RE 96709/2025-11-04
Replaces: 2024-04-15

rexroth
A Bosch Company

eLION motor
EMS1

- Permanent magnet synchronous reluctance motor (PMSRM)
- Nominal power range: 11 to 229 kW
- Continuous torque: 70 to 1283 Nm
- Maximum speed range: 4000 bis 12000 rpm
- Nominal voltage range from 400 to 750 VDC
- High operational efficiency (max. > 96%)
- Protection class IP6K7 to IP6K9K
- Ambient temperature range: –40 to +100 °C
- Fluid cooled with inlet temperature up to 65 °C
- Motor and generator operation

Features

- Modular and scalable design based on diameter, length, and number of windings
- Heavy-duty design for off-highway applications
- Designed for various functions including travel, working, and slew drives, etc.
- Standardized mechanical interface for direct gear unit, ICE, or pump connection
- Resolver as a robust feedback sensor

Contents

Motor selection overview

The EMS1 torque and power overview provides an overview of the torque and power of the EMS1-10, EMS1-13 and EMS1-20 motors at a nominal voltage of 700 VDC. For information on the EMS1-16 frame size, please contact your local sales representative.

The chapters "General Technical Data", "Technical Data EMS1-10", "Technical Data EMS1-13" and "Technical Data EMS-1-20" contain detailed values and characteristic curves for each motor size, length and winding.

▼ **Torque and power overview EMS1**

				Standard rotational speed[1]				High rotational speed[1]		
		Maximum rotational speed ▶ n_{max} [rpm]		Up to 6000				Up to 12000		
		Nominal rotational speed ▶ n_{nom} [rpm]		1000	1500	2000	2500	3000	4000	6000
eLION motor type	Length	Torque▼ M_0[Nm][2]	M_{max}[Nm]	Continuous power[3] ▼ P_{nom} [kW]				Continuous power[3] ▼ P_{nom} [kW]		
EMS1-10	F	72	172	–	11	15	18	22	29	39
	H	98	229	–	15	20	25	30	38	52
	J	124	286	–	19	26	31	37	48	63
	L	148	343	–	23	31	38	45	58	74

				Standard rotational speed[1]				High rotational speed[1]		
		Maximum rotational speed ▶ n_{max} [rpm]		Up to 6000				Up to 10500		
		Nominal rotational speed ▶ n_{nom} [rpm]		1000	1500	2000	2500	3000	4000	6000
eLION motor type	Length	Torque▼ M_0[Nm][2]	M_{max}[Nm]	Continuous power[3] ▼ P_{nom} [kW]				Continuous power[3] ▼ P_{nom} [kW]		
EMS1-13	F	158	335	–	22	30	38	45	57	77
	H	218	445	–	31	41	51	59	77	96
	J	273	555	–	40	52	63	75	96	112
	L	325	665	–	47	62	76	89	115	133

				Standard rotational speed[1]			
		Maximum rotational speed ▶ n_{max} [rpm]		Up to 4000			
		Nominal rotational speed ▶ n_{nom} [rpm]		1000	1500	2000	2500
eLION motor type	Length	Torque▼ M_0[Nm][2]	M_{max}[Nm]	Continuous power[3] ▼ P_{nom} [kW]			
EMS1-20	F	735	1265	72	99	130	144
	H	986	1685	96	136	168	176
	J	1210	2110	116	163	192	208
	L	1430	2520	134	190	218	229

1) See chapter "Technical data"
2) M_0 stands for "torque at low rotational speed"
3) Calculated with a voltage of 700 VDC

Product description

The eLION EMS1 motor is a permanent magnet synchronous reluctance motor. It is designed for the harsh environments where off-highway machines are used. The motor is available with two different diameters and with variable length and nominal speed. The product range is currently being expanded with two additional diameters.
Due to its mechanical design, the motor can be adapted to various machine functions, e.g. traction, gearbox connection, axle connection, and electrohydraulic devices.

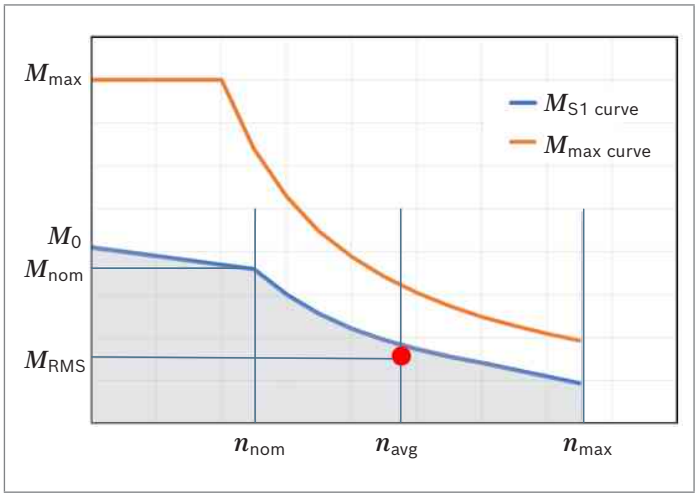
Selection of the frame size, length, and winding of the motor

The thermal equivalent torque (RMS torque) and the average rotational speed of the load cycles are required to select the right motor. This simplified calculation does not take into account the thermal time constant of the motor. It is sufficient if the overload time of each section of the torque requirement is shorter than the thermal time constant of the motor. For the calculations, the load must be separated into sections with torque over time. The equivalent thermal torque can be calculated using the following formula:

$$M_{RMS} = \sqrt{\frac{1}{T} \times \sum_{i=1}^{n} M_i^2 \, \Delta t_i}$$

$$n_{avg} = \frac{1}{T} \times \sum_{i=1}^{x} n_i \, \Delta t_i$$

The thermally equivalent torque can then be inserted into the torque-rotational speed diagram of the selected motor. This operating point must then be below the curve M_{S1}. All operating points of the load cycles must be within the maximum torque and speed capabilities of the motor.



Ordering code

01		02	03	04	05	06		07	08	09		10	11	12	13	14		15		16
EMS1	**–**	**10**			**L**	**M7**	**–**	**R**	**S**		**–**			**N**	**N**	**NNNN**	**–**	**NN**	**–**	**NN**

Product

01	eLION motor	**EMS1**

Axle height

02	100 mm	**10**

Length

03	Active length 150 mm	**F**
	Active length 200 mm	**H**
	Active length 250 mm	**J**
	Active length 300 mm	**L**

Nominal rotational speed

04	1500 rpm	**15**
	2000 rpm	**20**
	2500 rpm	**25**
	3000 rpm	**30**
	4000 rpm	**40**
	6000 rpm	**60**

Cooling

05	Liquid cooling	Connection G1/2	**L**

Design

06	Motor, 700 V	**M7**

Encoder type

07	Resolver	**R**

Encoder design

08	Single turn, 1 rotation, absolute	**S**

Electrical connection

09	Single connector C1		UVW, motor output for straight connection in the direction of the A-shield	**C1**
	Single connector C2		UVW, motor output for upward angled connection in the direction of the A-shield	**C2**
	Single connector C3		UVW, motor output for downward angled or straight connection in the direction of the B-shield	**C3**
	Single connector C4		UVW, motor output for upward angled connection in the direction of the B-shield	**C4**

01		02	03	04	05	06		07	08	09		10	11	12	13	14		15		16
EMS1	**–**	**10**			**L**	**M7**	**–**	**R**	**S**		**–**			**N**	**N**	**NNNN**	**–**	**NN**	**–**	**NN**

Shaft/hub design

10	External spline shaft 1 for motor (according to DIN 5480)	W28 x 2 x 12 x 8c	**W1**
	Internal-splined shaft 1 for pumps (according to ANSI B92.1)	N1 7/8 13T 16/32DP	**N1**

Flange

11	Compact motor flange		**M7**
	Pump flange (according to SAE J744)	101-2 (B), 45° steps	**P2**
	Compact gearbox flange		**G2**

Bearing

12	Standard	**N**

Mounting type

13	Flange mounting B5, including threaded holes for foot mounting B35	**N**

Attachments / Equipment

14	Standard	**NNNN**

Coating / Label

15	No coating, standard label	**NN**
	No coating, individual label	**MN**
	Standard coating, standard label	**BN**
	Standard coating, individual label (see data sheet 90314 "Standard coating of axial piston units")	**CU**

Other version

16	Standard	**NN**

▼ **Possible shaft/hub flange combinations**

	Flange		
Shaft/hub	**M7**	**P2**	**G2**
W1	●	–	●
N1	–	●	–

● = Possible – = Not possible

01		02	03	04	05	06		07	08	09		10	11	12	13	14		15		16
EMS1	**–**	**13**			**L**	**M7**	**–**	**R**	**S**		**–**			**N**	**N**	**NNNN**	**–**	**NN**	**–**	**NN**

Product

01	eLION motor	**EMS1**

Axle height

02	130 mm	**13**

Length

03	Active length 150 mm	**F**
	Active length 200 mm	**H**
	Active length 250 mm	**J**
	Active length 300 mm	**L**

Nominal rotational speed

04	1500 rpm	**15**
	2000 rpm	**20**
	2500 rpm	**25**
	3000 rpm	**30**
	4000 rpm	**40**
	6000 rpm	**60**

Cooling

05	Liquid cooling	Connection G1/2	**L**

Design

06	Motor, 700 V	**M7**

Encoder type

07	Resolver	**R**

Encoder design

08	Single turn, 1 rotation, absolute	**S**

Electrical connection

09	Terminal box	Single input UVW, input direction A/B	**AB**
	Single connector C1 	UVW, motor output for straight connection in the direction of the A-shield	**C1**
	Single connector C2 	UVW, motor output for upward angled connection in the direction of the A-shield	**C2**
	Single connector C3 	UVW, motor output for downward angled or straight connection in the direction of the B-shield	**C3**
	Single connector C4 	UVW, motor output for upward angled connection in the direction of the B-shield	**C4**

01		02	03	04	05	06		07	08	09		10	11	12	13	14		15		16
EMS1	**–**	**13**			**L**	**M7**	**–**	**R**	**S**		**–**			**N**	**N**	**NNNN**	**–**	**NN**	**–**	**NN**

Shaft/hub design

10	External spline shaft 2 for motor (according to DIN 5480)	W 40 × 2 × 18 × 9d	**W2**
	Internal-splined shaft 2 for pumps (according to ANSI B92.1)	N1 1/4 14T 12/24 DP	**N2**
	Internal-splined shaft 6 for gearbox (according to ANSI B92.1)	N1 1/4 14T 12/24 DP	**N6**

Flange

11	Motor flange (according to SAE J617)	SAE 5	**M5**
	Pump flange (according to SAE J744)	127-2 (C), 45° steps	**P3**
		127-4 (C), 45° steps	**P4**
		127-2/127-4 (C), 90° steps	**P5**
	Gearbox flange (according to SAE J617)	SAE 5	**G3**

Bearing

12	Standard	**N**

Mounting type

13	Flange mounting B5, including threaded holes for foot mounting B35	**N**

Attachments / Equipment

14	Standard	**NNNN**

Coating / Label

15	No coating, standard label	**NN**
	No coating, individual label	**MN**
	Standard coating, standard label	**BN**
	Standard coating, individual label (see data sheet 90314 "Standard coating of axial piston units")	**CU**

Other version

16	Standard	**NN**

▼ **Possible shaft/hub flange combinations**

	Flange				
Shaft/hub	**M5**	**P3**	**P4**	**P5**	**G3**
W2	●	–	–	–	–
N2	–	●	●	●	–
N6	–	–	–	–	●

● = Possible – = Not possible

01		02	03	04	05	06		07	08	09		10	11	12	13	14		15		16
EMS1	**–**	**20**			**L**	**M7**	**–**	**R**	**S**		**–**			**N**	**N**	**NNNN**	**–**	**NN**	**–**	**NN**

Product

01	eLION motor	**EMS1**

Axle height

02	200	**20**

Length

03	Active length 180 mm	**F**
	Active length 240 mm	**H**
	Active length 300 mm	**J**
	Active length 360 mm	**L**

Nominal rotational speed

04	1000 rpm	**10**
	1500 rpm	**15**
	2000 rpm	**20**
	2500 rpm	**25**

Cooling

05	Liquid cooling	Connection G1/2	**L**

Design

06	Motor, 700 V	**M7**

Encoder type

07	Resolver	**R**

Encoder design

08	Singleturn, 1 rotation, absolute	**S**

Electrical connection

09	Terminal box	Single input UVW, input direction A/B	**AB**

Shaft/hub design

10	External spline shaft 4 (according to DIN 5480)	W 55 × 2 × 26 × 8c	**W4**
	Internal splined shaft 4 for pumps (according to ANSI B92.1)	N1 3/4 13T 8/16 DP	**N4**

Flange

11	Motor flange (according to SAE J617)	SAE 2	**M2**
	Pump flange (according to SAE J744)	SAE 2 + SAE D4, 45° increments	**P6**

Bearing

12	Standard	**N**

Mounting type

13	Flange mounting B5, including threaded holes for foot mounting B35	**N**

Attachments / Equipment

14	Standard	**NNNN**

Coating / Label

15	No coating, standard label	**NN**
	No coating, individual label	**MN**
	Standard coating, standard label	**BN**
	Standard coating, individual label (see data sheet 90314 "Standard coating of axial piston units")	**CU**

Other version

16	Standard	**NN**

▼ **Possible shaft/hub flange combinations**

	Flange	
Shaft/hub	**M2**	**P6**
W4	●	–
N4	–	●

● = Possible – = Not possible

General technical data

The technical data are standard values. The tolerances that occur due to deviations of electrical properties can be found in the section "General tolerances".
The shown data are for a DC-voltage of 700VDC.
Please contact your local sales representative for data sheets with other voltages.

General tolerances

The values specified in the technical data are subject to natural dispersion. For the following parameters, the tolerance specifications must be observed.

Designation	Symbol	Tolerance value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	± 5%
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	± 5%
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	± 5%
S2 for 60 s torque (maximum torque)	$M_{S2,\ 60\ s}$	± 5%
Maximum short circuit braking torque	$M_{max,\ sc}$	± 5%
Phase-phase voltage constant at 20 °C	k_{EMK}	± 5%
Torque constant at 25 °C	k_T	± 5%
Rotor inertia	J_{rot}	± 10%

Operating environment conditions

Parameter		Unit	Value
Ambient temperature range according to ISO 16750-4		°C	–40 ... +100, code J
Climatic, according to ISO 16750-4			Code O
Relative humidity according to IEC 60068-2-38		°C	25±2 K at 80 ... 96% relative humidity 25±2 K at 93±3% relative humidity 55±2 K at ≤ 20% relative humidity 65±2 K at 93±3% relative humidity Tested: in 10 cycles of 24 h each
Protection class according to ISO 20653	open shaft		IP6K7
	assembled unit		IP6K9K
Vibration (sinusoidal)[1]		g	10 (10 ... 2000 Hz) Tested: 8 h per axis, in 20 min sweeps
Vibration (random noise) according to ISO 16750-3, test 2 (passenger car, gearbox)		g	9.66 RMS (10 ... 2000 Hz) Tested: 8 h per axis
Shock (non-recurring)		g	50 (11 ms) Tested: 3 shocks in all directions and axes (total: 18 shocks)
Shock (recurring)		g	25 (6 ms) Tested: 1000 shocks in all directions and axes (total: 6000 shocks)
Maximum altitude above sea level (NHN)			Up to 4000 m above sea level without power reduction
Chemical loads, based on ISO 16750-5			Code A and code D Additional fluids tested: Saltwater, motor oil, gear oil, rear axle oil, power steering fluid, brake fluid, axle grease, washing solvent, gasoline, diesel, biodiesel, isopropyl alcohol, antifreeze ethylene glycol cleaning agent, battery acid, fuel additives, kerosene, dust control (magnesium chloride), humidity control (calcium chloride), hydrochloric acid, fertilizer -28% nitrogen, herbicide, fungicide, ether, bleach solutions, primer, BASF G40 antifreeze, Shell universal cleaner

1) At the respective natural frequency in the range of ±30 Hz, the specified excitation is lower.

Technical data EMS1-10

General electrical properties

Parameter	Unit	EMS1-10					
		15	20	25	30	40	60
Nominal rotational speed	rpm	1500	2000	2500	3000	4000	6000
Maximum rotational speed	rpm		6000			12000	
Nominal voltage range	VDC	400 ... 750					
Operating DC voltage	VDC	270 ... 850					
Voltage range		HV_3 according to LV123					
Switching frequency	kHz	≥ 4					
Electrical connection		Star connection					

General mechanical properties

Parameter		Unit	EMS1-10			
			F	H	J	l
Weight	Internal splined shaft	kg	See chapter „Dimensions“			
	External spline shaft	kg	See chapter „Dimensions“			
Overall length		mm	398	448	498	548
Moment of inertia	Internal splined shaft	kgm^2	0.0108	0.0139	0.0168	0.0200
	External spline shaft	kgm^2	0.0109	0.0139	0.0168	0.0201
Center of gravity	Internal splined shaft	mm	X = 185.8 Y = 10.2 Z = 0.47	X = 210.98 Y = 9.08 Z = 0.41	X = 236.07 Y = 8.14 Z = 0.37	X = 261.15 Y = 7.39 Z = 0.34
	External spline shaft	mm	X = 189 Y = 10.2 Z = 0.47	X = 214 Y = 9.1 Z = 0.41	X = 240 Y = 8.1 Z = 0.37	X = 265 Y = 7.4 Z = 0.34

Mechanical interface

Parameter	
Motor mounting	
Motor flange (according to SAE J617)	Compact motor flange
AExternal spline shaft (type code W1) for motor (according to DIN 5480)	W 28 × 2 × 12 × 8c
Pump mounting	
Pump flange (according to SAE J744)	B2, 45° steps
Internal-splined shaft (type code N1) for pumps (according to ANSI B92.1)	N 7/8 13T 16/32DP
Gearbox mounting	
Gearbox flange (according to SAE J617)	Compact motor flange
Internal-splined shaft (type code N1) for gearboxes (according to ANSI B92.1)	N 7/8 13T 16/32DP

Cooling

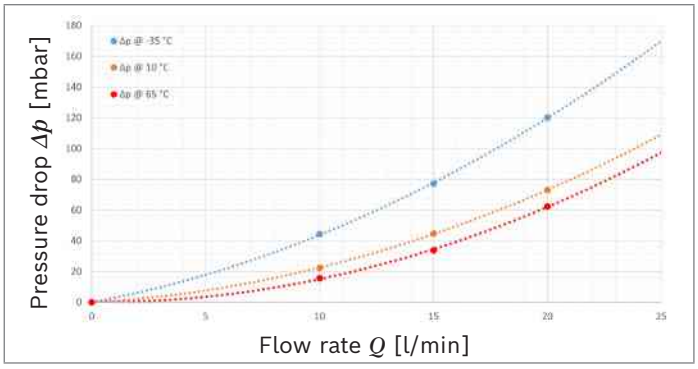
The table shows the operating conditions for the cooling liquid. Further information on motor cooling can be found in “Operating Instructions 96709-01-B”.

Parameter			Symbol	Unit	Value
Standard cooling liquid					Water:glycol 50:50 – Glysantin G40
Nominal flow rate			Q_{min}	l/min	20
Maximum inlet pressure			p_{max}	bar	6
Inlet temperature			T_{Inlet}	°C	Minimum –37 °C Maximum 65 °C
Cooling liquid volume	Length	F	V_{liquid}	l	0.9
		H	V_{liquid}	l	1.1
		J	V_{liquid}	l	1.3
		L	V_{liquid}	l	1.4
Coolant channels material					Aluminum, cast iron
Coolant connection					2 × G1/2" according to ISO 1179-1
Heat class according to IEC 60034-1					H

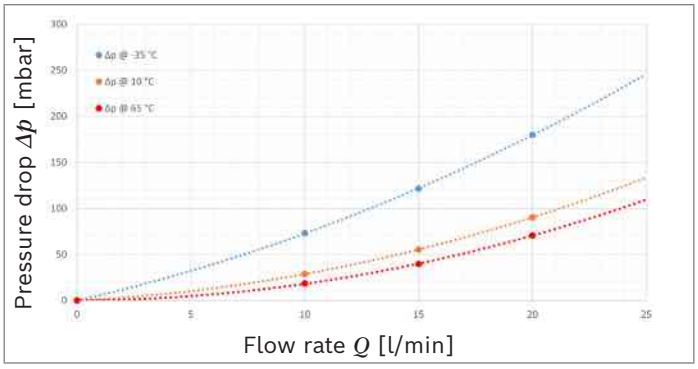
Pressure drop

The following graphs show the pressure drop at a 50:50 water to glycol ratio depending on the flow rate and the temperature of the cooling liquid

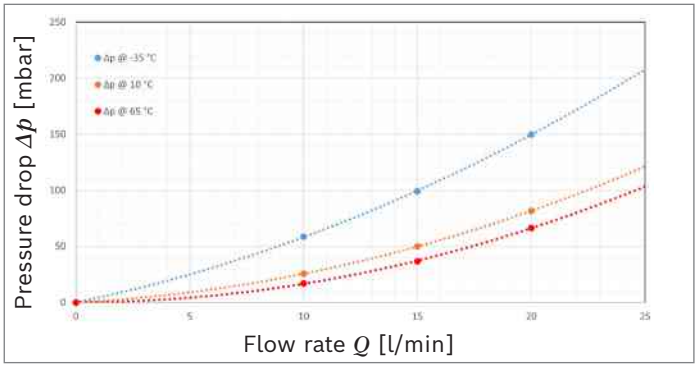
▼ EMS1-10F



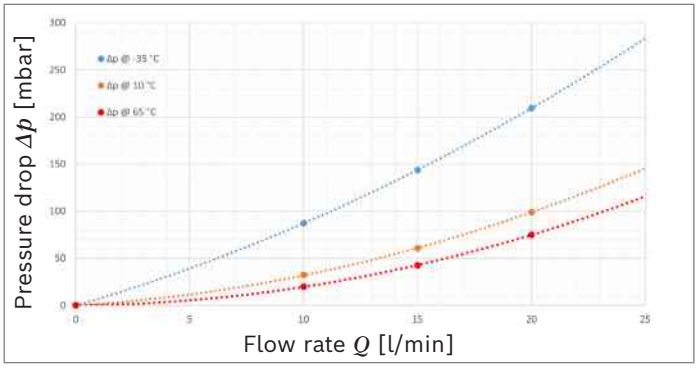
▼ EMS1-10J



▼ EMS1-10H



▼ EMS1-10L



Power data EMS1-10

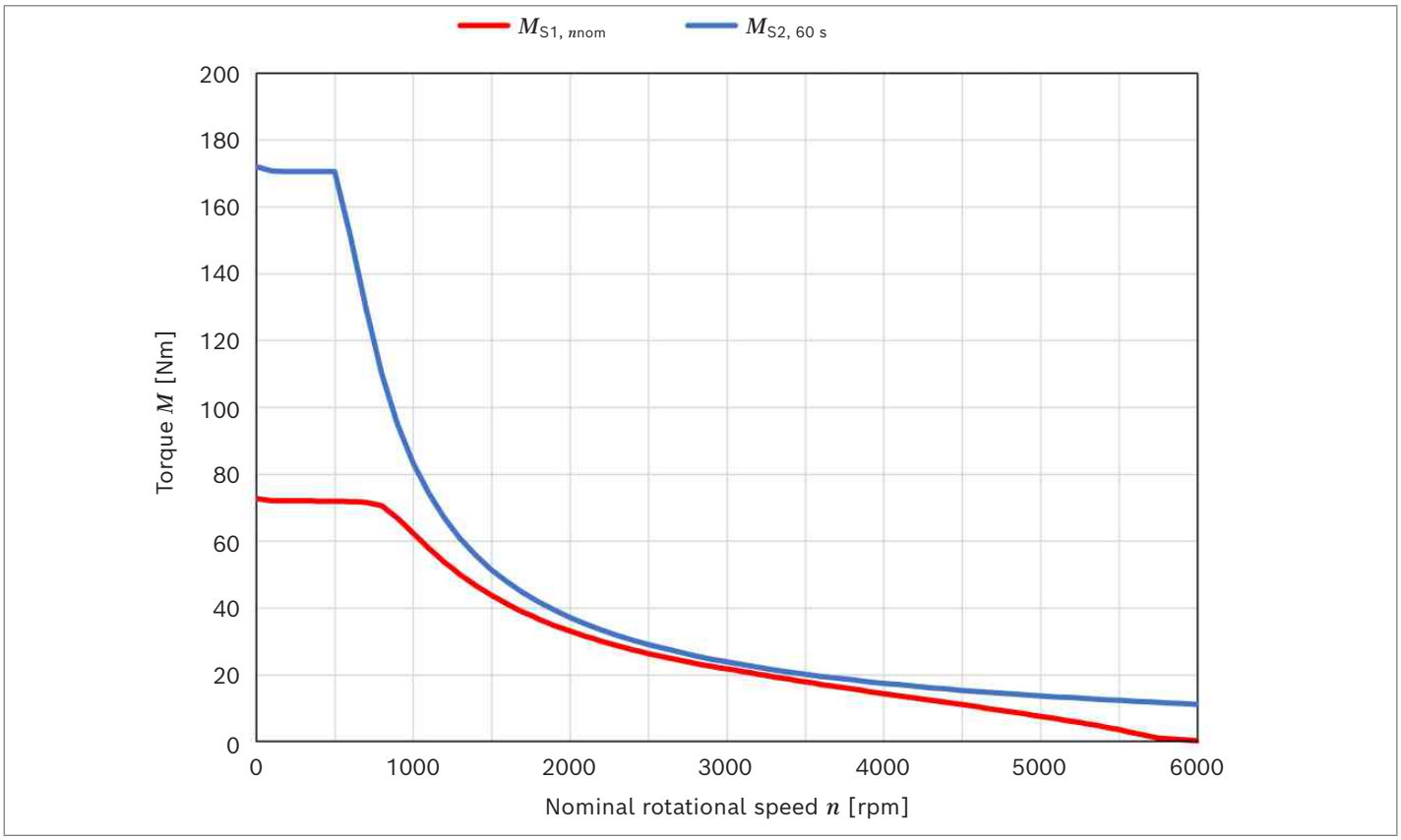
EMS1-10F15

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	148
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	39
Nominal rotational speed	n_{nom}	rpm	1500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	146
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	39
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	23
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	90.62
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	332
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	99
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	44
Maximum rotational speed	n_{max}	rpm	6000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	1
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	8
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	2
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	17.75
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	81
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	39
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	30
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	3480
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	92.14
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	19
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	57
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	123
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	57
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

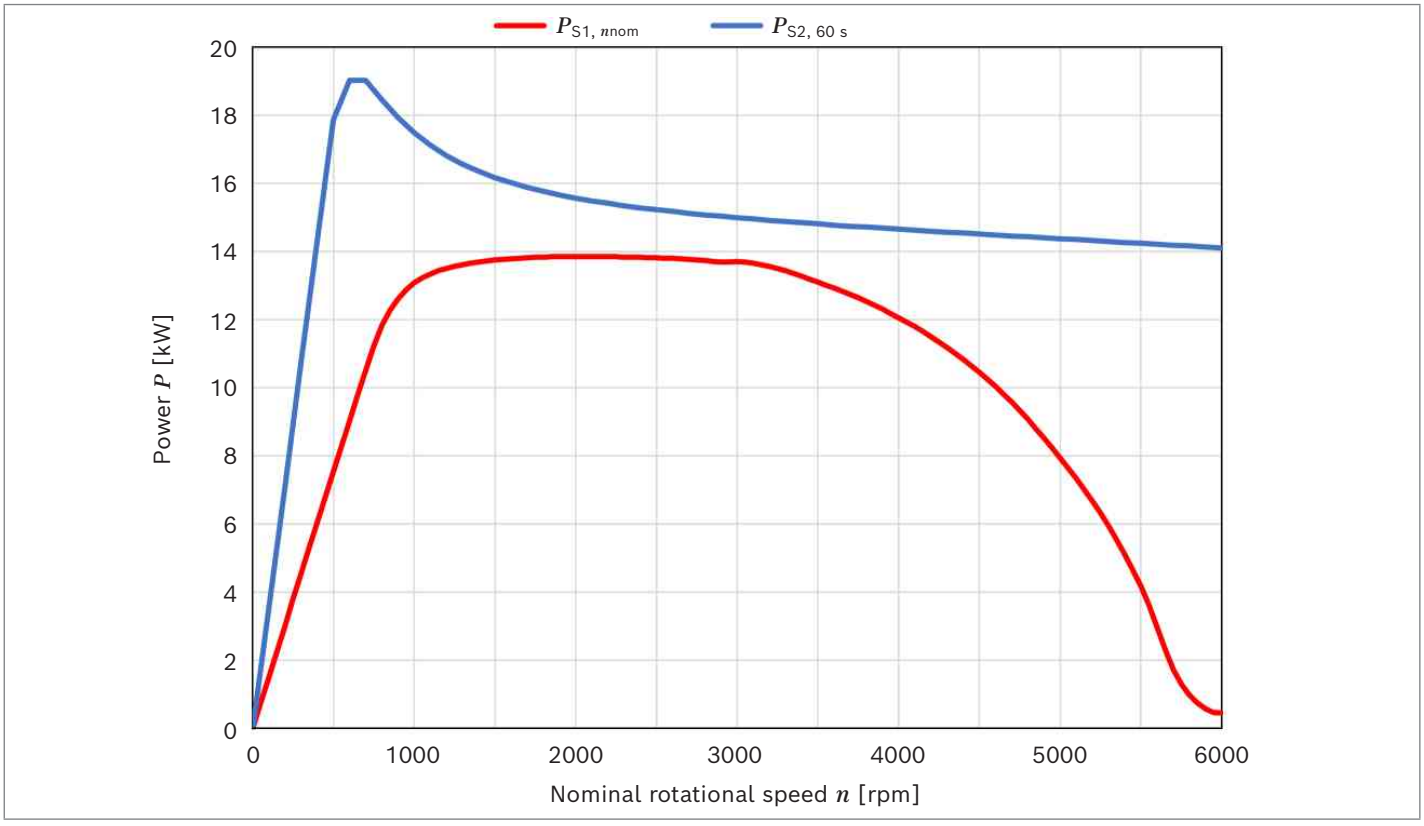
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	221.6
Torque constant at 25 °C	k_T	Nm / A_{RMS}	4.16
Synchronous inductance (d-axis) at rated current	L_d	mH	5.37
Synchronous inductance (q-axis) at rated current	L_q	mH	13.91
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.598
Cogging torque (unskewed)	M_{cog}	Nm	0.63
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	1.79

