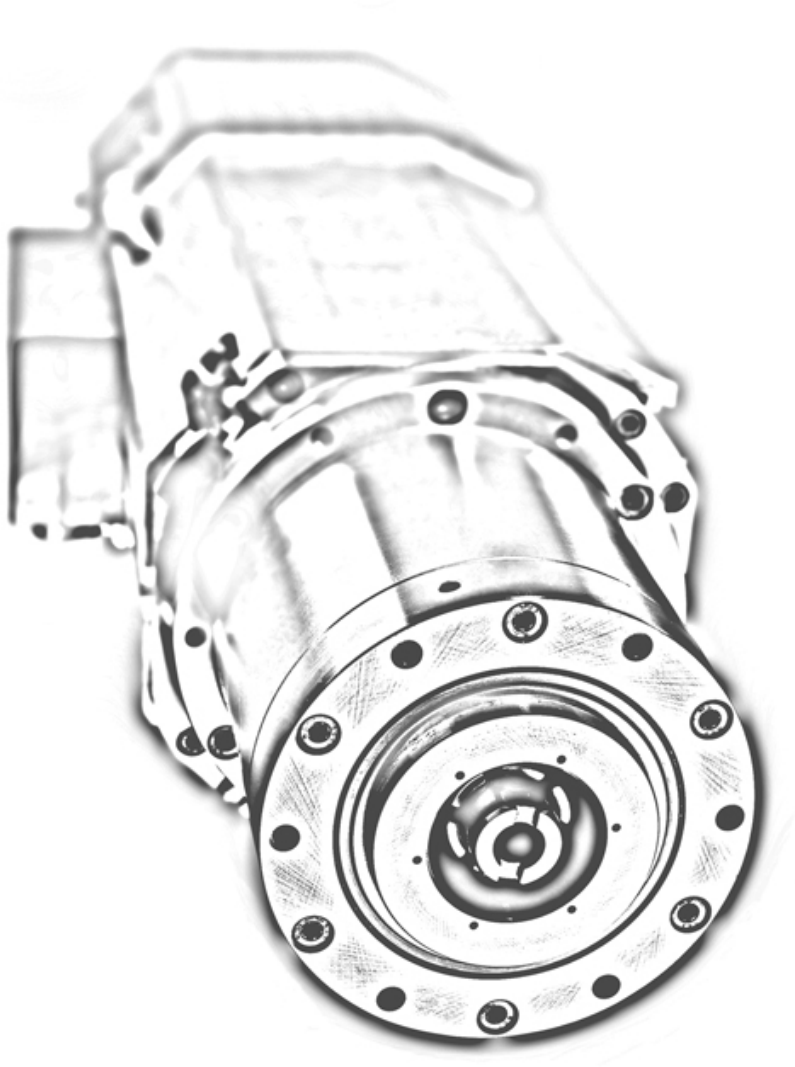
HSD
MECHATRONIC
SOLUTIONS

Translation of the original instructions

ES327, ES330, ES331, ES332, ES370

Electrospindle

Assembly instructions



Edition.Revision 2.3
H5801H0084 ENGLISH

Serial number

Information about the publication

Code	Issue	Code of previous issue
H5801H0084	2	H5801H0044

Revision	Description of updates
0 (11/2011)	new edition
1 (07/2012)	ES327 380V version
2 (12/2012)	revision of ES330 liquid version (chapter 1, 4, 6, 8, 11)
3 (07/2013)	revision (chapter 1, 9, 12, paragraph 3.4, 3.5, 4.2, 4.3, 4.7.3, 6.3)

Index

1 Preliminary Information

Introduction

This document, with the technical data sheet and any enclosures, provides the proper information for a correct installation. The procedures described must only be carried out by suitably trained personnel.

In order to prevent incorrect operation that could constitute a hazard for personnel and/or cause damage to the product, all the documents supplied must be read and fully understood. HSD (or its representative), from here on the **manufacturer**, cannot be held responsible or legally liable for any damage resulting from incorrect use of the documentation.

The description or illustration of certain devices may differ slightly from the actual ones without in any way compromising their comprehension. Some devices indicated and described in this manual may not be present on the product.

This document complies with the indications in Machinery Directive 2006/42/EC.

1.1 Scope of the manual

This manual is geared to the manufacturer, who will integrate this HSD product onto his own machinery or partly completed machinery, provides the necessary information for proper installation and maintenance of the unit in order to maintain it efficient and safe over time.

The manual forms an integral part of the product and as such must accompany it at all times, otherwise the product will be lacking in one of its primary safety requirements.

The manual must be well taken care of, distributed and made available to all personnel involved.

The purpose of the warning contained in the manual is to safeguard the health and safety of personnel exposed to residual risks.

The manual provides information on the most appropriate behaviour to adopt for the correct use of the product as provided for by the manufacturer.
In the case where the information contained in the manual conflicts with health and safety standards, contact the manufacturer to request the necessary corrections and/or adaptations.

The manual must be stored in an appropriate location and must always be readily available for consultation. The information contained in the manual is indispensable for using the product in a safe and correct manner for the purposes for which it has been designed.

1.2 Symbols used in the manual

Danger
Indicates a procedure, practice or similar action that could cause injury if not respected or carried out correctly.

Caution
Indicates an operating procedure, practice or similar action that could damage or completely destroy the product if not respected or carried out correctly.

Information
Highlights particularly important information of a general nature that must not be ignored.

1.3 Documents supplied with the product

The supplied documents must be stored in an appropriate location and must always be readily available for consultation.

The following is a list of the documents supplied with the product.

- **Assembly instructions** (this manual). It contains warnings and instructions for the transport, installation, use, maintenance and disposal of the product. Supplied on digital support (CD-ROM), Adobe Reader® (www.adobe.com) is required for consultation.
- **Test report.** Contains the testing results performed on the unit.
- **Declaration of incorporation** as provided for by Appendix IIB of Directive 2006/42/EC. This certifies that the product complies with the directives indicated.

Check that all the documents listed above are present on delivery of the product. If necessary, further copies can be obtained on request from the manufacturer.

- **Any enclosures.** These contain additional information that completes and/or replaces the information in the document with which they are enclosed.

Declaration of incorporation

The product is made in conformity with the Community Directives pertinent and applicable at the time of market placement, as shown in the declaration of incorporation (Appendix IIB, Machinery Directive) a facsimile of which is attached.

HSD MECHATRONIC DIVISION

DICHIARAZIONE D'INCORPORAZIONE
DECLARATION OF INCORPORATION
EINBAUERKLÄRUNG
DÉCLARATION D'INCORPORATION
DECLARACIÓN DE INCORPORACIÓN

CE

IL FABBRICANTE / THE MANUFACTURER / DER HERSTELLER / LE FABRICANT / EL FABRICANT:

HSD S.p.A. *registered office:* via Della Meccanica, 16 - 61122 Pesaro (PU) Italy
factory headquarters: p.le Alfio De Simoni, s/n - 61122 Pesaro (PU) Italy
Tel.: (+39) 0721 205 211 - Fax: (+39) 0721 205 247

DICHIARA CHE LA QUASI- MACCHINA (2006/42/CE ALLEGATO IIB) / DECLARE THAT THE PARTLY COMPLETED MACHINE (2006/42/EEC ANNEXE IIB) / ERKLÄRT, DASS DIE UNVOLLSTÄNDIGE MASCHINE (2006/42/EG ANLAGE IIB) / DÉCLARE QUE LA QUASI-MACHINE (2006/42/CE ANNEXE IIB) / DECLARA QUE LA CASI MÁQUINA (2006/42/CE ADJUNTO IIB):

Electrospindle
ES327/ES330/ES331/ES332/ES370

Matricola / Serial Number / Seriennummer / Numéro de série / Número de serie:

Codice HSD / HSD Code / Code HSD / Code HSD / Código HSD:

Codice Cliente / Customer Code / Kunden-Code / Code client / Código del cliente:

I

- RISPETTA I REQUISITI ESSENZIALI APPLICATI (2006/42/CE ALLEGATO I):
  1.1.5 - 1.3.2 - 1.3.4 - 1.3.6 - 1.5.01 – 1.5.08 – 1.5.09 – 1.5.10 – 1.5.11 – 1.7.1 - 1.7.3 – 1.7.4 – 1.7.4.1 – 1.7.4.2 - 1.7.4.3
- IL FABBRICANTE SI IMPEGNA A TRASMETTERE, IN RISPOSTA A D UNA RICHIESTA ADEGUATAMENTE MOTIVATA DALLE AUTORITÀ NAZIONALI, INFORMAZIONI PERTINENTI LA QUASI MACCHINA.
  PERSONA AUTORIZZATA A COSTITUIRE LA DOCUMENTAZIONE TECNICA PERTINENTE:
  NOME E COGNOME: GIUSEPPE GROSSO - INDIRIZZO: P.LE ALFIO DE SIMONI, SN – 61122 – PESARO (ITALY)

IL FABBRICANTE VIETA LA MESSA IN SERVIZIO FINCHÉ LA MACCHINA FINALE IN CUI DEVE ESSERE INCORPORATA NON E STATA DICHIARATA CONFORME SE DEL CASO ALLE DISPOSIZIONI DELLA PRESENTE DIRETTIVA.

GB

- COMPLIES WITH THE FOLLOWING APPLICABLE ESSENTIAL REQUIREMENTS (2006/42/EEC ANNEXE I):
  1.1.5 - 1.3.2 - 1.3.4 - 1.3.6 - 1.5.01 – 1.5.08 – 1.5.09 – 1.5.10 – 1.5.11 – 1.7.1 - 1.7.3 – 1.7.4 – 1.7.4.1 – 1.7.4.2 - 1.7.4.3
- THE MANUFACTURER UNDERTAKES TO TRANSMIT, IN RESPONSE TO A REASONED REQUEST BY THE NATIONAL AUTHORITIES, RELEVANT INFORMATION ON THE PARTLY COMPLETED MACHINERY.
  PERSON AUTHORISED TO COMPILE THE RELEVANT TECHNICAL DOCUMENTATION:
  NAME AND SURNAME: GIUSEPPE GROSSO - ADDRESS: P.LE ALFIO DE SIMONI, SN – 61122 – PESARO (ITALY)

THE MANUFACTURER STATES THAT THE PARTLY COMPLETED MACHINERY 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 THIS DIRECTIVE, WHERE APPROPRIATE.

D

- DEN FOLGENDEN WESENTLICHEN ANFORDERUNGEN ENTSPRICHT (2006/42/EG ANLAGE I):
  1.1.5 - 1.3.2 - 1.3.4 - 1.3.6 - 1.5.01 – 1.5.08 – 1.5.09 – 1.5.10 – 1.5.11 – 1.7.1 - 1.7.3 – 1.7.4 – 1.7.4.1 – 1.7.4.2 - 1.7.4.3
- DER HERSTELLER VERPFLICHTET SICH, DIE SPEZIELLEN UNTERLAGEN ZUR UNVOLLSTÄNDIGEN MASCHINE EINZELSTAATLICHEN STELLEN AUF VERLANGEN ZU ÜBERMITTELN.
  FÜR DIE AUSSTELLUNG DER TECHNISCHEN DOKUMENTATION BERECHTIGTE PERSON:
  VOR- UND NACHNAME: GIUSEPPE GROSSO - ANSCHRIFT: P.LE ALFIO DE SIMONI, SN – 61122 – PESARO (ITALY)

DIE UNVOLLSTÄNDIGE MASCHINE DARF ERST DANN IN BETRIEB GENOMMEN WERDEN, WENN FESTGESTELLT WURDE, DASS DIE MASCHINE, IN DIE DIE UNVOLLSTÄNDIGE MASCHINE EINGEBAUT WERDEN SOLL, DEN BESTIMMUNGEN DER VORLIEGENDEN RICHTLINIE ENTSPRICHT.

F

- EST CONFORME AUX CRITÈRES ESSENTIELS APPLIQUÉS (2006/42/EG ANNEXE I):
  1.1.5 - 1.3.2 - 1.3.4 - 1.3.6 - 1.5.01 – 1.5.08 – 1.5.09 – 1.5.10 – 1.5.11 – 1.7.1 - 1.7.3 – 1.7.4 – 1.7.4.1 – 1.7.4.2 - 1.7.4.3
- LE FABRICANT S'ENGAGE, EN RÉPONSE À UNE DEMANDE ADÉQUATEMENT MOTIVÉE DES AUTORITÉS NATIONALES, À LEUR TRANSMETTRE DES INFORMATIONS CONCERNANT LA QUASI-MACHINE.
  PERSONNE AUTORISÉE À CONSTITUER LA DOCUMENTATION TECHNIQUE PERTINENTE:
  PRÉNOM ET NOM: GIUSEPPE GROSSO - ADRESSE: P.LE ALFIO DE SIMONI, SN – 61122 – PESARO (ITALY)

LE FABRICANT INTERDIT LA MISE EN SERVICE TANT QUE LA MACHINE FINALE DANS LAQUELLE ELLE DOIT ÊTRE INCORPORÉE N'AURA PAS ÉTÉ DÉCLARÉE CONFORME, LE CAS ÉCHÉANT, AUX DISPOSITIONS DE LA PRÉSENTE DIRECTIVE.

E

- RESPETA LOS SIGUIENTES REQUISITOS ESENCIALES APLICADOS (2006/42/EG ADJUNTO I):
  1.1.5 - 1.3.2 - 1.3.4 - 1.3.6 - 1.5.01 – 1.5.08 – 1.5.09 – 1.5.10 – 1.5.11 – 1.7.1 - 1.7.3 – 1.7.4 – 1.7.4.1 – 1.7.4.2 - 1.7.4.3
- EL FABRICANTE SE COMPROMETE A TRANSMITIR, COMO RESPUESTA A UNA SOLICITUD ADECUADAMENTE MOTIVADA DE LAS AUTORIDADES NACIONALES, INFORMACIONES REFERENTES A LA CASI-MÁQUINA.
  PERSONA AUTORIZADA A CONSTITUIR LA DOCUMENTACIÓN TÉCNICA PERTINENTE:
  NOMBRE Y APELLIDO: GIUSEPPE GROSSO - DIRECCIÓN: P.LE ALFIO DE SIMONI, SN – 61122 – PESARO (ITALY)

EL FABRICANTE PROHIBE LA PUESTA EN SERVICIO HASTA QUE LA MÁQUINA FINAL EN LA CUAL DEBE SER INCORPORADA NO HAYA SIDO DECLARADA CONFORME, SI ES EL CASO, A LAS DISPOSICIONES DE LA PRESENTE DIRECTIVA.

Data / Date / Datum / Date / Fecha:
Pesaro, 25/03/2010

Procuratore Speciale
Special Attorney
Sonderbevollmächtiger
Fondé de pouvoir extraordinaire
Mandatario Especial

FABRIZIO PIERINI

M-SQ006 Rev. 09 25/03/2010

1.4 Risks associated with the use of the product

The manufacturer is not aware and cannot be aware of how the product will be installed. Consequently, the installer or final user must perform a risk analysis relating specifically to the type of installation and the methods adopted.

It is nevertheless the responsibility of the installer to ensure that there is adequate protection against risks of accidental contact with moving parts.

The installer and user must also take into account the possible presence of other types of risk, in particular that deriving from the entry of foreign bodies and the use of explosive, flammable, toxic or hot gases.

Consideration should also be given to risks inherent to maintenance operations, which must be carried out under conditions of maximum safety by ensuring that the product is isolated and at a complete standstill.

An overall risk analysis must be carried out on the completed machine on which the manufacturer's product will be installed. A conformity declaration must then be issued in line with Appendix IIA of directive 2006/42/EC and its subsequent amendments.

The product must not be put into service until the machine in which it has been incorporated has been made to comply with the requirements of Directive 2006/42/EC and its subsequent amendments.

1.4.1 Risks associated with improper handling and/or use

It is absolutely forbidden to bypass, remove, modify or render inoperative any safety devices, controls or guards protecting individual parts or the product as a whole.

- Never place hands, arms or any other parts of the body near to moving parts.
- The product must not be used in environments where there is an explosion risk .
- The elimination of faults or anomalies in the operation of the product or modifications to the type of operation or installation must not be carried out by unauthorised personnel.
- On completion of any extraordinary maintenance involving the removal of guards, barriers or other safety devices, these must be replaced before starting the product, making sure that they are positioned correctly and in full working order.
- All guards and safety devices must be maintained efficient and in perfect condition. Warning and danger signs and symbols must be clearly legible and must never be removed.
- When performing troubleshooting operation on the product, take all the necessary precautions described in the Instruction Manual to prevent damage or injury.
- Remember to tighten all screws, nuts and locking rings of each mechanical component that has been adjusted or set-up.
- Before starting the product, make sure that all the safety devices are installed and in perfect working order. If this is not the case, under no circumstances must the product be started, instead inform the works safety manager or the department head.
- The operator must be provided with Personal Protection Equipment (PPE) as provided for by current legislation. Loose bulky clothing and accessories (ties, wide sleeves, etc.) must not be worn.

- An incorrect electrical installation, such as the inversion of phases, represents an improper use of the product and is therefore not allowed.
- It is not allowed to violate or avoid the prescriptions contained in this manual.
- Any uses other than those intended by the manufacturer are not allowed.
- Installations, modifications or adjustments not described in this manual, or not authorised by the manufacturer, are not allowed.
- Maintenance intervention modalities, other than those described in the Instructions, are not allowed.
- Installation, on spindles, of boring bits with an inverted or incorrect rotation direction, is not allowed. Always pay the utmost attention to the rotation direction of the tools.
- The use of pressures greater than those expected, is not allowed.
- Lifting the product, in a manner other than how it is described in this manual, or by using belts in points other than those indicated, is not allowed.

1.4.2 Risks involved in product maintenance

⚠ **In order to be able to work in complete safety on a product already installed on a machine, refer to the machine's instruction manual.**

- Isolate the product from the mains power supply before proceeding with any maintenance operations!
- Even though the product has been disconnected from the mains power supply, the rotating and mobile parts may still be in motion due to inertia. Therefore, prior to carrying out any maintenance operations, make sure that the rotating and mobile parts of the product are stationary.

1.4.3 Residual risks

The product has been analysed in compliance with Directive 2006/42/EC in order to identify possible risk sources. The risks that remain (residual risks) and the relative countermeasures are highlighted in the relative sections of this manual.

1.5 Product Information

1.5.1 Purpose of the product

The product cannot function on its own: it is a machine component designed to be assembled with other machine parts or incorporated in machinery in order to constitute a machine as provided for by Directive 2006/42/EC.

The product must not be put into service until the machine in which it has been incorporated has been made to comply with the requirements of Directive 2006/42/EC and its subsequent amendments.

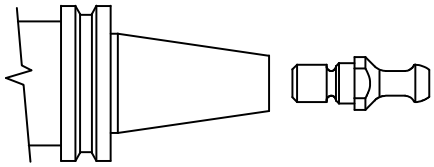
1.5.2 Identification of the product and manufacturer

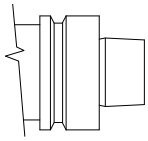
The serial number represents the only means recognised by the manufacturer of identifying the product. The product user is responsible for ensuring that the serial number remains intact.

The position of the product serial number is shown in chapter 2 “Technical Specifications” .

i An adhesive is applied to the product bearing the address of the registered offices of the manufacturer.

1.6 Glossary

<table>
<tr><td rowspan="3">ISO</td><td colspan="2">  </td><td rowspan="2">Tool holder cone locking system as described in standard DIN 69871.

A plate similar to that shown alongside is fixed to the electrospindle to indicate the type of locking system.</td></tr>
<tr><td>CONE ISO DIN 69871</td><td>SCREW
DOWEL
ISO30 HSD or BT30</td></tr>
<tr><td>  </td><td colspan="2">In spindles ES331 the position of dragging tenons differs from the norm DIN 69871.</td></tr>
<tr><td>HSK</td><td> 
HSK - DIN 69893 CONE</td><td colspan="2">Tool holder cone connection system, described in standard DIN 69893.

The electrospindle carries a plate similar to the one shown alongside, indicating the type of connection.</td></tr>
<tr><td>Dynamic balance quality grade</td><td colspan="3">The balance quality of a rotating object according to standard ISO 1940/1, indicated by the letter G. Low G values indicate better balancing. G=0.4 indicates maximum balancing precision. G assumes discrete values in multiples of 2.5 (G=0.4 G=1 G=2.5 …).</td></tr>
<tr><td>Rated voltage</td><td colspan="3">Maximum power supply voltage.</td></tr>
<tr><td>Rated frequency</td><td colspan="3">Minimum frequency at which the maximum power supply voltage is provided.</td></tr>
<tr><td>Rated characteristics</td><td colspan="3">The set of nominal values reached at rated frequency.</td></tr>
<tr><td>Service type S1</td><td colspan="3">Operation at constant load with a duration sufficient to ensure that the motor reaches thermal equilibrium.
Abbreviated to S1.
(Standard CEI EN 60034-1)</td></tr>
<tr><td>Service type S6</td><td colspan="3">A sequence of identical operating cycles, each consisting of a period of operation at constant load and a period of operation with no load, with constant rpm and without any intermediate rest times.
Abbreviated to S6, followed by the percentage ratio between the period of operation under load and the duration of one cycle.
For example: S6 40%
(40% operating time under load, 60% operating time without load)
(standard CEI EN 60034-1)</td></tr>
</table>

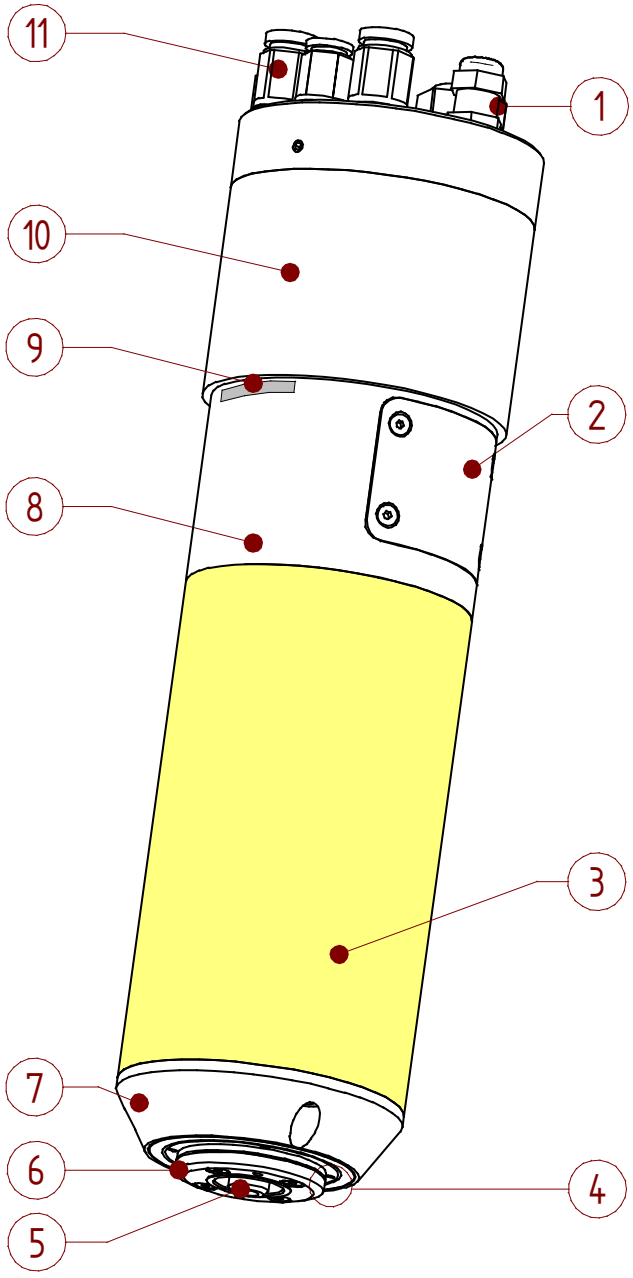
Torque and Power	$C(Nm) = \frac{(60xW)}{2x\pi xrpm}$	**C** = Torque **W** = Power **rpm** = revolutions per minute
	The precise definition of torque and power is beyond the scope of this manual. Nevertheless, it can be said that torque is the force with which the tool bites into the workpiece (and for the same torque, the force increases as the diameter of the tool decreases). Power, instead, is proportional to the torque and speed of rotation and, as such, determines the maximum machining speed (in line with tool performance, characteristics of the material being machined and the type of machining).	
Coolant	Fluid, liquid or gas (including air) used to transfer heat from the spindle to the environment.	
Programmed maintenance	A series of activities required to maintain the condition and operation of the product the same as that provided for by the manufacturer at the moment of its introduction onto the market. The maintenance is carried out by means of programmed adjustments, repairs, part replacements, etc..	

1.7 Warranty

For information about the warranty, please refer to the documentation issued on purchase of the machine.

