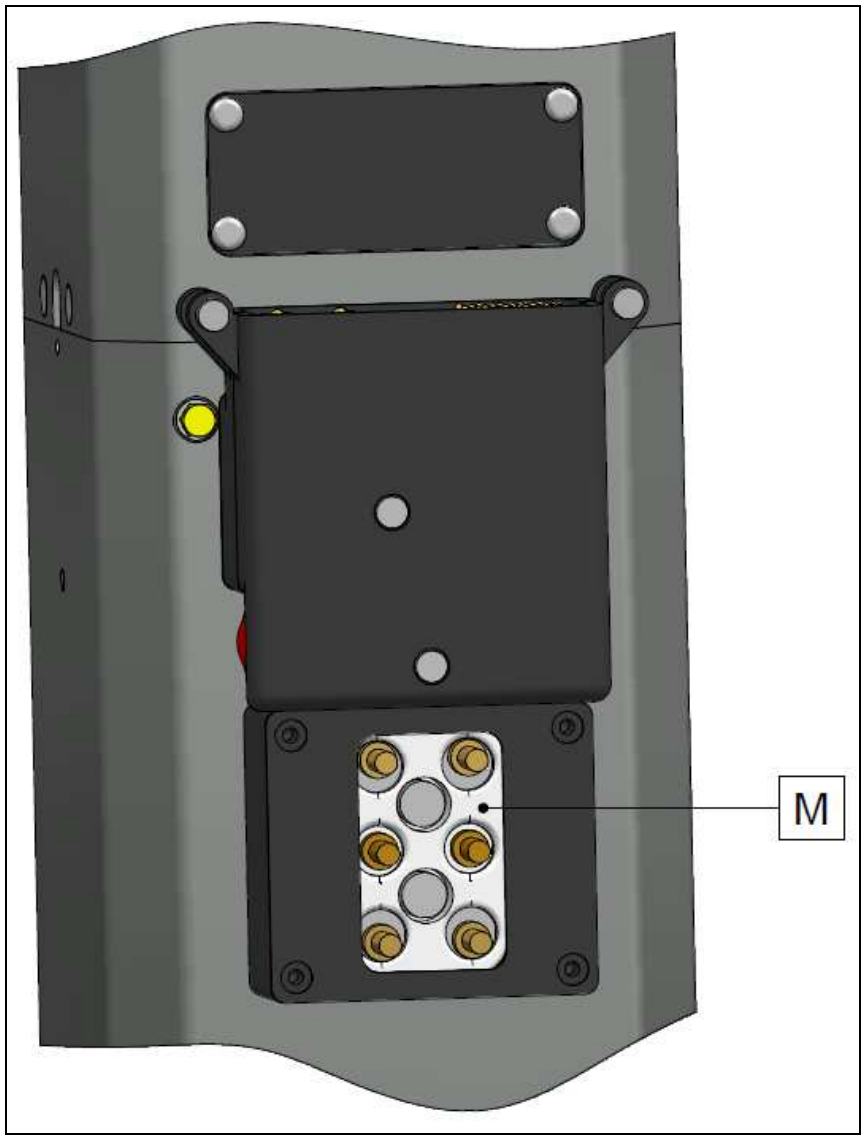
The electrospindle power supply MUST be through an adequately sized and parametrised inverter, in compliance with the electrical specifications of the motor, indicated on the electrospindle plate and in point 2.2 of this manual.

The wave shape PWM of the power supply voltage must have values of dV/dt<2 kV/micros. If not an an inductance-filter must be inserted between the inverter and the electrospindle that can flatten such voltage peaks that are harmful for the stator windings. The inductance must be sized as follows:

- ***Impedance value: 0.045 mH on the 3 phases.***
- ***Operating voltage: 400V***
- ***Maximum operating frequency: 1000 Hz***
- ***PWM switching frequency: 8 kHz***
- ***Flow value in current: higher than the maximum operating current considering the most demanding service (S1 or S6).***
- ***Maximum length of the wiring cables: 40 m***

4.12 Two-voltage electrical connection (BT) PP

The electrical connection of the electrospindle is performed with a power supply and signal terminal board located in the electrical box secured on the spindle casing.
On the cover of the electrical box there is a plate indicating the type of electrospindle and the mechanical and electrical specifications, such as: power, absorbed current, rotation speed, etc. The supply terminal board is used to change the connections of the phases, based on the selected power supply voltage.

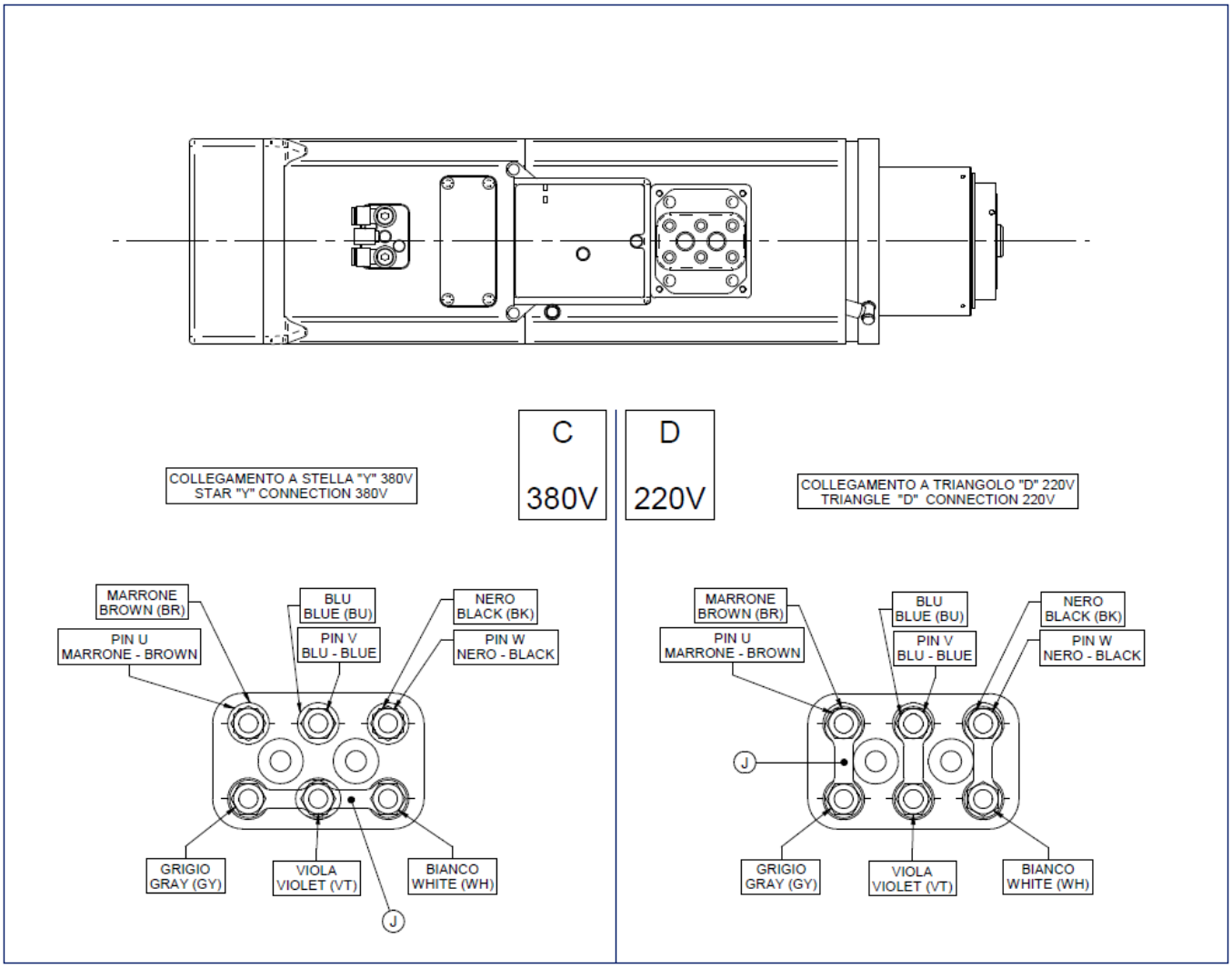


RIF / REF	COLLEGAMENTO / CONNECTOR	SIMBOLI / SYMBOL	TENSIONE / SUPPLY VOLTAGE
C	**STELLA / STAR**	Y	380 V
D	**TRIANGOLO / TRIANGLE**	D	220 V

4.12.1 Terminal board electrical connection

Connect the power supply cables to the terminal board (C) or (D) only with the electrical supply of the machine is cut off. If these indications are not complied with, there may be injuries to people and damage to the electrospindle.

The power supply (M) of the electrospindle is used for the power supply and to select the voltage power supply.
Place the jumpers (J) in the terminals to set a different voltage power supply.
Set the jumpers(J) as shown in the drawing (C) to work with a voltage of 380 V.
Set the jumpers (J) as shown in the drawing (D) to work with a voltage of 220 V.



Set the jumpers (J) in the terminal board only in the 2 positions available, see drawing (C) or (D). Different jumper (J) settings can cause injuries to people or damage to the electrospindle.

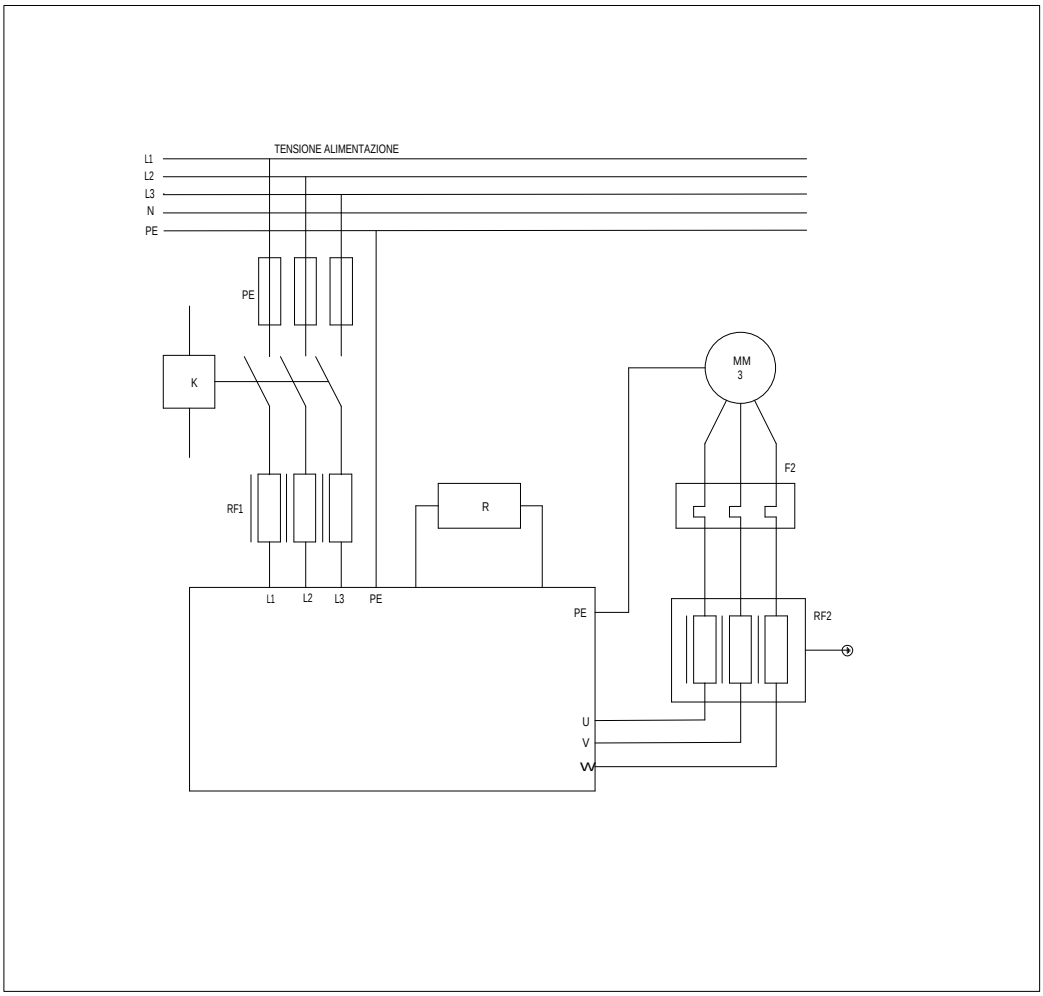
(C) Position of the jumper (J) for star connection - 380 V
(D) Position of the jumper (J) for triangle connection - 220 V

For the power supply of the phases inside the power wiring, use cables with a section of 6 mm2 (AWG 10) with a current density suitable for the electrospindle absorption indicated on the identification plate.

The electrospindle power supply MUST be through an adequately sized and parametrised inverter, in compliance with the electrical specifications of the motor, indicated on the electrospindle plate and in point 2.2 of this manual.

The wave shape PWM of the power supply voltage must have values of dV/dt<2 kV/micros.
If not an an inductance-filter must be inserted between the inverter and the electrospindle that can flatten such voltage peaks that are harmful for the stator windings.
The inductance must be sized as follows:
- Impedance value: 0.045 mH on the 3 phases.
- Operating voltage: 400V
- Maximum operating frequency: 1000 Hz
- PWM switching frequency: 8 kHz
- Flow value in current: higher than the maximum operating current considering the most demanding service (S1 or S6).
- Maximum length of the wiring cables: 40 m

4.13 Electrical power circuit



The electrospindle power supply MUST be through an adequately sized and parametrised inverter, in compliance with the electrical specifications of the motor, indicated on the electrospindle plate and in point 2.2 of this manual.

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5.1 Checks before starting up

5.1.1 Positioning

Check that all the specifications listed in chap. 4 paragraph 4.3 have been met.

5.1.2 Compressed air connections

Check that all the specifications listed in chap. 4 paragraph 4.4 have been met, and in particular:
- check that the air supplying the electrospindle is DRY and that it meets the specifications listed in chap. 4 paragraph 4.4.1.
- check that with the tool holder inserted pressurisation air comes out of the front ring nut
- check that the air for the taper cleaning blow is present during the tool change phase.

