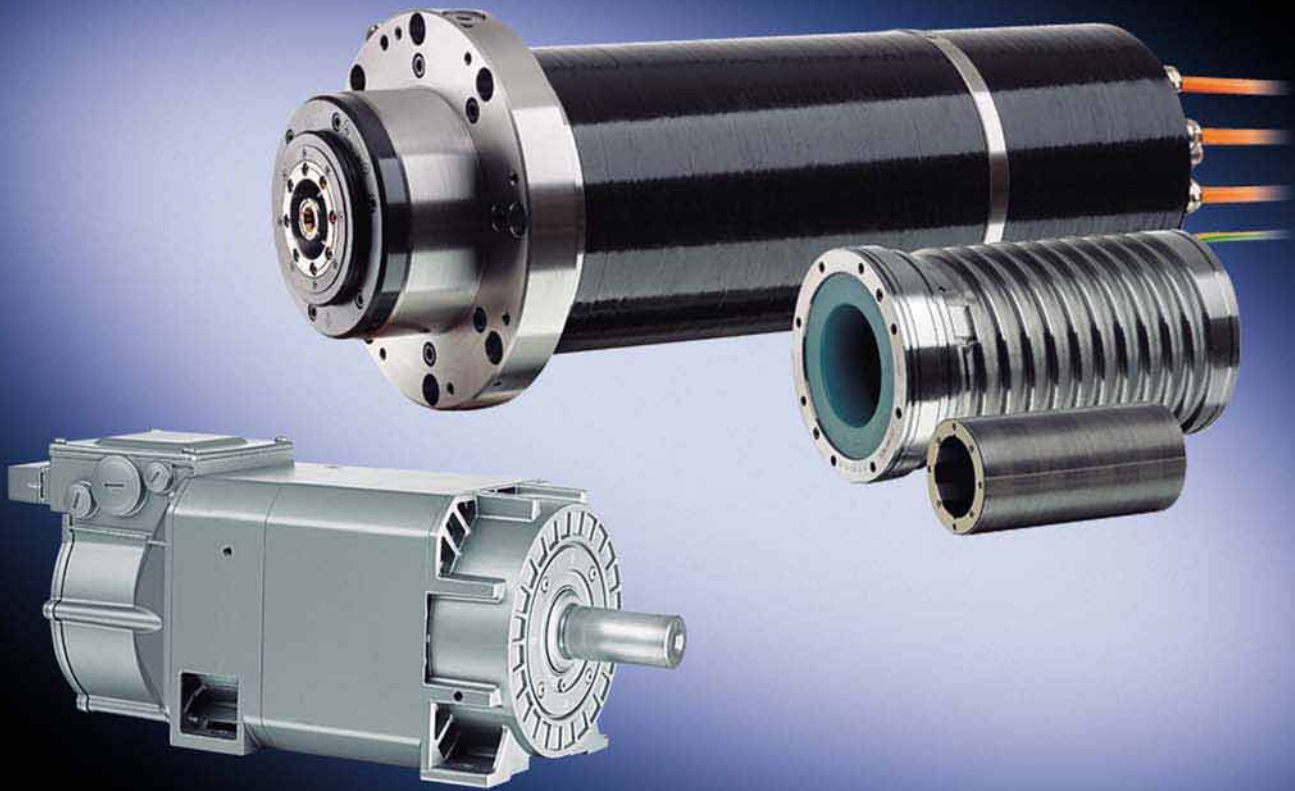


Spindle motors and motor spindles
for every requirement

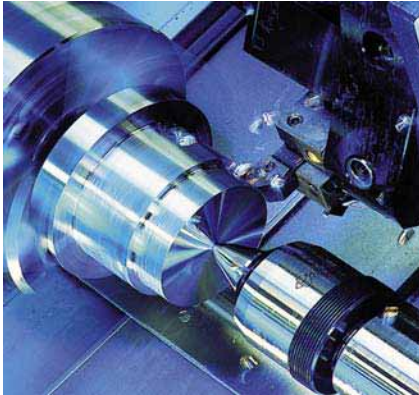


spindle

SOLUTIONS

SIEMENS

The right spindle solution for any task



The function, performance and accuracy of the electrical and mechanical components used are the deciding factors for productivity and the quality of the output from machines and systems – not to mention the mechanical execution of the task.

Therefore, when it comes to machine tools, the functionality and performance of the CNC are crucial, as are the performance capabilities of the drive system and the running characteristics and dynamic response of the motors used.

The quality of the drives for the feed axes determines the dimensional accuracy of the workpieces. The spindle also makes a decisive contribution to their surface quality.

From the controller to the motor, with its broad product range, Siemens can always offer the components that are needed to satisfy the performance and quality requirements of any machine.

This freedom of choice applies also to spindle applications.

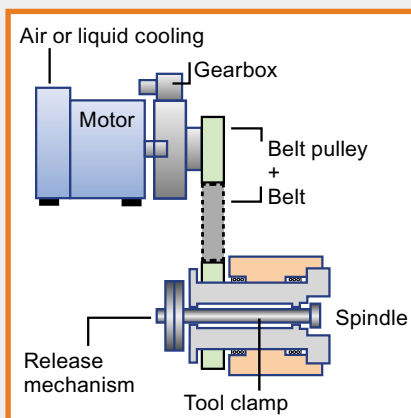
For conventional, typically belt-driven or coupled machine tool spindles, the user can choose from a wide spectrum of asynchronous motors. Our product range also includes externally driven spindles.

Compact motor spindles that are integrated in the machine are increasingly used to further improve efficiency in production. Here, too, Siemens has the right solution for the job. All activities relating to motor spindles and externally driven spindles are concentrated in our subsidiary, Weiss Spindeltechnologie GmbH, whose expertise ranks it as an international leader in the field of motor spindles for milling, turning and grinding.

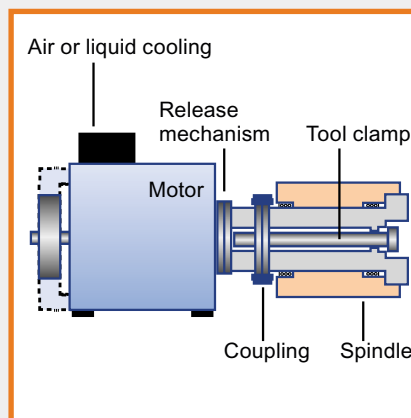
With SINUMERIK as the machine tool control, SINAMICS S120 or SIMODRIVE as the drive system and our feed and spindle motors, Siemens is capable of offering complete solutions for every machine type and performance class - solutions in which the components are ideally harmonized to ensure high productivity, high availability and optimum quality.

Conventional spindles (motor + externally driven spindle)