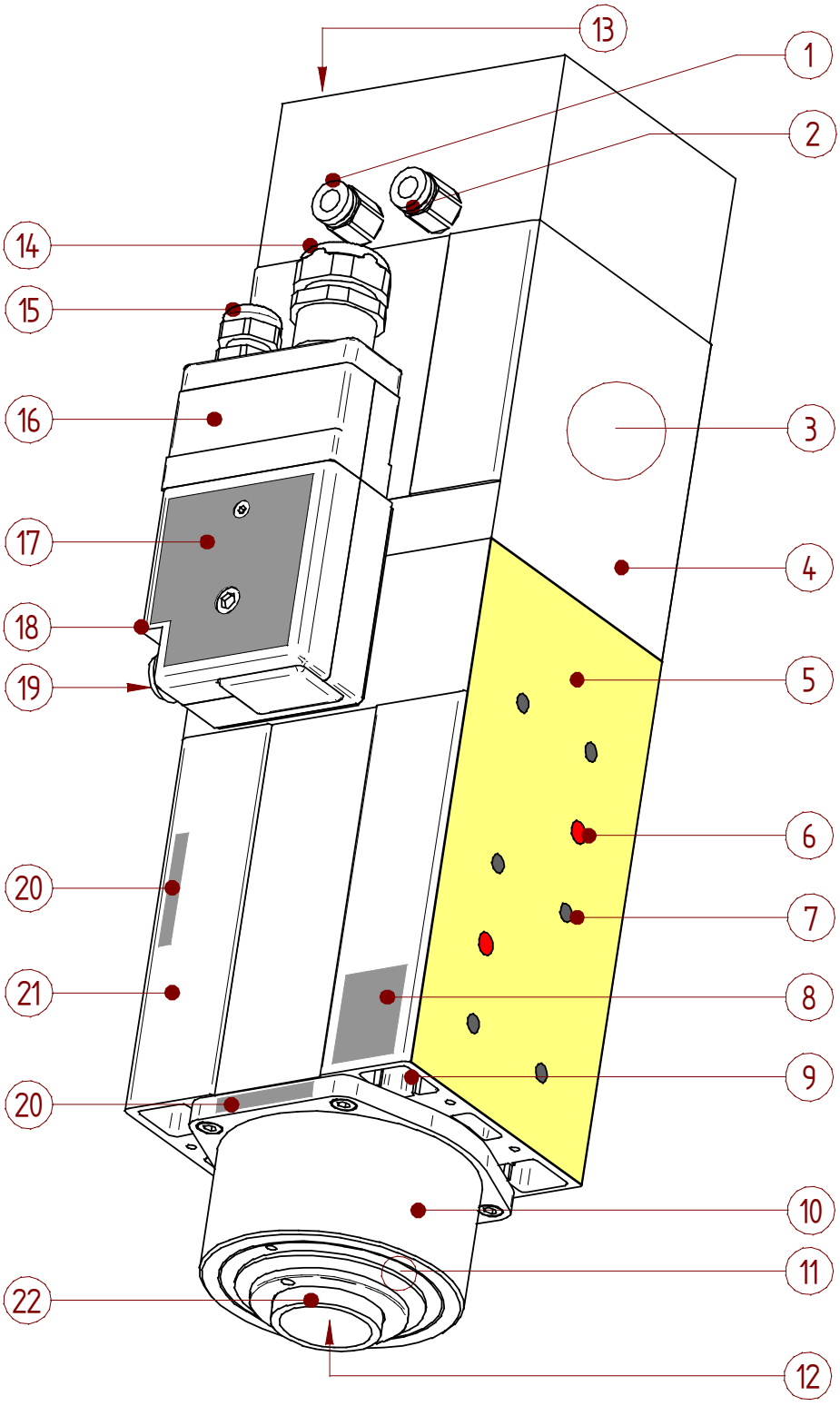
2 Technical Specifications

2.1 Main parts ES327



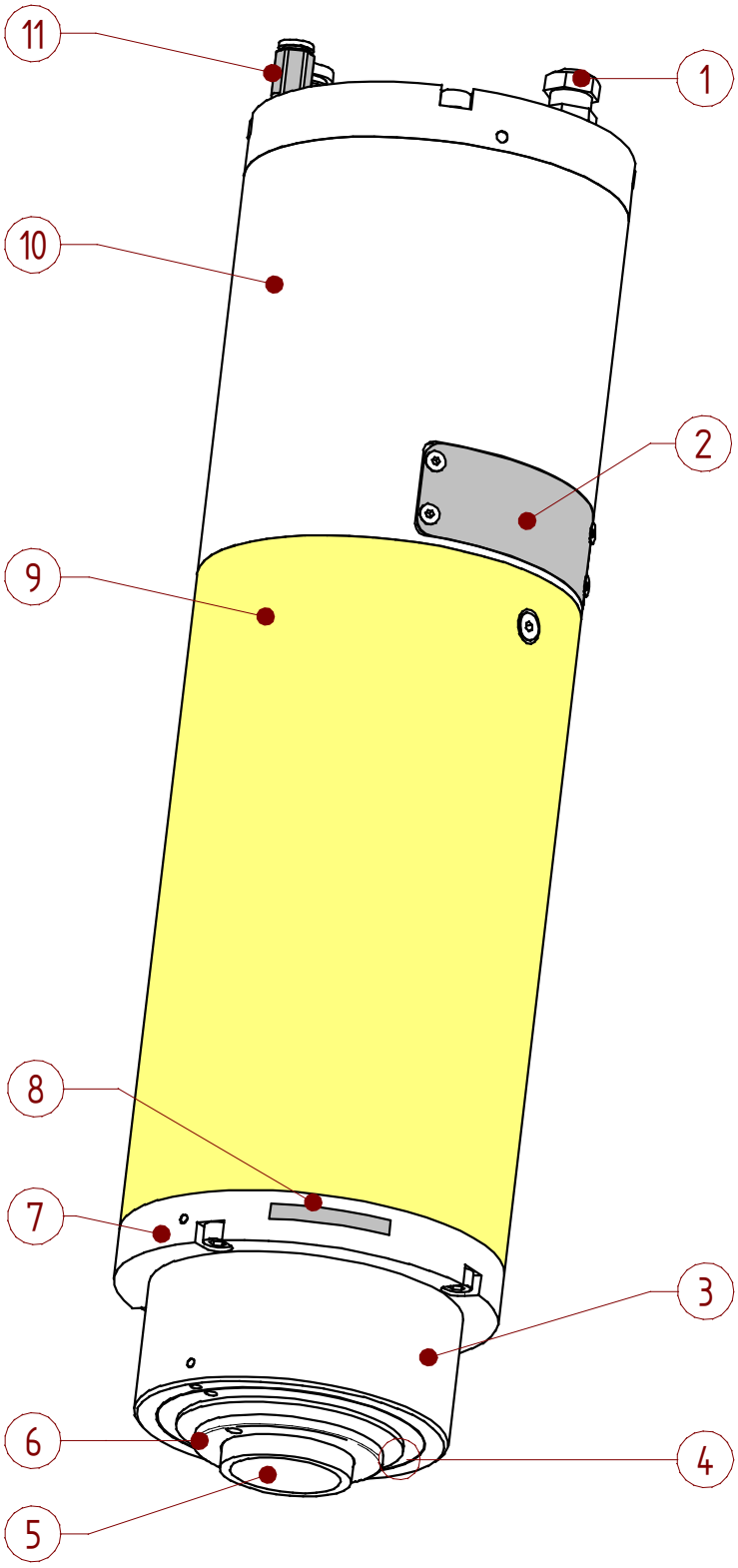
1	Power/signal wiring outlet
2	Sensor compartment cover
3	Electrospindle casing (joining area)
4	Labyrinth with pressurisation
5	Collet HSK E25
6	Spindle shaft
7	Front flange
8	Casing (sensors area)
9	Serial number
10	Pneumatic cylinder area
11	Pneumatic and hydraulic joins

2.2 Air-cooled ES330 main parts



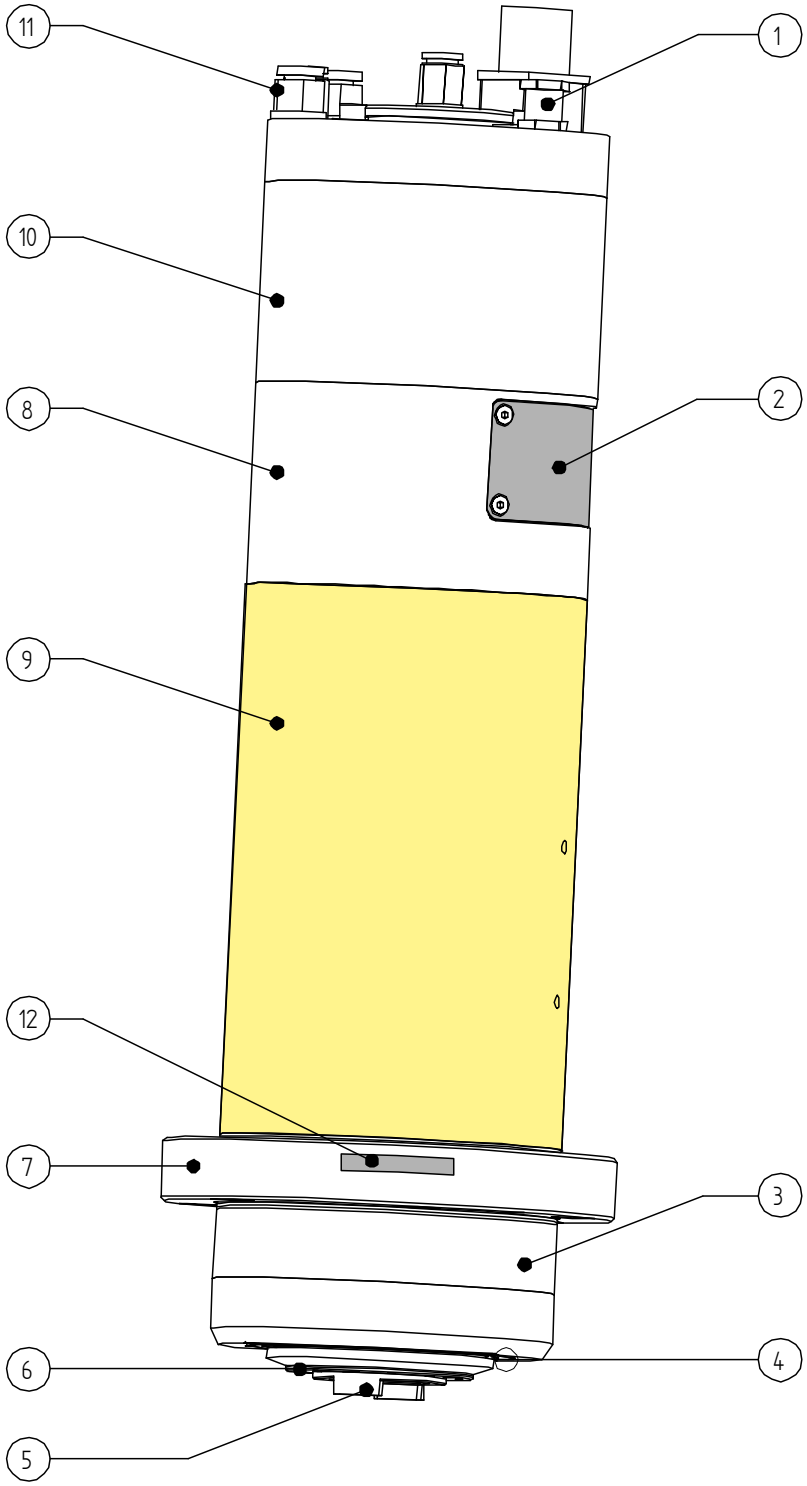
1	Air inlet for tool locking - ϕ 8/6 mm - hole 1/8”G
2	Air inlet for tool change and cone cleaning- ϕ 8/6 mm - hole 1/8”G
3	Cylinder area
4	Rear casing
5	2 rest surfaces (yellow area and opposite side of electric connector)
6	2 holes ϕ 8 mm H9 , 10 mm depth
7	6 holes M8 mm H9, thread depth of 12 mm
8	Tool holder description
9	Cooling air outlet channels
10	Electrospindle "nose"
11	Labyrinth with pressurisation
12	Coupling system ISO30 ("collet”)
13	Cooling air inlet grid (electric fan)
14	Power wiring outlet- cable clamp M25x1.5
15	Signal wiring outlet- cable clamp M16x1.5
16	Electric flying female connector (“flying mounting plate”)
17	EC plate
18	Fixed male electronic connector (“fixed mounting plate”)
19	Button for tool release manual command
20	Serial number
21	Casing
22	Shaft

2.3 Liquid-cooled ES330 main parts



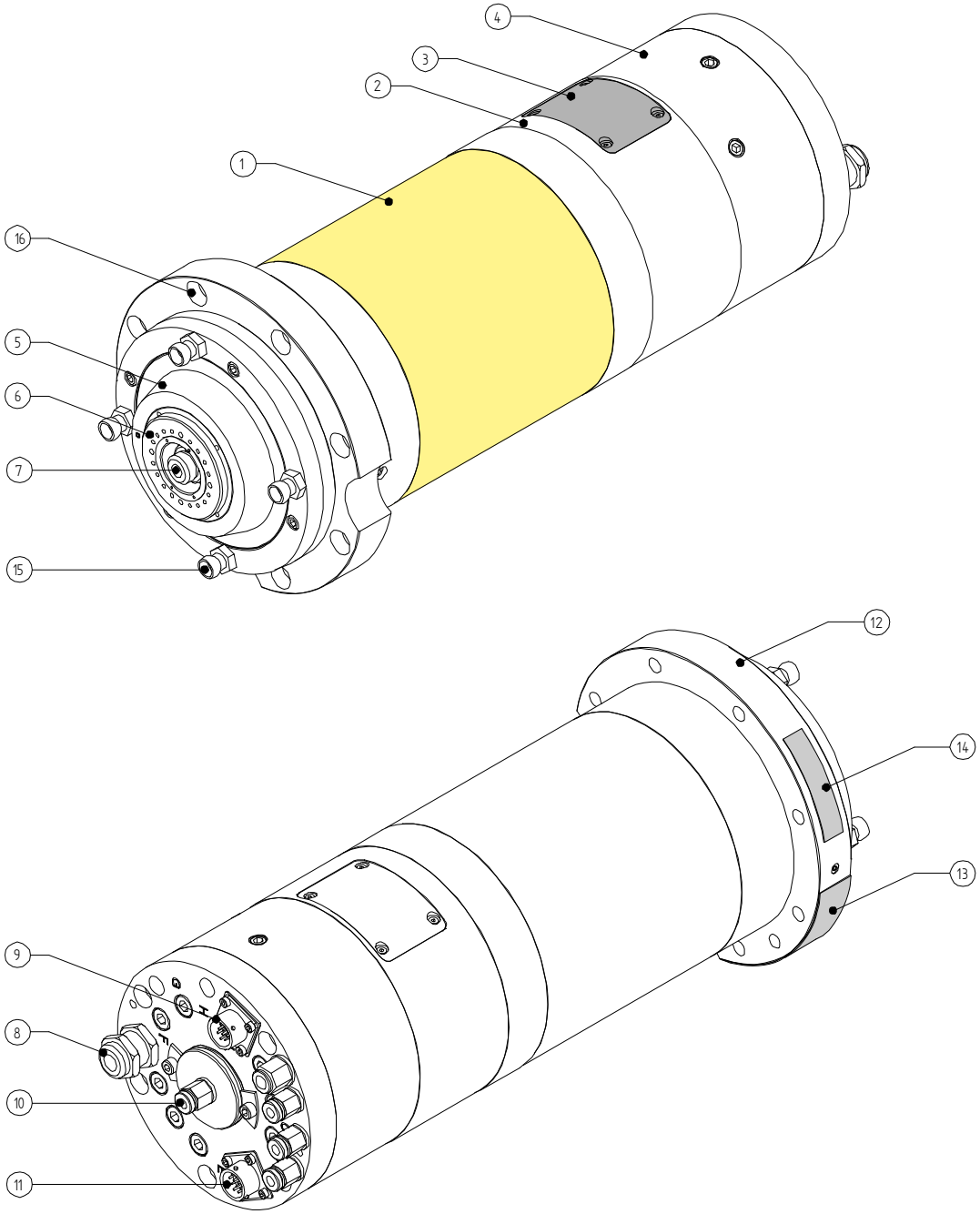
1	Power/signal wiring outlet- n. 2 cable clamps (1xM12 + 1x)
2	Sensor compartment cover
3	Electrospindle "nose"
4	Labyrinth with pressurisation
5	Coupling system ISO30
6	Spindle shaft
7	Front flange
8	Serial number
9	Casing
10	Pneumatic cylinder area
11	Pneumatic and hydraulic joins

2.4 ES331 Main parts



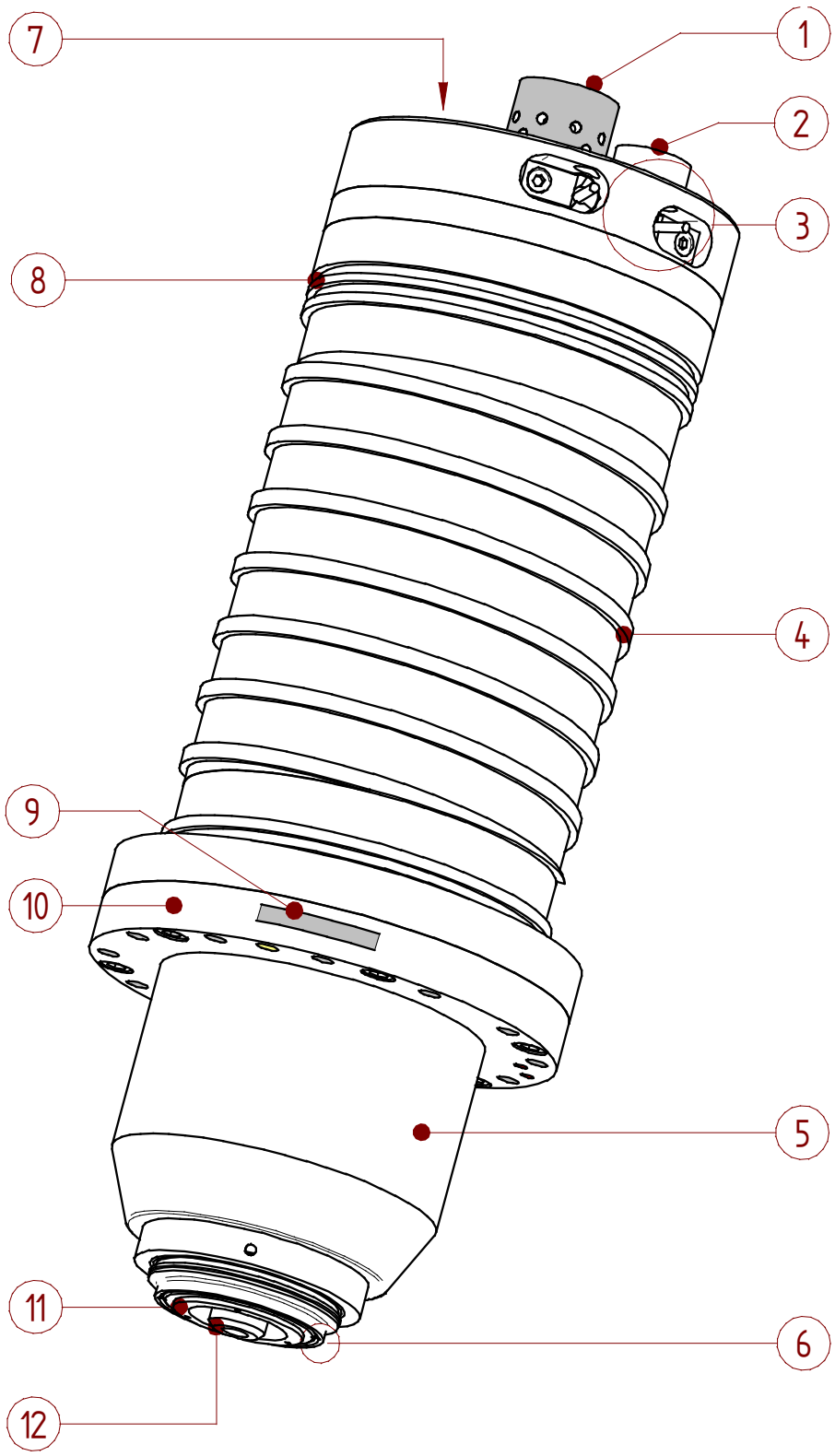
1	Power/signal wiring outlet- n. 2 cable clamps (1xM12 + 1x)
2	Sensor compartment cover
3	Electrospindle "nose"
4	Labyrinth with pressurisation
5	Coupling system ISO30
6	Spindle shaft
7	Front flange
8	Casing (sensors area)
9	Electrospindle casing
10	Pneumatic cylinder area
11	Pneumatic and hydraulic joins
12	Serial number

2.5 ES332 Main parts



1	Electrospindle casing
2	Casing (sensors area)
3	Sensor compartment cover
4	Pneumatic cylinder area
5	Electrospindle "nose"
6	Labyrinth with pressurisation
7	ISO coupling system
8	Power wiring outlet
9	Sensor wiring outlet
10	Pneumatic and hydraulic joins
11	Encoder wiring outlet
12	Front flange
13	EC plate
14	Serial number
15	Nozzles for external coolant (Optional)
16	Fixing holes

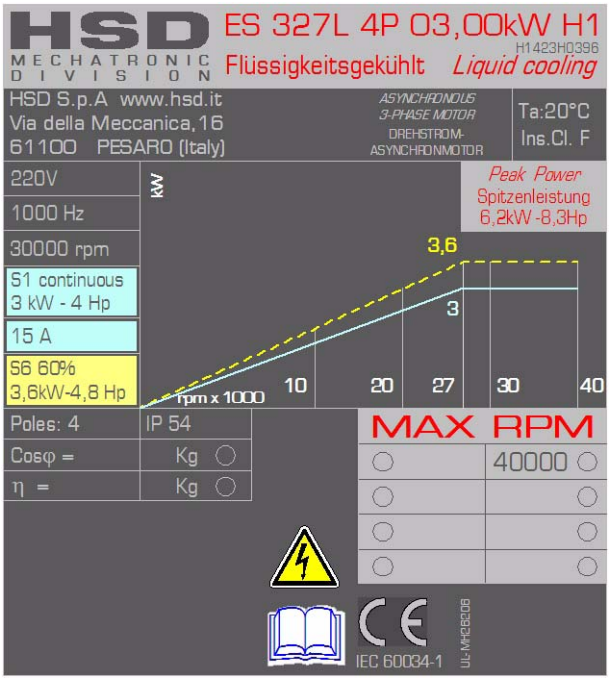
2.6 ES370 Main parts



1	Exposed area of the screw dowel to perform tool change
2	Electronic connector of the encoder
3	Sensors area
4	Helicoidal casing to optimise cooling
5	Electrospindle "nose"
6	Labyrinth with pressurisation
7	Stator cable outlet (electrospindle power)
8	No. 2 of 3 Or seats for the hydraulic seal of the cooling cylinder liner
9	Serial number
10	Front flange
11	Spindle shaft
12	Tool coupling system

2.7 Characteristics and performance

ES 327 220V



H1423H0396

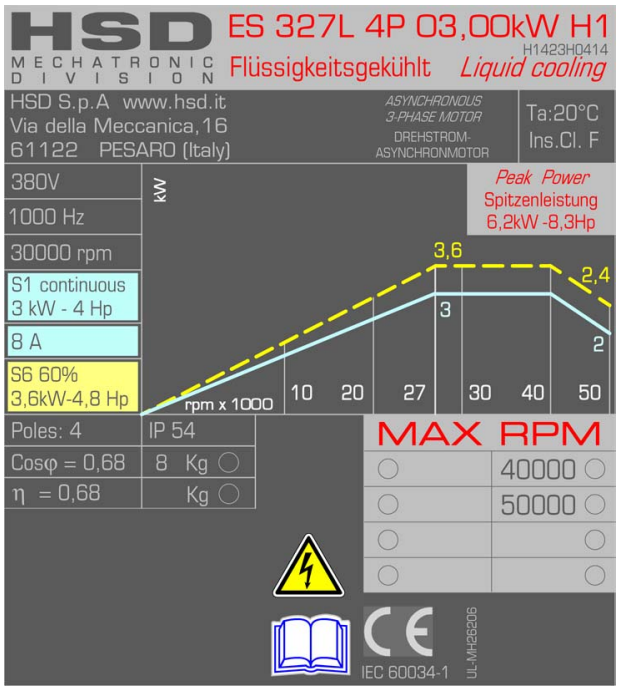
Rated voltage	V	132		198		220		220	
Rated frequency	Hz	600		900		1000		1333	
Rated speed	rpm	18000		27000		30000		40000	
Duty type		S1 cont	S6 60%	S1 cont	S6 60%	S1 cont	S6 60%	S1 cont	S6 60%
Rated power	kW	2	2.4	3	3.6	3	3.6	3	3.6
Rated torque	Nm	1.1	1.3	1.1	1.3	0.95	1.14	0.71	0.86
Rated current	A			15	18	14	16.8	13	15.6
Rated efficiency									
Power factor cos									
Number of poles		4							
Insulation class		F							
Cooling		Liquid							
Weight	Kg	15							
IP level									

The maximum rated current "S1/cont" is used to set the "maximum continuous current" parameter of the inverter.

SP ES327 220V

Description	Unit of measure-ment	Value	SIMODRIVE 611 D/U
Nominal power (S1)	kW	3	P1130
Nominal current (S1)	A	15	P1103
Nominal line voltage	V	207	P1132
Nominal speed at nominal load	Rpm	26100	P1400
Rated frequency	Hz	900	P1134
No-load line voltage	V	196	P1135
No-load current	A	7.9	P1136
Stator resistance (20°C)	Ohm	0.18	P1137
Rotor resistance (20°C)	Ohm	0.236	P1138
Stator dispersion reactance	Ohm	0.708	P1139
Rotor dispersion reactance	Ohm	1.53	P1140
Main field reactance	Ohm	13	P1141
Field weakening start speed	Rpm	29200	P1142
Motor moment of inertia	Kgm^2	0.000153	P1117
Connection	Y or D	Y	

ES 327 380V



H1423H0414

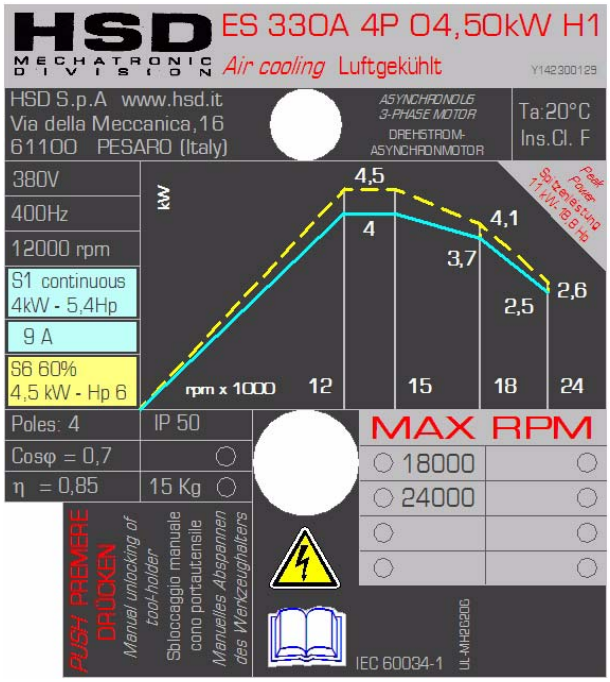
Rated voltage	V	351		380		380	
Rated frequency	Hz	900		1000		1333	
Rated speed	rpm	27000		30000		40000	
Duty type		S1 cont	S6 60%	S1 cont	S6 60%	S1 cont	S6 60%
Rated power	kW	3	3.6	3	3.6	3	3.6
Rated torque	Nm	1.06	1.27	0.95	1.14	0.71	0.86
Rated current	A	9	11	8	9.6	7	8.5
Rated efficiency		0.68					
Power factor cos		0.68					
Number of poles		4					
Insulation class		F					
Cooling		Liquid					
Weight	Kg	8					
IP level							

The maximum rated current "S1/cont" is used to set the "maximum continuous current" parameter of the inverter.