5.1.3 Electrical connections

The electrospindle grounding must be connected to the machine grounding.

The thermal protection of the motor normally closed (N.O.), must activate the "Motor Overheating" operating mode described in chap. 6.

Make sure that the electrical connection is closed correctly.

Make sure that the cable mounted plug of the wiring is secured correctly to the electrical box of the electrospindle with M4 screws.
Make sure that the shielding plug fitted on the cable mounted plug is secured correctly to the electrospindle casing, as specified in chap. 4, paragraph 4.6, in the various versions.

The non-compliance with the above can cause serious injuries to people (electrocution risk).

5.1.4 Inverter programming

Check:
- The maximum voltage set on the inverter must match the nominal value on the electrospindle plate.
- The frequency value at which the nominal voltage value is reached must match the nominal frequency indicated on the electrospindle plate.
- The maximum speed set on the inverter must match the value on the electrospindle plate.
- The maximum continuative current set on the inverter must match the maximum current value on the electrospindle plate, at the values indicated for the requested power and service.

In order to prevent dangerous overloads, set the values of the maximum current or the maximum torque that can be generated by the inverter at no more than 140% of the nominal current or nominal torque values.
This means allowing a maximum overload of 40% beyond the nominal values.

If other parameters are required, check the electrospindle plate and contact the technical support, if necessary.

5.1.5 Checks at the first start

To check the electrospindle at the first start we strongly recommend using a tool holder taper without tool and the relative clamping parts present (e.g. elastic collet, ring nut, etc.).
Do not exceed the speed indicated by the manufacturer of the tool holder.

Start the electrospindle only if the sensor S1 "tool clamped correctly" is "ON" corresponding to the power supply +24V DC

Check that the electrospindle cannot start without a tool: it is absolutely FORBIDDEN to start the electrospindle, in the ISO or HSK versions, WITHOUT the tool holder inserted.

Make sure that:
- the rotation direction of the electrospindle matches the direction set during the check (if it does not invert 2 phases on the wiring between inverter and electrospindle);
- the sensors S1, S2, S3, S5 (optional), are triggered as described in chap. 6;
- the tool change cycle occurs only with the spindle stopped;
- for air cooled electrospindles: the electric fan signal is ON with the electric fan rotating if the machine is on, even if the electrospindle is off;
- for liquid cooled electrospindles: that the flow is greater than 4 litres/min. and that the pressure of the liquid at the electrospindle top does not exceed 6 bar.

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6.1 Environmental Conditions

The electrospindle can be used under the following conditions.
Temperature: min. +5 °C; max. +40 °C
Installation height: Max. 1000 m a.s.l. (at higher altitudes, consult Manufacturer)
Make sure that there is good level of brightness; the minimum lighting allowed is 300 lux.
The electrospindle may not be used in the open air.
The electrospindle must be used in industrial environments.
The electrospindle is not suitable for use in areas classified as potentially explosive atmospheres, according to the Directive 99/92/EC.
The electrospindle has been tested in standard environmental conditions: in particular the air temperature is of 20°C.

6.2 Running-in

The electrospindles are fitted with high precision bearings lubricated for life with special high speed grease.
Before being delivered the electrospindle undergoes an automatic running-in cycle in order to distribute the lubricating grease uniformly along the bearing rolling tracks.
No further running-in procedures are required.
If the electrospindle remains in storage for more than 6 months after the installation, the following running-in procedure must be performed in steps BEFORE switching on the electrospindle and starting to work.

Both Vmax = maximum speed of the electrospindle;

Step	Speed %	Speed [Rpm]	Duration [min.]
1	6.3	0.063 * Vmax	15
2	Electrospindle stopped		5
3	12	0.12 * Vmax	15
4	Electrospindle stopped		5
5	19	0.19 * Vmax	15
6	Electrospindle stopped		5
7	25	0.25 * Vmax	15
8	Electrospindle stopped		5
9	38	0.38 * Vmax	10
10	Electrospindle stopped		5
11	50	0.50 * Vmax	10
12	Electrospindle stopped		5
13	67	0.67 * Vmax	10

The run-in procedure in steps lasts 2 hours.

6.3 Pre-heating

When starting the electrospindle for the first time in the morning, perform the following pre-heating cycle, in order to optimise the pre-loads and the lubrication conditions of the bearings.
The pre-heating cycle extends the life of the electrospindle.
The pre-heating cycle must be performed with the tool holder inserted without tool and without performing any machining.

Both Vmax = maximum speed of the electrospindle;

Step	Speed %	Speed [Rpm]	Duration [min.]
1	50	0.50 * Vmax	2
2	75	0.75 * Vmax	2
3	90	0.90 * Vmax	1

The pre-heating cycle must be performed each time that the machine remains inactive for a sufficient time to cool the electrospindle to the ambient temperature.

6.4 Sensors

The electrospindle is fitted with various sensors to monitor its state and guarantee the maximum level of reliability and operational safety.
The sensors that are inside the electrospindle are shown in the table below.

NAME	INFORMATION
S1	Tool correctly clamped
S2	Collet open
S3	Spindle rotation
S5 (optional)	Piston return (optional)
Encoder	Spindle angular position
Motor thermal protection	Motor overheating
Electric fan rotation	Electric fan rotation

The incorrect setting of the sensors S1, S2, S3 or S5 (optional) can cause malfunctions such as the ejection of the rotating tool, with the risk of fatal injuries for people.
To set the sensors refer to the instructions in chapter 8 unscheduled maintenance.

All the electrospindles are fitted with the sensor S3 "spindle rotation", to monitor the spindle rotation.

There is no "S4" sensor.

6.4.1 Technical specifications of the inductive sensors

The sensors S1, S2, S3 and S5 (optional) are inductive sensors (proximity) with the following specifications:

Type: PNP proximity normally open (N.O.)	
Supply voltage	22 ÷ 26 V DC
Nominal sensitivity	0.8 mm
Maximum load	200 mA
No load current	< 10 mA

The sensors are protected against:
- short circuit and overload;
- polarity inversion.

The sensors are housed in a nickel-plated brass casing to guarantee the maximum shielding.
The sensors comply with the following standards:
- electromagnetic compatibility (EMC) EN60947-5-2
- collisions and vibrations: IEC 68-2-27 and IEC 68-2-6

The sensors S1, S2, S3 and S5 (optional) are proximity sensors with the nominal operating voltage of 24Vcc.

The sensors can be in two states on the output terminal.

"ON": with an output voltage of 24 Vcc.

"OFF": with an output voltage of 0 Vcc.

6.4.2 State of the electrospindle and output of the sensors S1, S2 and S5 (optional)

The sensors S1 and S2 are used to manage and monitor the tool in the electrospindle, signalling to the machine when the tool has been clamped correctly or released.

SENSORS STATUS	S1 TOOL CLAMPED	S2 COLLET OPEN	S5 (optional) PISTON RETURN
TOOL CLAMPED CORRECTLY	ON	OFF	ON
TOOL NOT CLAMPED CORRECTLY TOOL NOT PRESENT	OFF	OFF	ON
TOOL RELEASED	OFF	ON	OFF

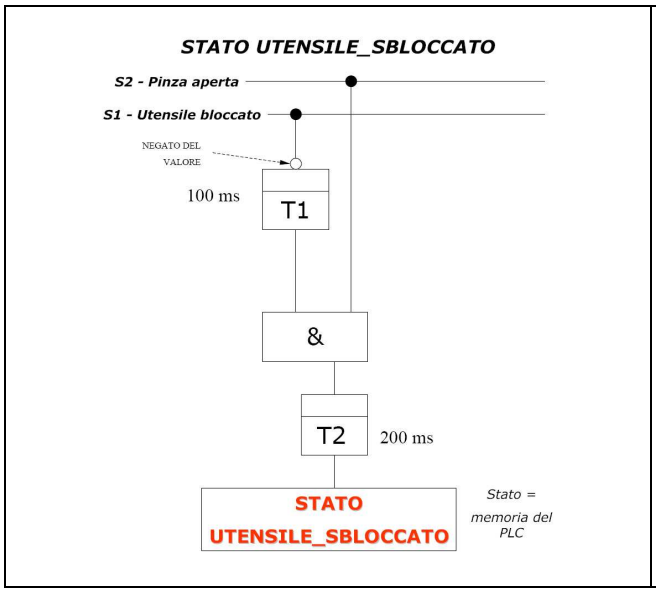
The incorrect setting of the sensors S1, S2, S3 and S5 (optional) can cause malfunctions such as the ejection of the rotating tool, with the risk of fatal injuries for people.
To set the sensors follow the instructions supplied in chapter 8.

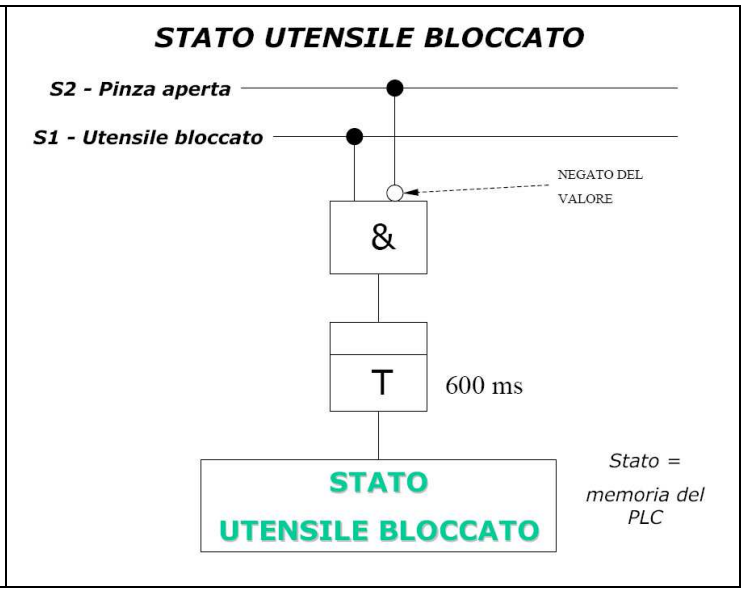
The rotation of the electrospindle can take place only when the sensor S1 "tool clamped" is ON and the sensor S2 "collet open" is OFF.
If the sensor S1 switches to OFF during machining, stop the electrospindle as there could be dangerous situations.

The taper cleaning blow can be activated and/or remove the tool from the electrospindle only when the sensors S2 "collet open" is ON.
Not following this indication can cause faults to the electrospindle and/or the machine that it is fitted on.

6.4.3 Logical management of the sensors output

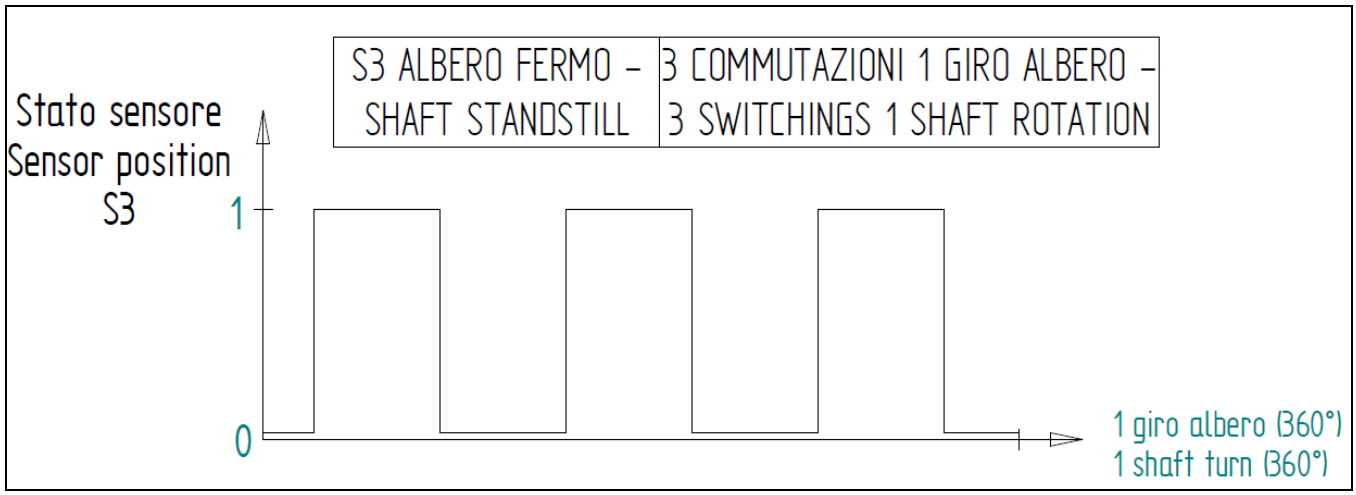
To define the electrospindle states of tool clamped and tool released, use the following logic diagrams based on the state of the electrospindle signals.





6.4.4 Sensor S3 output

The sensor S3 "spindle rotation" provides three "ON" impulses and two "OFF" impulses at every rotation of the electrospindle spindle as indicated in the picture.



During the rotation of the electrospindle the sensor generates a set of impulses at a variable frequency according to the rotation speed.

Thanks to the on-board electronics, the sensor S3 generates the set of impulses also at the maximum speed of the electrospindle. If it does not it means that the snesor is malfunctioning or adjusted incorrectly, therefore it must be adjusted as set out in chap. 8 "unscheduled maintenance".

THIS SET OF IMPULSES MUST SUBSEQUENTLY BE DECODED BY AN ELECTRONIC CONTROL UNIT INTO A LOGIC OR ANALOGUE SIGNAL TO BE MANAGED IN ORDER TO INFORM THE CONTROL IF THE ELECTROSPINDLE IS ROTATING OR NOT.

The decoded S3 signal from the control unit must be managed so as to avoid performing tool changes with the spindle still rotating. This must be observed for both automatic and manual tool changes. Once the tool change phase has started, ignore the status of the sensor S3 "spindle rotation" for the whole operation.