Belt drive

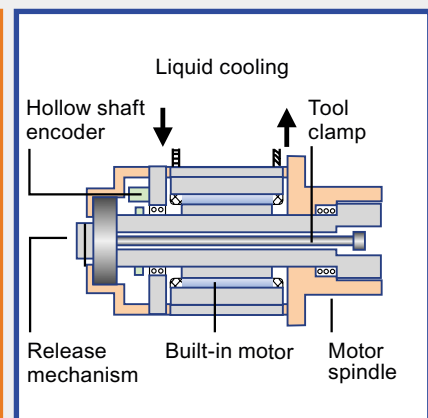


Coupled drive



Motor spindle

Direct drive



Main spindle drive variants – Overview

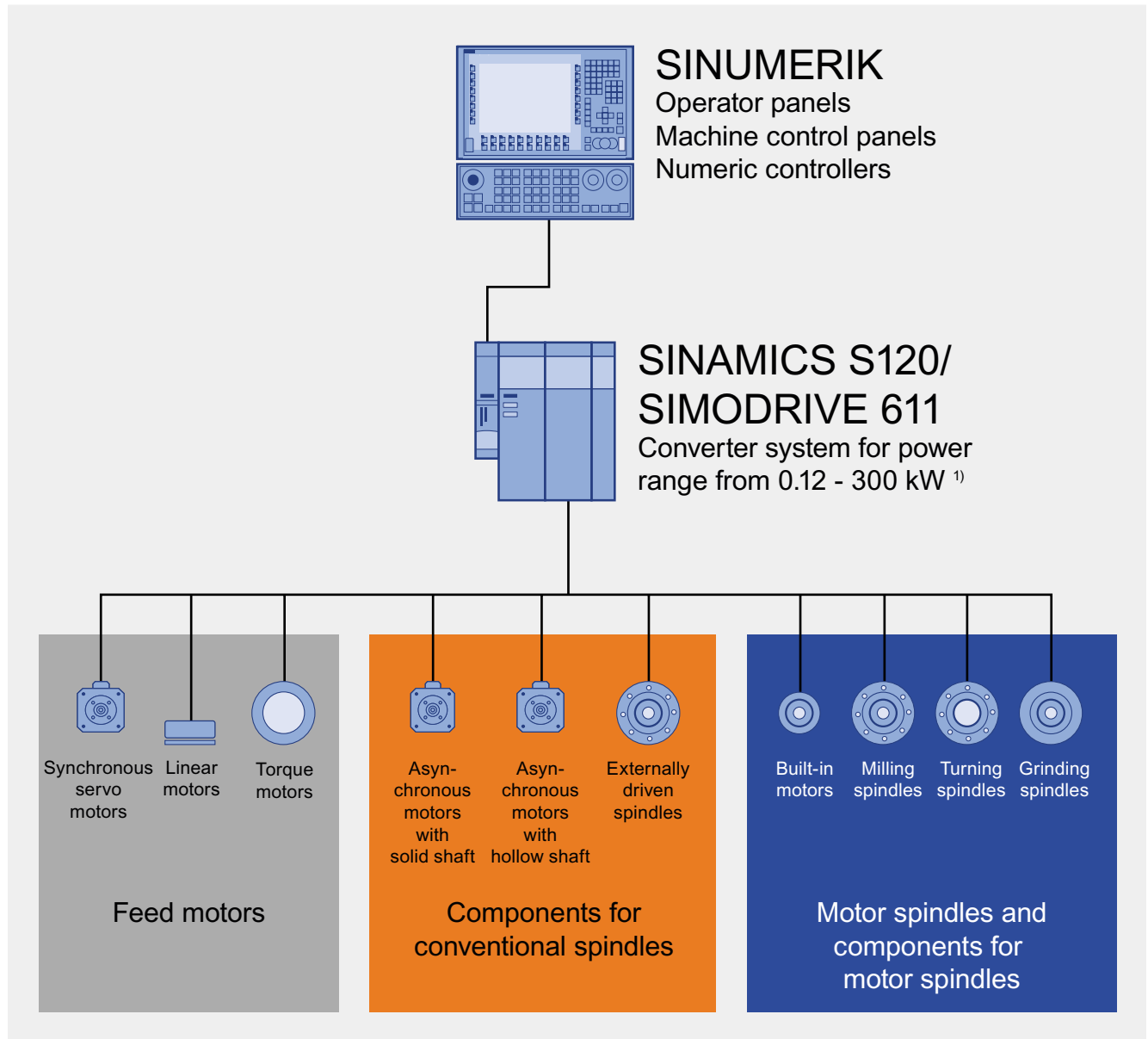
Topological overview

Motors and spindles for machine tools

Siemens is an experienced and competent complete supplier of machine tools.

On the basis of the SINUMERIK numerical control, the SINAMICS S120 or SIMODRIVE 611 drive systems and our extensive range of motors for drives and


main drives, extending to integrated motor spindles, Siemens is in a position to offer suitable electrical equipment with perfectly matched system components for every type of machine tool.



Siemens range of components for equipping machine tools

¹⁾ In combination with SINAMICS S120 and SINUMERIK.

Components for conventional spindles – Overview

Component	Type	Version	Max. speed	Rated power	Rated torque	Page	Catalog	
Motors for belt-driven spindles								
Components for conventional spindles		1PH7	Asynchronous motor with solid shaft and forced ventilation, IP54/IP55	up to 12,000 rpm	3.7 ... 300 kW ¹⁾	22 ... 2,480 Nm	7	NC 60 NC 61 D 21.1
		1PH4	Asynchronous motor with solid shaft, water-cooled, IP55/IP65	up to 12,000 rpm	7.5 ... 52 kW ¹⁾	45 ... 333 Nm	7	NC 60 NC 61 D 21.1
Motors with hollow shaft for coupled spindles								
		1PM6	Asynchronous motor with hollow shaft and forced ventilation, IP54/IP55	up to 18,000 rpm	3.7 ... 22 kW	24 ... 140 Nm	7	NC 60 NC 61
		1PM4	Asynchronous motor with hollow shaft, water/oil-cooled, IP55/IP65	up to 18,000 rpm	3.7 ... 27 kW	24 ... 172 Nm	7	NC 60 NC 61
Externally driven spindles								
		M-type	Externally driven spindles for milling with SK40/BT40/CAT40 tool interface	up to 15,000 rpm	up to 27 kW	up to 140 Nm	11	–

NC 60: Catalog "Machine tool equipment – SINUMERIK with SIMODRIVE"

NC 61: Catalog "Machine tool equipment – SINUMERIK with SINAMICS S120"

D 21.1: Catalog "SINAMICS S120 – Converter Chassis Units 0.12 to 1,200 kW"

¹⁾ In combination with SINAMICS S120 and SINUMERIK.

Built-in motors and motor spindles – Overview

Component	Type	Version	Max. speed	Rated power	Rated torque	Page	Catalog	
Built-in motors for motor spindles								
Built-in motors		1PH2	Built-in-synchronous motor for standard spindles	up to 10,000 rpm	7.5 ... 31 kW	48 ... 197 Nm	14	NC 60 NC 61
		1FE1 (High-Speed)	Built-in-synchronous motor for spindles with top speeds	up to 40,000 rpm	6 ... 94 kW	up to 300 Nm	14	NC 60 NC 61
		1FE1 (High-Torque)	Built-in-synchronous motor for spindles with maximum torques	up to 20,000 rpm	4 ... 104 kW	up to 820 Nm	14	NC 60 NC 61
Motor spindles								
Motor spindles		2SP1-series	Standard motor milling spindles	up to 18,000 rpm	up to 53.4 kW	up to 170 Nm	19	NC 60 NC 61
		F-type	Compact motor milling spindles	up to 40,000 rpm	up to 80 kW	up to 300 Nm	20	–
		D-type	Motor turning spindles	up to 10,500 rpm	up to 104 kW	up to 820 Nm	21	–
		S-type	Motor grinding spindles	up to 80,000 rpm	up to 30 kW	up to 24 Nm	22	–

NC 60: Catalog "Machine tool equipment – SINUMERIK with SIMODRIVE"

NC 61: Catalog "Machine tool equipment – SINUMERIK with SINAMICS S120"

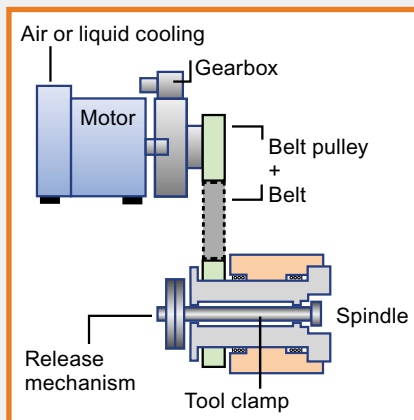
Conventional spindles

Conventional spindles are the most popular type of spindle in machine tools. They are modular in design, comprising the externally driven spindle unit with tool/workpiece holder and the motor for driving the

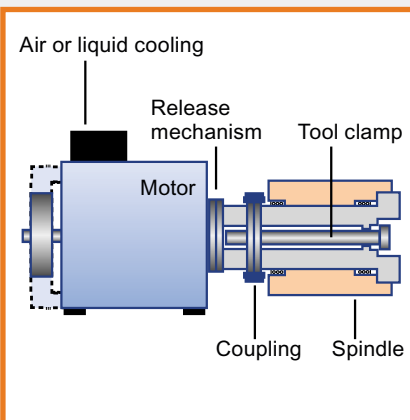
spindle. There is a choice of two basic types. The motor and spindle are connected to one another either via a belt or via a coupling.