SP ES327 380V

Description	Unit of measure-ment	Value	SIMODRIVE 611 D/U
Nominal power (S1)	kW	3	P1130
Nominal current (S1)	A	8	P1103
Nominal line voltage	V	348	P1132
Nominal speed at nominal load	Rpm	26100	P1400
Rated frequency	Hz	900	P1134
No-load line voltage	V	330	P1135
No-load current	A	4.6	P1136
Stator resistance (20°C)	Ohm	0.536	P1137
Rotor resistance (20°C)	Ohm	0.682	P1138
Stator dispersion reactance	Ohm	2.05	P1139
Rotor dispersion reactance	Ohm	4.48	P1140
Main field reactance	Ohm	38	P1141
Field weakening start speed	Rpm	28900	P1142
Motor moment of inertia	Kgm^2	0.000153	P1117
Connection	Y or D	Y	

ES 330 380V AIR



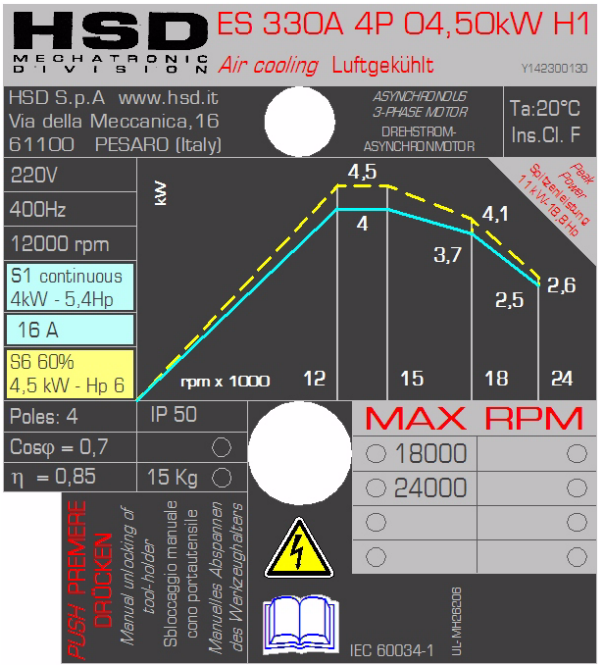
Rated voltage	V	380		380		380		380	
Rated frequency	Hz	400		500		600		800	
Rated speed	rpm	12000		15000		18000		24000	
Duty type		S1 cont	S6 60%	S1 cont	S6 60%	S1 cont	S6 60%	S1 cont	S6 60%
Rated power	kW	4	4.5	4	4.5	3.7	4.1	2.5	2.6
Rated torque	Nm	3.2	3.8	2.5	3	1.7	2.3	1	1.2
Rated current	A	9	10.7	9	10.8	8.5	11.5	6.5	7.8
Rated efficiency		0.85							
Power factor cos		0.7							
Number of poles		4							
Insulation class		F							
Cooling		Electric fan							
Weight	Kg	15							
IP level		50							

The maximum rated current "S1/cont" is used to set the "maximum continuous current" parameter of the inverter.

SP.090.100.4L AIR

Description	Unit of measure-ment	Value
Nominal power (S1)	kW	4
Nominal current (S1)	A	9
Nominal line voltage	V	380
Nominal speed at nominal load	Rpm	11760
Rated frequency	Hz	400
No-load line voltage	V	376
No-load current	A	3
Stator resistance (20°C)	Ohm	0.51
Rotor resistance (20°C)	Ohm	0.67
Stator dispersion reactance	Ohm	2.4
Rotor dispersion reactance	Ohm	5.7
Main field reactance	Ohm	49.2
Field weakening start speed	Rpm	12000
Maximum motor speed	Rpm	24000
Power factor		0.8
Connection	Y or D	Y

ES 330 220V AIR



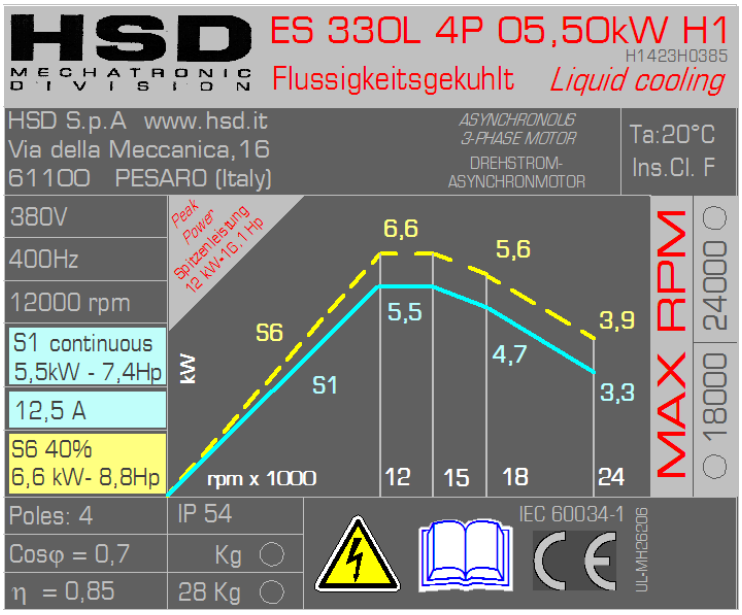
Rated voltage	V	220		220		220		220	
Rated frequency	Hz	400		500		600		800	
Rated speed	rpm	12000		15000		18000		24000	
Duty type		S1 cont	S6 60%	S1 cont	S6 60%	S1 cont	S6 60%	S1 cont	S6 60%
Rated power	kW	4	4.5	4	4.5	3.7	4.1	2.5	2.6
Rated torque	Nm	3.2	3.8	2.5	3	1.7	2.3	1	1.2
Rated current	A	16	19	16	19.2	15	20.3	11.5	14
Rated efficiency		0.85							
Power factor cos		0.7							
Number of poles		4							
Insulation class		F							
Cooling		Electric fan							
Weight	Kg	15							
IP level		50							

The maximum rated current "S1/cont" is used to set the "maximum continuous current" parameter of the inverter.

SP.090.100.4S

Description	Unit of measure-ment	Value
Nominal power (S1)	kW	4
Nominal current (S1)	A	16
Nominal line voltage	V	220
Nominal speed at nominal load	Rpm	11760
Rated frequency	Hz	400
No-load line voltage	V	218
No-load current	A	7
Stator resistance (20°C)	Ohm	0.14
Rotor resistance (20°C)	Ohm	0.17
Stator dispersion reactance	Ohm	0.8
Rotor dispersion reactance	Ohm	1.8
Main field reactance	Ohm	14.9
Field weakening start speed	Rpm	12000
Maximum motor speed	Rpm	24000
Power factor		0.8
Connection	Y or D	Y

ES 330 380V LIQUID



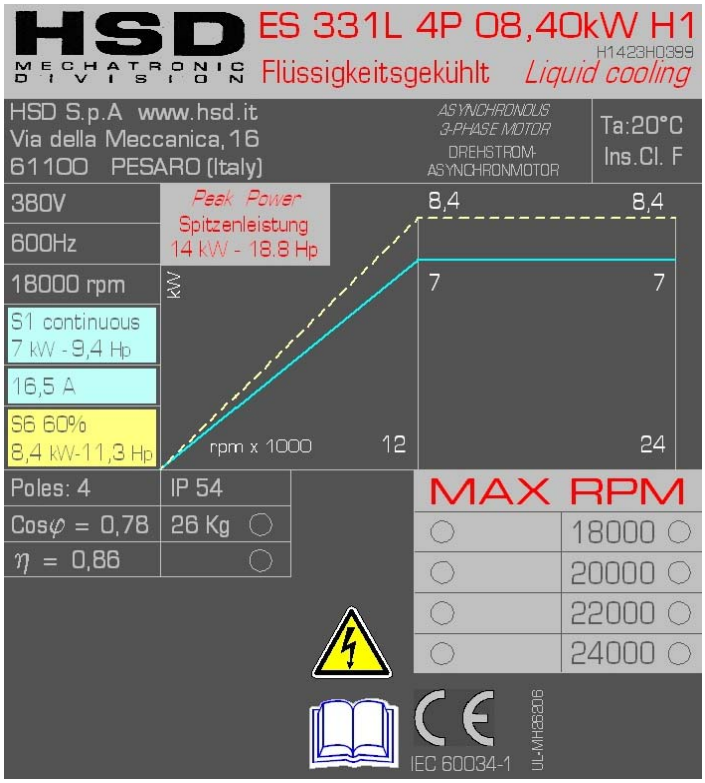
Rated voltage	V	380		380		380		380	
Rated frequency	Hz	400		500		600		800	
Rated speed	rpm	12000		15000		18000		24000	
Duty type		S1 cont	S6 60%	S1 cont	S6 60%	S1 cont	S6 60%	S1 cont	S6 60%
Rated power	kW	5.5	6.6	5.5	6.6	4.7	5.6	3.3	3.9
Rated torque	Nm	4.4	5.3	3.5	4.2	2.5	3	1.3	1.6
Rated current	A	12.5	15	12.5	15	10.8	13	8	9.6
Rated efficiency		0.85							
Power factor cos		0.7							
Number of poles		4							
Insulation class		F							
Cooling		Liquid							
Weight	Kg	28							
IP level		54							

The maximum rated current "S1/cont" is used to set the "maximum continuous current" parameter of the inverter.

SP.090.100.4L LIQUID

Description	Unit of measure-ment	Value
Nominal power (S1)	kW	5.5
Nominal current (S1)	A	12.5
Nominal line voltage	V	380
Nominal speed at nominal load	Rpm	11760
Rated frequency	Hz	400
No-load line voltage	V	376
No-load current	A	3
Stator resistance (20°C)	Ohm	0.51
Rotor resistance (20°C)	Ohm	0.67
Stator dispersion reactance	Ohm	2.4
Rotor dispersion reactance	Ohm	5.7
Main field reactance	Ohm	49.2
Field weakening start speed	Rpm	12000
Maximum motor speed	Rpm	24000
Power factor		0.8
Connection	Y or D	Y

ES 331



Rated voltage	V	260		380		380	
Rated frequency	Hz	400		600		800	
Rated speed	rpm	12000		18000		24000	
Duty type		S1 cont	S6 60%	S1 cont	S6 60%	S1 cont	S6 60%
Rated power	kW	7	8.4	7	8.4	7	8.4
Rated torque	Nm	5.6	6.7	3.7	4.5	2.8	3.3
Rated current	A	23	27.5	16.5	20.1	16	18.9
Rated efficiency		0.86					
Power factor cos		0,78					
Number of poles		4					
Insulation class		F					
Cooling		Liquid					
Weight	Kg	26					

The maximum rated current "S1/cont" is used to set the "maximum continuous current" parameter of the inverter.

SP.090.110.45

Description	Unit of measure-ment	Value
Nominal power (S1)	kW	7
Nominal current (S1)	A	23
Nominal line voltage	V	260
Nominal speed at nominal load	rpm	11780
Rated frequency	Hz	400
No-load line voltage	V	257
No-load current	A	10.7
Stator resistance (20°C)	W	0.2
Rotor resistance (20°C)	W	0.16
Stator dispersion reactance	W	0.6
Stator dispersion inductance	mH	0.2
Rotor dispersion reactance	W	1.1
Rotor dispersion inductance	mH	0.45
Main field reactance	W	13.5
Main field inductance	mH	5.4
Field weakening start speed	rpm	18000
Maximum motor speed	rpm	24000
Power factor		0.78
Rotor moment of inertia	Kg m^2	9.1E-04
Connection	Y or D	Y

ES 332

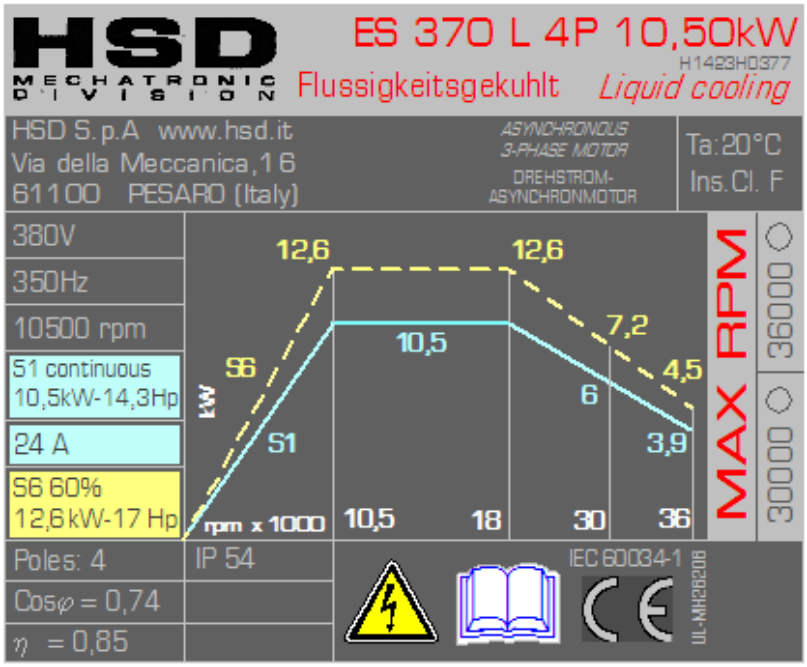
Rated voltage	V	380		380		380	
Rated frequency	Hz	400		600		800	
Rated speed	rpm	12000		18000		24000	
Duty type		S1 cont	S6 60%	S1 cont	S6 60%	S1 cont	S6 60%
Rated power	kW	13	15.6	13	15.6	10	12
Rated torque	Nm	10.3	12.4	6.9	8.3	4	4.8
Rated current	A	27.5	33	27.5	33	21.5	26
Rated efficiency		0,88					
Power factor cos		0,77					
Number of poles		4					
Insulation class		F					
Cooling		Liquid					
Weight	Kg	35					

The maximum rated current "S1/cont" is used to set the "maximum continuous current" parameter of the inverter.

SP.110.150.44

Description	Unit of measure-ment	Value
Nominal power (S1)	kW	13
Nominal current (S1)	A	27.5
Nominal line voltage	V	380
Nominal speed at nominal load	rpm	11640
Rated frequency	Hz	400
No-load line voltage	V	374
No-load current	A	11.5
Stator resistance (20°C)	W	0.17
Rotor resistance (20°C)	W	0.13
Stator dispersion reactance	W	1.4
Stator dispersion inductance	mH	0.6
Rotor dispersion reactance	W	0.5
Rotor dispersion inductance	mH	0.18
Main field reactance	W	19
Main field inductance	mH	7.6
Field weakening start speed	rpm	12000
Maximum motor speed	rpm	24000
Power factor		0.77
Rotor moment of inertia	Kg m^2	2.6E-03
Connection	Y or D	Y

ES 370 380V



Rated voltage	V	380		380		380		380	
Rated frequency	Hz	350		600		1000		1200	
Rated speed	rpm	10500		18000		30000		36000	
Duty type		S1 cont	S6 60%	S1 cont	S6 60%	S1 cont	S6 60%	S1 cont	S6 60%
Rated power	kW	10.5	12.6	10.5	12.6	6	7.2	3.9	4.5
Rated torque	Nm	9.5	11.5	5.6	6.7	1.9	2.3	1	1.2
Rated current	A	22.1	26.7	22	26.7	13	15.7	7.4	8.9
Rated efficiency		0.85							
Power factor cos		0,74							
Number of poles		4							
Insulation class		F							
Cooling		Liquid							
Weight	Kg								
IP level		54							

The maximum rated current "S1/cont" is used to set the "maximum continuous current" parameter of the inverter.

SP.100.140.42

Description	Unit of measure-ment	Value
Nominal power (S1)	kW	10.5
Nominal current (S1)	A	22.1
Nominal line voltage	V	380
Nominal speed at nominal load	Rpm	10225
Rated frequency	Hz	350
No-load line voltage	V	376.2
No-load current	A	5.9
Stator resistance (20°C)	Ohm	0.2
Rotor resistance (20°C)	Ohm	0.32
Stator dispersion reactance	Ohm	1.5
Rotor dispersion reactance	Ohm	3.1
Main field reactance	Ohm	35.1
Field weakening start speed	Rpm	10500
Maximum motor speed	Rpm	30000
Power factor		0.85
Connection	Y or D	Y

3 Transport, packing, unpacking, storage

3.1 Warnings

- Product lifting and handling operations can create hazardous situations for the personnel involved. Therefore, it is advisable to follow the instructions supplied by the manufacturer and to use the appropriate equipment.
- The installation and assembly operations must always be carried out by specialised technicians only.
- All the lifting and handling operations of the product and its parts must be performed with extreme care, avoiding impacts that could compromise its operation or damage any coated parts.

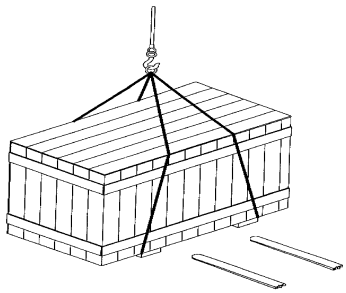
The user is responsible for selecting the lifting equipment (cables, straps or chains, etc.) regarded as most suitable in terms of operation and capacity with respect to the weight of the load indicated on the packing and on the product label.

3.2 Dimensions and weights

- Weight of the packed product: this is reported on the packing.
- Linear dimensions of the packed product: these are reported in the documents accompanying the product.

3.3 Transport and packing conditions

The product is shipped protected by a VCI plastic wrapping and expanded foam, and packed in a wooden case or in a special cardboard box.
The following figure illustrates methods that can be used to lift the case using cables and a forklift. In the case of a forklift, make sure that the centre of gravity of the case is between the forks when lifting.



The examples shown are for information purposes only, in that it is not possible for the manufacturer to determine all the possible configurations for lifting its products beforehand.

Furthermore, it is necessary that during transport the following environmental conditions are observed:

Transport temperature	**-25°C ÷ +60°C (-13°F ÷ +140°F)**
Non condensing relative humidity	**5% ÷ 55%**

3.4 Unpacking

Prior to opening the packing, make sure that the seals are still intact.

If the product is delivered in a wooden case, insert a screwdriver under the fastener. Use the screwdriver as a lever, taking care not to damage the case or its contents.

If the product is packed in a cardboard box, remove the strips of adhesive tape, taking care not to damage the box or its contents.

Do not lift the product by grasping the electric fan as this could damage the guard.

The expanded foam and plastic wrapping must be disposed of as plastic material.

3.5 Storage

If the product is to be placed in storage, it must be protected against weather, humidity, dust and aggressive atmospheric and environmental agents.

With the product in storage:

- Carry out periodic checks to ascertain the general storage condition of the product.
- Manually rotate the shaft approximately once a month to make sure that the bearings remain perfectly greased.

Furthermore, it is necessary that during storage the following environmental conditions are observed:

Storage temperature	**–5°C ÷ +55°C (23°F ÷ +131°F)**
Non condensing relative humidity	**5% ÷ 55%**

The maximum storage time for an HSD product is 12 months.
For periods longer than 12 months, the product must be inspected by personnel authorised by the manufacturer.
For more information, refer to the Assistance Service.

4 Installation and commissioning

4.1 Preliminary installation checks

Before carrying out any operations, MAKE SURE:

- that no parts of the product have been damaged by impact or any other cause during transport and/or handling;
- that the connectors are undamaged.

4.2 Preparing the factory services

It is the responsibility of the customer to ensure the availability of the factory services (e.g. electricity supply, compressed air supply, etc.).
The electricity supply line must have a sufficient power rating. The connection to the mains electricity supply must be carried out by a qualified electrician.

The customer is responsible for the entire power supply system to the product as far as the connectors.
The user must guarantee all the safety conditions necessary for "earthing" the product.
The earthing system must comply with current standards in the country of installation and must be checked regularly by qualified personnel.

Do not install the product in areas at risk of explosion.

Installation must be performed in a sufficiently lit area.

4.3 Environmental requisites

- Temperature: from +5 to +40 °C. (41÷104°F)
- Maximum relative humidity: 50% (at 40°C/104°F).
- Maximum altitude: 1000 metres a.s.l. (unless agreed otherwise with the customer).

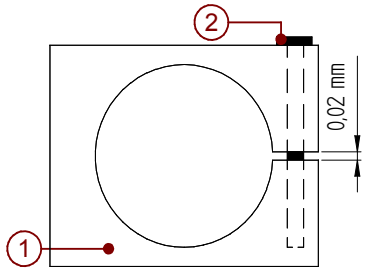
4.4 Mechanical connections

The load-bearing structure on which the product is to be mounted must be sufficiently rigid to support the weight and type of machining to be carried out.

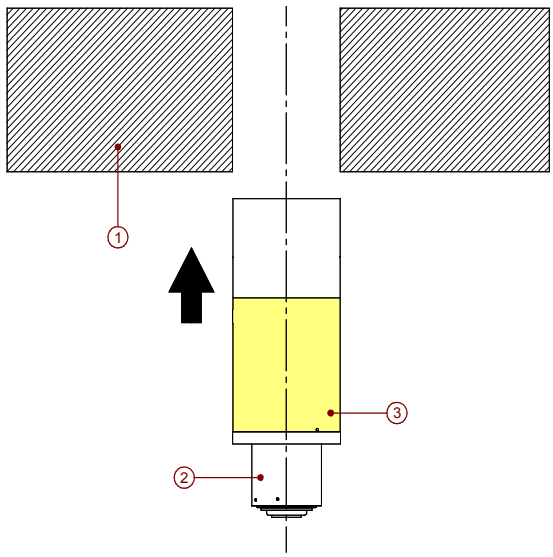
4.4.1 Fixing structure for ES327, “liquid” ES330

The electrospindle must be assembled in "clamped" housing.

Make available a structure which has a hole equal to the diameter of the spindle and an opening of 0.02 mm (it is advisable to use a thickness spacer appropriately machined).When the motor has been inserted, tighten the housing to obtain the correct pressure to lock the electrospindle



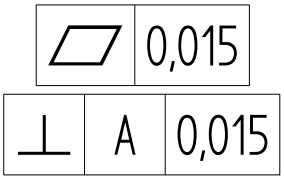
1	**Housing**
2	**Fixing screws**

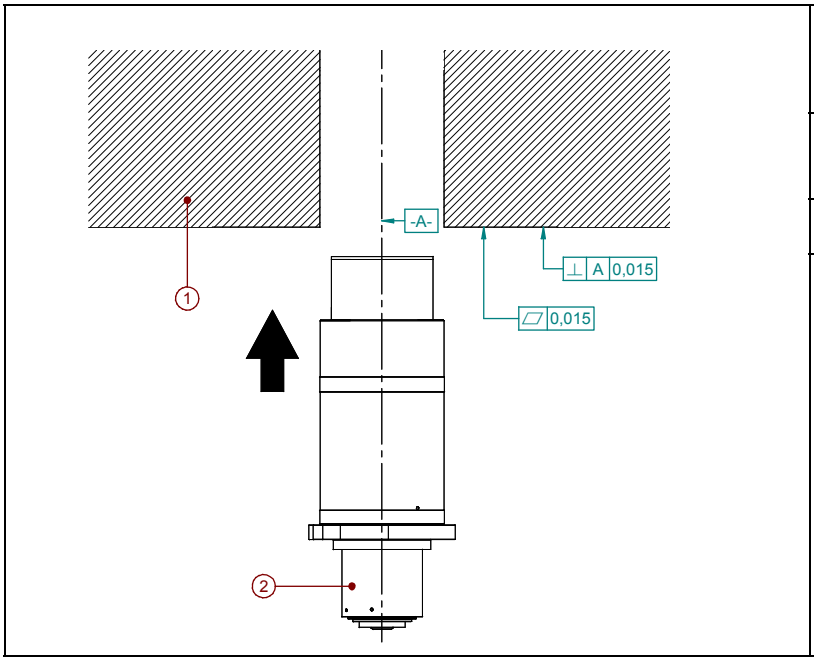


1	Fixing structure of the electrospindle
2	Electrospindle
3	Fixing area

4.4.2 Fixing structure for ES331-ES332-ES370

The fixing structure to which the spindle is fixed, must have a flatness of less than 0.015 mm and a perpendicularity to the axis of the spindle of less than 0.015 mm.





1	Fixing structure of the electrospindle
2	Electrospindle

ES331

Use the 6 available Ø8.5 mm through bores for assembly on the machine (ref. 2.4 “ES331 Main parts”).

ES332

Use the 8 available Ø9.mm through bores for assembly on the machine (ref. 2.5 “ES332 Main parts”).

ES370

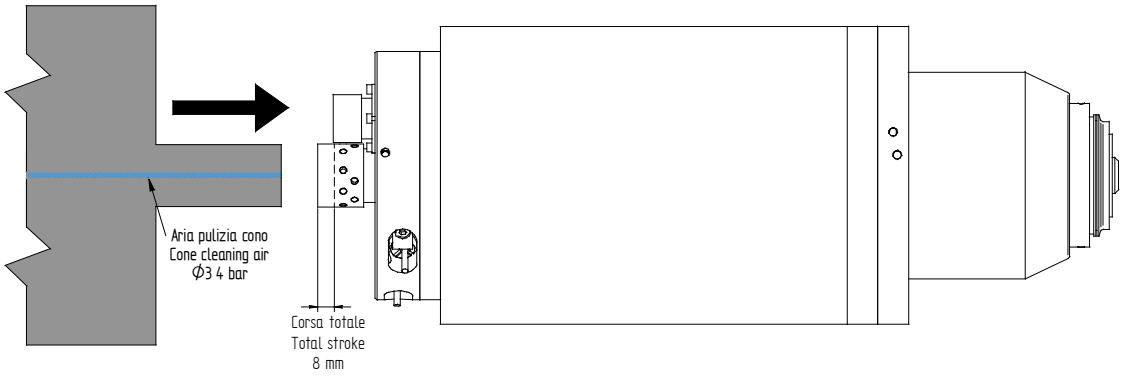
Use the 12 available Ø6.5 mm through bores for assembly on the machine (ref. 2.6 “ES370 Main parts”).