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

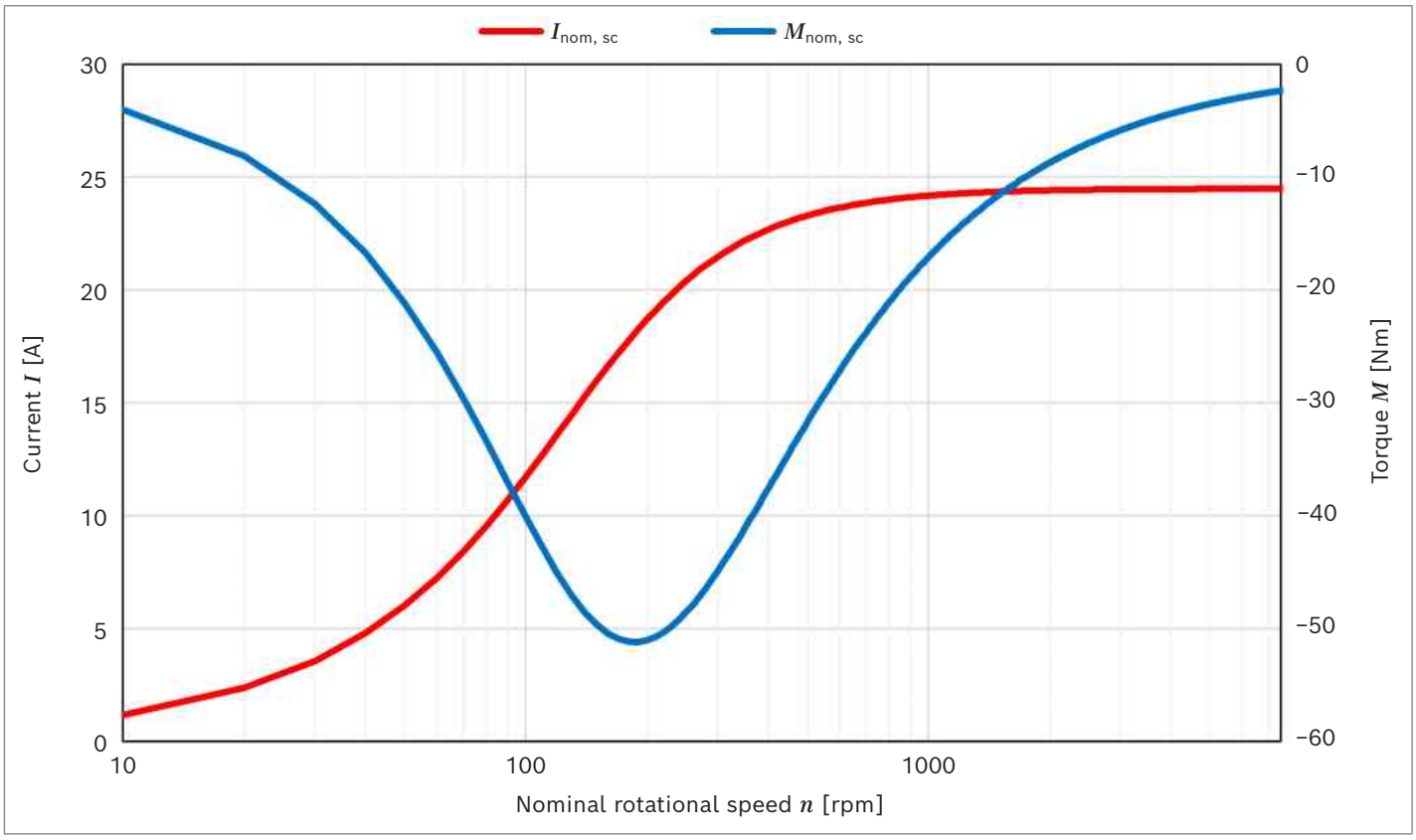
▼ Torque EMS1-10F15



▼ Power EMS1-10F15



▼ **Short circuit current and short circuit braking torque EMS1-10F15**



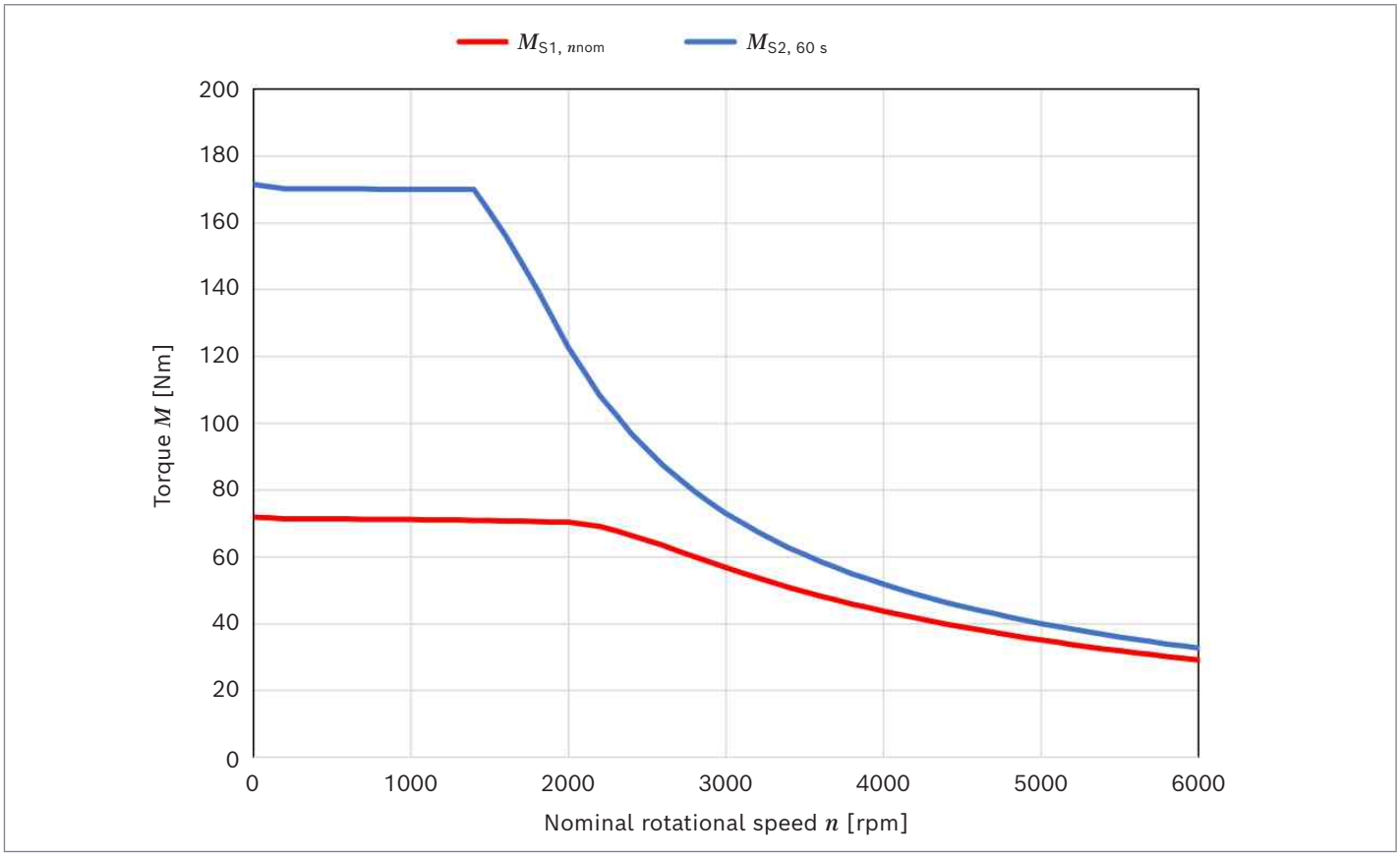
EMS1-10F20

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	71
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	25
Nominal rotational speed	n_{nom}	rpm	2000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	70
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	25
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	15
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	89.00
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	172
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	79
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	26
Maximum rotational speed	n_{max}	rpm	6000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	4
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	20
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	6
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	73.72
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	36
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	25
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	18
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	4920
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	90.42
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	9
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	32
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	51
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	32
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

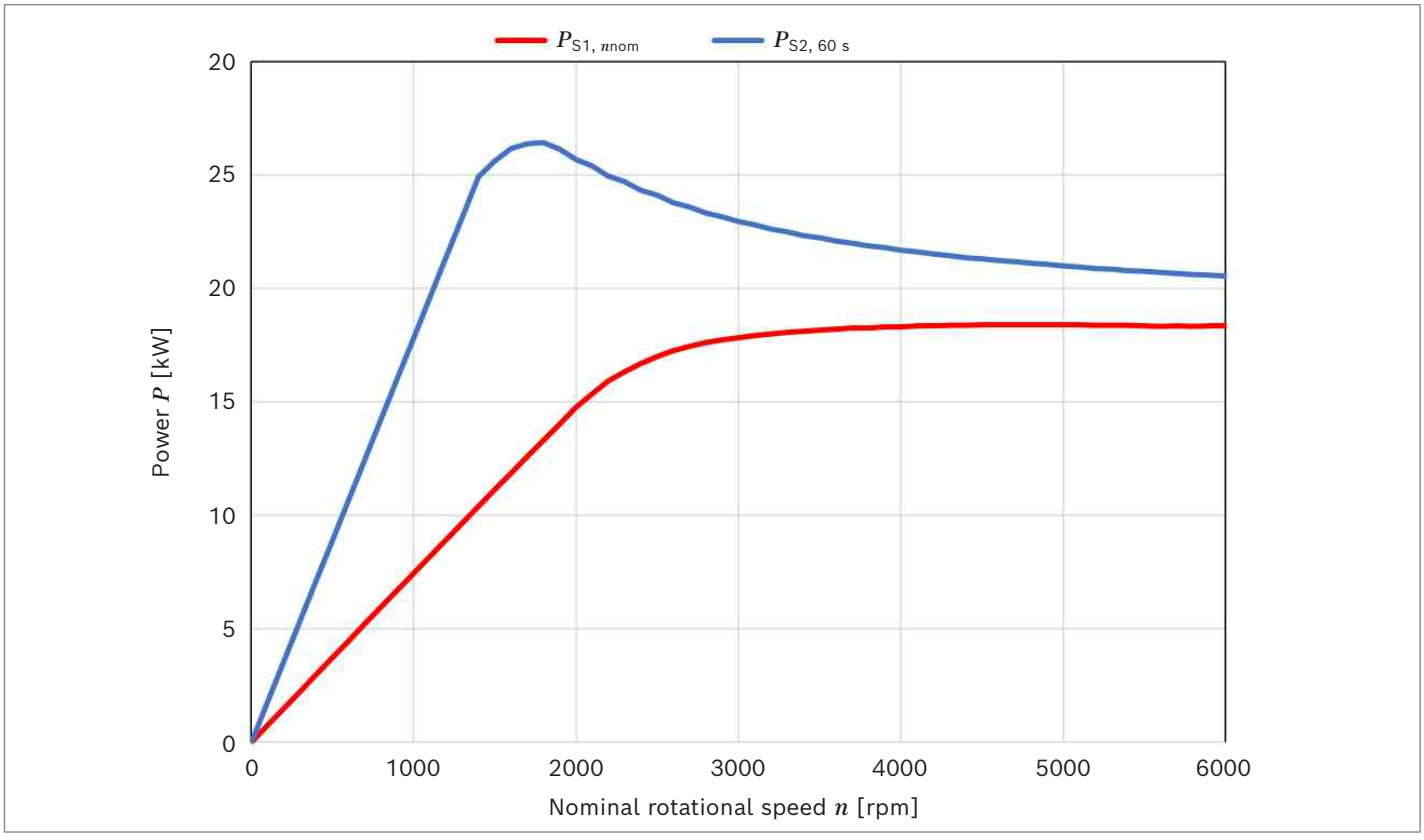
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	167.1
Torque constant at 25 °C	k_T	Nm / A_{RMS}	3.16
Synchronous inductance (d-axis) at rated current	L_d	mH	10.4
Synchronous inductance (q-axis) at rated current	L_q	mH	24.3
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	1.2425
Cogging torque (unskewed)	M_{cog}	Nm	1.44
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	2.2

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

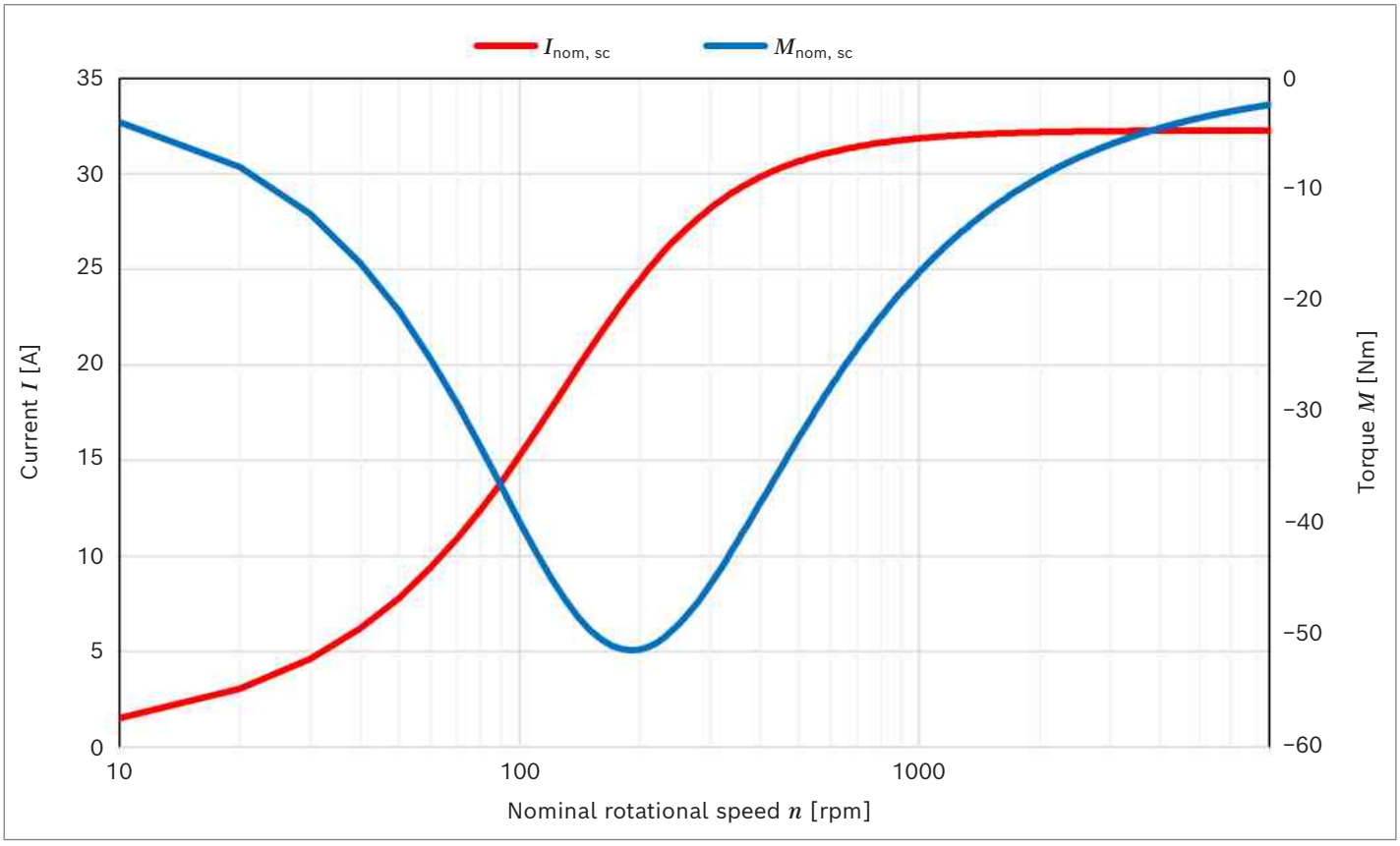
▼ **Torque EMS1-10F20**



▼ **Power EMS1-10F20**



▼ **Short circuit current and short circuit braking torque EMS1-10F20**



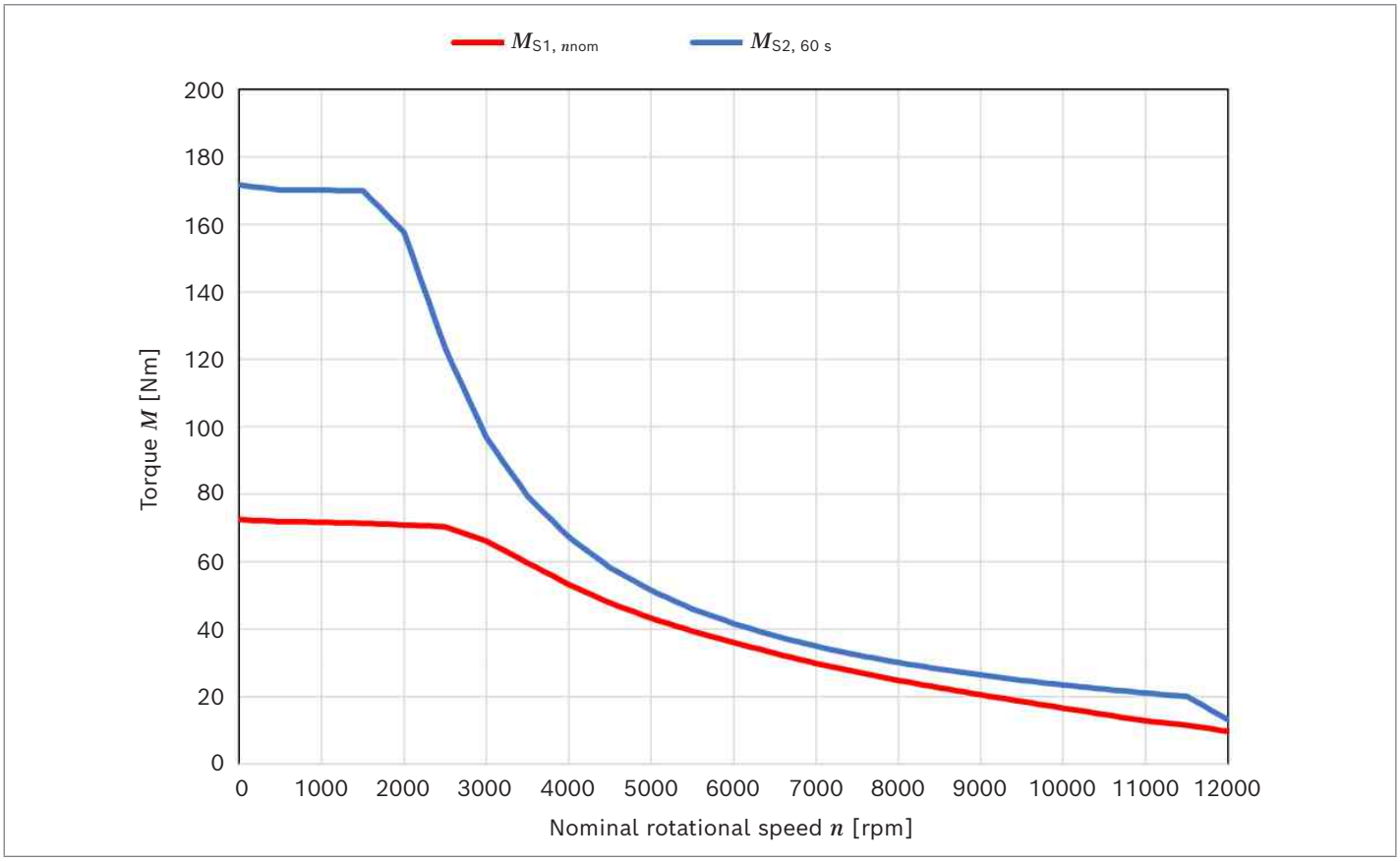
EMS1-10F25

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	72
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	30
Nominal rotational speed	n_{nom}	rpm	2500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	70
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	30
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	18
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	90.68
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	172
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	96
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	33
Maximum rotational speed	n_{max}	rpm	12000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	10
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	24
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	12
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	87.05
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	38
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	30
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	23
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	5760
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	91.97
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	7
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	39
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	51
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	39
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

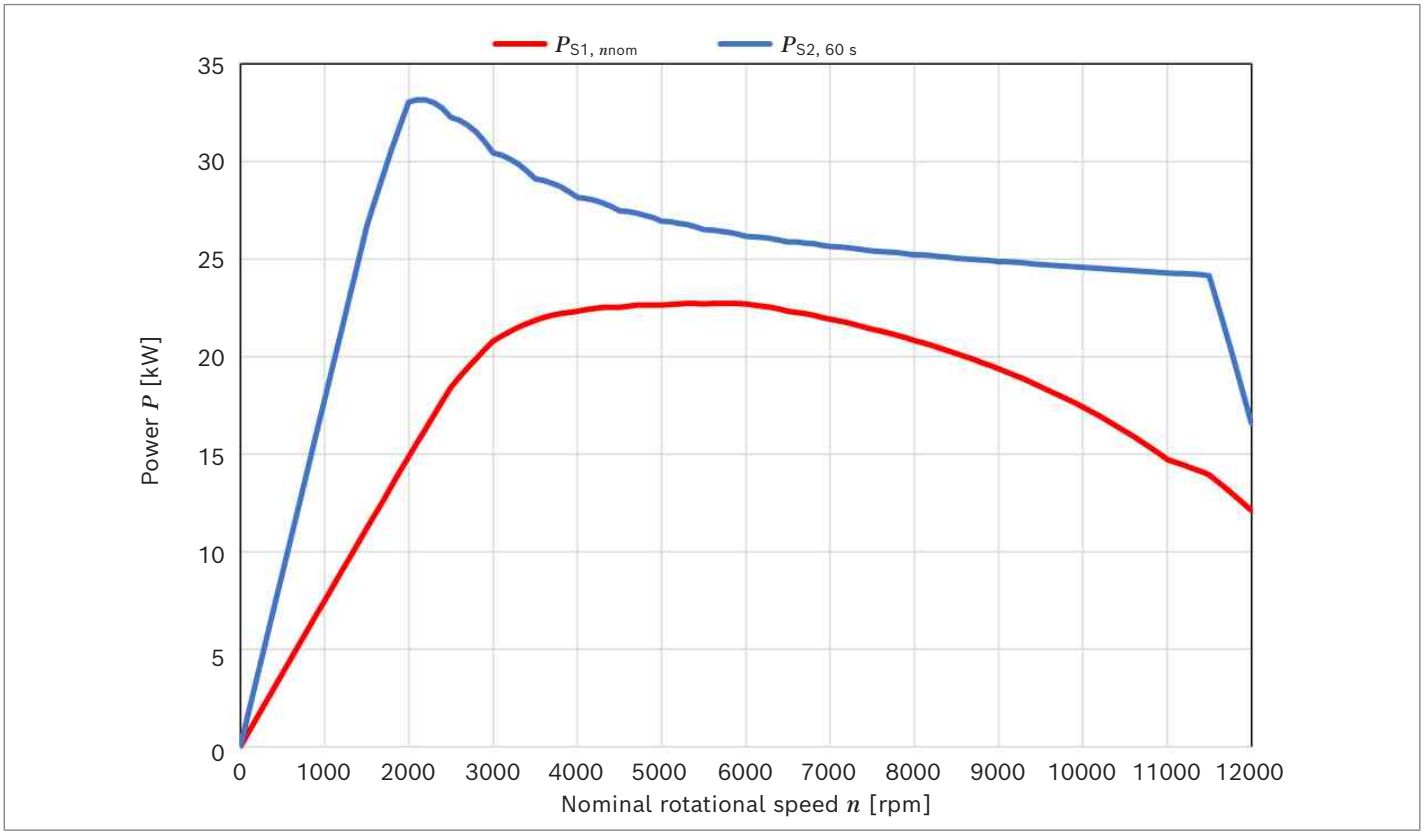
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	127.8
Torque constant at 25 °C	k_T	Nm / A_{RMS}	2.51
Synchronous inductance (d-axis) at rated current	L_d	mH	5.52
Synchronous inductance (q-axis) at rated current	L_q	mH	17.23
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.798
Cogging torque (unskewed)	M_{cog}	Nm	1.44
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	2.21

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

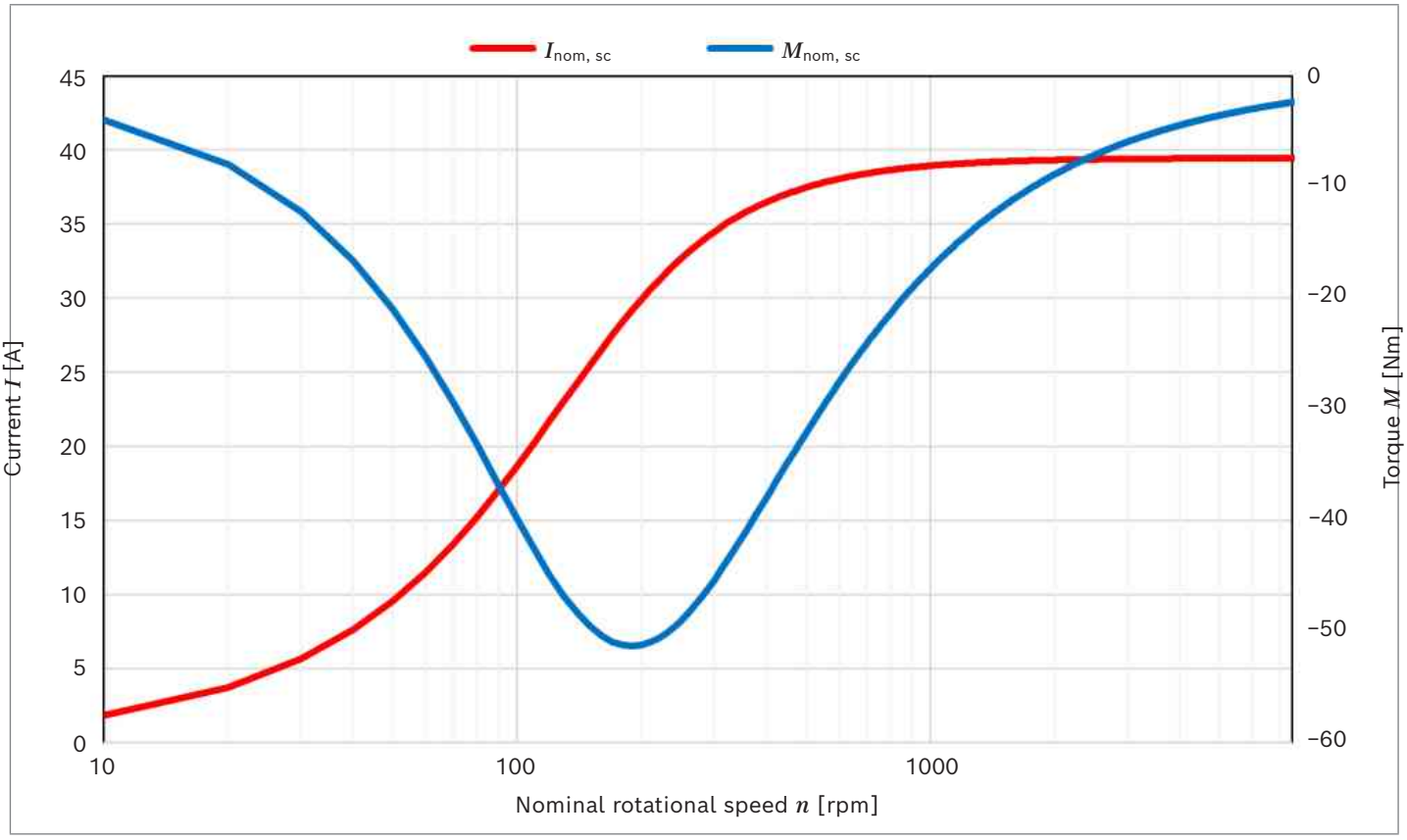
▼ Torque EMS1-10F25



▼ Power EMS1-10F25



▼ **Short circuit current and short circuit braking torque EMS1-10F25**



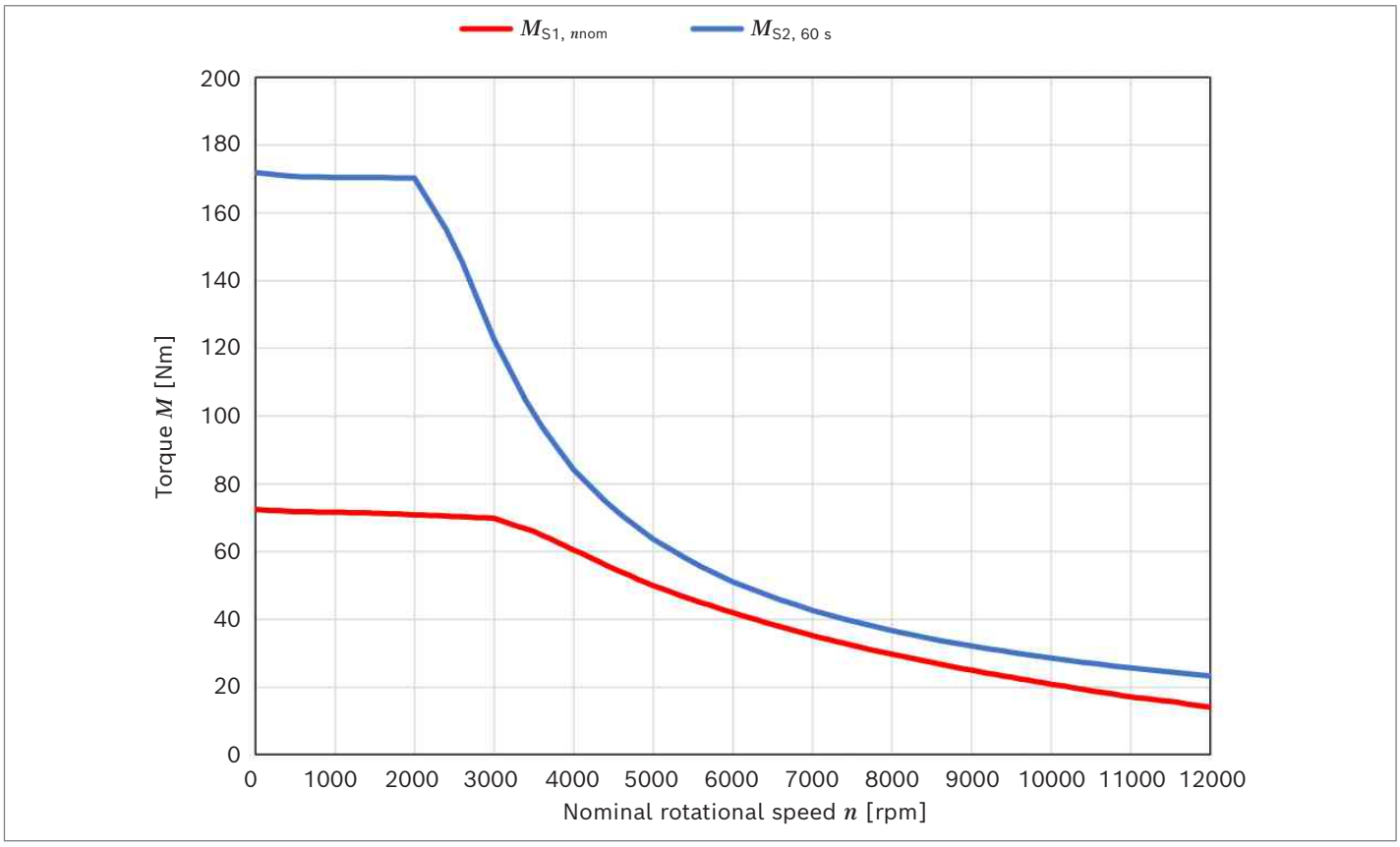
EMS1-10F30

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	72
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	35
Nominal rotational speed	n_{nom}	rpm	3000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	70
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	35
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	22
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	91.87
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	172
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	112
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	39
Maximum rotational speed	n_{max}	rpm	12000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	14
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	28
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	18
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	90.94
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	44
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	35
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	26
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	5760
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	92.91
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	6
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	46
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	51
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	46
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

