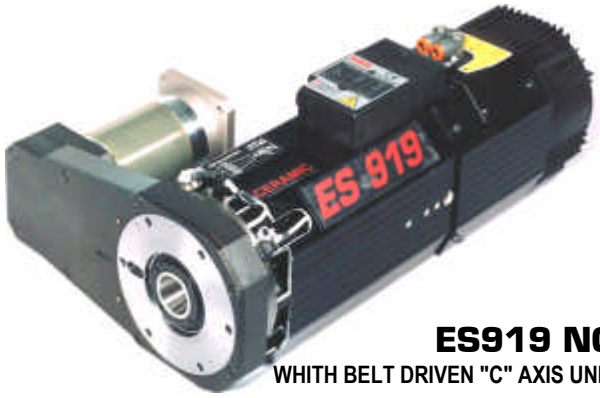
Installation, Operation and Maintenance Manual

5801H0017
Revision 02

ELECTRO-SPINDLES

for automatic tool changing

ES915



ES919 NC
WHITH BELT DRIVEN "C" AXIS UNIT

ES919 NC

ES919 NL

ES919 L NC

ES919 L NL

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§ 1 DOCUMENTS DELIVERED WITH THE ELECTRO-SPINDLE

The following documents are delivered with the electro-spindle:

- this manual containing the safety warnings and instructions for installation, operation and maintenance
- a series of other documents including:
  1. The Manufacturer's Declaration of conformity to attachment IIB of Directive 98/37/CE
  2. Attachments containing information on special parts of the electro-spindle. All such attachments must be consulted in conjunction with the main document to which they refer in order to avoid missing important information.

Make sure that all the above documents are delivered with the electro-spindle. If any are missing, ask HSD S.p.a. for a replacement copy.

§ 2 DOCUMENT INFORMATION

This manual has been written by the Electro-spindle department of the Technical Office at HSD S.p.a. for use by all the installers, operators and service engineers who work with the electro-spindle.

ISSUED BY	CODE	REVISION	APPROVED BY
HSD S.p.a. Via della Meccanica 16 Loc. Chiusa di Ginestreto 61100 PESARO (ITALIA)	**5801H0017**	**02**	**UTE 005 / 03**

Record of updates

Revision	Added §	Deleted §	Changed §
00	First issue	First issue	First issue
01	General revision	General revision	General revision
02	ES 915 L HSK F63 Long Nose	----	Overall dimensions of ES 919 L HSK F63 Long Nose

This manual is delivered as an essential part of the electro-spindle and at the time of revision was the most up to date documentation on the product.

§ 3 CUSTOMER ASSISTANCE SERVICE

HSD

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§ 4 TERMS OF WARRANTY

HSD S.p.a. guarantees that this electro-spindle has been QC passed in testing in the factory. HSD S.p.a. accepts responsibility only for defects in electrical and mechanical parts. The warranty does not cover defects caused by the normal use of parts subject to continuous or rapid wear (e.g. seals, belts, bearings, etc.). In particular HSD S.p.a. offers no guarantee as to the duration of bearings, since bearing wear depends on various factors including: tool balancing precision, type of machining operation, impacts and/or mechanical stress in excess of the manufacturer's declared limits.

HSD S.p.a. declines all responsibility for non-compliance of the electro-spindle caused by failure to follow the precautions and instructions given in this manual or by improper use or handling of the electro-spindle. The customer has the right to replacement of all parts shown to be defective, unless the said defects are caused by unauthorized tampering, including the fitting of non-original HSD spare parts and/or the replacement of parts not described or authorized in this manual unless authorized beforehand and in writing by HSD S.p.A..
In no case shall HSD S.p.A. or its suppliers accept any responsibility for damage (including damage to the unit, damage incurred for lost production and income, down-time in manufacturing, loss of information or other economic losses) deriving from the use of HSD products, even if HSD has been advised of such risks in advance.

The warranty becomes automatically null and void if the customer fails to notify HSD S.p.A. in writing of any faults found in the electro-spindle within 15 days of their occurrence. The warranty likewise becomes null and void if the customer fails to permit the seller to perform all necessary checks and tests, and if, when the seller requests the return of a defective part, the customer fails to do so within two weeks of the request.

Dimensioned drawings and photographs are provided only for information purposes and to facilitate understanding of text.

HSD S.p.A. has a policy of constant development and improvement, and reserves the right to make functional and stylistic modifications to its products, to change the design of any functional or accessory part, and to suspend manufacturing and supply without notice and without obligation to third parties. Furthermore, HSD S.p.A. reserves the right to make any structural or functional change to the units, and to change the supply of spare parts and accessories without any prior notice.

§ 5 WARNINGS AND SAFETY PRECAUTIONS

5.1 DISTRIBUTION OF THIS MANUAL

This manual contains important instructions and precautions, and must accompany the electro-spindle at all times since it is essential for the safe operation of the electro-spindle.
Keep this manual safe, and ensure that all persons involved with the electro-spindle know of it and have access to it.
The **safety precautions** contained herein are designed to ensure the safety of all persons exposed to the residual risks associated with the electro-spindle.
The **instructions** contained herein provide information necessary for the correct operation of the electro-spindle, as required by the manufacturer.
If any information given in this manual is found to be in conflict with applicable safety regulations, contact HSD S.p.A. on +39 0721 439612 to request the necessary corrections and/or adaptations.

Make sure that you read and fully understand all the documentation supplied with the electro-spindle to avoid incorrect operation of the unit and unnecessary risks of personal injury.
Keep this manual in a suitable place near the machine, where it will always be readily available to operators for consultation.

IMPORTANT: The information given in this manual is essential to ensure that the electro-spindle is installed and used safely and correctly.

5.2 GENERAL SAFETY SYMBOLS

In this manual, important instructions or precautions are marked with the following symbols:

WARNING: Identifies situations that could lead to personal injury.

WARNING: Live electrical parts.

IMPORTANT: Identifies particulary important information.

5.3 RISKS ASSOCIATED WITH THE ELECTRO-SPINDLE

HSD does not and can not know how end users will install their electro-spindles. The installer or customer must therefore perform risk assessment specific to each installation and application.

It is also the responsibility of the installer to ensure that adequate guards are provided to prevent accidental contact with moving parts.

The installer and the operator must also bear in mind other types of risk, particulary those associated with foreign bodies, explosive, inflammable, toxic or high temperature gasses.

Risks associated with maintenance operations must also be guarded against. Maintenance must be performed in conditions of maximum safety, and only with the electro-spindle fully stationary and switched off.

Once the electro-spindle has been installed in the way decided upon by the installer and/or customer, the machine becomes a "finished machine" as defined for the purposes of the Machinery Directive. ***Overall risk assessment*** *must therefore be performed on the finished machine and a declaration of conformity produced in compliance with Appendix IIA of the 98/37/CE Machinery Directive.*

5.4 RISKS ASSOCIATED WITH IMPROPER USE AND HANDLING

- Never impede the functioning of, remove, modify or in any way interfere with any safety device, guard, or control of individual parts or of the electro-spindle as a whole.
- Never place your hands, arms, or any other part of your body near moving machinery.
- Do not use the electro-spindle in atmospheres or environments where there is a risk of explosion.
- Unless you are duly authorized, never attempt to repair faults or electro-spindle malfunctions and never interfere in any way with the electro-spindle's operation or installation.
- On completion of servicing work for which guards, covers, or any other protections have been removed, always make sure that they have been correctly and securely replaced and are fully functional before re-starting the electro-spindle.
- Keep all protection and safety devices in perfect working order. Also make sure that all warning labels and symbols are correctly positioned and perfectly legible.
- When troubleshooting the electro-spindle always adopt all the safety precautions listed in this manual for the purpose of preventing injury or damage to persons and things.
- After adjusting any mechanical part, make sure that you fully tighten all screws, bolts or ring nuts you may have slackened or removed.
- Before you start the electro-spindle, make sure that all the safety devices are installed and perfectly functional. Do not start the electro-spindle if this is not the case, but immediately inform the person responsible for machine safety or your direct superior.
- Make sure that you have and use all the personal protective equipment (PPE) required by law. Do not wear loose or hanging clothing (ties, wide sleeves, etc.).
- Never use tool holders of different types to those specified in this manual. To do so could damage the tool holder cone or lead to unsafe tool holder locking.

5.5 RISKS SPECIFIC TO MAINTENANCE

- Take great care not to cut yourself on the tools while servicing or cleaning the electro-spindle. Ideally, tools should be removed prior to these operations.
- Rotating parts may continue to spin under the effect of inertia even when the electro-spindle has been switched off. Make absolutely sure that the spindle is not spinning before accessing it.
- Perform all scheduled maintenance as described in this manual. Failure to do so may lead to mechanical failures and breakage through wear or inadequate maintenance.

WARNING: NEVER:

- **Start any maintenance before making absolutely sure that the tool in the electro-spindle is completely stationary.**
- **Start any maintenance on the electro-spindle before disconnecting it from the main power supply.**
- **Attempt to clean the electro-spindle while it is operating.**

§ 6 GENERAL INFORMATION

6.1 PROPER USE OF THE PRODUCT

Electro-spindles are used as parts of machines.

The machine structure to which the electro-spindle is secured must be rigid and strong enough to support the weight of the electro-spindle and withstand the machining operations to be performed.

The electro-spindles described in this manual are designed for milling and drilling wood, plastic, aluminium and fiber-board.

They are all designed for operation in an S1 duty type. Technical specifications vary as detailed in section § 7.

All ES919 and ES915 variants can be fitted with a gear driven C axis unit as an optional.

Model ES919 ISO30 Short Nose (7 kW or 8 kW version, 2 poles) is also available with a belt driven C axis unit. (C axis belt drive is not available as an option for retro-fitting.)

Some models have their power terminals configured in either star or delta configuration.

A spindle shaft kit is available for rapid changes of the complete spindle shaft with bearing assembly on all models except models with belt driven C axis units.

To prevent damage to the precision bearings, all electro-spindles are fitted with a mechanical reaction system that counteracts the axial force that the piston applies to the spindle shaft during tool change operations.

6.2 IDENTIFICATION OF MANUFACTURER AND PART

The data label shown below is the only form of electro-spindle identification recognised by the manufacturer, and must be kept in its original legible condition. Figure 6.1 shows the electro-spindle data label, while Figure 6.2 shows its location on the electro-spindle (Position 2).

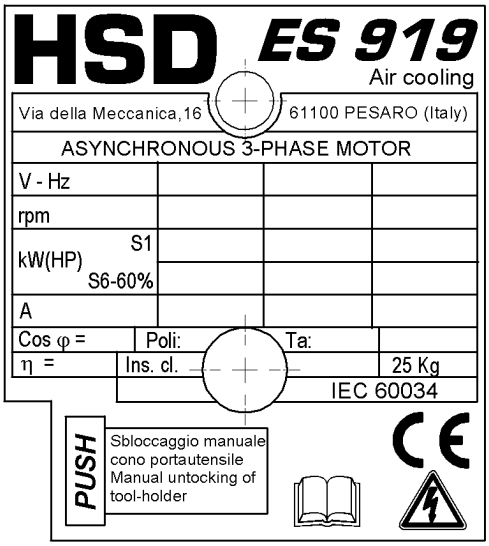


Figure 6.1 The CE label

1	Commercial part name and HSD code
2	CE label
3	"CERAMIC" (models with ceramic bearings only)
4	Serial number
5	Description of the tool holder cone
6	Commercial name of electro-spindle
7	Description of air inlets
8	HSD code for stator group
NOTE:	Some of the symbols shown here may not be present on your particular electro-spindle.

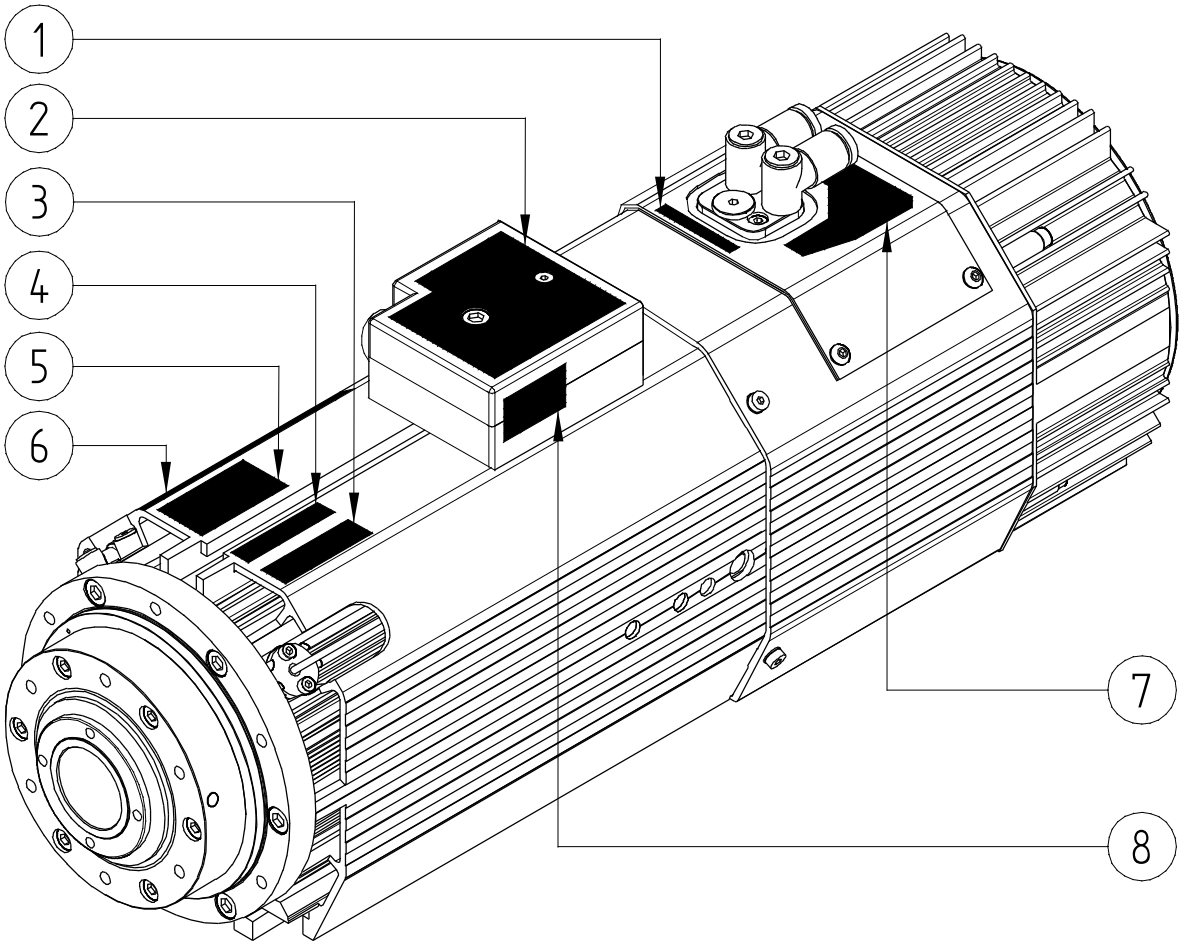


Figure 6.2 Location of the CE label and other symbols on the electro-spindle

6.3 DESCRIPTION OF THE MAIN PARTS OF THE ELECTRO-SPINDLE

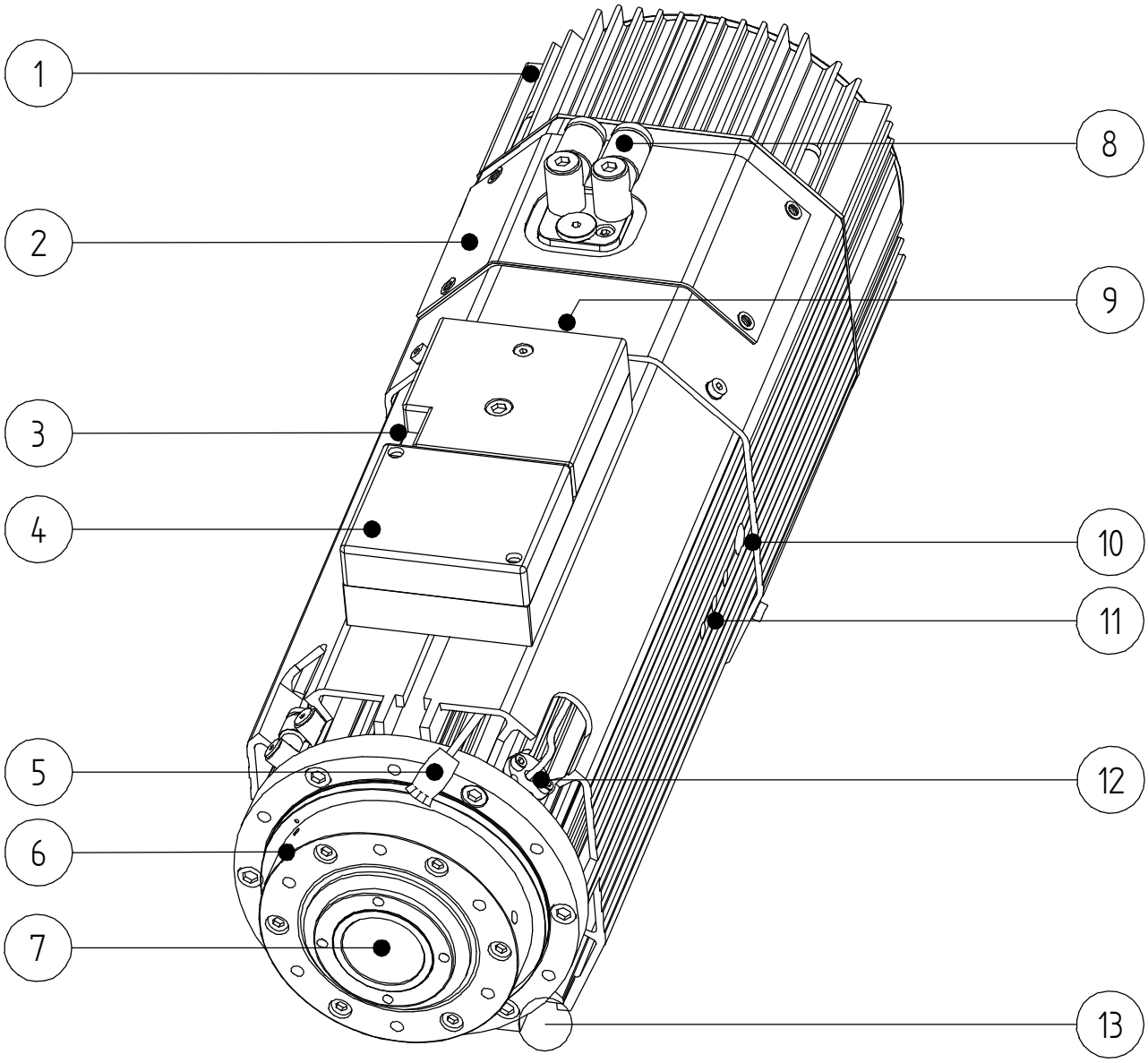
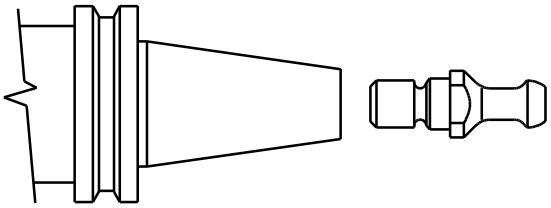
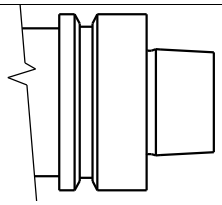


Figure 6.3 General view of the electro-spindle

1	Cooling fan
2	Sensor compartment
3	Manual tool holder release button
4	Configurable terminal block (optional)
5	C axis sensor connector (optional C axis)
6	Spindle nose
7	Spindle shaft
8	Compressed air connectors
9	Electrical terminals
10	Exhaust air silencer (one on each side)
11	Threaded service holes (see section 9.3.4)
12	Temperature sensor for front bearings (optional)
13	“T” slots for anchoring to support

6.4 GLOSSARY

ISO 30	 ISO30, DIN69871 CONE HSD PULL STUD 0804H0009	The locking system for the tool holder cone complies with DIN standard 69871. The electro-spindle has a label showing the type of tool holder mechanism (ISO or HSK), bearing a symbol like that shown at left.
HSK	 DIN69893 HSK F63 CONE	The locking system for the tool holder cone complies with DIN standard 69893. The electro-spindle has a label showing the type of tool holder mechanism (ISO or HSK), bearing a symbol like that shown at left.
Dynamic balancing class	The degree of balancing of a rotating object according to ISO standard 1940/1, defined as the G rating. Low G values mean better balancing. G = 0.4 specifies maximum balancing precision. G assumes discrete values that increment in multiples of 2.5 (G=0.4 , G=1 , G=2.5 , etc.).	
Scheduled maintenance	Actions required to maintain the electro-spindle in the original condition, as specified by HSD S.p.a.. Maintenance can include scheduled adjustments, repairs and part replacements.	
Duty type S1	Functioning at constant load for enough time to bring the electro-spindle to a state of thermal equilibrium. Abbreviated as S1.	
Duty type S6	A sequence of identical operating cycles, each comprising a period of functioning at constant load and a period of functioning at no load but at the same rotation speed, without any intermediate rest times. Abbreviated as S6 followed by the percentage ratio between the period of functioning under load and the duration of the cycle. *Example: S6 40%.* (40% functioning under load, 60% no load rotation).	
Rated voltage	The maximum voltage permissible for electrical power to the electro-spindle.	
Rated frequency	The minimum frequency at which power at rated voltage must be delivered.	
Torque	**Torque (Nm) = [60 · power (W)] : [2 · P · rpm]** Precise definition of torque and power goes beyond the scope of this manual. Nevertheless, torque can be adequately understood as being related to the force with which the tool bites into the work piece. (For the same torque, force increases as tool diameter decreases.) Power on the other hand is proportional to torque and rotation speed. Power limits the maximum machining speed (within the limits dictated by tool performance, the characteristics of the material being machined, and the type of machining involved).	
Power		
Ratings	The set of rated values declared at rated frequency.	
Coolants	Liquids or gases (including air), used as the medium for transferring heat from the spindle into the environment.	

§ 7 TECHNICAL SPECIFICATIONS

7.1 AVAILABLE MODELS

7.1.1 ES915 / ES915 L

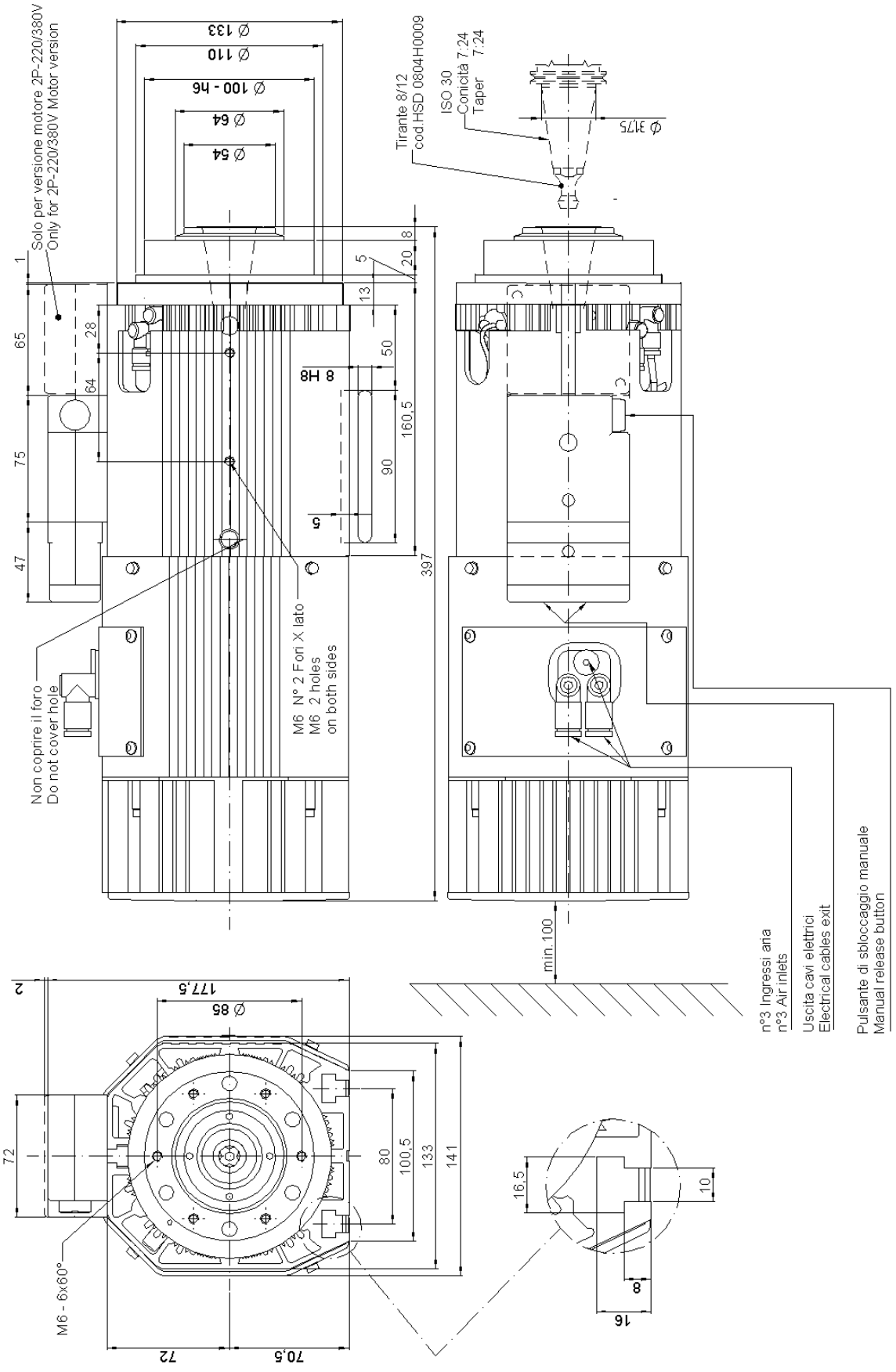
	ISO 30		HSK F63		RATED VOLTAGE	
	SHORT NOSE	LONG NOSE	SHORT NOSE	LONG NOSE	380 V	CONFIGURABLE 380 V / 220 V
3.8 kW 2 poles air cooling	●				●	●
5 kW 4 poles air cooling	●				●	
7.5 kW 4 poles liquid cooling				●	●	

7.1.2 ES919 / ES919 L

	ISO 30		HSK F63		RATED VOLTAGE	
	SHORT NOSE	LONG NOSE	SHORT NOSE	LONG NOSE	380 V	CONFIGURABLE 380 V / 220 V
7 kW 2 poles air cooling	●	●			●	●
7 kW 2 poles air cooling whith belt-driven "C Axis" unit	●				●	●
8 kW 2 poles air cooling	●	●			●	●
8 kW 2 poles air cooling whith belt-driven "C Axis" unit	●				●	●
5.5 kW 4 poles air cooling	●	●			●	
7.5 kW 4 poles air cooling	●	●	●	●	●	
12 kW 4 poles liquid cooling	●	●	●	●	●	

7.2 TECHNICAL SPECIFICATIONS OF ES915

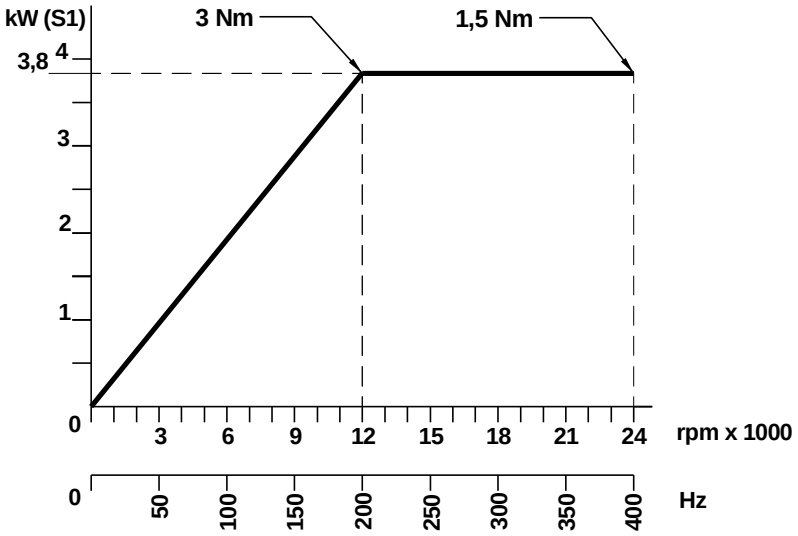
7.2.1 Overall dimensions of ES915



7.2.2 Specifications and performance of ES915 2 Pole, 3.8 kW units

Terminal connection type	Star	Delta
Rated voltage (*)	380 V ± 10%	220 V ± 10%
Rated current	8.3 A	14.4 A
Rated speed	12000 rpm (200 Hz)	
Rated power	3.8 kW	
Duty type	S1	
Rated torque	3 Nm	
Rated efficiency h	0.8	
Power factor cos j	0.8	
Number of poles	2	
Insulation class	H	
Type of cooling	Cooling fan	
Weight	~ 21 kg	

[(*) from inverter]



Notes:

TOOL HOLDER	FRONT BEARINGS	REAR BEARINGS	MAX SPEED
ISO30	STEEL	STEEL	20000rpm / 333Hz
ISO30	CERAMIC	STEEL	24000rpm / 400Hz
ISO30	CERAMIC	CERAMIC	24000rpm / 400Hz
ISO30	CRONIDUR / CHROMEX	CERAMIC	28000rpm / 467Hz

The 3.8 kW 2 Pole motor is also available in a configurable double voltage version.

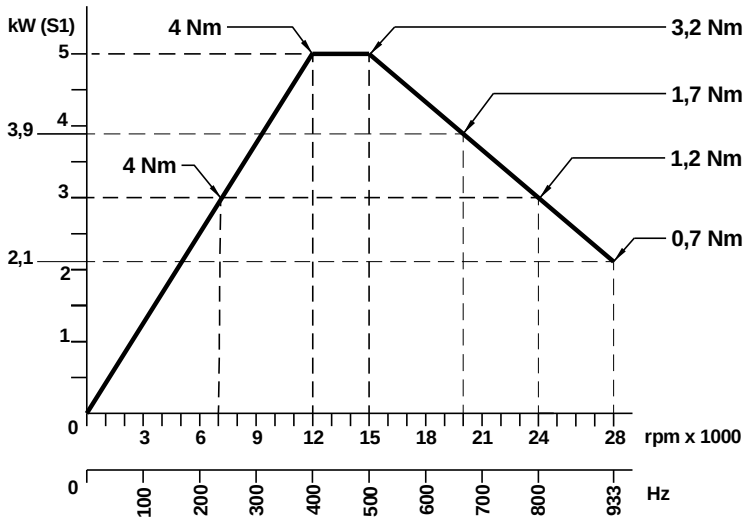
<u>Configurable models only:</u> Check that the power terminals are correctly wired for the supply voltage before installing the unit.