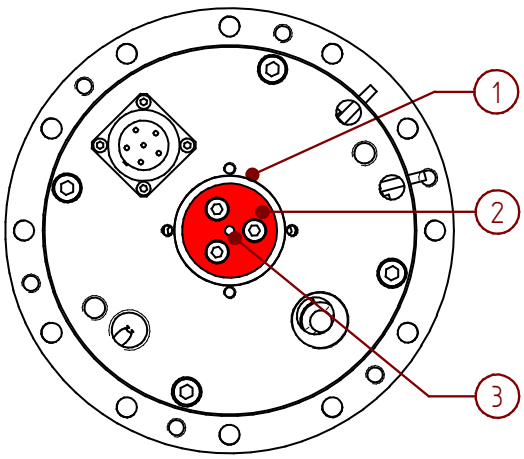
4.5 ES370: performing tool change

The ES370 electrospindle is not equipped with a cylinder/piston to perform the tool change. It is the responsibility of the client in this case to provide an external structure which enables tool change operations by taking advantage of the exposed area of the screw dowel. The expulsion system must also provide for a central hole for toolholder cone cleaning in the releasing phase.

Expulsion system specifications	
Force	min 1000 Kg - max 1250 Kg
Screw dowel stroke between positions “collet closed without tool” and “collet open”	8 mm
Diameter on stop	30 mm

The expulsion system should not cause radial loads on the screw dowel.





1	Pressurisation air outlet area
2	Exposed area of the screw dowel to be used to open the collet
3	ø 3 Hole air inlet cone cleaning 4 bar

4.6 Pneumatic connections

4.6.1 Specifications for the compressed air supplied to the manufacturer's products

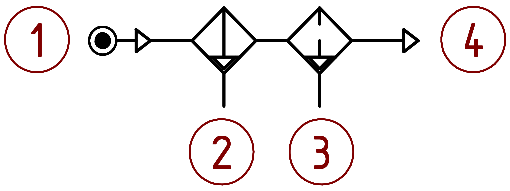
Introduce compressed air with purity according to ISO 8573-1, Class 2 4 3, i.e.:

- **Class 2 for the solid particles: size of the solid particles < 1 μm;**
- **Class 4 for humidity: dew point < 3°C (37.4°F);**
- **Class 3 for total oil: oil concentration < 1 mg/m^3.**

Failure to comply with these specifications may cause the malfunction of the electrospindle.
The guarantee will be deemed as null and void if traces of pollutants are found during repairs.

For example, compliance with the above specifications can be obtained following the instructions written below:

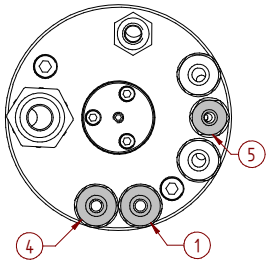
- If the machine has a lubricated air circuit, this must be isolated from the dry air circuit feeding the electrospindle by means of non-return valves.
- The filters shown in diagrams of the following figures must be installed as close as possible to the electrospindle.
- In view of the fact that the efficiency of the filters is <100%, it is important that the machine tool is supplied with suitably treated air.
  As an indication, introduce compressed air with a purity according to ISO 8573-1, classes 7 6 4, into the circuits illustrated below, i.e.:
  - Class 7 for solid particles:
    dimensions of solid particles < 40 μm;
    concentration of solid particles < 10mg/m3.
  - Class 6 for humidity: dew point < 10°C (°F).
  - Class 4 for total oil: oil concentration < 5 mg / m3.
- At the end of the working day, discharge the compressed air system to allow the filters to drain automatically.
- Perform regular maintenance on the filters in line with the manufacturer's instructions and replace them when they become saturated and less efficient (approximately every 6/12 months).



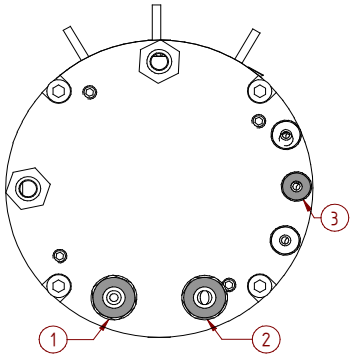
1. Main compressed air supply.
2. Pre-filter 5 μm.
3. Oil separator filter 0.1 μm.
4. To the manufacturer's product.

4.6.2 Pneumatic connection points

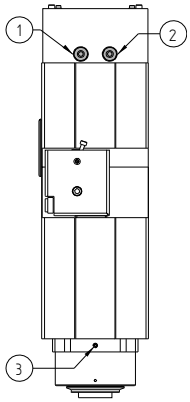
Figure 1: Pneumatic connection points



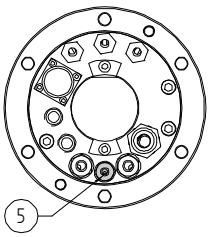
ES327



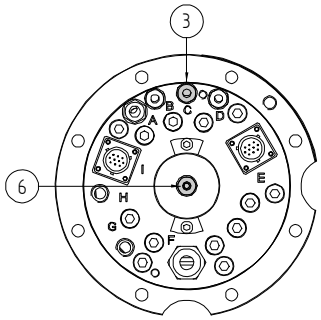
Liquid ES330



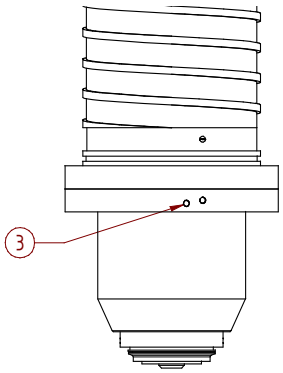
Air ES330



ES331



ES332



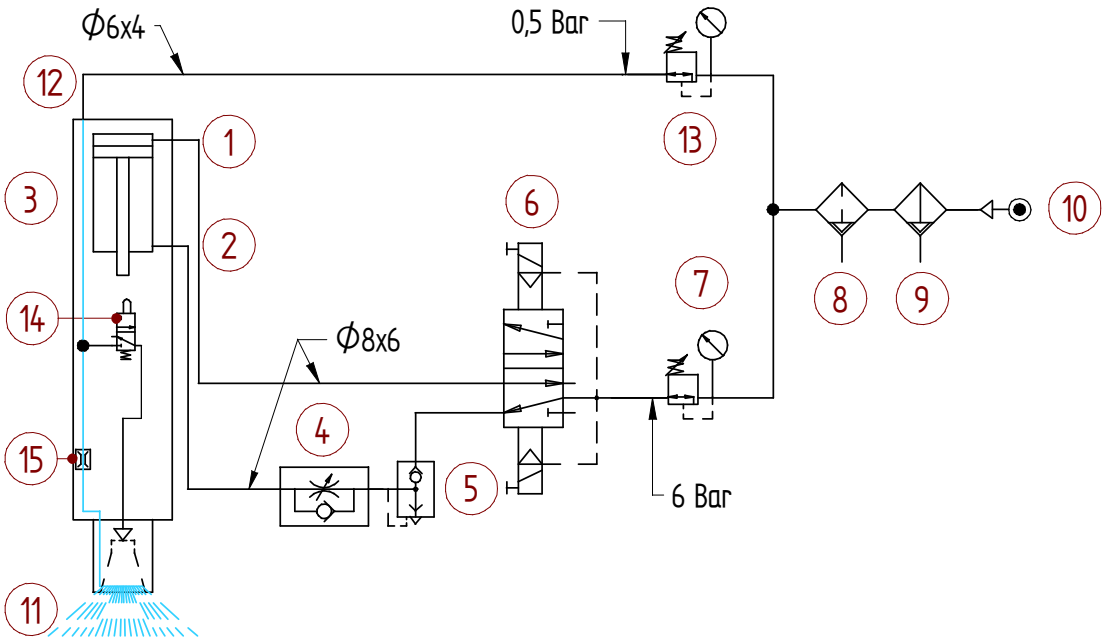
ES370

1	Tool locking air inlet (piston return)	6 bar - 87 PSI
2	Air inlet for tool release and cone cleaning	6 bar - 87 PSI
3	Pressurisation air inlet	0.5 bar - 7.2 PSI
4	Air inlet for tool release (ES327 only)	6 bar - 87 PSI
5	Air inlet for pressurisation and cone cleaning (ES331 only)	1 bar - 14 PSI
6	Air inlet for cone cleaning (ES332 only)	4 bar - 58 PSI

4.6.3 Pneumatic connections

For exemplary purposes we have provided the pneumatic connection layout in the figures below, which should be created by the user.

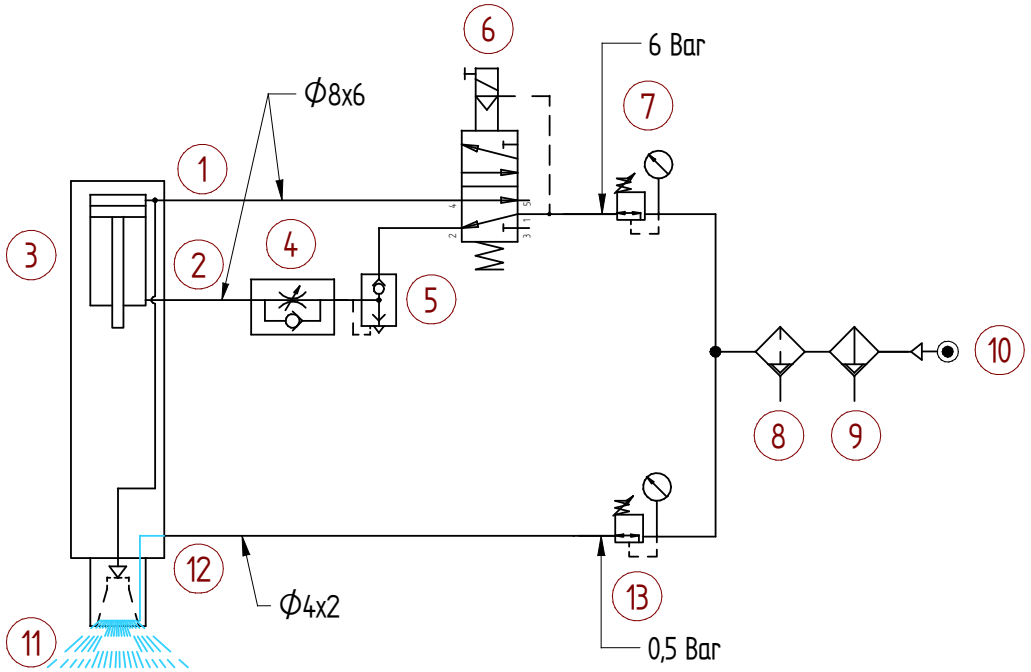
Figure 2: exemplary pneumatic layout of the ES327 electrospindles



1	Air inlet for tool change	6 bar - 87 PSI
2	Tool locking air inlet (piston return)	6 bar - 87 PSI
3	Double effect piston	
4	Unidirectional flow regulator for regulating the ejection speed	
5	Rapid discharge valve	
6	Monostable 5-2 valve with electro-pneumatic control and spring return	
7	Pressure regulator with pressure switch calibrated to 6 bar	
8	Oil separator filter 0.1 µm.	
9	Pre-filter 5 µm	
10	Mains power supply	
11	Continuous flow of pressurisation air	
12	Air inlet for pressurisation and cone cleaning	1 bar - 14 PSI
13	Pressure regulator with pressure switch calibrated to 1 bar	
14	Valve to operate cone cleaning (commanded by the piston)	
15	Throttling	

THE PROPOSED CIRCUIT IS PURELY EXEMPLARY.

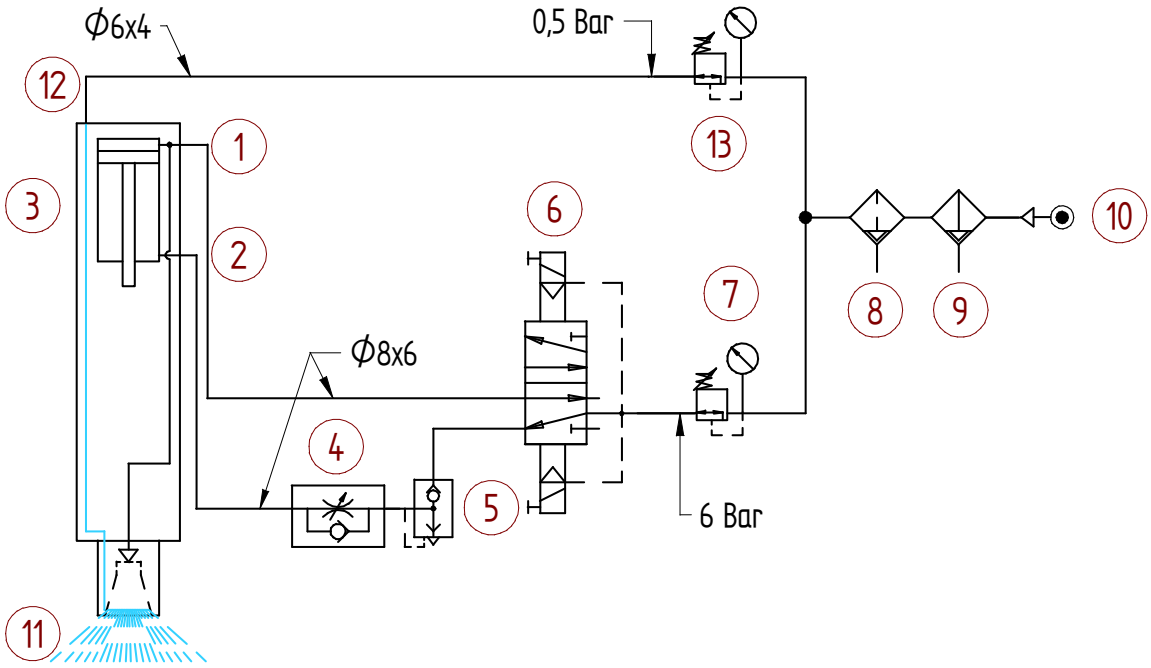
Figure 3: exemplary pneumatic layout for ES330 “air” electrospindle



1	Air inlet for tool release and cone cleaning	6 bar - 87 PSI
2	Tool locking air inlet (piston return)	6 bar - 87 PSI
3	Double effect piston	
4	Unidirectional flow regulator for regulating the ejection speed	
5	Rapid discharge valve	
6	Monostable 5-2 valve with electro-pneumatic control and spring return	
7	Pressure regulator with pressure switch calibrated to 6 bar	
8	Oil separator filter 0.1 µm.	
9	Pre-filter 5 µm	
10	Mains power supply	
11	Continuous flow of pressurisation air	
12	Pressurisation air inlet	0.5 bar - 7.3 PSI
13	Pressure regulator with pressure switch calibrated to 0.5 bar	

THE PROPOSED CIRCUIT IS PURELY EXEMPLARY.

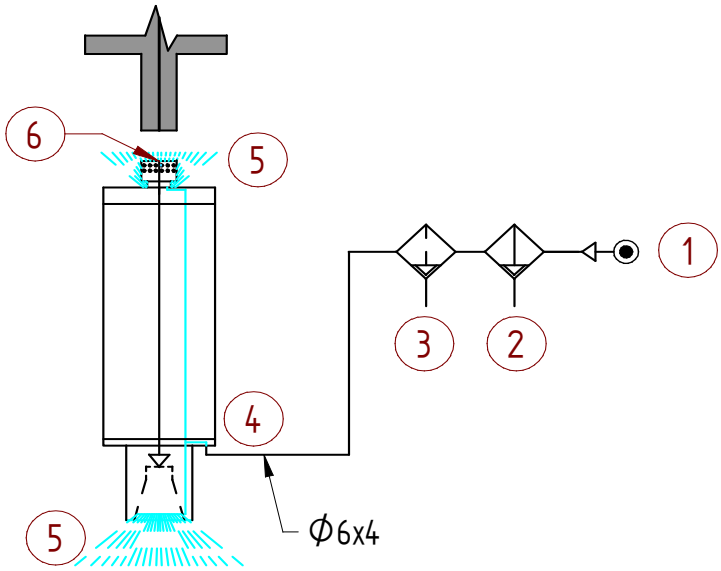
Figure 4: exemplary pneumatic layout of the ES330 "liquid" electrospindles



1	Air inlet for tool release and cone cleaning	6 bar - 87 PSI
2	Tool locking air inlet (piston return)	6 bar - 87 PSI
3	Double effect piston	
4	Unidirectional flow regulator for regulating the ejection speed	
5	Rapid discharge valve	
6	Monostable 5-2 valve with electro-pneumatic control and spring return	
7	Pressure regulator with pressure switch calibrated to 6 bar	
8	Oil separator filter 0.1 µm.	
9	Pre-filter 5 µm	
10	Mains power supply	
11	Continuous flow of pressurisation air	
12	Pressurisation air inlet	0.5 bar - 7.3 PSI
13	Pressure regulator with pressure switch calibrated to 0.5 bar	

THE PROPOSED CIRCUIT IS PURELY EXEMPLARY.

Figure 5: exemplary pneumatic layout for ES370 electrospindle



1	Mains power supply	
2	Pre-filter 5 µm	
3	Oil separator filter 0.1 µm.	
4	Pressurisation air inlet	4 bar - 58 PSI
5	Continuous flow of pressurisation air	
6	Exposed area of the screw dowel with Ø hole for cone cleaning	6 bar - 87 PSI

THE PROPOSED CIRCUIT IS PURELY EXEMPLARY.

4.6.4 Automatic tool holder collet spindle cleaning

The tool-holder cone and its conical housing in the spindle shaft are cleaned with the aid of a jet of compressed air during the tool change phase.
This procedure protects the coupling surfaces from the deposit of impurities.
The condition of the coupling surfaces and their degree of cleanliness should be checked periodically, as described in section 7 “Programmed maintenance”.

The jet of compressed air is active the entire time the collet remains open.

Create a hole in the expulsion actuator of the ES370 electrospindles to allow for the passage of compressed air in order to clean the cone during the tool changing phases.

4.7 Cooler specifications and hydraulic connections

For the cooling circuit, use demineralized water with 10% of ethylene glycol added and anti-corrosion additives.

The gaskets isolating the fluid circuits inside the electrospindle are made in NBR: use additives that do not degrade this material.

On request, the manufacturer can supply "ARTIC-FLU-5" (order code: H2161H0022).
ARTIC-FLU-5 is a pre-mixed ready-to-use liquid coolant tried and tested by the manufacturer.
The product contains monoethylene glycol and eco friendly corrosion inhibitors, without amines, nitrates and phosphates, and can guarantee protection against corrosion for approximately 1 year.
ARTIC-FLU-5 prevents the formation of rust, scale and foam deposits as well as hardening, cracking and swelling of seals and couplings.
The coolant complies with various international standards, including CUNA NC 956-16.

4.7.1 Cooler specifications

Cooling capacity	1600 W
Minimum flow	5 litres/minute
Coolant type	Demineralized water + 10% Ethylene Glycol + corrosion inhibitor
Cooler set temperature	+25+/-3°C (+77+/-5°F)

Cooling characteristics

- Input cooling temperature: t = 20 °C - 30 °C
- Anticorrosive means: V_{max} = 25 Vol%
- Solid materials filter < 100 µm

Type of water additives

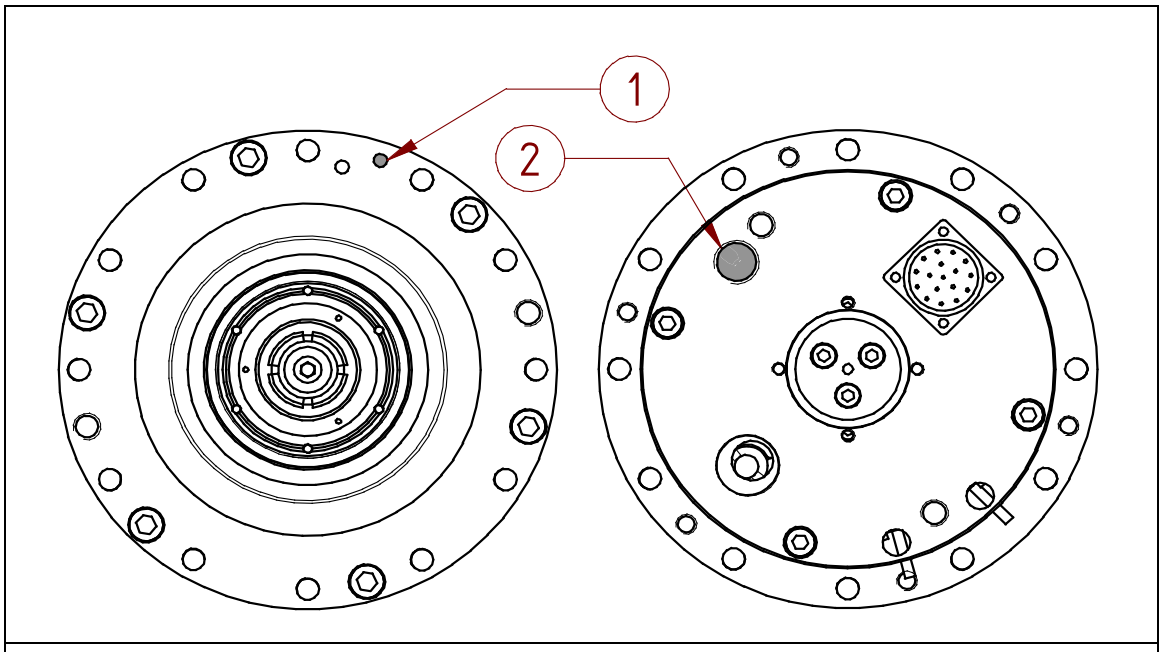
BRAND	TIPO (TYPE)
ARAL	SAROL 340 - 2 ÷ 3 %
CINCINNATI	CINCINNATI CIMCOOL MG 602 - 4 %
HENKEL	P3 - PREVOX 6710 - 2 ÷ 3 %
CASTROL	SYNTILO R PLUS - 2 ÷ 3 %

4.7.2 Hydraulic connection points

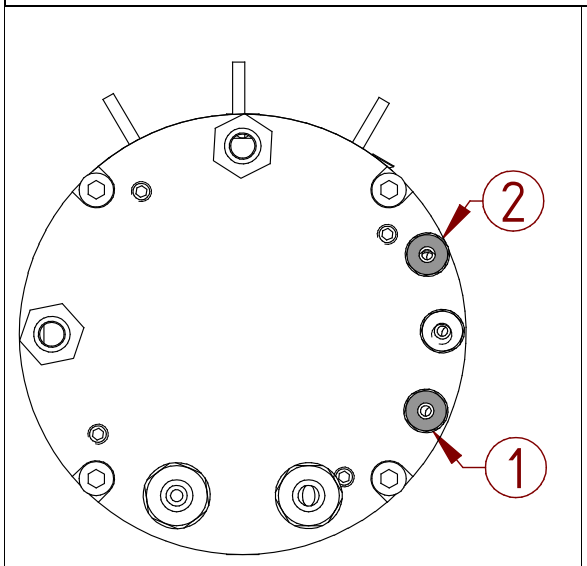
The following figures illustrate the hydraulic connection points according to the correspondence shown in this table:

1	Motor cooling liquid inlet
2	Motor cooling liquid outlet
3	Oil inlet for front piston
4	Oil inlet for rear piston

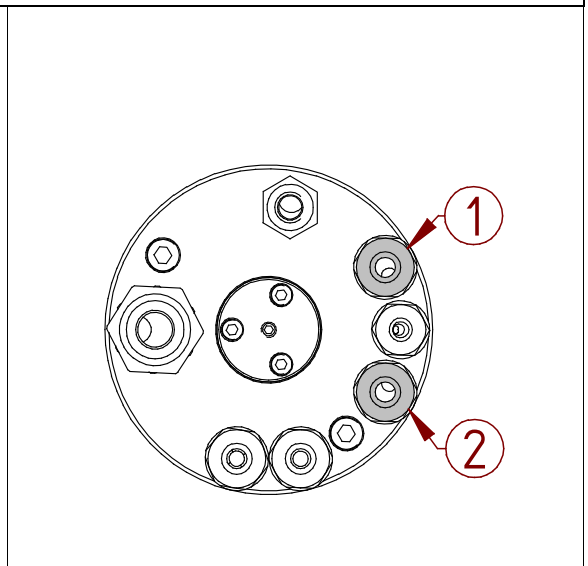
Figure 6: Hydraulic connection points



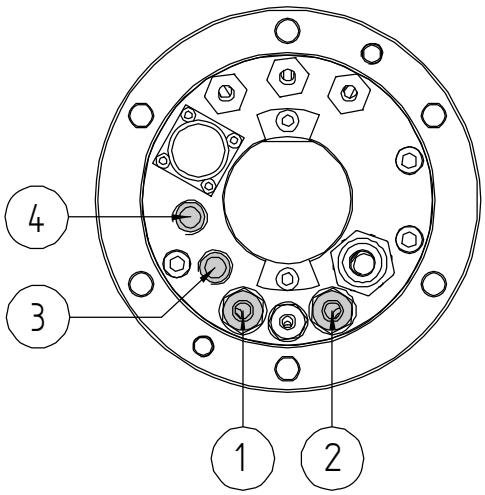
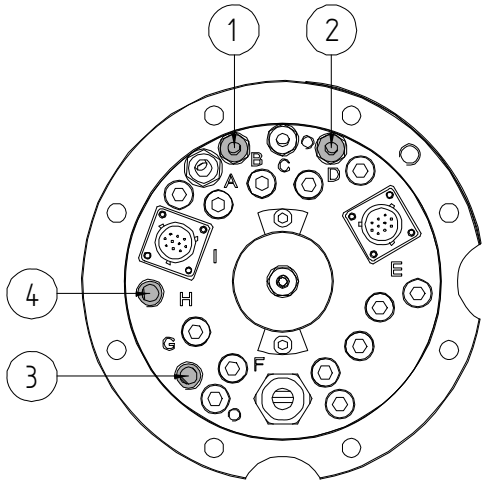
ES370



ES330L



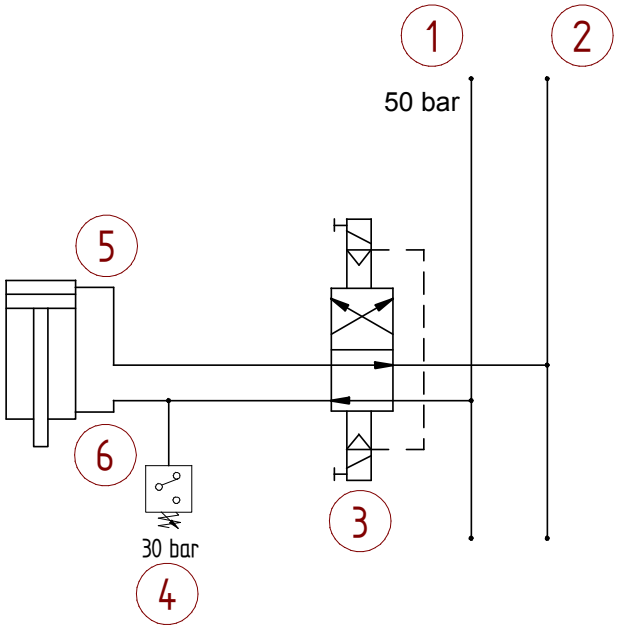
ES327

	
ES331	**ES332**

4.7.3 Tool change piston drive

The circuit indicated here is merely an example.