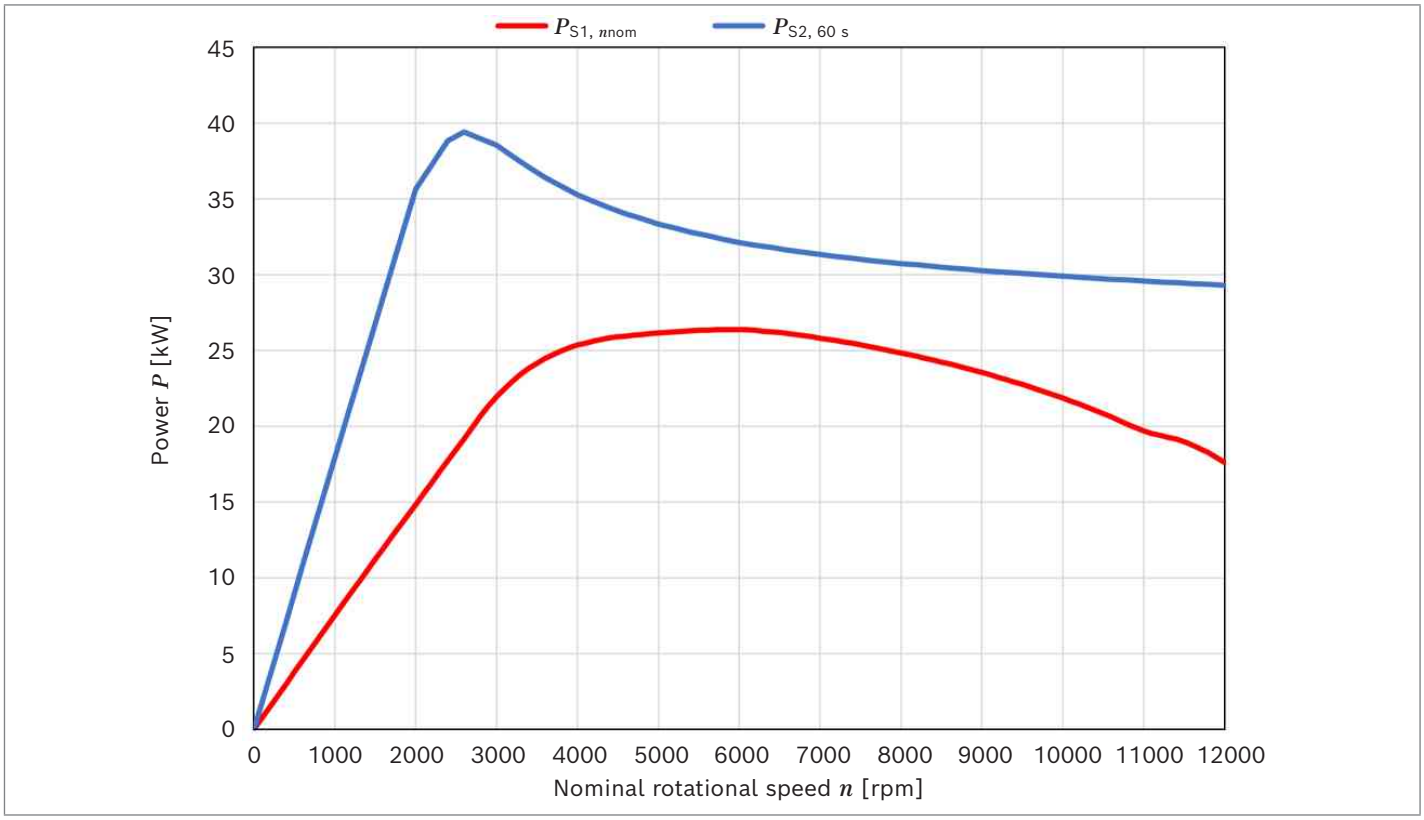
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	110
Torque constant at 25 °C	k_T	Nm / A_{RMS}	2.16
Synchronous inductance (d-axis) at rated current	L_d	mH	4.09
Synchronous inductance (q-axis) at rated current	L_q	mH	12.79
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.5926
Cogging torque (unskewed)	M_{cog}	Nm	1.44
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	2.16

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

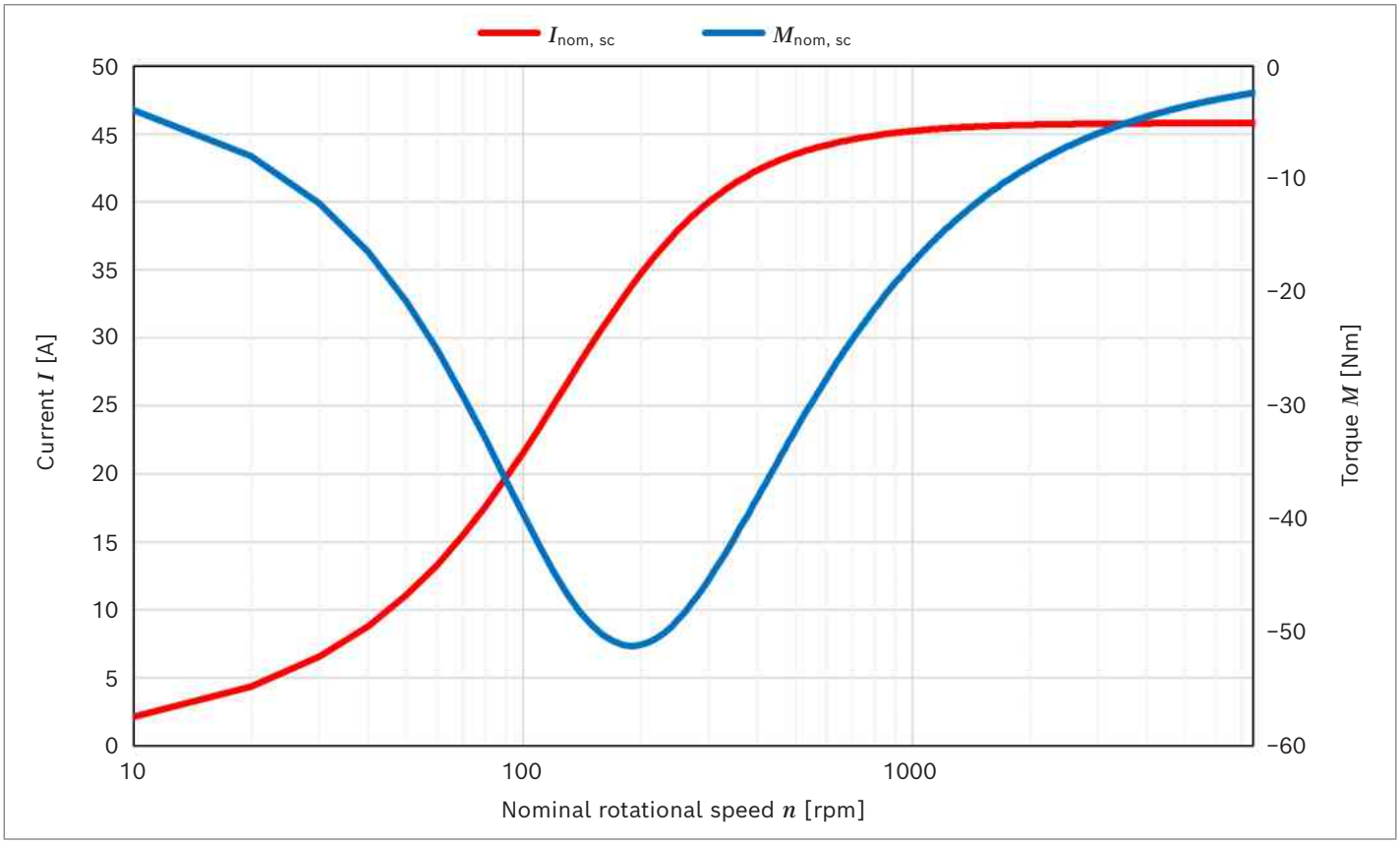
▼ **Torque EMS1-10F30**



▼ **Power EMS1-10F30**



▼ **Short circuit current and short circuit braking torque EMS1-10F30**



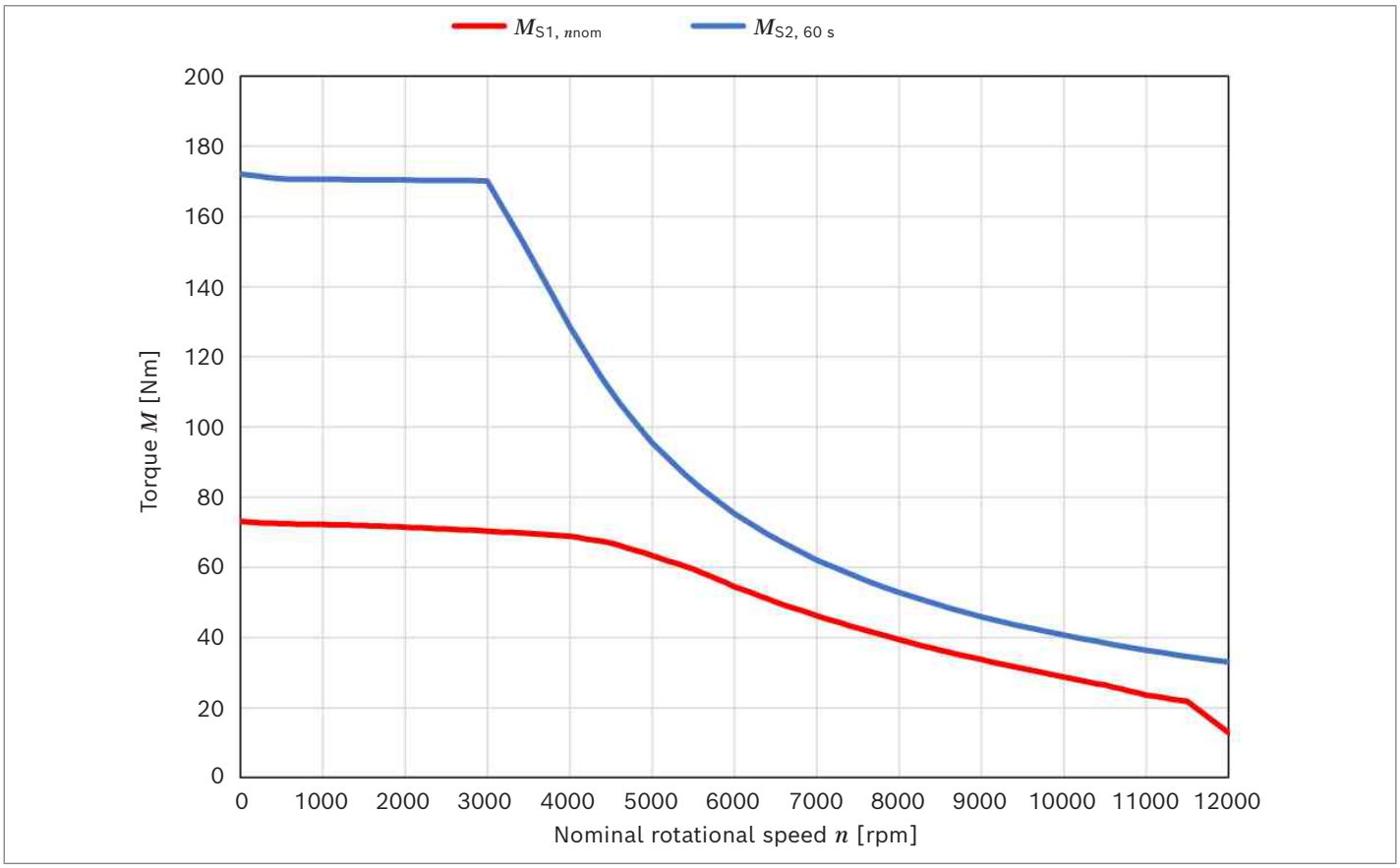
EMS1-10F40

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	73
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	48
Nominal rotational speed	n_{nom}	rpm	4000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	69
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	47
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	29
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	93.27
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	172
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	151
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	55
Maximum rotational speed	n_{max}	rpm	12000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	13
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	32
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	16
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	91.04
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	57
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	46
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	34
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	5760
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	94.44
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	4
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	62
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	51
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	62
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

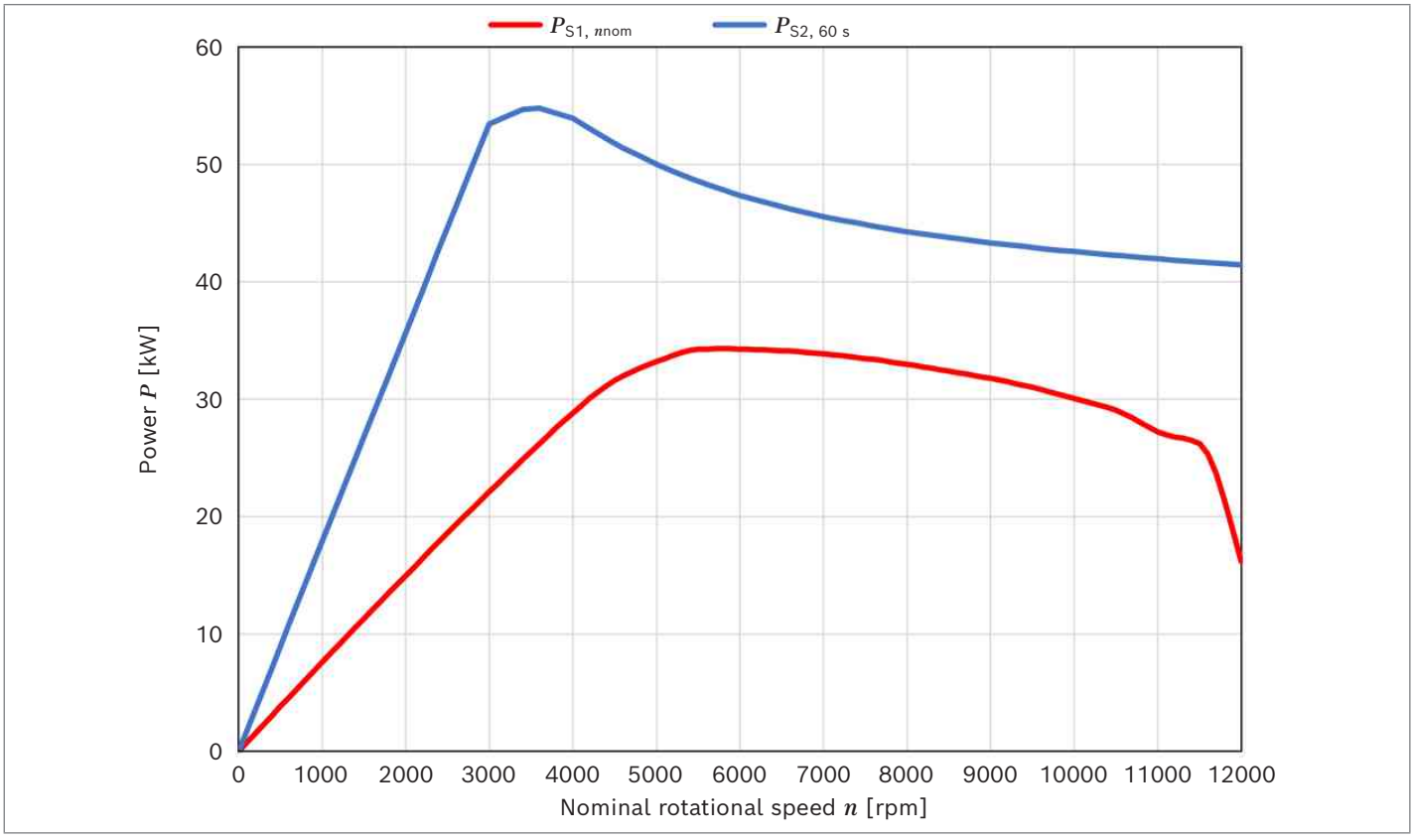
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	81.6
Torque constant at 25 °C	k_T	Nm / A_{RMS}	1.6
Synchronous inductance (d-axis) at rated current	L_d	mH	2.26
Synchronous inductance (q-axis) at rated current	L_q	mH	7.05
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.322
Cogging torque (unskewed)	M_{cog}	Nm	1.44
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	2.18

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

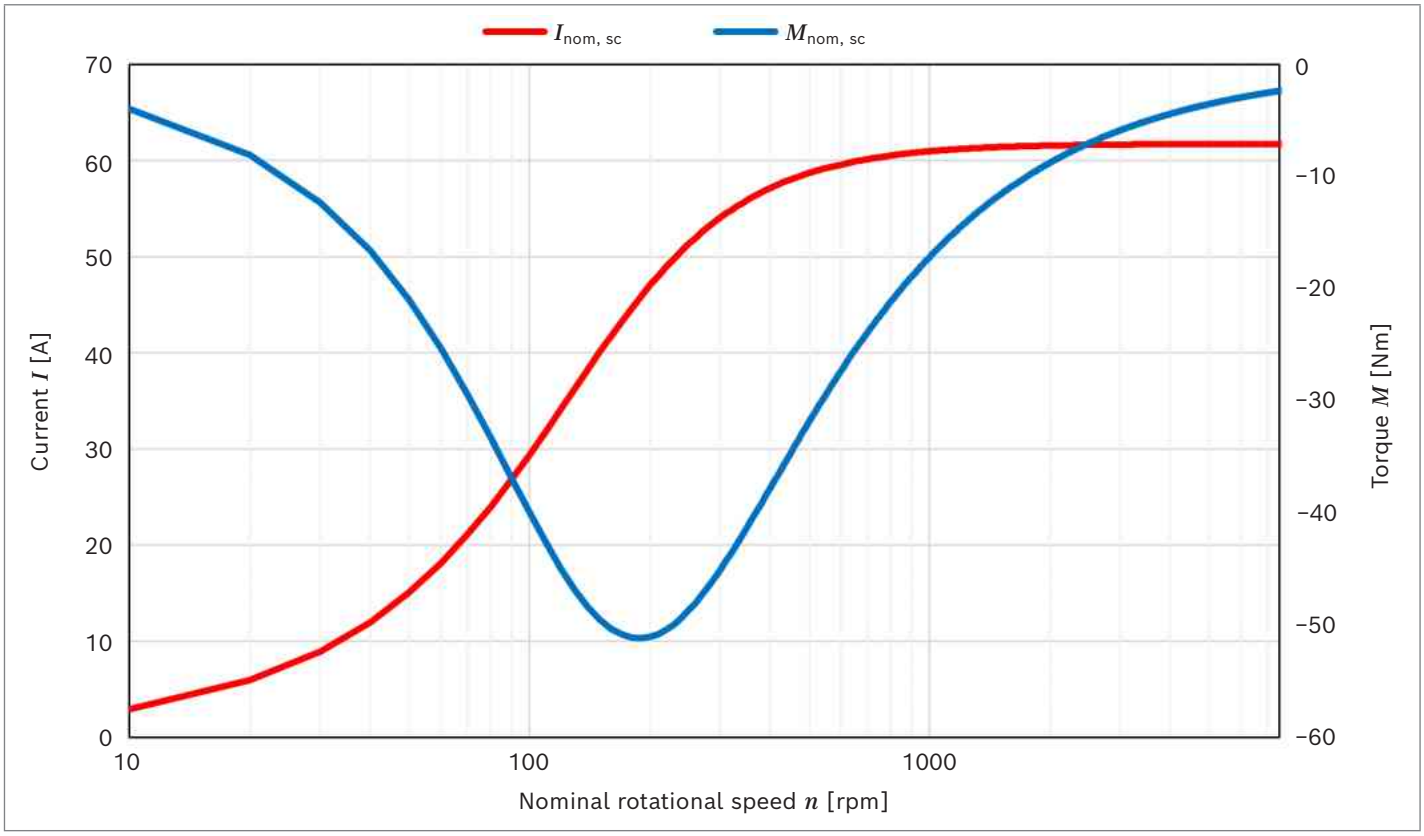
▼ **Torque EMS1-10F40**



▼ **Power EMS1-10F40**



▼ **Short circuit current and short circuit braking torque EMS1-10F40**



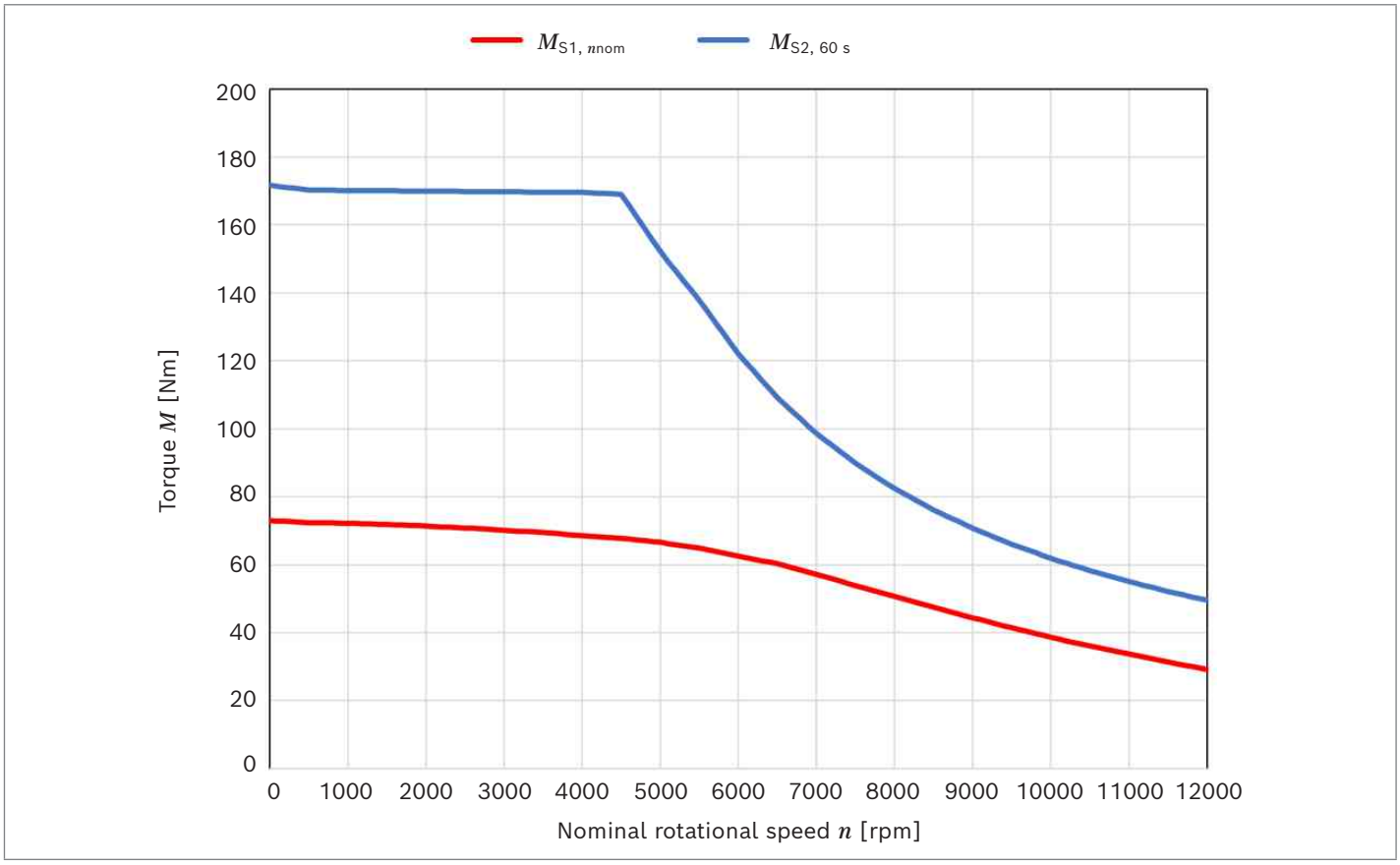
EMS1-10F60

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	73
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	69
Nominal rotational speed	n_{nom}	rpm	6000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	62
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	61
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	39
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	94.86
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	172
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	217
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	80
Maximum rotational speed	n_{max}	rpm	12000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	29
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	47
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	37
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	95.26
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	50
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	56
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	43
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	8040
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	95.58
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	3
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	89
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	51
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	89
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

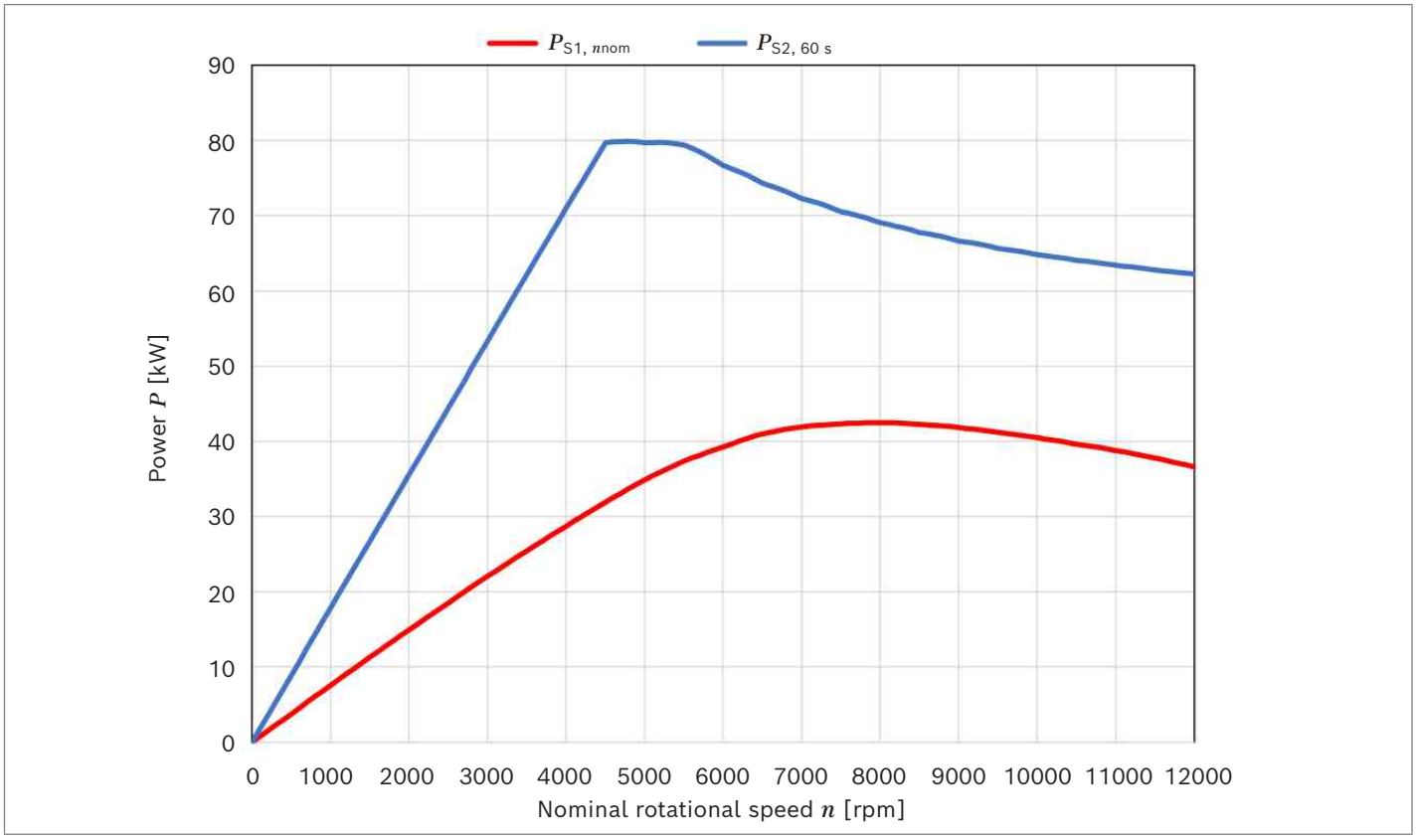
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	56.8
Torque constant at 25 °C	k_T	Nm / A_{RMS}	1.11
Synchronous inductance (d-axis) at rated current	L_d	mH	1.1
Synchronous inductance (q-axis) at rated current	L_q	mH	3.48
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.156
Cogging torque (unskewed)	M_{cog}	Nm	1.44
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	1.99