Conventional spindles (motor + externally driven spindle)

Belt drive



Coupled drive



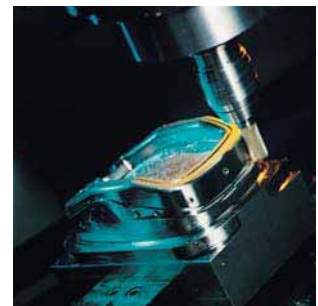
Conventional spindle designs

For conventional spindles, the Siemens product range contains different versions of asynchronous motors ranging from 3.7 to 300 kW¹⁾ and can therefore provide a suitable spindle motor for every machining technique – milling, turning or grinding. And complementing this range, Siemens can also offer conventional spindles²⁾ from Weiss Spindeltechnologie GmbH, a subsidiary 100%-owned by Siemens.

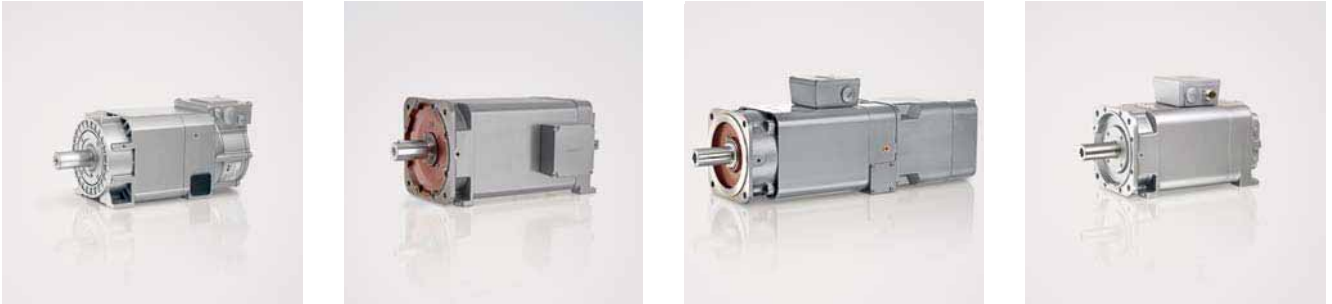
This gives the user the opportunity to purchase not just the control and drive system, but also the key components of conventional spindles through his Siemens contact partner.

¹⁾ In combination with SINAMICS S120 and SINUMERIK.

²⁾ Referred to as externally driven spindles in the following



Motors for conventional spindles



Asynchronous motors for conventional spindles 1PH7, 1PH4, 1PM6 and 1PM4

Motors for belt-driven spindles

Motors from the 1PH7 or 1PH4 series are the preferred choice for belt-driven spindles. These are compact, highly dynamic asynchronous motors with integrated encoder and solid shaft for mounting the belt pulley.

While 1PH7 motors have degree of protection IP54/IP55¹⁾ and are cooled by a separate fan module (forced-air cooling), 1PH4 motors have degree of protection IP55/IP65²⁾ and water cooling, making them more suited to work in tough environments or for installation under cramped conditions. 1PH4 motors are also the right choice for applications in which the efficient removal of heat from the machine is important.

With a power spectrum ranging from 3.7 to 300 kW in combination with the SINAMICS S120 drive system and top speeds of up to 12,000 rpm, these motors are suitable for numerous different spindle applications. Integrated encoders ensure excellent speed stability and spindle positioning for automatic tool change, for example. With a twofold overload capability in relation to the rated torque, the motors boast a high acceleration capacity and therefore ensure high productivity.

Motors for coupled spindles

For conventional spindles in which the spindle and motor are directly linked via a coupling, the 1PH4/1PH7 motors are joined by the 1PM4 and 1PM6 versions. 1PM4/1PM6 motors feature a hollow shaft, through which coolant can be conveyed from the back of the motor through a turning bushing to the internally cooled tool. Here, too, is a choice of cooling method: the 1PM6 with forced ventilation and the 1PM4 with water/oil cooling.

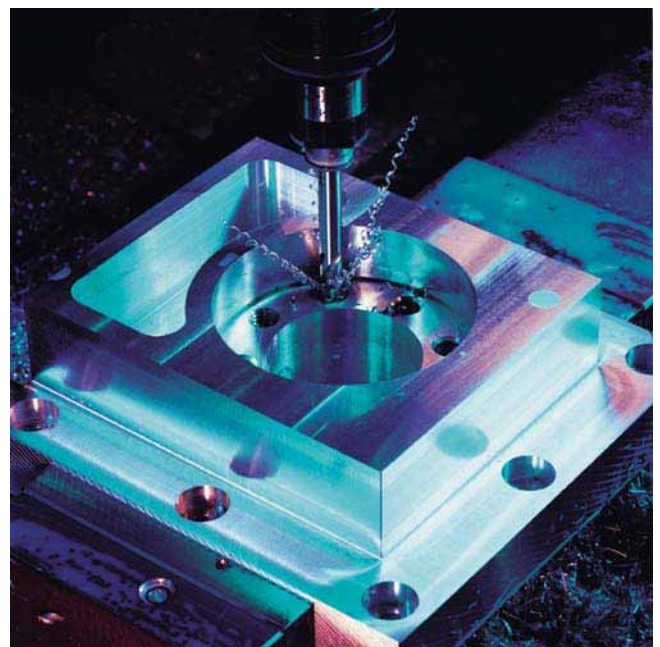
These motors are available in a power range from 3.7 to 27 kW. With top speeds of up to 18,000 rpm, the motors enjoy an even broader application spectrum.

Applications

- Belt-driven spindles in
- Directly coupled spindles in
 - Milling machines
 - Drilling machines
 - Turning machines
 - Grinding machines

Benefits and characteristics





- Compact motor
- Broad power spectrum
- High acceleration capability
- Wide torque spectrum
- Highly versatile thanks to a wealth of different mechanical versions and options.
- Ideally suited for use with the SINAMICS S120 drive system
 - Reliable, targeted configuration with SIZER
 - Easy commissioning due to electronic nameplate and DRIVE-CLiQ interface



¹⁾ IP54 degree of protection of fan
IP55 degree of protection at shaft exit

²⁾ IP55 degree of protection at shaft exit
IP65 degree of protection of motor housing

Motors for conventional spindles

Technical data	Asynchronous motors with solid shaft		Asynchronous motors with hollow shaft	
				
Motor series	1PH7	1PH4	1PM6	1PM4
Cooling method	Forced ventilation	Water cooling	Forced ventilation	Water cooling, oil cooling
Shaft height (SH)	100 ... 280	100 ... 160	100 and 132	100 and 132
Degree of protection	IP55	IP65 IP55 at shaft exit	IP55 Fan IP54	IP65 IP55 at shaft exit
Type of construction	IM B3 (IM V5, IM V6), IM B5 (IM V1, IM V3), SH 100 and SH 132 only, IM B35 (IM V15, IM V35)	IM B35 (IM V15, IM V36)	IM B5 (IM V1, IM V3)	IM B35 (IM V15, IM V35)
System voltage	400 ... 480 V	400 ... 480 V	400 ... 480 V	400 ... 480 V
Rated power P_{rated}	3.7 ... 300 kW ¹⁾	7.5 ... 52 kW	3.7... 22 kW	3.7... 27 kW
Rated speed n_{rated}	400 ... 2,900 rpm	1,500 ... 2,000 rpm	1,500 ... 4,000 rpm	1,500 ... 4,000 rpm
Rated torque M_{rated}	22 ... 2,480 Nm ¹⁾	45 ... 333 Nm	24 ... 140 Nm	24 ... 172 Nm
Overload capability	> 2 x M_{rated} for a short time		> 2 x M_{rated} for a short time	
Max. speed n_{max}	up to 12,000 rpm	up to 12,000 rpm	up to 12,000 rpm, 18,000 rpm as an option	up to 12,000 rpm, 18,000 rpm as an option
Connection method	Signal connection via connectors or DRIVE-CLiQ interface Power connection via terminal box		Signal connection via connectors or DRIVE-CLiQ interface Power connection via terminal box	
Insulation of stator winding	Temperature class 155 (F) for ambient temperatures up to 40 °C	Temperature class 155 (F) for coolant inlet tempera- tures up to 30 °C	Temperature class 155 (F) for ambient temperatures up to 40 °C	Temperature class 155 (F) for coolant inlet tempera- tures up to 30 °C
Sound pressure level (tolerance + 3 dB)	70 to 76 dB (A) with 50 Hz fan operation, depending on shaft height and direc- tion of air flow	69 to 71 dB (A) depending on shaft height	70 dB (A) with 50 Hz fan operation	69 dB (A)
Built-in encoder systems, with/without DRIVE-CLiQ interface	Incremental encoder sin/cos 1 V _{pp} 2048 pulses/revolution, Absolute encoder EnDat 2048 pulses/revolution		Hollow shaft measuring system: Incremental encoder sin/cos V _{pp} 256 pulses/revolution	
Mounted gearing/ gear ratio	upon request		–	
Siemens drive system	SINAMICS S120, SIMODRIVE 611		SINAMICS S120, SIMODRIVE 611	
Typical applications	Main spindles (conventional: belt-driven or directly coupled)	Main spindles, when: - Environmental condi- tions are extreme - The environment must not be subjected to ther- mal load (conventional: belt-driven or directly coupled)	Main spindles with inter- nal tool cooling (directly coupled)	Main spindles with inter- nal tool cooling in extreme environmental conditions (directly coupled)
Tools				
• SINAMICS configuration	SIZER	SIZER	SIZER	SIZER
• SIMODRIVE configuration	SIDIM/NCSD	SIDIM/NCSD	SIDIM/NCSD	SIDIM/NCSD
• CAD data	CAD Creator	CAD Creator	CAD Creator	CAD Creator