The electrospindle is fitted with an oil cylinder for tool change purposes.
An example system layout is shown below.



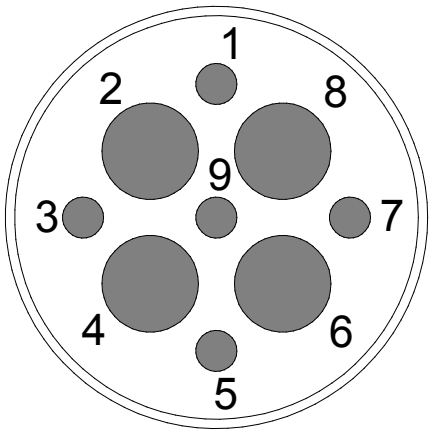
Reference	Description
1	High pressure circuit (50 bar Max)
2	Low pressure circuit
3	Bistable solenoid valve
4	Safety switch on the piston return circuit (calibrated at 30 bar Max)
5	Oil inlet for tool release
6	Oil inlet for tool locking

It is not necessary to supply 50 bar constantly for tool locking.
When the safety switch has confirmed piston recovery at the upper limit switch, you can reduce the pressure to 10 bar.

4.8 Electronic connections for models with electronic connectors

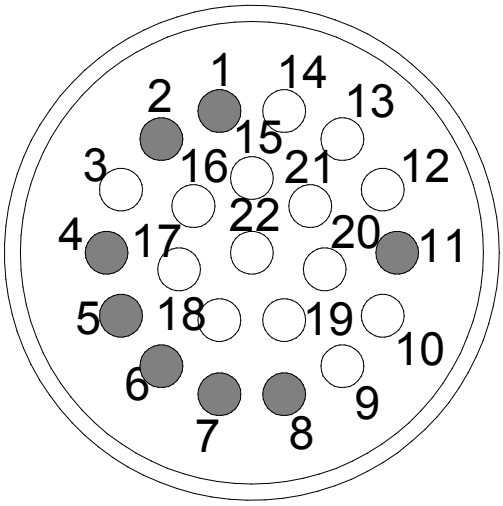
The electricity supply to the electrospindle MUST be through an inverter.

4.8.1 Air-cooled ES330 power connector (fixed part)



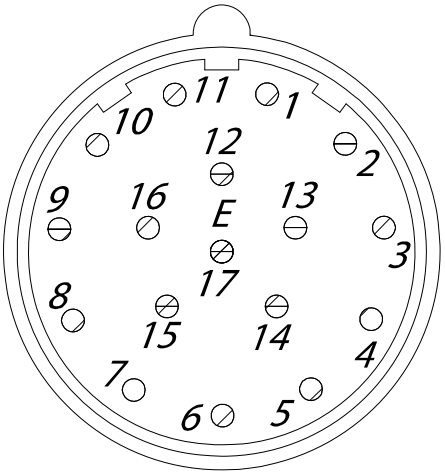
PIN	DESCRIPTION
1	Thermal alarm
2	Earth PE W common with PIN 7
3	0 V Electric fan
4	Motor phase U
5	Thermal alarm
6	Motor phase V
7	Earth PE W common with PIN 2
8	Motor phase W
9	+24 V DC Electric fan

4.8.2 Air-cooled ES330 signal connector (fixed part)



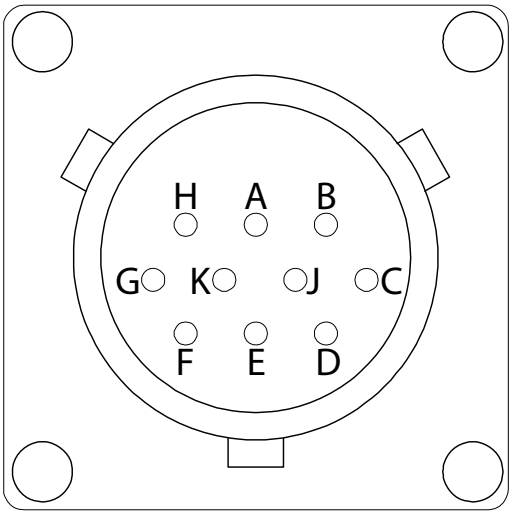
PIN	DESCRIPTION
1	OUTPUT Sensor S2
2	OUTPUT Sensor S1
3	Not used
4	+24V DC Sensors
5	+24 V DC Button light
6	0 V Sensors
7	+24 V DC Button
8	Button OUTPUT
9	Not used
10	Not used
11	0 V Button and button light
from 12 to 22 : Not used	

4.8.3 ES331 encoder connector



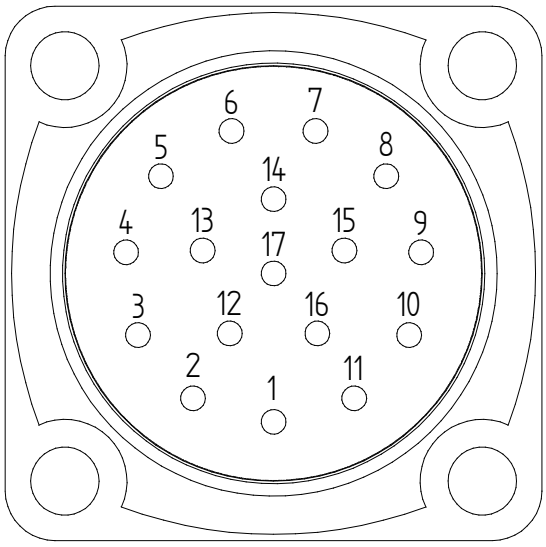
PIN	DESCRIPTION
1	A
2	A-
3	Z
7	0V
10	+5V
11	B
12	B-
13	Z-
16	5V Sense
17	Encoder cable screening

4.8.4 ES332 encoder connector



PIN	DESCRIPTION
A	A
B	A-
C	B-
D	GND
E	Z+
F	5V
G	Encoder cable screening
J	B+

4.8.5 ES370 encoder connector (fixed part)



PIN	DESCRIPTION
1	A
2	A-
3	Z
7	0V
10	+5V
11	B
12	B-
13	Z-
16	5V Sense
17	Encoder cable screening

4.9 Electronic connections for models with free cables

The electricity supply to the electrospindle MUST be through an inverter.

CABLE ES327	CABLE ES330/ES370	CABLE* ES331/ES332	DESCRIPTION
Blue (couple)	**Orange (couple)**		
Yellow/green	**Yellow/green**	**Yellow/green**	Earth PE W
Brown	**White**	**White**	Motor phase U
Blue	**Red**	**Red**	Motor phase V
Black	**Black**	**Black**	Motor phase W

* AWG14 (ES331) - AWG10 (ES332)

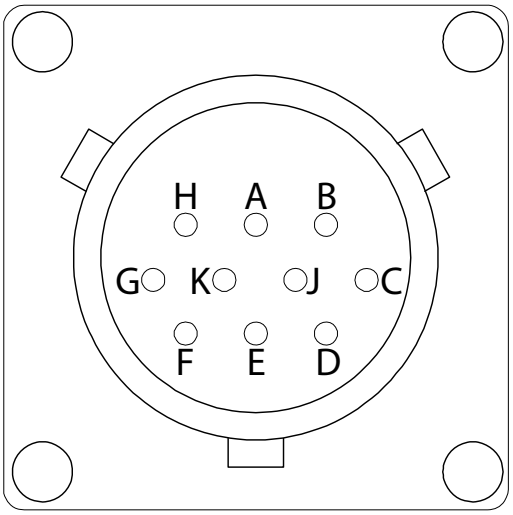
4.10 Sensor connections

ES330 “AIR”/ES370		
	**COLOUR**	**DESCRIPTION**
	Brown	+24 V
	Blue	0 V
	Black	Output

ES327	
COLOUR	**DESCRIPTION**
Sensor S1	
Green	+24 V
White	0 V
Brown	Output
Sensor S2	
Pink	+24 V
Yellow	0 V
Grey	Output
Sensor S3	
Black	+24 V
Blue	0 V
Red	Output

ES330 “LIQUID”	
COLOUR	**DESCRIPTION**
Sensor S2	
Green	+24 V
White	0 V
Brown	Output
Sensor S3	
Pink	+24 V
Yellow	0 V
Grey	Output
Sensor S4	
Black	+24 V
Blue	0 V
Red	Output
Pulse counter Sensor	
Purple	+24 V
Orange	0 V
Beige	Output

4.10.1 ES332 Sensor Connector + Thermal alarm



PIN	DESCRIPTION
A	OUTPUT S2 (Tool released)
B	OUTPUT S1+S4 (Tool locked)
C	OUTPUT S5 (no tool)
D	24V CC sensor feed: S1, S2, S5
E	0V sensor feed: S1, S2, S4, S5
F	Motor thermal alarm BIMETALLIC N.C. 130°C
G	Motor thermal alarm BIMETALLIC N.C. 130°C
J	OUTPUT S2 (Tool released)

5 General post-installation checks

5.1 Pre start-up checks

5.1.1 Positioning of the electrospindle

Check that there are no jets of compressed air, water or other liquids directed towards the electrospindle labyrinth (see section 2 “Technical Specifications”).

5.1.2 Pneumatic circuit

- The pneumatic circuit pipes must have the diameter specified in section 4.6 “Pneumatic connections”, and must supply dry, filtered compressed air in accordance with that indicated;
- for connections, see possible labels on the product, and section 4.6 “Pneumatic connections”;
- the cone cleaning air must be present during the tool change;
- the progress of the tool holder cone ejection must be that specified in section 6.5 “Tool holder locking and ejection device”.

5.1.3 Electrical circuit

- **The earth of the product (indicated in section 4.9 “Electronic connections for models with free cables”) must be connected to the earth of the machine;**

- **the thermal safety must trigger an overheating protection procedure of the electrospindle coils (see section 4.8).**

5.1.4 Inverter programming

- The maximum voltage set on the inverter must correspond to the rated value indicated on the motor rating plate.
- The set frequency value at which the voltage becomes maximum (rated frequency) must correspond to the rated value indicated on the motor rating plate.
- The maximum speed set on the inverter must correspond to the value indicated on the motor rating plate.
- The maximum continuous current set on the inverter must correspond to the rated current value indicated on the motor rating plate.
- Contact the manufacturer if it is considered necessary to check the other parameters of the inverter.

5.2 First start-up checks

Only switch on the electrospindle if the sensors S1 for models ISO or S1+S4 for models HSK (where present) are “ON” (tool holder coupled)

The sensor “ON” condition corresponds to an output equal to the power supply voltage.
The sensor “OFF” condition corresponds to an output of 0 V.

Only for HSK models:
The electrospindle must not be started without the tool holder inserted.

The cylinder of the ES330 electrospindle is double acting: the cylinder must be kept under pressure to hold the piston on the upper limit switch, away from fast-rotating parts.

- The tool holder cone ejection progress must be that specified in section 6.5 “Tool holder locking and ejection device”.
- The control sensors must intervene according to the logic described in section 6.8.
- The tool change cycle must only take place with the shaft stopped.
- with the tool holder inserted and without performing machining operations, perform the preheating cycle described in section 6.3.

6 Operation and regulation

6.1 Environmental conditions

The manufacturer has tested and verified its products according to environmental conditions standard (IEC 60034-1:2006-05).Contact the manufacturer for information on potential uses in special environments

6.2 Running-in

Prior to being packed, the product is subjected to an automatic running-in cycle to ensure the correct distribution of lubricant (long-life grease) along the ball races of the bearings and to run-in the balls and races of the bearings themselves. Where present, the reduction gears and servo motors are also run-in and dynamic tests of the internal pneumatic and hydraulic circuits are carried out.
The running-in cycle also includes a detailed check of all the control and signaling devices through the simulation of various machining cycles on the test-bench.

6.3 Warm-up

The manufacturer uses high-precision angular contact bearing pairs, pre-loaded and lubricated for life with special high-speed grease.
When starting-up the electrospindle for the first time each day, allow it to run a short warm-up cycle to allow the bearings to gradually reach a uniform operating temperature and obtain uniform expansion of the races and correct pre-loading and rigidity.

The following cycle, with a tool holder inserted and without performing machining operations, is recommend:

- **50% maximum rated speed for 2 minutes;**
- **75% maximum rated speed for 2 minutes;**
- **100% maximum rated speed for 1 minute.**

Pre-heating cycle must also be performed each time the machine is not working for a period of time sufficient to cool the electrospindle to room temperature.

Only in the case of the first start-up after storage or machine downtime over four months, anticipate the pre-heating cycle by a preliminary phase of 2 minutes at 5000rpm.

During machining, the spindle can reach high temperatures and, as such, must not be touched without taking the due precautions.

Only for HSK models:
To perform the preheat it is necessary to insert a toolholder WITHOUT a tool.

6.4 Electric fan

The cooling of the "air" ES330 electrospindle is obtained using an electric fan installed subsequently.
Its rotation is independent from the rotation regime of the spindle shaft: a better cooling efficiency is thus obtained compared to that achieved when a fan synchronised with the spindle shaft is used.

The electric fan must always be active, even when the electrospindle is idle.

TECHNICAL CHARACTERISTICS OF THE ELECTRIC FAN			
24 V DC	0.27 A	6.5 W	IP 20

6.5 Tool holder locking and ejection device

The tool holder is locked mechanically by means of elastic springs that develop an axial force equal to:

ELECTROSPINDLE MODEL	AXIAL FORCE OF THE SPRING	AXIAL FORCE ON THE TOOL HOLDER
ES327 HSK E25	980 ± 10%	2800 ± 10%
ES330 ISO30	3200 ± 10%	3000 ± 10%
ES331 BT30	3200 ± 10%	3200 ± 10%
ES332 HSK A40	2200 ± 10%	6800 ± 10%
ES370 HSK E40	2400 ± 10%	6800 ± 10%

The ejection of the tool holder cone ISO30 must be about **0.5 mm - 0.9 mm**.

The ejection of the tool holder cone HSK E25 must be about **0.5 mm - 0.6 mm**.

The ejection of the tool holder cone HSK E40 / A40 must be about **0.5 mm - 0.6 mm**.

The ejection of the tool holder cone BT30 must be about **0.5 mm - 0.6 mm**.

The axial force exerted on the tool holder by the locking system is maintained constant for a minimum duration of 1.000.000 tool change cycles.
1 Tool Change Cycle = Tool Locked / Tool Released / Tool Locked.

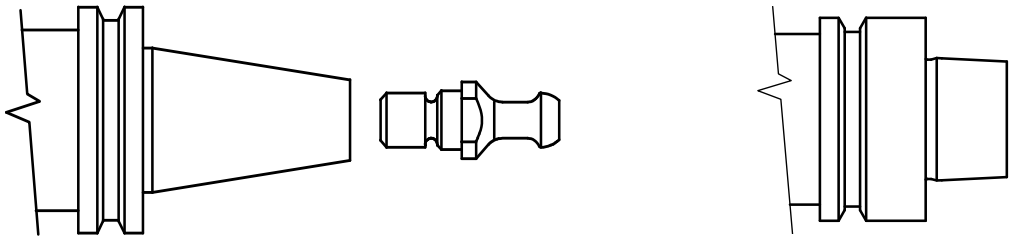
All electrospindles of the manufacturer are equipped with a mechanical reaction system that neutralises the axial force of the piston on the shaft during the tool change phase, thus guaranteeing the integrity of the precision bearings.

6.5.1 Tool holder cone

CONE ISO30
DIN69871

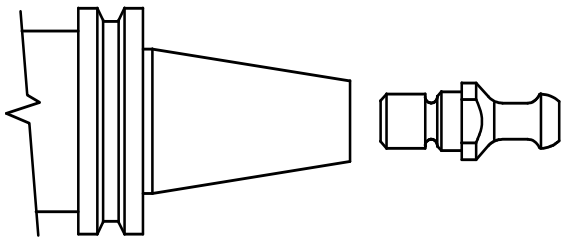
HSD SCREW
DOWEL
0804H0009

HSK CONE
DIN69893



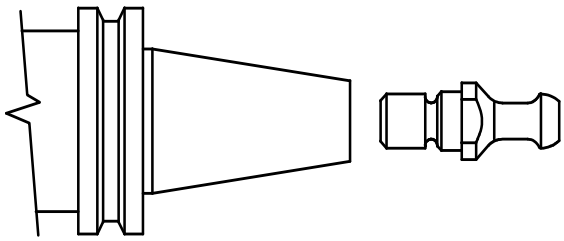
CONE ISO30
DIN69871

SCREW
DOWEL
MAS 403 PT1



CONE ISO30
DIN69871

SCREW
DOWEL
BT30



- The geometry of the taper must comply with standard DIN69871 for ISO30 cones and standard DIN69893 for HSK cones.
- The ISO30 tool holder cone must have a degree of accuracy AT3.
- Avoid the presence of inserts, slots or other forms that could disturb the dynamic balance of the tool holder.
- At the maximum rated speed of the electrospindle, the dynamic balance quality grade must be G = 2.5 or better (standard ISO1940).
- The balancing is carried out with the tool holder assembled (cone, spring collet, ring nut, tool).
- The screw dowel (also called the tang) of the ISO30 cone must be exclusively that supplied by manufacturer (part number 0804H0009).

6.5.2 Installation of the screw dowel in the cone ISO30 DIN69871

- Thoroughly clean the screw dowel and its housing in the ISO30 cone.
- Spread high-strength thread locking compound LOCTITE 2701 (or other equivalent product) on the thread of the screw dowel.
- Tighten the screw dowel to the cone with a torque of 62 Nm.
- Leave the cone to rest to allow the thread-locking compound to set (12 hours in the case of LOCTITE 270, or according to the manufacturer's instructions if an alternative equivalent product is used).

The use of non-original manufacturer-provided screw dowels or an incorrect installation can lead to protrusion of the tool holder cone.

It is forbidden to use ISO or HSK tool holders that do not comply with the above conditions. Non compliance with these instructions can lead to a risk of breakage or an imperfect coupling of the tool holder cone, with the resulting risks for the user.

6.5.3 General recommendations regarding tool holder cones

IMPORTANT:

- **The choice of tool holder is a determining factor as regards safety;**
- **The tapered surfaces of the tool holder and its housing on the spindle-shaft must be kept extremely clean to allow safe coupling (see section 7 “Programmed maintenance”);**

- **During machining operations, avoid all contact whatsoever between the non-cutting rotating parts and the piece being machined;**
- **The tool holder cone seating must always be protected against the entry of impurities: use a suitable plug or a tool holder cone;**
- **At the end of the working day, always remove the tool holder cone from the electrospindle to avoid sticking. Close the tool holder housing using a clean tool holder cone at ambient temperature;**
- **Do not rotate the electrospindle without a tool holder inserted. In particular for HSK models, rotating the electrospindle without a tool holder will upset the balance and operation of the collet.**

6.6 Tool

At the maximum rated speed of the electrospindle, the tools must have a dynamic balance quality grade G = 2.5 or better (standard ISO1940).

.

RESPECT THE MAXIMUM REVOLUTIONS PER MINUTE (rpm) INDICATED BY THE TOOL MANUFACTURER.

Depending on the type and quality of the machining operation to be performed, and the material used, it is the users responsibility to operate at lower speeds (NEVER HIGHER) than those specified by the tool manufacturer.

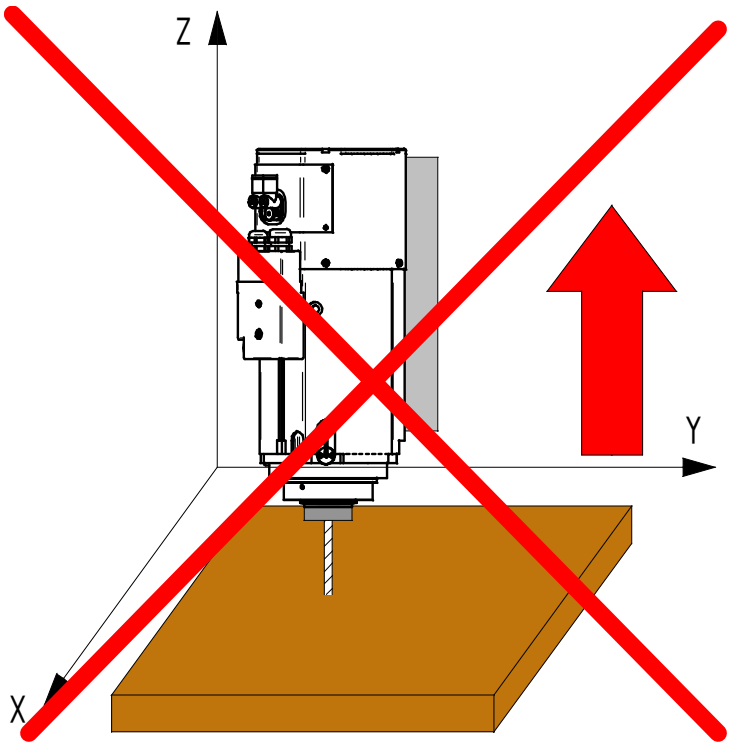
When selecting the tool to use, the following recommendations must be taken into consideration:

- Always use tools with optimum sharpness qualities and correctly tightened in the relative tool holder.
- Never use deformed or damaged tools or those with missing parts or not perfectly balanced.
- Always make sure that all the surfaces are unmarked and perfectly clean before inserting the tool in the relative collet.

The essential requisites for using high-speed tools are:
- compact, short and light tools
- precise, with any inserts correctly fitted with a high degree of safety
- balanced and symmetrically coupled with the tool holder
- with cutting edges near to the rotation axis

6.7 Procedure to follow if the tool becomes jammed in the piece being machined

For models with ISOP type tool coupling, in the case where the machine goes into alarm status or stops with the tool locked onto the piece being machined, do not move the spindle along the Z-axis!

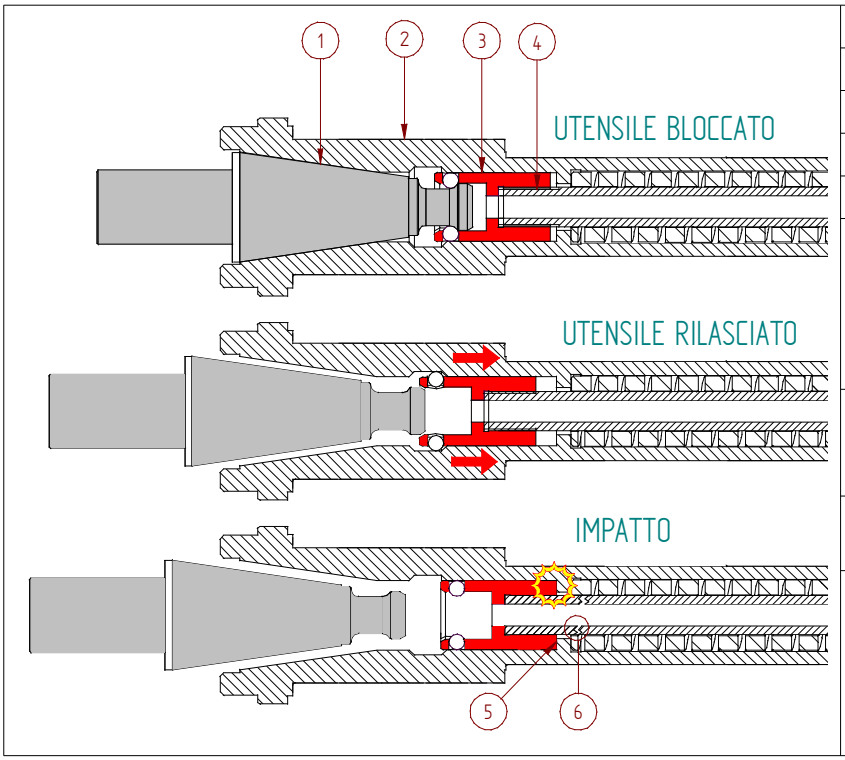


If possible, free the piece by hand and then perform a tool change.

If this is not possible, proceed as follows:

- Supply air to the tool change circuit
- Slowly move the spindle away from the workpiece by moving it along the Z-axis until the collet opens (sensor S2 output “ON”)
- Make sure that the cone has been freed from the collet
- Move the spindle away from the workpiece
- Then manually remove the jammed tool.

If this procedure is not followed, the tool holder will drag the locking system (collet/screw dowel) with it until the cone is released. After which, the collet will move back violently due to the force exerted by the spring and could cause damage to the screw dowel.



N.	Description
1	ISO cone
2	Spindle shaft
3	ISO collet (or nut)
4	Screw dowel
The arrows indicate the direction in which the locking system returns after having freed the cone	
5	Point at which the collet will hit the shaft
6	Screw dowel breakage

6.8 Sensors

6.8.1 ES327 electrospindle sensors

The ES327 electrospindle is fitted with inductive sensors for monitoring its state and a "thermal alarm" for protecting the electric windings.

NAME	SIGNAL INFORMATION
S1	Tool holder cone coupled
S2	Collet open - Tool uncoupled
S3	"Shaft stopped"
Thermal Alarm	Motor overheated: stop the electrospindle!

6.8.2 ES330 “air” electrospindle sensors

The ES330 air electrospindle is fitted with inductive sensors for monitoring its state and a "thermal alarm" for protecting the electric windings.

NAME	SIGNAL INFORMATION
S1	Tool holder cone coupled
S2	Collet open - Tool uncoupled
Thermal Alarm	Motor overheated: stop the electrospindle!

6.8.3 ES330 “liquid” electrospindle sensors

The ES330 liquid electrospindle is fitted with inductive sensors for monitoring its state and a "thermal alarm" for protecting the electric windings.

NAME	SIGNAL INFORMATION
S2	Tool ejected
S3	No tool
S4	Tool coupled
Pulse counter Sensor	Tool coupled
Thermal Alarm	Motor overheated: stop the electrospindle!