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

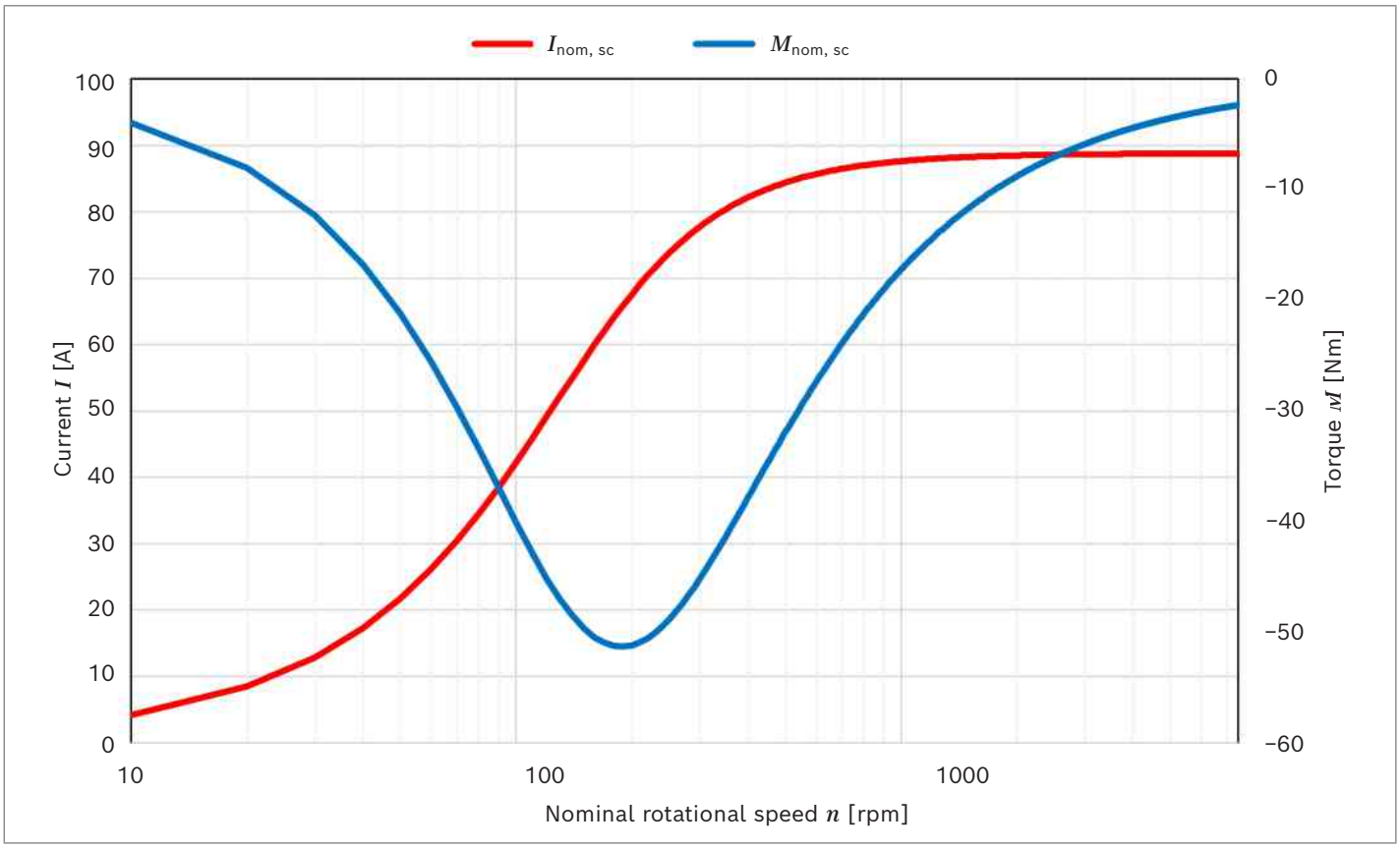
▼ **Torque EMS1-10F60**



▼ **Power EMS1-10F60**



▼ **Short circuit current and short circuit braking torque EMS1-10F60**



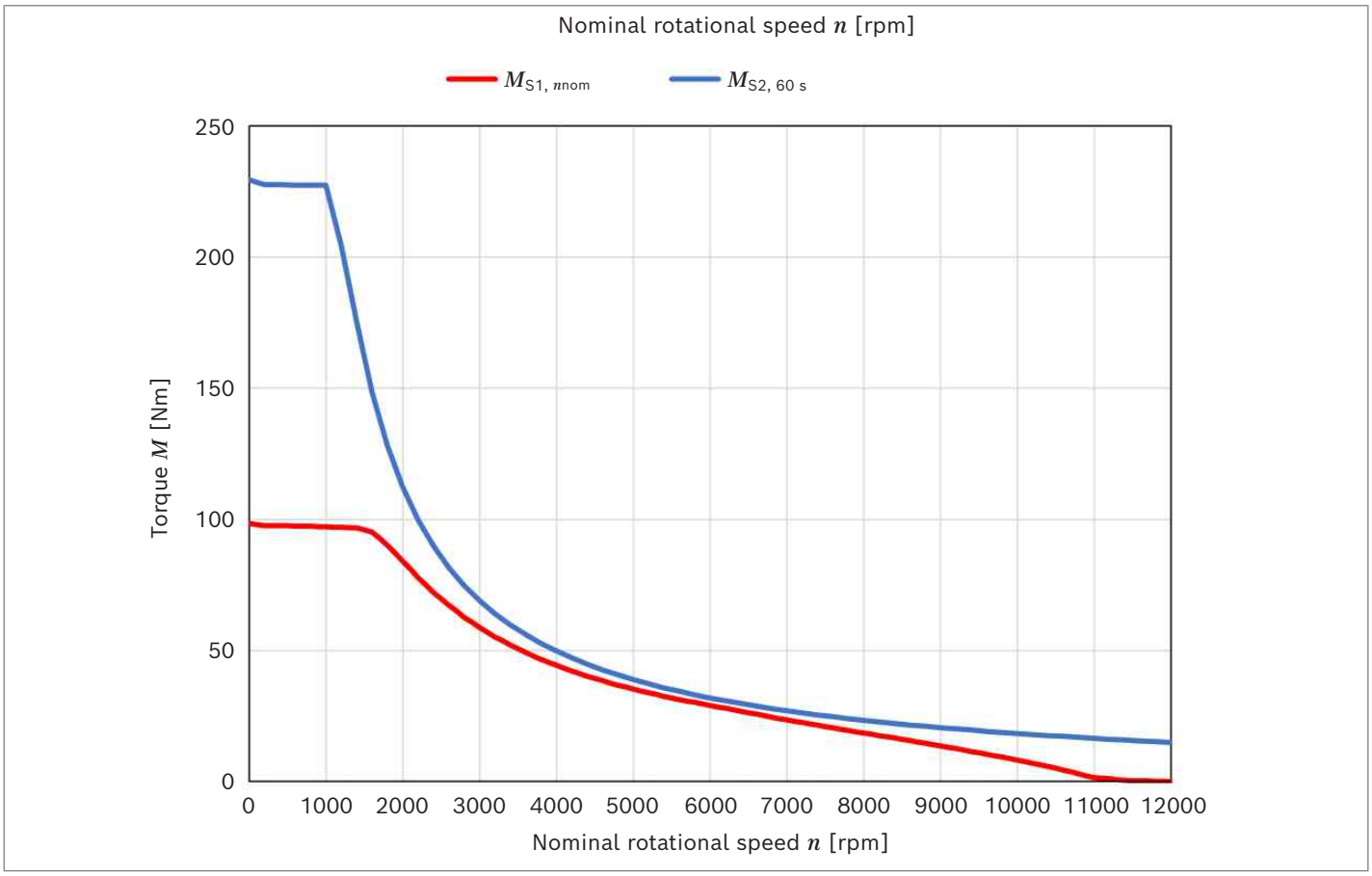
EMS1-10H15

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	98
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	25
Nominal rotational speed	n_{nom}	rpm	1500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	96
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	25
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	15
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	87.27
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	229
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	79
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	26
Maximum rotational speed	n_{max}	rpm	12000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	0
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	5
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	0
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	0.00
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	48
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	25
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	19
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	3720
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	88.92
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	14
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	32
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	69
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	33
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

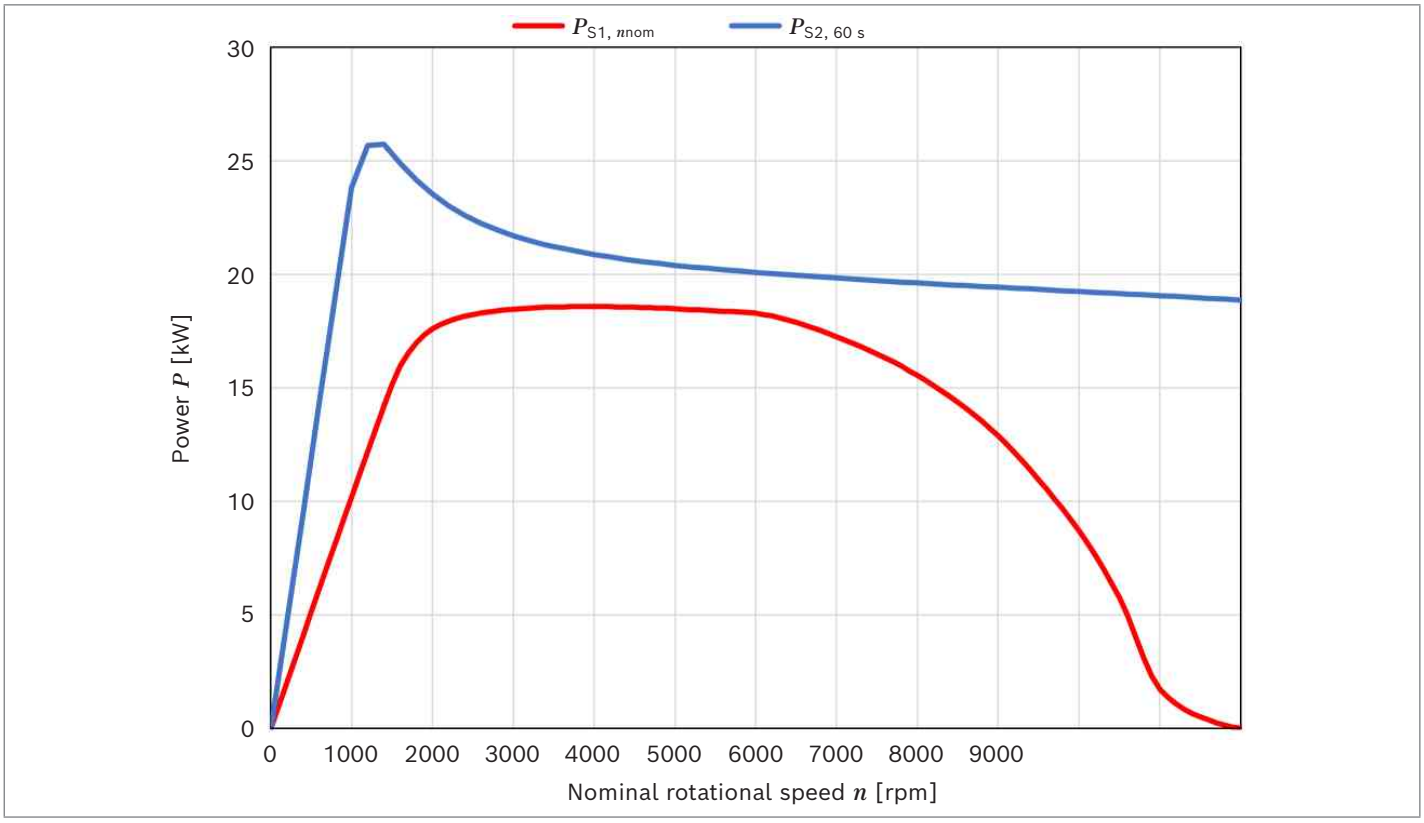
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	208.23
Torque constant at 25 °C	k_T	Nm / A_{RMS}	4.1
Synchronous inductance (d-axis) at rated current	L_d	mH	10.87
Synchronous inductance (q-axis) at rated current	L_q	mH	26.12
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	1.4289
Cogging torque (unskewed)	M_{cog}	Nm	1.92
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	3.06

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

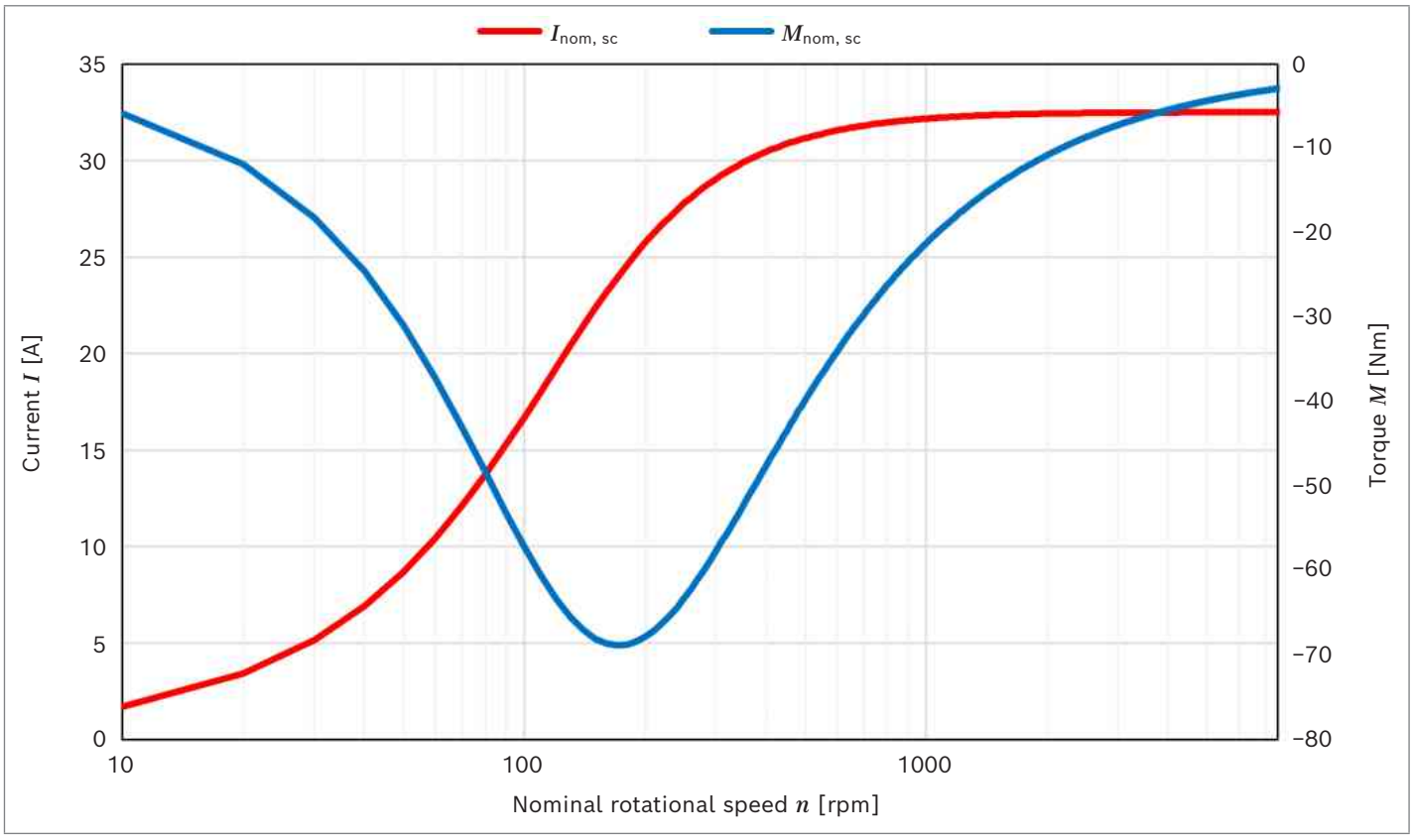
▼ Torque EMS1-10H15



▼ Power EMS1-10H15



▼ **Short circuit current and short circuit braking torque EMS1-10H15**



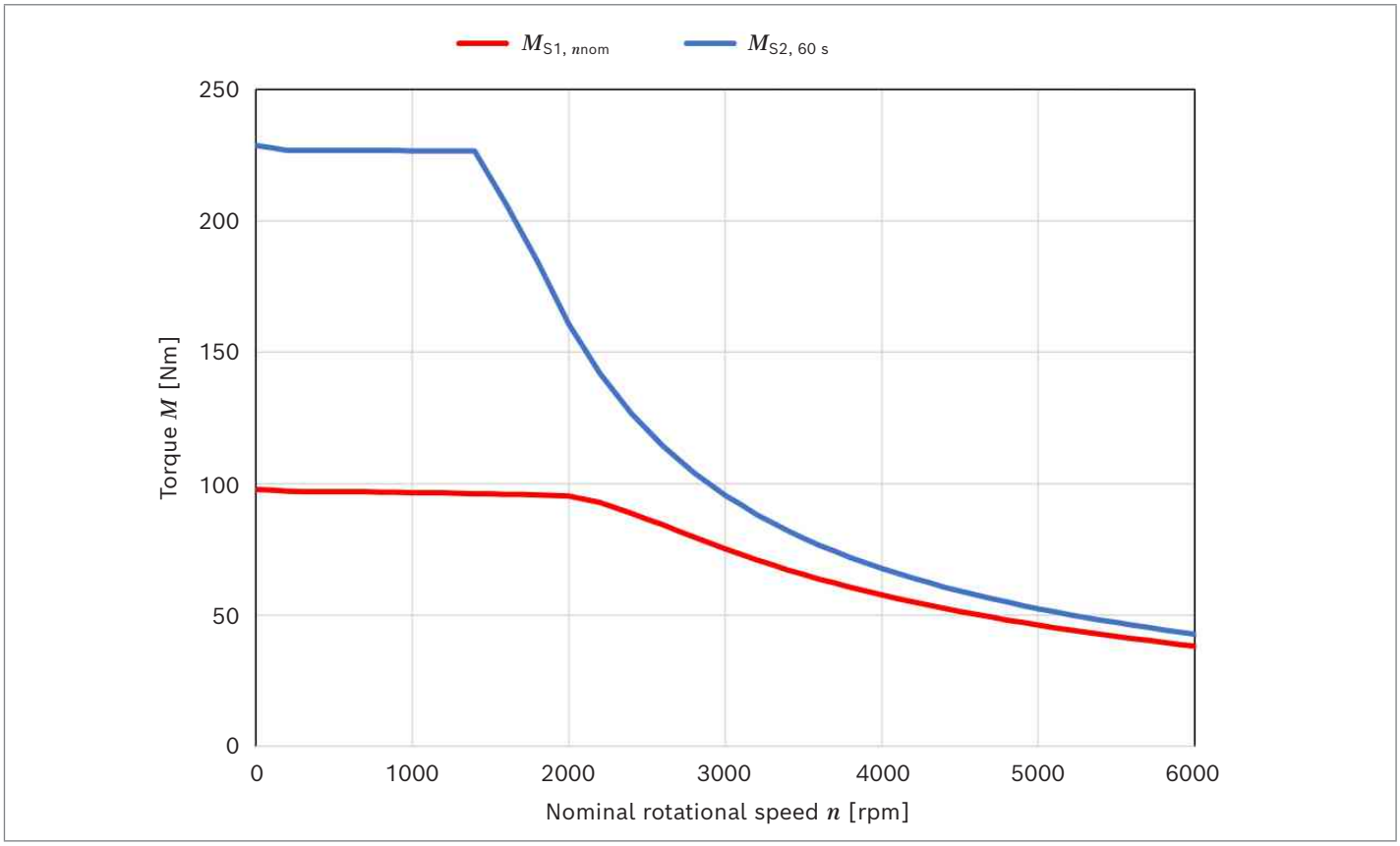
EMS1-10H20

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	97
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	32
Nominal rotational speed	n_{nom}	rpm	2000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	95
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	32
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	20
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	89.89
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	229
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	102
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	35
Maximum rotational speed	n_{max}	rpm	6000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	2
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	25
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	2
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	19.78
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	51
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	32
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	24
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	4500
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	91.05
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	11
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	42
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	69
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	42
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

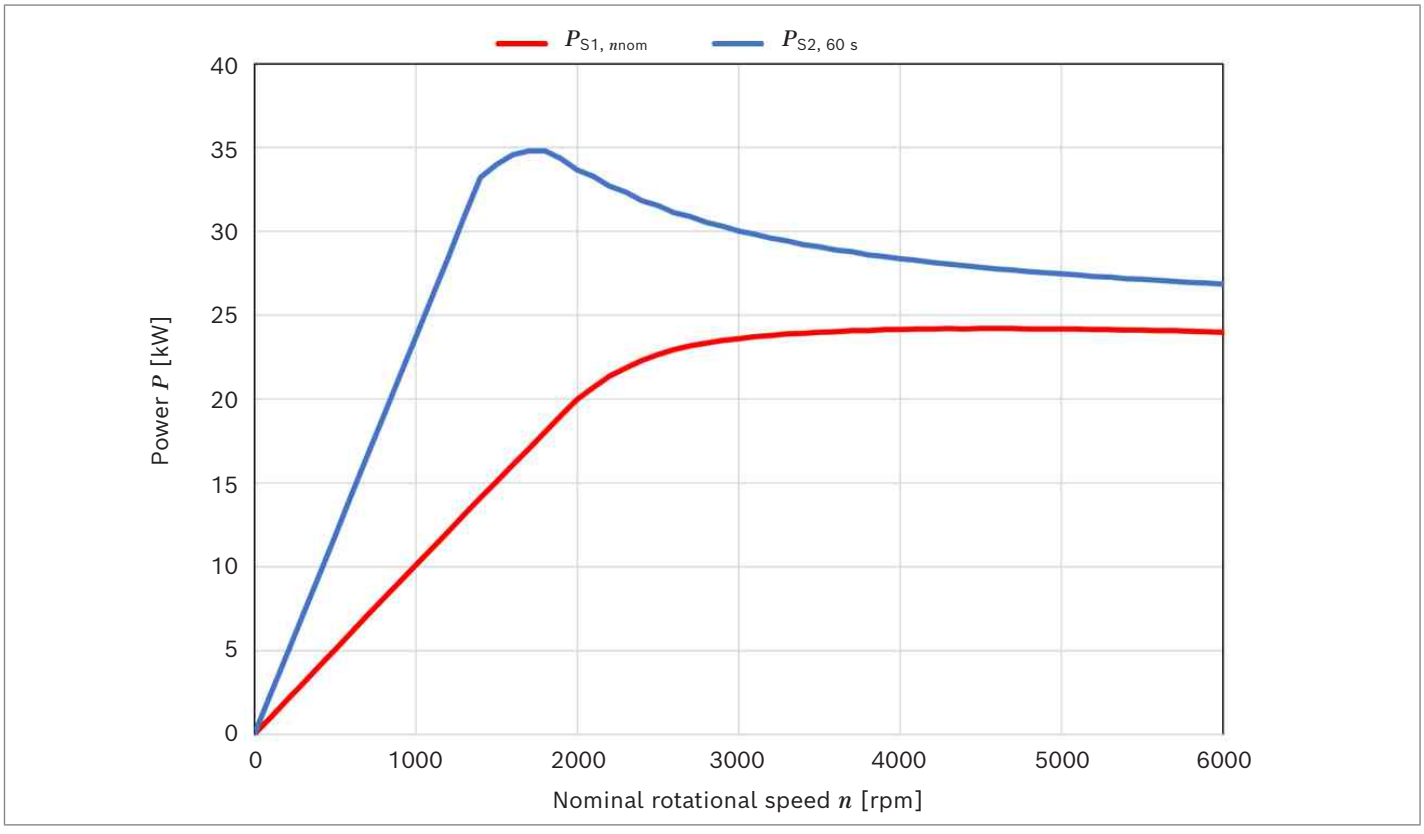
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	160.9
Torque constant at 25 °C	k_T	Nm / A_{RMS}	3.16
Synchronous inductance (d-axis) at rated current	L_d	mH	6.5
Synchronous inductance (q-axis) at rated current	L_q	mH	15.64
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.8566
Cogging torque (unskewed)	M_{cog}	Nm	1.92
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	3.01