The *maximum continuous current* inverter parameter must match the rated current value in the table above (also stated on the motor's data label).
<u>Select the right value depending on whether the connection is star or delta.</u>

7.2.3 Specifications and performance of ES915 4 Pole, 5 kW units

Rated voltage (*)	V	225 ±10%	380 ±10%	380 ±10%	380 ±10%	380 ±10%	380 ±10%
Rated frequency	Hz	233	400	500	667	800	933
Rated speed	rpm	7000	12000	15000	20000	24000	28000
Rated power	kW	3	5	5	3.9	3	2,1
Duty type		S1					
Rated torque	Nm	4	4	3.2	1.7	1.2	0.7
Rated current	A	12	12	10,5	9.2	7	4
Rated efficiency h		0.8	0.8	0.8	0.8	0.8	0.8
Power factor cos j		0.85	0.85	0.85	0.8	0.8	0.75
Number of poles		4					
Insulation class		F					
Type of cooling		Cooling fan					
Weight	kg	~ 21					

[(*) from inverter]



Notes:

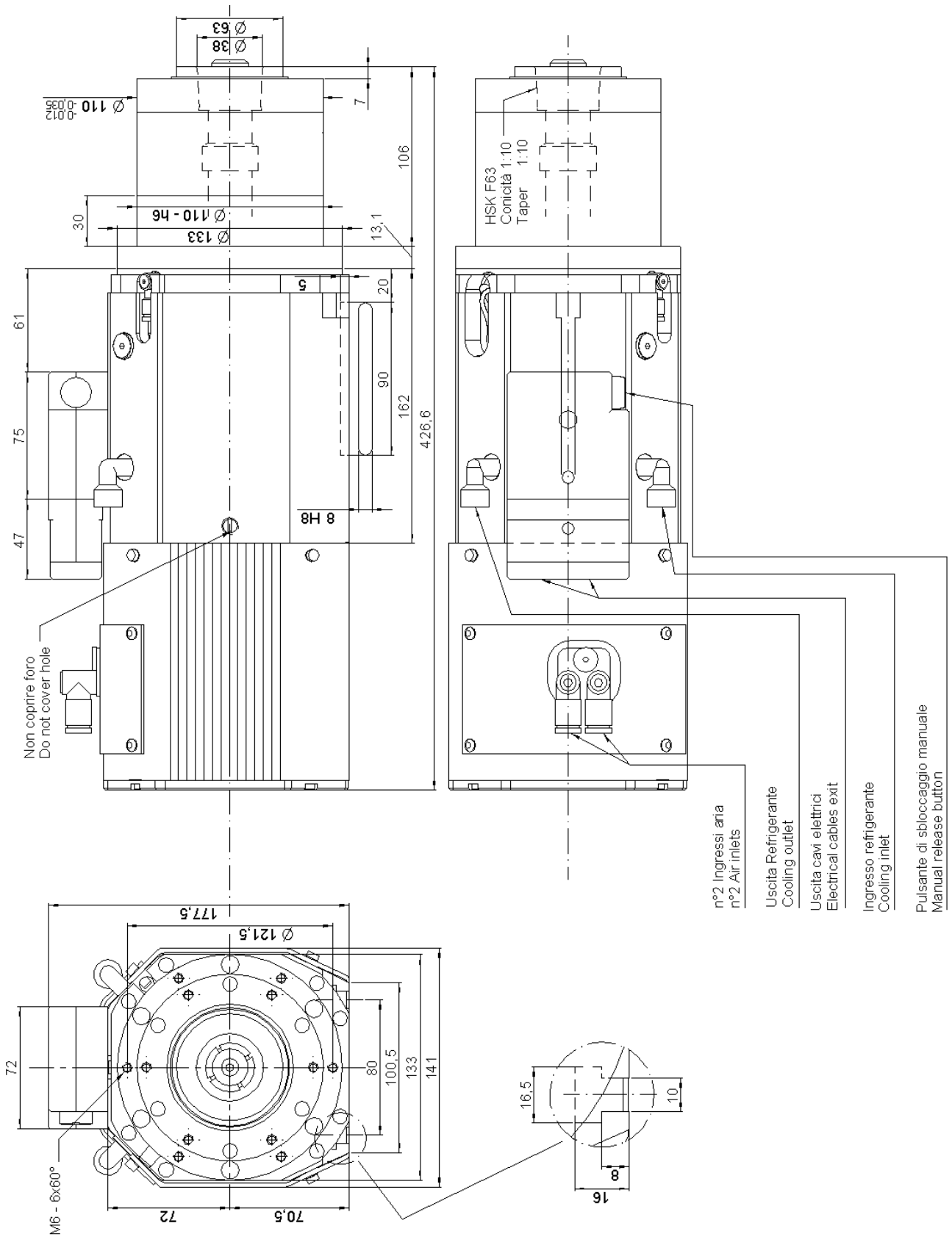
TOOL HOLDER	FRONT BEARINGS	REAR BEARINGS	MAX SPEED
ISO30	STEEL	STEEL	20000rpm / 667Hz
ISO30	CERAMIC	STEEL	24000rpm / 800Hz
ISO30	CERAMIC	CERAMIC	24000rpm / 800Hz
ISO30	CRONIDUR / CHROMEX	CERAMIC	28000rpm / 933Hz

The 5 kW, 4 Pole motor is not available with configurable double voltage power terminals.

The *maximum continuous current* inverter parameter must match the maximum value of the rated current in the table above (also stated on the motor's data label).

7.3 TECHNICAL SPECIFICATIONS OF ES915 L

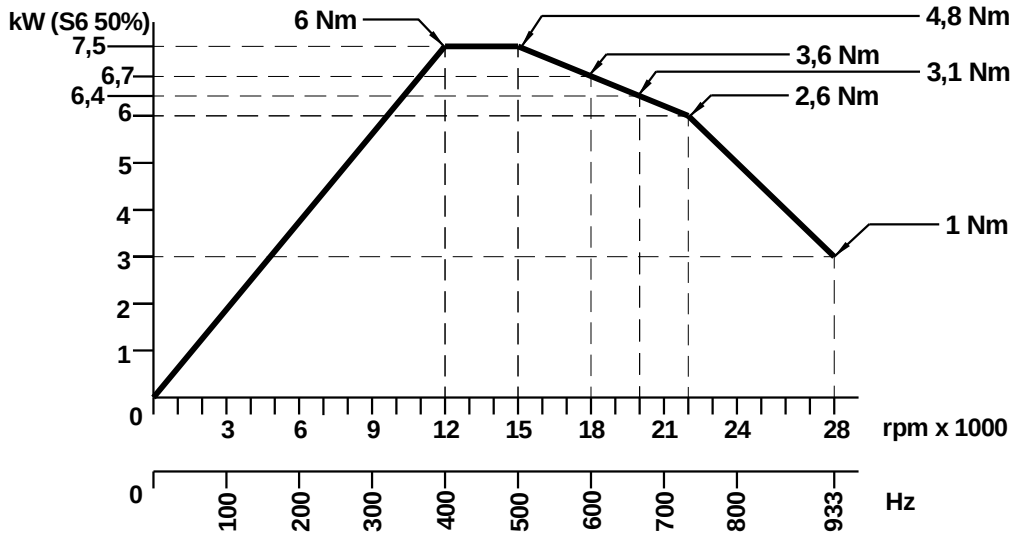
7.3.1 Overall dimensions of ES915 L HSK F63 Long Nose



7.3.2 Specifications and performance of ES915 L 4 Pole, 7.5 kW units

Rated voltage (*)	V	380 ±10%		380 ±10%		380 ±10%		380 ±10%		380 ±10%		380 ±10%	
Rated frequency	Hz	400		500		600		667		733		933	
Rated speed	rpm	12000		15000		18000		20000		22000		28000	
Duty type		S1 cont	S6 50%	S1 cont	S6 50%	S1 cont	S6 50%	S1 cont	S6 50%	S1 cont	S6 50%	S1 cont	S6 50%
Rated power	kW	6,5	7,5	6,5	7,5	6,1	6,7	5,8	6,4	5,5	6	3	3
Rated torque	Nm	5,2	6	4,1	4,8	3,2	3,6	2,8	3,1	2,4	2,6	1	1
Rated current	A	15	18	15	18	14	15,7	13	16	13,1	14,1	7,5	7,5
Rated efficiency h		0,82											
Power factor cos j		0,74											
Number of poles		4											
Insulation class		F											
Type of cooling		Liquid cooling											
Weight of LONG NOSE variant	kg	~ 29											

[(*) from inverter]



Note:

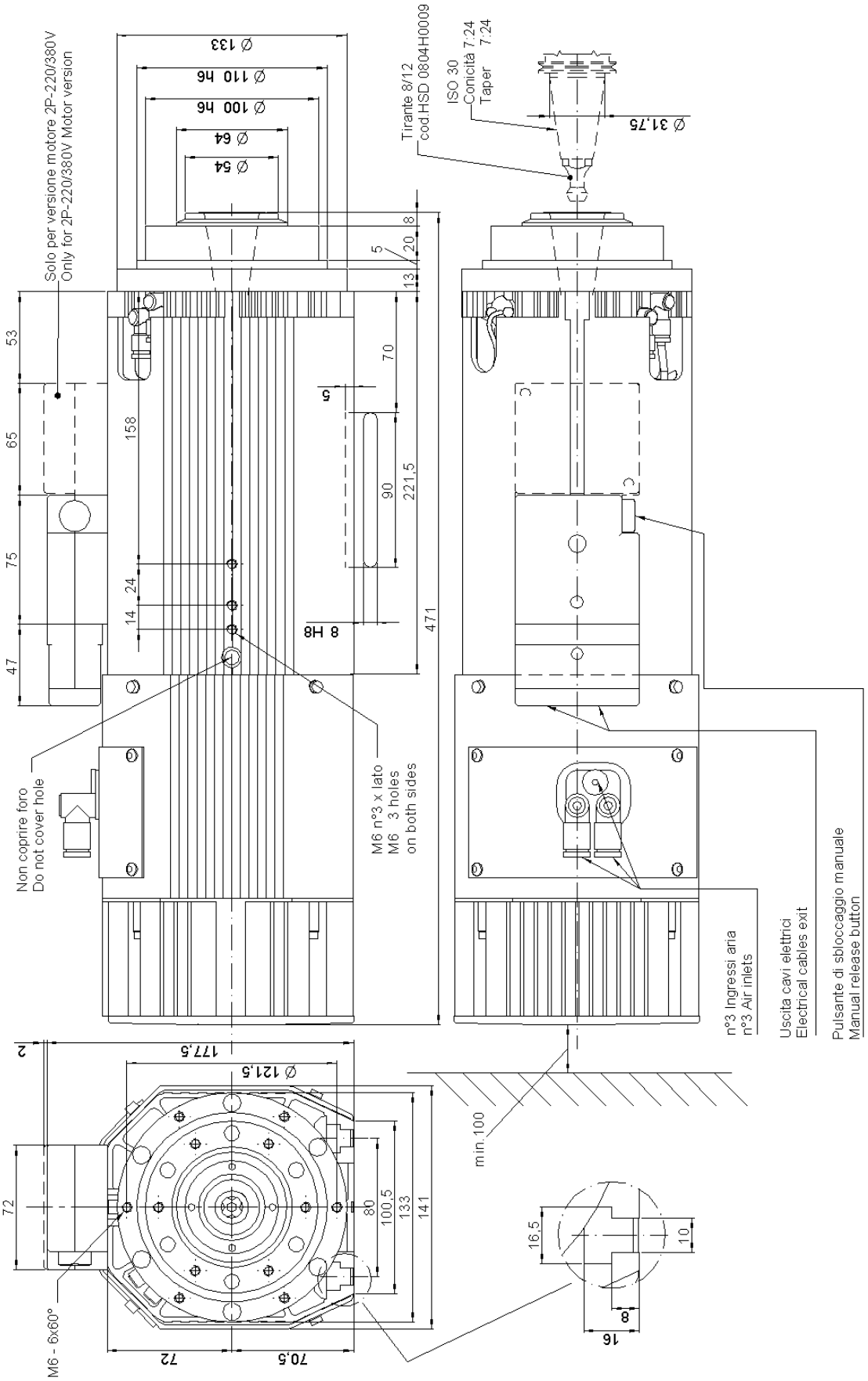
TOOL HOLDER	FRONT BEARINGS	REAR BEARINGS	MAX SPEED
HSK F63	STEEL	STEEL	18000rpm / 600Hz
HSK F63	CERAMIC	STEEL	20000rpm / 667Hz
HSK F63	CERAMIC	CERAMIC	22000rpm / 733Hz
HSK F63	CRONIDUR / CHROMEX	CERAMIC	28000rpm / 933Hz

The 7.5 kW, 4 Pole motor is not available with configurable double voltage power terminals.

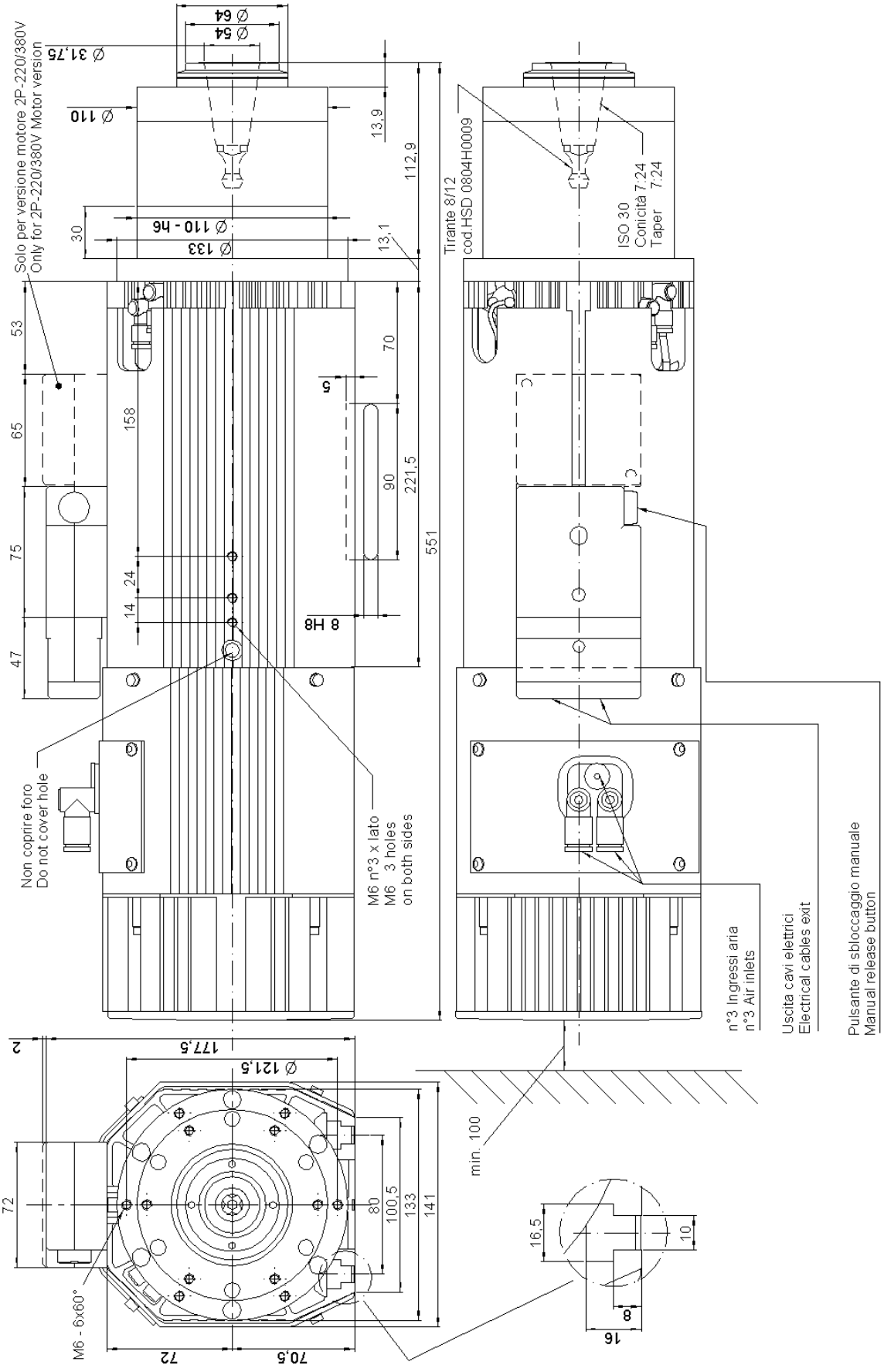
The *maximum continuous current* inverter parameter must match the maximum value of the rated current in the table above (also stated on the motor's data label).

7.4 TECHNICAL SPECIFICATIONS OF ES919

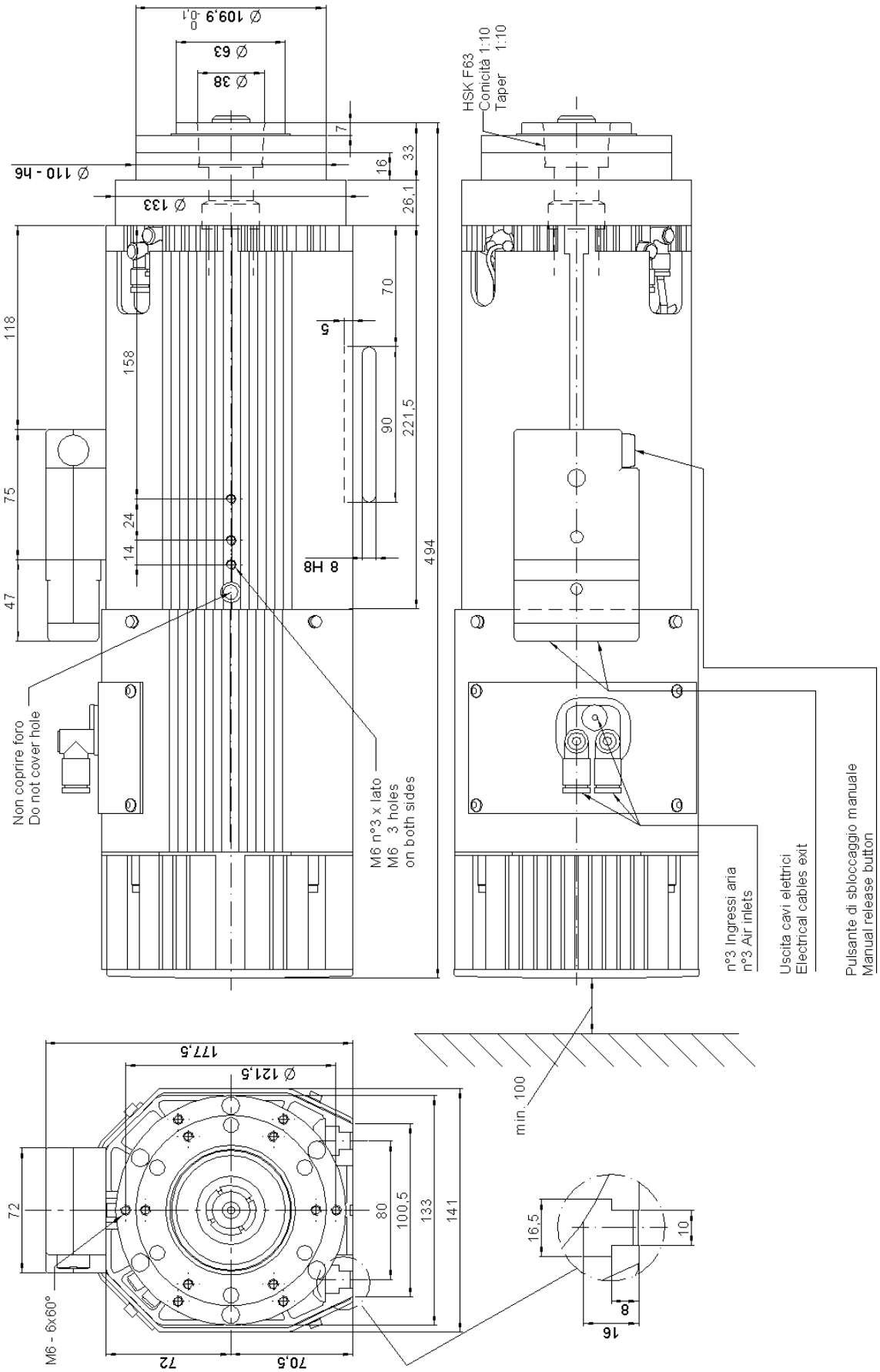
7.4.1 Overall dimensions of ES919 ISO30 Short Nose



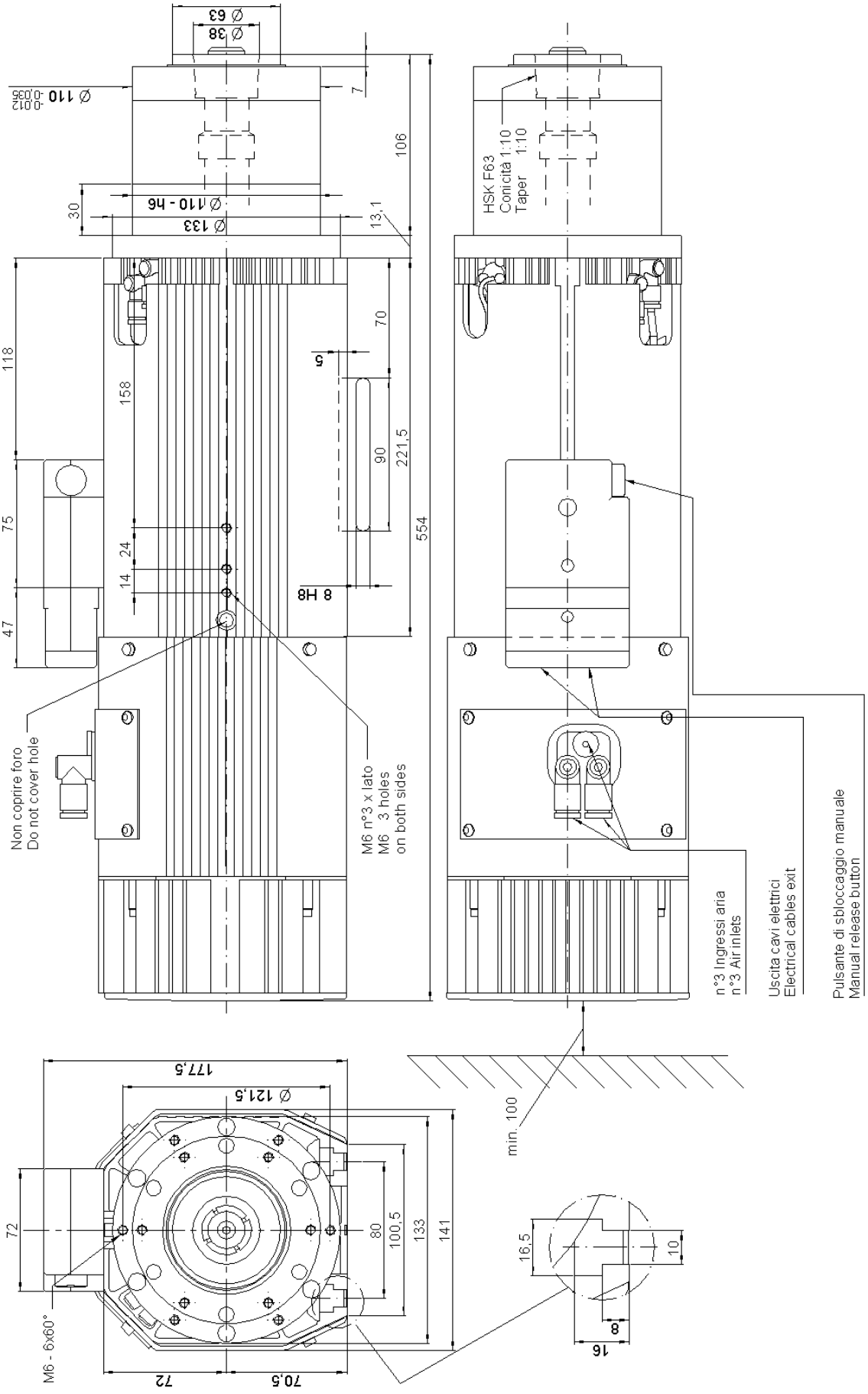
7.4.2 Overall dimensions of ES919 ISO30 Long Nose



7.4.3 Overall dimensions of ES919 HSK F63 Short Nose



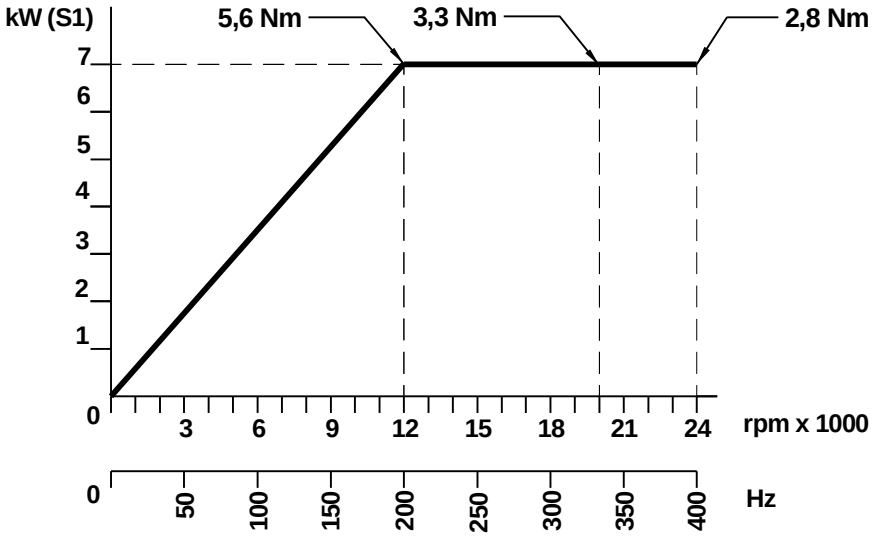
7.4.4 Overall dimensions of ES919 HSK F63 Long Nose



7.4.5 Specifications and performance of ES919 2 Pole, 7 kW units

Terminal connection type	Star	Delta
Rated voltage (*)	380 V ± 10%	220 V ± 10%
Rated current	16 A	28 A
Rated speed	12000 rpm (200 Hz)	
Rated power	7 kW	
Duty type	S1	
Rated torque	5.6 Nm	
Rated efficiency h	0.8	
Power factor cos j	0.8	
Number of poles	2	
Insulation class	H	
Type of cooling	Cooling fan	
Weight of SHORT NOSE variant	~ 26 kg	
Weight of LONG NOSE variant	~ 31 kg	

[(*) from inverter]



Notes:

TOOL HOLDER	FRONT BEARINGS	REAR BEARINGS	MAX SPEED
ISO30	STEEL	STEEL	20000rpm / 333Hz
ISO30	CERAMIC	STEEL	24000rpm / 400Hz
ISO30	CERAMIC	CERAMIC	24000rpm / 400Hz
ISO30	CRONIDUR / CHROMEX	CERAMIC	28000rpm / 467Hz

The 7 kW 2 Pole motor is also available in a configurable double voltage version.

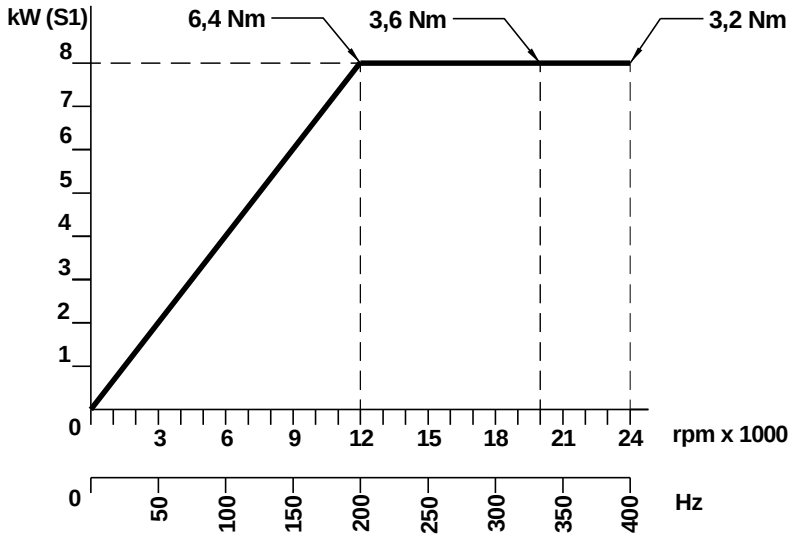
<u>Configurable models only:</u> Check that the power terminals are correctly wired for the supply voltage before installing the unit.

The *maximum continuous current* inverter parameter must match the rated current value in the table above (also stated on the motor's data label).
<u>Select the right value depending on whether the connection is star or delta.</u>

7.4.6 Specifications and performance of ES919 2 Pole, 8 kW units

Terminal connection type	Star	Delta
Rated voltage (*)	380 V ± 10%	220 V ± 10%
Rated current	18 A	32 A
Rated speed	12000 rpm (200 Hz)	
Rated power	8 kW	
Duty type	S1	
Rated torque	6.4 Nm	
Rated efficiency h	0.8	
Power factor cos j	0.8	
Number of poles	2	
Insulation class	H	
Type of cooling	Cooling fan	
Weight of SHORT NOSE variant	~ 26 kg	
Weight of LONG NOSE variant	~ 31 kg	

[(*) from inverter]



Notes:

TOOL HOLDER	FRONT BEARINGS	REAR BEARINGS	MAX SPEED
ISO30	STEEL	STEEL	20000rpm / 333Hz
ISO30	CERAMIC	STEEL	24000rpm / 400Hz
ISO30	CERAMIC	CERAMIC	24000rpm / 400Hz
ISO30	CRONIDUR / CHROMEX	CERAMIC	28000rpm / 467Hz

The 8 kW 2 Pole motor is also available in a configurable double voltage version.

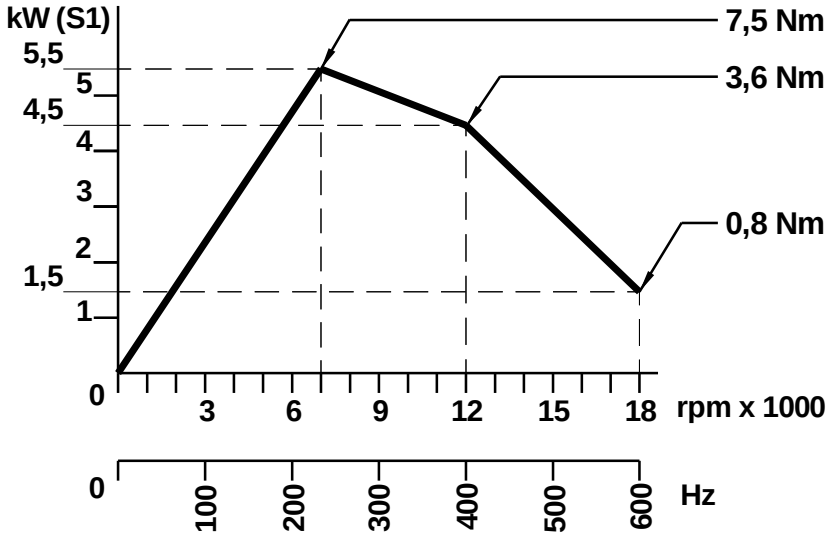
<u>Configurable models only:</u> Check that the power terminals are correctly wired for the supply voltage before installing the unit.

The *maximum continuous current* inverter parameter must match the rated current value in the table above (also stated on the motor's data label).
<u>Select the right value depending on whether the connection is star or delta.</u>

7.4.7 Specifications and performance of ES919 4 Pole, 5.5 kW units

Rated voltage (*)	**380 V ± 10%**	**380 V ± 10%**	**380 V ± 10%**
Rated frequency	**233 Hz**	**400 Hz**	**Hz 600**
Rated speed	**7000 rpm**	**12000 rpm**	**18000 rpm**
Rated power	**5.5 kW**	**4.5 kW**	**1.5 kW**
Duty type	**S1**		
Rated torque	**7.5 Nm**	**3.6 Nm**	**0.8 Nm**
Rated current	**15 A**	**14 A**	**6.5 A**
Rated efficiency h	**0,8**		
Power factor cos j	**0,8**		
Number of poles	**4**		
Insulation class	**H**		
Type of cooling	**Cooling fan**		
Weight	**~ 26 kg**		

[(*) from inverter]



Notes:

TOOL HOLDER	FRONT BEARINGS	REAR BEARINGS	MAX SPEED
ISO30	STEEL	STEEL	18000rpm / 600Hz
ISO30	CERAMIC	STEEL	18000rpm / 600Hz

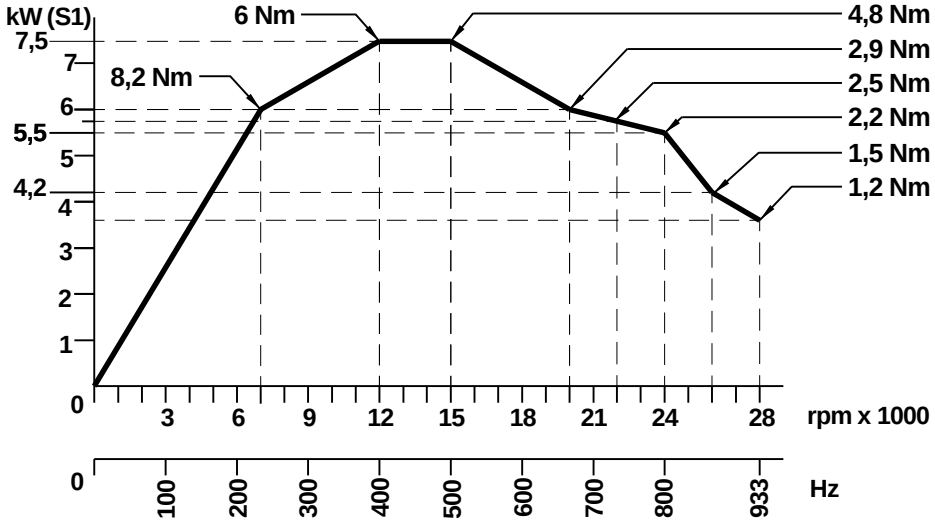
The 5.5 kW, 4 Pole motor is not available with configurable double voltage power terminals.

The *maximum continuous current* inverter parameter must match the maximum value of the rated current in the table above (also stated on the motor's data label).