6.8.4 ES331 electrospindle sensors

The ES331 electrospindle is equipped with inductive sensors to monitor its condition.

NAME	SIGNAL INFORMATION
S2	Tool ejected
S3	No tool
S4	Tool coupled

6.8.5 ES332 electrospindle sensors

The electrospindle ES332 is fitted with inductive sensors for monitoring its state and a "thermal alarm" for protecting the electric windings.

NAME	SIGNAL INFORMATION
S1	Tool holder cone coupled
S2	Collet open - Tool uncoupled
S1+S4	HSK cone locked in the correct position
S5	Cylinder in place
Thermal Alarm	Motor overheated: stop the electrospindle!

6.8.6 ES370 electrospindle sensors

The ES370 electrospindle has a "thermal alarm" to protect the electric windings and inductive sensors can be fitted (optional) to monitor the correct coupling of the toolholder cone.

NAME	SIGNAL INFORMATION
S1	Tool holder cone coupled
S4	HSK cone coupled and in the correct position
Thermal Alarm	Motor overheated: stop the electrospindle!

In the case of electrospindle models without sensors it is the customer's responsibility to monitor its state, with particular attention to the toolholder coupling.
An imprecise coupling may constitute a serious risk to the operator.

6.8.7 Technical characteristics of inductive sensors

Proximity PNP type Normally Open (N.O.)	
Power supply voltage	10 ÷ 30 V (DC)
Maximum load	100 mA
No-load absorption	< 17 mA
Nominal reading distance	1mm

6.8.8 Electrospindle states and corresponding outputs from inductive sensors

The sensor “ON” condition corresponds to an output equal to the power supply voltage. The “OFF” condition corresponds to a 0 V output..

ES327 and ES330 “air”

STATE	S1	S2
Collet open (tool holder cone ejected)	OFF	ON
Tool holder cone coupled	ON	OFF
Collet closed but with no tool holder cone	OFF	OFF

The electrospindle shaft can only rotate in the *"tool holder cone coupled"* state; if S1 output changes to “OFF”, stop the rotation of the electrospindle shaft.

ES330 “liquid”

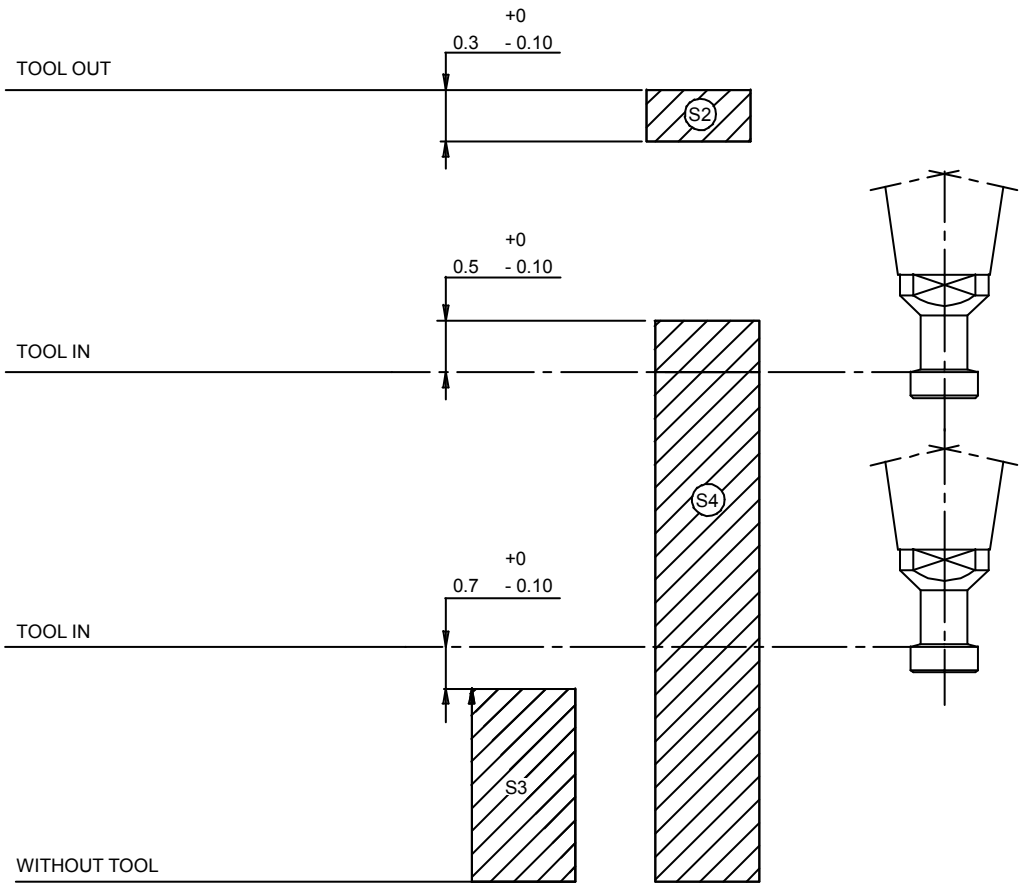
STATE	S2	S3	S4	Pulse counter Sensor
Collet open (tool holder cone ejected)	ON	OFF	OFF	STILL
Tool holder cone coupled	OFF	OFF	ON	IDLE or STARTED UP*
Collet closed but with no tool holder cone	OFF	ON	OFF	STILL

* Depending on the operating status of the electrospindle.

The electrospindle shaft can only rotate in the *"tool holder cone coupled"* state; if S4 output changes to “OFF”, stop the rotation of the electrospindle shaft.

ES331

DIAGRAM SETTING SENSORS



CONDITIONS	S2	S3	S4	S2 - S3 - S4
WITHOUT TOOL	OFF	ON	ON	BROWN + UB10-30V BLACK BLU - 0V PNP NO
TOOL IN	OFF	OFF	ON	
TOOL OUT	ON	OFF	OFF	

ES332

STATE	S1	S2	S1+S4	S5
Collet open (tool holder cone ejected)	OFF	ON	OFF	OFF
Tool holder cone coupled	ON	OFF	ON	ON
Collet closed but with no tool holder cone	OFF	OFF	OFF	ON

ES370

STATE	S1	S1+S4
Tool holder cone coupled but not in contact with the HSK surface	ON	OFF
Tool holder cone coupled	ON	OFF
Tool holder cone missing	OFF	OFF
Tool holder cone locked correctly	ON	ON

The electrospindle shaft can only rotate in the *"tool holder cone locked correctly"* state; if S1 or S1 + S4 output changes to "OFF", stop the rotation of the electrospindle shaft.

6.8.9 Description of the inductive sensors

Sensor S1: “tool holder coupled” signal

The signal from sensor S1 indicates the presence of the tool holder cone in the closed collet.

Ignore output S1 during the period from the tool release command to the tool couple command.

Sensors S1+S4: “HSK Cone locked in the correct position” signal

Sensors S1 and S4 must be connected in series.
Sensor S1 checks the presence of the HSK tool holder cone in the closed collet, and if positive enables the reading of sensor S4.
When enabled by S1, S4 checks that the mating surfaces of the tool holder cone and the HSK coupling system are in correct contact.
The output only changes to “ON” if both conditions are verified as positive.

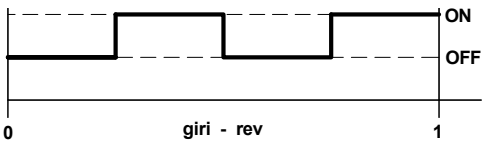
Ignore the S1+S4 output during the period from the release command to the couple tool command.

Sensor S2: “collet open” signal

Signal S2 is used during the tool change cycle: it detects the opening of the collet and whether it is possible to continue with the next phases of the tool-change cycle.

Sensor S3: “shaft stopped” signal

Sensor S3 supplies two “ON” pulses and two “OFF” pulses at each rotation of the shaft, as shown in the figure below.



Over and beyond a given rotation speed, output S3 could appear permanently "ON" and then subsequently regulate the speed to below the set threshold limit. This is not a malfunction but depends on the performance of the CNC.

Ignore signal S3 during the tool-change phase as this could randomly appear on one of the two states (“ON” or “OFF”).

The S3 signal is not present in any version.

Use and technical characteristics of the thermal alarm

The electrospindle may be fitted with a normally-closed bimetallic strip switch inserted in the electric windings of the stator which opens when a temperature that may damage the windings is reached. The contacts re-close when the temperature reduces and returns to the safe values. The thermal alarm must be connected to the Numerical Control, which should interrupt the machining operation and stop the rotation of the spindle shaft if the switch opens.

If the shaft stops while the tool is still being pushed against the piece being machined, the spindle bearings may break. If the tool is not immediately moved away from the piece and the rotation stopped, there is a risk of burning out the stator.

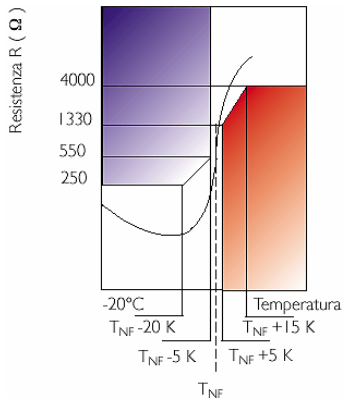
For the bimetallic strip switch connection, see section 4.9 “Electronic connections for models with free cables”.

Technical characteristics of the bimetallic strip:

Power supply	48 V DC MAX
Current	1.6 A MAX
Switching cycles	10000 Cycles
Contact interruption time	< 1 ms
Contact resistance (according to MIL R 5757)	< 50 mΩ
Isolation voltage	2 kV

PTC Thermistor

In some versions, a PTC thermistor may be inserted into the stator windings to check the temperature. When the operation temperature has almost been reached (130° C), resistance increases briskly. This signal must be used by a device which stops the machine to protect the electrospindle. The operation temperature threshold varies according to the type of electrospindle (for further information contact the manufacturer's assistance service).
The thermistors used comply with regulations DIN44081-44082.

Diagram Temperature-Resistance according to DIN44081/44082	Principal Characteristic values		
	Nominal operation temperature TNF= from 50°C to 200°C in steps of 10K or 5K		
	Characteristic values for every thermistor - PTC	Resistance	Measurement voltage
	Resistance in the area of a temperature from -20°C to T_{NF}-20K	20 to 250 Ω	<2.5 V
	Resistance at T_{NF}-5K	<550 Ω	<2.5 V
	Resistance at$_{NF}$+5K	>1330 Ω	<2.5 V
	Resistance at$_{NF}$+15K	>4000 Ω	<7.5 V - pulsed

If the shaft stops while the tool is still being pushed against the piece being machined, the spindle bearings may break. If the tool is not immediately moved away from the piece and the rotation stopped, there is a risk of burning out the stator.

6.9 Encoder (optional)

6.9.1 General description

The encoder produces an incremental coding of the position value detected with signals A and B (A inverted and B inverted) in phase quadrature; it also provides the Zero and inverted Zero signals (see the figures below).The signals are shown on the outside as illustrated in section 4.8 “Electronic connections for models with electronic connectors”.

There are three encoder models available:

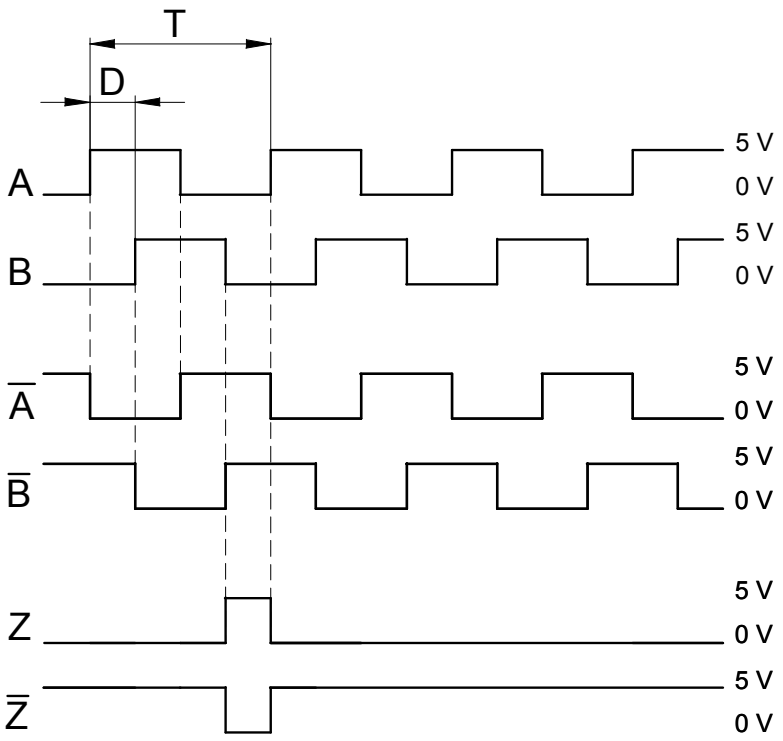
- "Square Wave" from the manufacturer;
- Lenord+Bauer "Square Wave";
- "Sine" (Lenord+Bauer).

6.9.2 Technical characteristics of the manufacturer's rectangular encoder

CHARACTERISTICS	VALUE
Rated power supply	12 V DC ÷ 24 V DC +/- 10%
Absorption	99 mA to 12 V DC 51 mA to 24 V DC
Operating temperature	0°C ÷ 70°C (+32°F ÷ 158°F)
Max. operating altitude	2000m (6500ft)
Signal input	400 pulses per rotation + zero notch
Signal output	TTL electrical levels compatible (0V, +5V line driver)

A voltage level higher than the one specified (24V ±10%) may damage the encoder reader.

Manufacturer's Square Wave encoder signal

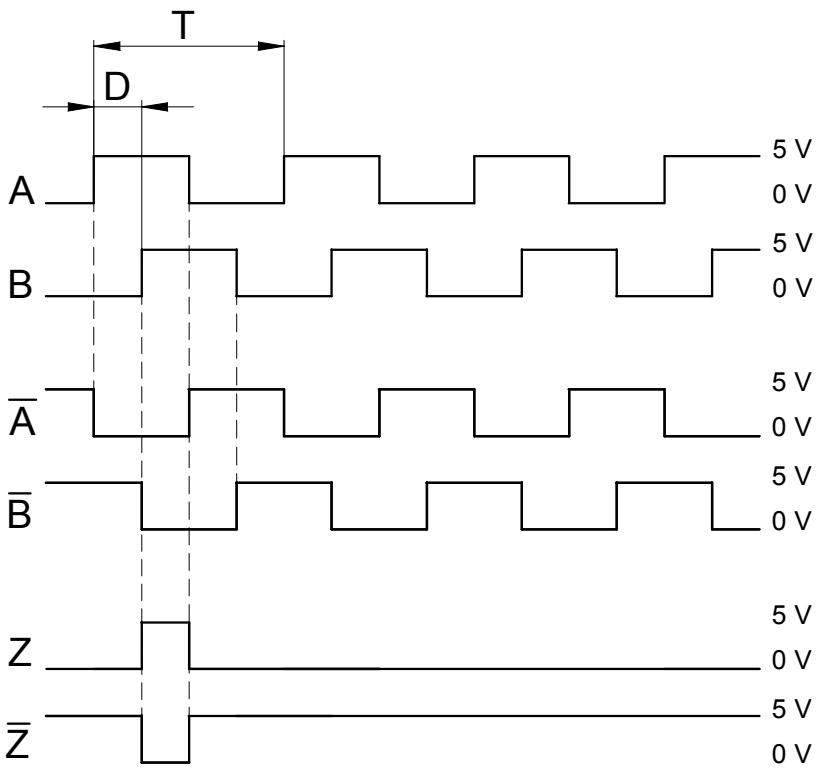


T	Period
D	Phase displacement (D=T/4)

6.9.3 Lenord+Bauer Square Wave Encoder technical specifications

CHARACTERISTICS	VALUE
Rated power supply	5V DC +/- 5%
Operating temperature	-30°C ÷ +85°C (-22°F ÷ +185°F)
Max. operating altitude	2000m (6500ft)
Signal input	1024 impulses per rev. + zero mark (256 impulses multiplied x4 internally)
Signal output	TTL electrical levels compatible (0V, +5V line driver)

Lenord+Bauer Square Wave Encoder Signals



T	Period
D	Phase displacement (D=T/4)

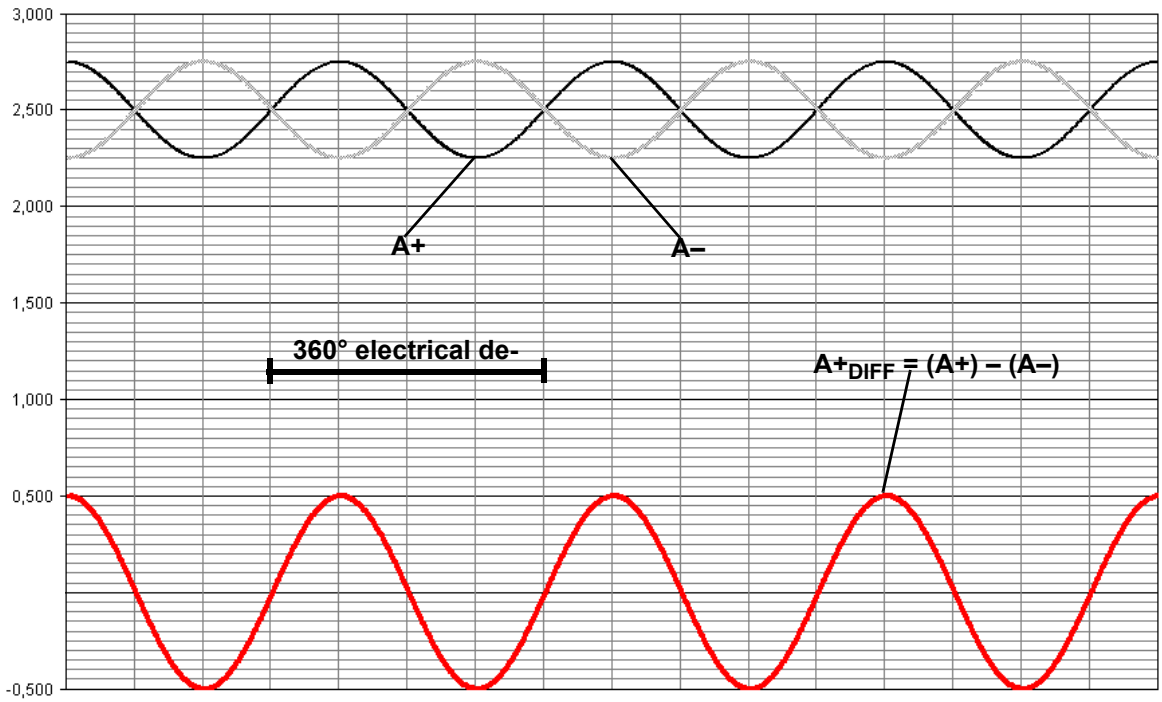
A voltage level higher than the one specified (5V ±5%) may damage the encoder reader.

6.9.4 Technical characteristics of the Lenord+Bauer sine encoder

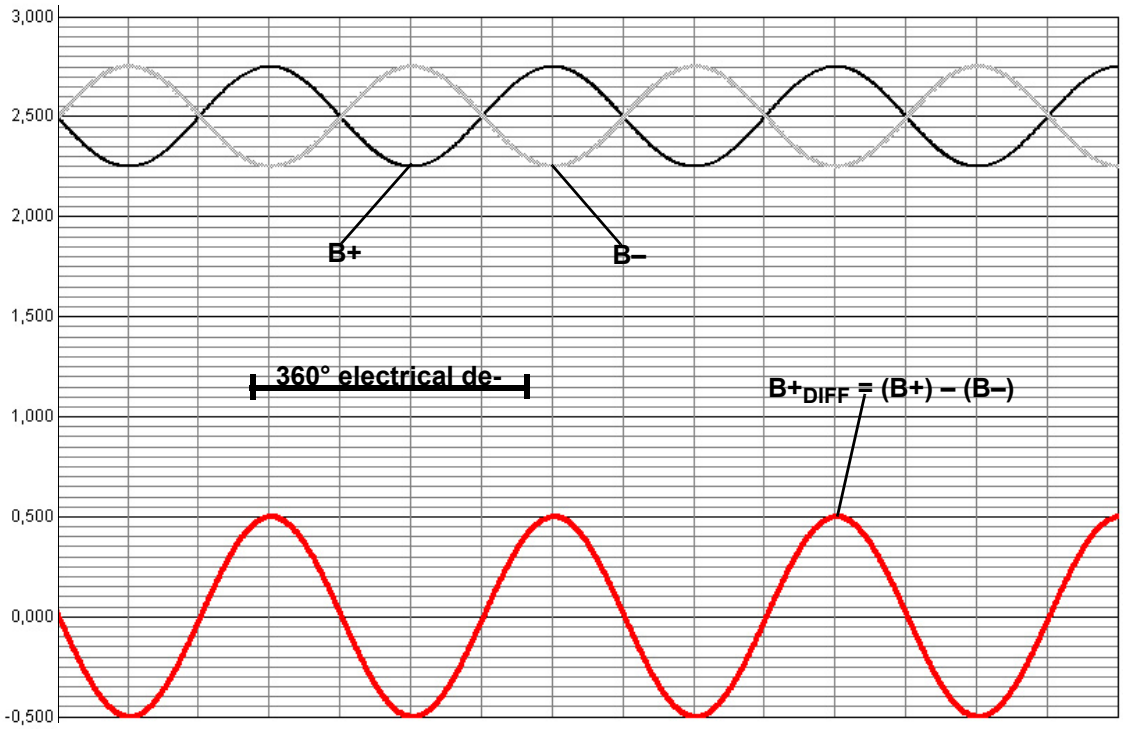
CHARACTERISTICS	VALUE
Rated power supply "U"	5V DC +/- 5%
Operating temperature	-30° C ÷ 85° C (-22° F ÷ 185° F)
Max. operating altitude	2000m (6500ft)
Signal input	■ 128 pulses per rotation + zero notch ■ 100 pulses per rotation + zero notch
A/B signal output	500 mV peak-to-peak with average value “U ref.”=U/2
	1V peak-to-peak as difference of signals with average value “U ref.” (see figures below)
A/B signal phase displacement	90° (a quarter period)
Z signal output	500 mV peak compared with idle value U ref. ±80mV
	1V peak as difference of signals with idle value U ref.-160mV= 2.34V (see figures below)

A voltage level higher than the one specified (5V ±5%) may damage the encoder reader.

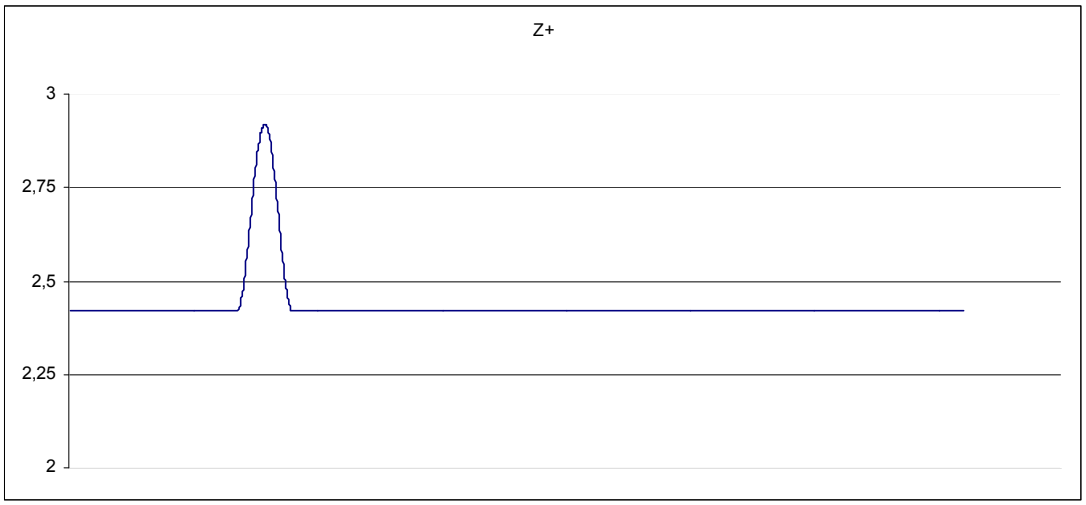
Trend of signal A over time:

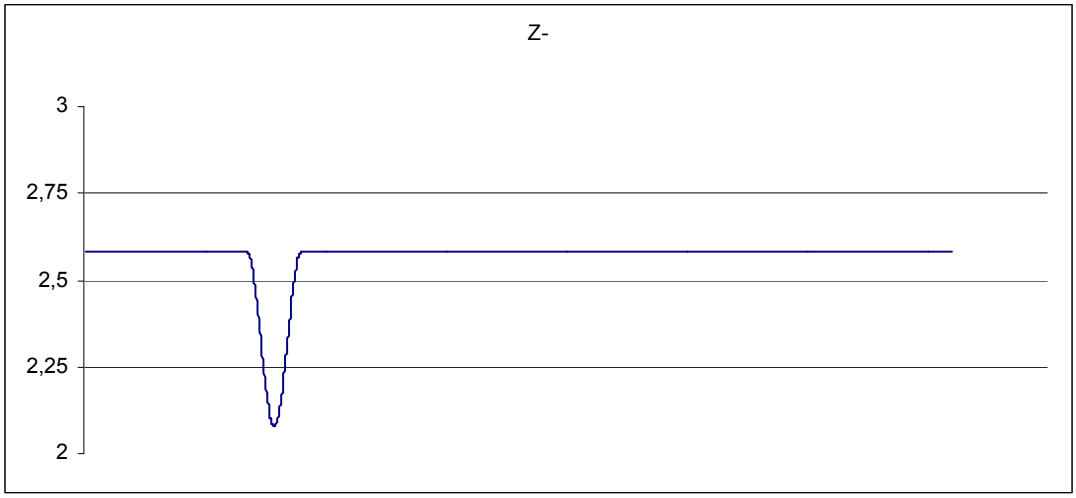


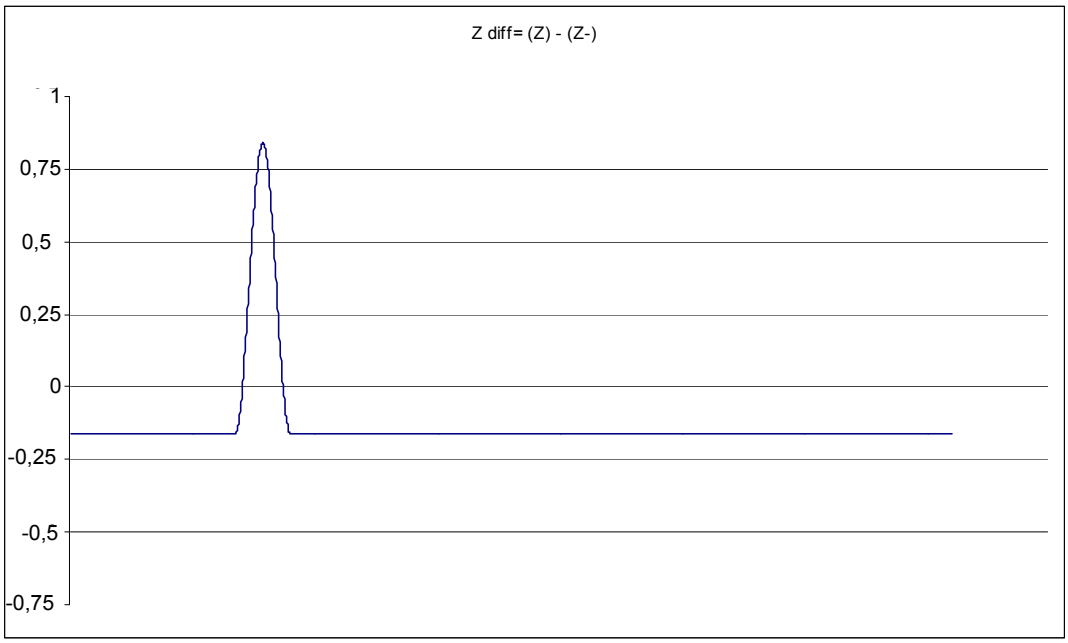
Trend of signal B over time:



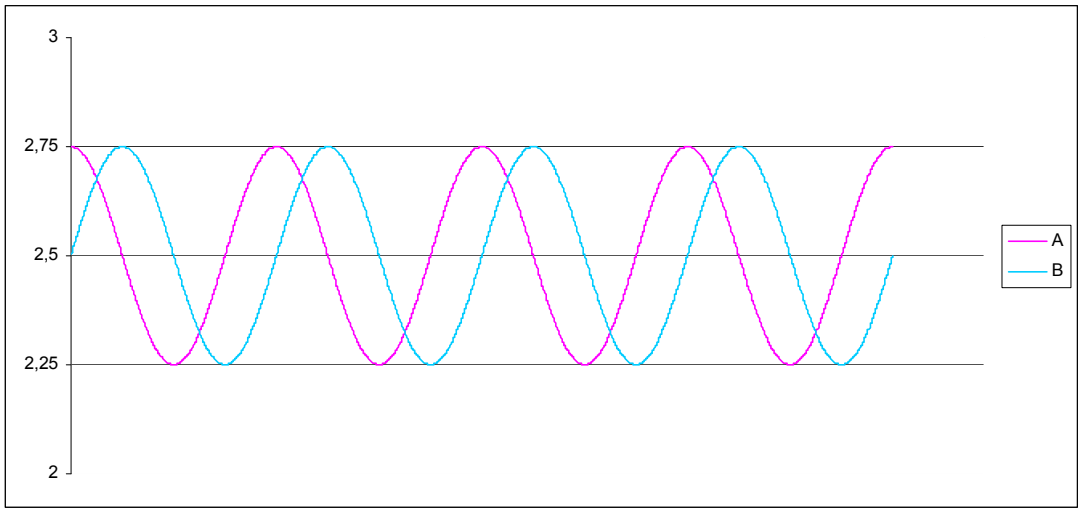
Trend of signal Z over time:



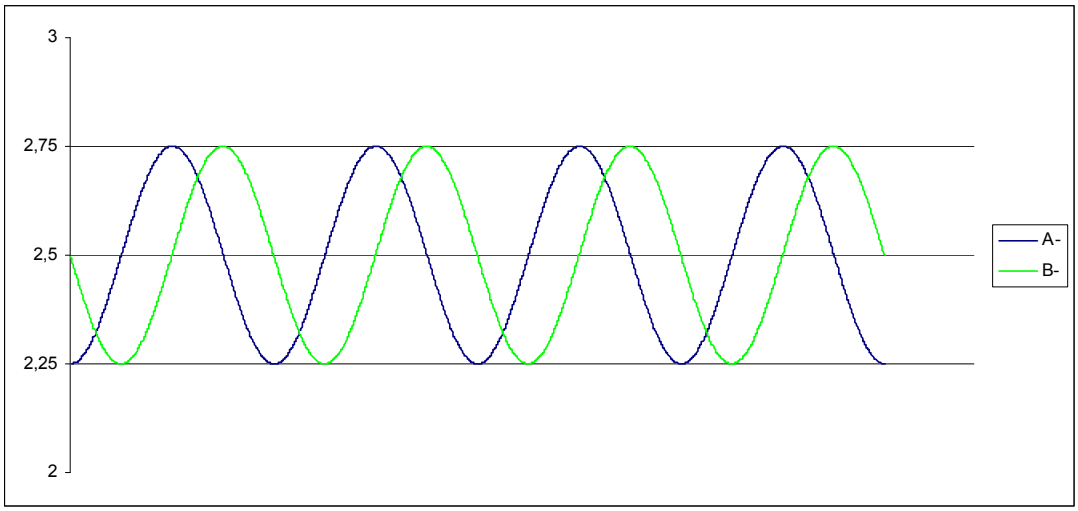




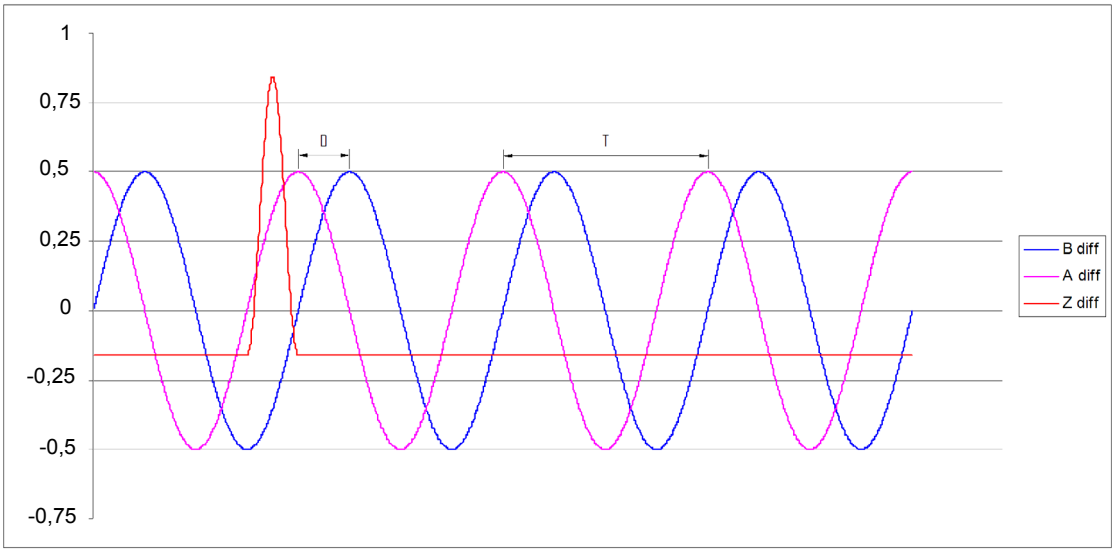
Phase displacement of signals A and B



Phase displacement of inverted signals A and B



Trend of differential signals over time:



T	Period
D	Phase displacement (D=T/4)
A diff.	(A) - (A-)
B diff.	(B) - (B-)
Z diff.	(Z) - (Z-)

7 Programmed maintenance

In order to be able to work in complete safety on an electrospindle installed on a machine, refer to the machine's instruction manual.

Fully complying with programmed maintenance is essential for maintaining the usage and operating conditions envisaged by the manufacturer at the moment the product is placed on the market.

The frequency was assessed considering a 5-day working week, 8 hours per day under normal working conditions.

Thoroughly read this section before carrying out any maintenance operations on the electrospindle.
The safety requirements to take into account during the various phases of maintenance work on the electrospindle are:

- the maintenance and/or lubrication operations must only be carried out by qualified skilled personnel, appropriately authorised by the technical management of the works and in accordance with current directives and standards, using equipment, tools and products suitable for the purpose.
- Suitable clothing must be worn when carrying out maintenance operations, such as close-fitting overalls and safety shoes, and avoiding at all costs loose clothing and that with protruding parts.
- During the various maintenance phases, it is advisable to delimit the machine and identify it with a sign indicating "MACHINE UNDER MAINTENANCE".

During all maintenance operations, make sure that the electrospindle:

- is disconnected from the electricity supply
- and that the tool is absolutely stationary (not rotating).

The maintenance manager must make use of a well co-ordinated team of personnel capable of guaranteeing the absolute safety of anyone exposed to possible hazardous situations. All personnel taking part in the maintenance operations must be in full visual contact with each other in order to be able to signal any dangers that may arise.

7.1 Daily maintenance

7.1.1 Control and cleaning of the tool holder seat and tool holder cone

The surfaces of contact between tool holder and tool holder seat must be kept clean to ensure a secure coupling.

At the beginning of the working day, make sure that the surfaces highlighted in the figures from 7to 10are clean, and free of dust, grease, coolant, oil, metal particles or machining waste, as well as free of traces of oxide or scale;
if necessary, **clean with a clean and soft cloth**.

Figure 7:
ISO tool holder

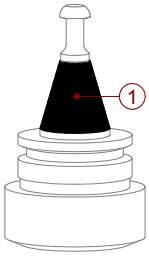
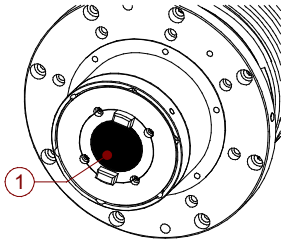


Figure 8:
ISO tool holder seat



(1) Conical surfaces (in black)

(2) Contact surfaces (in grey, HSK only)

Figure 9:
HSK tool holder

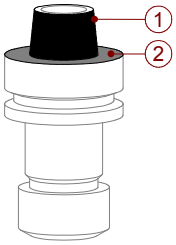
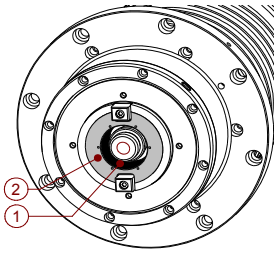


Figure 10:
HSK tool holder seat

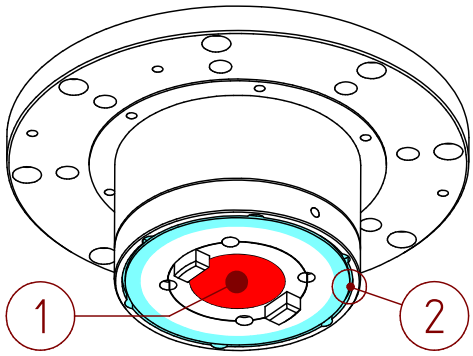


To clean the highlighted surfaces, use a soft clean cloth;
<u>DO NOT</u> use abrasive tools such as steel wool, metal brushes, emery cloth, acids or any other aggressive means.

<u>At the end of the working day clean the surfaces highlighted</u> in figures from 7 to 10 with a soft and clean cloth; imperfect cleaning can lead to serious consequences for the user's safety, the wear of the electrospindle and the tool holder, and the accuracy and efficiency of the machining operation.

Never direct a jet of compressed air in the zone of the pressurised labyrinth seal, in that any infiltration would damage the interior of the electrospindle.

Do not direct a jet of compressed air inside the electrospindle when the tool holder is not coupled, as this could dirt the mating surface with the tool holder or cause machining residues to enter the electrospindle itself.



1	Coupling surface
2	Labyrinth seal

7.1.2 Protection of the tool holder seat

The tool holder seat must always be protected from the intrusion of impurities, which could soil, oxidise, or in any way degrade the contact surfaces: never leave the electrospindle without a tool holder cone inserted.

The cone used for protection must not have through holes.

To avoid sticking, remove the tool holder in the electrospindle both after any heavy work as well as at the end of the working day, and replace it with a clean tool holder at room temperature to protect the interior of the electrospindle from the external environment.

The tool holder to be removed may be hot! Use gloves!

7.2 Biweekly maintenance

7.2.1 Tool holder cone cleaning with alcohol

- For all versions:
  - Carefully clean the contact surfaces of the tool holders (shown in the figure7 and 9) with a clean and soft cloth, moistened with ethyl alcohol;
- For HSK versions only
  - after cleaning with ethyl alcohol, spray the tapered surface with the product KLÜBER LUSIN PROTECT G 31 and uniformly distribute using a dry clean cloth.
  - Rinse and dry the product before re-using the tool holder.

7.3 Bearings

Do not touch the bearings as they are permanently lubricated with special high speed grease, and DO NOT NEED THE PERIODIC ADDITION OF GREASE.

8 Replacing components

In order to be able to work in complete safety on an electrospindle installed on a machine, refer to the machine's instruction manual.

The electrospindle contains a spring that has been pre-loaded with a force of around one hundred kilograms. This spring is applied to a screw dowel that can be violently ejected if the electrospindle is dismantled by inadequately trained personnel.

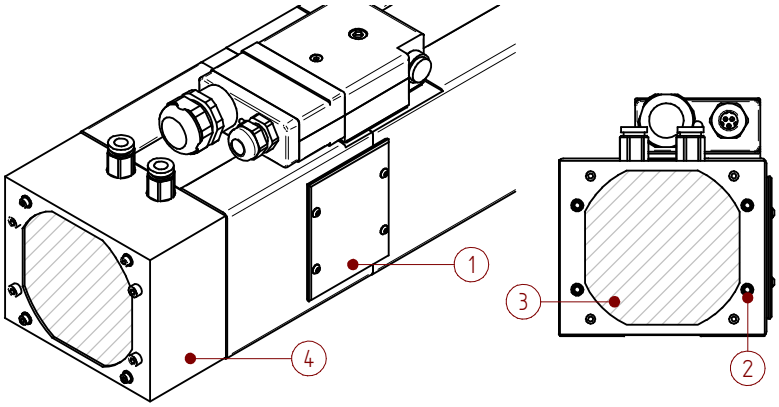
Only carry out the operations described in this manual. Follow the instructions scrupulously and in the case of doubt, contact the Manufacturer's Assistance Service.

Observe the maintenance safety instructions given on page 91.

Replacement and adjustment operation are only authorised with the original spare parts of the manufacturer described in this section of the manual.
Any other type of intervention is not allowed and will invalidate the warranty.

8.1 Replacing the electric fan

Figure 11



1	Sensor compartment cover
2	4 locking screws
3	protective mesh
4	Electric fan carter

1. Open the cover “1” by unscrewing the 4 screws that lock it;
2. disconnect the electrical connector from the electric fan;
3. Unscrew the 4 screws “ “2””
4. remove the faulty electric fan unit;
5. connect the electric connector of the new electric fan unit
6. lock the electric fan unit to the spindle by means of the 4 screws “ “2”” without pulling on them too much;
7. close the cover “1” and rescrew the 4 screws that lock it.
8. Check that the electrovalve is free to rotate by making it rotate by blowing some compressed air.

8.2 Shaft kit replacement

Spare shaft kits are available for installation in the event of worn bearings. The shaft kits include a shaft, already run-in bearings, rotor, screw dowel and coupling system.
To obtain the correct shaft kit for the model in question, inform the Manufacturer's sales office of the spindle serial number.
The serial number is usually stamped on the front flange or on the front of the casing (see section 2 “Technical Specifications”).

The replacement of the shaft kit is only possible for the standard ES370 electrospindle; for ES330 and ES370 electrospindles consult the manufacturer for assistance.

8.2.1 Shaft kit ES370 replacement

Op	Description
1	Remove the no. 3 screws TCEI 4x20 from the rear balancing block
2	Remove the balancing block
3	Remove the 6 screws TCEI 6x20 from the front flange of the electrospindle
4	Gently remove the worn shaft kit by pulling it from the front flange
5	Insert the new kit in the same way, checking the presence of the ORM0040-10 gasket and replacing it if it is damaged
6	Screw the 6 screws TCEI 6x20 back again with a flat washer 6 and a drop of loctite 243 thread-locking compound (or equivalent product) on the front flange of the electrospindle. Tighten with a torque of 10 Nm
7	Reinsert the balancing block so that the mark on it corresponds to those on the shaft
8	Screw the 3 screws TCEI 4x20 with a knurled washer and tighten it with a maximum torque of 4 Nm

8.3 Encoder reader ES370 replacement

In the event that it is necessary to replace the encoder reader, proceed as follows:

- Remove the no. 3 screws TCEI 4x20 from the rear balancing block
- Remove the balancing block
- Remove the 4 screws TCEI 5x12 from the rear cover
- remove the rear cover, taking care not to damage the cables and sensors (if present)
- unscrew the two fixing screws of the encoder reader,
- remove the defective reader,
- rest the new reader on its seat keeping it at a distance from the gear wheel,
- screw the two screws without tightening them completely,
- interpose the thickness spacer included with the reader between the gear wheel and the new reader,

Interpose the thickness spacer between the gear wheel and the encoder reader BEFORE proceeding with other operations.
If this is not done the magnetic component of the reader could be attracted and knock against the gear wheel, which could cause potential damage to the reader.

- push the reader towards the gear wheel bringing everything close together,
- definitively tighten the two fixing screws of the encoder reader,
- remove the thickness spacer which had previously been inserted,

- visually verify that the gear wheel does not touch the reader when the shaft rotates,
- follow the procedure for assembling the shaft kit in reverse.
- Perform the sensor calibration procedure:

8.4 Replacement and adjustment of the sensor unit

8.4.1 Access to sensors

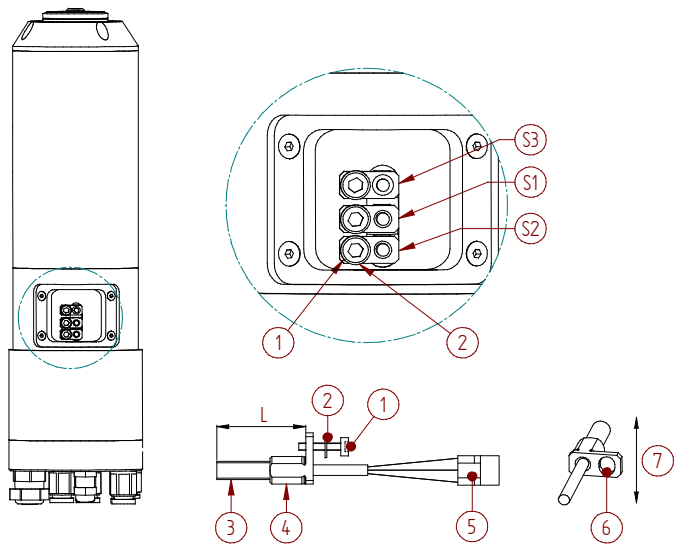
To access the sensor compartment lift the cover after having unscrewed the 4 screws that lock it

The adjustment of the sensors in model ES327 occurs by moving the sensor axially in relation to the electrospindle; while with models ES330 and ES370 the adjustment occurs by rotating the sensor unit and taking advantage of the eccentricity of the nut that contains it.

8.4.2 Identification and description of the sensor unit

ES327

Figure 12



S1	sensor S1
S2	sensor S2
S3	sensor S3
1	Screw
2	Washer
L	Calibrated position
3	Sensor
4	nut
5	Electric connector
6	Slot with clearance
7	Calibration movement

“air” ES330

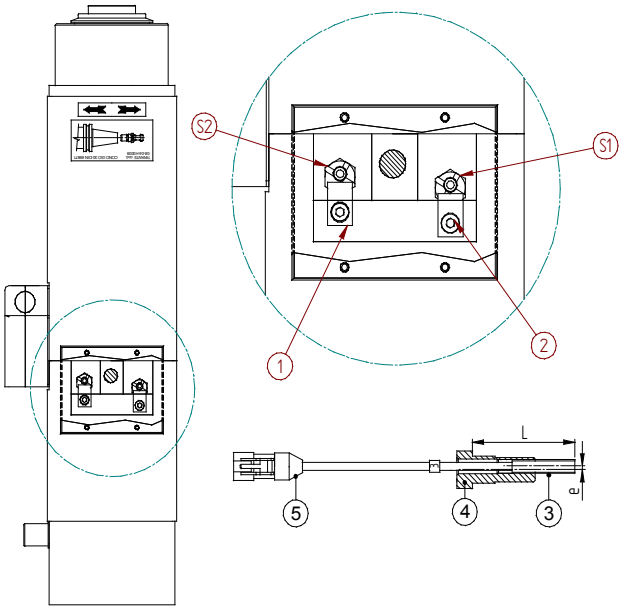


Figure 13

S1	sensor S1
S2	sensor S2
1	sensor block
2	screws with washer
e	eccentricity between the nut and sensor, for adjustment
L	calibrated position
3	Sensor
4	nut
5	electric connector

“liquid” ES330

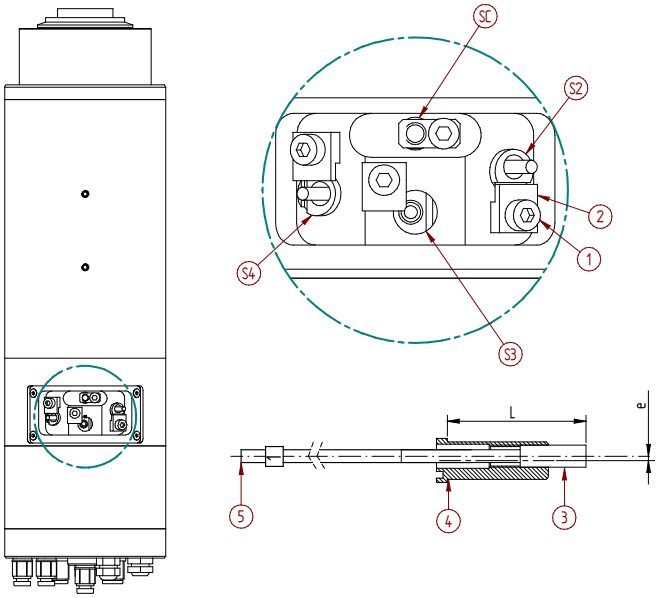


Figure 14

S2	sensor S2
S3	sensor S3
S4	sensor S4
SC	pulse counter sensor SC
1	screws
2	washer
e	eccentricity between the nut and sensor, for adjustment
L	calibrated position
3	Sensor
4	nut
5	free cable outlet

ES331

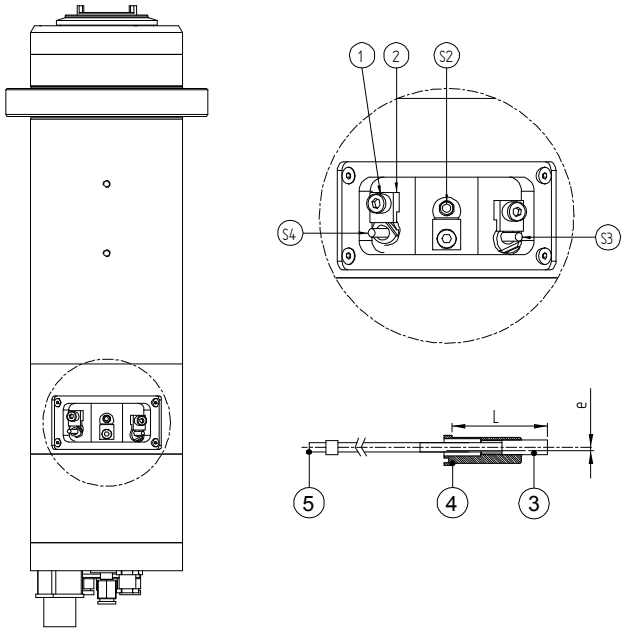


Figure 15

S1	sensor S1
S2	sensor S2
S3	sensor S3
1	screws
2	Fixing block
e	eccentricity between the nut and sensor, for adjustment
L	calibrated position
3	Sensor
4	nut
5	free cable outlet

ES332

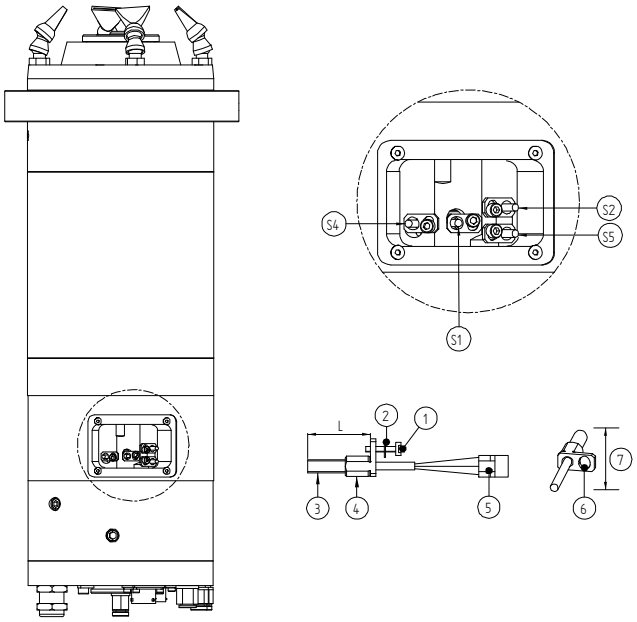


Figure 16

S1	sensor S1
S2	sensor S2
S3	sensor S3
1	screws
2	washer
L	calibrated position
3	Sensor
4	nut
5	electric connector
6	Slot with clearance
7	Calibration movement