¹⁾ In combination with SINAMICS S120 and SINUMERIK.

Motors for conventional spindles – Variants of 1PH7/1PH4 motors at a glance.

Our product range – what we have to offer												
Rated power S1	Rated torque range S1	Rated power S6-40%	Rated torque range S6-40%	Rated speeds	Maximum speeds	Motor type		Shaft height	Edge dimension	Flange diameter	Motor shaft diameter	Motor shaft length
kW	Nm	kW	Nm	n_{rated} rpm	n_{rated} rpm		<i>L</i> mm	<i>h</i> mm	<i>f</i> mm	<i>b</i> mm	d_{shaft} mm	l_{shaft} mm
1PH7 with forced ventilation												
3.7 ... 10.5	23.6 ... 59.7	5.25 ... 14.5	33.5 ... 84	1,000 ... 2,000	up to 12,000	1PH710	411 ... 529	100	196	180	38	80
11 ... 28	70 ... 162.3	16.5 ... 43	105 ... 238.7	1,000 ... 2,000	up to 10,000	1PH713	538 ... 646	132	260	250	42	110
12 ... 41	171.9 ... 305.5	18 ... 61	248.3 ... 458.2	500 ... 2,000	up to 8,000	1PH716	640 ... 723	160	314	300	55	110
21.5 ... 85	298 ... 565	30.5 ... 126	439 ... 820	500 ... 1,750	up to 7,000	1PH718	835 ... 925	180	360	300 / 350	60 / 65	140
55 ... 205	636 ... 1080	75 ... 303	865 ... 1595	700 ... 2,500	up to 5,500	1PH722	1100 ... 1280	225	450	450	75	140
80 ... 270	1228 ... 2286	118 ... 397	1806 ... 3648	500 ... 1,750	up to 3,300	1PH728	1146 ... 1386	280	560	550	95	170
1PH4 water-cooled												
7.5 ... 14	48 ... 90	10 ... 18.75	64 ... 120.5	1,500	up to 12,000	1PH410	416 ... 541	100	190	180	38	80
15 ... 30	95 ... 190	21 ... 42	133 ... 266	1,500	up to 10,000	1PH413	458 ... 578	132	246	250	42	110
37 ... 52	235 ... 331	52.5 ... 73	333.4 ... 464.6	1,500	up to 8,000	1PH416	591 ... 691	160	290	300	55	110

Motors for conventional spindles – Variants of 1PM4/1PM6 motors at a glance.

Our product range – what we have to offer												
Rated power S1	Rated torque range S1	Rated power S6-40%	Rated torque range S6-40%	Rated speeds	Maximum- speeds	Motor type		Shaft height	Edge di- men- sion	Flange dia- meter	Motor shaft dia- meter	Motor shaft length
kW	Nm	kW	Nm	n_{rated} rpm	n_{rated} rpm		L mm	h mm	f mm	b mm	d_{shaft} mm	l_{shaft} mm
1PM6 air-cooled/1PM4 oil-cooled												
3.7 ... 7.5	24 ... 48	5.25 ... 11	33 ... 70	1,500 / 4,000	up to 18,000	1PM610	389 ... 721	100	196	180	38	80
11 ... 22	70 ... 140	16.5 ... 33	105 ... 210	1,500 / 4,000	up to 15,000	1PM613	468 ... 874	132	260	250	42	110
1PM4 water-cooled												
5 ... 11	32 ... 70	6.5 ... 14.75	41 ... 94	1,500	up to 18,000	1PM410	389 ... 494	100	196	180	38	80
15 ... 27	95 ... 172	21 ... 38	134 ... 242	1,500	up to 15,000	1PM413	468 ... 588	132	260	250	42	110

Externally driven spindles



Externally driven spindle

Overview

The externally driven spindle is a belt-driven, water-cooled unit that offers the optimum price/performance ratio for machine tools in the lower to medium power range.

By means of a labyrinth with purge air, the externally driven spindle achieves the protection class IP64 on the drive end.

The integrated precision spindle bearings in a rigid bearing arrangement enable high spindle rigidity and excellent axial and radial runout. Automatic re-greasing of the bearings enables a max. spindle speed of up to 15,000 rpm. It also considerably extends the life of the bearings.

This rigid bearing arrangement increases the quality of the machined workpiece surface.

Applications

Machine tools for

- Milling
- Drilling

Benefits and characteristics

- Long or short spindle nose
- Spindle with belt pulley
- Tool holder universal ISO 40 standard taper with SK40 interface
- Tool clamping with force-amplified spring stack
- Max. speed up to 15,000 rpm
- Automatic re-greasing of bearings
- Precision spindle bearings for maximum accuracy
- Max. torque up to (S1) 140 Nm¹⁾.
- Max. power up to (S1) 27 kW¹⁾
- Max. radial and axial machining forces depending upon optional bearing arrangements and load ratios $F_{\text{radial}} / F_{\text{axial}}$ on drive end

Options

- Tool holder universal ISO 40 standard taper for CAT40 / BT40 / 30° / BT40/45° interface
- Tool release mechanism: Hydraulic for minimized tool change times and drawbar position monitoring
- Rotary unit for internal tool cooling up to 70 bar and 50 l/min.
- Bearing arrangement on drive end:
 - 2 bearings
 - 4 bearings