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

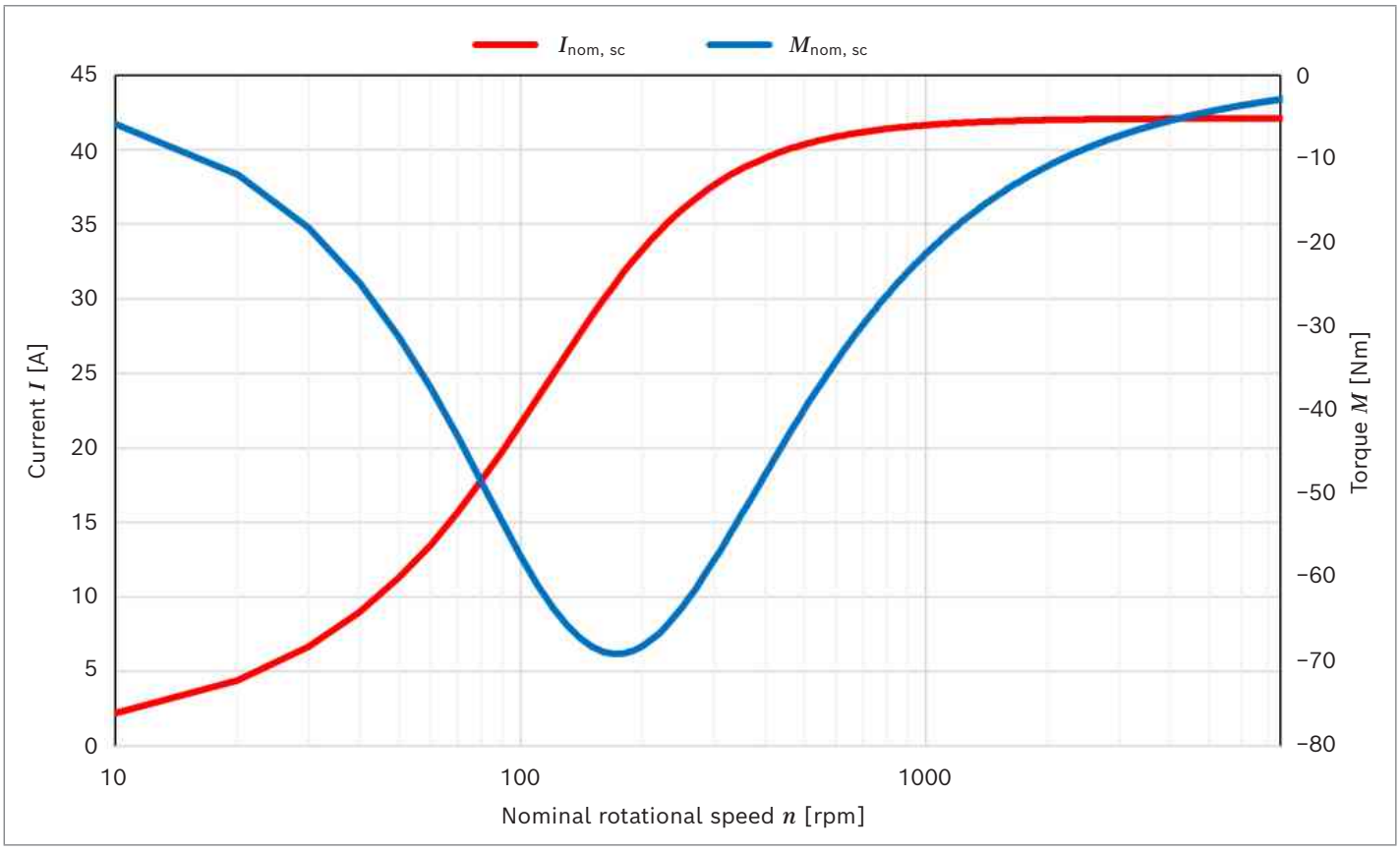
▼ **Torque EMS1-10H20**



▼ **Power EMS1-10H20**



▼ **Short circuit current and short circuit braking torque EMS1-10H20**



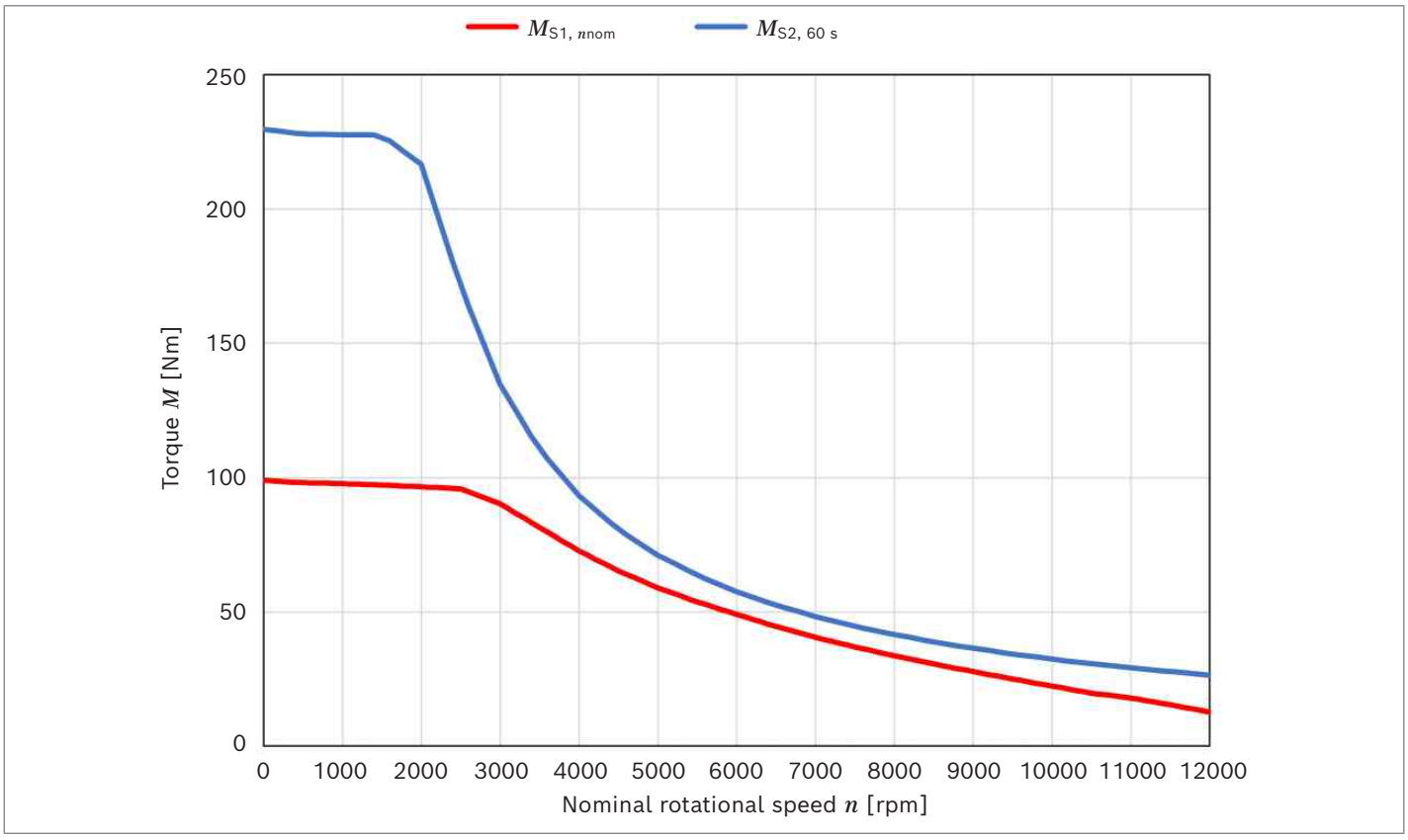
EMS1-10H25

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	99
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	41
Nominal rotational speed	n_{nom}	rpm	2500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	96
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	41
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	25
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	91.35
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	230
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	129
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	45
Maximum rotational speed	n_{max}	rpm	12000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	13
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	31
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	16
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	88.22
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	56
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	41
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	31
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	5280
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	92.55
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	9
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	53
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	69
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	53
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

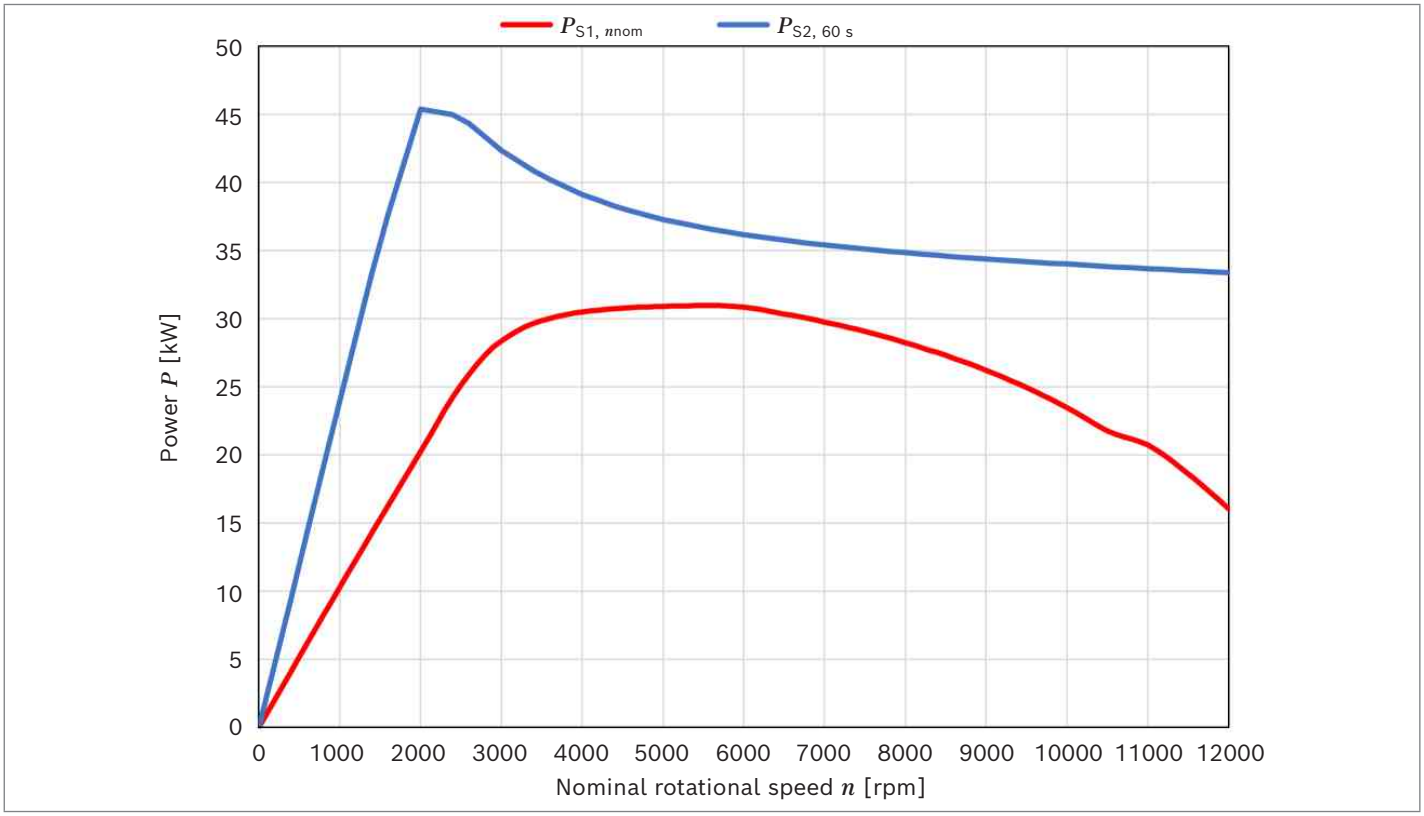
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	127.8
Torque constant at 25 °C	k_T	Nm / A_{RMS}	2.51
Synchronous inductance (d-axis) at rated current	L_d	mH	4.09
Synchronous inductance (q-axis) at rated current	L_q	mH	9.83
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.54
Cogging torque (unskewed)	M_{cog}	Nm	1.92
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	3

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

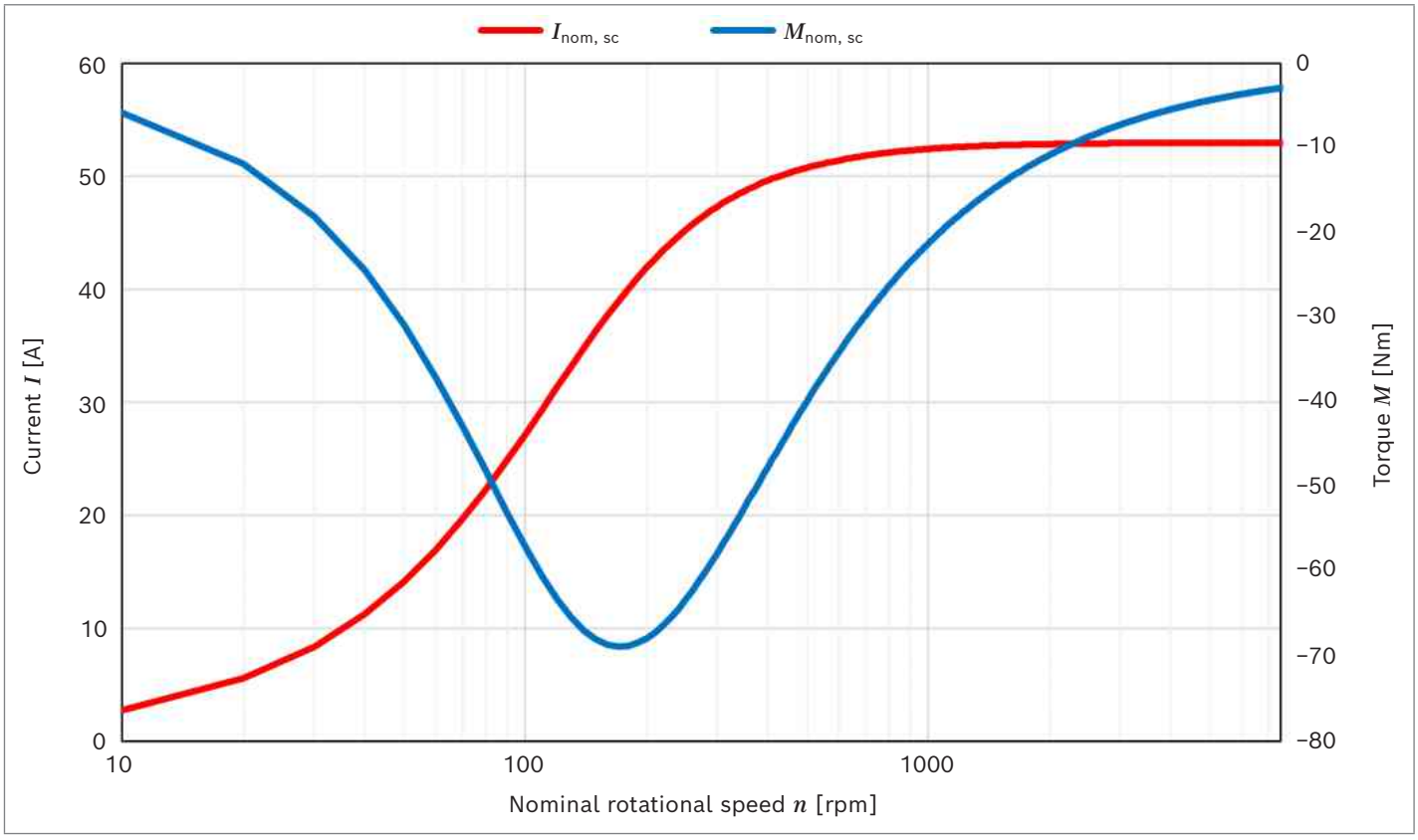
▼ Torque EMS1-10H25



▼ Power EMS1-10H25



▼ **Short circuit current and short circuit braking torque EMS1-10H25**



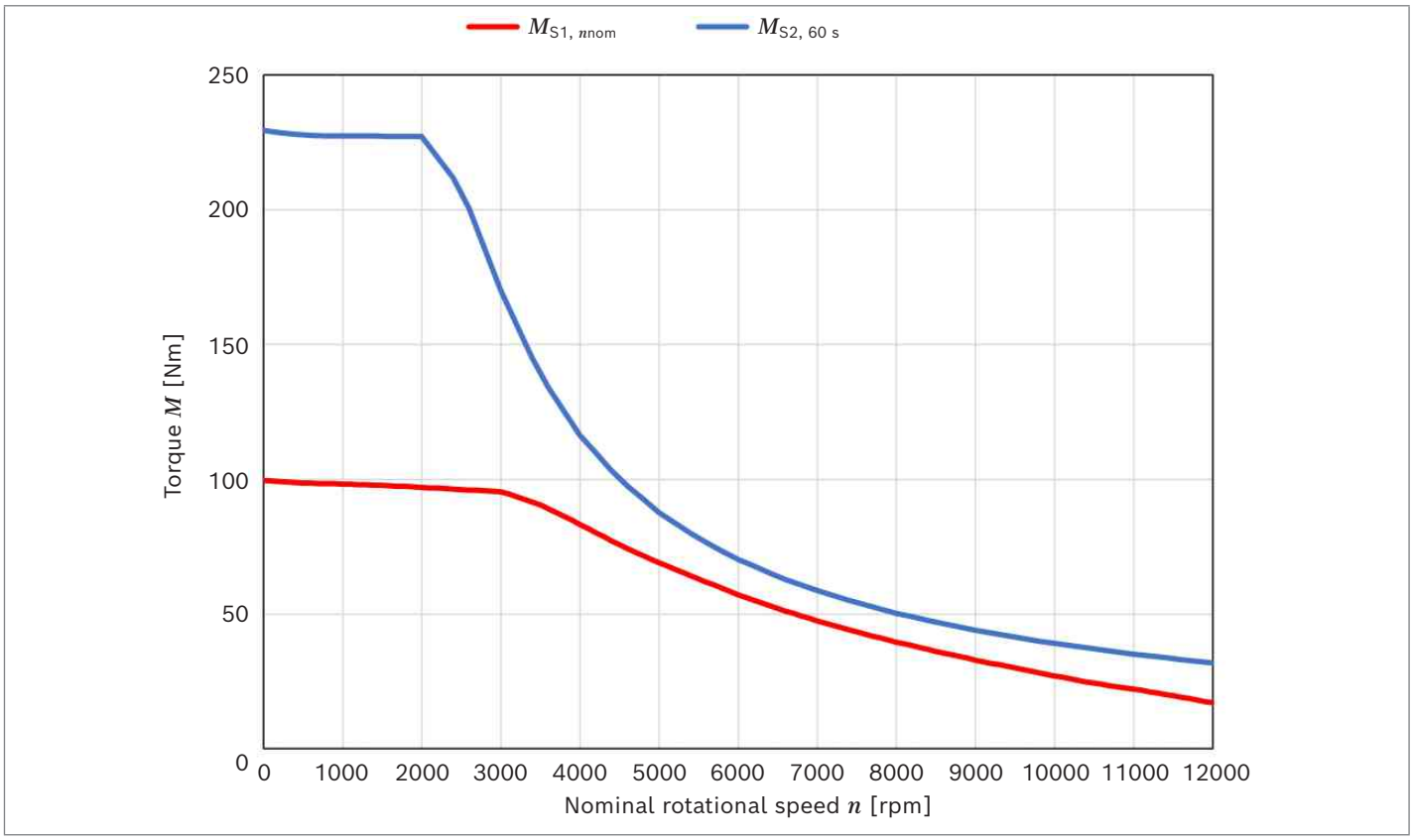
EMS1-10H30

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	99
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	49
Nominal rotational speed	n_{nom}	rpm	3000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	95
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	48
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	30
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	92.49
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	229
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	151
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	54
Maximum rotational speed	n_{max}	rpm	12000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	17
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	36
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	21
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	91.00
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	64
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	48
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	36
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	5400
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	93.68
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	7
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	62
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	69
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	62
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

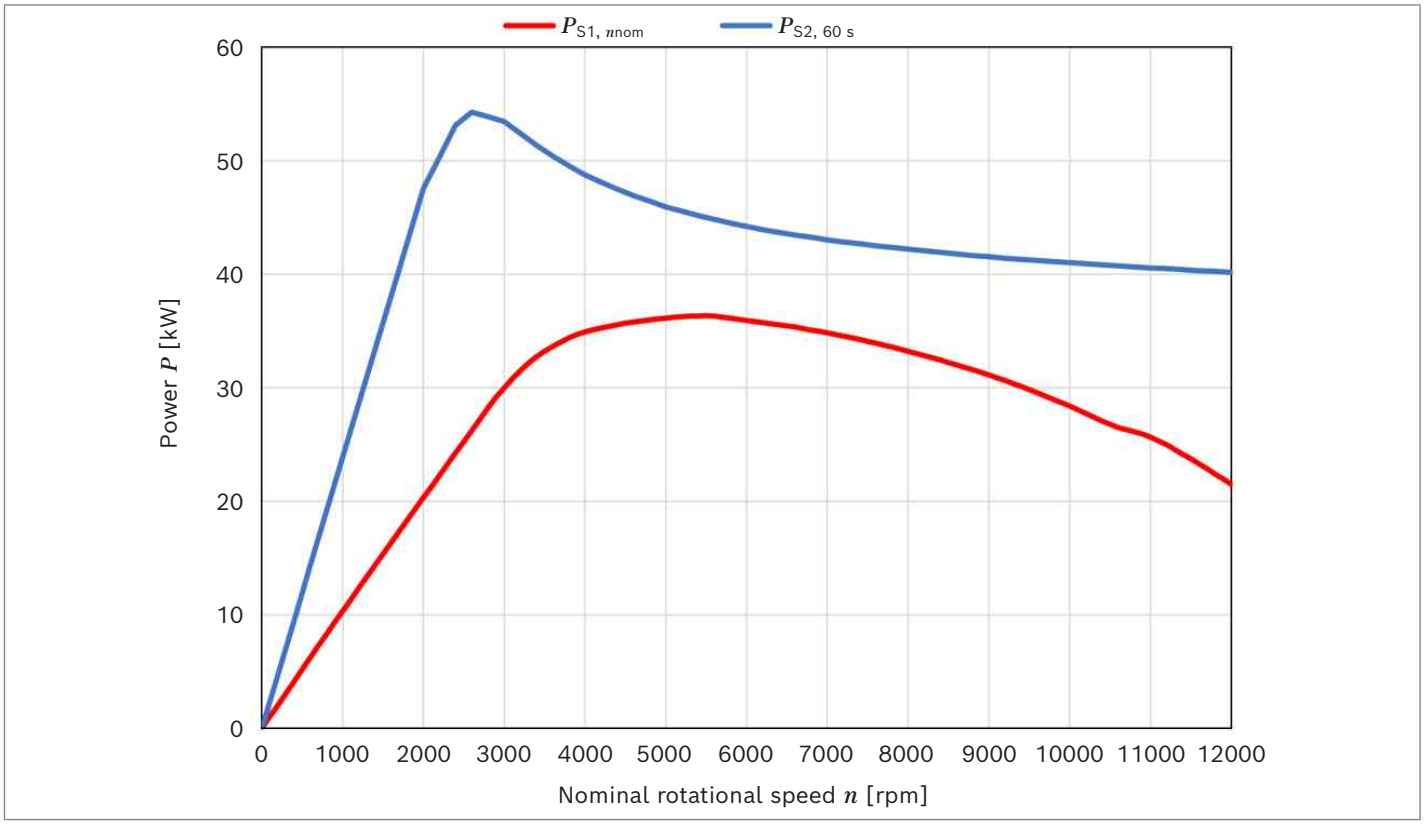
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	108.9
Torque constant at 25 °C	k_T	Nm / A_{RMS}	2.14
Synchronous inductance (d-axis) at rated current	L_d	mH	3.19
Synchronous inductance (q-axis) at rated current	L_q	mH	8.98
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.386
Cogging torque (unskewed)	M_{cog}	Nm	1.92
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	3

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

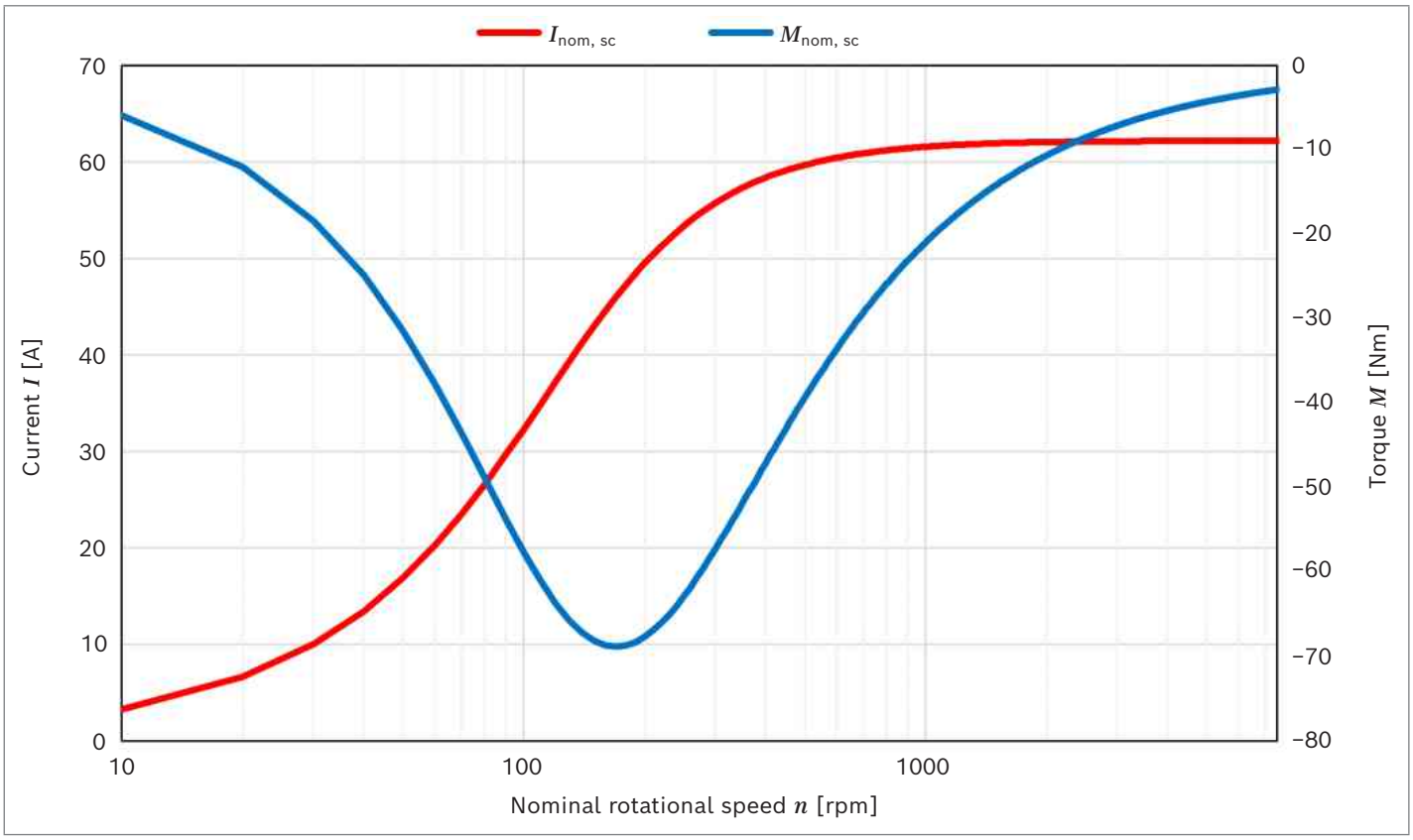
▼ **Torque EMS1-10H30**



▼ **Power EMS1-10H30**



▼ **Short circuit current and short circuit braking torque EMS1-10H30**



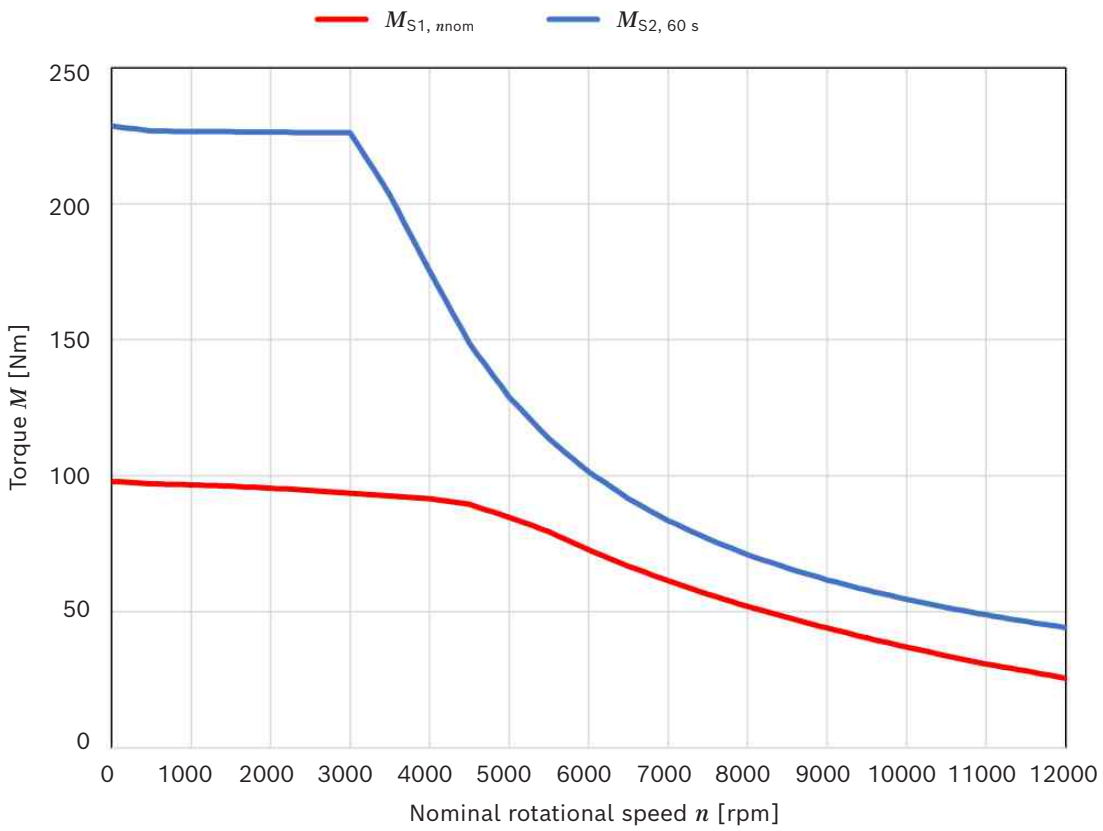
EMS1-10H40

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	98
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	65
Nominal rotational speed	n_{nom}	rpm	4000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	92
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	63
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	38
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	93.73
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	229
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	203
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	75
Maximum rotational speed	n_{max}	rpm	12000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	25
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	46
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	32
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	93.77
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	76
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	61
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	46
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	5760
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	94.87
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	5
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	84
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	69
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	84
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

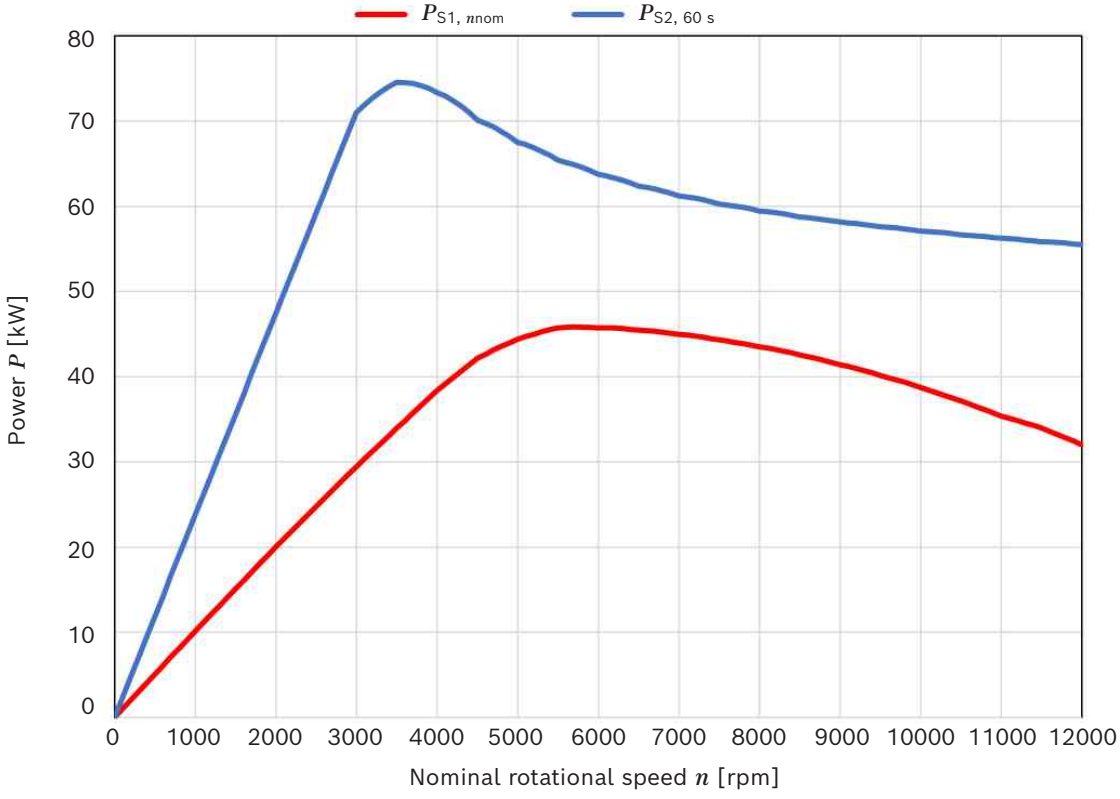
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	80.5
Torque constant at 25 °C	k_T	Nm / A_{RMS}	1.58
Synchronous inductance (d-axis) at rated current	L_d	mH	1.63
Synchronous inductance (q-axis) at rated current	L_q	mH	5.12
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.214
Cogging torque (unskewed)	M_{cog}	Nm	1.92
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	2.9