7.4.8 Specifications and performance of ES919 4 Pole, 7.5 kW units

Rated voltage (*)	**V**	**225 ± 10%**	**380 ± 10%**	**380 ± 10%**	**380 ± 10%**	**380 ± 10%**	**380 ± 10%**	**380 ± 10%**	**380 ± 10%**
Rated frequency	**Hz**	**233**	**400**	**500**	**667**	**733**	**800**	**867**	**933**
Rated speed	**rpm**	**7000**	**12000**	**15000**	**20000**	**22000**	**24000**	**26000**	**28000**
Rated power	**kW**	**6**	**7.5**	**7.5**	**6**	**5.75**	**5.5**	**4.2**	**3.6**
Duty type		**S1**							
Rated torque	**Nm**	**8.2**	**6**	**4.8**	**2.9**	**2.5**	**2.2**	**1.5**	**1.2**
Rated current	**A**	**25**	**20**	**17**	**15**	**13**	**13**	**10**	**11.5**
Rated efficiency h		**0,8**							
Power factor cos j		**0,8**							
Number of poles		**4**							
Insulation class		**F**							
Type of cooling		**Cooling fan**							
Weight of SHORT NOSE variant		**~ 26 kg**							
Weight of LONG NOSE variant		**~ 31 kg**							

[(*) from inverter]



Notes:

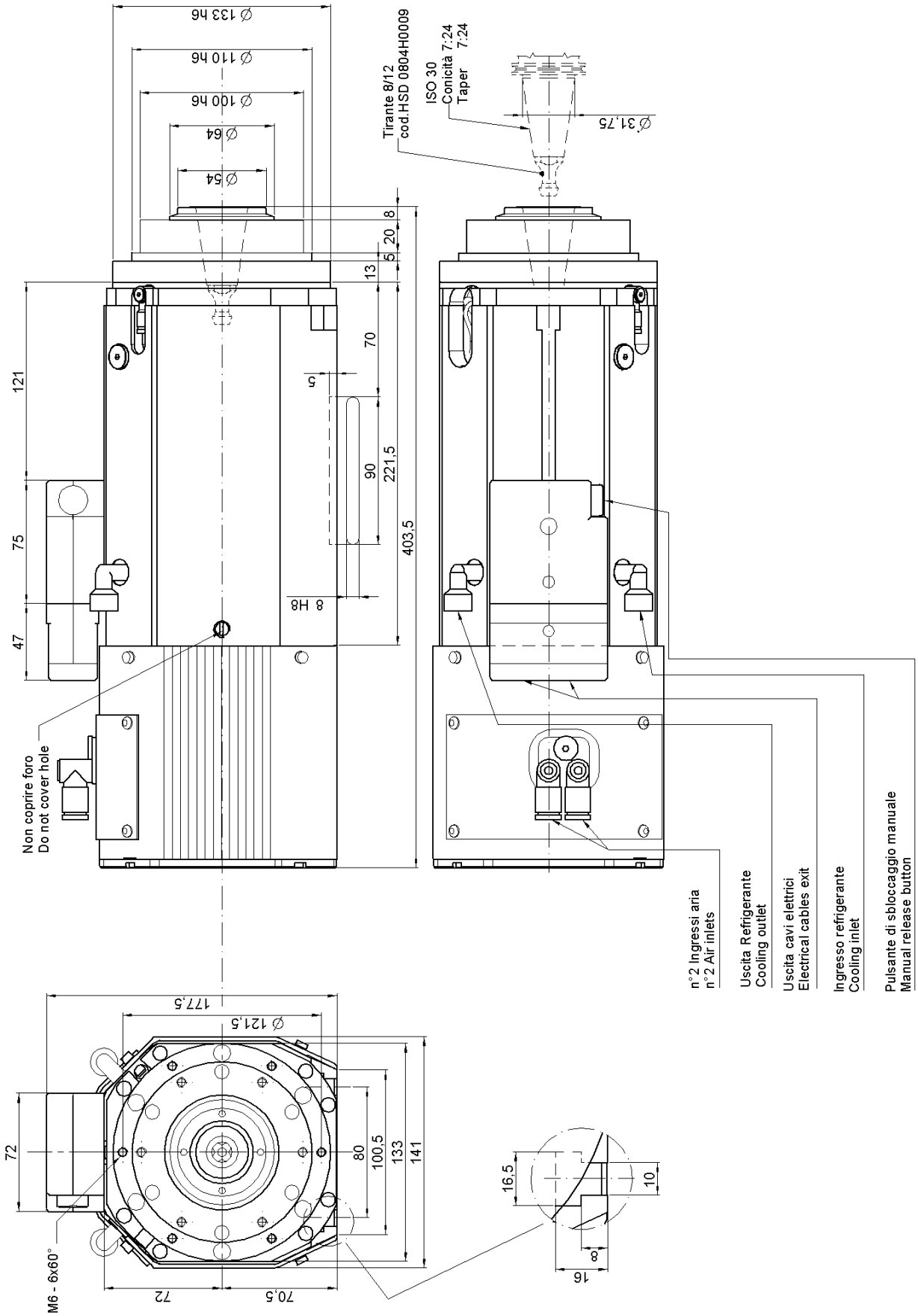
TOOL HOLDER	FRONT BEARINGS	REAR BEARINGS	MAX SPEED
HSK F63	STEEL	STEEL	18000rpm / 600Hz
HSK F63	CERAMIC	STEEL	20000rpm / 667Hz
HSK F63	CERAMIC	CERAMIC	22000rpm / 733Hz
HSK F63	CRONIDUR / CHROMEX	CERAMIC	26000rpm / 867Hz
ISO30	STEEL	STEEL	20000rpm / 667Hz
ISO30	CERAMIC	STEEL	24000rpm / 800Hz
ISO30	CERAMIC	CERAMIC	24000rpm / 800Hz
ISO30	CRONIDUR / CHROMEX	CERAMIC	28000rpm / 933Hz

The 7.5 kW, 4 Pole motor is not available with configurable double voltage power terminals.

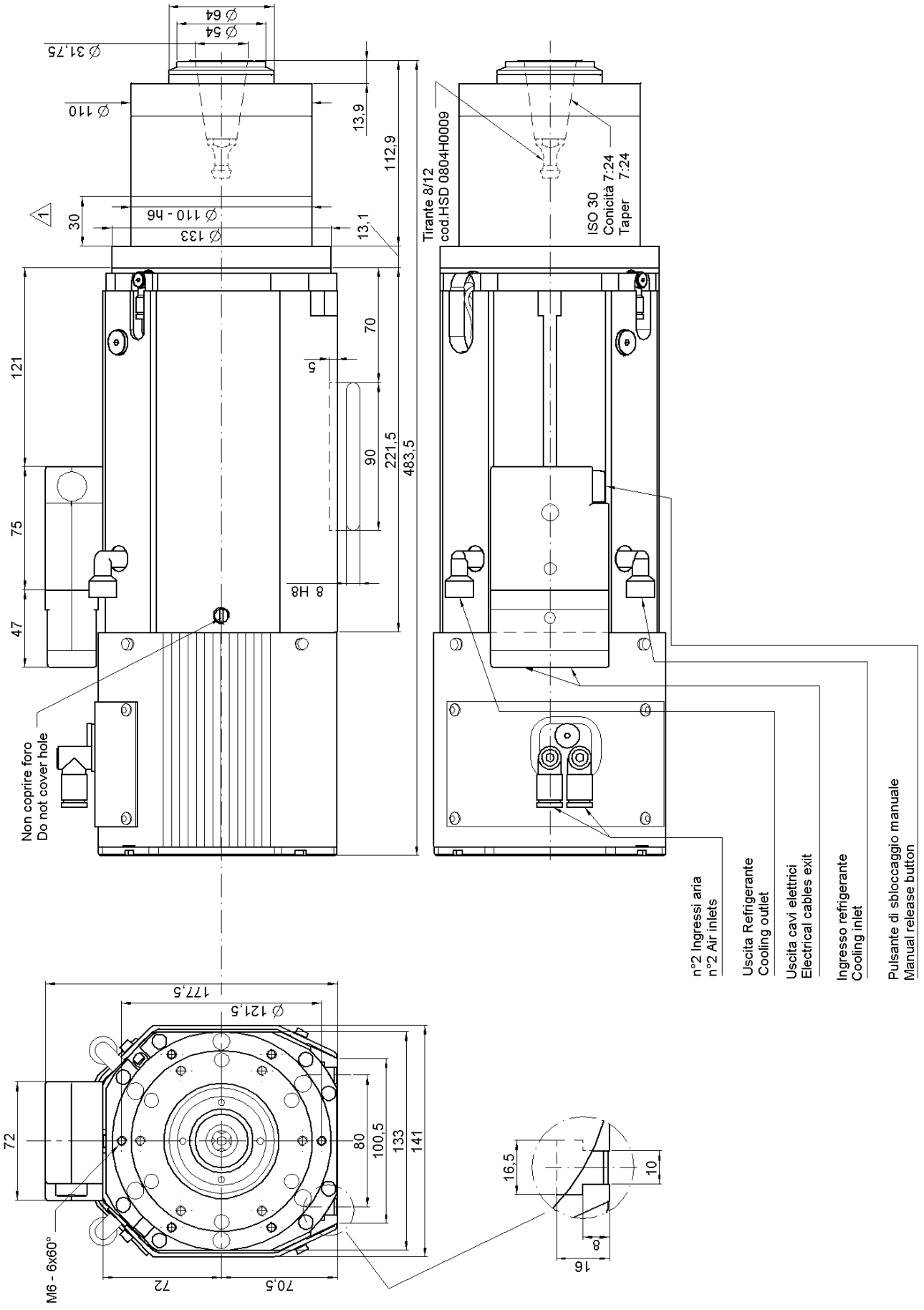
The *maximum continuous current* inverter parameter must match the maximum value of the rated current in the table above (also stated on the motor's data label).

7.5 TECHNICAL SPECIFICATIONS OF ES919 L

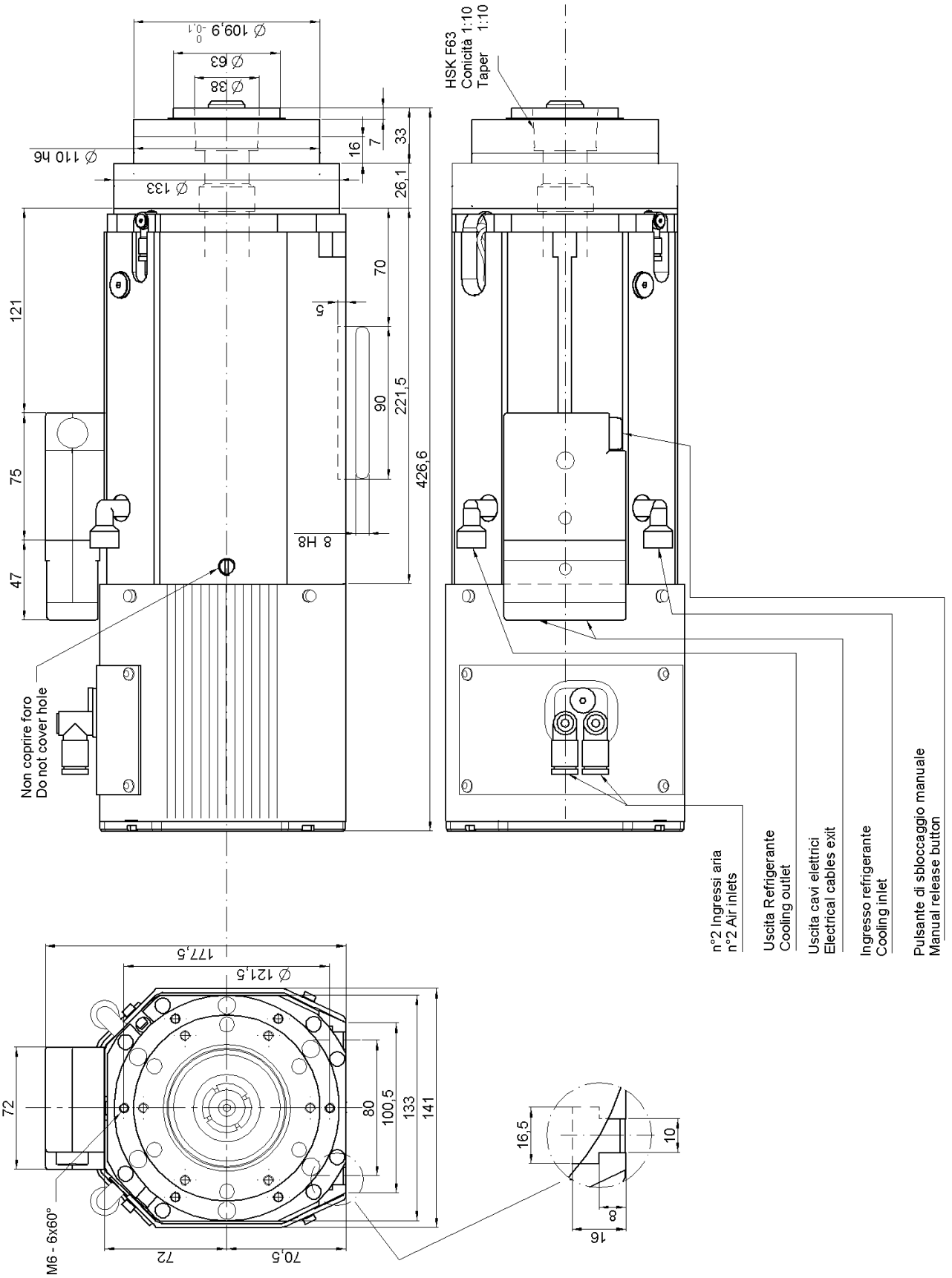
7.5.1 Overall dimensions of ES919 L ISO30 Short Nose



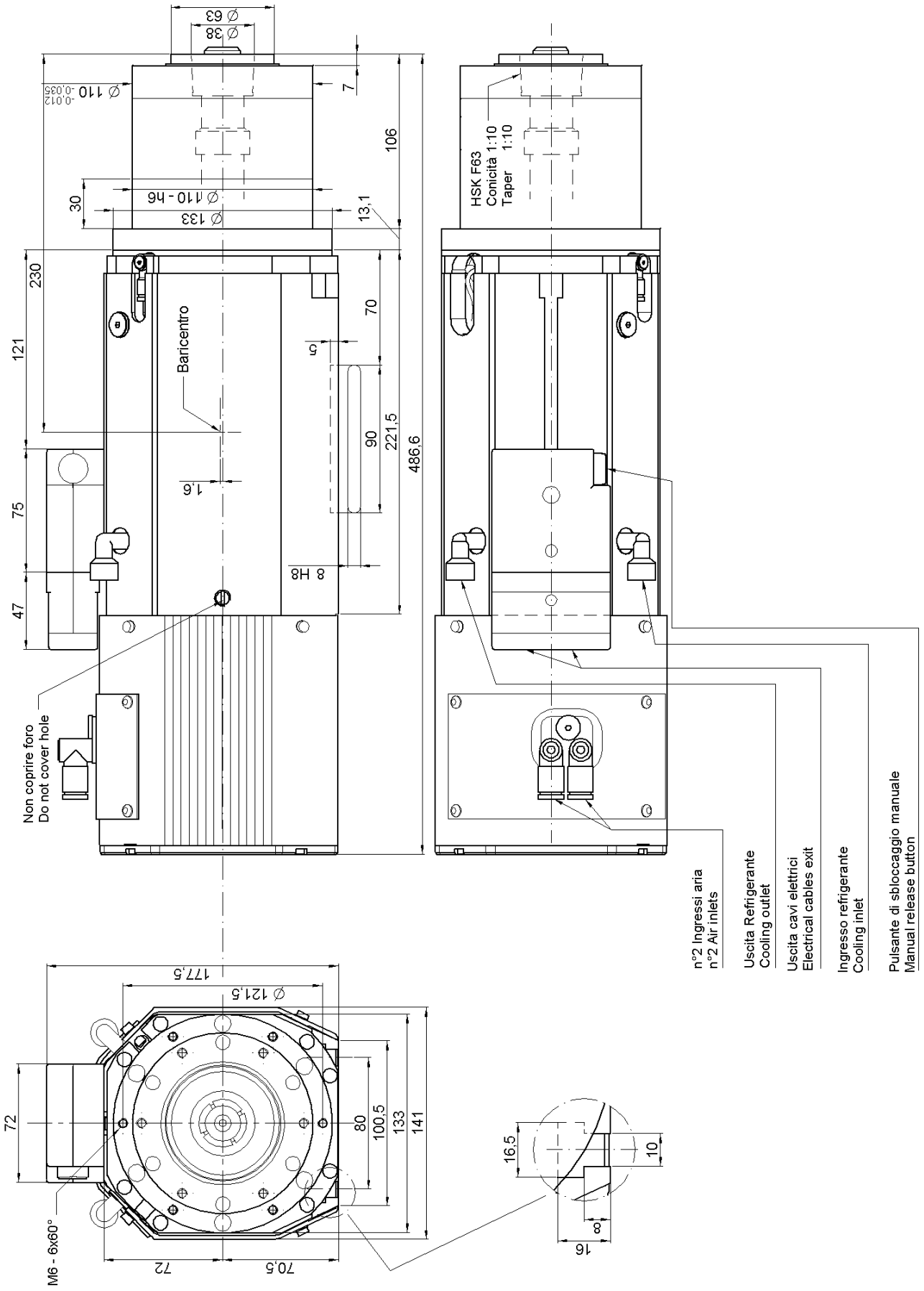
7.5.2 Overall dimensions of ES919 L ISO30 Long Nose



7.5.3 Overall dimensions of ES919 L HSK F63 Short Nose



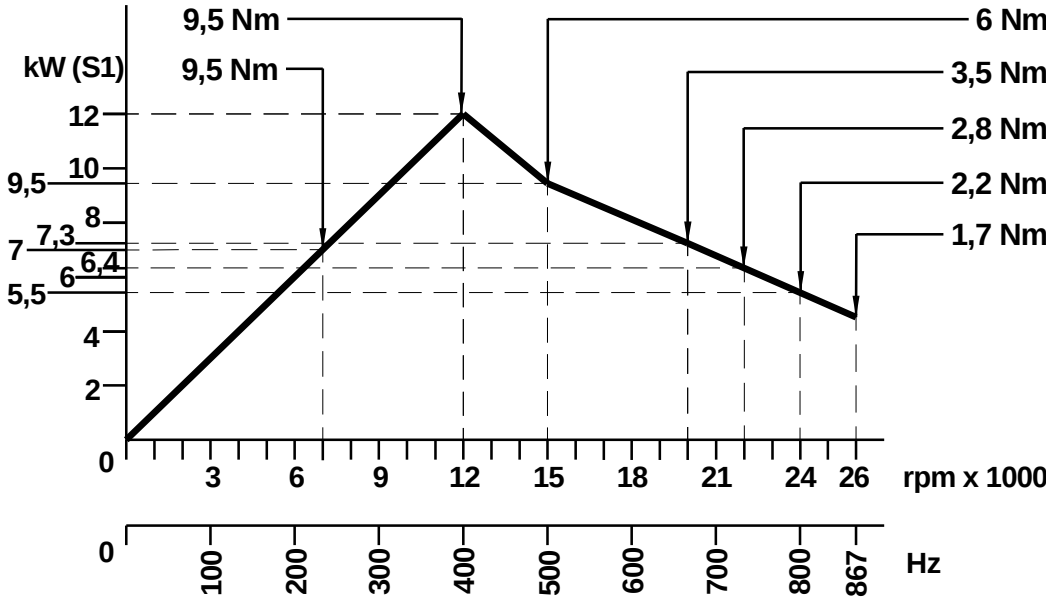
7.5.4 Overall dimensions of ES919 L HSK F63 Long Nose



7.5.5 Specifications and performance of ES919 L 4 Pole, 12 kW units

Rated voltage (*)	**V**	**225 ± 10%**	**380 ± 10%**	**380 ± 10%**	**380 ± 10%**	**380 ± 10%**	**380 ± 10%**	**380 ± 10%**
Rated frequency	**Hz**	**233**	**400**	**500**	**667**	**733**	**800**	**867**
Rated speed	**rpm**	**7000**	**12000**	**15000**	**20000**	**22000**	**24000**	**26000**
Rated power	**kW**	**7**	**12**	**9,5**	**7,3**	**6,4**	**5,5**	**4,6**
Duty type		**S1**						
Rated torque	**Nm**	**9,5**	**9,5**	**6**	**3,5**	**2,8**	**2,2**	**1,7**
Rated current	**A**	**27**	**27,5**	**22**	**17**	**16,5**	**14**	**11,8**
Rated efficiency *h*		**0,8**						
Power factor cos *j*		**0,8**						
Number of poles		**4**						
Insulation class		**F**						
Type of cooling		**Liquid**						
Weight of SHORT NOSE variant		**~ 30 kg**						
Weight of LONG NOSE variant		**~ 34 kg**						

[(*) from inverter]



Notes:

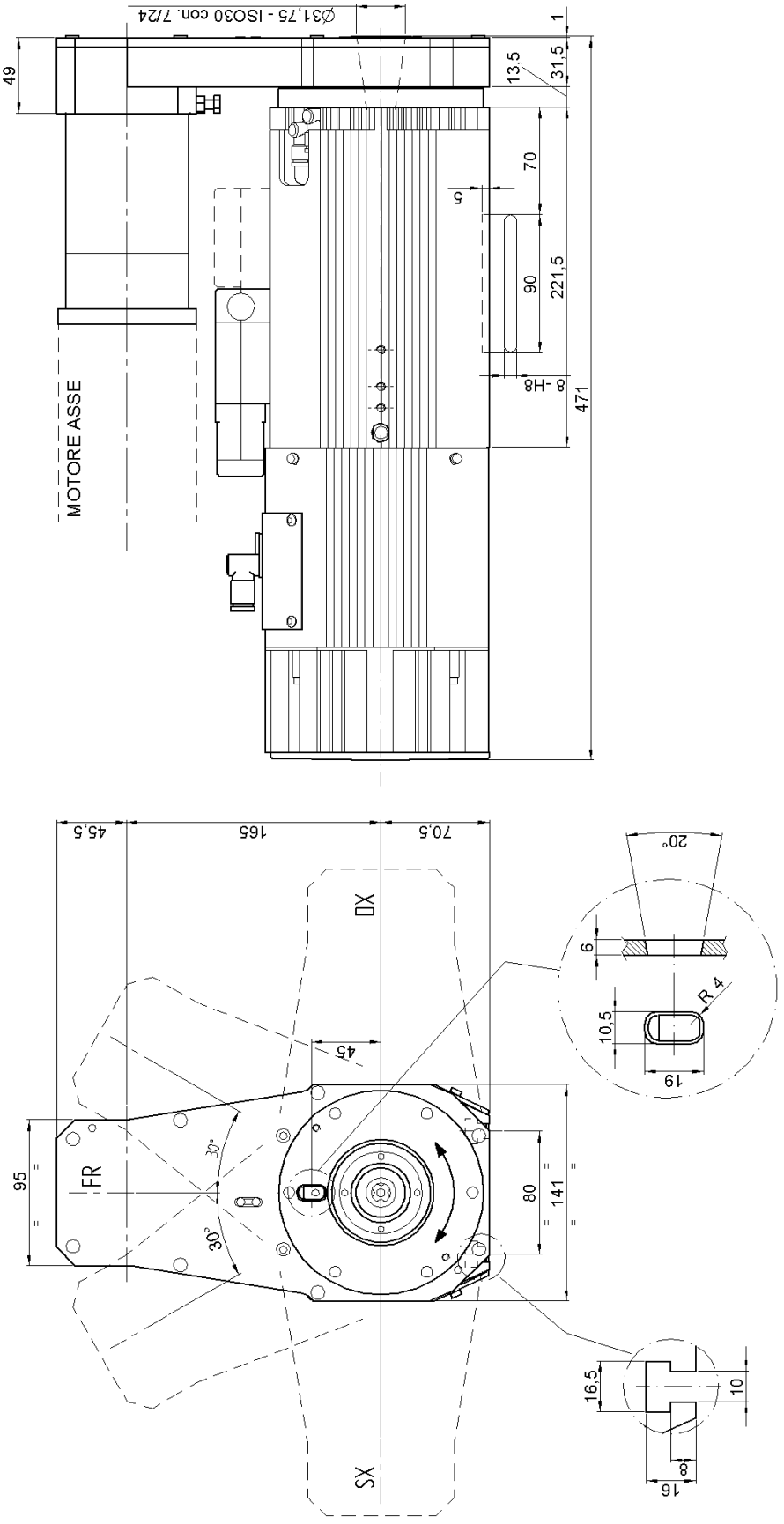
TOOL HOLDER	FRONT BEARINGS	REAR BEARINGS	MAX SPEED
HSK F63	CERAMIC	STEEL	20000rpm / 667Hz
HSK F63	CERAMIC	CERAMIC	22000rpm / 733Hz
HSK F63	CRONIDUR / CHROMEX	CERAMIC	26000rpm / 867Hz
ISO30	CERAMIC	CERAMIC	24000rpm / 800Hz

The 12 kW, 4 Pole motor is not available with configurable double voltage power terminals.

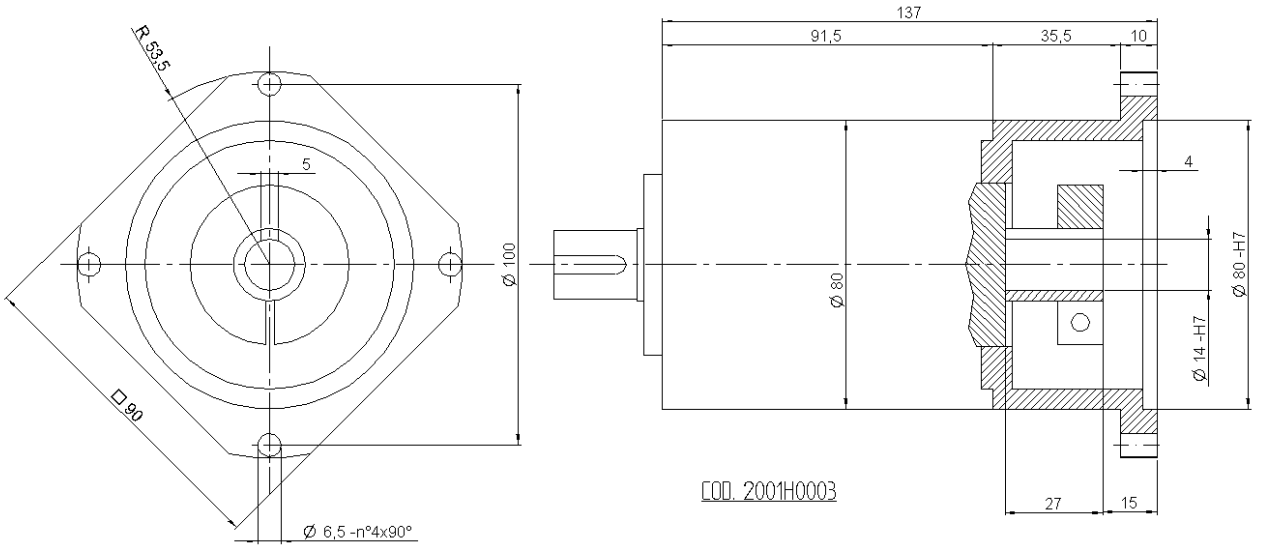
The *maximum continuous current* inverter parameter must match the maximum value of the rated current in the table above (also stated on the motor's data label).

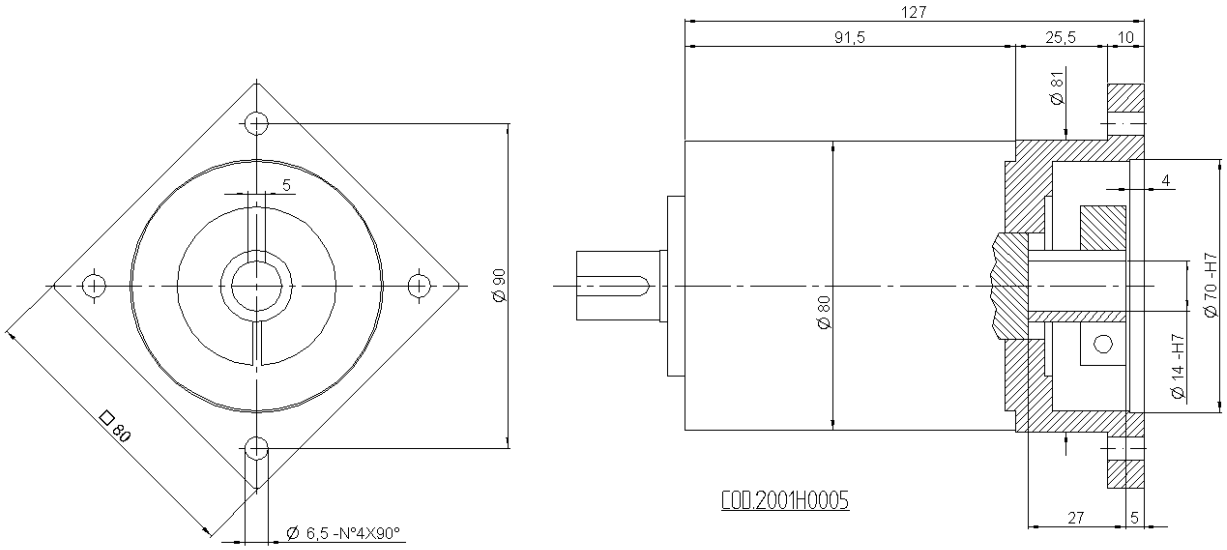
7.6 TECHNICAL SPECIFICATIONS OF BELT DRIVEN C AXIS UNIT

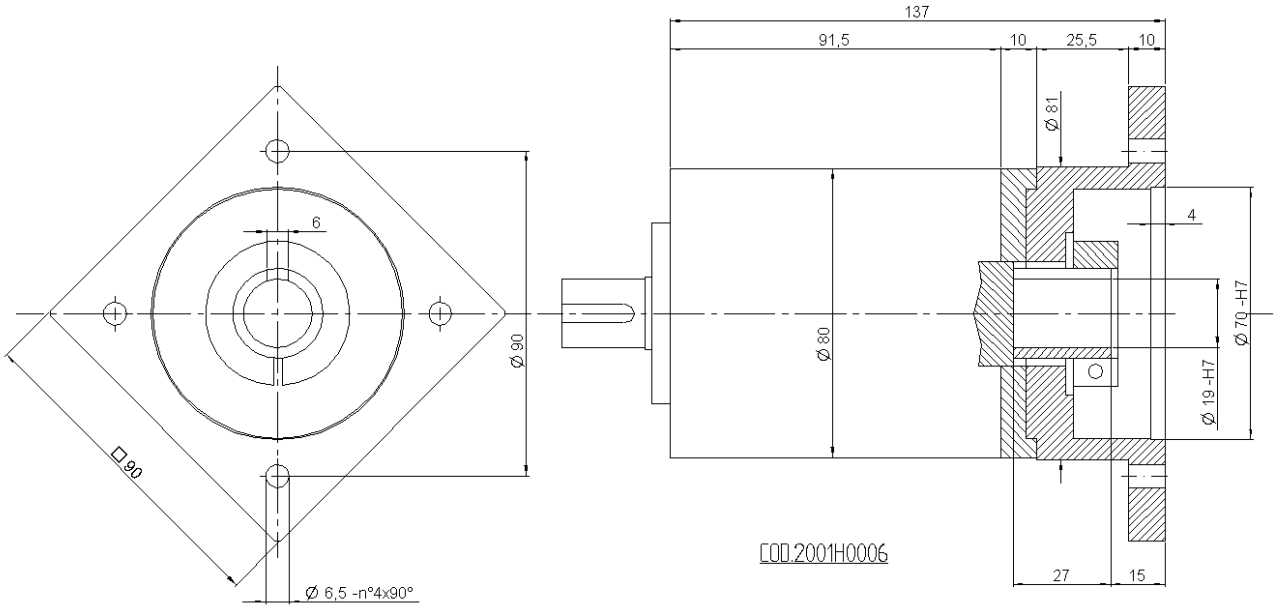
7.6.1 Overall dimensions of ES919 ISO30 Short Nose with belt driven C Axis unit



7.6.2 Overall dimensions of gear units







7.6.3 Technical specifications for belt driven C axis unit

Syncroflex ATS5 transmission belt drive.

***Main specifications for a servomotor giving 1.27 Nm at 3000 rpm** (*)*

Rated torque	**60 Nm** (*)
Starting torque	**80 Nm** (*)
Overall gear ratio	**1 / 60**
Total mechanical efficiency	**0.8**
Epicyclic gear backlash	**5'**
Positioning precision	**10'**
Gearbox input rpm	**3000 rpm (4000 rpm max)**
Rated gearbox input torque	**2.5 Nm**
Starting gearbox input torque	**4 Nm**
Weight	**4 Kg (without servomotor)**

(*) Technical specifications depend on the type of servomotor installed by the customer.

i Use of the belt driven C axis unit is described in section 13.3

i **ONLY FOR UNITS WITH *BELT DRIVEN C AXIS*:**
On models with belt driven C axis, the spindle shaft kit must be replaced by HSD technical assistance. Replacement by the customer is not permitted.

7.7 TECHNICAL SPECIFICATIONS OF COMPONENTS

7.7.1 Bearings

The front of the shaft is supported by a pair of precision angular contact ball bearings, 40 mm diameter for versions with ISO 30 tool fittings and 45 mm diameter for versions with HSK F63 fittings.
The rear of the shaft is supported by a pair of precision angular contact ball bearings of 30 mm diameter.
All bearing pairs are pre-loaded and lubricated for life with special high speed grease.

The bearings are lubricated for life and do not require greasing.