All the electrospindles are fitted with the sensor S3 "spindle rotation", to monitor the spindle rotation.

6.4.5 Thermal alarm and its management

The electrospindle is fitted with a "thermal alarm" consisting of a bimetallic probe sunk inside the windings of the stator, so that the control circuit is opened when th temperature exceeds values that could compromise the reliability of the electrospindle.
In this way, if the user asks for a higher power than the power that the electrospindle can deliver, overheating it, the information is transmitted to the control.
In acceptable operating conditions the thermal alarm is closed, therefore the monitoring circuit is closed.
In NON-acceptable operating conditions the thermal alarm opens, interrupting the circuit.
The thermal alarm closes the circuit when the temperature returns to acceptable values.

The thermal alarm must be managed by the PLC that must immediately:
- stop the machine axes
- stop the electrospindle if the thermal alarm opens the circuit.

Not following this indication can cause serious damages to the electrospindle and/or the machine that it is installed in.

6.4.5.1 Technical specifications of the thermal alarm

Power supply	22 ÷ 26 V DC max.
Isolation voltage	2 kV
Contact resistance (according to MIL R 5757)	< 50 mΩ
Contact interruption voltage	< 1 ms

6.4.6 Electric fan rotation

(6.8.6 45f ce)

The solenoid valve is fitted with an integrated sensor that can generate 2 impulses per fan rotation.
See section 6.5.2.

6.5 Electric fan

(6.9 45f ce)

If the electrospindle is air cooled, it may include an electric fan to generate autonomously the cooling air flow.
The electric fan is located in the rear of the electrospindle, as shown in chap. 2 paragraph 2.5 (main parts).
The rotation of the electric fan is independent from the rotation speed of the electrospindle, to ensure optimal cooling and silence of the electrospindle at all speeds.

When the machine is on, the electric fan must ALWAYS be operating, even if the electrospindle is stopped.

6.5.1 Technical specifications of the electric fan

(6.9.1 45f ce)

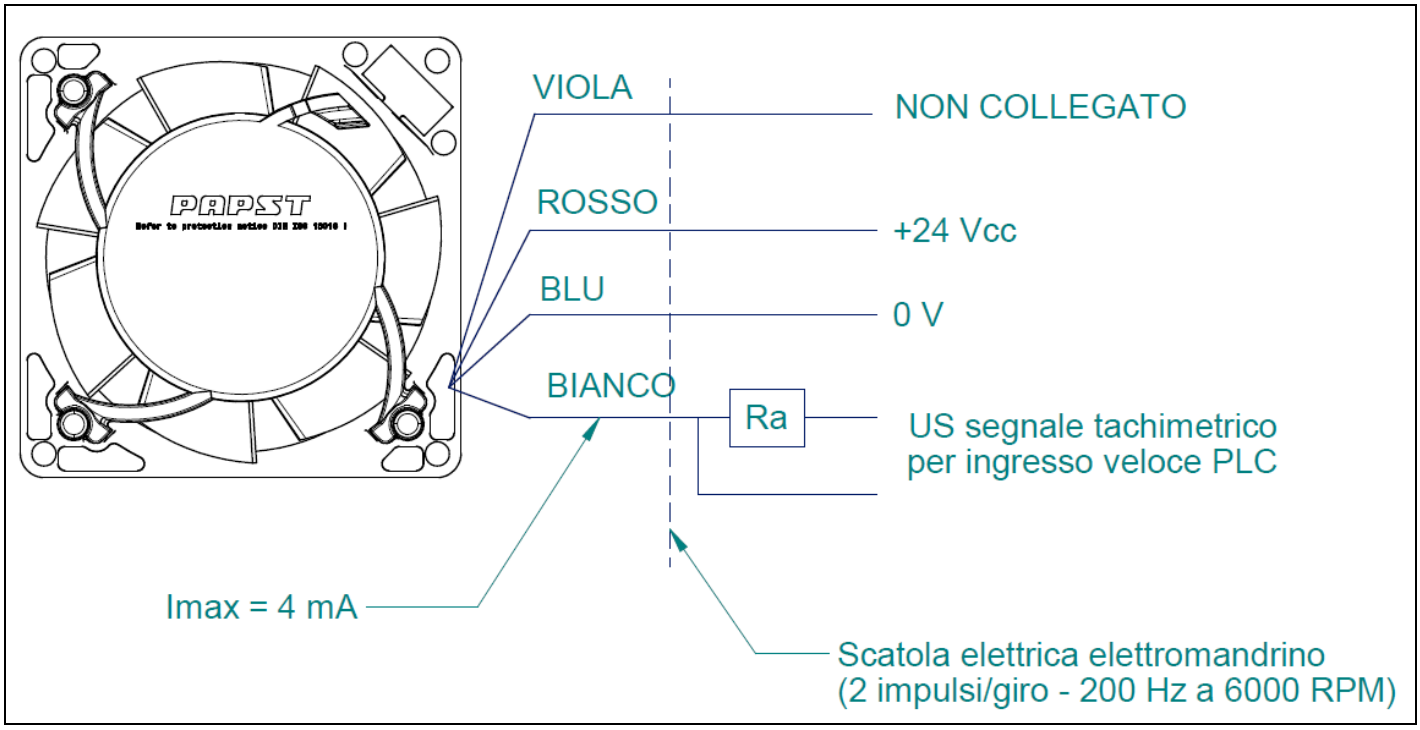
Power supply voltage	24 (16-30) V DC
Rotation speed	6000 RPM
Electrical input	1.6 A
Power	38.5 W
Protection rating	IP 20
Supports	On ball bearings
Sensors	Rotation signal 2 impulses/revolution
Protections	Against polarity inversion, spindle blockage and overload

The electric fan is fitted with a brushless motor and on board integrated electronics.
As can be seen in the table, the power supply voltage is the same that powers the proximity installed on the electrospindle. Seeing as the rotation speed is directly proportional to the power supply voltage, we strongly recommend the stabilised 24Vcc already used for the sensors, in order to guarantee an optimal and constant cooling flow.
The electric fan complies with the electromagnetic pollution standard (EMC) EN610000-6-3.

The electric fans are installed on Silentblok rubber anti-vibration supports, to protect the electric can from vibrations generated by the cutting during the electrospindle machining phases.

6.5.2 Monitoring the electric fan

The electric fan is fitted with an on-board sensor that can generate two voltage impulses for every revolution of the fan. This allows the operation of the electric fan to be monitored and prevents
the electro-spindle from overheating.
The sensor us supplied by the same terminals used to supply the electric fan.
To identify the contact connected to the sensor, refer to chap. 4 paragraph 4.6 in the various versions.
The electric fan terminal must be connected as shown in the figure below.



The signal must be connected to a fast input of the PLC or to an electronic control unit.
A specially designed control unit is available on request.
The value of resistance for the connection must be determined based on the "On" +Ubs and
"Off" USlow voltage typical of the PLC inputs assigned the Isink current typical of the electric fan.

$$R_a=(U_{bs}- U_{slow})/I_{sink}$$

The value of the Isink current for the electric fan installed on the electrospindles E is shown below.

I_{sink}	2 mA

Example.
If the electrospindle is controlled by a PLC whose "On" state is 24V and the "Off" state is 5 V
it is Ra=(24-5)/(2/1000)=9500 ohm

6.6 ENCODER (optional)

6.6.1 General description

There are four encoder models available:

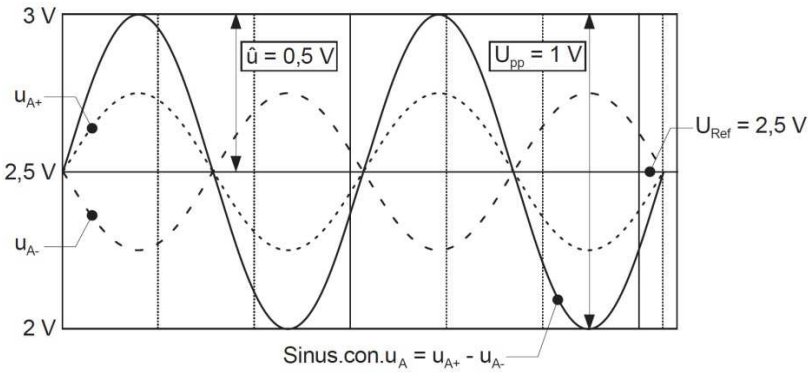
- Sin-Cos 128 impulses
- Square wave TTL 512 impulses
- Square wave TTL 1024 impulses

6.6.2 Sin – Cos encoder (optional)

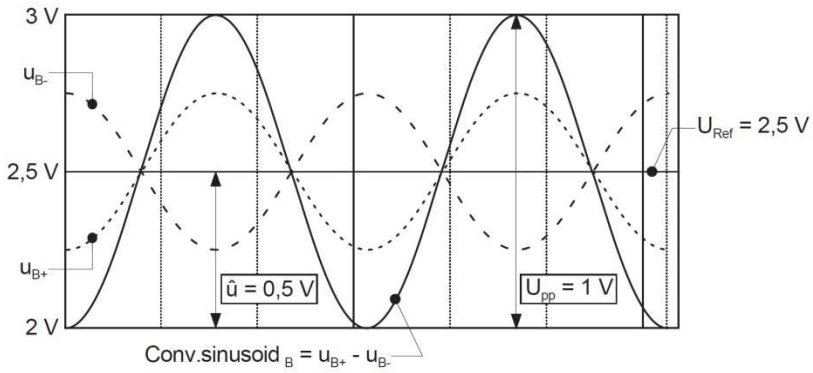
(6.8.6 45f ce)

Specifications	Values
Output wave shape	Analogue with sinusoidal shape 1 Vpp
Module:	0.5 mm
Power supply	5V DC +/- 5%
Operating temperature	-30°C ÷ +85°C (-22 °F ÷ +185°F)
Max. running altitude	1000 m (3500 ft)
Input signal	128 impulses / revolution + reference impulse
Output signal	Ua: SIN 1 Vpp – Ub: COS 1 Vpp N: single impulse 160…240 mV (reference impulse)

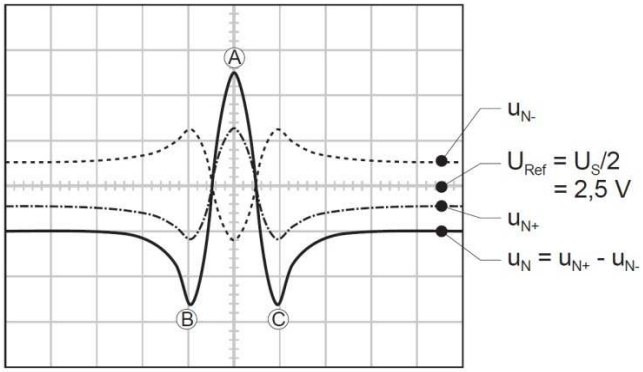
Output signal shape:



Sinusoidal Wave: 1Vpp UA



Cosinusoidal Wave: 1Vpp UB



Reference type: UN (Peak A =160-240 mV)

Ua+ = sinusoidal encoder signal A (2.5±0.5V)
Ua- = sinusoidal encoder signal A negative (2.5±0.5V)
Ub+ = cosinusoidal encoder signal B (2.5±0.5V)
Ub- = cosinusoidal encoder signal B negative (2.5±0.5V)
Un+ = zero signal N
Un- = zero signal N negative
T= period

The phase displacement between the sinusoidal signal Ua and the cosinusoidal signal Ub is T/4, where T is the period of all the sinusoidal waves.

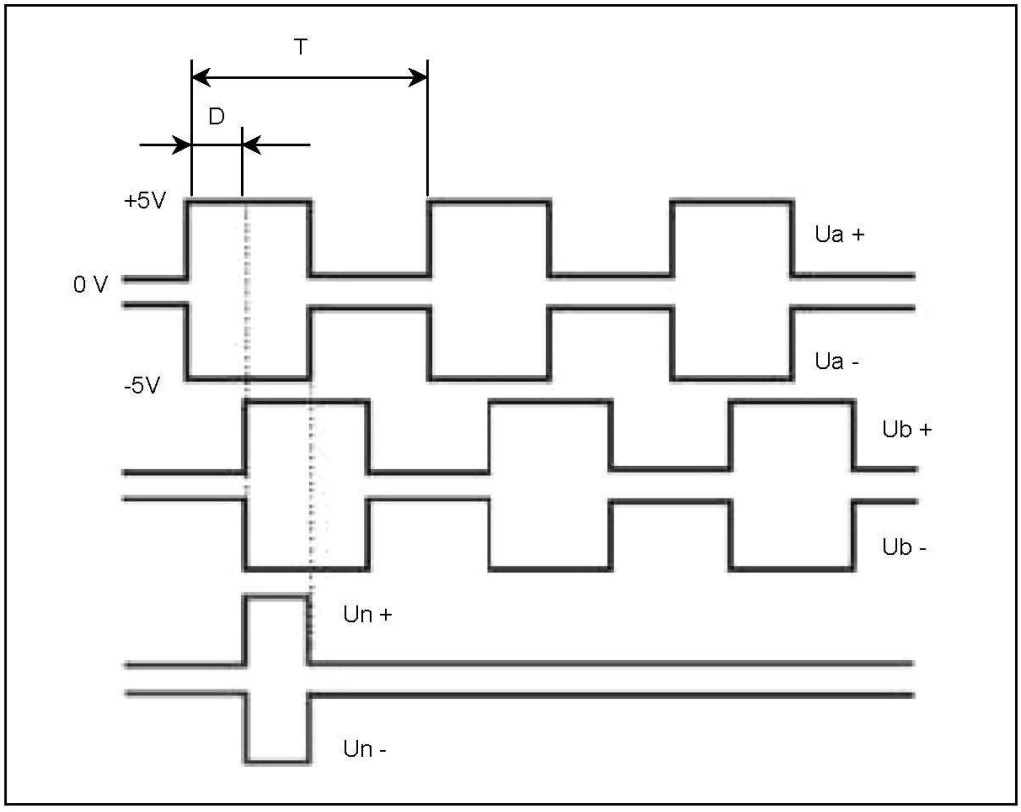
6.6.3 512 square wave encoder (optional)