¹⁾ 4 bearings on drive end

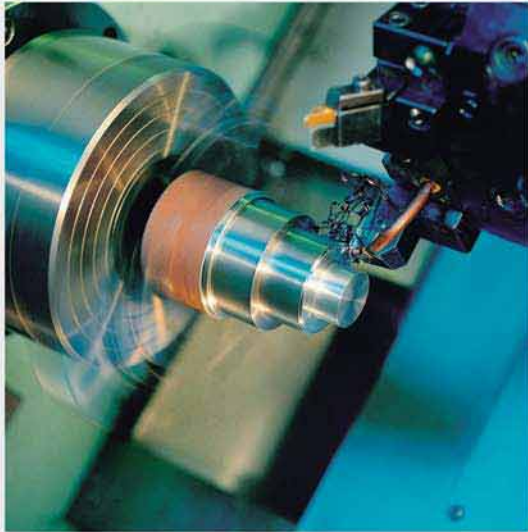


Spindle with belt pulley

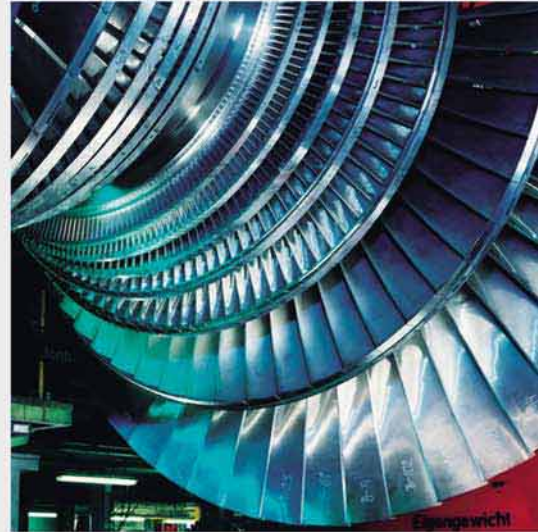
... with automatic relubrication

... also with release mechanism

... also with rotary unit for internal cooling



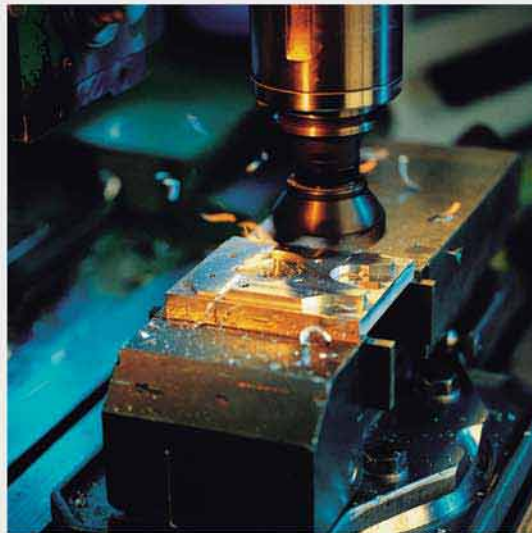
Turning technology



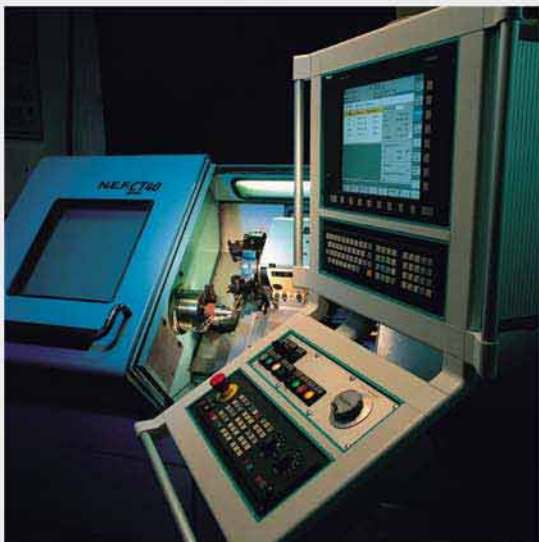
Production of turbine blades



Grinding technology



Milling technology – model building



SINUMERIK operator panel with machine control panel



Automotive industry

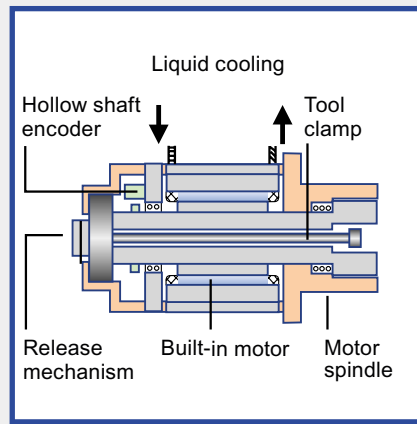
Built-in motors and motor spindles

With the trend towards greater productivity and more compact machine designs, the use of integrated motor spindles is becoming more and more common. Their dynamic rigidity and low vibration tendency make a further leap in machining quality possible.

Their ability to accelerate and operate at high speeds shortens the machining time, thereby increasing the productivity of the machine as a whole.

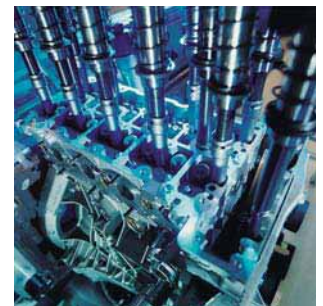
Motor spindle

Direct drive



Schematic diagram of a motor spindle

The Siemens range includes both complete motor spindles for milling, turning and grinding applications and built-in motors for motor spindles.



Motor spindles are the preferred choice for extremely demanding precision applications

Built-in motors for spindles



1PH2 built-in asynchronous motor



1FE1 built-in synchronous motor

Overview

Users who produce their own motor spindles can obtain the right built-in motor from Siemens. These motors are characterized by their compact design, ruggedness, superior precision and accuracy.

Siemens offers three different types of built-in motors for motor spindles:

- The 1PH2 built-in asynchronous motor is employed as a compact, standard built-in motor for lathe and grinding-wheel spindles with maximum speeds of up to 10,000 rpm.
- The "High Torque" version of the 1FE1 motor is characterized by maximum torques and achieves peak speeds of 20,000 rpm.
- The "High Speed" version of the 1FE1 motor is characterized by extremely short acceleration times and achieves max. speeds of up to 40,000 rpm.

Principle of operation, design

The 1PH2 motor is asynchronous. The rotor, which is of the squirrel-cage type, and the stator, which is equipped with coils, are delivered as components, which the engineer combines to form a motor spindle that he then installs in the machine.

The same applies to 1FE1 motors. However, unlike the 1PH2 version, they are synchronous, with a rotor that is equipped with permanent magnets.

With all these motors, water cooling is used to dissipate the heat. The position is sensed by external encoders and most commonly with a SIMAG H2 hollow shaft measuring system in the case of the 1PH2 motor.

Benefits and characteristics

Since mechanical power transmission elements (belt, gearing) and the resulting backlash are dispensed with, built-in motors boast the following characteristics:

- Excellent quality of surface finish
- High acceleration capability
- High rigidity thanks to compact design
- Free of wear
- High efficiency

Applications

Our built-in motors are ideal for use in motor spindles for machine tools:

- 1PH2 motors for grinding-wheel and lathe spindles
- 1FE1 motors for lathe, grinding-wheel and milling spindles

Built-in motors for standard and high-performance spindles

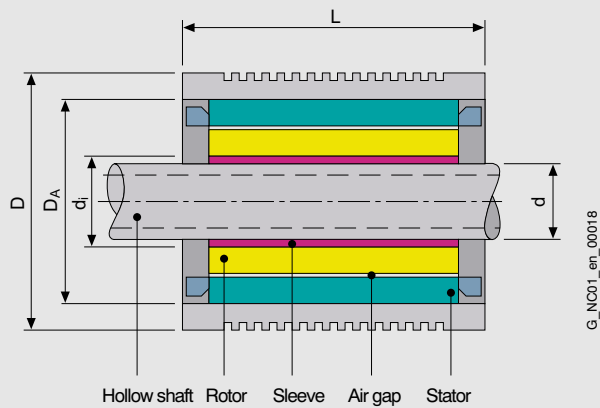
Technical data	Built-in asynchronous motors for standard spindles	Built-in synchronous motors for high torque and high speed applications	
			
Motor series	1PH2	1FE1	1FE1
Version		High Torque	High Speed
Cooling method	Water cooling	Water cooling	
Stator diameter D_A	180 and 220	85 ... 280	106 ... 240
Degree of protection	IP00 or as stated by spindle manufacturer	IP00 or as stated by spindle manufacturer	
Type of construction	Delivered as components	Delivered as components	
System voltage	400 ... 480 V	400 ... 480 V	
Rated power P_{rated}	7.5 ... 31 kW	4 ... 104 kW	6 ... 94 kW
Rated speed n_{rated}	1,500 rpm	750 ... 15,800 rpm	2,000 ... 25,000 rpm
Rated torque M_{rated}	48 ... 197 Nm	up to 820 Nm	up to 300 Nm
Overload capability	285 Nm (S6-25%)	1,240 Nm (S6-25%)	465 Nm (S6-25%)
Max. speed n_{max}	up to 10,000 rpm	up to 20,000 rpm With field weakening	up to 40,000 rpm With field weakening
Connection method	Free cable ends	Free cable ends	
Insulation of stator winding	Temperature class 155 (F) for coolant inlet temperatures up to 25 °C	Temperature class 155 (F) for coolant inlet temperatures up to 25 °C	
Sound pressure level	Depending on spindle design	Depending on spindle design	
Integrated encoder systems	Hollow shaft measuring system: SIMAG H2 up to 800 pulses/revolution as an option	External encoder, depending on machine design	
Siemens drive system	SINAMICS S120, SIMODRIVE 611		
Typical applications	Motor spindles in machine tools, e.g. turning and grinding machining centers	Motor spindles in machine tools requiring high torques, e.g. turning and grinding machining centers	Motor spindles in machine tools requiring high speeds, e.g. grinding and milling machining centers
Tools			
• SINAMICS configuration	–	SIZER	SIZER
• SIMODRIVE configuration	SIDIM/NCSD	SIDIM/NCSD	SIDIM/NCSD
• CAD data	–	CAD Creator	CAD Creator

Built-in motors for spindles – Variants of the 1PH2 at a glance.