7.7.2 Tool holder locking and release device

The tool holder is mechanically locked by springs that develop an axial force of:

ELECTRO-SPINDLE MODEL	AXIAL SPRING FORCE	AXIAL FORCE ON TOOL HOLDER
ES915 ISO 30	3200 N ± 10%	3000 N ± 10%
ES919 ISO 30	3500 N ± 10%	3200 N ± 10%
ES919 HSK F63	3850 N ± 10%	11000 N ± 10%

Tool release is achieved by the movement of a single acting, double stage, compressed air cylinder operating at a pressure of 7 bar (100 PSI).

The axial force applied to the tool holder by the locking springs is guaranteed to remain constant for a minimum of 2,000,000 tool change cycles.

1 tool change cycle = tool locked / tool released / tool locked

7.7.3 Automatic cleaning of the tool holder and internal pressurization

The tool holder cone and its conical housing in the spindle shaft are automatically cleaned by the air purge during the tool change phase.

This prevents dirt from building up on the mating surface. The condition of the surface should nevertheless be regularly checked as described in section 12.1 on scheduled maintenance.

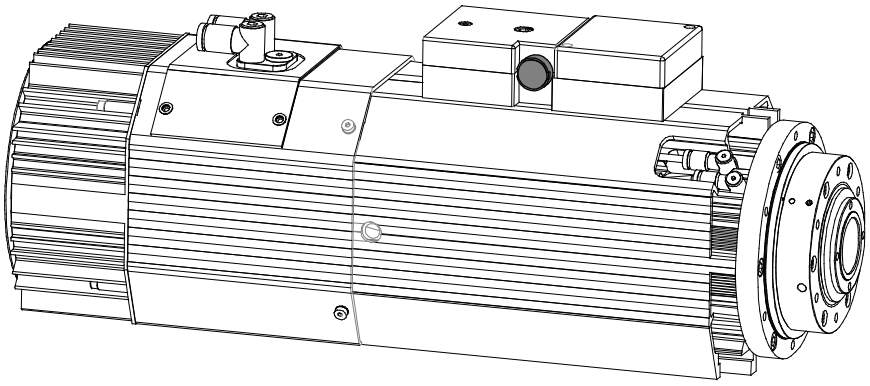
The pneumatic circuit for internal pressurization prevents dirt from entering the electro-spindle. This system is fed at 4 bar (58 PSI). Waste air is exhausted through the forward facing labyrinth ports in the spindle nose.

Compressed air at 4 bar (58 PSI) must always be delivered to the electro-spindle even when it is not operating.

7.7.4 Proximity sensors

Sensor type: PNP proximity; NO (Normally Open)	
Voltage	10 - 30 V (DC)
Maximum load	200 mA
No-load consumption	< 10 mA
Rated read distance	0.8 MM

7.7.5 Tool release button



Push-button specifications	
Rated voltage (DC)	24 V
Maximum current	100 mA

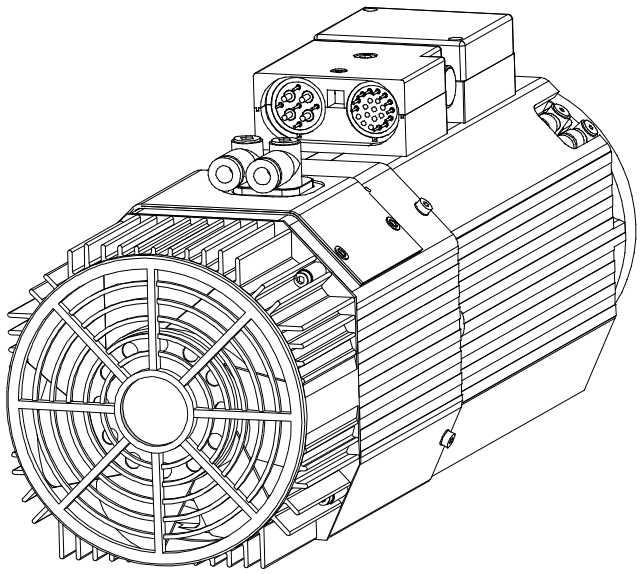
Lamp specifications	
Rated voltage (DC)	24 V
Rated power	0.7 W
Rated current	29 mA

7.7.6 Thermal switch

The electro-spindle motor windings are protected by a normally closed bi-metallic switch encased in the stator. A second bi-metallic switch protects the cooling fan motor.
The two switches are connected in series (see Figure 11.3).
The switches open if temperature reaches a potentially damaging level and close again when temperature drops to normal operating levels.
This thermal switch system must be connected in series to the machine's safety stop system as shown in section 9.6.4 .
The series of bi-metallic switches has the following specifications:

DC power	48 VDC MAX
AC power	230 VAC MAX
Current	1.6 A MAX

7.7.7 Cooling fan



The electro-spindle is cooled by a rear mounted fan.
The fan must be powered up even when the spindle is not operating.
The fan is independent of the spindle shaft. This solution gives improved efficiency compared to shaft mounted fans.
If the fan motor overheats, the fan's own thermal switch, wired in series with the main electro-spindle switch, shuts the unit down. Operation is re-enabled when the fan's motor drops to a safe operating temperature again.

Power	230 ± 10% VAC	
Cycles/second	50 Hz	60 Hz
Consumption	45 W	39 W
Thermal switch:	Bi-metallic switch	

The fan's thermal switch only detects fan motor overheating. It cannot detect that the fan is prevented from turning, unless this causes overheating. For this reason, check the condition of the fan regularly.

The fan must remain on at all times when the machine is active even if the electro-spindle is not operating.

§ 8 TRANSPORT AND MOVING

Lifting and moving electro-spindles can create situations of risk to persons nearby. Always follow the instructions provided by HSD and always use suitable lifting equipment.

Installation and assembly work must be performed only by specialist technicians.

Always use great care in lifting and moving electro-spindles and their components. Avoid impacts that can damage the body which could cause malfunctions.

> IT IS THE RESPONSIBILITY OF THE CUSTOMER TO ENSURE THAT THE LIFTING EQUIPMENT, CABLES, SLINGS AND CHAINS USED IS SUITABLE FOR THE PURPOSE IN TERMS OF FUNCTIONING AND LOAD CAPACITY.

8.1 STORAGE

If the electro-spindle is to be stored for any length of time, make sure that it is protected against the elements and in particular against damp, dust, and other forms of damage by the atmosphere or storage environment.
Check on the general condition of the electro-spindle periodically to prevent deterioration. Turn the spindle shaft by hand about once a month to keep the bearings free.

STORAGE TEMPERATURE: **from –5°C (+23°F) to +55°C (+131°F)**
NON-CONDENSING RELATIVE HUMIDITY: **from 5% to 90%**

8.2 LIFTING THE ELECTRO-SPINDLE IN ITS CRATE

The electro-spindle is shipped in a wooden crate packed with expanded polystyrene foam. The electro-spindle itself is packed in a VCI plastic bag and is coated in protective grease to prevent corrosion. Use a clean cloth to wipe the protective grease off the new electro-spindle.
(Note: The expanded polystyrene and the protective bag are plastics and must be disposed of as such).

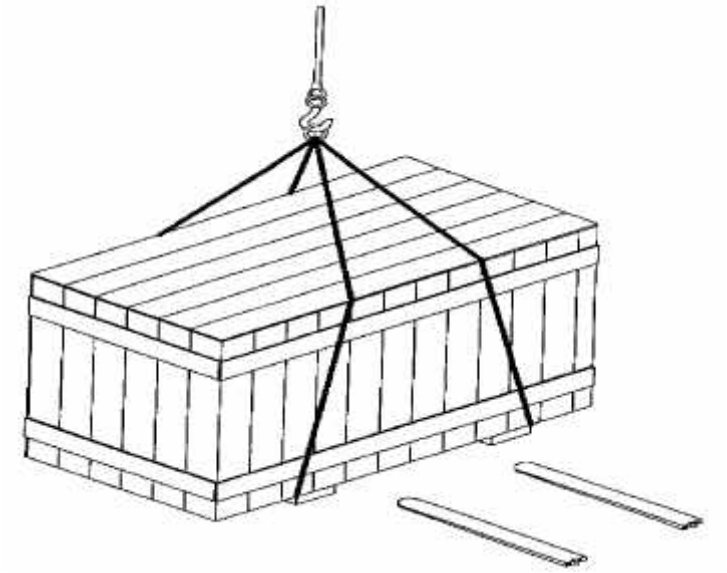


Figure 8.1 Example of how to lift the crate

A label, shown in figure 7.2, is applied to the crate, stating its weight. The box corresponding to the correct weight is checked (25 kg in the example shown).

GROSS WEIGHT				
15		kg		90
25	Ö			110
35				130
45				160
55				215
65				270
75				...

Figure 8.2 Label showing weight of crate

Do not lift the electro-spindle by the cooling fan cover. The cover could break and the electro-spindle could fall, causing serious damage to the unit and injury to the operator.

The lifting diagrams reproduced here are merely examples of possible ways of lifting the electro-spindle. HSD S.p.a. cannot foresee all possible lifting methods and configurations for its electro-spindles.

THIS SYMBOL IS USED TO IDENTIFY POTENTIAL LIFTING POINTS.

§ 9 INSTALLATION

9.1 FIRST CHECK

Before starting installation, check:

- That no part of the electro-spindle has been damaged during transport and/or handling.
- That the connectors are not damaged in any way.

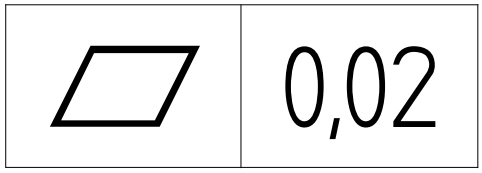
9.2 PREPARATION OF THE EQUIPMENT REQUIRED FOR INSTALLATION ON SITE

All work in preparation for installation of the electro-spindle is the responsibility of the customer (e.g. preparation of electrical power supplies, compressed air etc.).
Make sure that the electrical power line to the electro-spindle is of adequate gauge and power. Connection of the unit to the power supply must only be done by qualified electricians. The customer is responsible for all parts of the electrical power supply to the electro-spindle.
The customer is expressly reminded that the electro-spindle must be correctly connected to earth. Furthermore, the earth connection must comply with applicable regulations in the country in which the unit is installed and must be duly checked and tested by a qualified electrician.
See below for the installation layout and connection diagrams.

9.3 MECHANICAL INSTALLATION

9.3.1 The supporting surface

The supporting surface on which the electro-spindle is fixed must have a flatness better than 0.02 mm.



9.3.2 Positioning the electro-spindle

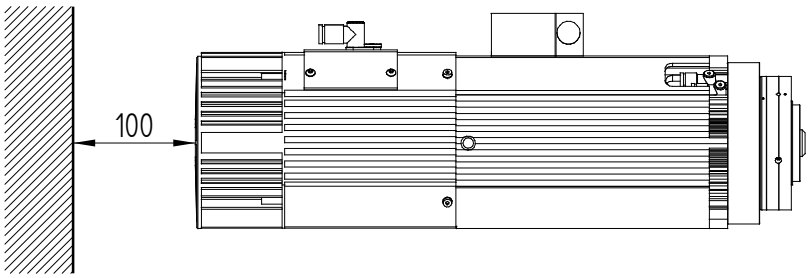


Figure 9.1 Minimum clearance of fan

The electro-spindle must be installed with at least 100 mm of free space behind the cooling fan cover to ensure an adequate flow of cooling air.

9.3.3 Mechanical fixing of the electro-spindle

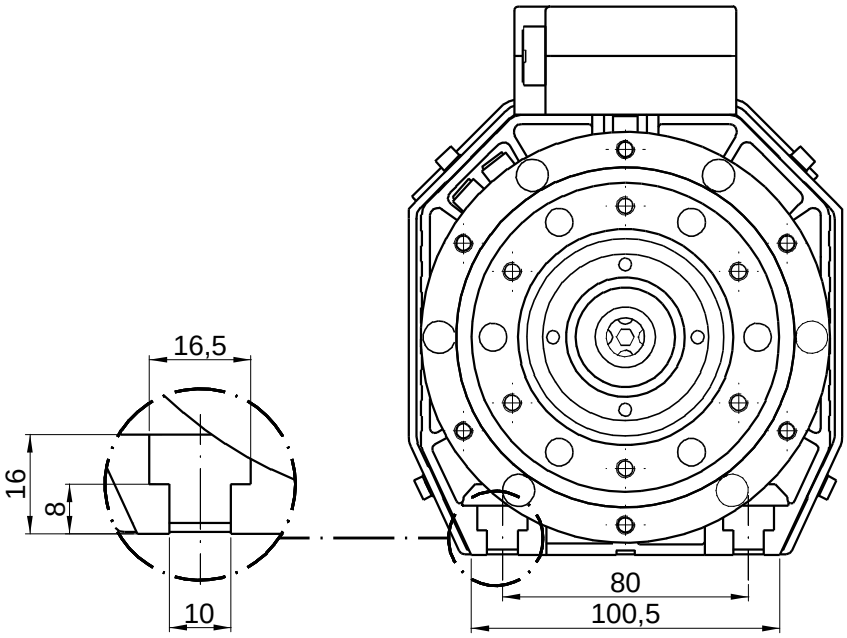


Figure 9.2 T slots for anchoring the electro-spindle

Fix the electro-spindle to the carriage or spindle mounting using M8 bolts and nuts fitted in the T slots and tightened to a torque of 20 Nm. Maximum permitted protrusion of the fixing bolts is 15 mm, as shown in Figure 9.3. Greater protrusion can deform the electro-spindle body and lead to incorrect fixing, reduced machining precision and reduced machining safety.

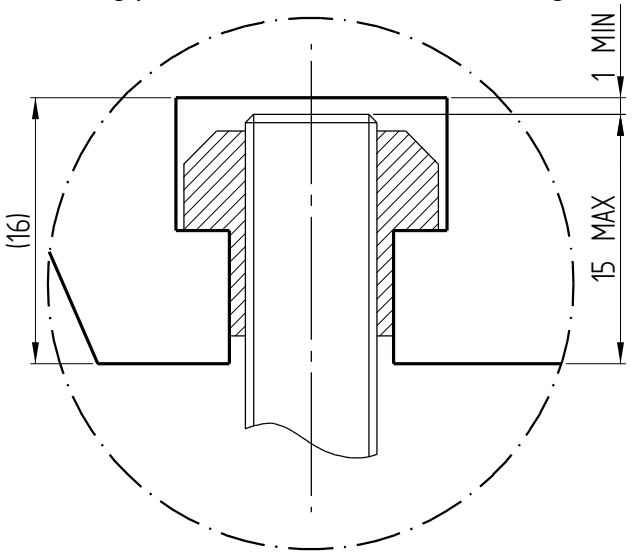


Figure 9.3 Maximum permitted protrusion of bolts in T slots

Maximum protrusion of bolt: 15 mm.

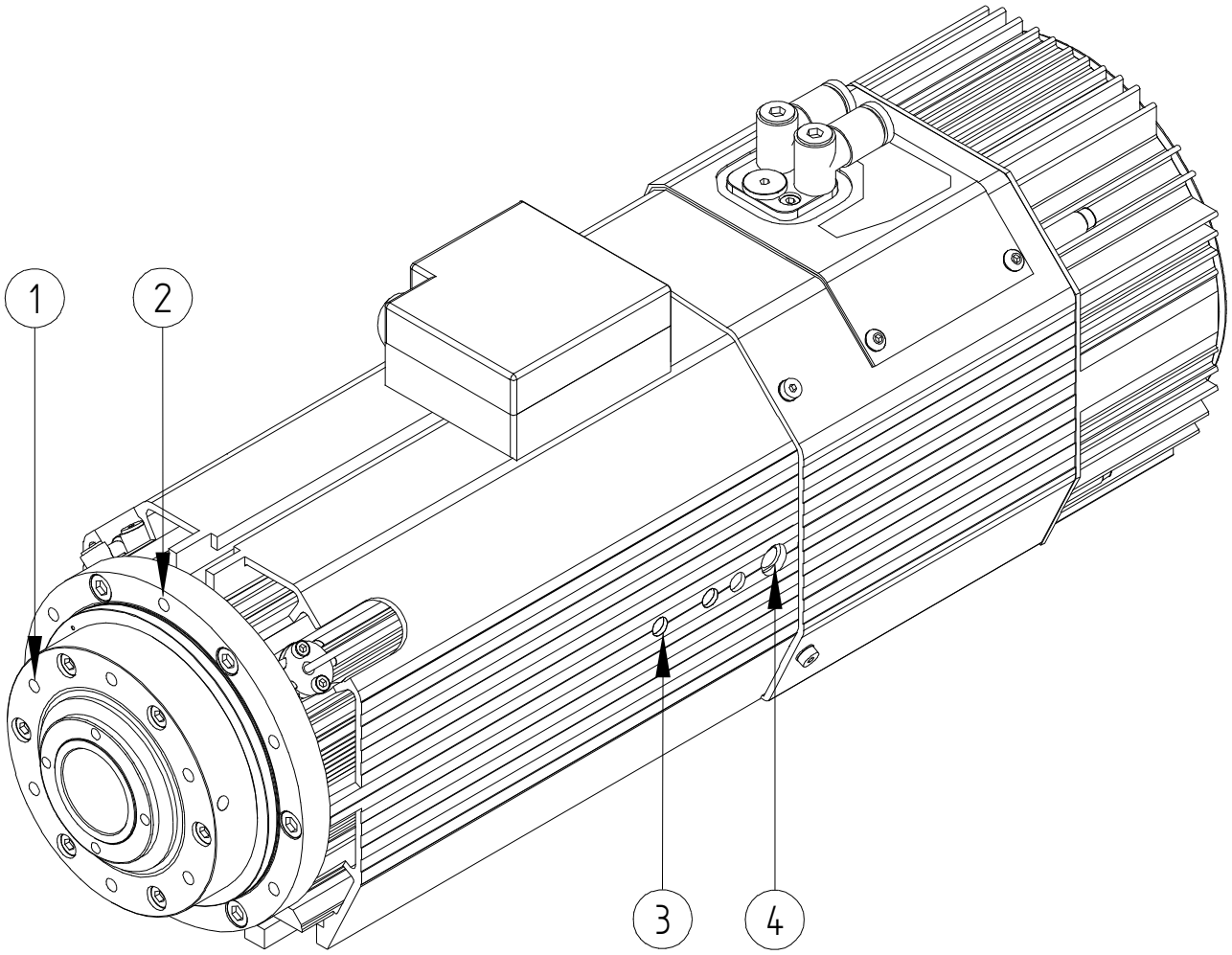
Leave a clearance of at least 1 mm.

Excessive protrusion can deform the electro-spindle body and reduce machining precision and safety.

9.3.4 Threaded service holes

There are a number of M6 threaded holes in the electro-spindle body, located as shown in Figure 9.4.

> Attention: never to block the silenced exhaust air holes (Position 4 in Figure 9.4).



1	Frontal service holes	6
2	C axis fixing holes	6
3	Side service holes	3 (ES919) per side 2 (ES915) per side
4	Silenced exhaust air hole	1 per side

Figure 9.4 Service holes and silenced exhaust air hole

9.4 COMPRESSED AIR CONNECTIONS

9.4.1 Compressed air unions

The compressed air unions are quick-fit unions. They are located as shown in Figure 9.5 and are described in the table below.

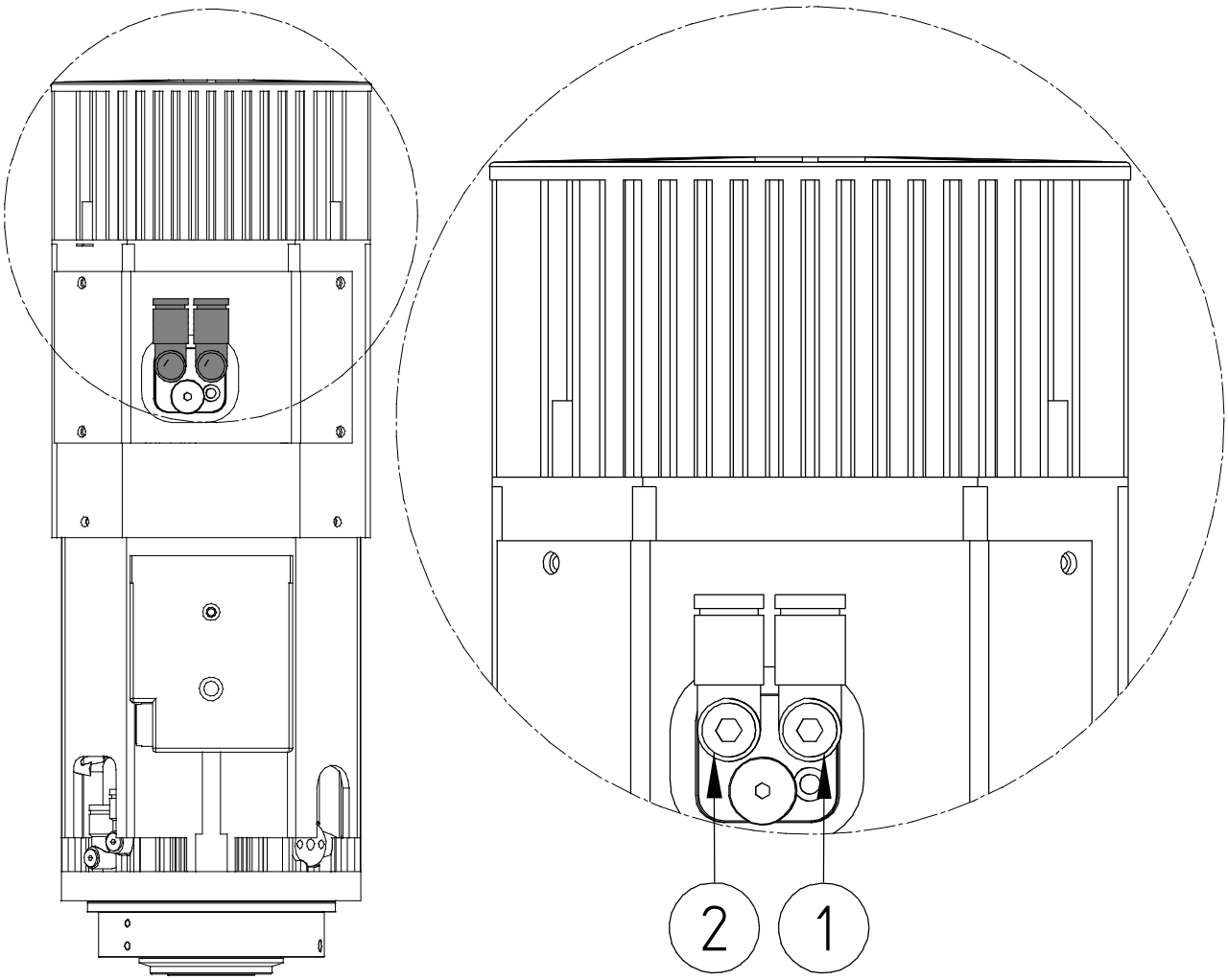


Figure 9.5 Location of the compressed air quick-fit unions

	DESCRIPTION	*PRESSURE (bar / PSI)*	*EXTERNAL HOSE Ø (mm)*
1	**Inlet for pressurization and cone cleaning air**	**4 / 58**	**8**
2	**Tool release air inlet - outlet**	**7 / 100**	**8**

9.4.2 Functional diagram of electro-spindle compressed air connections

Figure 9.6 shows typical compressed air system connections, to be prepared by the customer. The use of two solenoid valves connected in series reduces the risk of system malfunctions. Though it is very rare for this type of fault to occur, it can have very serious consequences if it does. Redundancy is therefore recommended.

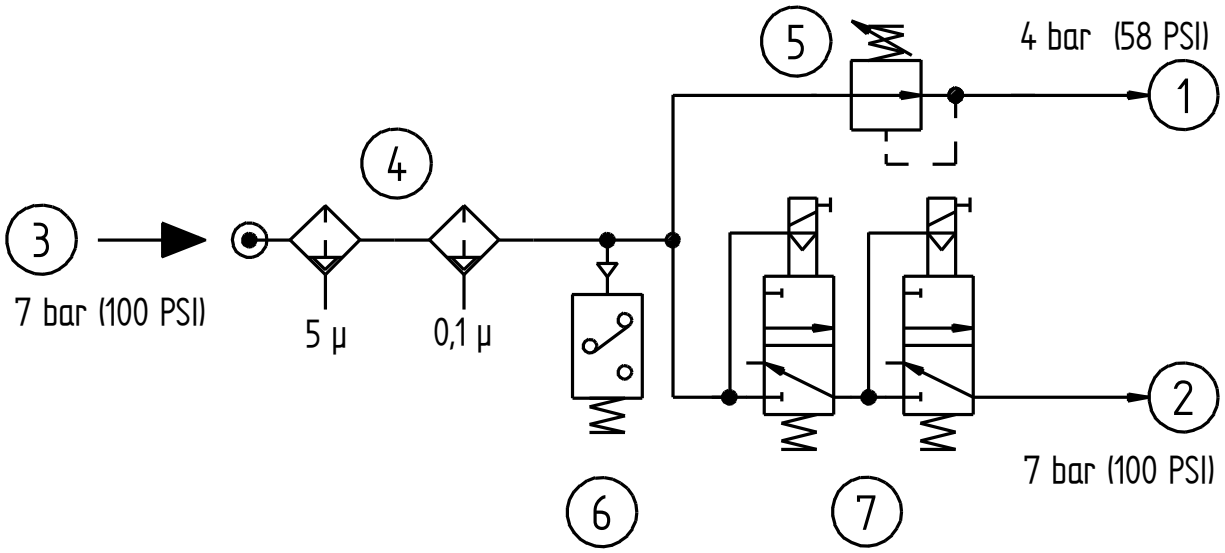


Figure 9.6 Typical compressed air connection diagram

1	Cone cleaning and internal pressurization air inlet (see also n°1 in Figure 9.5)
2	Tool holder release air inlet (see also n°2 in Figure 9.5)
3	Factory air supply inlet
4	Compressed air filtration/drying group with automatic condensate drain: first stage 5µ and second stage 0.1µ
5	4 bar (58 PSI) pressure regulator
6	Pressure switch
7	Pair of 3 way, mono-stable solenoid valves

Use 2 separate circuits to connect the solenoid valves (pos. 7 in Figure 9.6) to the numeric control unit or manual control system.

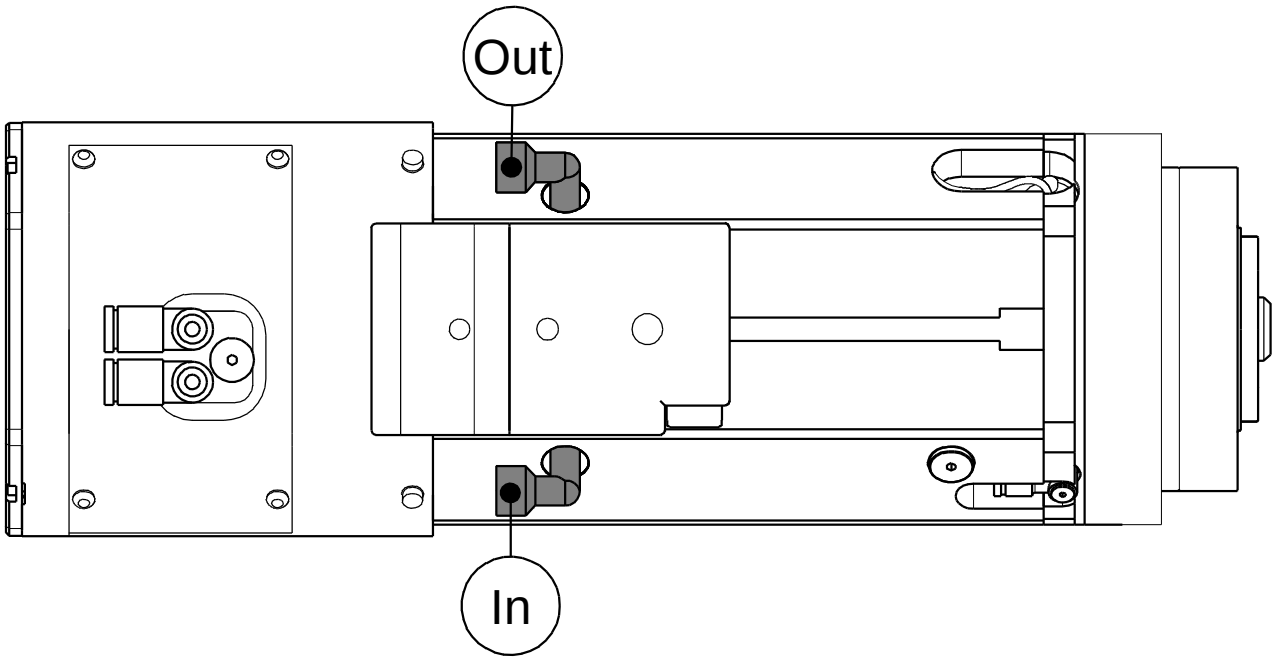
IMPORTANT: The air supply to the compressed air circuit must be **dry and filtered**

When the machine is powered on, pressurized air must be delivered even when the electro-spindle is stopped, to prevent dust and dirt from the machining area from entering the electro-spindle (see section7.7.3).

With the spindle stopped, make sure that there is uniform flow of air around the spindle shaft (pressurization air). If there is not, check the compressed air circuit and connections.

9.5 COOLING CIRCUIT

Liquid-cooled models must be connected to a coolant circuit to dissipate the heat generated during machining. Coolant must be: water with 10% ethylene glycol.



CONNECTION	DESCRIPTION	THREAD
Out	Coolant circuit outlet	G 1/4”
In	Coolant circuit inlet	G 1/4”

Hose internal diameter (at least)	8 mm (5/16 in. - 315 mils)

9.5.1 Cooler specifications

Cooling capacity	1600 W
Minimum delivery	3 litres/minute (0.11 cfm)
Coolant type	H_2O + 10% ethylene glycol
Cooler set temperature	+25°C (+77°F)

9.6 ELECTRICAL CONNECTIONS

9.6.1 Connectors

The electro-spindle is fitted with two connectors, one for power and the other for signals.

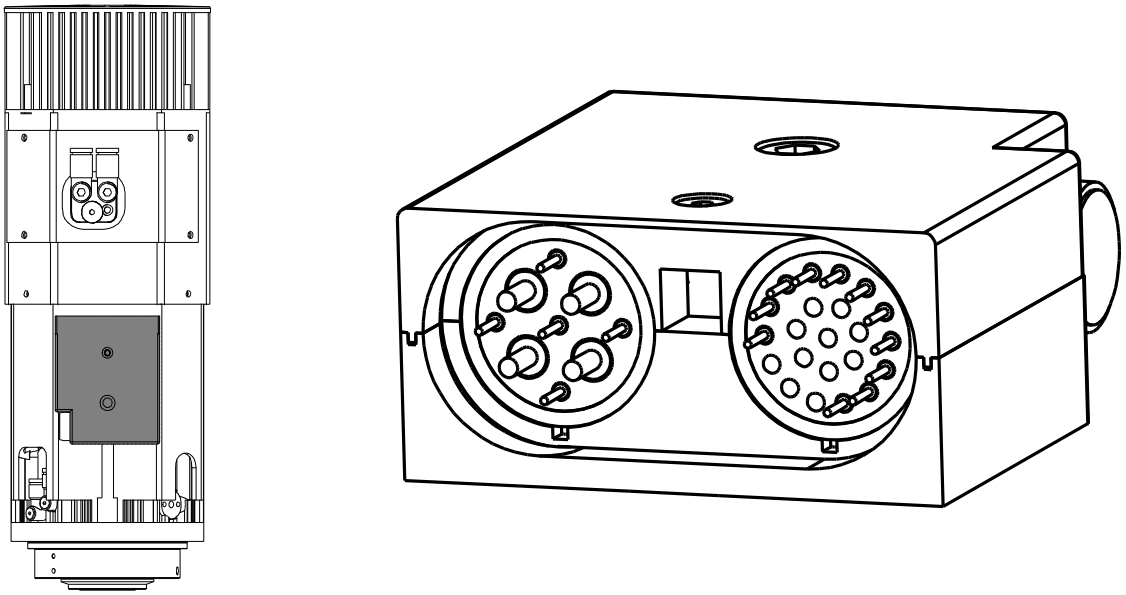
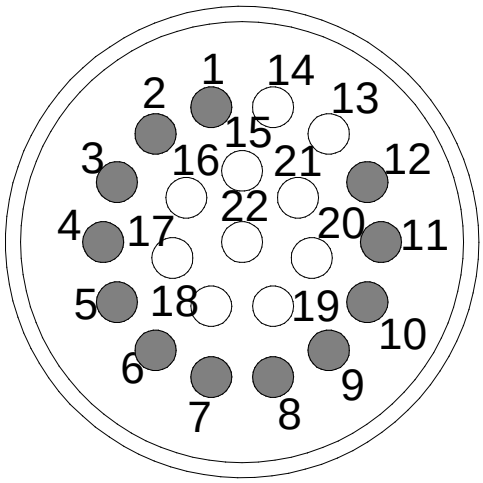


Figure 9.7 Location of electrical connectors

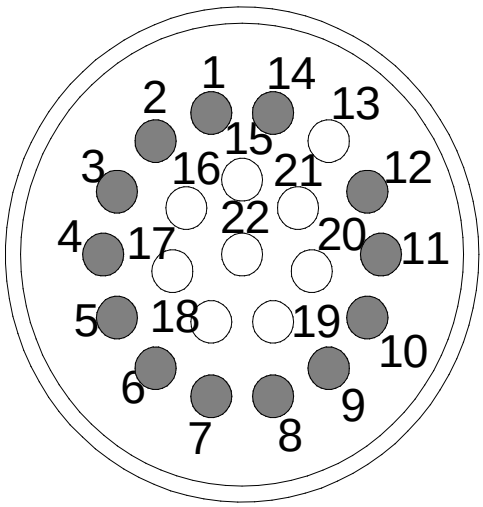
9.6.2 Pin layout of fixed signals connector - ISO 30 version



PIN	DESCRIPTION
1	Sensor S2 (tool ejected) output
2	Sensor S1 (tool locked) output
3	Sensor S3 (shaft stopped) output
4	+24V DC power to S1, S2, S3
5	+24V DC power to push-button lamp
6	0V power to S1, S2, S3
7	+24V DC power to push-button and C axis zeroing sensor (SC sensor)
8	Push-button output
9	Temperature sensor for front bearings
10	Temperature sensor for front bearings
11	0V power to push-button, lamp, and SC
12	C axis zeroing sensor output (SC sensor)

Use AWG22 wires.