(6.8.6 70g)

The electric fan is fitted with an integrated sensor that can create 2 impulses for every revolution of the fan, if present.
See paragraph 6.5.2

Specifications	Values
Manufacturer	Lenord+Bauer
Wave shape	Square wave
Phonic wheel module	0.5 mm
Power supply	5V DC +/- 5%
Operating Temperature	-30°C ÷ +85°C (-22 °F ÷ +185°F)
Max. Operating altitude	1000 m (3500 ft)
Signals input	512 impulses per revolution + zero mark (128 impulses multiplied x 4 internally)
Signals output	TTL 5V GEL 2444TN4G5K150-E

Output signal shape:



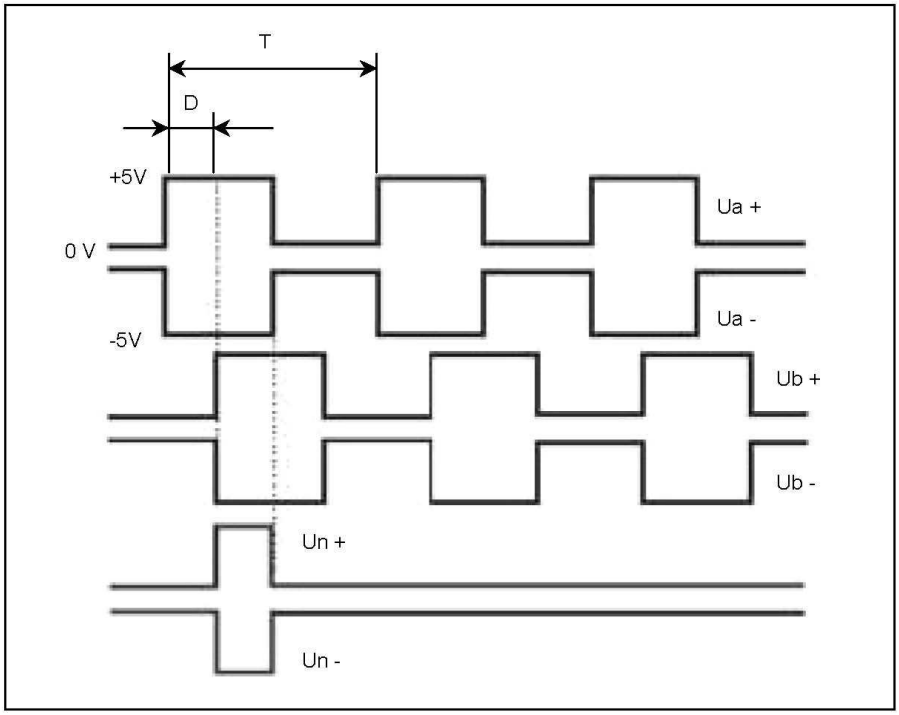
Ua+ = encoder signal A (0 ¸ 5V)
Ua- = encoder signal A negative (-5V ¸ 0)
Ub+ = encoder signal B (0 ¸ 5V)
Ub- = encoder signal B negative (-5V ¸ 0)
Un+ = zero signal N (0 ¸ 5V)
Un-= zero signal N negative (-5V ¸ 0)
T= period
D = phase displacement (D=T/4)

6.6.4 1024 square wave encoder (optional)

The electric fan is fitted with an integrated sensor that can create 2 impulses for every revolution of the fan, if present.
See paragraph 6.5.2

Specifications	Values
Manufacturer	Lenord+Bauer
Wave shape	Square wave
Phonic wheel module	0.5 mm
Power supply	5V DC +/- 5%
Operating Temperature	-30°C ÷ +85°C (-22 °F ÷ +185°F)
Max. Operating altitude	1000 m (3500 ft)
Signals input	1024 impulses per revolution + zero mark (128 impulses multiplied x 8 internally)
Signals output	TTL/RS422 (0V DC, +5V DC line driver)

Output signal shape:



Ua+ = encoder signal A (0 ¸ 5V)
Ua- = encoder signal A negative (-5V ¸ 0)
Ub+ = encoder signal B (0 ¸ 5V)
Ub- = encoder signal B negative (-5V ¸ 0)
Un+ = zero signal N (0 ¸ 5V)
Un-= zero signal N negative (-5V ¸ 0)
T= period
D = phase displacement (D=T/4)

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General notes on performing any type of operation on the electrospindle, whether scheduled or unscheduled maintenance.

To perform the operations safely on an electrospindle installed on the machine, refer to the manual supplied with the machine.

Perform only the interventions described in this manual, following all the instructions set out scrupulously and if there are any doubts contact the technical support.

Only original spare parts can be used for any replacements and adjustments. Any other type of intervention NOT allowed voids the warranty.

The maintenance operations must be carried out exclusively by qualified personnel, by complying with the applicable directives and safety standards , using suitable instruments and products.

During any maintenance operation the electrospindle must be:
- disconnected and cut off from the electrical power supply;
- with the tool completely stopped (not rotating).

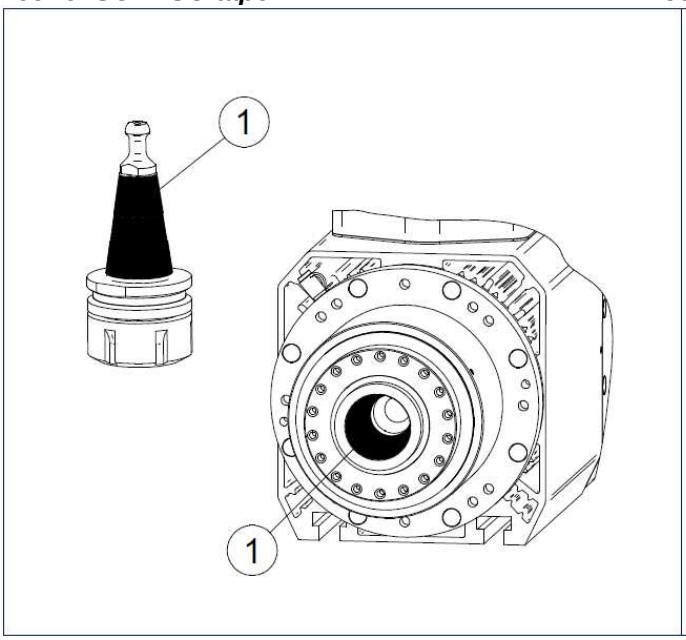
The regular compliance with all the scheduled maintenance operations is essential to maintain the use and performance conditions indicated by the manufacturer at the delivery.

7.1 Checking the cleaning of the tool holder taper and of the conical seating of the spindle spindle

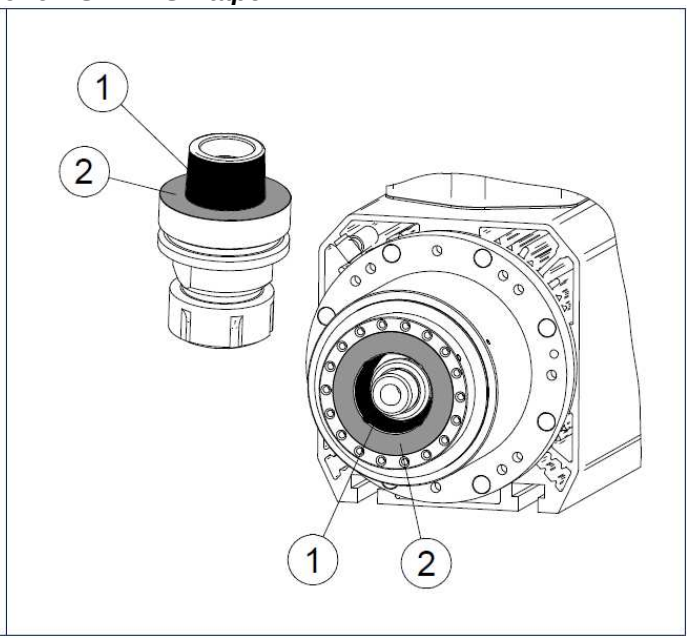
Frequency: DAILY

Before using the electrospindle, check that the conical seating (1) and the support plane (2) of the spindle and the corresponding coupling surfaces on the taper are clean and do not have traces of dust, grease, oil, metal particles and anything else that could compromise the ideal coupling between tool and tool holder.
Make sure that there are no dents.
The surfaces to check are shown in dark in the figures below.

cono ISO – ISO taper

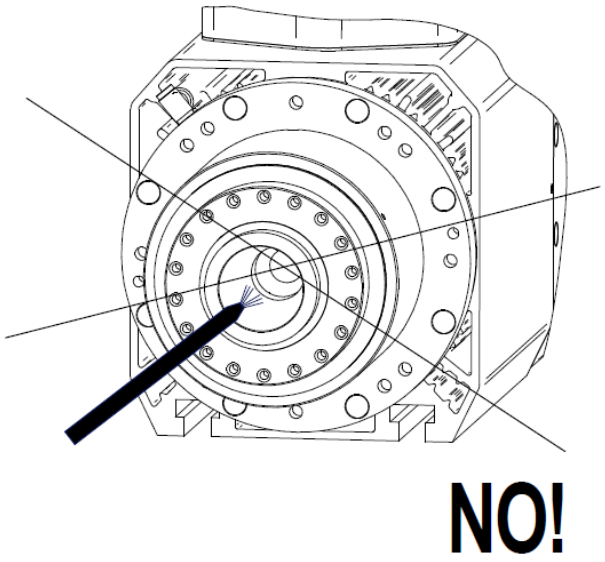
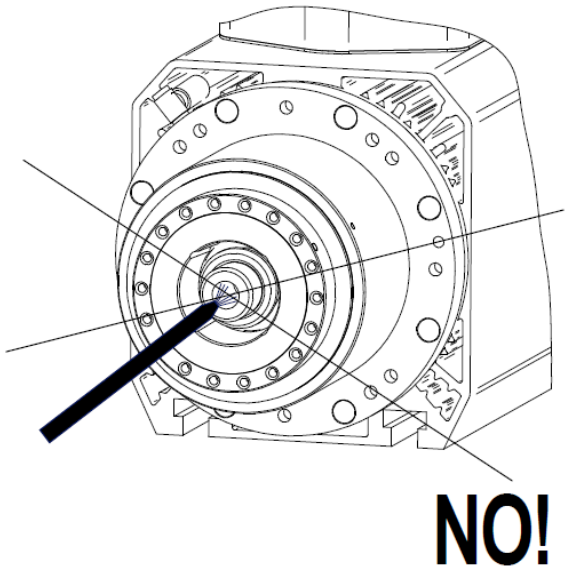


cono HSK – HSK taper



NEVER leave the electrospindle without the tool holder taper during the cleaning operations. Make sure that there is the setup ring nut inside the tool holder.

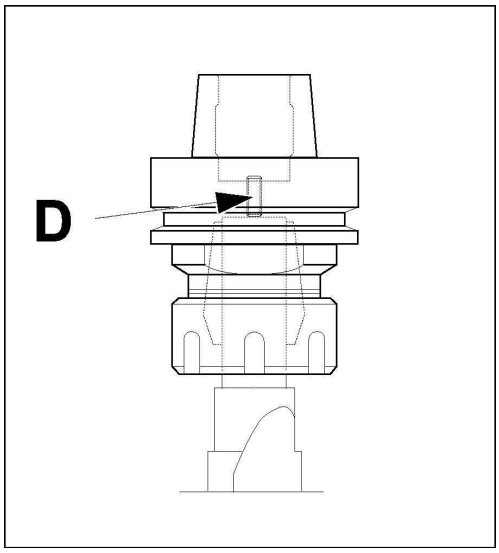
NEVER point compressed air jets inside the spindle spindle.
The non-compliance cause the buildup of dirt in the conical seating of the spindle and allows dust to enter inside the electrospindle.

cono ISO – ISO taper	*cono HSK – HSK taper*
	

Imperfect cleaning prevents the correct coupling of the tool holder with the spindle of the electrospindle with:
- serious consequences for the SAFETY of the operator;
- serious consequences on the duration of the electrospindle and the tool;
- serious consequences for the cutting precision and finish;
- risks of machine down times during the tool changes.

To clean the surfaces highlighted, USE clean and soft cloths, if necessary slightly soaked in acetone. NEVER USE abrasive or aggressive tools such as steel wool, abrasive cloths, aggressive acids, etc.

Check that the "D" ring nut is always fitted in the tool holder taper:
if it is missing dust can infiltrate inside the electrospindle. If it is missing from the tool holder, fit it.



7.2 Protection of the conical seating of the spindle spindle

Frequency: DAILY

The seating of the tool holder body in the electrospindle spindle MUST always be protected from impurities: use an empty tool holder taper (without tool) closed with its own setup ring nut.

At the end of the work shift, replace the tool holder taper with the empty one used to protect the electrospindle. This taper must be inserted clean and at ambient temperature. This prevents the non-release of the tool holder at the machine start.

7.3 Cleaning and lubrication of the HSK tool holder taper

Frequency: EVERY 2 WEEKS

Every month clean thoroughly the surfaces of the tool holder with a clean and soft cloth soaked in acetone.
After cleaning, lubricate with the solid, dry lubricant indicated below.

TOOL HOLDER TAPERS LUBRICATION	**TEFLUB CRC**
	KLUËBERT LUSIN PROTECT G31

The lubricant is contained inside a canister, therefore simply point the tube supplied towards the surfaces and spray rotating the taper in order to distribute it uniformly.
Spread the lubricant thoroughly with a CLEAN cloth if necessary.
Buildups of lubricant are damaging: remove them with a clean soft cloth.

THE NON-COMPLIANCE WITH THE ABOVE CAN CREATE RELEASE PROBLEMS OF THE TOOL HOLDER TAPERS.

ALWAYS CLEAN AND LUBRICATE THE TAPERS AT THEIR FIRST USE.

DO NOT USE LUBRICANTS DIFFERENT FROM THE ONES INDICATED.
DO NOT MIX DIFFERENT TYPES OF GREASE.