ES370

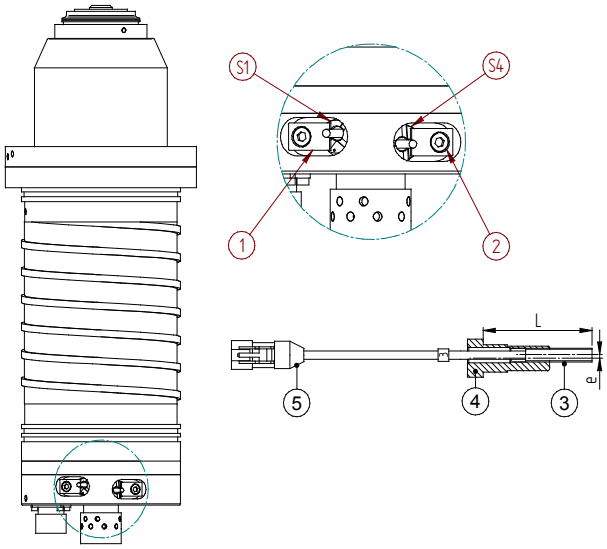


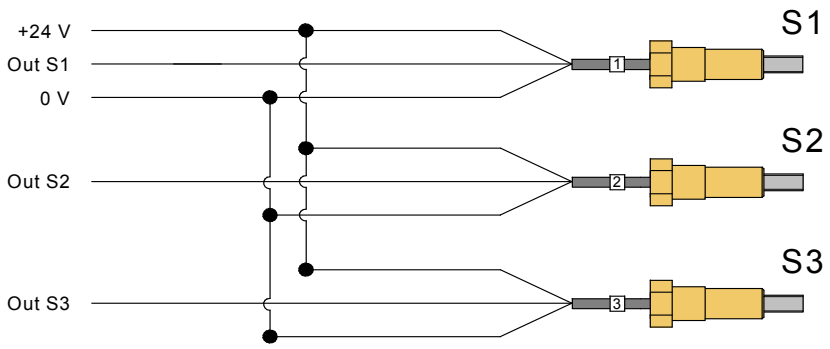
Figure 17

S1	sensor S1
S4	sensor S4
1	screws
2	washer
e	eccentricity between the nut and sensor, for adjustment
L	calibrated position
3	Sensor
4	nut
5	electric connector

8.4.3 Sensor wiring

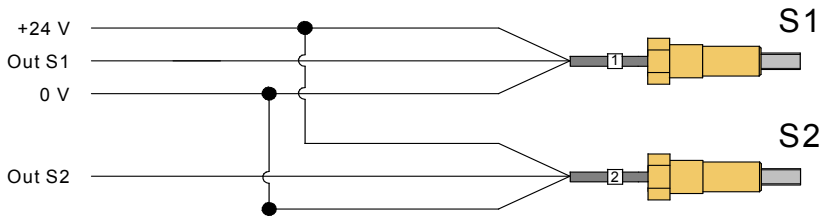
ES327

Figure 18



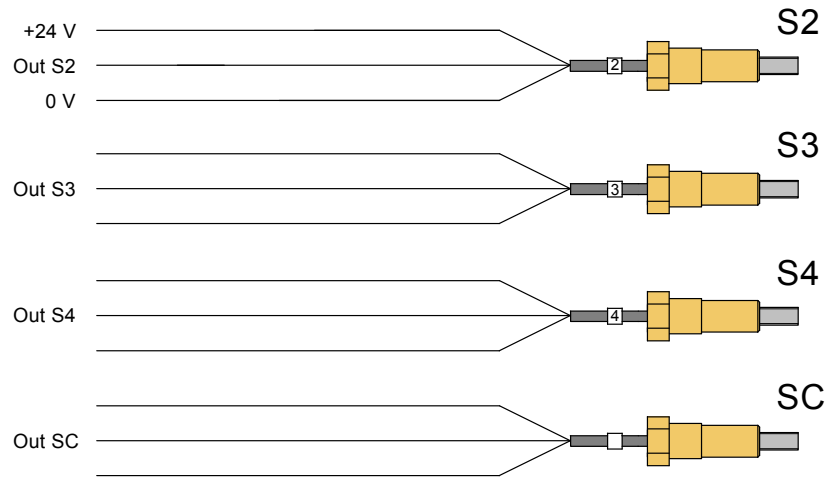
“air” ES330

Figure 19



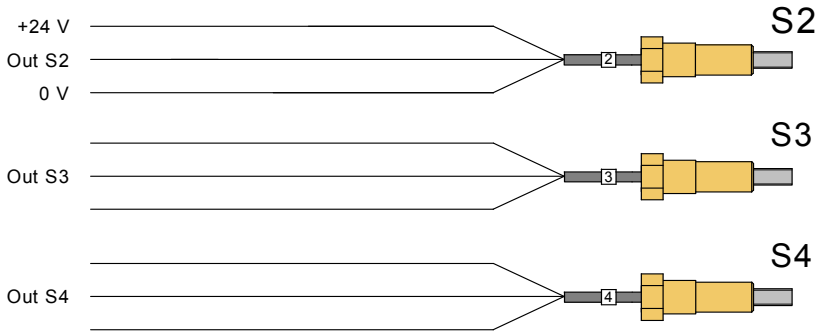
“liquid” ES330

Figure 20



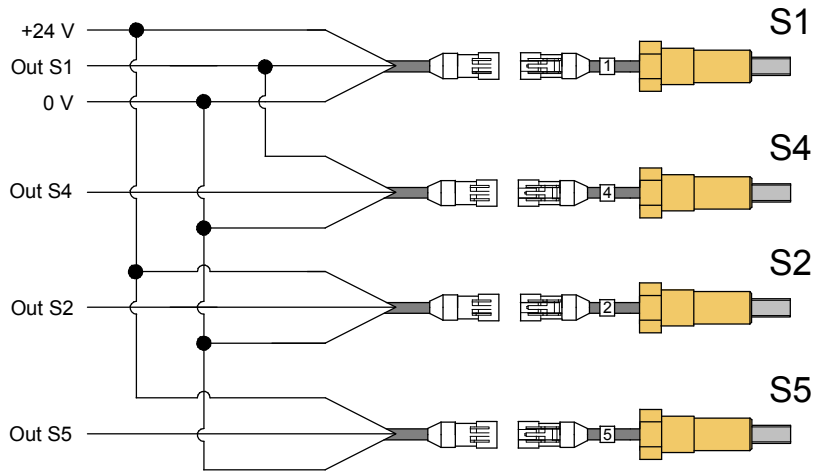
ES331

Figura 21



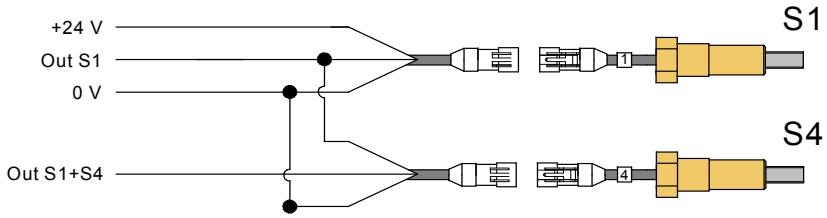
ES332

Figure 22



ES370

Figure 23



+24 V	**Brown**
0 V	**Blue**
Output	**Black**

8.4.4 Replacement and adjustment of the sensor unit

For the replacement and adjustment of the sensors illustrated in this and subsequent paragraphs, refer to figures 12, 14 and 17 of the previous paragraph.

Procedure not valid for model “liquid” ES330

1. remove the screw “1” which locks the sensor unit to be replaced;
2. remove the worn sensor unit from its seat;
3. Disconnect the sensor electronically or (if present) its electronic connector “5”;
4. electronically connect the new sensor unit;
5. verify the functionality of the new sensor by placing it in contact with a metal object;
6. insert the new sensor unit in the empty seat;
7. rescrew the screw “1” without tightening it completely, so that the sensor unit can rotate;
8. adjust the sensor unit, so as to obtain the outputs required in the paragraphs immediately below;

tighten the screw “1” locking the sensor unit, so as to maintain the performed calibration.

8.4.5 Adjustment of sensor S1 (for all models)

For HSK models gauges and thickness spacers are available for the adjustment of S1 and S4 sensors; the kit is described in the paragraphs from 8.4.8 to 8.4.10.
The use of a calibration kit allows not only faster but also more precise calibration: the manufacturer recommends the use of the kit, given the importance in terms of safety for the proper adjustment of the sensors.

After having replaced the sensor unit as described in section 8.4, adjust it as follows:

1. do not fully tighten the sensor as careful adjustment must be performed;
2. attach the tool holder cone and check that the output of S1 is **"ON"**; if the output is **"OFF"** rotate the sensor unit until it turns to **"ON"**;
3. the sensor "3" is eccentric with respect to the nut "5" that holds it: slowly rotate the nut in the direction that moves the sensor away from the tool holder;
   stop as soon as the output of the sensor changes to **"OFF"**;
4. delicately turn the nut back by about 15° - 20°, so that the output of the sensor returns to **"ON"**;
5. manually turn the shaft and check that the signal remains **"ON"** for the entire rotation;
6. tighten the fixing screw "2";
7. release the tool holder pressurising the piston at the value indicated in section 4.6 "Pneumatic connections", and check that in this condition (collet open) the S1 output is **"OFF"**;
8. remove the pressure from the piston and let the collet close without tool holder: in this condition the S1 output must be **"OFF"** for the entire rotation of the shaft;
9. if points (7) and (8) **are not verified**, repeat the procedure from the beginning, reducing the amplitude of the rotation performed at point (4);
10. if points (7) and (8) **are verified**, perform a cycle of 10 tool changes;
11. at the end of the cycle make sure the following table is met:

CONDITION	OUTPUT S1
tool holder blocked	**ON ***
no tool holder with collet closed	**OFF ***
collet open (tool holder ejected)	**OFF**

* for the entire rotation of the shaft

12. if the table **is not verified**, repeat the procedure from the beginning;
13. if the table **is verified**, make the machine perform a cycle of 100 tool changes, using the largest possible number of different tool holders;

14. at the end of the cycle check that the table at point (11) is satisfied: **if so** the adjustment procedure of S1 is finished; **if not** repeat the procedure from the beginning.

The sensors of the electrospindle ES327 are regulated by axially moving the sensor instead of rotating it.

8.4.6 Adjustment of sensor S2 for ISO models

After having replaced the sensor as described in paragraph 8.4, calibrate it as follows:

1. attach a tool holder properly before proceeding with the calibration of the sensor;
2. check that the output of S2 is **"OFF"**; if the output is **"ON"** rotate the sensor unit until it turns to **"OFF"**;
3. feed the cylinder by means of a unidirectional pressure regulator, set initially at 0 bar (0 PSI);
4. increase the feed pressure in increments of 0.1 bar (1.5 PSI), to slowly advance the piston, and at the same time check that the output of S2 is **“OFF”**;
5. as long as the tool holder is firmly blocked, the S2 output must be **"OFF"** ;
   if the output changes during the advance of the piston, rotate the sensor unit slightly until the output returns to **"OFF"**;
6. when the tool holder begins to loosen, but is not yet free to fall, the S2 output must still remain **"OFF"** (if necessary rotate the sensor unit);
7. when the supply pressure at which the tool holder is finally free to fall is reached, increase the pressure further by 0.2 bar (3 psi), and block the pressure regulator;
8. rotate the sensor unit so that in this condition the S2 output is **“ON”;**
9. perform a cycle of 10 tool changes;
10. at the end of the cycle check that steps (1) to (8) have been verified **without having to rotate the sensor**;
11. if the requested output **have not been** verified, repeat the entire procedure from the beginning;
12. if the requested output **are** verified, make the machine perform a cycle of 100 tool changes, using the largest possible number of different tool holders;
13. at the end of the cycle check that steps (1) to (8) have been verified **without having to rotate the sensor**;
14. if the requested output **have not been** verified, repeat the entire procedure from the beginning;
15. if the requested output **have** verified, the adjustment procedure of S2 is finished.

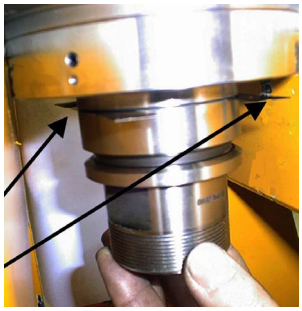
The sensors of the electrospindle ES327 are regulated by axially moving the sensor instead of rotating it.

8.4.7 Adjustment of the S4 sensor (only in HSK models)

For HSK models gauges and thickness spacers are available for the adjustment of S1 and S4 sensors; the kit is described in the paragraphs from 8.4.8 to 8.4.10.
The use of a calibration kit allows not only faster but also more precise calibration: the manufacturer recommends the use of the kit, given the importance in terms of safety for the proper adjustment of the sensors.

After having replaced the sensor as described in paragraph 8.4, calibrate it as follows:

1. acquire thickness spacers of 0.12 mm and 0.16 mm, to be placed between the stop surfaces of the tool holder cone and the shaft-spindle, as shown in the figure below;
2. Insert and lock the tool holder cone in the spindle, then check that the signal from sensor S4 corresponds to that indicated in the following table:

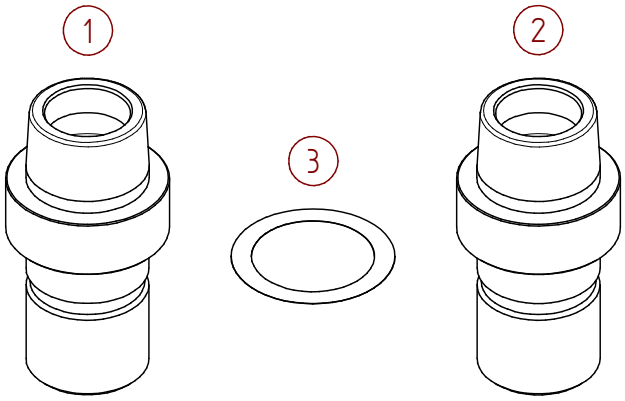


CONDITION	SPACER INTRODUCED	OUTPUT S4
tool holder blocked	**0.12 mm**	**ON**
tool holder blocked	**0.16mm**	**OFF**
collet open (tool holder ejected)		**OFF**

3. Rotate the shaft manually and check that the table is verified for the entire 360° rotation.
4. if not, rotate the sensor until the position necessary to obtain the output described in the table is found;
5. Fully tighten screw “2”.
6. perform a cycle of 10 tool changes;
7. at the end of the cycle, check that the table shown in point (2) has been satisfied for the entire 360° rotation of the shaft. Otherwise repeat the procedure from the start;
8. if the table is verified, make the machine perform a cycle of 100 tool changes, using the largest possible number of different tool holders;
9. at the end of the cycle, check that the table shown in point (2) has been satisfied for the entire 360° rotation of the shaft. Otherwise repeat the procedure from the start;
10. If the table in point (2) is satisfied, the calibration of S4 is complete.

8.4.8 Gauge kit for adjusting sensors HSK S1 and S4

Figure 24: kit H3811H0402 for adjusting sensors S1 and S4 HSK - E40 -F50



1	Gauge for regulating sensor S1 (11.56 mm)
2	Gauge for regulating sensor S4 (11.32 mm)
3	Thickness 0.04mm.

Figure 25: the use of the gauge as a normal tool holder, with or without spacer inserted

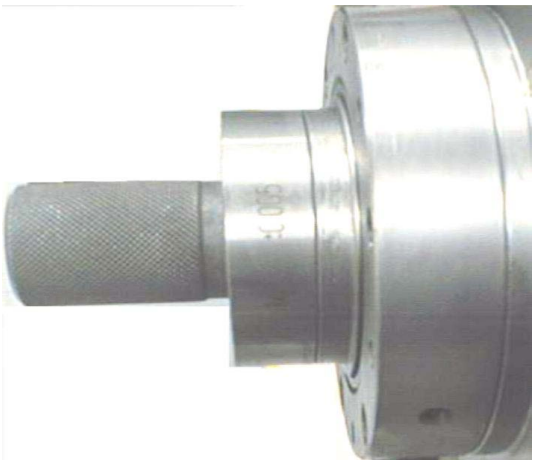
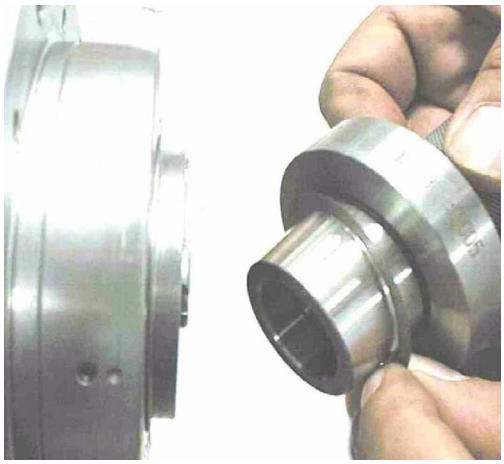


Figure 26: position of the spacer between the stop surfaces of the gauge and spindle shaft



Use of the gauges allows the immediate positioning of collet HSK at the position at which the sensors are regulated, thus allowing not only faster but also more precise calibration, given that the gauges have been manufactured to tighter tolerances with respect to normal tool holders.

Even though it is possible to adjust sensors without using the kit (as described in the preceding paragraphs), the manufacturer highly recommends the use of the kit, given the importance of ensuring accurate calibration of the sensors for safety reasons.

The gauges and spacers described in figure 25 and 26 are identified by their thicknesses engraved on the surface or listed on the label of the pack.

8.4.9 Regulating S1 using the kit

After having replaced the sensor as described in paragraph 8.4, calibrate it as follows:

1. for models E40 - F50 use the 11.56 mm gauge and the 0.04 mm thickness spacer
2. Use the gauges and spacers as shown in figures 25 and 26 and check that the signal from sensor S1 corresponds to that indicated in the following table:

CONDITION	OUTPUT S1
Gauge locked thickness spacer interposed	**ON**
Gauge locked no thickness spacer interposed	**OFF**
No collet (no tool holder)	**OFF**
Collet open (tool holder ejected)	**OFF**

3. Rotate the shaft manually and check that the table is verified for the entire 360° rotation.
4. if not, rotate the sensor until the position necessary to obtain the output described in the table is found;
5. Fully tighten screw “2”;
6. perform a cycle of 10 tool changes;
7. at the end of the cycle, check that the table shown in point (2) has been satisfied for the entire 360° rotation of the shaft. Otherwise repeat the procedure from the start;
8. if the table is verified, make the machine perform a cycle of 100 tool changes, using the largest possible number of different tool holders;
9. at the end of the cycle, check that the table shown in point (2) has been satisfied for the entire 360° rotation of the shaft. Otherwise repeat the procedure from the start;
10. If the table in point (2) is satisfied, the calibration of S1 is complete.

The sensors of the electrospindle ES327 are regulated by axially moving the sensor instead of rotating it.

8.4.10 Regulating S4 using the kit

After having replaced the sensor as described in paragraph 8.4, calibrate it as follows:

1. for models E40 - F50 use the 11.32 mm gauge and the 0.04 mm thickness spacer
2. Use the gauges and spacers as shown in figures 25 and 26 and check that the signal from sensor S4 corresponds to that indicated in the following table:

CONDITION	OUTPUT S4
Gauge locked 0.04 mm	**ON**
Gauge locked NONE	**OFF**
Collet open (tool holder ejected)	**OFF**

3. Rotate the shaft manually and check that the table is verified for the entire 360° rotation.
4. if not, rotate the sensor until the position necessary to obtain the output described in the table is found;
5. Fully tighten screw “2”;
6. perform a cycle of 10 tool changes;
7. at the end of the cycle, check that the table shown in point (2) has been satisfied for the entire 360° rotation of the shaft. Otherwise repeat the procedure from the start;
8. if the table is verified, make the machine perform a cycle of 100 tool changes, using the largest possible number of different tool holders;
9. at the end of the cycle, check that the table shown in point (2) has been satisfied for the entire 360° rotation of the shaft. Otherwise repeat the procedure from the start;
10. if the table in point (2) is satisfied, the calibration of S4 is complete.

8.4.11 Adjusting sensor S3

After having replaced the sensor as described in paragraph 8.4, calibrate it as follows:

1. verify that the signal provided by the sensor corresponds to that described in section 6.8.7;
2. if not, rotate the sensor until the position necessary to obtain the output described in the table is found 6.8.7;
3. fully tighten the screw “2”.

9 Disposal of the product

The electrospindle contains a spring that has been pre-loaded with a force of around one hundred kilograms. This spring is applied to a screw dowel that can be violently ejected if the electrospindle is dismantled by inadequately trained personnel.

Only carry out the operations described in this manual. Follow the instructions scrupulously and in the case of doubt, contact the Manufacturer's Assistance Service..

At the end of the electrospindle's life cycle, it is the user's responsibility to dispose of it in the correct manner.
First of all, clean the various parts and then separate them into mechanical and electrical components.

The different materials, such as electric motors (copper windings), metal components, plastic materials, lubricants, liquid coolants, etc. must be sorted and separated then disposed of in accordance with the laws applicable in the country of installation .

10 Troubleshooting

BEFORE CARRYING OUT ANY OPERATIONS ON THE ELECTROSPINDLE, READ AND IMPLEMENT ALL THE WARNINGS AND RECOMMENDATIONS REGARDING SAFETY AND MAINTENANCE.

Problems	Cause	Remedy
The electrospindle does not rotate:	No power supply:	Check for the presence of mains voltage. Check the connectors. Check the integrity and continuity of the electrical connections.
	The tool holder is not inserted:	Insert a tool holder.
	The tool holder is not inserted correctly:	See item "The tool holder is not coupled" in this chapter.
	The thermal switch has tripped:	Wait for the electrospindle to cool down: the thermal switch will reset automatically to allow operation. If the thermal switch trips frequently, consult item "The electrospindle overheats" later in this chapter.
	The inverter protection has tripped:	Consult the manual or contact the manufacturer of the inverter.
	Sensor S1 or sensor S4 (HSK only) is disconnected or faulty:	Check the connectors. Check the integrity and continuity of the electrical connections. Regulate the sensor as described in section 8.4 “Replacement and adjustment of the sensor unit”. Replace the defective sensor as described in section 8.4 “Replacement and adjustment of the sensor unit”.
	Rotation denied:	Consult the manuals or the suppliers of the machine, the numerical control and the inverter that is connected to the electrospindle.

Problems	Cause	Remedy
The tool holder does not couple:	Foreign bodies between the tool holder and shaft-spindle:	Remove the macroscopic impurities and clean as described in section 7 “Programmed maintenance”.
	The tool holder cone is not the correct type:	Choose a tool holder according to the indications described in section 6.5.1 “Tool holder cone”.
	The collet does not open due to insufficient pressure:	■ Check the required pressure values in section 4.6 “Pneumatic connections”. ■ Check the integrity and efficiency of the pneumatic circuit.
	Sensor S1 and/or S2 are disconnected or out of order:	■ Check the connectors. ■ Check the integrity and continuity of the electrical connections. ■ Regulate the sensor as described in section 8.4 “Replacement and adjustment of the sensor unit”. ■ Replace the defective sensor as described in section 8.4 “Replacement and adjustment of the sensor unit”.
The tool holder does not eject:	Insufficient pressure:	■ Check the required pressure values in section 4.6 “Pneumatic connections”. ■ Check the integrity and efficiency of the pneumatic circuit.
	Tool ejection enabling denied:	Consult the manuals or the suppliers of the machine, numerical control or inverter that is connected to the electrospindle.
No pressurisation:	Insufficient pressure or pneumatic circuit inefficient:	■ Check the required pressure values in section 4.6 “Pneumatic connections”. ■ Check the integrity and efficiency of the pneumatic circuit. ■ Contact the manufacturer's assistance service.
One of the sensors does not supply the required output:	Sensor disconnected or faulty:	■ Check the connectors. ■ Check the integrity and continuity of the electrical connections. ■ Regulate the sensor as described in section 8.4 “Replacement and adjustment of the sensor unit”. ■ Replace the defective sensor as described in section 8.4 “Replacement and adjustment of the sensor unit”.

Problems	Cause	Remedy
The electrospindle overheats:	Insufficient cooling:	■ Check the specifications of the system in section 4.7 “Cooler specifications and hydraulic connections”; ■ Check the integrity and efficiency of the cooling circuit.
	Machining is too heavy:	■ Lighten the machining.
	The inverter parameters are incorrect:	■ Check the parameters on the electrospindle plate in chapter 2 “Technical Specifications” (in the paragraph relating to your model).
Performance lower than specifications:	The inverter parameters are incorrect:	■ Check the parameters on the electrospindle plate in chapter 2 “Technical Specifications” (in the paragraph relating to your model).
Electrospindle vibrates:	The tool holder is not balanced:	■ Choose a tool holder according to the indications described in section 6.5.1 “Tool holder cone”.
	The tool is not balanced:	■ Choose and use the tool as shown in section 6.6 “Tool”.
	Dirt between the tool holder cone and shaft-spindle:	■ Remove the macroscopic impurities and clean as described in section 7 “Programmed maintenance”.
	The inverter parameters are incorrect:	■ Check the parameters on the electrospindle plate in chapter 2 “Technical Specifications” (in the paragraph relating to your model).
	Machining is too heavy:	■ Lighten the machining.
	Fixing screws loose:	■ Tighten the fixing screws:
	Bearings damaged:	■ Contact the manufacturer's assistance service.
Bearings noisy:	Bearings damaged:	■ Contact the manufacturer's assistance service.

11 List of spare parts

Manufacturer code	Description
H2161H0022	Liquid coolant ARTIC-FLU-5
ES327	
H5664H0053	Sensor S1
H5664H0054	Sensor S2
H5664H0055	Sensor S3
H1419H0105	Sensor cover gasket
“air” ES330	
Y566400001	S1 or S2 Sensor
Y141900005	Sensor cover gasket
H1707H0030	ISO30 cone for protecting the interior of the spindle
H6200H0050	Electric flying female connector
H5618H0003	Button
H566100007	Electric fan
“liquid” ES330	
H5664H0052	Sensor S2
H5664H0057	Sensor S3
H5664H0058	Sensor S4
H5664H0065	Pulse counter Sensor
H1707H0030	ISO30 cone for protecting the interior of the spindle
H1419H0102	Sensor cover gasket
ES331	
H5664H0056	Sensor S2
H5664H0057	Sensor S3
H5664H0058	Sensor S4
H5638H0016	Movable connector collection
ES332	
H5664H0019	Sensor S1
H5664H0082	Sensor S2
H5664H0083	Sensor S4
H5664H0084	Sensor S5
H3811H0402	HSK E40 -F50 gauge kit for regulating sensors S1 and S4

2138A0229	Sensor and encoder movable connectors
2147A0404	Connector join
2450A3847	Flat jet
2450A3902	Stackable segment 1/4’’
2450A3940	1/8’’ gas join
ES370	
H5664H0048	S1 or S4 Sensor
H3811H0402	HSK E40 -F50 gauge kit for regulating sensors S1 and S4

12 Customer service

12.1 Customer service

The manufacturer has customer service points throughout the world. The entire structure forms a highly efficient, integrated network which the user can contact for any requirement, information, advice or news.

The service department employs technicians with a high level of knowledge and experience on the models manufactured, gained through special training in our factory, who are able to service machines on site.

The list of the manufacturer's Customer Service Authorised Centres can be seen below.

HSD S.p.A.

registered office:
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