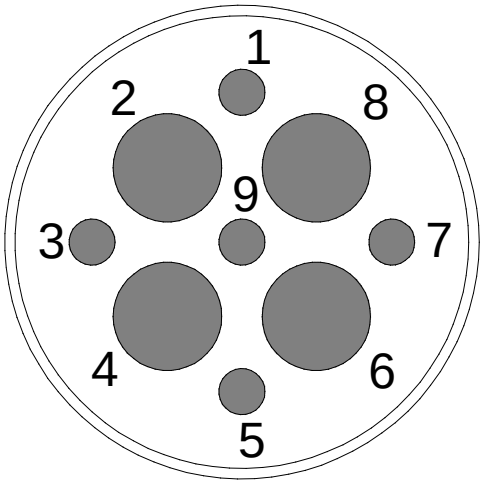
9.6.3 Pin layout of fixed signals connector - HSK F63 version



PIN	DESCRIPTION
1	Sensor S2 (tool ejected) output
2	Sensor series S1 + S4 (tool locked) output
3	Sensor S3 (shaft stopped) output
4	+24V DC power to S1, S2, S3
5	+24V DC power to push-button lamp
6	0V power to S1, S2, S3, S4
7	+24V DC power to push-button and C axis zeroing sensor (SC sensor)
8	Push-button output
9	Temperature sensor for front bearings
10	Temperature sensor for front bearings
11	0V power to push-button, lamp, and SC
12	C axis zeroing sensor output (SC sensor)
14	For maintenance

Use AWG22 wires.

9.6.4 Pin layout of fixed power connector

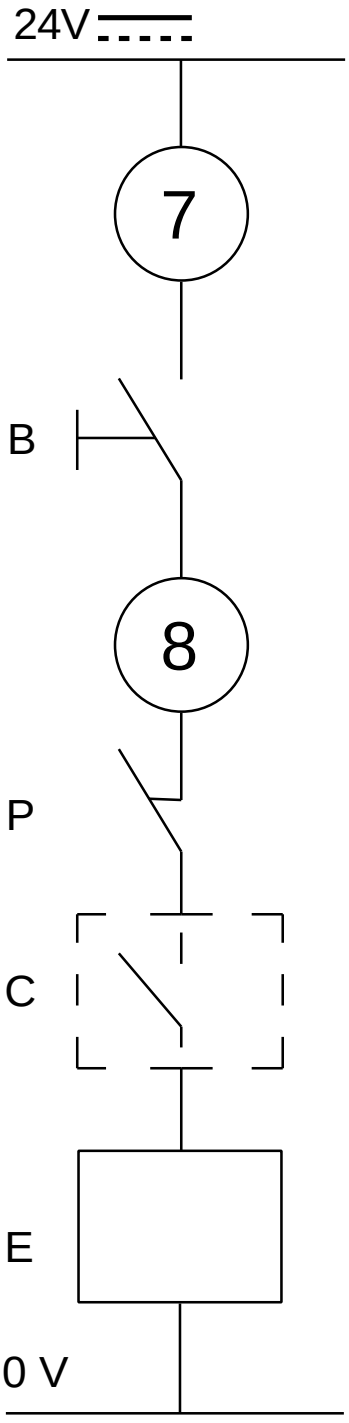


PIN	DESCRIPTION
1	Thermal switch: normally closed bi-metallic switch to be connected in series to machine safety stop system. **230V AC MAX; 48V DC MAX; 1.6A MAX**
2	⏚ PE common to pin 7
3	230V AC 50/60 Hz cooling fan
4	U Motor phase
5	Thermal switch (see pin 1)
6	V Motor phase
7	⏚ PE common to pin 2
8	W Motor phase
9	230V AC 50/60 Hz cooling fan

Use AWG10 wires for the even pins and AWG18 for odd pins.

9.6.5 Tool holder release system electrical wiring diagram for electro-spindles not controlled by CNC

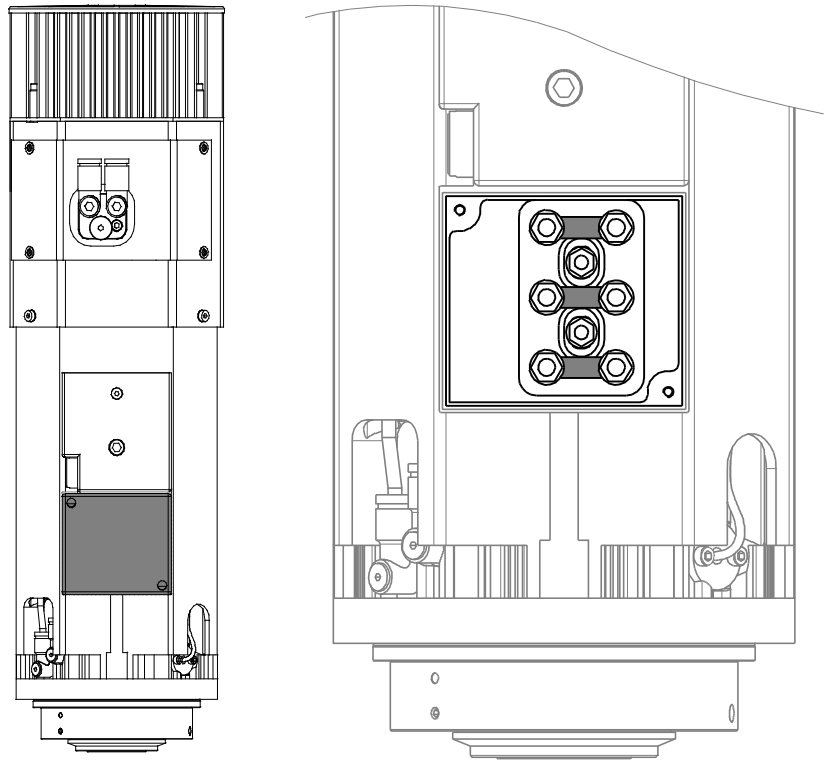
- **The control system must disable the tool release push-button signal while the spindle is rotating.**
- **The push-button must only be enabled when the spindle is completely stationary.**
- **Only use the push-button to lock/release tools on manually controlled machines.**



7 - 8	Pins 7 and 8 of the signals connector
B	Tool release button (See section 7.7.5 for technical specifications.)
P	Pressure switch to prevent tool release in case of insufficient air pressure
C	Safety check (spindle stopped check device)
E	Tool release solenoid valves (See pos. 7 in Figure 9.6 and the warnings for it.)

- When button “B” on the electro-spindle is pressed, the coils of solenoids “E” (not supplied) are energized and the tool holder is released.
- Press button “B” to release the tool holder.

9.6.6 Configurable power terminals (optional)



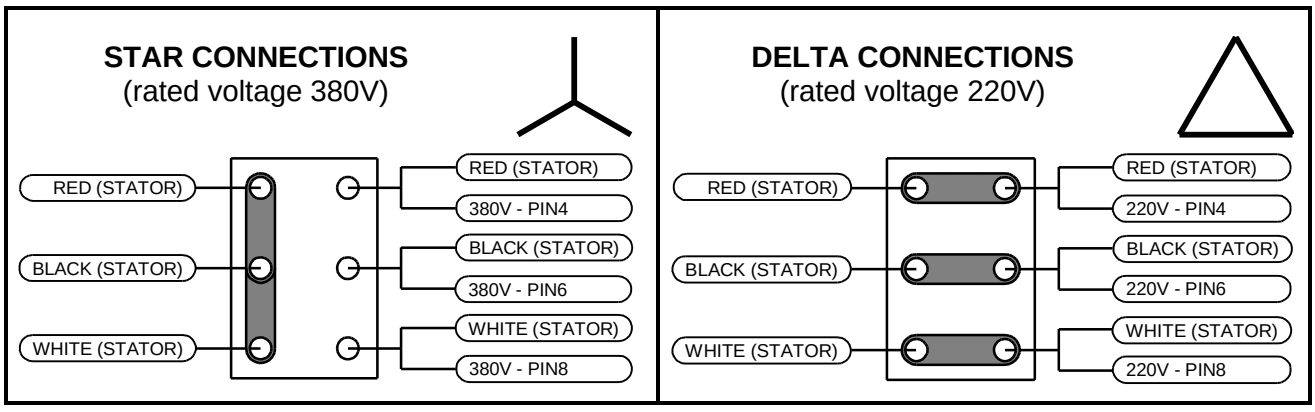
On request, some models can be provided with power terminals that can be configured either for delta or star connections, for use with rated voltages of 380 V or 220 V.

See section § 7 for details of models available with configurable power terminals.

The figure on the left shows the location of the power terminals, under a protective cover fixed in place by two screws.

Check what type of connections have been made in the terminal block before installing the unit.

CONNECTION DIAGRAM



IMPORTANT: **In star connections (for rated voltages of 380V) the terminals to be short circuited together are those connected to a single wire.**

§ 10 GENERAL CHECKS AFTER INSTALLATION AND DURING START-UP

10.1 CHECKING THE ELECTRO-SPINDLE *BEFORE START-UP*

Positioning

- There must be at least 100 mm of free space behind the cooling fan cover.

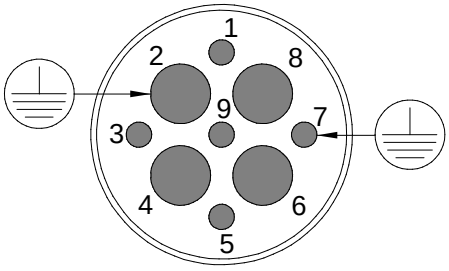
Compressed air connections

- The internal pressurization and cone cleaning air hose must have an external diameter of 8 mm, and must deliver dry, filtered air at a pressure of 4 bar (58 psi).
- The tool change air hose must have an external diameter of 8 mm, and must deliver dry, filtered air at a pressure of 7 bar (100 psi).
- (For connection details see the labels on the unit itself and see also section 9.4 above).

i	**THE TOOL RELEASE CYLINDER IS SINGLE ACTING.**

Electrical connections

- The ground wire of the electro-spindle and cooling fan must be connected to the ground (pins 2 and 7 of the power connector in the figure on the right).
- The motor's thermal switch (NC switch) must be connected in series with the machine's safety stop system (pins 1 and 5 of the power connector in the figure on the right and section 9.6.4 above).
- 2 pole 220V - 380V configurable motors only: The connections in the terminal block (380 V star or 220 V delta) must match the electro-spindle power. (See section 9.6.6 and § 7.)



Inverter programming

- The maximum power voltage setting must match the value on the electro-spindle's data label.
- The minimum frequency value at which maximum voltage is delivered (rated frequency, also referred to as *knee* or *bend* frequency) must match the value on the electro-spindle's data label.
- The maximum frequency value must match the value on the electro-spindle's data label.
- The maximum continuous current value must match the value on the electro-spindle's data label.
- Contact HSD S.p.a. if you wish to check other inverter parameters.

10.2 CHECKING THE ELECTRO-SPINDLE *ON FIRST START-UP*

- Warm up the electro-spindle briefly at no load (see section 11.3).
- Make sure that pressurization air comes out from the labyrinth ports in the spindle nose. (Check with the electro-spindle stationary.)
  PRESSURIZED AIR MUST ALWAYS BE PRESENT, EVEN WHEN THE ELECTRO-SPINDLE IS NOT OPERATING.
- Check that the air from the fan flows towards the spindle nose.
  THE FAN MUST ALWAYS BE ON, EVEN WHEN THE ELECTRO-SPINDLE IS NOT OPERATING.
- Check that the air purge is on during tool changes.
- Check that the compressed air hoses and unions do not interfere with cables or machine parts during tool change movements (approx. 1 mm).
- Check that the electro-spindle control sensors operate according to the logic described in section 0.
  HSK F63 VERSIONS ONLY: THE ELECTRO-SPINDLE MUST ONLY BE STARTED UP WITH THE TOOL HOLDER LOCKED IN PLACE ([SENSOR 1 + SENSOR 4] ON AND SENSOR 2 OFF).
- The tool holder must be ejected about 0.5 – 0.9 mm in ISO 30 versions and 0.5 – 0.6 mm in HSK F63 versions.
  TOOL CHANGES MUST ONLY TAKE PLACE WHEN THE SPINDLE AND THE MACHINE ARE STATIONARY (SENSOR 2 ON AND SENSOR 1(ISO30) OR SENSOR 1+4(HSK) OFF).
- The push-button on the terminal block must execute a manual tool change.
  THIS BUTTON MUST ONLY BE ENABLED WHEN THE SPINDLE AND MACHINE ARE STATIONARY. (See section 9.6.5 .)
- The direction of spindle rotation must match the settings in the numeric controller.

§ 11 OPERATING THE ELECTRO-SPINDLE

11.1 CLIMATIC CONDITIONS

HSD S.p.a. has designed and tested its electro-spindles to operate under the following standard climatic conditions:

- Altitude not above 1000 m above sea level
- Maximum ambient air temperature not above +40°C (+104°F)
- Minimum ambient air temperature not below -15°C (+5°F)
- Coolant temperature (if relevant) at inlet to electro-spindle not above +27°C (+81°F) and not below +23°C (+73°F).

Outside these tolerances some of the values declared in the tables and figures in section § 7 may vary.
Contact HSD S.p.a. for information on installations other than the standard ones illustrated or described in this manual.

11.2 RUNNING IN

The electro-spindle is run in in the factory prior to shipment. This ensures correct distribution of the long-life grease in the bearing races. The run in cycle also includes comprehensive testing of all electro-spindle controls and signal devices, and simulates various types of working cycles.

11.3 WARMING UP

Every day, when the electro-spindle is started up for the first time, let it warm up slowly without load, this ensures that the bearings reach their running temperature gradually, and that the bearing races expand evenly.
The following warming up cycle is recommended, to be performed **with the tool holder in place** but without actually machining (no load):
50% maximum rated speed for 2 minutes.
75% maximum rated speed for 2 minutes.
100% maximum rated speed for 1 minute.
Warm the electro-spindle up before machining whenever the machine has been left idle long enough for it to cool down to ambient temperature.

HSK VERSION ONLY:

NEVER START THE ELECTRO-SPINDLE WITHOUT THE TOOL HOLDER IN PLACE.
Starting an HSK electro-spindle with no tool holder puts the balance and functioning of the collet at risk.
Push the tool holder in until it touches the face.

11.4 SELECTING THE TOOL HOLDER AND TOOL

11.4.1 ISO 30 tool holders

Always respect the following conditions when selecting a tool holder:

- Cone geometry must comply with DIN 69871 standard.
- Use only ISO 30 tool holders of AT3 precision rating.
- Do not use tool holders that have lumps, hollows, or other shapes that could affect dynamic balancing.
- Dynamic balancing must be better than G=2.5 (ISO 1940 standard) at the electro-spindle's maximum rated speed.
- Balancing must always be done with the tool assembled (pull stud, cone, elastic collet, ring nut, tool).
- Only use pull studs (also referred to as retention knobs) provided by HSD (code 0804H0009).

Proceed as follows to install the pull stud in the ISO 30 cone:

- Thoroughly clean the mating surfaces of the pull stud and its seat.
- Smear the threads of the pull stud with LOCTITE 270 (or similar thread locking compound).
- Tighten the pull stud in place to a torque of 62 Nm.
- Leave the cone rest for at least 12 hours, so that the thread locking compound grips (or follow the instructions of the locking compound manufacturer, if you have used an alternative to LOCTITE 270).

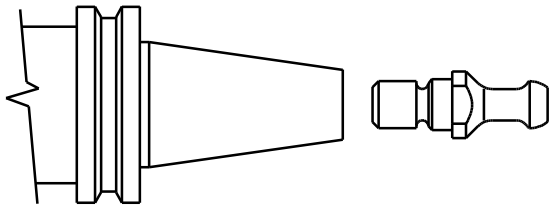


Figure 11.1

WARNING: Incorrect installation or the use of non-original HSD pull studs can lead to the tool holder cone being thrown from the electro-spindle.

Use only pull studs (or retention knobs) from HSD (code 0804H0009).

i **"Pull studs" are also referred to as "retention knobs".**

11.4.2 HSK F63 tool holders

Always respect the following conditions when selecting a tool holder:

- Cone geometry must comply with DIN 69893 standard.
- Do not use tool holders that have lumps, hollows, or other shapes that could affect dynamic balancing.
- Dynamic balancing must be better than G=2.5 (ISO 1940 standard) at the electro-spindle's maximum rated speed.
- Balancing must always be done with the tool assembled (cone, elastic collet, ring nut, tool).

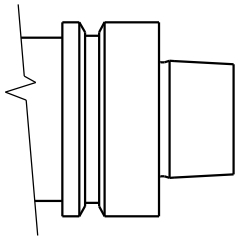


Figure 11.2 **HSK F63 CONE DIN 69893**

Never use tool holders that do not comply with the above conditions. Failure to comply can lead to breakage and accidental release of the tool holder cone, with potentially serious consequences for the operator.

HSK VERSION ONLY:

NEVER START THE ELECTRO-SPINDLE WITHOUT THE TOOL HOLDER IN PLACE.
Starting an HSK electro-spindle with no tool holder puts the balance and functioning of the collet at risk.
Push the tool holder in until it touches the face.

11.4.3 General safety precautions for tool holders

THE RIGHT CHOICE OF TOOL HOLDER IS ESSENTIAL FOR SAFE MACHINING. CAREFULLY FOLLOW THE INSTRUCTIONS GIVEN IN SECTIONS 11.4.1 (ISO 30) AND 11.4.2 (HSK F63).

KEEP THE CONICAL SURFACES OF THE TOOL HOLDER AND ITS HOUSING IN THE SPINDLE SHAFT PERFECTLY CLEAN TO ENSURE A SAFE GRIP (SEE SECTION 12.1).

DURING MACHINING, TAKE GREAT CARE TO AVOID CONTACT BETWEEN NON-CUTTING ROTATING PARTS AND THE WORK.

DIRT MUST NOT BE ALLOWED TO ENTER THE CONICAL HOUSING. CLOSE IT WITH A SUITABLE PLUG OR A SPARE TOOL HOLDER.

AT THE END OF THE WORKING DAY, ALWAYS REMOVE THE TOOL HOLDER FROM THE SPINDLE, TO PREVENT IT FROM STICKING.

PROTECT OR COVER THE SPINDLE NOSE AGAINST CONTAMINATION.

11.4.4 Choosing tools

Dynamic balancing must be better than G=2.5 (ISO 1940 standard) at the electro-spindle's maximum rated speed.

Always respect the following conditions when selecting a tool:

- Only use fully sharpened tools, and make sure that they are securely locked in the tool holder.
- Never use bent or damaged tools, chipped tools, or tools that are not perfectly balanced.
- Always make sure that the mating surfaces of a tool are perfectly clean and dent free before fitting the tool in the collet and tool holder.
- Never use tools at speeds in excess of the rated speed by the manufacturer.
- Always ensure that the following essential requirements are met before using any tool at high speed:
  - The tool must be of compact, short, and lightweight design.
  - The tool must be a precision instrument, and any inserts must be secured tightly.
  - The tool must be balanced and must mate symmetrically with the tool holder.
  - The cutting surfaces of the tool must be located near its centre of rotation.

11.5 SPEED LIMITATIONS

ALWAYS RESPECT THE MAXIMUM TOOL SPEED (RPM) SPECIFIED BY THE TOOL MANUFACTURER.

Never exceed the maximum speed specified by the tool manufacturer.
It is the operator's responsibility to decide whether to perform certain machining operations at slower speeds (NEVER HIGHER) than those specified by the tool manufacturer or those listed as guidelines in the following pages.

11.5.1 Content of graphs

The graphs on the following pages show sample maximum no-load electro-spindle rotation speeds. These have been calculated for different total weights of the TOOL + TOOL HOLDER assembly (including ring nut and elastic collet), and for different distances between the nose of the electro-spindle and the centre of gravity “G” of the tool + tool holder assembly.

The tool + tool holder assembly has been considered as a single mass applied at the centre of gravity “G” (without considering size or shape).

The degree of balancing is that recommended in the previous sections.

The graphs on the following pages are purely indicative. HSD S.p.a. does not know and the graphs therefore cannot take into account details of individual machining operations, tool specifications, or characteristics of the material being machined. **It is therefore the operator's responsibility to determine maximum safe speed on a case by case basis**.

11.5.2 Reading the graphs

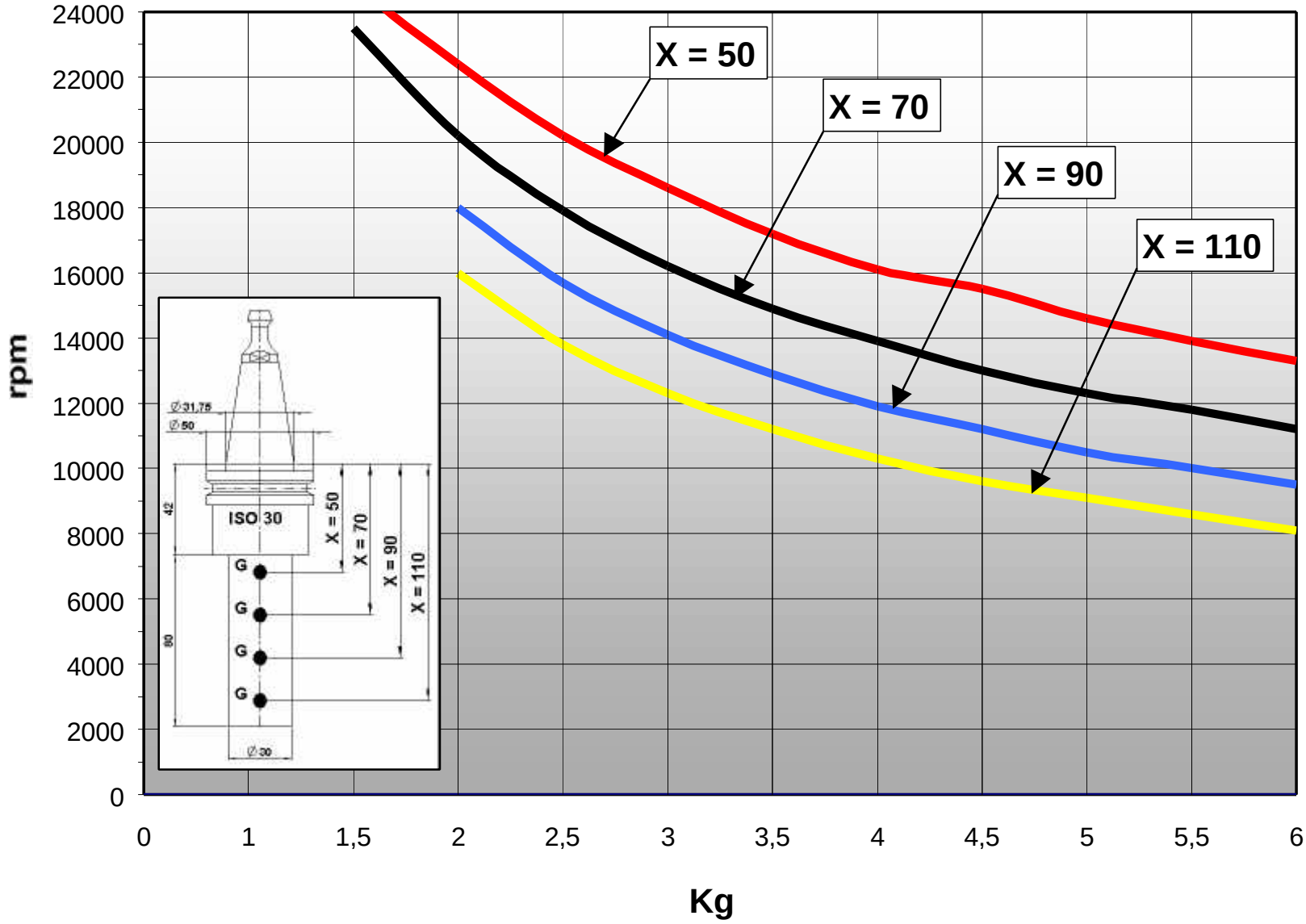
1. Find the graph for your own electro-spindle.
2. Select the curve for distance “X” between the nose of the spindle and the centre of gravity “G” of the tool + tool holder assembly. If the value of “X” measured on your electro-spindle does not appear in the graph, use the curve for the next higher value of “X” (see example).
3. Read off the maximum speed value for the weight of the tool + tool holder assembly.

EXAMPLE

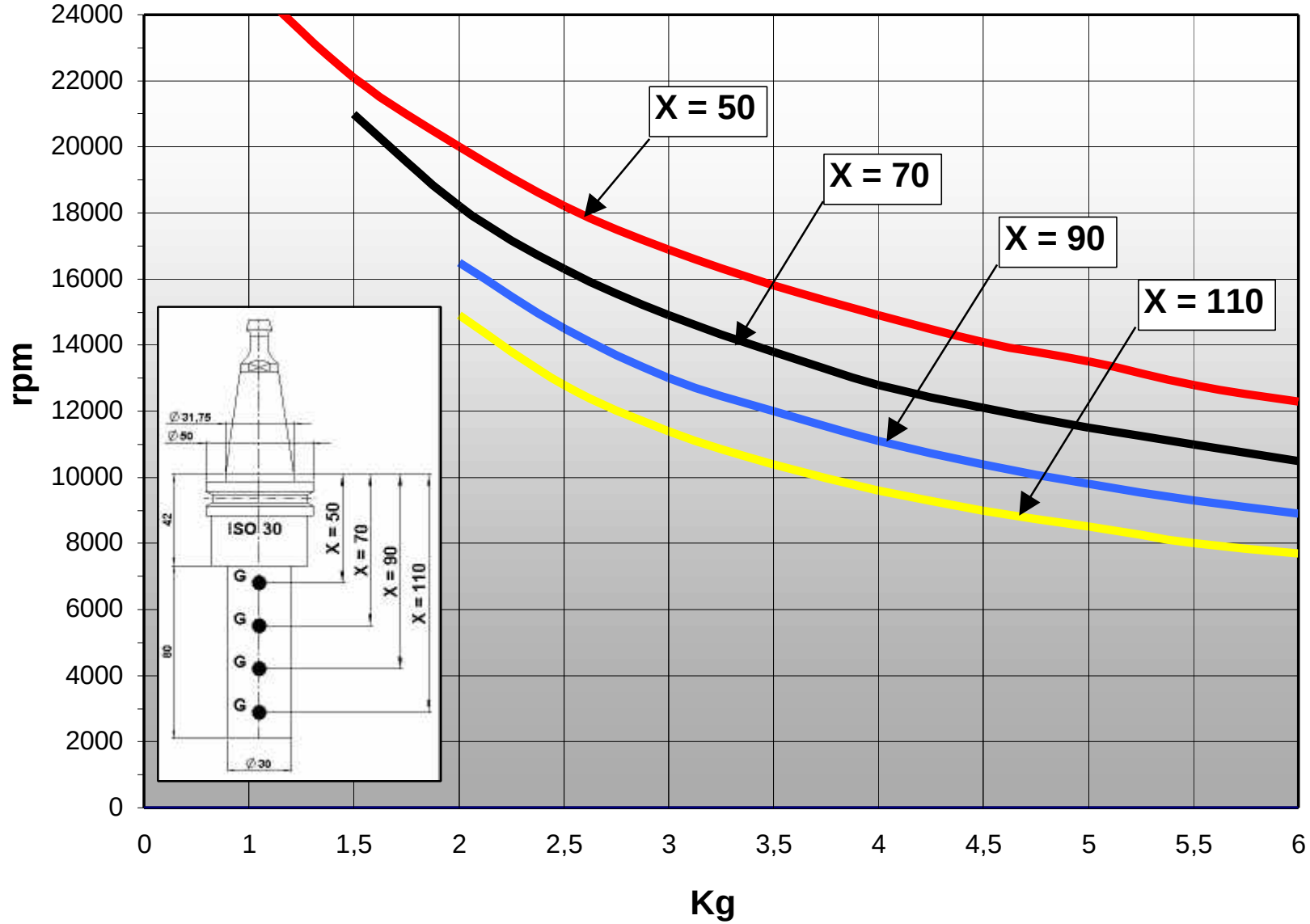
You have an ES919 L HSK F63 SHORT NOSE electro-spindle, and want to use a tool + tool holder assembly weighing a total of 3.5 kg (including ring nut and elastic collet). The distance between the spindle nose and the centre of gravity “G” of the tool + tool holder assembly “X” is 120 mm.

1. The graphic for this particular electro-spindle is that in section 11.5.6 .
2. Since there is no curve for “X”=120 mm, use the curve for the next higher value, i.e. the yellow curve for “X”=130 mm.
3. Against the weight 3.5 kg read off the maximum no-load speed, which is 10000 rpm.