NEVER LUBRICATE THE ISO 30 TAPER. THIS LUBRICATION APPLIES ONLY FOR THE HSK TAPER.

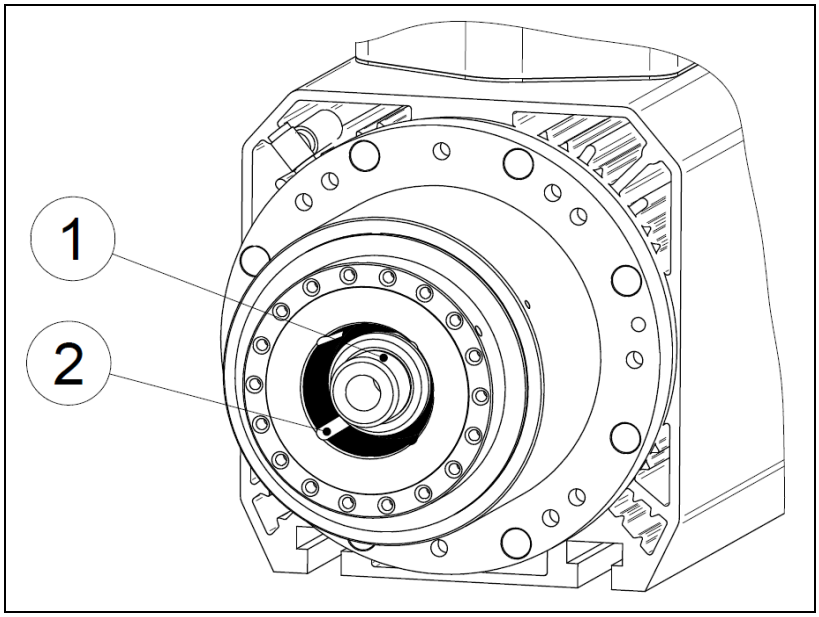
7.4 Cleaning and lubrication of the HSK tool holder collet

Frequency: MONTHLY

Every month lubricate the HSK tool holder collet of the electrospindle: use the spray grease indicated below.

HSK COLLET LUBRICATION	**CHEM TREND LUSIN LUB PM 1001**
	WOLFRACOTE S5P SPRAY
	METAFLUX 70-81 METAL SPRAY

After having stopped the electrospindle and set the machine in manual mode, move the electrospindle in the most easily accessible point.
Release the tool and leave the electrospindle in the released position. Disable the taper air blow on the specific solenoid valve, if necessary.
Insert the tube of the canister in one of the slots between the "petals" of the collet (1) and, holding the canister vertical,spray a small quantity of grease. Repeat the operation for the other gaps.
Do not apply too much lubricating grease.



To distribute the grease uniformly between the collet (1) petals, perform 10-15 openings (release) and closures (clamp) of the collet without the tool holder taper.
Insert an empty tool holder taper and rotate the electrospindle at 12000 RPM for a about one minute.
Stop the electrospindle, remove the tool holder taper and remove any grease that has deposited on the internal walls of the electrospindle spindle with a clean cloth soaked in acetone, if necessary.
Clean also the hollow part (") of the tool holder taper.
Buildups of lubricant are damaging: remove them with a clean cloth.

DO NOT USE LUBRICANTS DIFFERENT FROM THE ONES INDICATED.
DO NOT MIX DIFFERENT TYPES OF GREASE.

7.5 Tool pull check

After 500000 tool change cycles we recommend checking the pull exercised on the tool.
The control must be carried out after having previously cleaned and lubricated the tool holder collet as set out in chapter 7 "Scheduled maintenance".
if the pull drops below 220 Kg and 8 kN (HSK) after cleaning and lubricating, the electrospindle must be overhauled. After 500000 tool changes the pull check must be repeated every 150000 cycles. The check must be performed by a specialised technician appointed by Hiteco.
Frequency: first check after 500000 tool change cycles; the subsequent ones every 150000 tool change cycles.
- 1 tool change cycle 0 collet opening, tool release, collet opening and tool clamping.

THE NON-COMPLIANCE WITH THE CHECK ON THE PULL ON THE TOOL CAN CAUSE SERIOUS ACCIDENTS OR FAULTS ON THE ELECTROSPINDLE.

7.6 Compressed air circuit filters discharge

Frequency: DAILY

At the end of every work shift discharge the filters of the compressed air circuit connected to the electrospindle.
If there is excessive condensation operate.

7.7 Connections check

Frequency: MONTHLY

Check:
- integrity of the power and signal cables;
- that the wiring connector is well secured with its screws;
- the seal of the pipes and pneumatic connections;
- in case of liguid cooling, the seal of the pipes and hydraulic connections.

7.8 Compressed air circuit filters replacement

Frequency: FOLLOW THE MANUFACTURER'S INSTRUCTIONS

Perform a regular maintenance of the compressed air circuit filters connected to the electrospindle.
Replace the filters as indicated by the filter manufacturer.

7.9 Bearings

The bearings of the electrospindle are lubricated for life, therefore they DO NOT REQUIRE any topping up with grease.

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General notes on performing any type of operation on the electrospindle, whether scheduled or unscheduled maintenance.

To perform the operations safely on an electrospindle installed on the machine, refer to the manual supplied with the machine.

Perform only the interventions described in this manual, following all the instructions set out scrupulously and if there are any doubts contact the technical support.

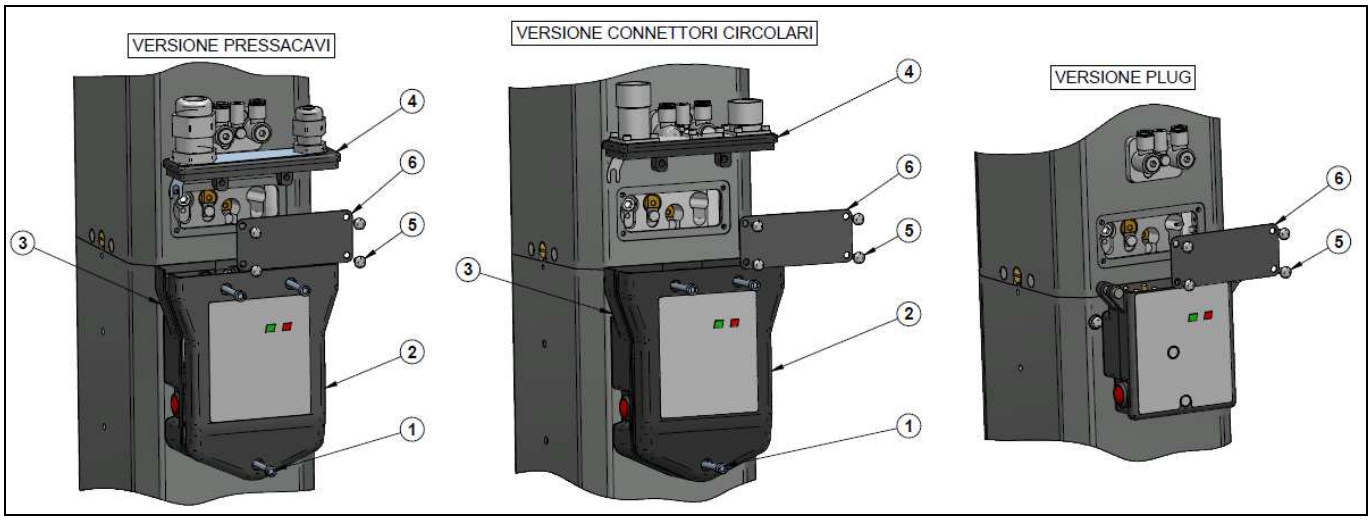
Only original spare parts can be used for any replacements and adjustments. Any other type of intervention NOT allowed voids the warranty.

The maintenance operations must be carried out exclusively by qualified personnel, by complying with the applicable directives and safety standards , using suitable instruments and products.

During any maintenance operation the electrospindle must be:
- disconnected and cut off from the electrical power supply;
- with the tool completely stopped (not rotating).

8.1 Sensors replacement and adjustment

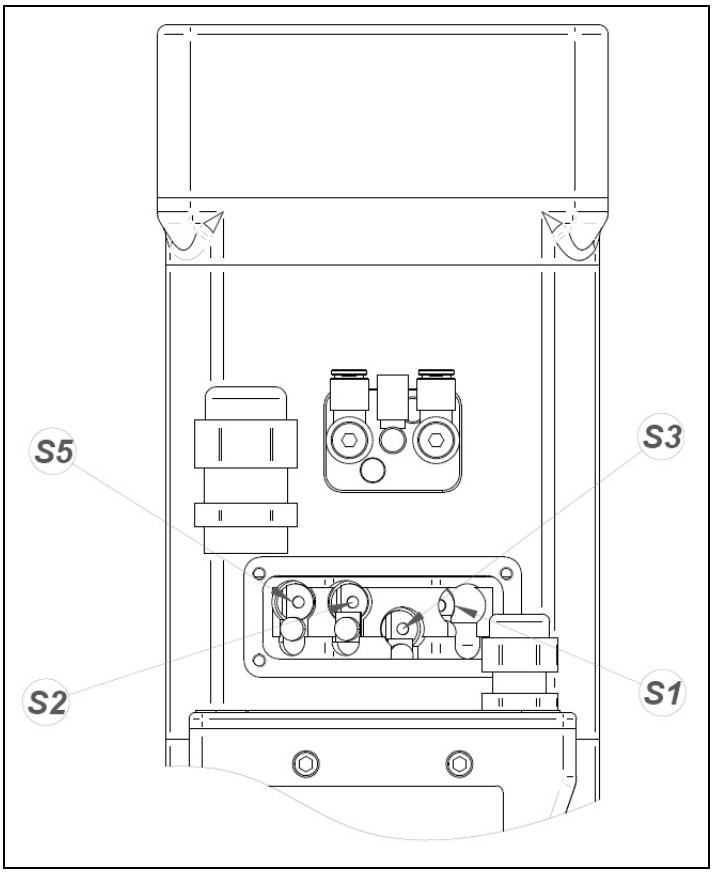
8.1.1 Access to the sensors



The proxy sensors are located in the electrospindle under the connectors.
To access the sensors, proceed as follows:

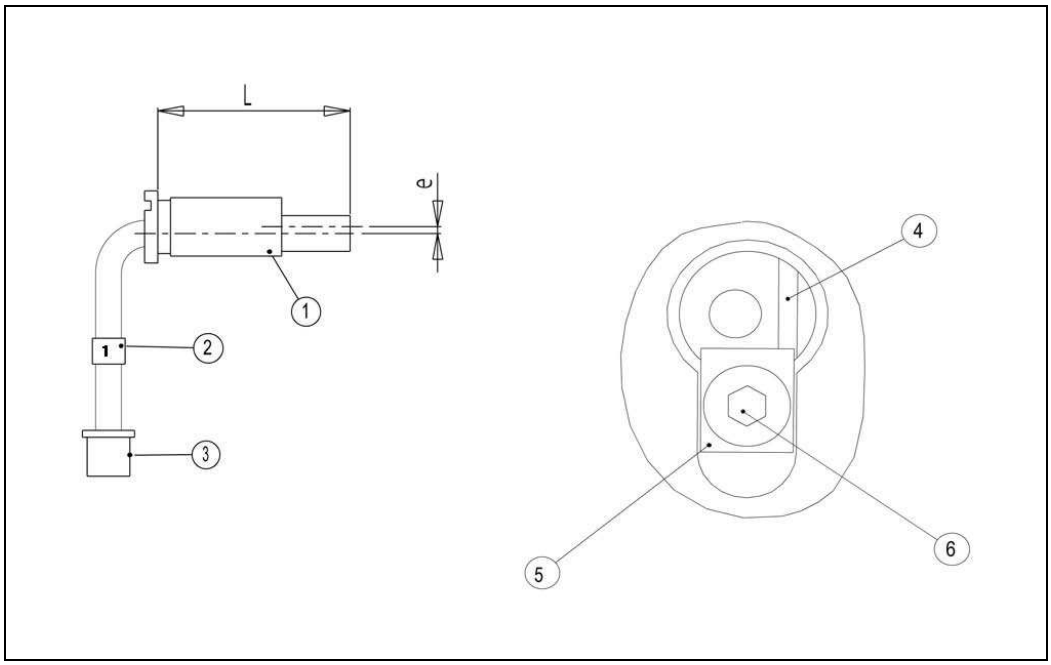
A	Unscrew the three screws M4x30 (1), then remove the cover of the electrical box (2).
B	Loosen the screw M4 under the electrical box, then remove the cable glands or connectors assembly (4).
C	Unscrew the four convex head screws M4 (5), then remove the metal cover (6).
D	Store the previously removed parts with care as they will be required to reassemble the electrospindle once the sensor adjustment and replacement have been completed.
E	Replace the faulty sensors.
F	To restore the electrospindle proceed with the steps in reverse, starting from: C – B – A

8.1.2 Position and description of the sensors units



Once accessed the sensors units S1, S2, S3 and S5 (optional) look as shown above.
The position of the different types of sensors S1, S2, S3 and S5 (optional) is shown in the figure..

For the function of each single sensor and the relative logical operation, consult paragraph 6.4 "Sensors".



Each sensor is positioned inside an eccentric bush (1) and fitted with an identification band (2) and a micro connector (3) to disconnect it electrically.
The eccentric bush is centres on the sensors support of the electrospindle and it is secured in position by a bracket (5) held in place by the screw (6).

There is no "S4" sensor.

Sensors with identification "1" are used for different functions (S1, S2, S3 or S5 optional).

8.1.3 Sensor units replacement

The sensors can be replaced exclusively with original spare parts.
The use of non-original spare parts can damage property or persons.
To order the spare parts refer to the table below.