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

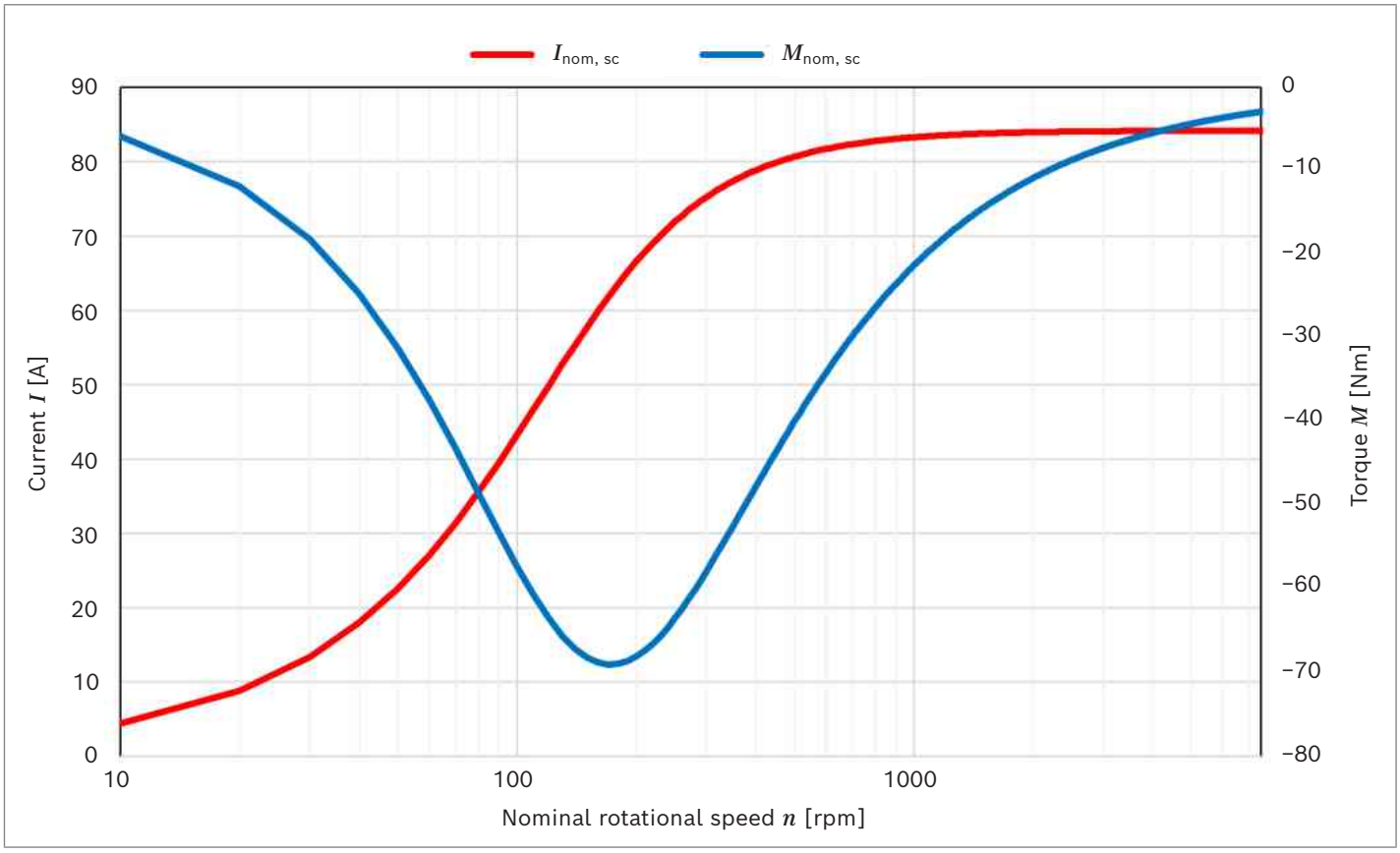
▼ Torque EMS1-10H40



▼ Power EMS1-10H40



▼ **Short circuit current and short circuit braking torque EMS1-10H40**



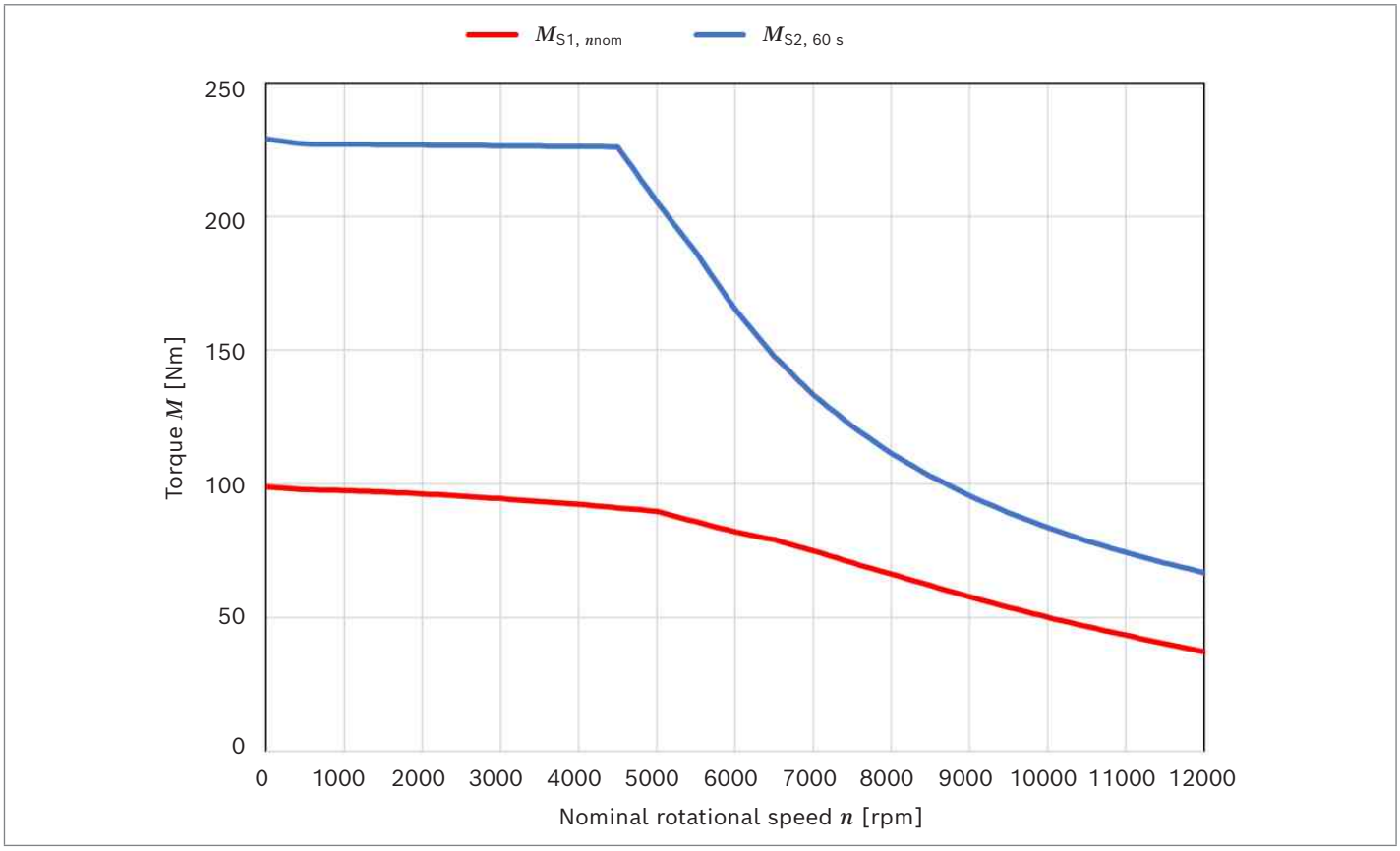
EMS1-10H60

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	98
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	93
Nominal rotational speed	n_{nom}	rpm	6000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	82
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	81
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	52
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	95.19
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	229
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	289
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	108
Maximum rotational speed	n_{max}	rpm	12000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	37
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	61
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	47
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	95.52
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	67
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	74
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	56
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	7920
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	95.86
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	4
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	119
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	69
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	119
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

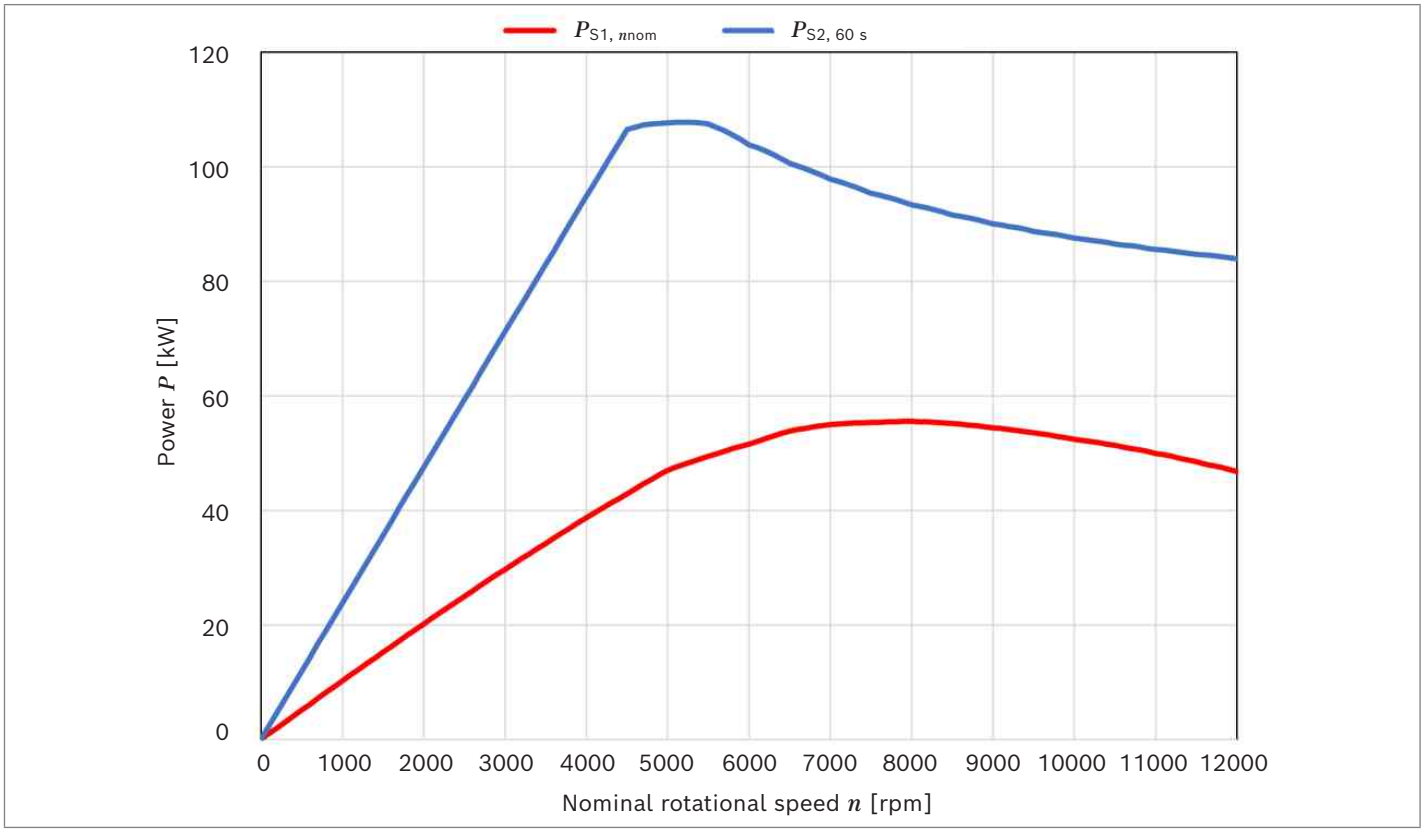
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	56.8
Torque constant at 25 °C	k_T	Nm / A_{RMS}	1.11
Synchronous inductance (d-axis) at rated current	L_d	mH	0.82
Synchronous inductance (q-axis) at rated current	L_q	mH	2.6
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.106
Cogging torque (unskewed)	M_{cog}	Nm	1.92
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	2.64

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

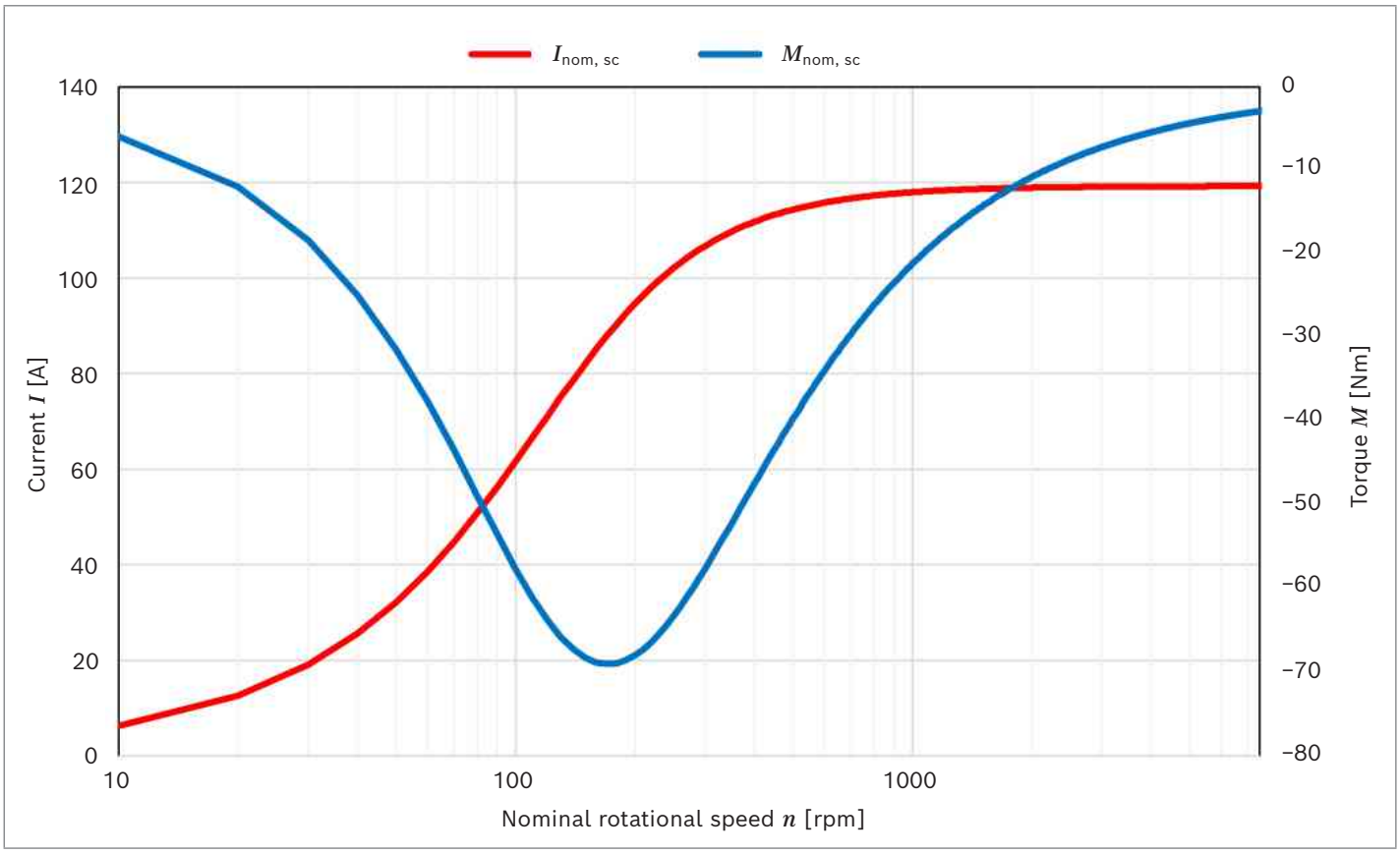
▼ **Torque EMS1-10H60**



▼ **Power EMS1-10H60**



▼ **Short circuit current and short circuit braking torque EMS1-10H60**



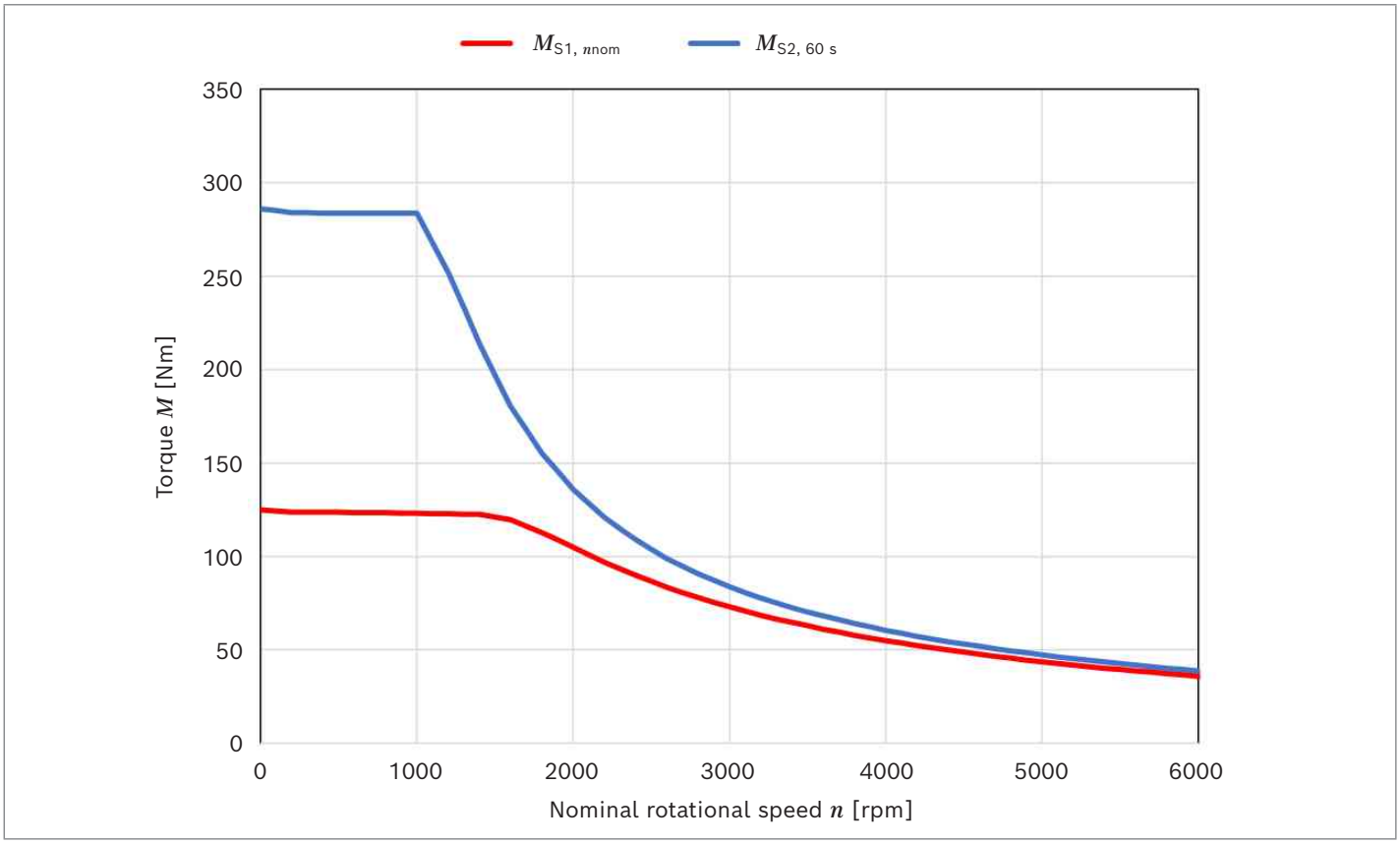
EMS1-10J15

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	124
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	31
Nominal rotational speed	n_{nom}	rpm	1500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	121
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	31
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	19
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	87.97
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	286
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	96
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	32
Maximum rotational speed	n_{max}	rpm	6000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	0
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	0
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	0
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	0.00
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	59
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	31
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	23
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	3720
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	89.37
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	17
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	40
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	87
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	40
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

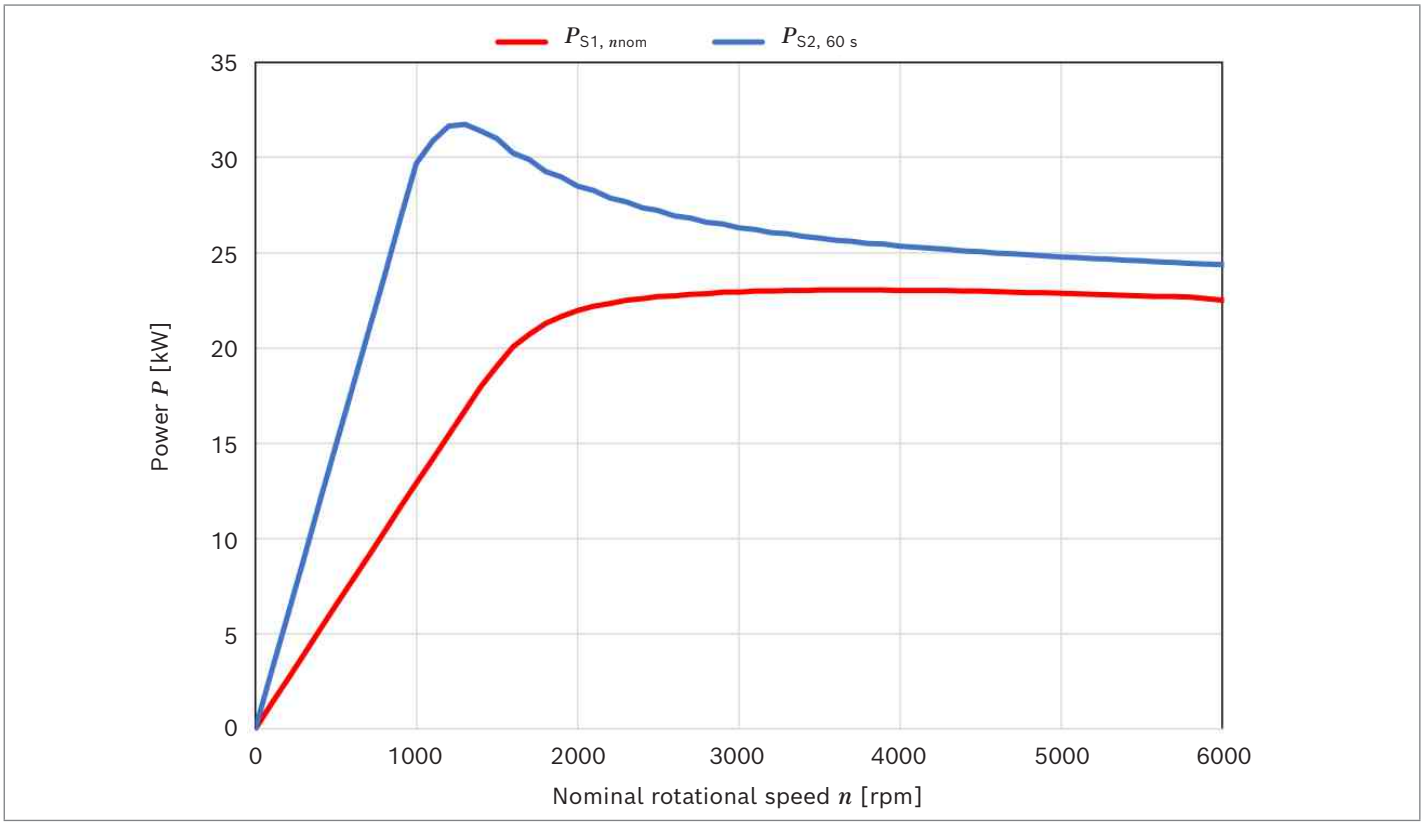
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	212.96
Torque constant at 25 °C	k_T	Nm / A_{RMS}	4.19
Synchronous inductance (d-axis) at rated current	L_d	mH	9.04
Synchronous inductance (q-axis) at rated current	L_q	mH	21.71
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	1.1087
Cogging torque (unskewed)	M_{cog}	Nm	2.4
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	3.91

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

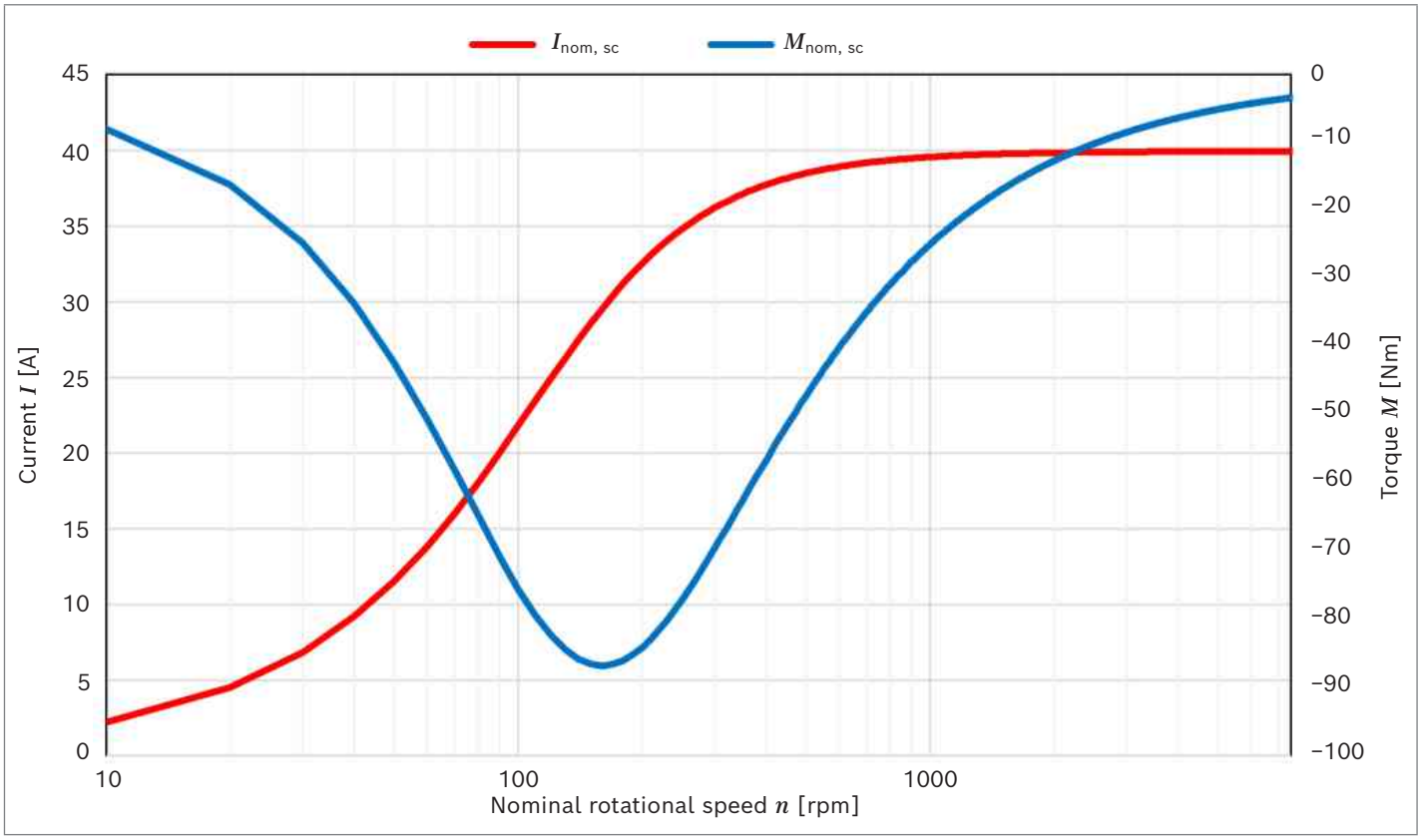
▼ Torque EMS1-10J15



▼ Power EMS1-10J15



▼ **Short circuit current and short circuit braking torque EMS1-10J15**



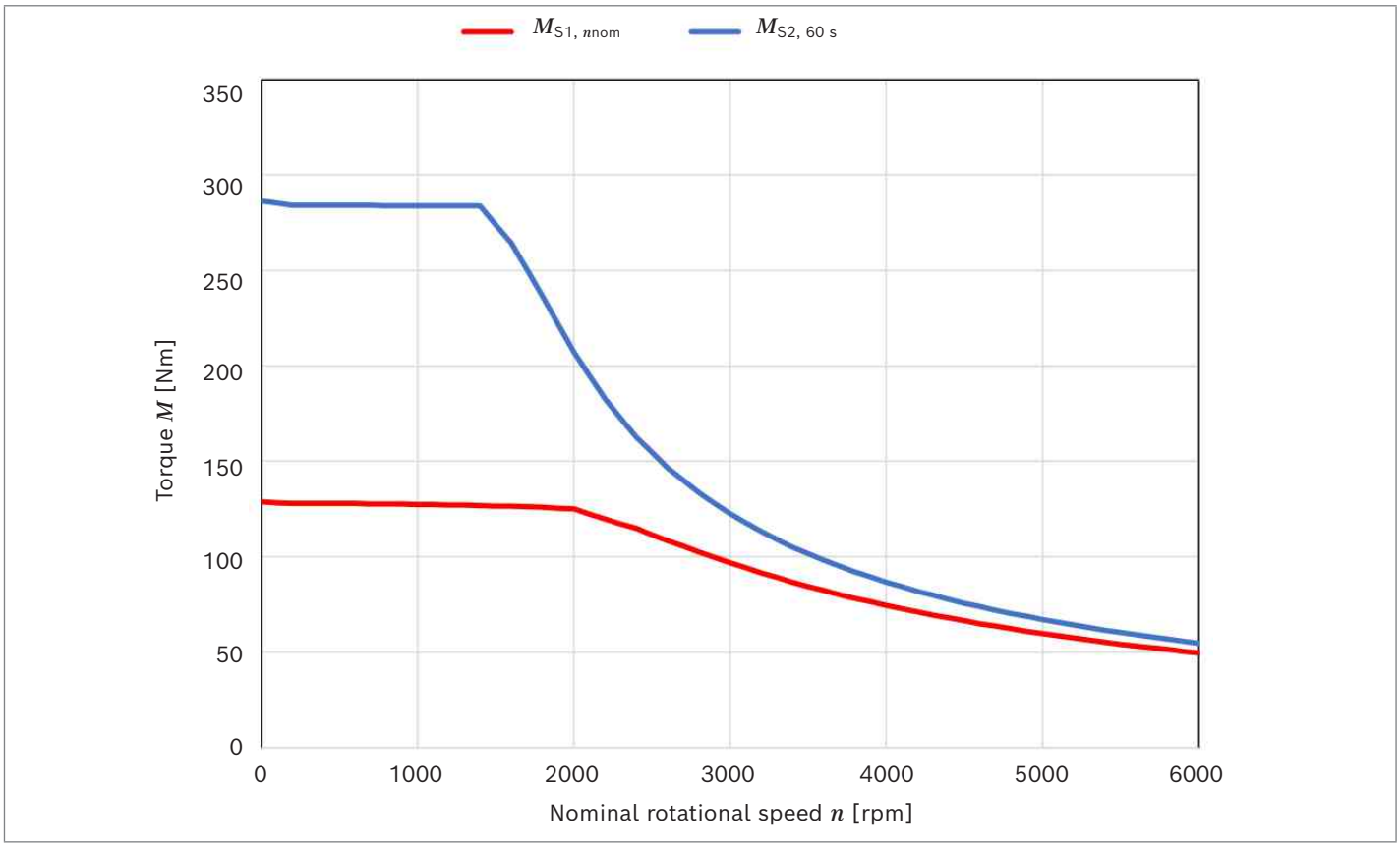
EMS1-10J20

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	128
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	42
Nominal rotational speed	n_{nom}	rpm	2000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	125
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	42
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	26
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	90.64
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	286
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	129
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	45
Maximum rotational speed	n_{max}	rpm	6000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	3
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	31
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	3
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	21.23
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	66
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	42
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	31
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	4500
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	91.63
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	13
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	53
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	87
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	53
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