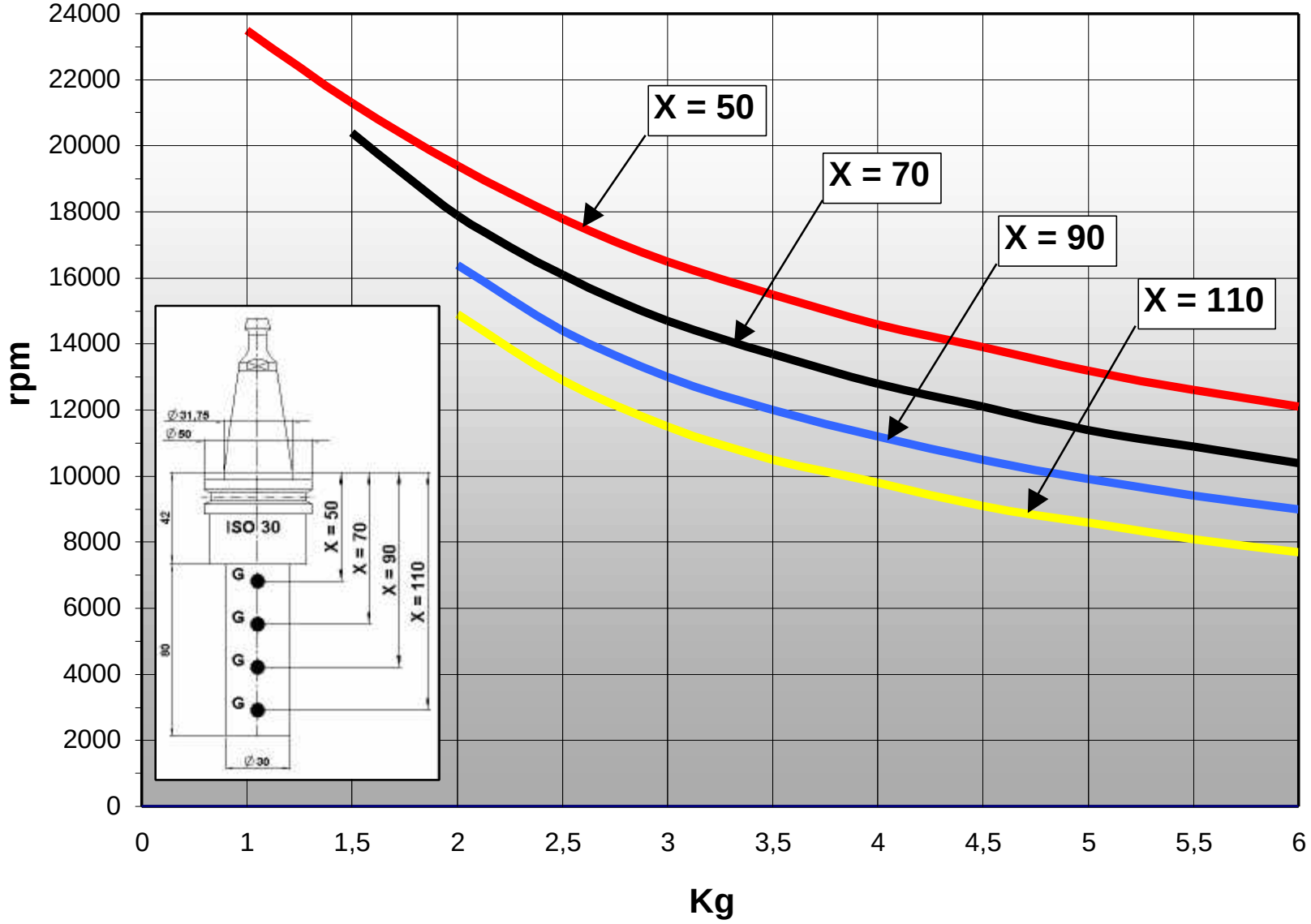
11.5.3 ES915 ISO30



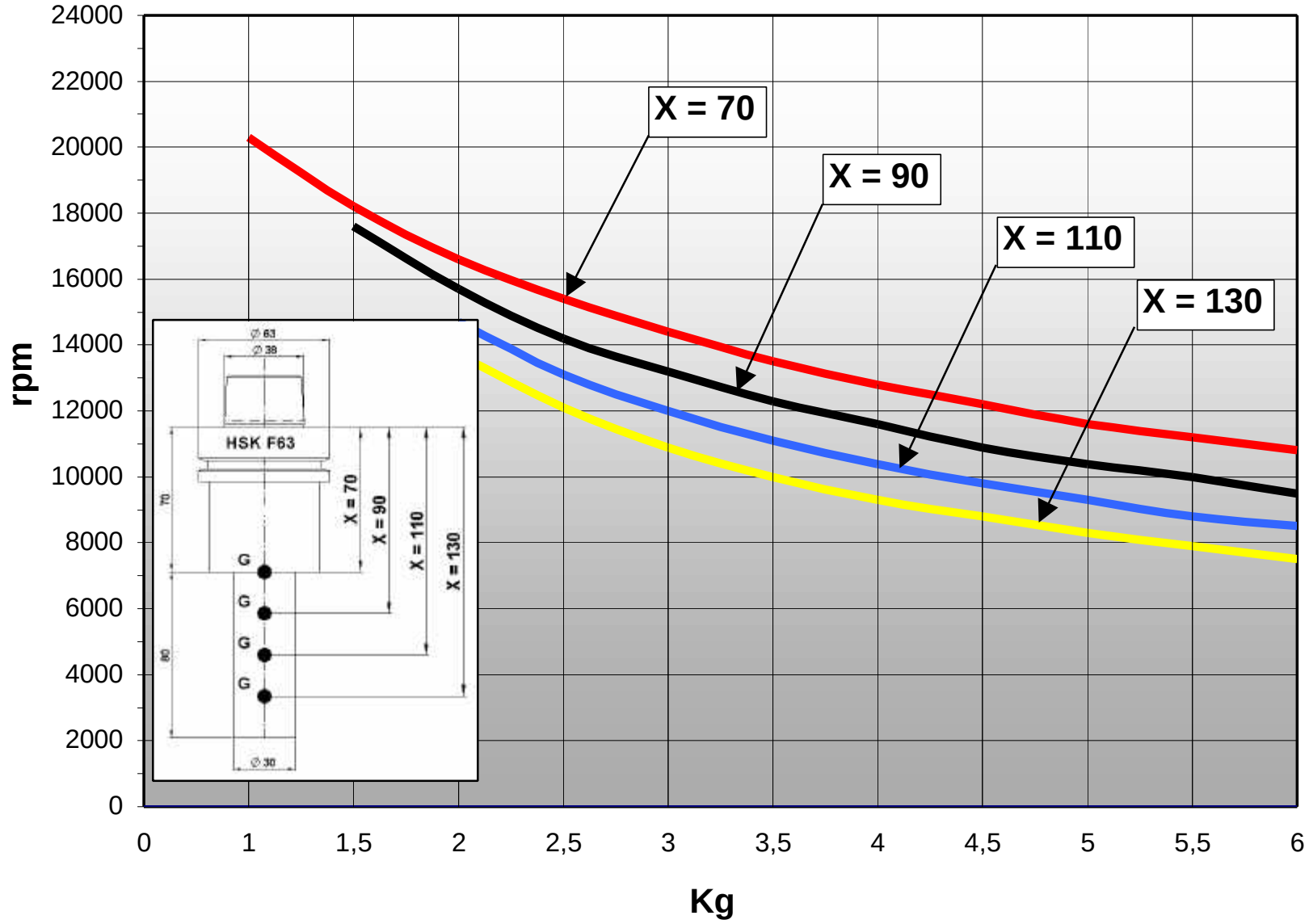
11.5.4 ES919 ISO30 Short Nose , ES919 L ISO30 Short Nose



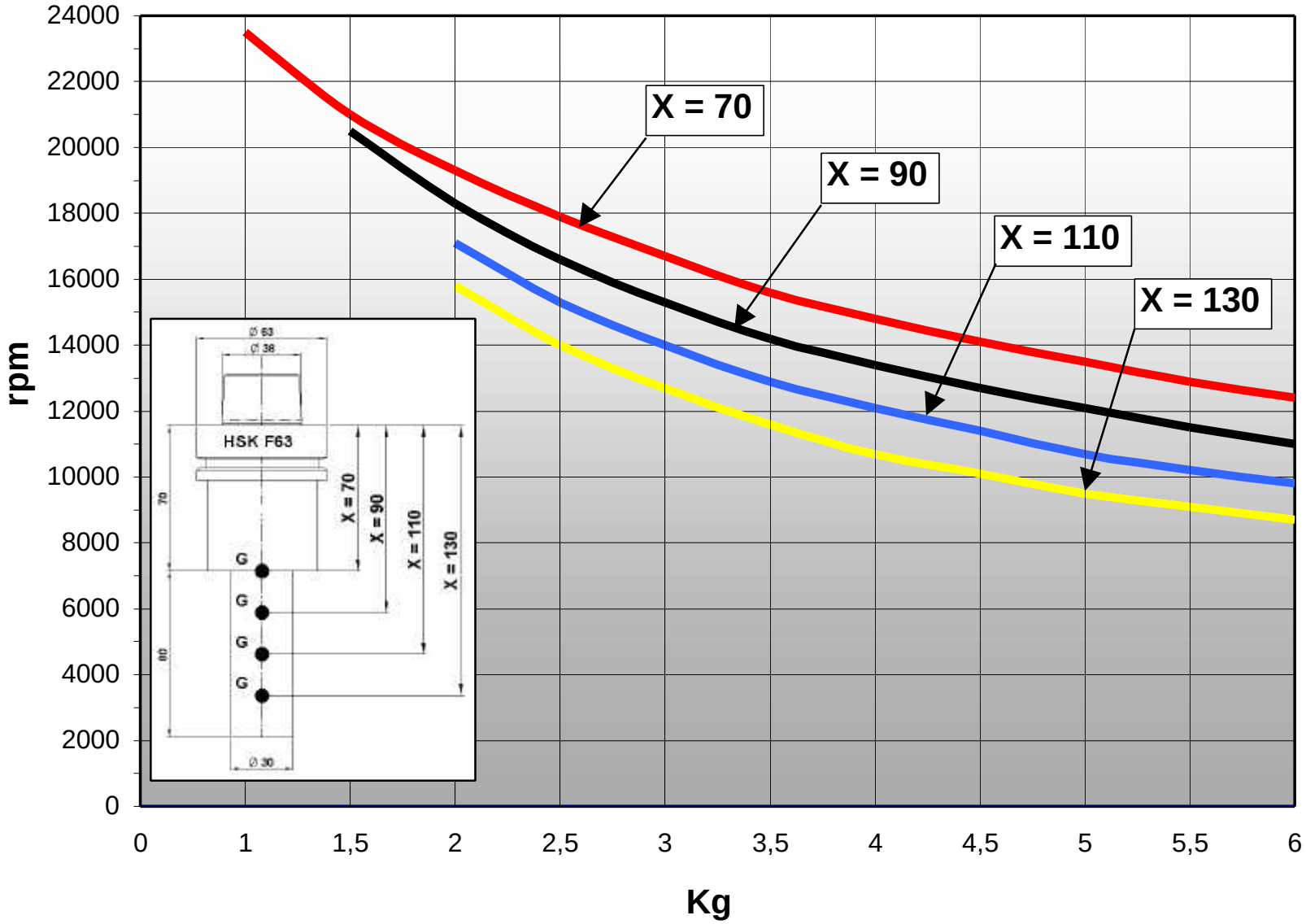
11.5.5 ES919 ISO30 Long Nose , ES919 L ISO30 Long Nose



11.5.6 ES919 HSK F63 Short Nose , ES919 L HSK F63 Short Nose



11.5.7 ES919 HSK F63 Long Nose , ES919 L HSK F63 Long Nose



11.6 SENSOR FUNCTIONING

Note: The optional sensors (the “spindle shaft stopped” sensor S3 and the “front bearing temperature sensor”) are optionally installed in ISO 30 and HSK F63 versions. They are both described in detail in chapter § 13, where sensor “SC” for the optional “C” axis is also described.
This section only describes the sensors present in the basic configuration.

The technical specifications of the sensors described here are given in section 7.7.4 .

Sensor output is delivered to the “signals connector” described in sections 9.6.2 (ISO 30) and 9.6.3 (HSK F63).

11.6.1 ISO 30 versions

ISO 30 versions are fitted with two electro-spindle sensors. Sensors S1 and S2 perform the functions described below.

S1 **Detects correct locking of the tool holder. It is used to provide the NC with a safety signal permitting spindle rotation.**

CONDITION	OUTPUT S1
Tool holder locked	+24 V
No tool holder	0 V
Tool holder ejected (collet open)	0 V

Always monitor S1 during electro-spindle rotation and stop rotation if S1 drops to 0 Volt.

Ignore S1 from the moment the tool eject command is given until the next tool locking command is given.

S2	**Important during tool changes. Detects ejection of the tool holder, permitting the next phase in the tool change cycle to take place.**

CONDITION	OUTPUT S2
Tool holder locked	0 V
No tool holder	0 V
Tool holder ejected (collet open)	+24 V

11.6.2 HSK F63 versions

HSK F63 versions are fitted with three electro-spindle sensors: S1, S2 and S4. S1 and S4 are connected in series and provide a single output. S1, S2 and S4 perform the functions described below.

S1 + S4	**Wired in series to detect correct locking of the tool holder. Their output is used to provide the NC with a safety signal permitting spindle rotation.**

CONDITION	OUTPUT <S1+S4>
Tool holder locked	+24 V
No tool holder	0 V
Tool holder ejected (collet open)	0 V

Always monitor the output from <S1+S4> during electro-spindle rotation and stop rotation if it drops to 0 Volt.

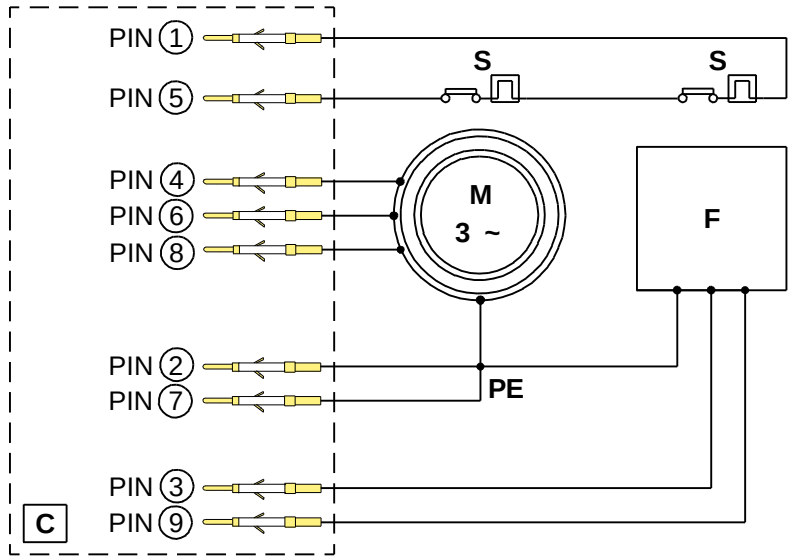
Ignore <S1+S4> from the moment the tool eject command is given until the next tool locking command is given.

S2	**Important during tool changes. Detects ejection of the tool holder, permitting the next phase in the tool change cycle to take place.**

CONDITION	OUTPUT S2
Tool holder locked	0 V
No tool holder	0 V
Tool holder ejected (collet open)	+24 V

11.7 THERMAL SWITCH

The electro-spindle is protected by two normally closed bi-metallic switches wired in series. These protect the electro-spindle motor and cooling fan motor respectively.
They must be connected in series with the machine's safety stop system or inverter safety stop system (see section 9.6.4).
The switches open if temperature reaches a potentially damaging level, tripping the machine's safety stop system and stopping machining. They close again when temperature drops to normal operating levels.



C	Power connector (see section 9.6.4)
S	Bi-metallic switches
M	Electro-spindle motor
F	Cooling fan
PE	Electrical protection ⏚

Figure 11.3 Bi-metallic switch and motor wiring

The fan's thermal switch only detects fan motor overheating. It cannot detect that the fan is prevented from turning, unless this causes overheating. For this reason, check the condition of the fan regularly.

The fan must remain on at all times when the machine is active even if the electro-spindle is not operating.

§ 12 MAINTENANCE

Read this section carefully before attempting any maintenance on the electro-spindle. This section contains information that is important for the safety of maintenance personnel and for the reliability of maintenance work itself.

All applicable safety precautions must be taken whenever maintenance work is done on the electro-spindle. In particular:

- Maintenance and/or lubrication must be performed only by qualified, expert personnel, with the authorization of factory management, in compliance with applicable safety directives and standards, and with the use of suitable tools and instruments.
- When performing maintenance, always wear suitable clothing such as tight fitting work overalls and safety shoes. Never wear long or slack clothing or clothes with parts that hang loose.
- When performing maintenance on a machine, mark it clearly with panels stating “MACHINE UNDERGOING MAINTENANCE”, and guard from unauthorized access.

During all maintenance work make sure that the electro-spindle is:
- **disconnected and insulated from the electrical power supply;**
- **fully stopped (not still spinning).**

Maintenance managers must ensure that their team is trained to ensure optimum co-ordination and safety. All persons performing maintenance must remain fully visible to colleagues at all times so that they can signal for assistance if necessary.

WARNING: USE ONLY SUITABLE LIFTING AND MOVING EQUIPMENT TO DISCONNECT OR REMOVE HEAVY PARTS FROM THE MACHINE.

SPECIAL TOOLS ARE NOT NORMALLY REQUIRED FOR ELECTRO-SPINDLE MAINTENANCE.

12.1 SCHEDULED MAINTENANCE

The following maintenance schedule must be followed scrupulously to keep the electro-spindle in peak condition.

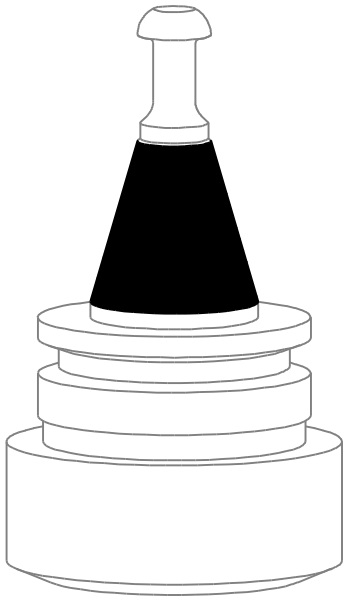
> *i* The frequency has been calculated taking into account an 8-hour a day, 5-dayworking week, in a normal working environment.

12.1.1 Checking the cleanliness of the tool holder cone and of the spindle shaft tool housing

DAILY

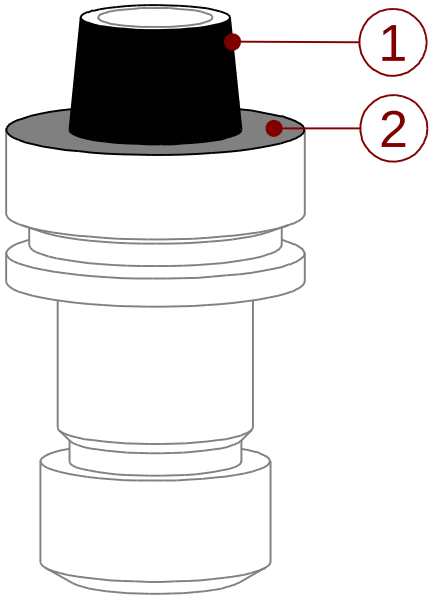
Always keep the conical surface of the tool holder (shown in black in Figure 12.1 and Figure 12.2) and that of the housing in the spindle shaft (shown in black in Figure 12.3 and Figure 12.4) perfectly clean and free from dust, grease, coolant, oil, metal shavings, and corrosion or lime scale. Check these before you start to use the electro-spindle.

HSK VERSION ONLY: Make sure that the faces of the tool holder and spindle shaft (shown in grey and identified by No. 2 in Figure 12.2 and Figure 12.4) are clean too.



ISO 30

Figure 12.1 Conical surface of an ISO 30 tool holder (in black)



HSK

Figure 12.2 HSK tool holder:
(1) Conical surface (in black)
(2) Face (in grey)

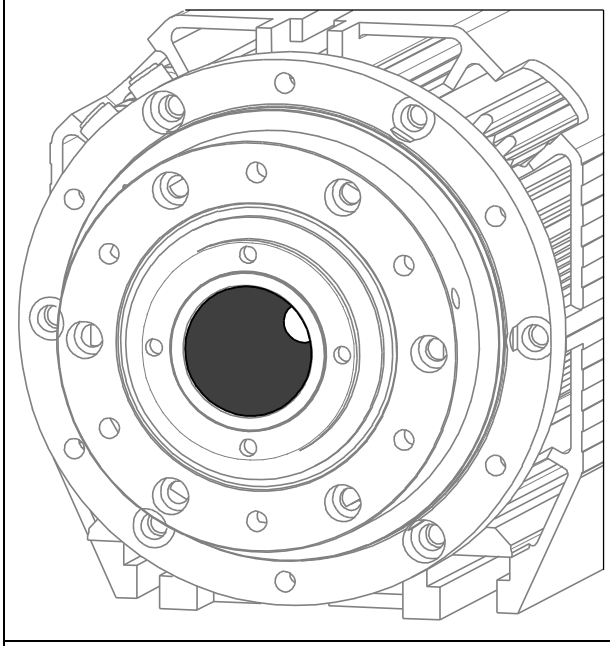


Figure 12.3 Conical surface of ISO 30 spindle shaft (in black)

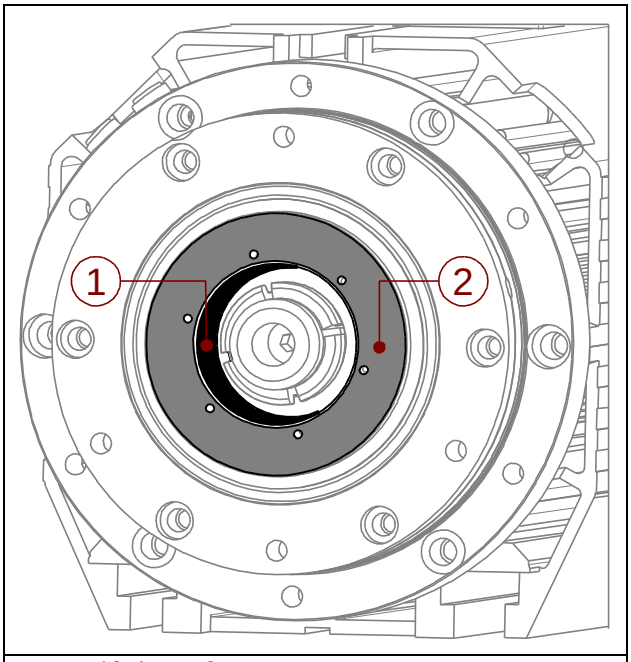


Figure 12.4 HSK tool holder housing
(1) Conical surface (in black)
(2) Face (in grey)

Clean these parts carefully at the end of every working day with a clean and soft cloth.

BLOWING COMPRESSED AIR INTO THE SPINDLE NOSE WHEN THERE IS NO TOOL HOLDER IN PLACE CAN CAUSE DAMAGE (Figure 12.5).

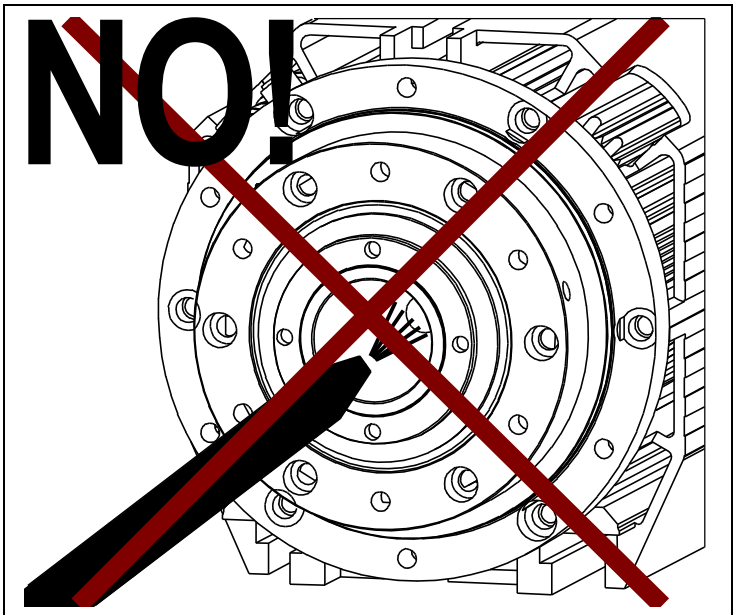


Figure 12.5 Follow the instructions in section 12.1.1 to clean the tool holder housing in the spindle nose.

DIRTY MATING SURFACES CAUSE AN UNCORRECT TOOL HOLDER SEATING, WITH SERIOUS CONSEQUENCES FOR OPERATOR SAFETY, ELECTRO-SPINDLE AND TOOL HOLDER WEAR, AND MACHINING PRECISION.

USE A CLEAN AND SOFT CLOTH TO CLEAN THE CONICAL SURFACES AND THE FACES SHOWN IN FIGURES FROM Figure 12.1 TO Figure 12.4. *ABSOLUTELY NEVER* USE ABRASIVE TOOLS OR MATERIALS LIKE METAL BRUSHES, EMERY CLOTH, ACIDS AND OTHER AGGRESSIVE CHEMICALS.

12.1.2 Cleaning the tool holder cone

EVERY TWO WEEKS

Clean carefully the conical surface of the tool holder (shown in black in Figure 12.1 and Figure 12.2) using a clean, soft cloth dipped in ethyl alcohol.

HSK VERSION ONLY: after cleaning by ethyl alcohol, spray the product **KLÜBER LUSIN PROTECT G 31**, on the conical surface, and spread the product evenly using a clean, dry cloth.

12.1.3 Protecting the spindle shaft's conical housing

DAILY

DIRT MUST NOT BE ALLOWED TO ENTER THE CONE SEAT. CLOSE IT WITH A SUITABLE PLUG OR A SPARE TOOL HOLDER.

AT THE END OF THE WORKING DAY, ALWAYS REMOVE THE TOOL HOLDER FROM THE SPINDLE, TO PREVENT IT FROM STICKING.

PROTECT OR COVER THE SPINDLE NOSE AGAINST CONTAMINATION.

12.1.4 Lubricating HSK fingers

MONTHLY

To keep HSK type collets perfectly efficient, grease them every month with:

METAFLUX-Fett-Paste Nr.70-8508
or:
METAFLUX-Moly-Spray Nr.70.82

Apply the grease into the gaps between the collet sections as shown in Figure 12.6.

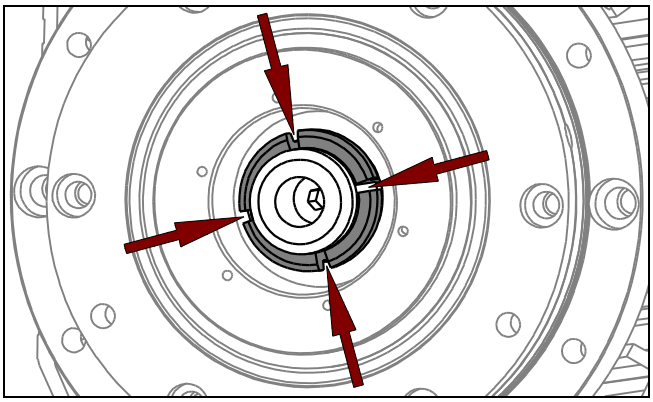


Figure 12.6 Monthly greasing of HSK fingers

TOO MUCH GREASE CAN CAUSE DAMAGE.
After you have applied the specified grease as shown in Figure 12.6, perform a number of tool changes to distribute it evenly. Then remove the tool holder from the spindle shaft and wipe any visible lumps of grease off with a clean cloth. Free standing grease can retain metal particles and dirt from the machining, and foul the fingers, cone and faces. These parts must be kept as clean as possible to ensure operator safety and machining precision and to reduce wear of the spindle and tool holder cone.

ONLY USE THE GREASE LISTED ABOVE.

OTHER PRODUCTS ARE NOT COMPATIBLE WITH THE GREASE INITIALLY APPLIED BY HSD.

IF INCOMPATIBLE GREASES ARE MIXED OR APPLIED TO THE SAME FINGERS, THEY CAN REACT TO FORM SUBSTANCES THAT CAUSE DAMAGE OR PREVENT CORRECT COLLET FUNCTIONING, WITH SERIOUS CONSEQUENCES FOR OPERATOR SAFETY.

12.1.5 Bearings

NEVER

THE BEARINGS ARE LUBRICATED FOR LIFE AND DO NOT REQUIRE GREASING.

12.2 REPLACING PARTS

Parts must only be removed and replaced by qualified and authorized personnel.

RESIDUAL RISKS:

THE DRAW BAR SPRING IS PRE-LOADED WITH A FORCE OF HUNDREDS OF KILOGRAMS. IN HSK MODELS IN PARTICULAR THE DRAW BAR CAN BE VIOLENTLY EXPELLED FROM THE UNIT, WITH SERIOUS RISK OF INJURY, IF THE ELECTRO-SPINDLE IS DISASSEMBLED BY UNTRAINED PERSONNEL.

PERFORM ONLY THE TASKS DESCRIBED IN THIS MANUAL. FOLLOW THE INSTRUCTIONS SCRUPULOUSLY. IN CASE OF DOUBT, CONTACT THE HSD TECHNICAL ASSISTANCE SERVICE.

ALL DISASSEMBLY AND RE-ASSEMBLY OPERATIONS MUST BE PERFORMED WITH:

ABSOLUTE CERTAINTY THAT THE MACHINE IS STOPPED, THE CONTROL PANEL IS DISCONNECTED AT THE POWER SWITCH, AND THE SWITCH LOCKED, WITH THE KEYS HELD BY THE MAINTENANCE MANAGER
ABSOLUTE CERTAINTY THAT THE TOOL IN THE ELECTRO-SPINDLE IS STATIONARY
A WORKING ENVIRONMENT THAT IS EQUIPPED WITH ALL NECESSARY TOOLS AND EQUIPMENT AND FREE FROM SOURCES OF POTENTIAL DANGER
THOROUGH CLEANLINESS OF THE PARTS BEING FITTED, WHICH MUST ALSO BE EITHER DEGREASED OR LUBRICATED ACCORDING TO THEIR USE.

USE ONLY ORIGINAL HSD SPARE PARTS AND PERFORM ONLY THE INSTRUCTIONS DESCRIBED IN THIS MANUAL. NO OTHER WORK ON THE ELECTRO-SPINDLE IS PERMITTED AND WOULD INVALIDATE THE WARRANTY.

12.2.1 Changing the spindle shaft kit

To replace the spindle shaft kit, follow the instructions given in the “Spindle Shaft Kit Replacement Manual” (code HSD 5802H0001) that comes with the kit and can be ordered from the Technical Assistance Service.

ONLY FOR UNITS WITH *BELT DRIVEN C AXIS*:
On models with belt driven C axis, the spindle shaft kit must be replaced by HSD technical assistance. Replacement by the customer is not permitted.

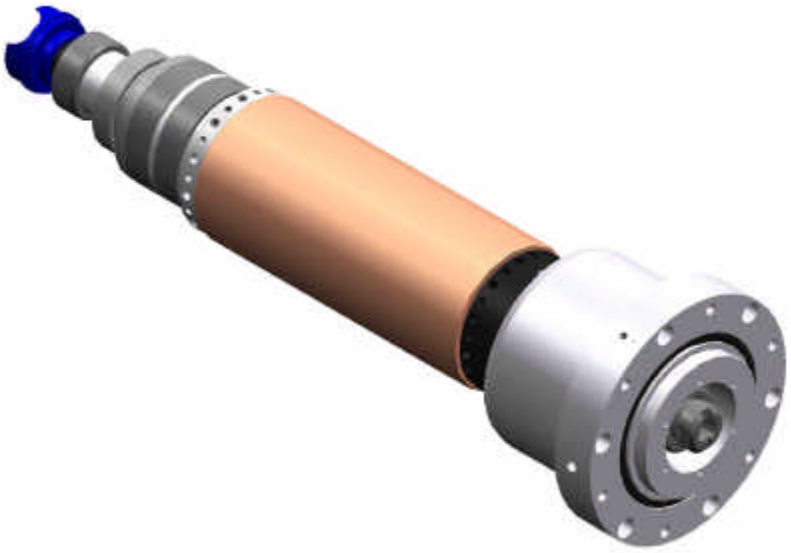


Figure 12.7 ES919 HSK F63 Short Nose spindle shaft kit

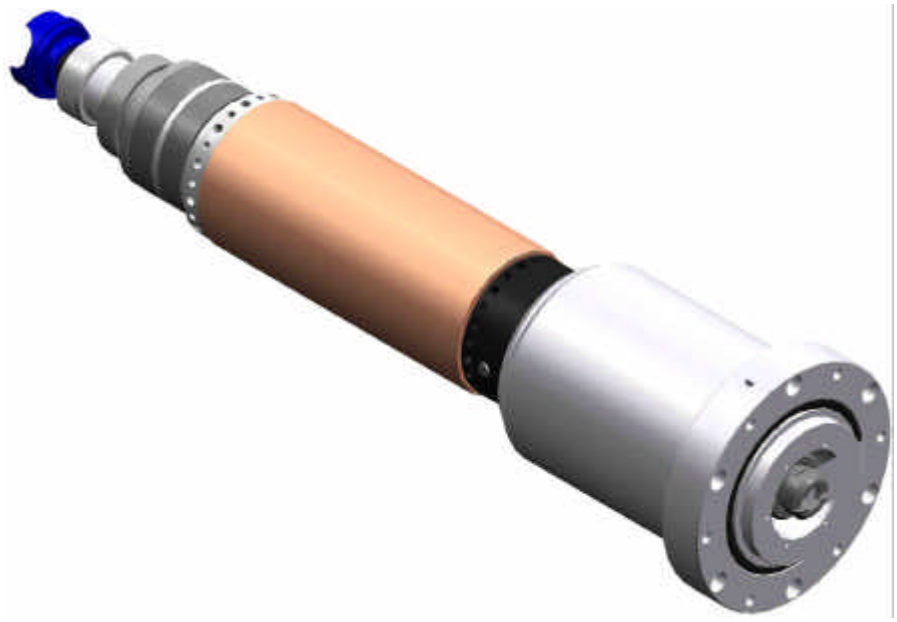


Figure 12.8 ES919 HSK F63 Long Nose spindle shaft kit

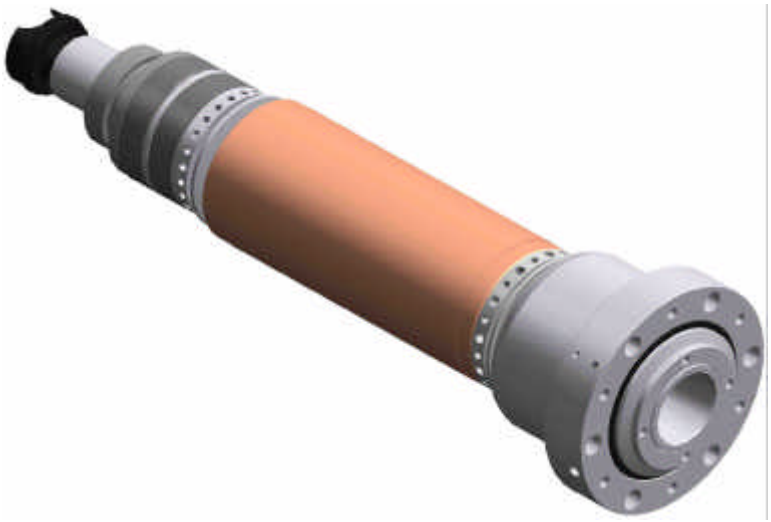


Figure 12.9 ES919 ISO 30 Short Nose spindle shaft kit

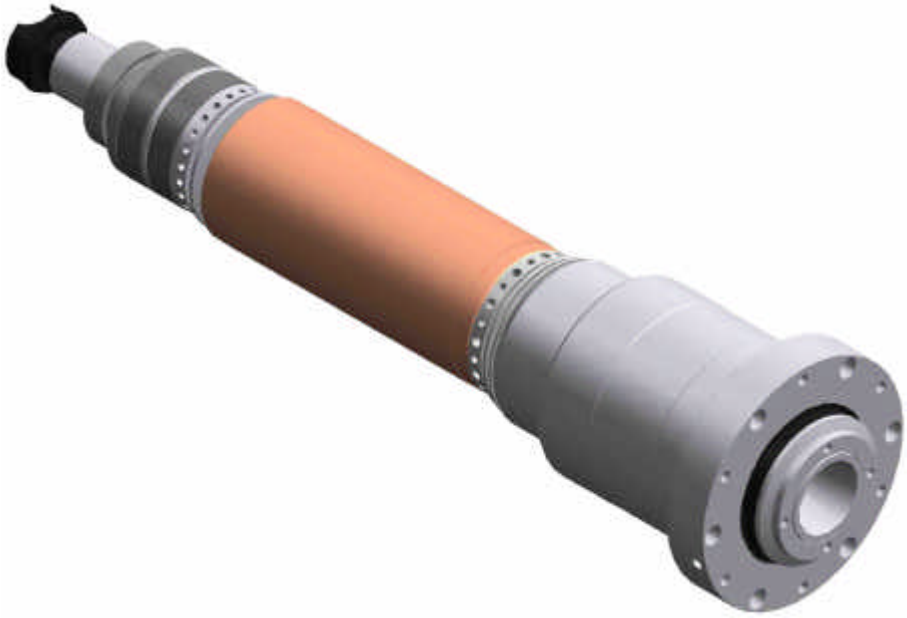


Figure 12.10 ES919 ISO 30 Long Nose spindle shaft kit

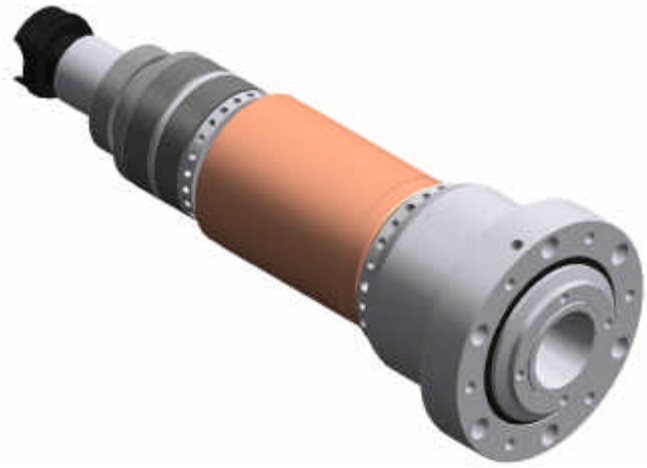
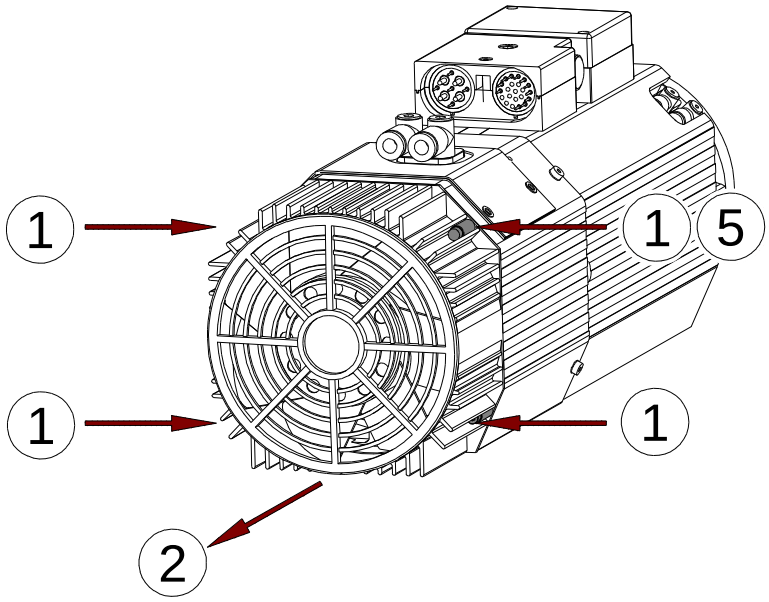