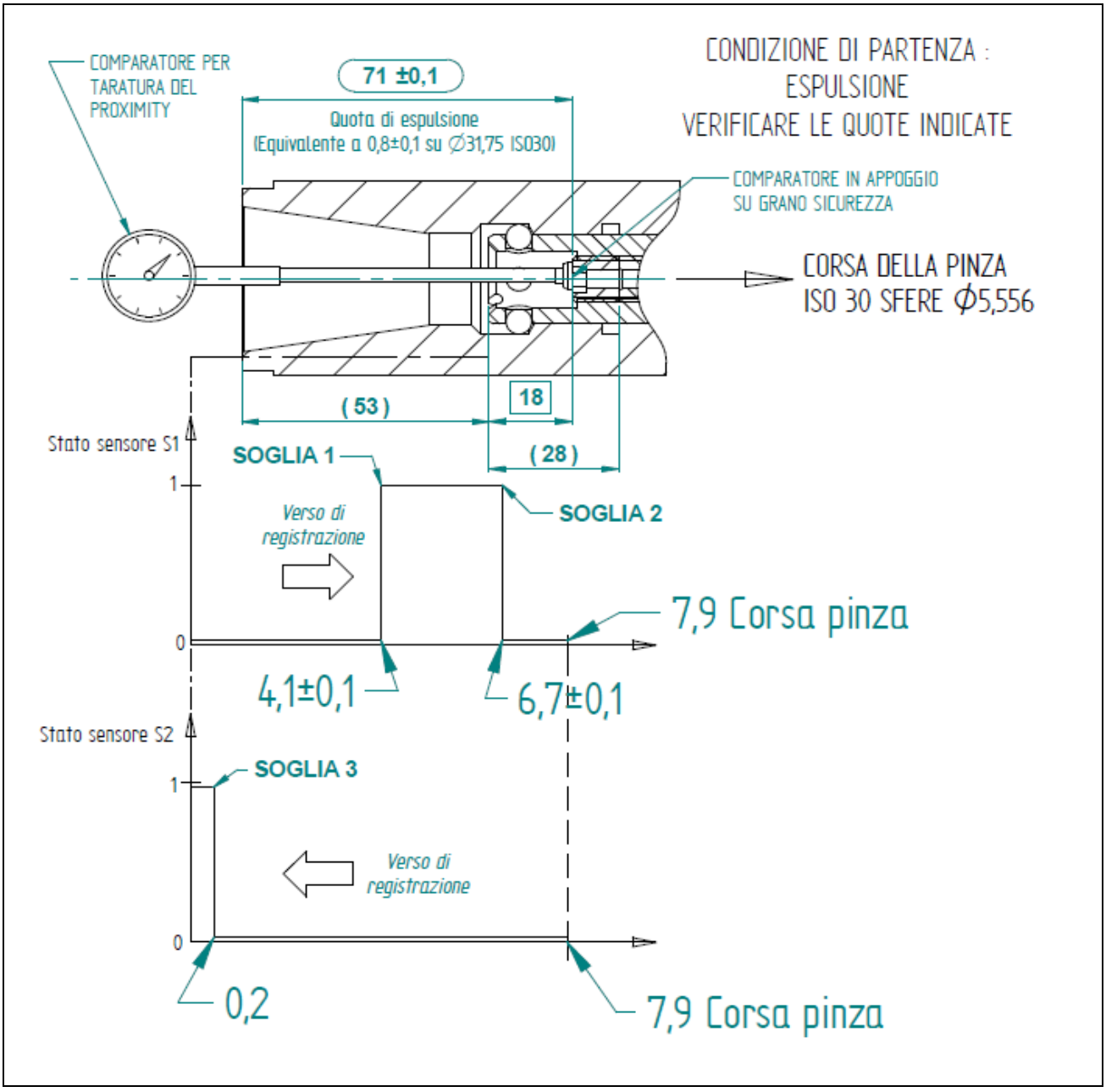
SENSOR UNIT	ORDER CODE
S1	2736240995F
S2	2736240995F
S3	2736240995F
S5 (optional)	2736240995F

Use only original sensors supplied by Hiteco. Using non-original sensors can cause serious malfunctions with a risk for the safety of people.

To replace the sensor unit, follow the procedure below:

A	Unscrew the screw M4 (6) of the sensor to be replaced.
B	Remove the blocking bracket (5).
C	Remove the sensor from its seating and disconnect the electrical connector (3). Store any shims present between sensor and electrospindle seating.
D	Connect the new sensor, of the same type, to the micro-connector on the electrospindle.
E	Check the operation of the sensor by placing it close to a metal mass, such as a screw driver or a key.
F	Insert the sensor in its seating.
G	Reassemble the bracket (5) and tighten the screw (6) without blocking it, so that the sensor can be rotated for the adjustment.
H	Adjust the sensor as indicated in the following paragraphs, by inserting a screw driver in the slot (4) of the external bush.
I	Screw the screw M4 (6), paying attention not to rotate the already adjusted sensor.

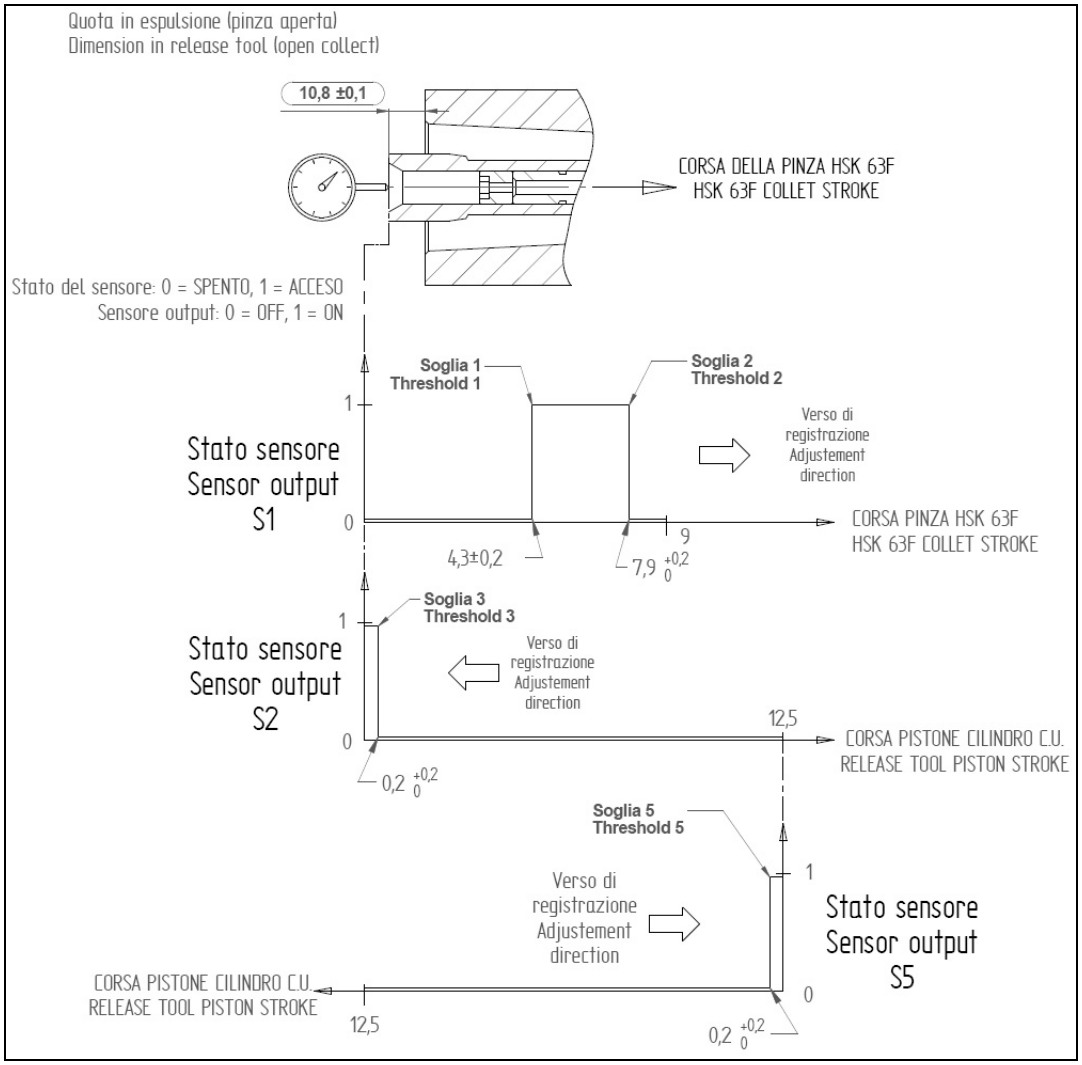
8.1.4 Diagrams for the adjustment of sensors units S1 and S2 (ISO)



For the adjustment of the sensors S1 and S2 see paragraphs 8.1.5 and 8.1.6

An incorrect adjustment of the sensors S1, S2, S3 and S5 (optional) can cause serious malfunctions such as the ejection of the rotating tool, with the risk of fatal injuries for people.
Scrupulously follow the procedures set out below for the adjustment of the sensors.

8.1.5 Diagrams for the adjustment of sensors units S1 and S2 (HSK)



For the adjustment of the sensors S1 and S2 see paragraphs 8.1.5 and 8.1.6

An incorrect adjustment of the sensors S1, S2, S3 and S5 (optional) can cause serious malfunctions such as the ejection of the rotating tool, with the risk of fatal injuries for people.
Scrupulously follow the procedures set out below for the adjustment of the sensors.

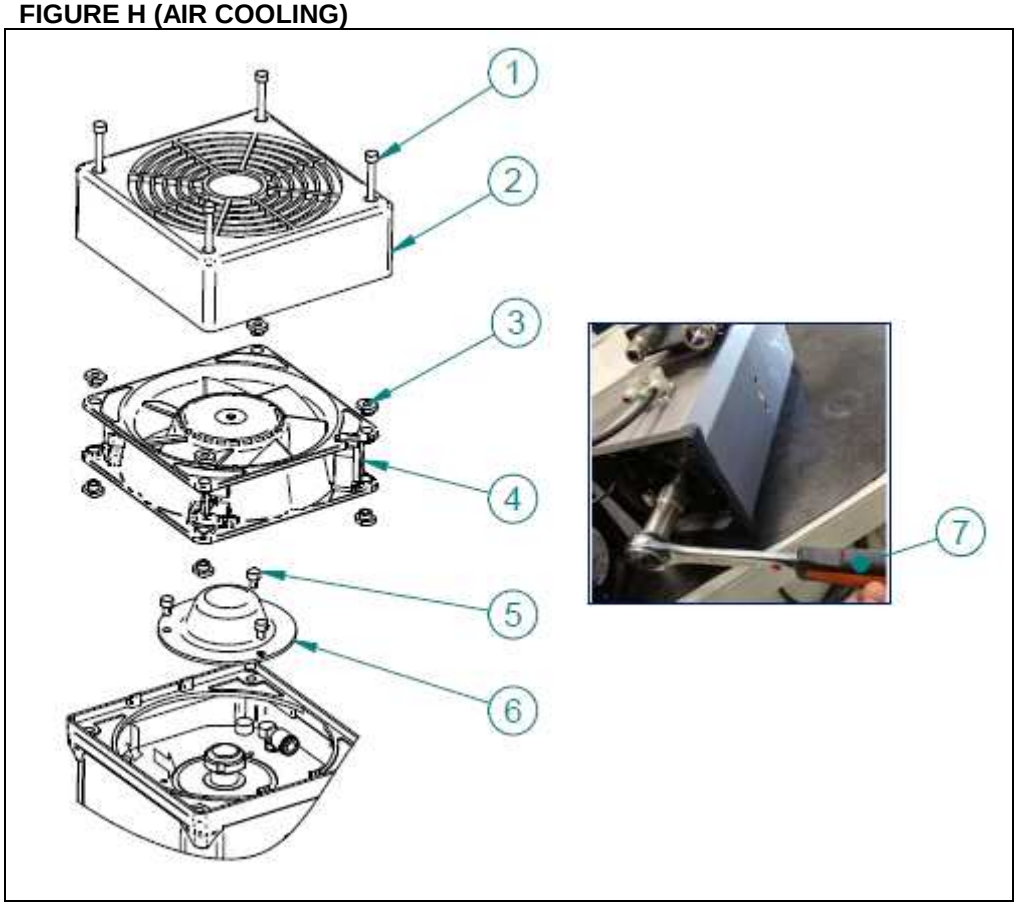
8.1.6 S1 sensor adjustment “tool clamped correctly”

Perform the following procedure:

A	If there is a tool, release it from the electrospindle.
B	Disconnect the pipe E6 (see compressed air diagram) of the electrospindle release.
C	Insert a pressure regulator on the disconnected pipe and connect the pressure regulator to the electrospindle with a section of pipe E6 (see compressed air diagram).
D	Release the electrospindle.
E	Point a centesimal comparator on the central nucleus of the collet as shown in the figure: (see step 8.1.4 for ISO and step 8.1.5 for HSK).
F	***WITH AIR COOLING:*** Check the quota of the central nucleus of the face of the collet ISO 30 or HSK from the tool stop plane on the spindle. The quota must be: **71±0.1 mm (ISO)** or **10.8±0.1 mm (HSK)** (see step 8.1.4 for ISO and step 8.1.5 for HSK). If the quota is not the one indicated, proceed as follows, (see figure H): - Remove the cover (2) by unscrewing the 4 fixing screws (1) - Remove the fan (4) and the anti-vibrating parts (3) of the electric fan - Remove the 3 screws (5) of the ring nut cover (6) - Remove the ring nut cover (6) - Use the GUK – 15 tool (7) to adjust the collet ejection and reach the quota **71±0.1 mm (ISO)** or **10.8±0.1 mm (HSK)** - Perform 5 clamp/release cycles and check that the quota matches the quota indicated - Reassemble the ring nut cover (6), checking that there is the O-ring gasket above the cylinder cover. - Reassemble the electric fan (4) with the relative anti-vibration parts (3) (4 + 4) - Tighten the 4 threaded screws (1) using Loctite 243; when tightening the 4 screws pay **ATTENTION** not to deform the external plastic cover (2). ***WITH LIQUID COOLING:*** Check the quota of the central nucleus of the face of the collet ISO 30 or HSK from the tool stop plane on the spindle. The quota must be: **71±0.1 mm (ISO)** or **10.8±0.1 mm (HSK)** (see step 8.1.4 for ISO and step 8.1.5 for HSK). If the quota is not the one indicated, proceed as follows, (see figure H): - Unscrew the 4 screws (1) - Remove the cylinder guard cover (2) - Unscrew the 3 screws (3) of the ring nut cover. - Remove the ring nut cover (4) - Use the GUK – 15 tool (5) to adjust the collet ejection and reach the quota **71±0.1 mm (ISO)** or **10.8±0.1 mm (HSK)** - Perform 5 clamp/release cycles and check that the quota matches the quota indicated - Reassemble the ring nut cover, checking that there is the O-ring gasket above the cylinder cover.