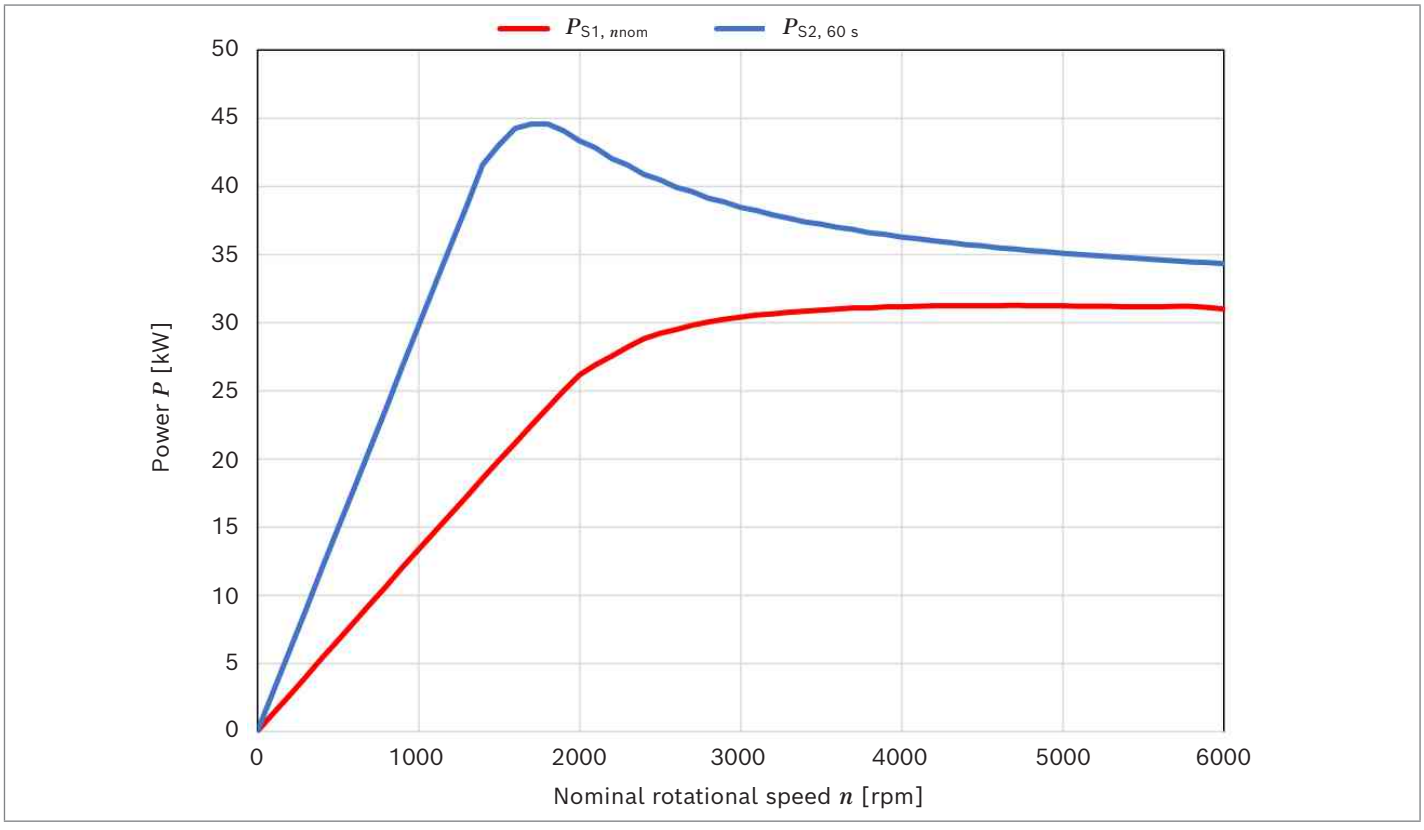
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	159.7
Torque constant at 25 °C	k_T	Nm / A_{RMS}	3.13
Synchronous inductance (d-axis) at rated current	L_d	mH	5.05
Synchronous inductance (q-axis) at rated current	L_q	mH	16.81
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.628
Cogging torque (unskewed)	M_{cog}	Nm	2.4
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	3.91

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

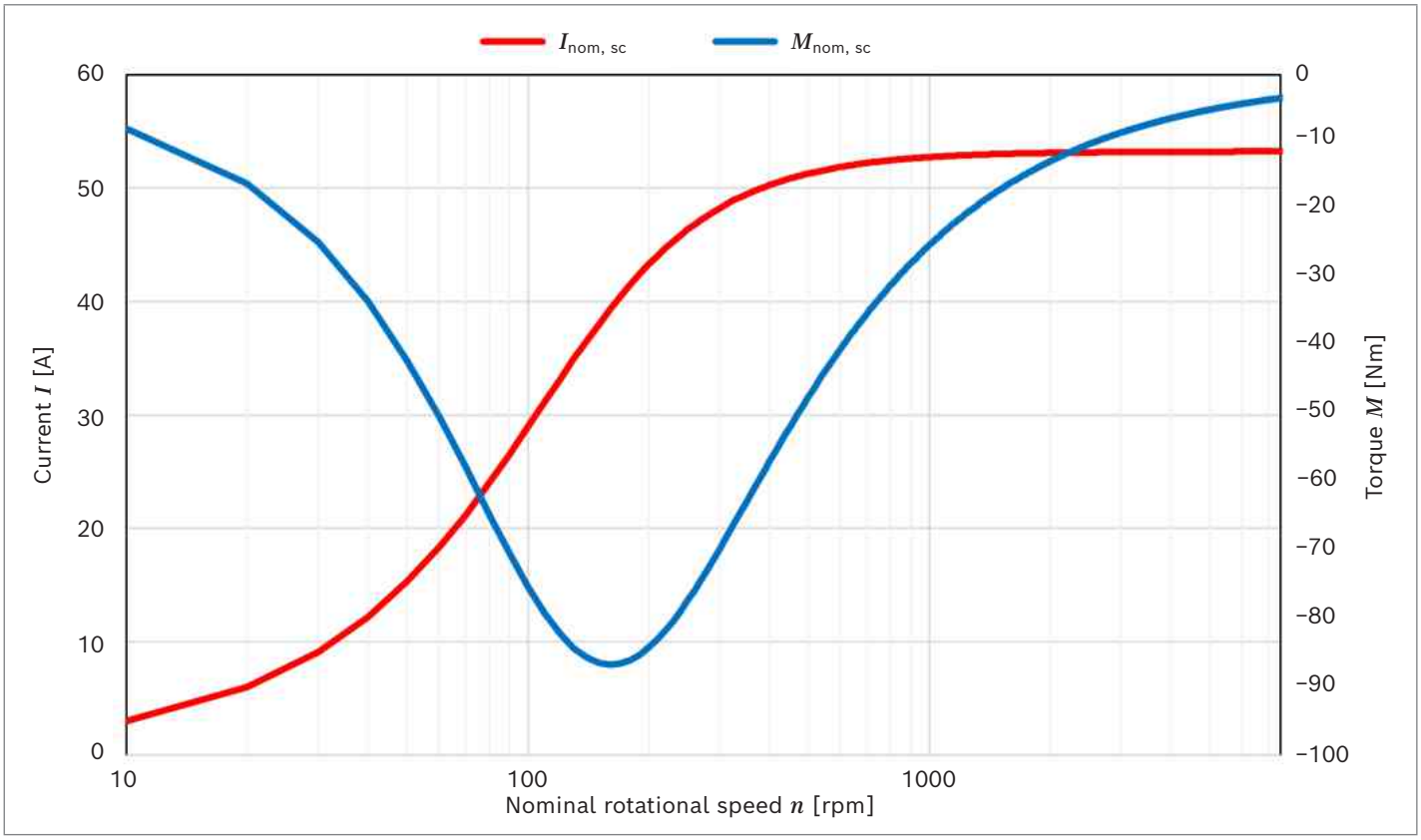
▼ **Torque EMS1-10J20**



▼ **Power EMS1-10J20**



▼ **Short circuit current and short circuit braking torque EMS1-10J20**



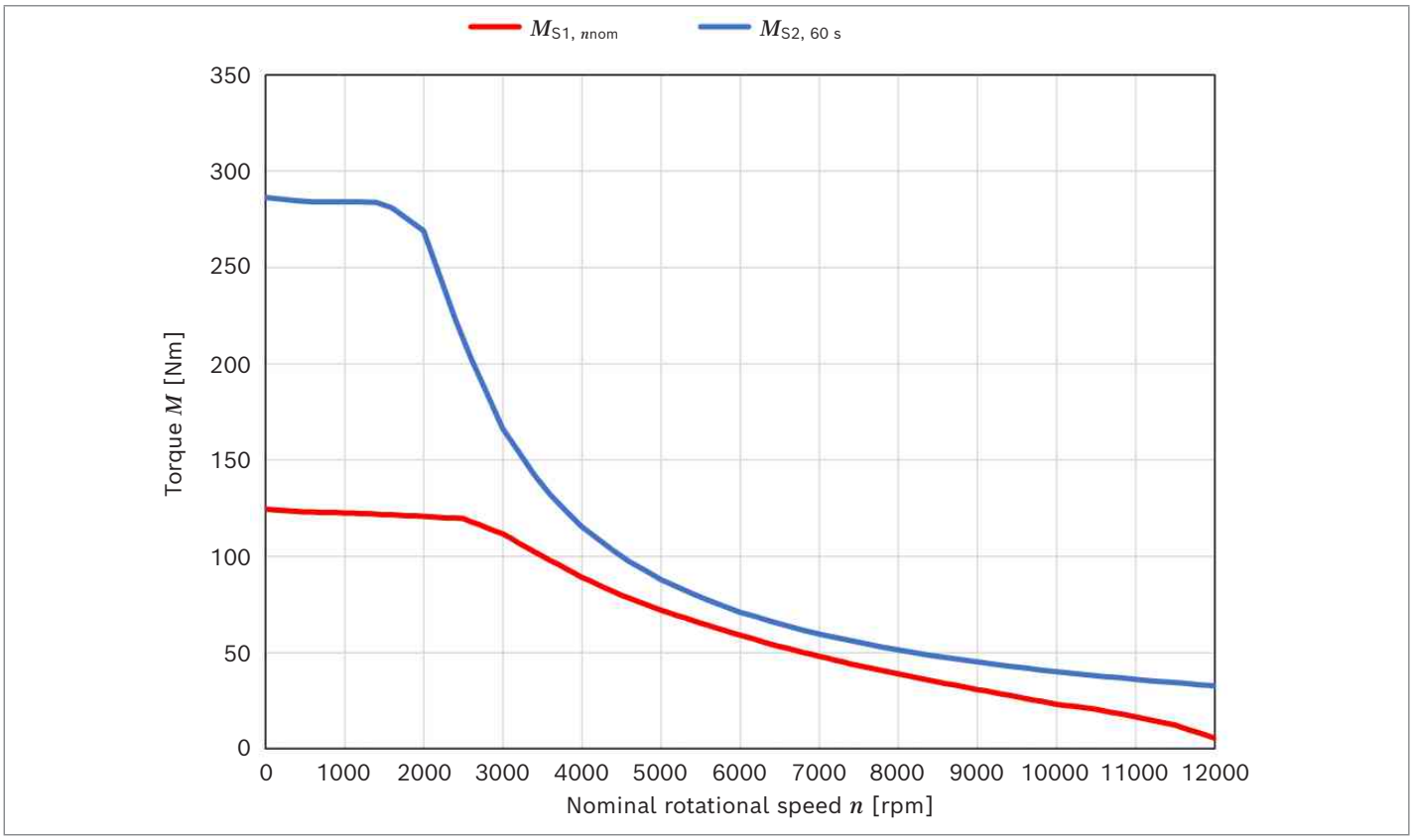
EMS1-10J25

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	124
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	51
Nominal rotational speed	n_{nom}	rpm	2500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	120
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	50
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	31
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	91.88
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	287
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	157
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	56
Maximum rotational speed	n_{max}	rpm	12000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	6
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	36
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	7
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	64.67
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	68
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	50
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	38
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	5280
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	92.76
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	10
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	65
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	87
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	65
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

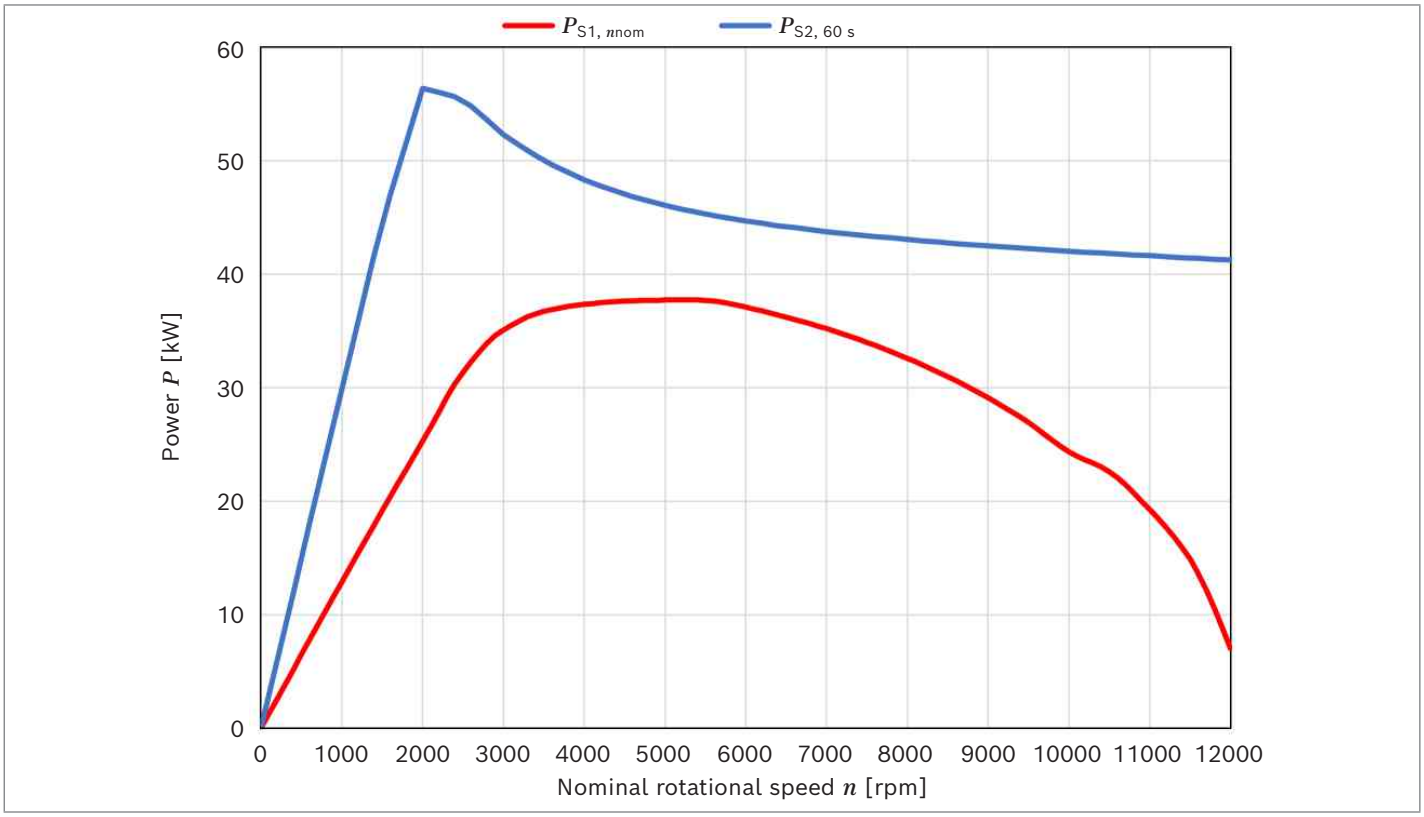
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	130.1
Torque constant at 25 °C	k_T	Nm / A_{RMS}	2.56
Synchronous inductance (d-axis) at rated current	L_d	mH	3.38
Synchronous inductance (q-axis) at rated current	L_q	mH	10.6
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.416
Cogging torque (unskewed)	M_{cog}	Nm	2.4
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	3.82

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

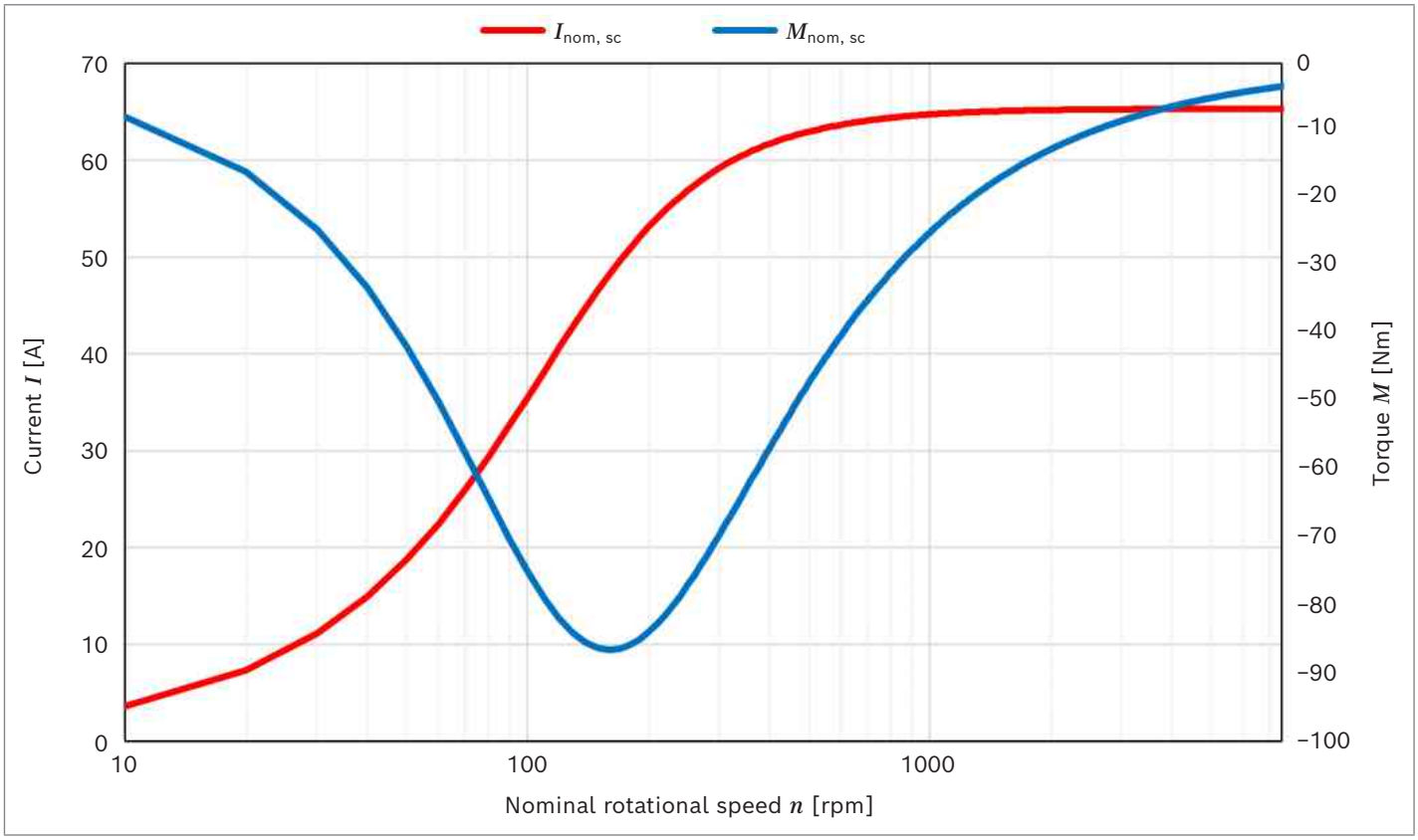
▼ Torque EMS1-10J25



▼ Power EMS1-10J25



▼ **Short circuit current and short circuit braking torque EMS1-10J25**



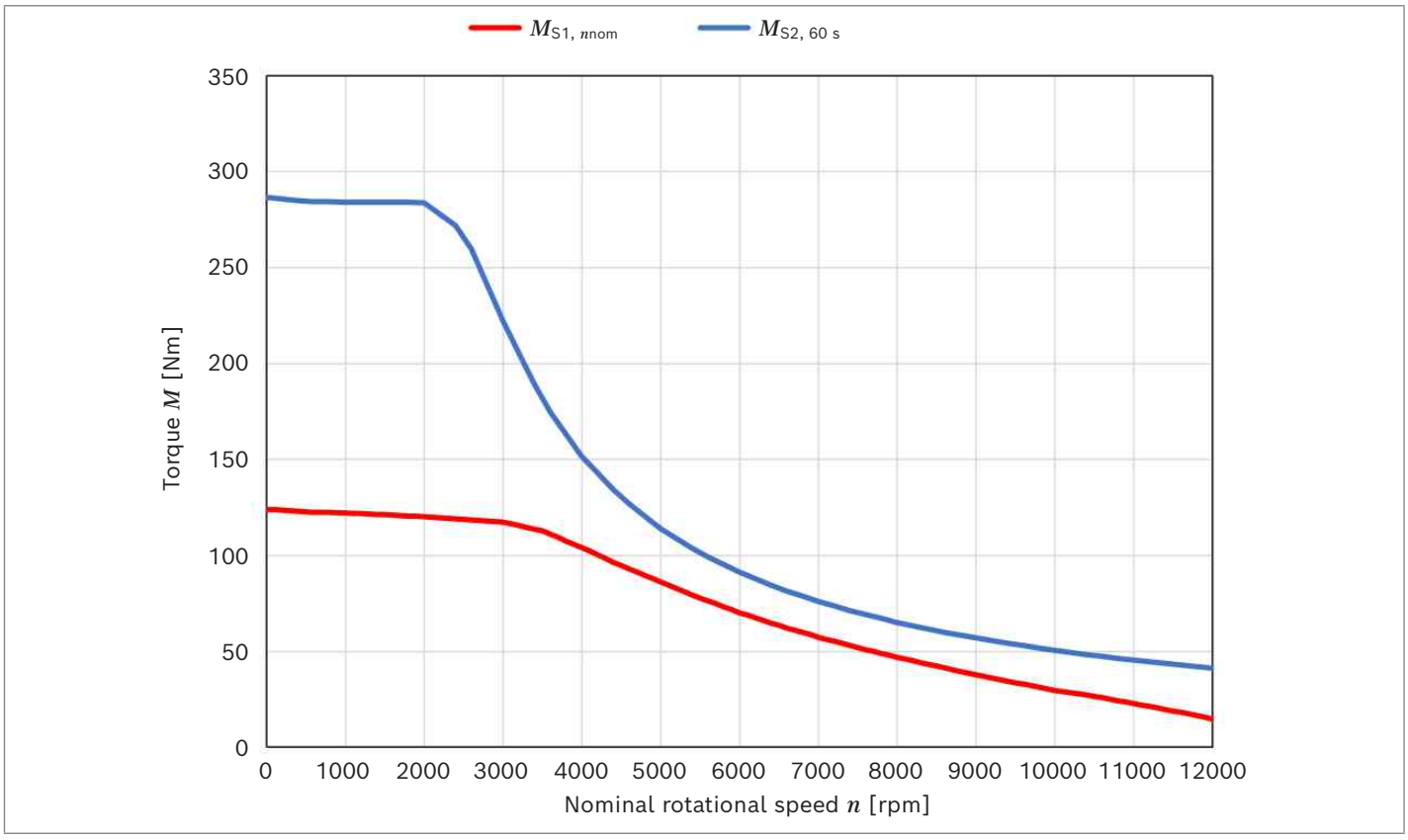
EMS1-10J30

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	123
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	62
Nominal rotational speed	n_{nom}	rpm	3000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	118
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	61
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	37
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	92.83
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	287
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	192
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	70
Maximum rotational speed	n_{max}	rpm	12000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	15
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	42
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	19
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	87.70
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	86
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	60
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	45
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	5040
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	93.87
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	8
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	80
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	87
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	80
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

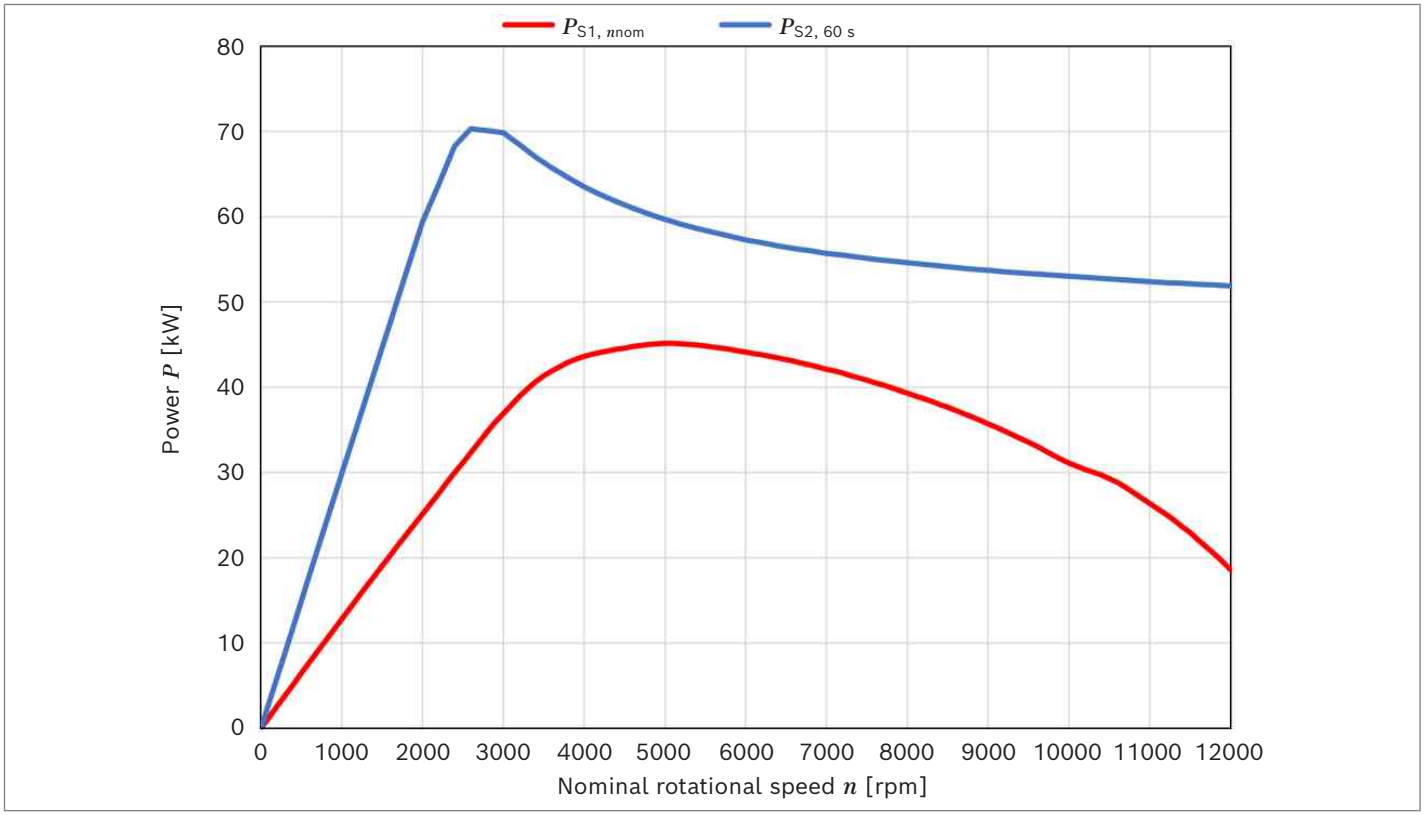
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	106.5
Torque constant at 25 °C	k_T	Nm / A_{RMS}	2.09
Synchronous inductance (d-axis) at rated current	L_d	mH	2.27
Synchronous inductance (q-axis) at rated current	L_q	mH	7.12
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.277
Cogging torque (unskewed)	M_{cog}	Nm	2.4
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	3.85