Product range

Rated power S1	Rated torque range S1	Rated power S6-40%	Rated torque range S6-40%	Rated speeds	Maximum speeds	Motor type	L	D	D_A	d_i
kW	Nm	kW	Nm	n_{rated} rpm	n_{rated} rpm		mm	mm	mm	mm
7.5 ... 13	48 ... 83	9 ... 15.4	57 ... 98	1,500	up to 10,000	1PH209	250 ... 300	205	180	67
15.1 ... 31	95 ... 197	19 ... 38.6	119 ... 245	1,500	up to 10,000	1PH211	290 ... 390	250	220	82

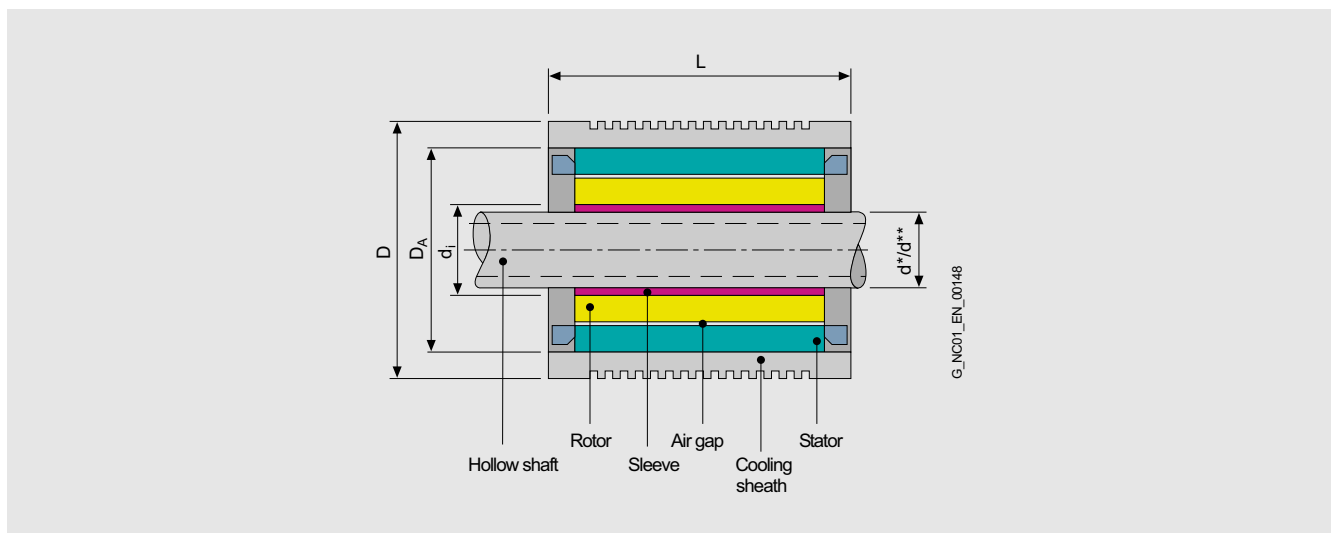
Dimension drawing



Built-in motors for spindles – Variants of the 1FE1 at a glance.

Product range										
Rated power S1	Rated torque range S1	Rated power S6-40%	Rated torque range S6-40%	Rated speeds	Maximum speeds	Motor type	L	D	D _A	d _i
kW	Nm	kW	Nm	n _{rated} rpm	n _{rated} rpm		mm	mm	mm	mm
High Speed series										
6.5 ... 31.4	5 ... 20	8 ... 35	7 ... 27	7,900 ... 25,000	up to 40,000	1FE105	130 ... 230	120	106	46
14 ... 48	28 ... 60	16 ... 51	40 ... 86	3,200 ... 9,700	up to 24,000	1FE107	185 ... 285	155	135	58
8.8 ... 38	42 ... 105	8.8 ... 38	55 ... 140	2,000 ... 4,300	up to 20,000	1FE108	190 ... 340	180	160	68
10.5 ... 52	24 ... 150	10.5 ... 52	35 ... 206	1,800 ... 4,500	up to 18,000	1FE109	200 ... 400	205	180	72/80
25 ... 72.6	102 ... 204	30 ... 85	142 ... 270	1,200 ... 3,800	up to 16,000	1FE110	265 ... 415	230	200	96
63 ... 94	200 ... 300	75 ... 112	275 ... 410	2,000 ... 3,000	up to 14,000	1FE112	315 ... 415	270	240	110
High Torque series										
7.4 ... 14.4	4.5 ... 11	10 ... 18	6 ... 14	10,000 ... 15,800	20,000	1FE104	107 ... 157	95	85	44/-
6.3 ... 23	10 ... 37	6.3 ... 8.3	12.6 ... 46	6,000 ... 8,000	up to 15,000	1FE105	170 ... 320	115	103.5	42/33
4 ... 25	13 ... 56	5.3 ... 36.5	17 ... 81	3,000 ... 8,500	up to 12,000	1FE106	130 ... 280	130	118	58/48
15 ... 34	65 ... 130	18.7 ... 42	81 ... 175	1,100 ... 5,000	up to 9,000	1FE108	195 ... 295	190	170	93/67, 74, 80
6.3 ... 36.6	28 ... 100	7.5 ... 47	36 ... 128	1,600 ... 3,500	up to 7,000	1FE109	150 ... 250	205	180	92/67, 80
22 ... 41.9	150 ... 300	24 ... 48.3	190 ... 384	700 ... 2,100	up to 6,500	1FE111	260 ... 410	250	220	120/82, 102, 105
63 ... 104	430 ... 820	80 ... 124	620 ... 1,110	750 ... 1,700	8,000	1FE114	340 ... 490	310	280	166,7/ 150,3

Dimension drawing



Motor spindles



Motor spindles for milling, turning and grinding

Overview

As well as spindle motors in various designs, Siemens also offers complete motor spindles.

Our modular range of motor spindles covers the milling, drilling, turning and grinding machining techniques, so a tailor-made solution can be designed for virtually every application as well. All our expertise in the field of motor spindles is concentrated in our 100%-owned subsidiary, Weiss Spindeltechnologie GmbH, a leading supplier of motor spindles. In addition to spindles described here for milling, turning and grinding, the experts at Weiss Spindeltechnologie GmbH also design and manufacture individual spindle solutions. These can be designed and made available with a power range of up to 130 kW and up to 1,250 Nm without gear, or up to 3,280 Nm with integrated gearbox.

The spindles are available with synchronous or asynchronous motor technology.