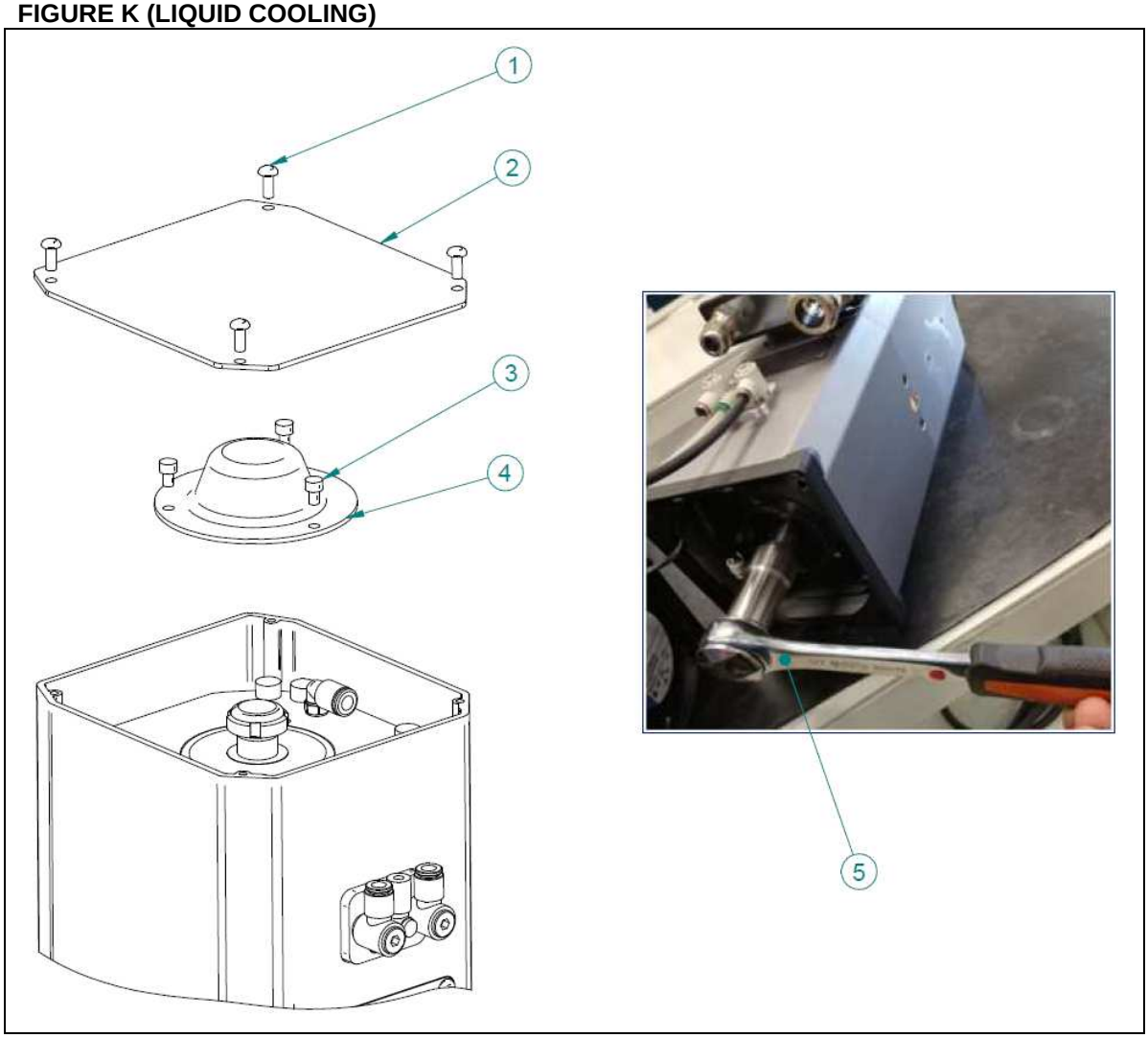
G	With the electrospindle in release and the centesimal comparator positioned on the central nucleus of the ISO or HSK collet, gradually reduce the pressure on the release pipe with the regulator. With this reduction the central nucleus of the collet will move towards the inside of the electrospindle, pulled by the rod springs pack.
H	Make a note of the quota when the sensor S1 switches from off to on (THRESHOLD 1) and from on to off (THRESHOLD 2).
I	Rotate the sensor with a screw driver inserted in the slot on the eccentric bush, so that the THRESHOLD 1 and the THRESHOLD 2 are within the respective values indicated in the figure: see step 8.1.4 for ISO and step 8.1.5 for HSK. We recommend centring the value for THRESHOLD 1 and check that the value of THRESHOLD 2 falls within the interval indicated.
L	Repeat the steps H and I, if necessary returning the electrospindle in the ejection conditions, increasing the feed pressure of the clamp pipe with the regulator.
M	Check the adjustment by inserting an empty taper inside the electrospindle and checking that the sensor S1 is on. If it is not, repeat steps from G to L and repeat this step.
N	Test the adjustment by inserting 2 shims of 0.5 mm between the tool holder ISO 30 and the electrospindle spindle, in diametrically opposite areas in relation to the electrospindle spindle. In this condition the sensor must be off. If it is on, repeat steps from G to M and repeat this step.

FIGURE H (AIR COOLING)



To render the adjustment easier, you can use the following circular shims that adjust the radial position of the sensor. The spare parts are as follows:

FIGURE K (LIQUID COOLING)



To render the adjustment easier, you can use the following circular shims
that adjust the radial position of the sensor. The spare parts are as follows:

SHIM FOR SENSOR UNIT	ORDER CODE
0.05 mm	0336240988A
0.10 mm	0336240989C

Inserting the spacer between the sensor unit and the seating on the electrospindle means moving closer the ON THRESHOLD 1
and the OFF THRESHOLD 2, reducing the distance in mm. The larger the space
the closer the position.
If there are shims between the sensor unit and the seating on the electrospindle, we recommend
re-inserting them when replacing the sensor unit and then decide whether to reuse them
or not during the sensor adjustment, with the quotas to hand.
The presence of these shims is necessary due to the tolerances of the electronics
of the proximity.

8.1.7 S2 sensor adjustment “collet open”

Perform the following procedure:

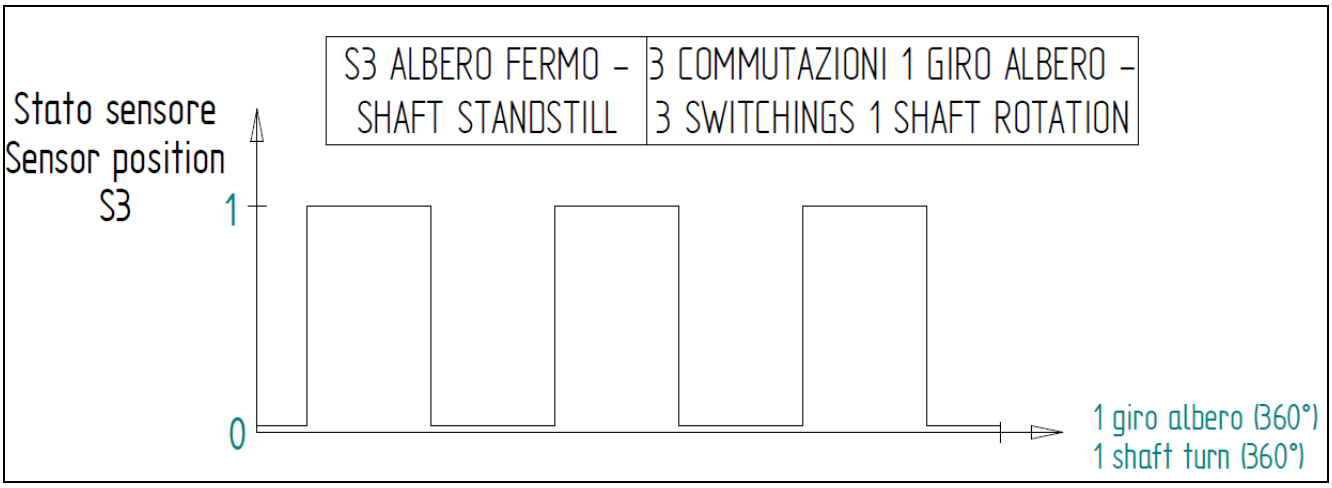
A	If there is a tool, release it from the electrospindle.
B	Disconnect the pipe E6 (see compressed air diagram) of the electrospindle release.
C	Insert a pressure regulator on the disconnected pipe and connect the pressure regulator to the electrospindle with a section of pipe E6 (see compressed air diagram).
D	Release the electrospindle.
E	Point a centesimal comparator on the central nucleus of the collet as shown in the figure: (see step 8.1.4 for ISO and step 8.1.5 for HSK).
F	***WITH AIR COOLING:*** Check the quota of the central nucleus of the face of the collet ISO 30 or HSK from the tool stop plane on the spindle. The quota must be: **71±0.1 mm (ISO)** or **10.8±0.1 mm (HSK)** (see step 8.1.4 for ISO and step 8.1.5 for HSK). If the quota is not the one indicated, proceed as follows, (see figure H): - Remove the cover (2) by unscrewing the 4 fixing screws (1) - Remove the fan (4) and the anti-vibrating parts (3) of the electric fan - Remove the 3 screws (5) of the ring nut cover (6) - Remove the ring nut cover (6) - Use the GUK – 15 tool (7) to adjust the collet ejection and reach the quota **71±0.1 mm (ISO)** or **10.8±0.1 mm (HSK)** - Perform 5 clamp/release cycles and check that the quota matches the quota indicated - Reassemble the ring nut cover (6), checking that there is the O-ring gasket above the cylinder cover. - Reassemble the electric fan (4) with the relative anti-vibration parts (3) (4 + 4) - Tighten the 4 threaded screws (1) using Loctite 243; when tightening the 4 screws pay **ATTENTION** not to deform the external plastic cover (2). ***WITH LIQUID COOLING:*** Check the quota of the central nucleus of the face of the collet ISO 30 or HSK from the tool stop plane on the spindle. The quota must be: **71±0.1 mm (ISO)** or **10.8±0.1 mm (HSK)** (see step 8.1.4 for ISO and step 8.1.5 for HSK). If the quota is not the one indicated, proceed as follows, (see figure H): - Unscrew the 4 screws (1) - Remove the cylinder guard cover (2) - Unscrew the 3 screws (3) of the ring nut cover. - Remove the ring nut cover (4) - Use the GUK – 15 tool (5) to adjust the collet ejection and reach the quota **71±0.1 mm (ISO)** or **10.8±0.1 mm (HSK)** - Perform 5 clamp/release cycles and check that the quota matches the quota indicated - Reassemble the ring nut cover, checking that there is the O-ring gasket above the cylinder cover.

G	Always with the electrospindle in release and the centesimal comparator positioned on the central nucleus of the ISO or HSK collet, gradually reduce the pressure on the release pipe with the regulator. With this reduction the central nucleus of the collet will move towards the inside of the electrospindle, pulled by the rod springs pack. Continue reducing the pressure until the sensor S2 switches from on to off.
H	Increase the pressure on the release pipe with the regulator and then make a note of the quota when the sensor S2 switched from off to on (THRESHOLD 3).
I	Rotate the sensor with a screw driver inserted in the slot on the eccentric bush, so that the THRESHOLD 3 is within the respective values indicated in the figure: see step 8.1.4 for ISO and step 8.1.5 for HSK.
L	Repeat the steps G and H, if necessary returning the electrospindle in the ejection conditions, increasing the feed pressure of the clamp pipe with the regulator.
M	Check the adjustment by performing some clamp/release cycles, checking that the sensor S2 switches on and off, repetitively. If it does not, repeat steps from G to L and repeat this step.

If there are shims between the sensor unit and the seating on the electrospindle, we recommend re-inserting them when replacing the sensor unit (see also 8.1.6).

8.1.8 S3 sensor adjustment “spindle rotation”

The sensor S3 does not require any particular adjustment: simply replace the sensor, taking care to position the slot on the eccentric bush parallel to the rotation axis of the electrospindle and check that the sensor switches 3 times with every complete cycle of the spindle of the electrospindle as shown in the figure below.