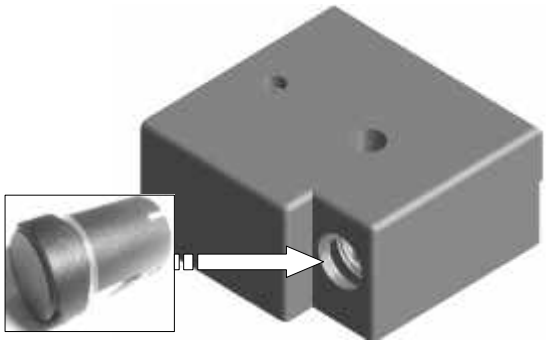
Figure 12.11 ES915 spindle shaft kit

12.2.2 Replacing the cooling fan



1	Remove the four fixing screws from the cooling fan unit.
2	Pull the fan unit off in the direction shown by the arrow.
3	Disconnect the cooling fan's electrical connector.
4	Connect up the connector of the new cooling fan unit.
5	Push the earth cable of the new cooling fan unit into the hole **(5)**, to ensure that it will be locked in position by the screw fitted in the next step **(6)**.
6	Fit the new cooling fan unit and secure it with the four fixing screws, taking care to achieve an efficient earth connection.

12.2.3 Replacing the tool change push-button



1	Remove the two screws from the terminal block cover.
2	Remove the terminal block cover.
3	Disconnect the push-button cable.
4	Gently push the old button out from inside the terminal block while also pulling it from the outside.
5	Fit the new push-button.
6	Connect up the push-button cable.
7	Replace the cover on the terminal block.
8	Fit and tighten the two cover screws.
9	Check the functioning of the new push-button.

IT IS STRICTLY FORBIDDEN TO CHANGE CABLES INSIDE THE TERMINAL BLOCK.

12.2.4 Replacing sensors S1, S2, S3 and S4

12.2.4.1 Wiring of sensors in ISO 30 versions

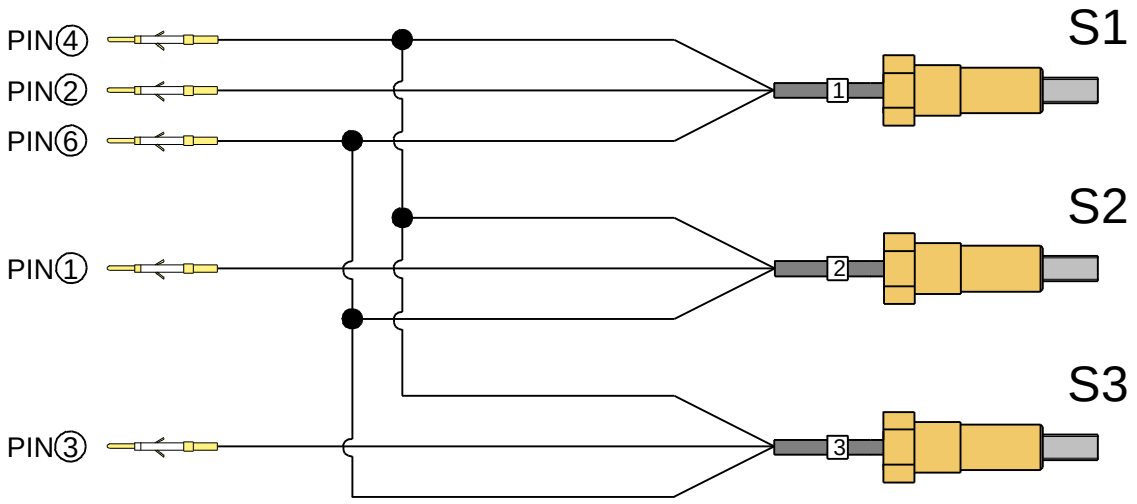


Figure 12.12 Connection of sensors in ISO 30 electro-spindles to the pins of the signals connector (see section 9.6.2)

12.2.4.2 Wiring of sensors in HSK versions

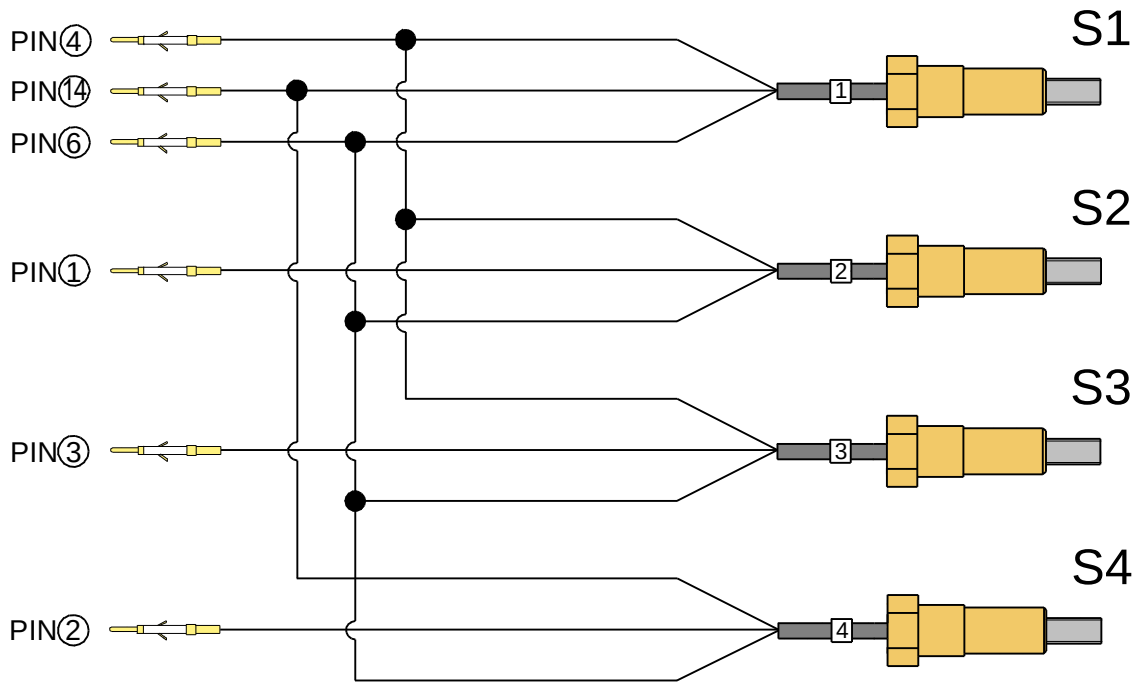


Figure 12.13 Connection of sensors in HSK electro-spindles to the pins of the signals connector (see section 9.6.3)

NOTE FOR HSK VERSIONS: The output to pin "14" must not be used for machine control purposes, but only to identify which sensor in the <S1+S4> set is faulty in case of malfunction, and to calibrate sensor S1 as instructed in sections 12.2.4.8 and 12.2.4.10 .

12.2.4.3 Accessing the sensors

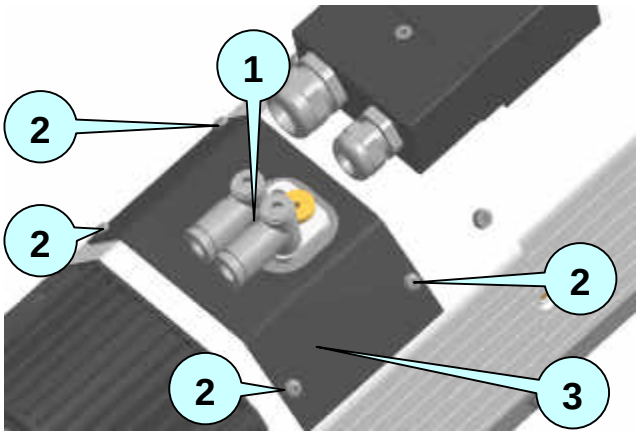


Figure 12.14

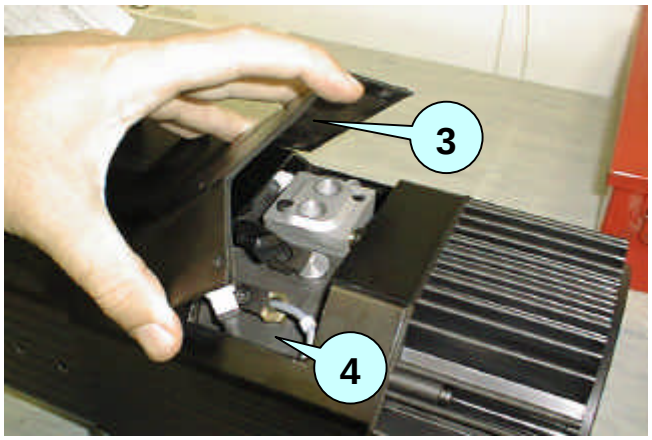


Figure 12.15

1	PAIR OF QUICK-FIT UNIONS	**3**	COVER OF SENSOR COMPARTMENT
2	SCREWS	**4**	SENSOR COMPARTMENT

- Disconnect the air hoses from the quick-fit unions **1**, and turn the quick-fit unions to face the nose of the spindle.
- Remove the screws **2** from the cover **3**.
- Remove the cover **3** to access the sensor compartment **4**, taking care not to damage the cover seal.

12.2.4.4 Location of sensors

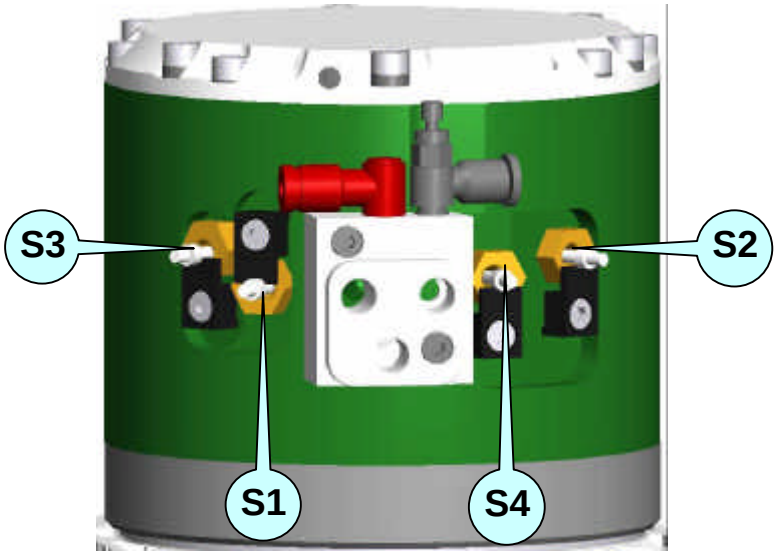


Figure 12.16 Identification of the sensors

12.2.4.5 The sensor assembly

The sensors are identified by a numbered cable tag. Take care not to mix up the sensors. This could damage moving parts of the electro-spindle.

The sensors are pre-fitted in calibrated seats to enable them to be quickly fitted to the electro-spindle at the correct depth.
For this reason always make absolutely sure what sensor you need to replace. The cables of the sensors installed in the electro-spindle and of those provided as spares are all tagged with a number ring to facilitate identification (Figure 12.17).

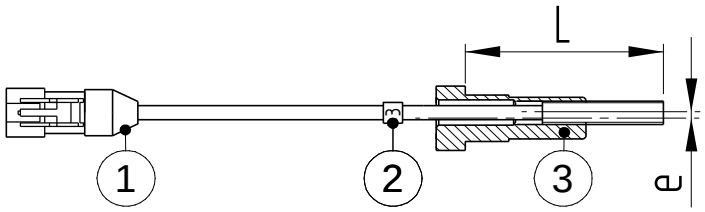


Figure 12.17 Sensor assembly

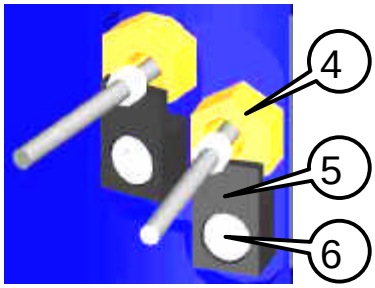


Figure 12.18

1	Electrical connector	**e**	Adjustment eccentric
2	Cable number ring	**4**	Sensor
3	Calibrated seat and sensor	**5**	Sensor fixing bracket
L	Calibrated depth	**6**	Allen screw

12.2.4.6 Replacing a sensor assembly

Refer to figures Figure 12.17 and Figure 12.18, and proceed as follows to replace the sensors.

1. Remove screw (6) securing the bracket (5) of the sensor to be replaced (4).
2. Pull the faulty sensor out from its housing and disconnect its electrical connector (1).
3. Fit the replacement sensor in the housing and connect the electrical connector.
4. Replace bracket (5) and replace and tighten screw (6). Do not fully tighten yet. Leave it loose enough to turn the sensor for calibration as described in sections 12.2.4.7 , 12.2.4.8 and 12.2.4.10 .
5. After you have calibrated the sensor, tighten the fixing screw to maintain the calibration setting.

Perform as many tests as possible using all available tool holders to verify the effectiveness of the new sensor calibration.

Warning: Incorrect sensor calibration can lead to electro-spindle malfunctions.

When reading sections from 12.2.4.7 to 12.2.4.10 on sensor calibration, always refer to the position numbers in Figure 12.17 and Figure 12.18.

12.2.4.7 Calibrating sensors S1, S2, and S3 on ISO 30 electro-spindles

When you have replaced the sensor as instructed in section 12.2.4.6 , proceed as follows to calibrate it.

1. Check whether the signal output from the sensor corresponds to that specified in section 11.6.1 in the table for the sensor you are calibrating. (See Figure 13.1 for sensor S3.)
2. If it does not, turn the sensor seat (4) until you obtain the output specified in the table for the sensor you are calibrating. Hold the sensor in this position and tighten the fixing screw (6).

12.2.4.8 Calibrating sensors S1, S2, S3 and S4 on HSK F63 electro-spindles

i

A kit of gauges and shims is available to assist in calibrating HSK F63 sensors. Their use is described in sections 12.2.4.9 and 12.2.4.10 .
The kit makes calibration not only quicker but more precise too. HSD strongly recommends the use of this kit, given the importance that correct sensor calibration has for machining safety.

12.2.4.8.1 Procedure for S1

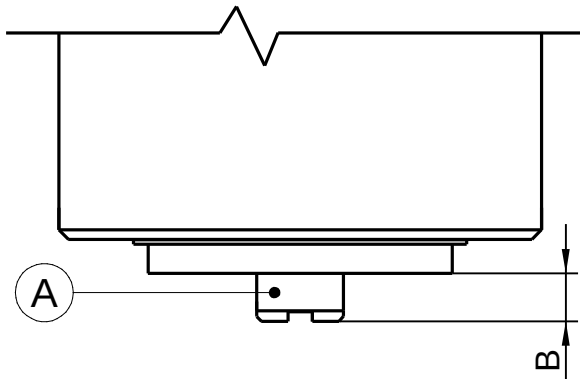
When you have replaced the sensor as instructed in section 12.2.4.6 , proceed as follows to calibrate it.

1. Check whether the signal output from sensor S1 corresponds to that specified in the table below.

CONDITION	OUTPUT S1
Tool holder locked	+24 V
No tool holder	0 V
Tool holder ejected (collet open)	0 V

2. Turn the spindle shaft by hand and check whether the conditions in the table are fulfilled throughout the 360° of a complete revolution.
3. If they are not, turn the sensor seat (4) until you obtain the output specified in the table. Hold the sensor in this position and tighten the fixing screw (6).

12.2.4.8.2 Procedure for S2



A	Ejector
B	Reference measurement

Figure 12.19

When you have replaced the sensor as instructed in section 12.2.4.6 , proceed as follows to calibrate it.

1. Connect compressed air at 6/7 bar (85/100 PSI) to the electro-spindle's cylinder and set the electro-spindle in a condition of "tool holder ejected (collet open)".
2. Use a depth callipers as shown in Figure 12.19 to check whether distance **(B)** from the tip of the ejector to the nose of the spindle at its maximum is **10.5 ± 0.1 mm**. If it is not, do NOT proceed but contact the HSD Customer Assistance Service.
3. Release the air from the cylinder. The ejector retracts, and **(B)** returns to its minimum value.
4. Use a pressure regulator to gradually increase pressure in the cylinder and extend the ejector.
5. Stop when distance **(B)** reaches **10.3 ± 0.1 mm**.
6. If necessary, slacken off the fixing screw (6) for sensor S2.
7. Turn the seat (4) of sensor S2 until the sensor gives a **"high" signal (24V) with (B) = 10.3 ± 0.1 mm** and a **"low" signal (0V) with (B) < 10.3 ± 0.1 mm**. Hold the sensor seat firmly in this position.
8. Turn the spindle shaft by hand and check that when **(B)** = 10.3 ± 0.1 mm the output from S2 is "high" (24V) and "low" (0V) when **(B)** < 10.3 ± 0.1 mm through 360° of a complete revolution.
9. Tighten the screw (6) to secure the sensor fixing bracket (5).
10. Perform as many tests as possible using all available tool holders to verify the effectiveness of the new sensor calibration.

Contact the HSD Customer Assistance Service if distance (B) is not 10.3 ± 0.1 mm when you feed compressed air at 6/7 bar (85/100 PSI) into the cylinder.

12.2.4.8.3 Procedure for S3

When you have replaced the sensor as instructed in section 12.2.4.6 , proceed as follows to calibrate it.

1. Check whether the signal output from the sensor corresponds to that illustrated in figure 13.1.
2. If it does not, turn the sensor seat (4) until you obtain the output specified in the table. Hold the sensor in this position and tighten the fixing screw (6).

12.2.4.8.4 Procedure for S4

When you have replaced the sensor as instructed in section 12.2.4.6 , calibrate it as follows.

1. Place shims first of thickness 0.12 mm or 0.16 mm between the faces of the tool holder cone and the spindle shaft as shown in Figure 12.20 in accordance with the table below.
2. Fit and lock the tool holder cone in the spindle shaft and check whether the signal output from sensor S4 corresponds to that specified in the table below.

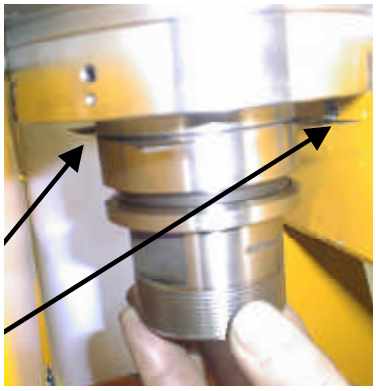
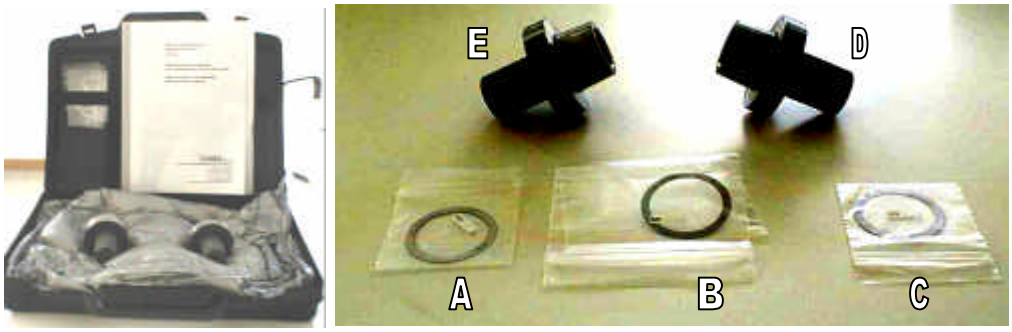


Figure 12.20

CONDITION	SHIM IN PLACE	OUTPUT S4
Tool holder locked	0.12 mm	HIGH (+24V)
Tool holder locked	0.16 mm	LOW (0V)
Tool holder ejected (collet open)	-	LOW (0V)

3. Turn the spindle shaft by hand and check whether the conditions in the table are fulfilled throughout the 360° of a complete revolution.
4. If they are not, turn the sensor seat (4) until you obtain the output specified in the table. Hold the sensor in this position and tighten the fixing screw (6).
5. Perform as many tests as possible using all available tool holders to verify the effectiveness of the new sensor calibration.

12.2.4.9 Gauge and shim kit for calibrating S1 and S4 sensors on HSK F63 electro-spindles (HSD code 3811H0110)



A	Shim for calibrating sensor S1 (0.04 mm)
B	Shim for calibrating sensor S4 (0.12 mm)
C	Shim for calibrating sensor S4 (0.16 mm)
D	Gauge for calibrating sensor S1 (14.29 mm)
E	Gauge for calibrating sensor S4 (14.13 mm)

Figure 12.21 Gauge and shim kit for sensors on F63 electro-spindles, HSD 3811H0110

A gauge and shim kit, HSD code 3811H0110, is available for calibrating the sensors on HSK F63 electro-spindles.
This kit allows you to set HSK collets at exactly the right position for sensor calibration. This makes calibration a lot quicker and more precise too. The gauges are manufactured to far greater precision than standard tool holders.

It is possible to calibrate the sensors without this kit, proceeding as described in section 12.2.4.8 . HSD nevertheless strongly recommends the use of it, given the importance that correct sensor calibration has for machining safety.

The gauges and shims shown in Figure 12.21 have their size punched on them or marked on the label of the bag containing them.

12.2.4.10 Calibrating sensors S1 and S4 on F63 HSK electro-spindles using the 3811H0110 kit

Figure 12.22 Using the gauge as a tool holder, with or without shims (Figure 12.23) according to the table in sections 12.2.4.10.1 and 12.2.4.10.2

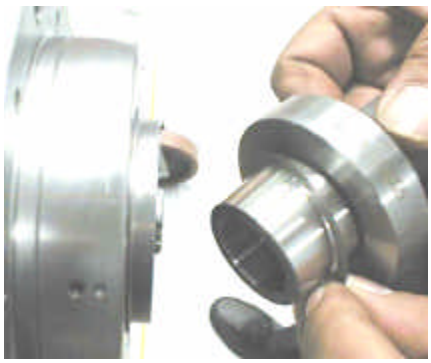


Figure 12.23 Placing a shim between the faces of the gauge and spindle shaft

12.2.4.10.1 Procedure for S1

When you have replaced the sensor as instructed in section 12.2.4.6 , calibrate it as follows.

1. Use the **14.29 mm gauge** and the **0.04 mm shim** as shown in Figure 12.22 and Figure 12.23, and check whether the output signal from sensor S1 corresponds to the following table.

CONDITION	SHIM IN PLACE	OUTPUT S1
Gauge locked (tool holder locked)	***YES***	**HIGH (+24V)**
Gauge locked (tool holder locked)	***NO***	**LOW (0V)**
No gauge (no tool holder)	**-**	**LOW (0V)**
Collet open (tool holder ejected)	**-**	**LOW (0V)**

2. Turn the spindle shaft by hand and check whether the conditions in the table are fulfilled through 360° of a complete revolution.
3. If they are not, turn the sensor seat (4) until you obtain the output specified in the table. Hold the sensor in this position and tighten the fixing screw (6).
4. Perform as many tests as possible using all available tool holders to verify the effectiveness of the new sensor calibration.

12.2.4.10.2 Procedure for S4

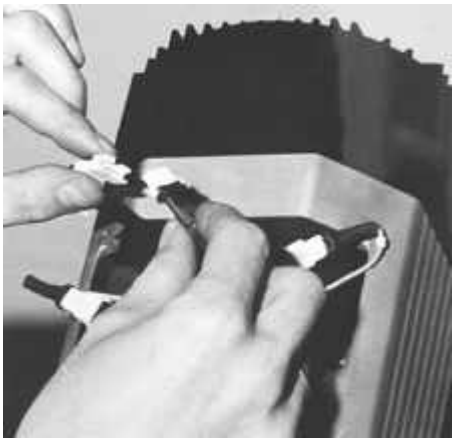
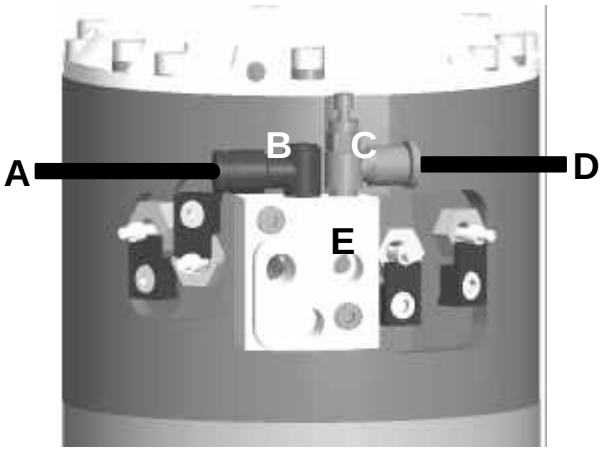
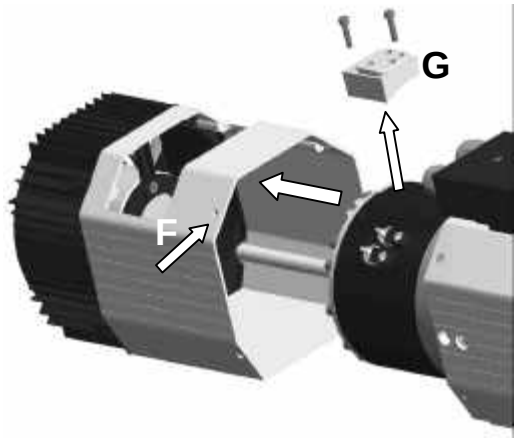
When you have replaced the sensor as instructed in section 12.2.4.6 , calibrate it as follows.

1. Use the 14.13 mm gauge and the 0.12 mm and 0.16 mm shims as shown in Figure 12.22 and Figure 12.23, and check whether the output signal from sensor S4 corresponds to the following table.

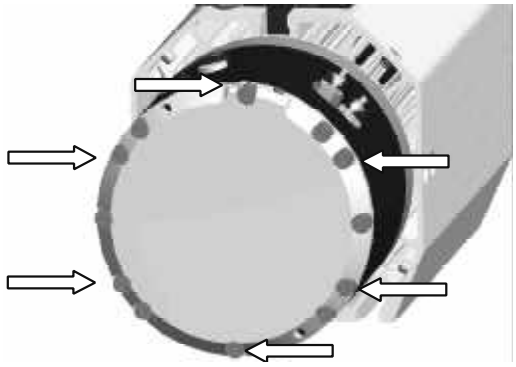
CONDITION	SHIM IN PLACE	OUTPUT S1
Gauge locked (tool holder locked)	**0.12 mm**	**HIGH (+24V)**
Gauge locked (tool holder locked)	**0.16 mm**	**LOW (0V)**
Collet open (tool holder ejected)	**-**	**LOW (0V)**

2. Turn the spindle shaft by hand and check whether the conditions in the table are fulfilled through 360° of a complete revolution.
3. If they are not, turn the sensor seat (4) until you obtain the output specified in the table. Hold the sensor in this position and tighten the fixing screw (6).
4. Perform as many tests as possible using all available tool holders to verify the effectiveness of the new sensor calibration.

12.2.5 Replacing the cylinder assembly

1		Open the sensor compartment as instructed in section 12.2.4.3 .
2		Disconnect all the electrical connectors.
3	**IMPORTANT:**	**Before you disconnect hoses A and D (see step 4 below) tag them or mark them with adhesive tape, so that you can recognize which is which in the rest of the procedure.**
4		**A** Compressed air line for optional functions **B** Quick-fit union **C** Quick-fit union with pressure regulator **D** Compressed air line for internal pressurization **E** Compressed air inlet for cone cleaning and pressurization
5		• Clearly mark hoses **A** and **D** as instructed in step **3**. • Disconnect hoses **A** and **D** from unions **B** and **C**. • Remove the two fixing screws from block **G**. • Remove block **G** taking care not to lose or damage the seals. • Remove the four screws **F**. • Remove the cooling fan cover in the direction shown by the arrow.

6

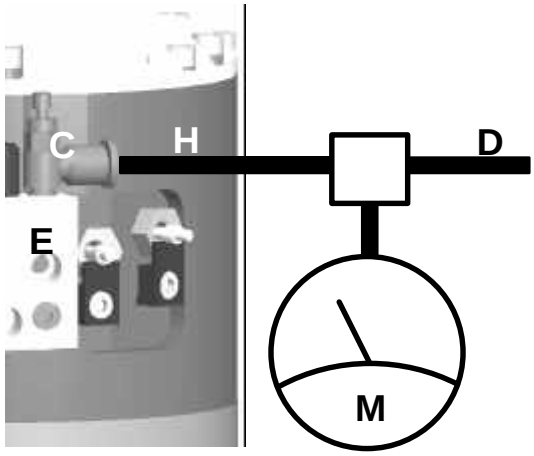


Remove only the six screws shown to release the cylinder.

7

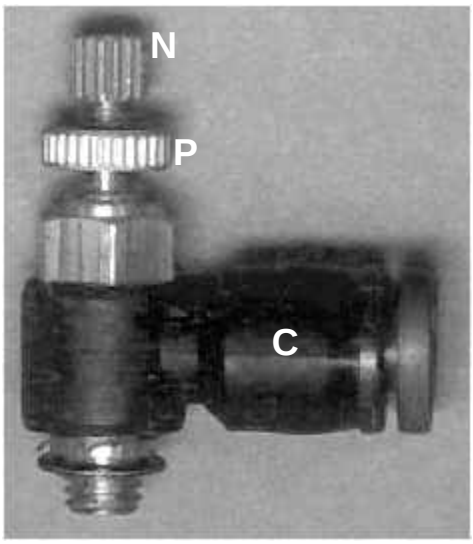
Fit the new cylinder using the six screws removed in step **6**.