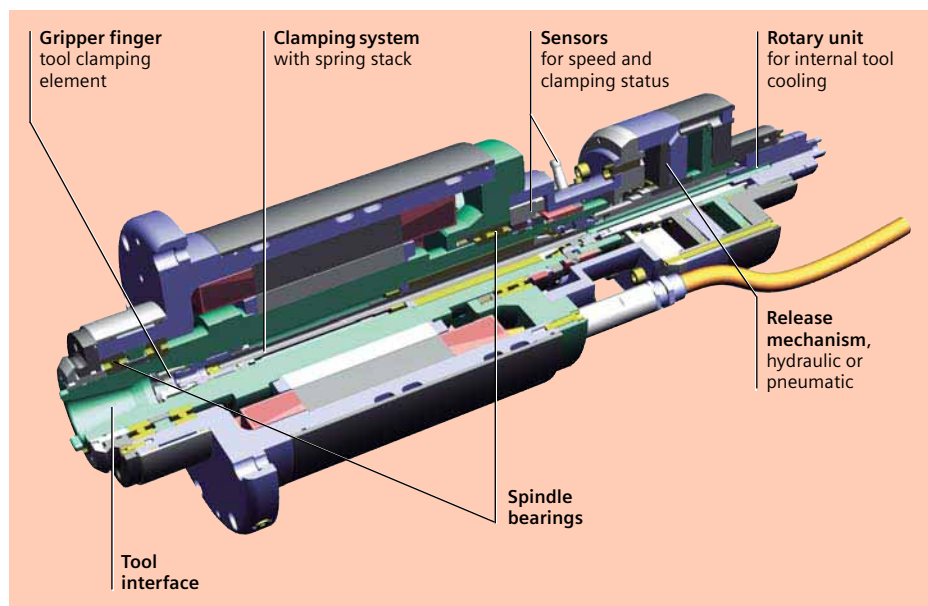
All the components of our motor spindles – bearings, sensors, cooling, clamping mechanism, etc., are perfectly matched and pretested.

The design of Weiss motor spindles enables the maximum degree of robustness. Moreover, it ensures fast integration in the machine and problem-free commissioning.

Benefits and characteristics

- Excellent surface finish, high accuracy and high dynamic rigidity
- Short acceleration times and high maximum speeds
- Compact design
- Flexible adaptation to user requirements due to various tool and workpiece clamping systems
- Easy installation and commissioning due to self-contained system unit
- Easy installation due to defined interfaces regarding mechanics, cooling, electronics and hydraulics/pneumatics
- Ideally suited for use with the SINAMICS S120 and SIMODRIVE 611 drive systems

Problem-free commissioning is assured by standardized interfaces to the spindles for media and signal connections and by system tests conducted in advance at Weiss.



Standard motor milling spindles – 2SP1 series



2SP120 standard motor milling spindle

Standard motor milling spindles from the 2SP1 series are motor spindles that can be ordered from our catalog. They are designed for high torques and can therefore be used for both roughing and finishing.

Different levels of performance with torques ranging from 42 to 170 Nm and maximum speeds from 10,000 to 18,000 rpm are available based on two different diameter sizes.



2SP125 standard motor milling spindle

They represent the ideal drive solution for main spindles in standard milling machines and machining centers and boast the following characteristics:

- The complete solution is comparable with belt-driven solutions and more economical than the classical customized motor spindle designs
- Hydraulic or pneumatic tool release mechanism depending on user preference
- With a pneumatic tool and release mechanism, no hydraulic unit is required
- Integrated analog and digital sensors (for indexing and monitoring of the tool change)
- Worldwide supply of complete systems, including mechanical spindle components, from a single source
- Higher speed and shorter acceleration time compared to externally driven solutions

Options

- Available with HSK A63, SK40, CAT40 and BT40 tool interfaces
- Choice of internal or external tool cooling

The entire 2SP1 series spectrum

Order No.	Rated power	Rated torque	Rated speed	Rated current	Rated power	Rated torque	Rated power	Rated torque	Rated speed	Rated current	Maximum speed
	S1 kW	S1 Nm	rpm	S1 A	S6-40% kW	S6-40% Nm	S1 kW	S1 Nm	rpm	S1 A	rpm
Synchronous											
Star operation											
2SP1202-1HA-1-DF2	12.0	42	2,700	30	12.0	55					15,000
2SP1202-1HB-2-DF2	15.5	42	3,500	42	15.5	55					18,000
2SP1204-1HA-1-DF2	26.4	84	3,000	60	26.4	110					15,000
2SP1204-1HB-2-DF2	35.0	78	4,300	79	35.0	110					18,000
Asynchronous											
2SP1253-8HA0-0-2	13.2	70	1,800	28	18.9	100	13.2	32	4,000	29	10,000
2SP1253-8HA0-1D-2	13.2	70	1,800	28	18.9	100	13.2	32	4,000	29	15,000
2SP1255-8HA0-0-2	11.7	140	800	30	16.7	200	11.7	62	1,800	29	10,000
2SP1255-8HA0-1D-2	11.7	140	800	30	16.7	200	11.7	62	1,800	29	15,000
Synchronous											
2SP1253-1HA0-0-2	26.0	100	2,500	53	29.0	130					10,000
2SP1253-1HB0-1D-2	35.0	100	3,300	68	38.0	130					15,000
2SP1255-1HA0-0-2	46.3	170	2,600	95	55.0	236					10,000
2SP1255-1HB0-1D-2	53.4	170	3,000	120	64.0	236					15,000

F-type milling spindles



F1xx compact milling spindle

F-type motor spindles are compact spindles designed especially for milling applications. According to the customer requirements, F-type milling spindles are designed specifically to the customer needs using a common base of mechanical and electrical components.

They cover a power range from 11 to 80 kW (S1 operation) and rated torques up to 300 Nm.

They are available in both synchronous and asynchronous technology and are especially noted for their compact design. With a maximum speed of 40,000 rpm, they satisfy the requirements of typical, high-performance milling spindles in typical high-speed applications.

Performance characteristics

- Tool holder:
 - HSK in all standard sizes
 - Optional ISO for adapted speeds
- Taper and planar face cleaning:
 - Filtered compressed air in the taper and on the planar face for keeping the tool interface clean and ensuring constant accuracy
- Bearing lubrication:
 - Lifetime grease lubrication
 - Oil/air lubrication
- Bearing temperature monitoring:
 - PT100 or PT1000
- Seal on drive end:
 - Labyrinth with purge air
- Motor temperature monitoring with KTY84 and PTC
- Tool clamp:
 - Tool clamping using a force-amplified spring stack
- Tool release mechanism:
 - Hydraulic for minimized tool changeover times, optional installation of pneumatic cylinders
- Sensors for tool clamping status:
 - Analog or digital
- Rotary unit:
 - Cutting coolant up to 80 bar, minimum quantity lubrication and dry machining possible without modification

Options

- Sensor for axial spindle growth:
 - Direct feedback for length compensation in the machine
- Acceleration sensor:
 - For sensing and monitoring the occurring acceleration to protect the spindle

Overview of F-type spindle variants for milling

ASYNCHRONOUS VERSION				Tool interface DIN 68 893-1	SYNCHRONOUS VERSION			
Spindle No.:	Diameter	Max. speed	Rated power S1-100% kW		Rated power S1-100% kW	Max. speed	Diameter	Spindle No.:
	mm	rpm				rpm	mm	
F150A.30.18 F150A.40.18	150 150	30,000 40,000	18 18	◀ E40 ▶	11	30,000	150	F150S.30.11
F170A.18.46 F170A.24.46 F210A.18.18 F210A.24.18 F230A.18.40 F230A.24.40 F230A.30.80	170 170 210 210 230 230 230	18,000 24,000 18,000 24,000 18,000 24,000 30,000	46 46 18 18 40 40 80	◀ A63 ▶	29 41 28 28 35	18,000 18,000 18,000 20,000 18,000	150 170 210 210 230	F150S.18.29 F170S.18.41 F210S.18.28 F210S.20.28 F230S.18.35
F285A.10.32 F285A.15.32	285 285	10,000 15,000	32 32	◀ A100 ▶	78 78	10,000 14,000	285 285	F285S.10.78 F285S.14.78

D-type turning motor spindle



D1xx compact turning spindle

Motor spindles from the D-type spindles feature interfaces from sizes A4 to A11 (DIN EN 55026).

The spindles are very compact and cover a power range up to 104 kW (S1 operation) and rated torques of up to 820 Nm.

They are available in both synchronous and asynchronous technology and are especially noted for their compact design. With their high concentricity and maximum speeds of up to 10,500 rpm, they satisfy every requirement faced by turning machines.