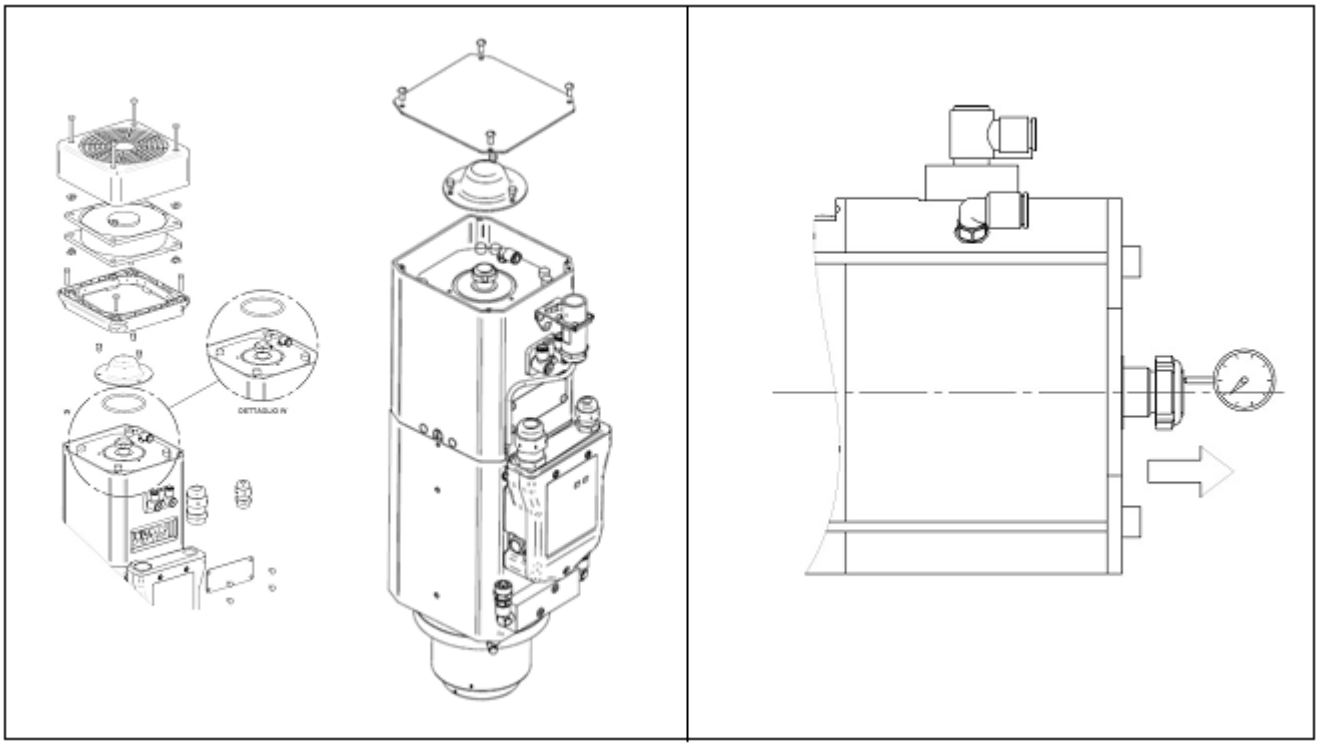


This applies to the electrospindle moved manually and with the electrospindle at the maximum speed, to ensure the correct operation at all operating speeds.
When the electrospindle is moving, the sensor output can be monitored:
- with an oscilloscope;
- with a PLC fast input;
- with an electronic control unit that can count the number of impulses in output from the sensor and transform them in a single control signal.

In the latter case you must check that the output signal is stable from the number of cycles that it is triggered to the maximum speed.
If the sensor does not switch more regularly when the speed increase, rotate the eccentric slightly to move the sensor closer to the electrospindle nose.

8.1.9 S5 sensor adjustment “piston at stroke end” (optional)

Perform the following procedure:

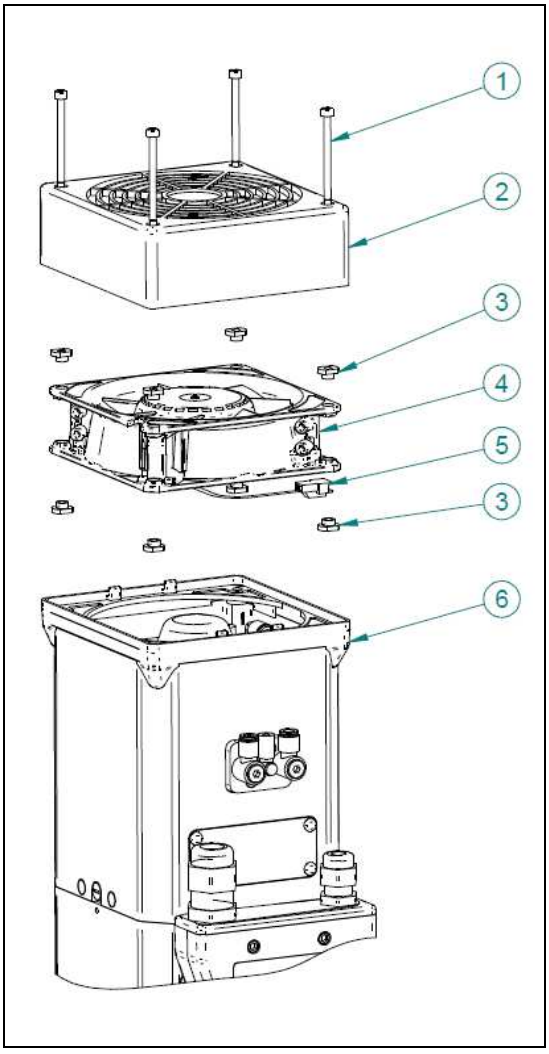


A	Disconnect the pipe E6 of the electrospindle tool release.
B	Insert a pressure regulator on the disconnected pipe and connect the pressure regulator to the electrospindle with a section of pipe at the E6 tool release inlet of the electrospindle.
C	Disassemble the electric fan and the guard above the tool changer cylinder, as shown in the figure above.
D	Point the centesimal comparator on the piston of the electrospindle as shown above.
E	Set the electrospindle in the work condition, feeding the tool clamping pipe E4.
F	Reset the centesimal comparator.
G	Feed the tool release pipe E6 until the collet opens.
H	Gradually reduce the pressure on the pipe E6 (tool release), with the regulator; with this reduction the piston will move back, as shown in the figure above (see the arrow). Looking at the comparator, position the piston within a threshold between 0.2 and 0.4 mm (THRESHOLD 5, see paragraph 8.1.5).
I	Rotate the sensor with a screw driver inserted in the slot on the eccentric bush, so that the sensor switches on, as indicated in the diagram in paragraph 8.1.5.
L	Repeat the steps H and I as a check. Return the electrospindle in the ejection mode, increasing the feed pressure of the tool release pipe E6, with the regulator. Reduce the pressure to move the piston towards the right, as shown in the figure (direction of the arrow).
M	Check the adjustment by performing some clamp/release cycles, checking that the sensor S5 switches on and off, repetitively. If it does not, repeat steps from I to L and repeat this step.
N	After having performed the sensor adjustment, disassemble the centesimal comparator, reassemble the cylinder guard and the solenoid valve.

8.2 Electric fan replacement

(8.1.9 45f ce)

The electric fan is found only on electrospindle models with SERVO-VENTILATED AIR COOLING. Certain models of electrospindles with aspiration air cooling don't have them.



Spare parts order codes for electric fan:

Component	Code
Electric fan 127 x 127	07L0213870H
Anti-vibration support	0366131547F

To replace the electric fan, follow the procedure below.

A	Unscrew the 4 screws M4 x 65 (1).
B	Lift the upper guard (2).
C	Lift the electric fan (4) disconnecting it from the power supply, by disconnecting the connector (5).
D	Disassemble the anti-vibration supports from the electric fan (3).
E	Insert the anti-vibration supports (3) on the through holes Ø 7 of the new electric fan (4).
F	Connect the electric fan to the power supply, with the connector (5).
G	Return the electric fan in position on the plastic support (6), ensuring that the connector (5) does not interfere with the fan blades. (Hide the connector under the support - 6).
H	Reassemble the guard (2) with the screws (1): place a thin layer of threadlock on the threaded end part of the screws.
I	Tighten the screws until the guard (2) is close to the support (6) so that there is no gap.

The anti-vibration supports protect the electric fan from the vibrations generated during cutting ensuring its reliability. Always re-assemble the anti-vibration supports.
When replacing the electric fan, we strongly recommend replacing all 8 anti-vibration supports.

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9.1 Decommissioning

Disconnect the electrospindle:
- from the electrical power supply
- from the compressed air supply network
- from the cooling circuit (if present).

Follow the installation instructions in reverse order.
Clean the surfaces. Oil the parts that can be subject to oxidization, such as the HSK plane of the spindle.
Cover the electrospindle end so it is properly protected against dust and dirt.

9.2 Scrapping

Inside the electrospindle spindle there is a pack of Belleville washers preloaded with a force of a hundred Kg. The disassembly must be performed only by trained personnel.

Decommission the electrospindle as described above.
Split up the parts according to type and dispose of them according to the legislation in force in the country in which the device was installed.
For the removal and transport of the electrospindle, see Chapter 3: "Handling, storage and unpacking".
The user is responsible for scrapping the device correctly.

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10.1 Fault – probable cause – possible solution

BEFORE WORKING ON THE ELECTROSPINDLE, SET IN SAFETY AS INDICATED IN CHAPTER 8 "UNSCHEDULED MAINTENANCE".

PROBLEM	PROBABLE CAUSE	SOLUTION
The electrospindle does not rotate	There is no power supply	● Check the connector plug. ● Check the continuity and integrity of the electrical connections. ● Check the supply voltage.
	The tool holder is not inserted	Insert the tool holder
	The tool holder is not inserted correctly	See "*The tool holder is not clamped*" section in this chapter.
	Thermal protection triggered	Wait for the electrospindle to cool down: the operation will be restored. If the thermal protection is triggered often, see *"The electrospindle overheats"* section in this chapter.
	No signal from sensors S1 or S2	● Check the connector plug. ● Check the continuity and integrity of the electrical connections. ● Check the supply voltage. 24V DC ● If the sensors are burnt replace them and proceed with the adjustment, as described in chap.8 paragraph 8.1.
The electrospindle rotates backwards	Incorrect wiring of the phases	Invert 2 phases on the wiring between inverter and electrospindle

The tool holder is not clamped	Foreign bodies between tool holder and electrospindle spindle	Remove the impurities and clean as described in chapter 7.
	Collet dirty and/or not lubricated.	Clean and lubricate the collet and the taper as set out in chapter 7.
	The tool holder taper does not comply with standard DIN 69871-1 for (ISO) or DIN 69893 for (HSK)	Replace the tool holder with one that complies with standard DIN 69871-1 for (ISO) or DIN 69893 for (HSK).
	The tool holder collet does not open	● Check the pressure of the compressed air pipes at the top of the electrospindle see: chap. 4 paragraph 4.4.2. ● Check that the outlets of the solenoid valve that drives the tool changer are not blocked see: chap. 4 paragraph 4.4.3. ● Check that the tubes of the compressed air circuit do not have traces of condensation and that the inlet filters are clean. ● Check that the circuit pipes are connected correctly to the fittings. ● Check the integrity of the compressed air circuit.
	No signal from sensors S1 or S2	● Check the connector plug. ● Check the continuity and integrity of the electrical connections. ● Check the supply voltage 24V DC ● If the sensors are burnt replace them and proceed with the adjustment, as described in chap.8 paragraph 8.1.

The tool holder is not ejected	Insufficient pressure	● Check the pressure of the compressed air pipes at the top of the electrospindle, see: chap. 4 paragraph 4.4.2. ● Check that the outlets of the solenoid valve that drives the tool changer are not blocked see: chap. 4 paragraph 4.4.3. ● Check that the tubes of the compressed air circuit do not have traces of condensation and that the inlet filters are clean. ● Check that the circuit pipes are connected correctly to the fittings. ● Check the integrity of the compressed air circuit.
	Tool holder collet and/or tapers dirty	Clean and lubricate the collet and the taper as set out in chapter 7.
Absence of pressure	Pressure insufficient or compressed air circuit unsuitable	● Check the pressure of the compressed air pipes at the top of the electrospindle, see: chap. 4 paragraph 4.4.2. ● Check that the circuit pipes are connected correctly to the fittings. ● Check the integrity of the compressed air circuit.
A sensor does not supply the output	Sensor disconnected or faulty.	● Check the connector plug. ● Check the continuity and integrity of the electrical connections. ● Check the supply voltage 24V DC ● If the sensors are burnt replace them and proceed with the adjustment, as described in chap.8 paragraph 8.1.

The electrospindle overheat (thermal protection triggered)	The electric fan does not work correctly	● Check that the electric fan is working. ● Check that the electric fan is intact. ● Check that the rotation of the electric fan is not blocked by foreign bodies. ● Replace the electric fan if it is faulty, as indicated in chap. 8 paragraph 8.2.
	The cooling air passages through the electrospindle body are blocked.	Disassemble the electric fan (chap. 8 paragraph 8.2) or the extractor hood of the electrospindle and clean the air passages with a compressed air jet, if necessary. Reassemble the electric fan or the extractor hood.
	The liquid cooling is not efficient	● Check the level of liquid in the circuit. ● Check that the specifications are complied with, see: chap. 4 paragraph 4.5.3. ● Check that the flow is greater than the minimum indicated, see: chap. 4 paragraph 4.5.3. ● Check the integrity of the cooling hydraulic circuit. ● Consult the cooling unit manual.
	The machining process is too demanding	Reduce the feed speed for the machining.
	Incorrect inverter parameter settings.	Check that the parameters set for the inverter are coherent with the values on the electrospindle plate or indicated in chap. 2 paragraph 2.2.
	Insufficient power supply voltage	● Check that the parameters set for the inverter are coherent with the values on the electrospindle plate or indicated in chap. 2 paragraph 2.2. ● Check the value of the three-phase voltage in input to the inverter.

Performance lower than specifications	Incorrect inverter parameter settings.	Check that the parameters set for the inverter are coherent with the values on the electrospindle plate or indicated in chap. 2 paragraph 2.2.
The electrospindle vibrates empty	The tool holder is not balanced	Balance the tool holder unit as specified in chap.2 paragraphs 2.7 and 2.8.
	Incorrect inverter parameter settings.	Check that the parameters set for the inverter are coherent with the values on the electrospindle plate or indicated in chap. 2 paragraph 2.2.
	Dirt and/or foreign bodies between electrospindle spindle and tool holder	Remove the impurities and clean and lubricate as described in chapter 7.
	Tool holder collet and/or tapers dirty	Clean and lubricate the collet and the taper as set out in chapter 7.
	The machining process is too demanding	Reduce the feed speed for the machining.
	Fixing screws loosened	Check and tighten the electrospindle fixing screws
	Bearings damaged.	Overhaul the electrospindle
Electrospindle noisy	Bearings damaged.	Overhaul the electrospindle