8



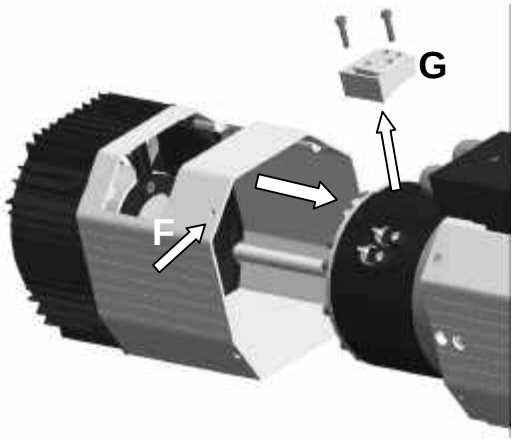
C	Quick-fit union with pressure regulator
D	Compressed air line internal pressurization
E	Compressed air inlet for cone cleaning and pressurization
H	Connection hose
M	Pressure gauge

9



C	Quick-fit union with pressure regulator
N	Adjuster
P	Lock nut

- Fit a pressure gauge **M** as shown in step **8** to measure the outlet pressure from union **C**.
- Connect an air supply at **4 bar (58 PSI)** to **E**.
- Turn adjuster **N** until the pressure on the gauge reads **0.8 bar (11.6 PSI)**.
- Tighten lock nut **P** to lock the adjustment.
- Disconnect the pressure gauge **M** and hoses **D** and **H** from union **C**.

10		• Block **G** must be removed to re-fit the cooling fan cover. • Remove the two fixing screws from block **G**. • Remove block **G** taking care not to lose or damage the seals. • Fit the cooling fan cover and secure with screws **F**. • Fit block **G** again, taking care to seat the seals correctly, and tighten the two fixing screws. • Reconnect hoses **A** and **D** to quick-fit unions **B** and **C** respectively (see the figure for step **4**). • Connect the cooling fan's electrical connector.
11		Follow the instructions in section 12.2.4 to: • remove the sensors from the old cylinder; • fit them on the new cylinder; • calibrate the sensors; • Close the sensor compartment.
12		• Use an M6 Allen key to remove the EXTERNAL compressed air unions (pos. 8, Figure 6.3) from the old cylinder and fit them to the new cylinder.

CALIBRATE THE SENSORS AFTER THE CYLINDER ASSEMBLY HAS BEEN REPLACED.

§ 13 ACCESSORIES AND OPTIONS

BEFORE STARTING ANY WORK ON THE ELECTRO-SPINDLE, READ AND FOLLOW ALL THE SAFETY PRECAUTIONS AND MAINTENANCE SAFETY WARNINGS.
SEE IN PARTICULAR CHAPTER § 5 AND PAGES 66 AND 71 OF CHAPTER § 12.

On request, the electro-spindle can be fitted with the following accessories and options:

1. "Spindle shaft stopped" sensor S3 (See section 13.1)
2. Bearing temperature sensor (See section 13.2)
3. Belt driven C axis (See section 13.3)
4. Gear driven C axis (See section 13.3)
5. Forced air cooling (See section 13.4)

13.1 "SPINDLE SHAFT STOPPED" SENSOR S3

The “SPINDLE SHAFT STOPPED” sensor outputs two “ON” and two “OFF” pulses per shaft revolution. It remains permanently “ON” at high speeds.

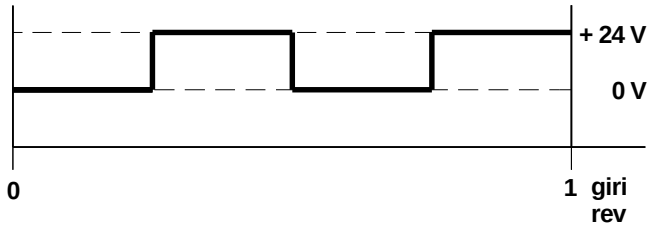


Figure 13.1 Output from sensor S3

See section 7.7.4 for the sensor's electrical specifications.
See section 12.2.4 to install and calibrate the sensor. Make sure that output is as specified in Figure 13.1.

Ignore the output of S3 during tool changes.

13.2 BEARING TEMPERATURE SENSOR

A temperature sensor (PT 1000 type) can be fitted to the electro-spindle to detect high bearing temperatures.
The sensor can be connected to any numeric controller capable of interfacing with a temperature sensitive resistance (analog input).

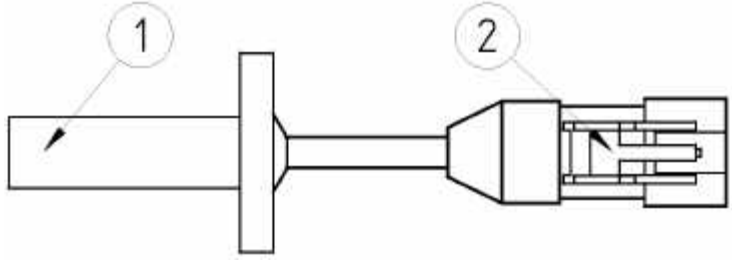


Figure 13.2

1	Seat for sensor hole (Pos. 4 in Figure 13.3)
2	Electrical connector

13.2.1 Installing the bearing temperature sensor

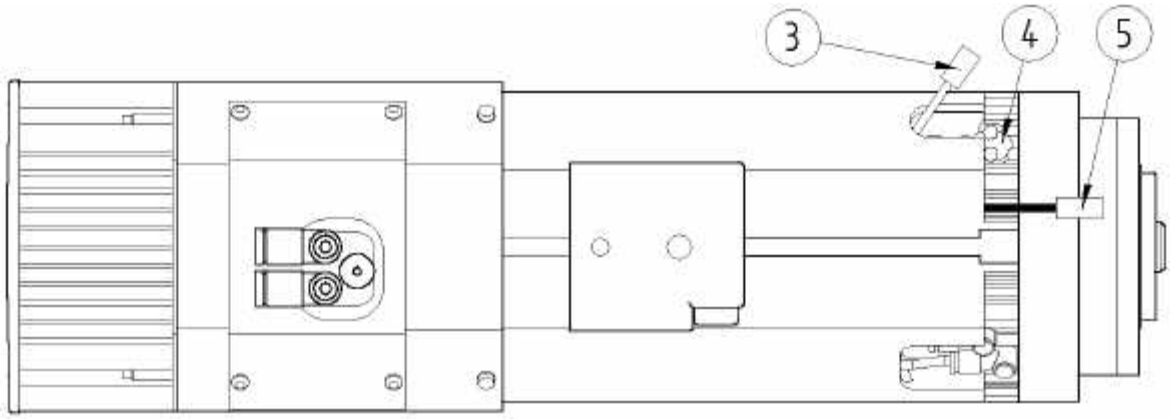


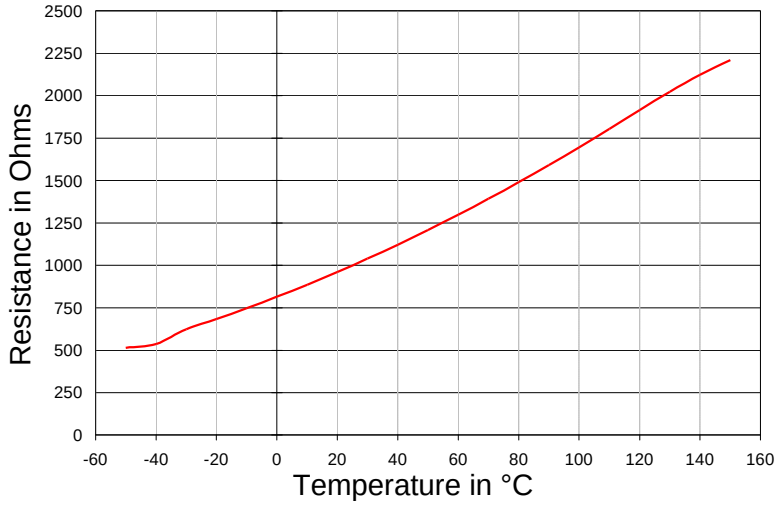
Figure 13.3

3	Electrical connector for bearing temperature sensor (in shrink wrapped protective sheath)
4	Sensor hole with protective cover secured by two screws
5	Connector for sensor SC of the gear driven C axis (optional C axis)

Take care not to mix up connector 3 with connector 5.

- Remove the cover fixing screws and remove the cover from the temperature sensor hole **4**.
- Fit the seat **1** in the hole **4**.
- Fix the sensor in place with the two screws previously removed from the cover.
- Remove the shrink wrapped sheath from connector **3**.
- Connect connector **2** to connector **3**.

13.2.2 Characteristic curve of the temperature sensor referred to 1 mA



Resistance	+/- 2%	(Ohm)	815	886	961	1000	1040	1122	1208	1299	1392	1490	1591	1696
Temperature	+/- 5%	(°C)	0	10	20	25	30	40	50	60	70	80	90	100
Temperature	+/- 5%	(°F)	32	50	68	77	86	104	122	140	158	176	194	212

13.3 "C" AXIS UNIT

ES919 and ES915 variants can be fitted with a *C Axis unit*.

The C axis unit rotates heads, gearboxes etc. fixed to the electro-spindle through 360° on the assembly plane by means of a quick lock device and specially shaped drive pin.

Rotational movement is powered by a servomotor, rigidly mounted in line with a low-backlash epicyclic gearbox.

A PNP, NC inductive sensor, "SC", provides a zero position reference signal and allows the assembly to be positioned quickly and accurately for tool release into the tool magazine.

C axis units can be *Gear driven* or *Belt driven.* Gear driven C axis units are available as separate optionals for all "Short Nose" and "Long Nose" variants. Belt driven C axis units are not available as separate optionals, but come pre-fitted, and only to ES919 ISO30 (7 kW or 8 kW version, 2 poles) Short Nose variants.

Choice of the C axis servomotor is left to the customer. The mounting flanges for Belt driven C axis units are shown in section 7.6.2 .

> ***i*** **All parts of the C axis are lubricated for life and are maintenance free.**

13.3.1 Belt driven "C" axis unit

> ***i*** **For the overall dimensions and technical specifications of belt driven C axis unit, see section 7.6 .**

13.3.2 Gear driven "C" axis unit

Helical gears with automatic backlash elimination.
For installation instructions and technical specifications, see the manual delivered with the unit or available from the HSD Technical Assistance Service (code HSD 5801H0019).

Main specifications for a servomotor giving 0.64 Nm at 3000 rpm *(*)*

Rated torque	**67 Nm** (*)
Starting torque	**105 Nm** (*)
Overall gear ratio	**1 / 123**
Total mechanical efficiency	**0,85**
Epicyclic gear backlash	**3'**
Positioning precision	**5'**
Gearbox input rpm	**3000 rpm (4000 rpm max)**
Rated gearbox input torque	**2.5 Nm**
Starting gearbox input torque	**4 Nm**
Weight	**10 Kg (without servomotor)**

(*) Specifications depend on the choice of servomotor.

13.3.3 SC sensor for the belt driven “C” axis unit

Sensor type: PNP proximity; NC (Normally Closed)	
Voltage	10 - 30 V (DC)
Maximum load	200 mA
No-load consumption	< 10 mA
Rated read distance	0.8 mm

The C axis unit comes complete with a PNP NC (Normally Closed) inductive sensor designated SC.
The closing of the sensor contacts signals the zero reference position and allows the assembly to be positioned quickly and accurately for tool release into the tool magazine.
The zero position is the position at which the hole for the shaped drive pin aligns with sensor SC, as shown in the detail inside the white circle in Figure 13.4.

CONDITION	***STATE OF CONTACTS***
Zero position	Closed
All other positions	Open

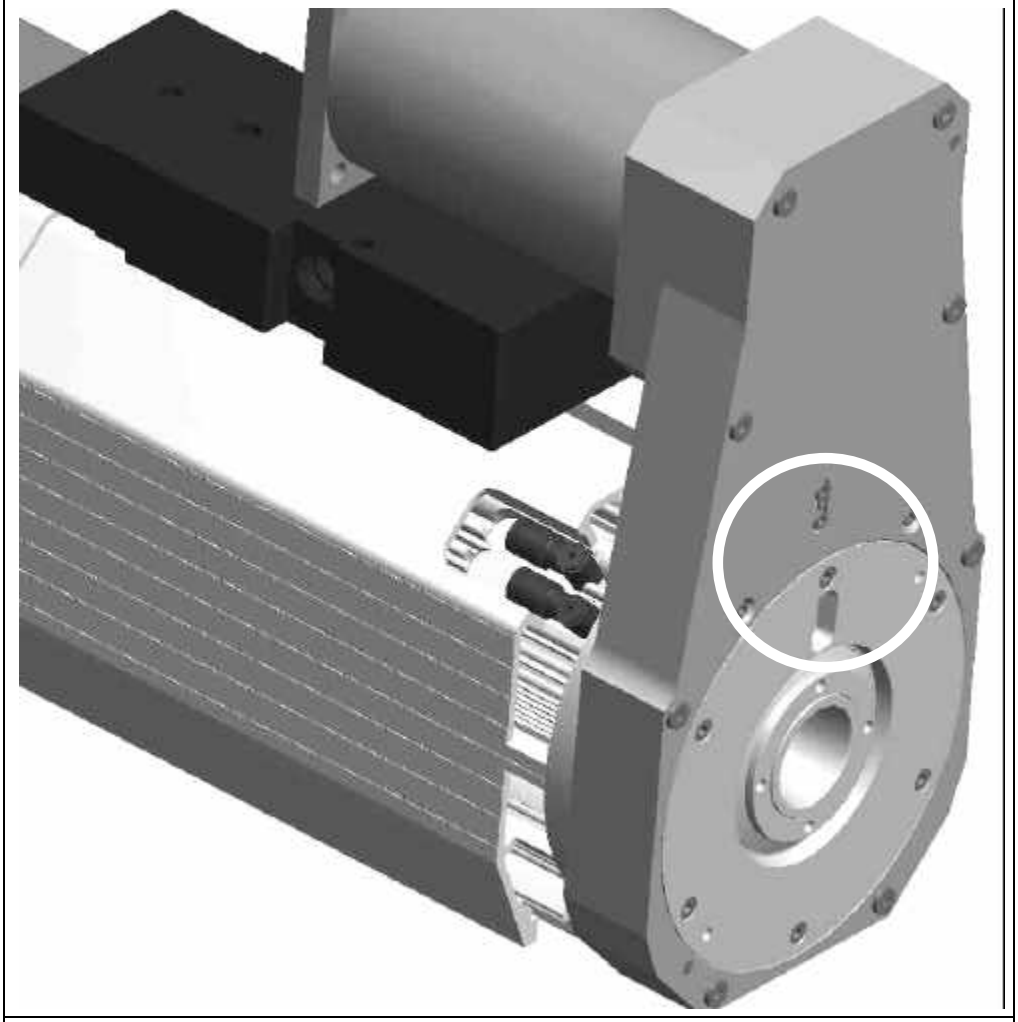
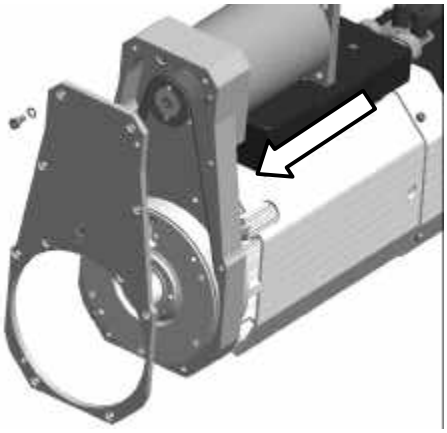
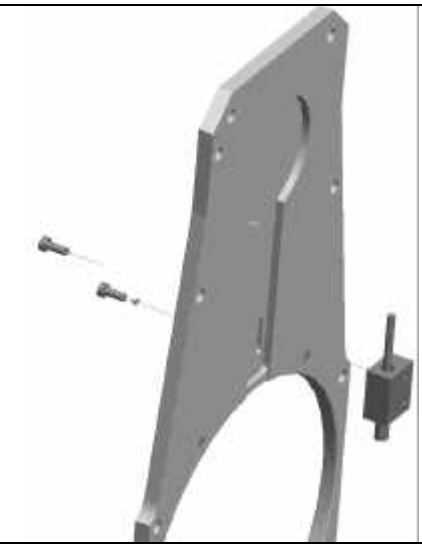
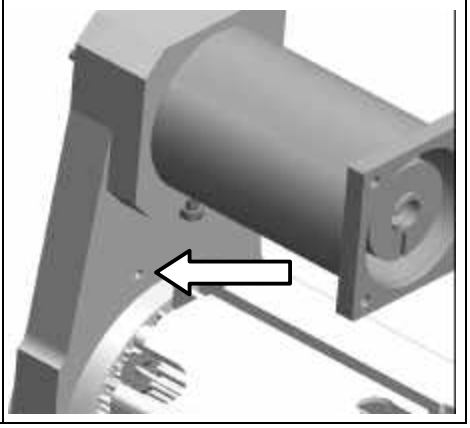
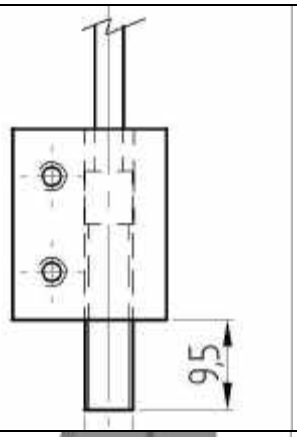
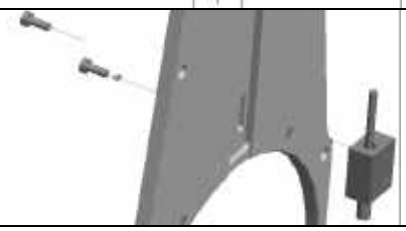
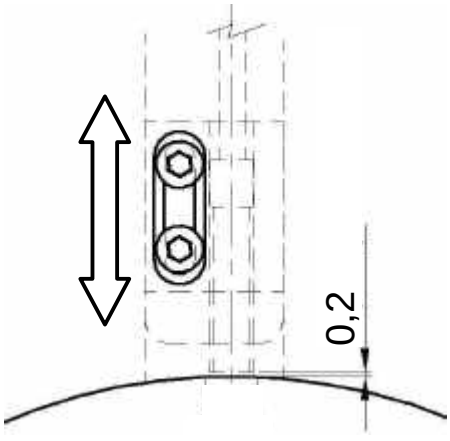


Figure 13.4 The zero reference position

13.3.4 Replacing and calibrating the SC sensor in belt drive versions

BEFORE STARTING ANY WORK ON THE ELECTRO-SPINDLE, READ AND FOLLOW ALL THE SAFETY PRECAUTIONS AND MAINTENANCE SAFETY WARNINGS.
SEE IN PARTICULAR CHAPTER § 5 AND PAGES 66 AND 71 OF CHAPTER § 12.

1	• Turn the C axis to any position other than the zero reference position, i.e. to any position other than that shown in Figure 13.4. • Disconnect the electro-spindle from the electrical supply. • Remove the eight fixing screws and remove the cover from the body of the C axis unit (see figure on the right). • Disconnect the sensor's electrical connector, which is located in the point shown by the arrow in the figure on the right (see also position 5 of Figure 6.3 in chapter § 6).	
2	• Cut the cable of the faulty sensor to facilitate removal. • Remove the two screws fixing the sensor block to the cover (figure on the right).	
3	• Insert the new sensor in the hole shown by the arrow in the figure on the right.	

4	• Apply some Loctite 243 or equivalent medium strength thread locking compound to the threads of the sensor. • Screw the sensor into the side of the sensor block with the largest hole. • Screw the sensor in until you achieve the protrusion shown in the figure on the right. • Wait for the thread locking compound to set in compliance with the manufacturer's instructions.	
5	• Fit the assembled sensor + sensor block to the cover (figure on the right), but leave the screws loose enough for the sensor block to move.	
6	• Apply silicon sealant to the sensor cable hole. • Check that the C axis unit is still in a position other than the zero position, i.e. that the drive pin hole is <u>not</u> in the position shown in Figure 13.4. Turn the C axis unit if necessary. • Fit the cover back on the body of the C axis unit. Fit and tighten all the fixing screws (figure on the right).	
7	• Adjust the sensor read distance using either "PROCEDURE A" or "PROCEDURE B": **PROCEDURE A** • Place a shim of 0.2 mm between the pulley and the sensor. • Push the sensor against the pulley and into firm contact with the shim. • Tighten the two sensor block fixing screws. • Remove the shim. **PROCEDURE B** • Push the sensor against the pulley and check that the sensor contacts are open. • Slowly slide the sensor away from the pulley until the contacts close. • Slowly slide the sensor towards the pulley again until the contacts just open. • Tighten the two sensor block fixing screws.	
8	• Re-connect the electro-spindle's electrical connections. • Turn the C axis unit, and check that the contacts of sensor SC remain closed at all positions other than zero position (see Figure 13.4) when they must open. • Check sensor functioning at as many axis positions as practical.	

13.4 FORCED AIR COOLING

The electro-spindle can be cooled by compressed air instead of by the cooling fan.
Compressed air is delivered to a distribution flange, pre-fitted by HSD or retro-fitted as a kit.
This cooling solution reduces the overall length of the electro-spindle by 5 cm and dispenses with the need to maintain a gap (10 cm) behind the fan. Compressed air cooling therefore reduces the electro-spindle's overall space requirement by 15 cm (Figure 13.5).

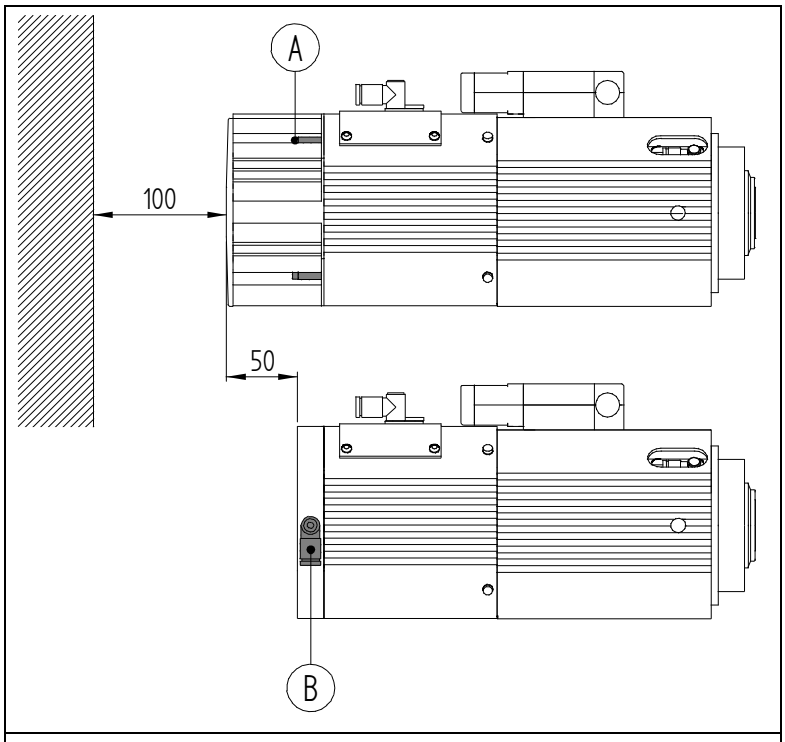


Figure 13.5

A	Four cooling fan fixing screws		
B	Cooling air inlet	External hose Ø:	8 mm
		Pressure:	6 / 7 bar – 85 / 100 PSI
		Consumption:	4 cfm referred to 1 Atm, 68°F (7000 normal litres/hour)

The stated values for air consumption and inlet pressure are for the S1 duty type described in the tables in chapter § 7. If the unit is used with lighter duty types, the user can evaluate whether to reduce air consumption by lowering the inlet pressure.

13.4.1 Installing the forced air cooling kit

BEFORE STARTING ANY WORK ON THE ELECTRO-SPINDLE, READ AND FOLLOW ALL THE SAFETY PRECAUTIONS AND MAINTENANCE SAFETY WARNINGS.
SEE IN PARTICULAR CHAPTER § 5 AND PAGES 66 AND 71 OF CHAPTER § 12.

1. Remove the fixing screws and pull the fan unit off the electro-spindle (see section 12.2.1).
2. Disconnect the cooling fan's electrical connector and fit the bridge connector provided.
3. Fit the air distribution flange in the place of the cooling fan unit and secure it with the four screws removed from the fan unit.
4. Connect the compressed air supply to the quick-fit union (B) on the air distribution flange.

§ 14 TROUBLE SHOOTING

BEFORE STARTING ANY WORK ON THE ELECTRO-SPINDLE, READ AND FOLLOW ALL THE SAFETY PRECAUTIONS AND MAINTENANCE SAFETY WARNINGS.

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
The electro-spindle does not turn	There is no power	• Check the mains power supply. • Check all power terminals. • Check all electrical cables and connections for breaks.
	No tool holder is fitted	Fit a tool holder.
	The tool holder not correctly seated	See *"The tool holder is not locked"* below.
	The thermal switch has tripped	Wait for the electro-spindle to cool down and the thermal switch will automatically reset. If the thermal switch trips frequently, see *"The electro-spindle overheats"* below.
	The inverter switch has tripped	Consult the inverter's own manual or contact the inverter manufacturer. *On electro-spindles with configurable power terminals only:* see section 9.6.6 and check that the power terminals are configured correctly for the mains power rating.
	Sensor S1 (ISO 30) or sensor series <S1+S4> (HSK) is disconnected or faulty	• Check the sensor connectors. • Check the sensor cables for breaks. • Calibrate the sensors as instructed in section 12.2.4 . • Replace any faulty sensors as instructed in section 12.2.4 .
	There is no electro-spindle enabling signal	Consult the manuals or contact the manufacturers of the machine, numeric controller, and inverter.

The tool holder is not locked	There is dirt or foreign bodies between the tool holder and the spindle shaft housing	Remove any large foreign bodies and clean the tool holder cone and spindle housing as instructed in section 12.1.2 .
	The tool holder cone is not of the right type	Choose a tool holder as instructed in sections 11.4.1 (ISO 30), 11.4.2 (HSK) and 11.4.3 (all).
	There is insufficient air pressure to open the collet	• Check the air pressure settings in accordance with section 9.4 • Check the compressed air system for leaks and pressure losses.
	The electro-spindle is not aligned with the tool holder magazine	Consult the machine's own manual or contact the machine manufacturer.
	Sensor S2 is disconnected or faulty	• Check the sensor connectors. • Check the sensor cables for breaks. • Calibrate the sensors as instructed in section 12.2.4 . • Replace any faulty sensors as instructed in section 12.2.4 .
	There is a control error	Consult the machine's own manual or contact the machine manufacturer.
The tool holder is not ejected	There is insufficient air pressure	• Check the air pressure settings in accordance with section 9.4 • Check the compressed air system for leaks and pressure losses.
	There is no ejection enabling signal	Consult the manuals or contact the manufacturers of the machine, numeric controller, and inverter.
There is no air pressure inside the electro-spindle	There is insufficient air pressure or the compressed air system is faulty	• Check the air pressure settings in accordance with section 9.4 . • Check the compressed air system for leaks and pressure losses. • Contact the HSD Technical Assistance Service.
One of the sensors does not give the required output	A sensor is disconnected or faulty	• Check the sensor connectors. • Check the sensor cables for breaks. • Calibrate the sensors as instructed in section 12.2.4 . • Replace any faulty sensors as instructed in section 12.2.4 .

The electro-spindle overheats	The cooling fan is not working properly	• Check that the cooling fan is working. • Check the cooling fan for damage. • Check that nothing is preventing the fan from turning. • If the fan unit itself is faulty, replace it as instructed in section 12.2.2 .
	The air channels through the electro-spindle body are blocked	• Remove the cooling fan as instructed in section 12.2.2 . • Inspect and clear the air channels through the electro-spindle body. • Re-fit the cooling fan.
	The machining is taking up too much power	Reduce the machining power requirements.
	The inverter setup is incorrect	Check the specifications for your model of electro-spindle on its data label and in section § 7.
	The power supply voltage is incorrect	Check the voltage requirements on the electro-spindle's data label.
	For models with configurable power terminals only: the connections at the configurable power terminals are incorrect	See section 9.6.6 and check that the power terminals are configured correctly for the mains power rating.
Excessive current absorption	*For models with configurable power terminals only:* the connections at the configurable power terminals are incorrect	See section 9.6.6 and check that the power terminals are configured correctly for the mains power rating.
Performance below specifications	*For models with configurable power terminals only:* the connections at the configurable power terminals are incorrect	See section 9.6.6 and check that the power terminals are configured correctly for the mains power rating.
	The inverter setup is incorrect	Check the specifications for your model of electro-spindle on its data label and in section § 7.
	The power supply voltage is incorrect	Check the power supply voltage requirements on the electro-spindle's data label.

The electro-spindle vibrates	The tool holder is not balanced	Choose a tool holder in accordance with sections 11.4.1 (ISO 30), 11.4.2 (HSK) and 11.4.3 (all).
	The tool is not balanced	Choose a tool in accordance with sections 11.4.4 and 11.5 .
	There is dirt or foreign bodies between the tool holder and the spindle shaft housing	Remove any large foreign bodies and clean the tool holder cone and spindle housing as instructed in section 12.1.2 .
	The inverter setup is incorrect	Check the specifications for your model of electro-spindle on its data label and in section § 7.
	The machining is taking up too much power	Reduce the machining power requirements.
	The fixing bolts are loose	Tighten the fixing bolts.
	The bearings are worn or damaged	Replace the spindle shaft kit.
The bearings are noisy	The bearings are worn or damaged	Replace the spindle shaft kit.

§ 15 SPARE PARTS LIST

HSD CODE	DESCRIPTION
KS915INC	ES915 ISO 30 Short Nose spindle shaft kit Version K+C: CRONIDUR or CHROMEX front bearings – Ceramic rear bearings Version C+C: Ceramic front and rear bearings Version C+A: Ceramic front bearings – steel rear bearings Version A+A: Steel front and rear bearings
KS919INC	ES919 ISO 30 Short Nose spindle shaft kit Version K+C: CRONIDUR or CHROMEX front bearings – Ceramic rear bearings Version C+C: Ceramic front and rear bearings Version C+A: Ceramic front bearings – steel rear bearings Version A+A: Steel front and rear bearings
KS919INL	ES919 ISO 30 :Long Nose spindle shaft kit Version K+C: CRONIDUR or CHROMEX front bearings – Ceramic rear bearings Version C+C: Ceramic front and rear bearings Version C+A: Ceramic front bearings – steel rear bearings Version A+A: Steel front and rear bearings
KS919HNC	ES919 HSK F63 Short Nose spindle shaft kit Version K+C: CRONIDUR or CHROMEX front bearings – Ceramic rear bearings Version C+C: Ceramic front and rear bearings Version C+A: Ceramic front bearings – steel rear bearings Version A+A: Steel front and rear bearings
KS919HNL	ES919 HSK F63 Long Nose spindle shaft kit Version K+C: CRONIDUR or CHROMEX front bearings – Ceramic rear bearings Version C+C: Ceramic front and rear bearings Version C+A: Ceramic front bearings – steel rear bearings Version A+A: Steel front and rear bearings
6202H0011A	Cylinder assembly for : ES915 ISO30 , ES919 ISO30 , ES919 L ISO30
6202H0016A	Cylinder assembly for : ES919 HSK F63 , ES919 L HSK F63
5664H0001	Sensor S1
5664H0002	Sensor S2
5664H0006	Sensor S3
5664H0016	Sensor S4
5664H0024	Sensor SC (Belt driven “C” axis)
5664H0003	Temperature sensor for front bearings
6390H0001	Forced air cooling kit
5661H0001	Cooling fan kit (complete with basic cover and protective cover)
5618H0001	Push-button
6200H0045	“Signal + Power” cable connector
6200H0046	“ Power” cable connector

§ 16 DISPOSING OF THE ELECTRO-SPINDLE

 **RESIDUAL RISKS:**	**THE DRAW BAR SPRING IS PRE-LOADED WITH A FORCE OF HUNDREDS OF KILOGRAMS: IN HSK MODELS IN PARTICULAR THE DRAW BAR CAN BE VIOLENTLY EXPELLED FROM THE UNIT, WITH SERIOUS RISK OF INJURY, IF THE ELECTRO-SPINDLE IS DISASSEMBLED BY UNTRAINED PERSONNEL.** **TAKE GREAT CARE AND IN CASE OF DOUBT, CONTACT THE HSD TECHNICAL ASSISTANCE SERVICE.**

At the end of the electro-spindle's working life it is the customer’s responsibility to dispose of it correctly.
First of all, clean the unit and separate the various components into mechanical and electrical parts. Then separate the component parts according to type of material: electric motors (copper windings), metal parts (body, etc.), plastic parts, etc.. Dispose of the various materials in compliance with the laws and regulations applicable in the country where the electro-spindle has been installed.

HSD S.p.a.

TECHNOLOGICAL EQUIPMENT FOR AUTOMATION

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