Performance characteristics

- High radial and axial rigidity
 - High accuracy
 - Seal on drive end:
 - Labyrinth, optional with purge air
 - Connection dimensions:
 - Standard chucks and clamping cylinders
 - Speed range at constant power:
 - 1:3 to 1:8
 - Motor:
 - Synchronous or asynchronous motors
 - Shaft encoder:
 - Integrated
 - Hollow shaft measuring system depending on accuracy requirements and in different reference numbers up to 2048 pulses/revolution V_{pp}
 - Mounting position:
 - Horizontal or vertical, spindle nose down
 - Optional: vertical, spindle nose up
 - Housing:
 - Cartridge with flange
 - Motor temperature monitoring with KTY84 and PTC
- ## Options
- Bearing arrangements (standard, high-speed or hybrid) for different speed classes
 - Purge air

Overview of D-type spindle variants for turning

ASYNCHRONOUS VERSION		Interface for power chucks DIN 55026-	SYNCHRONOUS VERSION	
Spindle No.:	Rated torque S1-100% Nm		Rated torque S1-100% Nm	Spindle No.:
D175375-VXXX	85	◀ A4 ▶	100	D175408-VXXX
D175376-VXXX D175374-VXXX	85 140	◀ A5 ▶	100 200	D175409-VXXX D175413-VXXX
D175380-VXXX D175377-VXXX	140 200	◀ A6 ▶	200 300	D175414-VXXX D175410-VXXX
D175378-VXXX	480	◀ A8 ▶	820	D175411-VXXX
D175379-VXXX	750	◀ A11 ▶	–	–

S-type grinding spindles



Sxxx motor grinding spindle

Motor spindles from the S series achieve top speeds of up to 80,000 rpm and are therefore ideal for internal cylindrical grinding.

SM/SH spindles have a power range up to 30 kW and rated torques up to 24 Nm.

Performance characteristics

- Tool interface:
 - Cylindrical
- Shaft support:
 - Hybrid bearing
- High-precision balancing:
 - Shaft and rotor
 - Dynamic balancing of the complete assembled spindle
 - Vibration speed $v \leq 1$ mm/s
- Housing:
 - Cylindrical
- Bearing lubrication:
 - Oil/air minimum quantity lubrication
 - Alternatively with lifetime grease lubrication SM (F)
- Seal on drive end:
 - Labyrinth seal purged with air from oil/air lubrication or with separate purge air in the case of grease-packed spindle units SM (F)
- Energy supply:
 - Axial via cover at end of spindle
- Motor:
 - Low-loss asynchronous motors
 - Motor temperature monitoring protection with PTC

Options

- Speed encoder
- Coded plug units

Overview of S-type spindle variants for grinding



OIL/AIR LUBRICATION, GREASE LUBRICATION, MEDIUM POWER RANGE

Model No.:	Maximum speed rpm	Rated speed rpm	Maximum frequency Hz	Rated frequency Hz	Voltage V	Maximum current S1-100% A	Rated power S1-100% kW
SM100-81/74	81,000	74,000	1,350	1,234	350	10	4
SM120-72/60	72,000	60,000	1,200	1,000	350	16	5
SM120-60/51	60,000	51,000	1,000	850	350	21	7
SM120-51/36	51,000	36,000	850	600	350	22	7
SM120-45/36	45,000	36,000	750	600	350	20	9
SM(F)150-24/15	24,000	15,000	400	250	350	28	12
SM(F)150-30/24	30,000	24,000	500	400	350	37	16
SM(F)120-36/24	36,000	24,000	600	400	350	37	16
SM(F)170-18/9	18,000	9,000	600	300	350	50	20

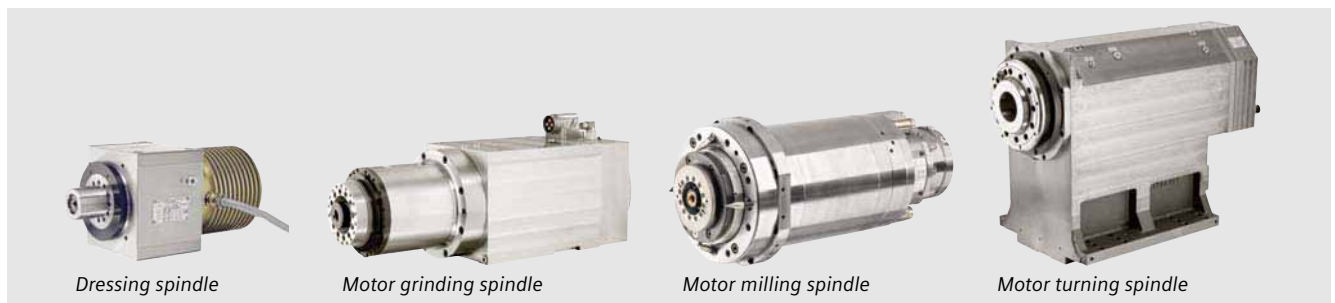
OIL/AIR LUBRICATION, HIGH POWER RANGE

Model No.:	Maximum speed rpm	Rated speed rpm	Maximum frequency Hz	Rated frequency Hz	Voltage V	Maximum current S1-100% A	Rated power S1-100% kW
SH120-51/45	51,000	45,000	850	750	350	27	9
SH150-40/30	40,000	30,000	667	500	350	37	17
SH150-33/24	33,000	24,000	550	400	350	41	18
SH170-27/18	27,000	18,000	900	600	350	54	20
SH170-21/12	21,000	12,000	700	400	350	74	30

Motor spindles

Technical data	Catalog type		Preferred type	
	Standard motor milling spindles, synchronous and asynchronous versions	Compact motor milling spindles, synchronous and asynchronous versions	Motor turning spindles, synchronous and asynchronous versions	Motor grinding spindles for internal cylindrical grinding, asynchronous version
				
Motor series	ZSP1 series	F-type	D-type	S-type
Cooling method	Water cooling			
Spindle diameter	200 and 250 mm	150 ... 285 mm	220 ... 442 mm	100 ... 170 mm
Degree of protection	IP64 with purge air on drive end			
Tool/workpiece interface	Tool interface HSK A63 or ISO 40	Tool interface HSK 25 to HSK 100 or ISO 30 to ISO 50	Workpiece interface A4 to A11 as per DIN 55026	Tool interface Grinding arbor 12 to 60 mm
System voltage	400 ... 480 V			
Rated power P_{rated}	up to 53.4 kW	up to 80 kW	up to 104 kW	up to 30 kW
Rated speed n_{rated}	Depending on type	Depending on type	Depending on type	Depending on type
Rated torque M_{rated}	up to 170 Nm	up to 300 Nm	up to 820 Nm	up to 24 Nm
Overload capability	1.5 ... 2 x M_{rated} for a short time	1.5 ... 2 x M_{rated} for a short time	1.5 ... 2 x M_{rated} for a short time	1.5 ... 2 x M_{rated} for a short time
Max. speed n_{max}	up to 18,000 rpm	up to 40,000 rpm	up to 10,500 rpm	up to 80,000 rpm
Connection method	Power supply connection: Free cable lengths Option: Power connector Signal connection via connector		Power supply connection: Power connector Signal connection via connector	
Insulation of stator winding	Temperature class 155 (F) for coolant inlet temperatures up to 25 °C without derating	Temperature class 155 (F) for coolant inlet temperatures up to 25 °C without derating	Temperature class 155 (F) for coolant inlet temperatures up to 25 °C without derating	Temperature class 155 (F) for coolant inlet temperatures up to 25 °C without derating
Sound pressure level (tolerance + 3 dB)	Depending on machine design	Depending on machine design	Depending on machine design	Depending on machine design
Integrated encoder systems	Incremental encoder sin/cos 1 V _{pp}	Incremental encoder sin/cos 1 V _{pp}	Incremental encoder sin/cos 1 V _{pp}	Optional: Pulse speed encoder
Siemens drive system	SINAMICS S120, SIMODRIVE 611			upon request
Typical applications	Main spindles for milling machines		Main spindles for turning machines	Main spindles for grinding machines
Tools				
• SINAMICS configuration	upon request	upon request	upon request	upon request
• SIMODRIVE configuration	SIDIM/NCSD	SIDIM	SIDIM	SIDIM
• CAD data	upon request	upon request	upon request	upon request

In addition to the preferred and listed types, Weiss Spindeltechnologie GmbH also produces diverse spindle solutions for individual customer requirements. These can be designed with a power range of up to 130 kW and up to 1,250 Nm without gear, or up to 3,280 Nm with integrated gear.



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