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

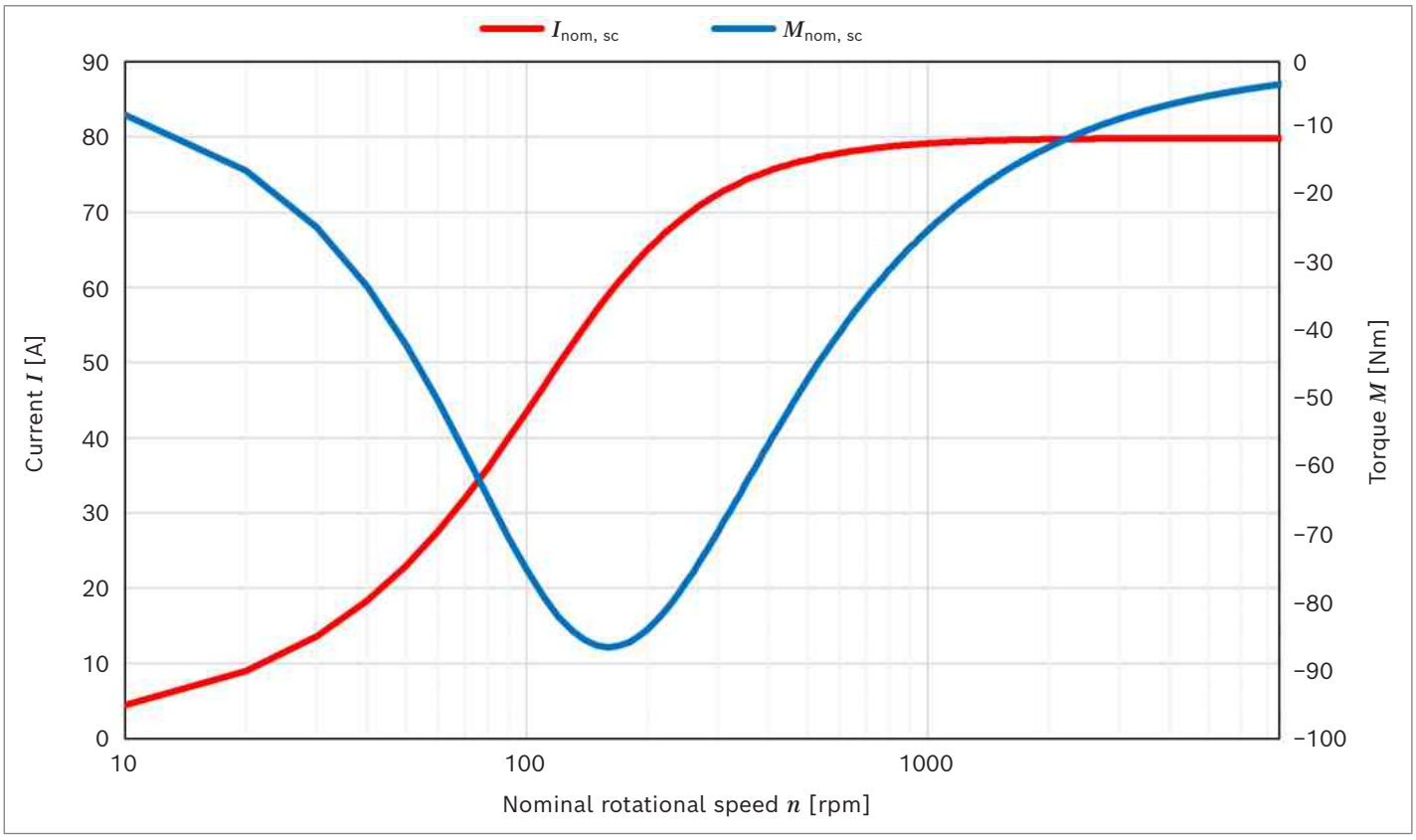
▼ **Torque EMS1-10J30**



▼ **Power EMS1-10J30**



▼ **Short circuit current and short circuit braking torque EMS1-10J30**



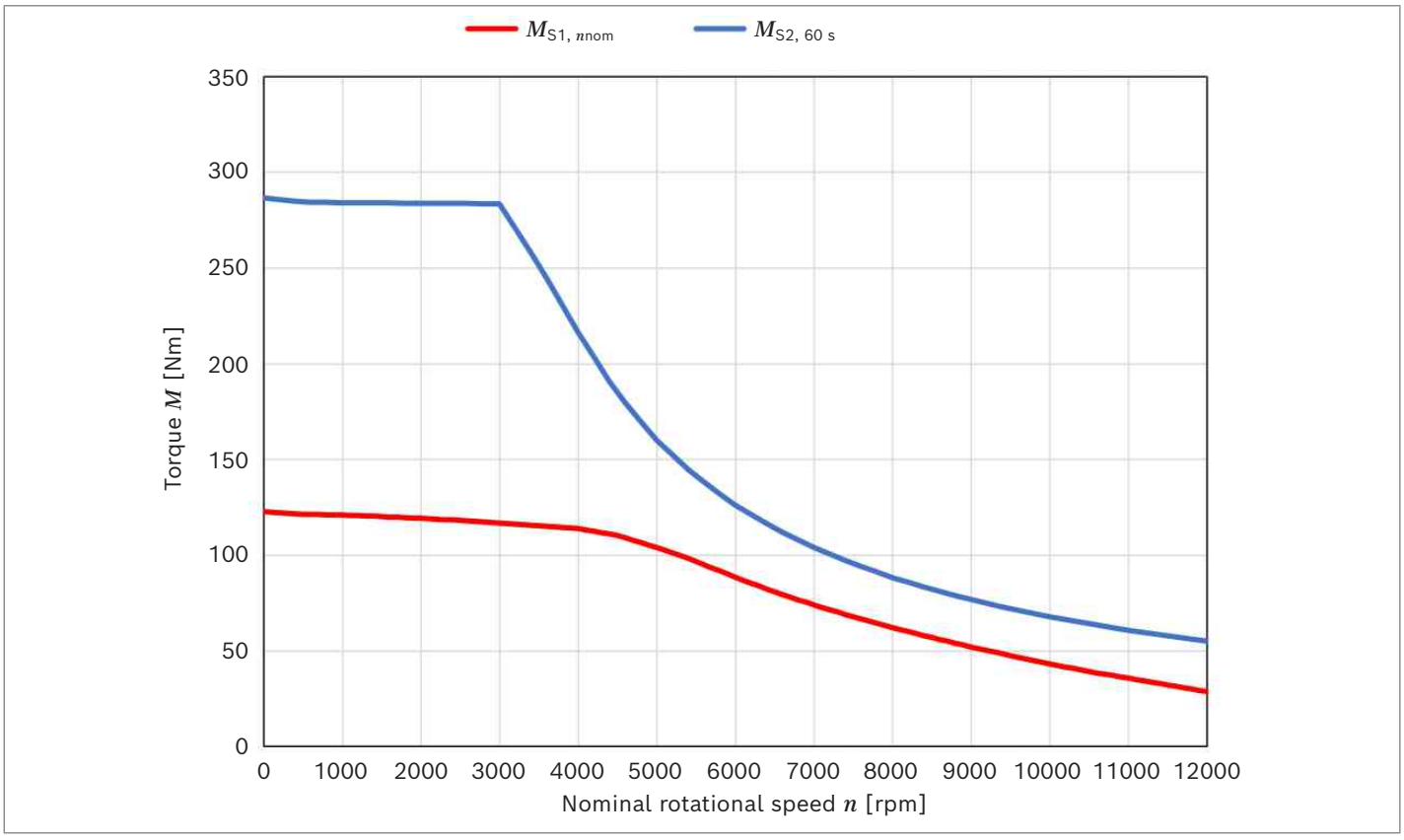
EMS1-10J40

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	122
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	79
Nominal rotational speed	n_{nom}	rpm	4000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	114
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	76
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	48
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	94.03
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	287
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	247
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	92
Maximum rotational speed	n_{max}	rpm	12000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	29
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	54
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	36
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	93.50
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	94
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	74
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	56
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	5640
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	95.00
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	6
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	103
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	87
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	103
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

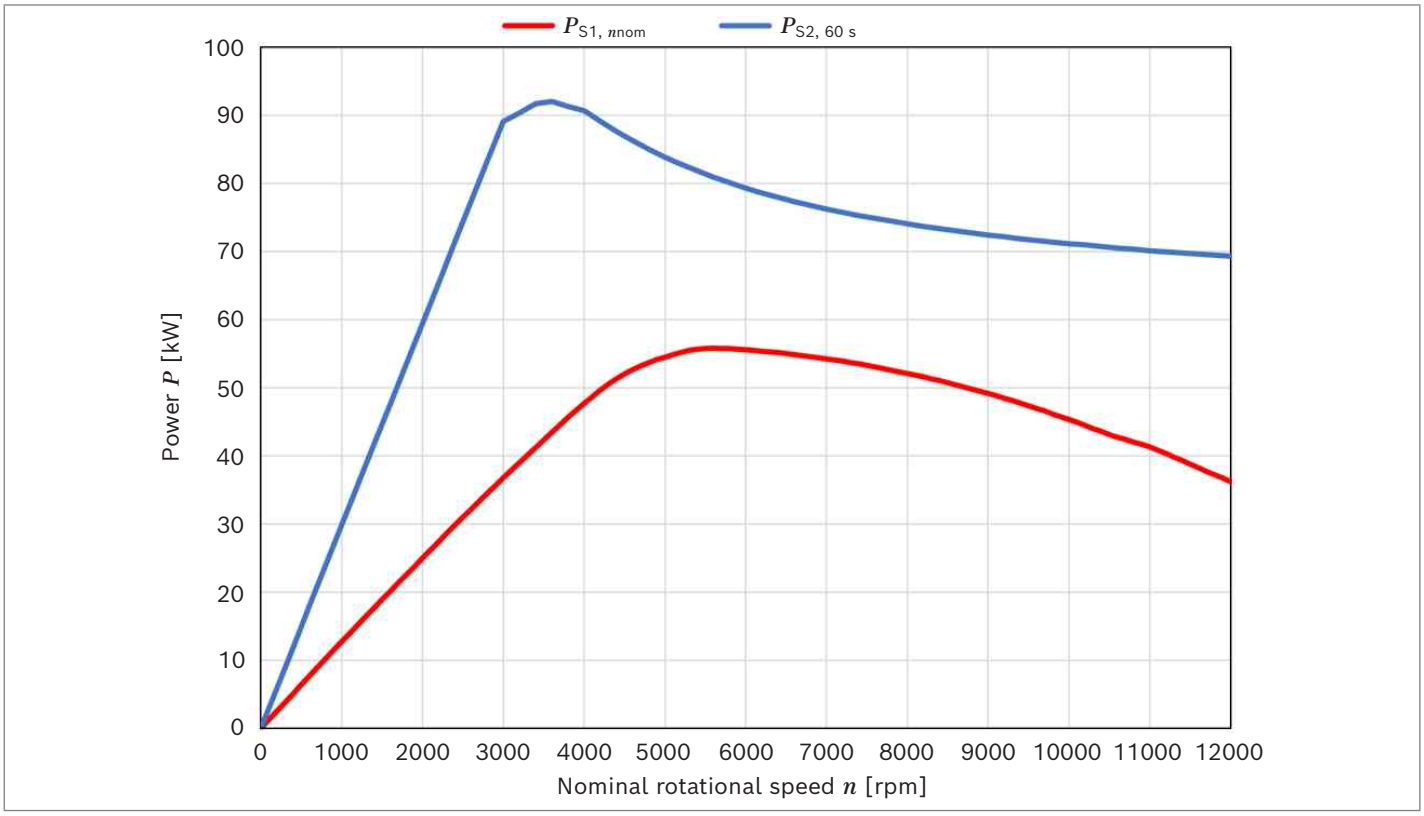
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	82.8
Torque constant at 25 °C	k_T	Nm / A_{RMS}	1.63
Synchronous inductance (d-axis) at rated current	L_d	mH	1.38
Synchronous inductance (q-axis) at rated current	L_q	mH	4.34
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.171
Cogging torque (unskewed)	M_{cog}	Nm	2.4
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	3.6

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

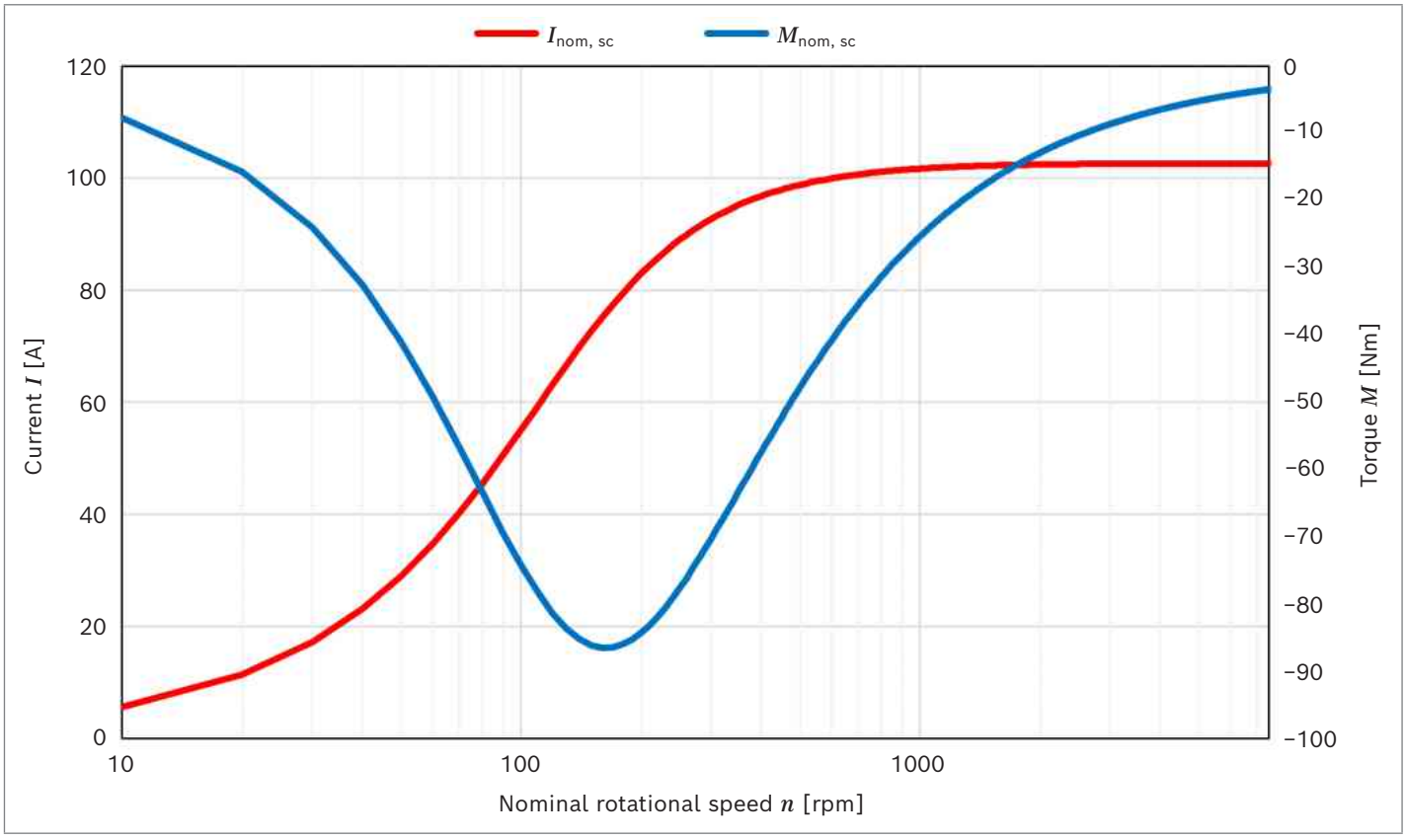
▼ **Torque EMS1-10J40**



▼ **Power EMS1-10J40**



▼ **Short circuit current and short circuit braking torque EMS1-10J40**



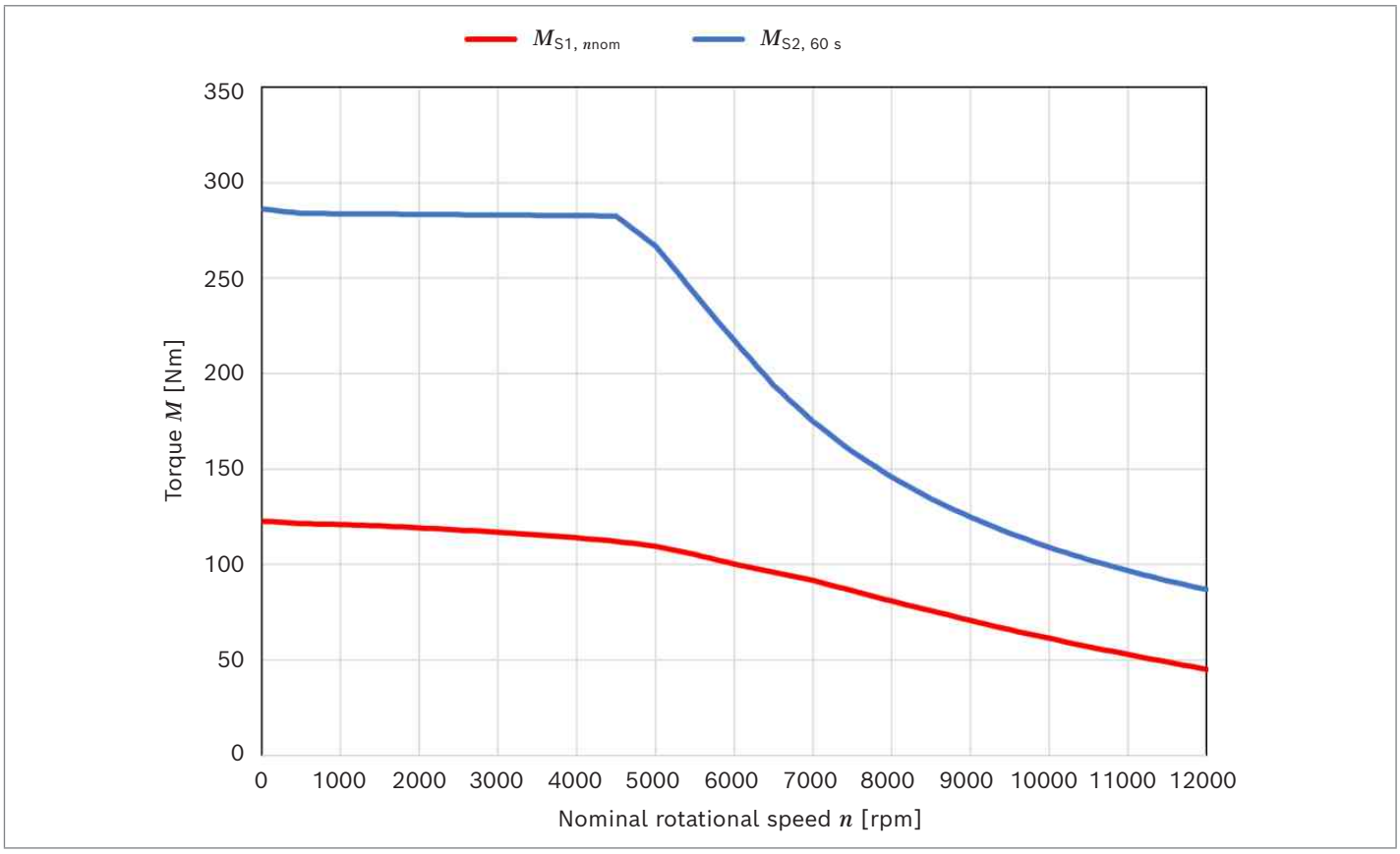
EMS1-10J60

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	122
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	118
Nominal rotational speed	n_{nom}	rpm	6000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	100
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	101
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	63
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	95.34
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	286
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	371
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	140
Maximum rotational speed	n_{max}	rpm	12000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	45
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	74
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	57
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	95.61
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	84
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	92
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	68
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	7680
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	95.92
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	4
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	154
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	87
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	154
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

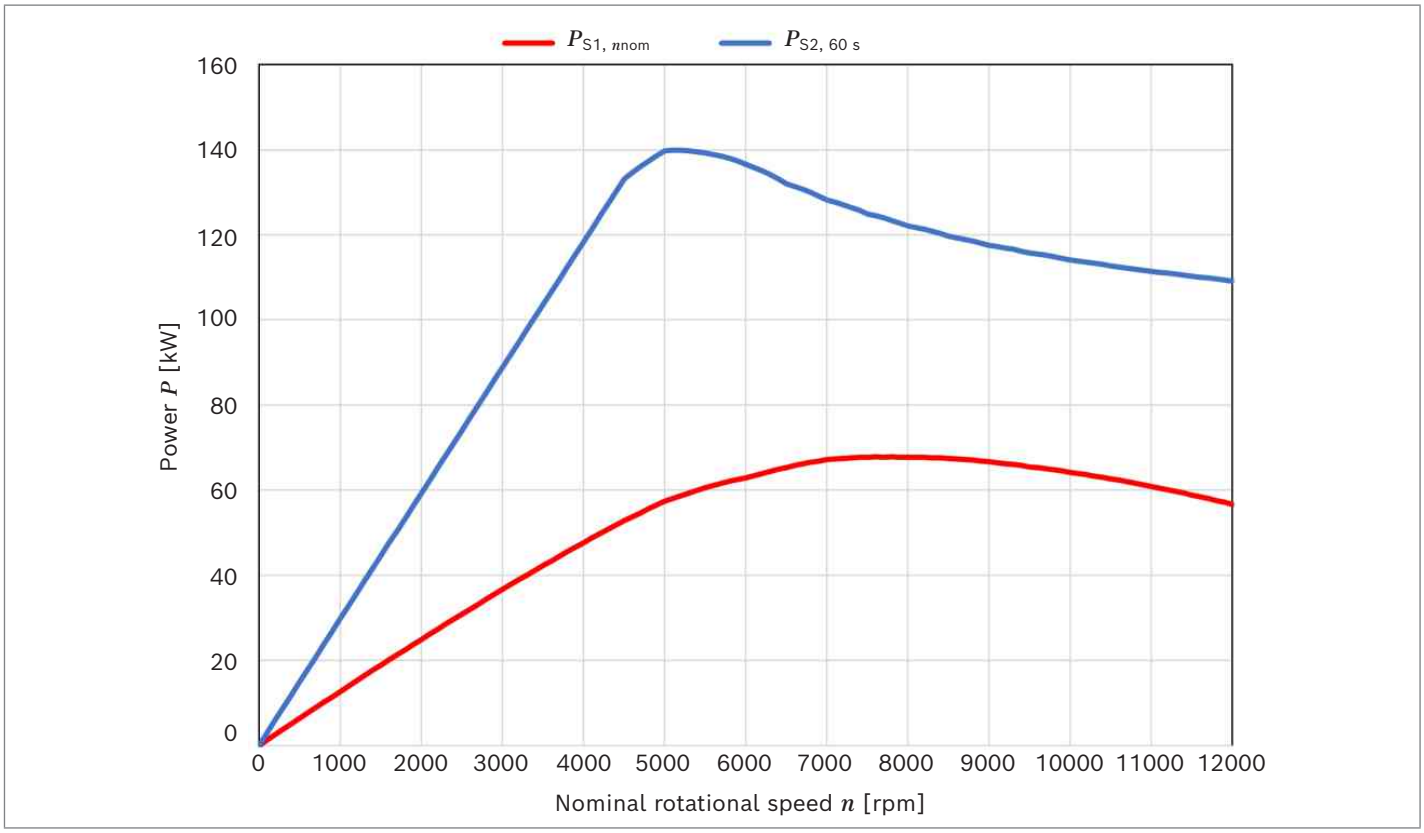
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	55.2
Torque constant at 25 °C	k_T	Nm / A_{RMS}	1.08
Synchronous inductance (d-axis) at rated current	L_d	mH	0.61
Synchronous inductance (q-axis) at rated current	L_q	mH	2
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.076
Cogging torque (unskewed)	M_{cog}	Nm	2.4
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	3.18

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

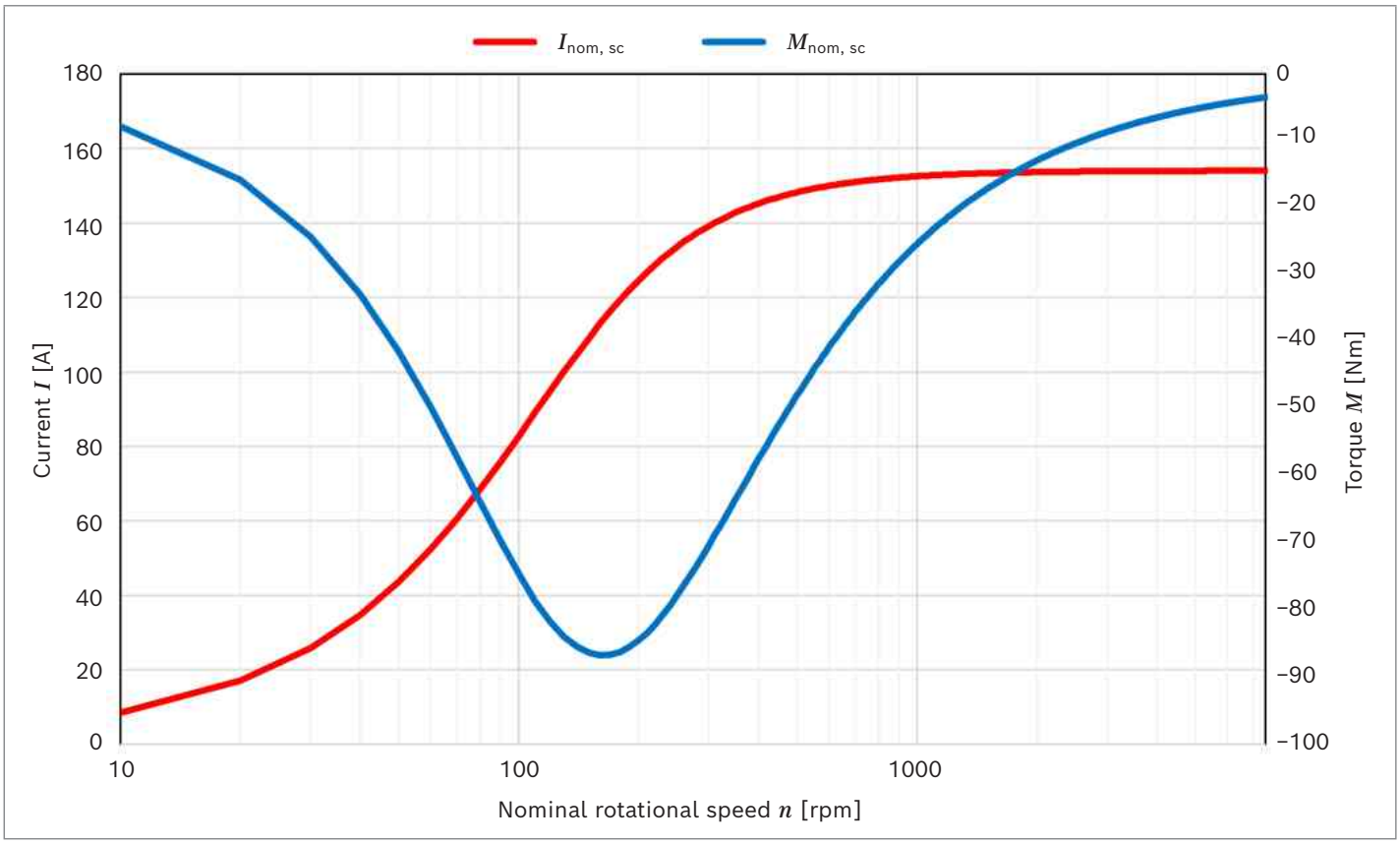
▼ **Torque EMS1-10J60**



▼ **Power EMS1-10J60**



▼ **Short circuit current and short circuit braking torque EMS1-10J60**



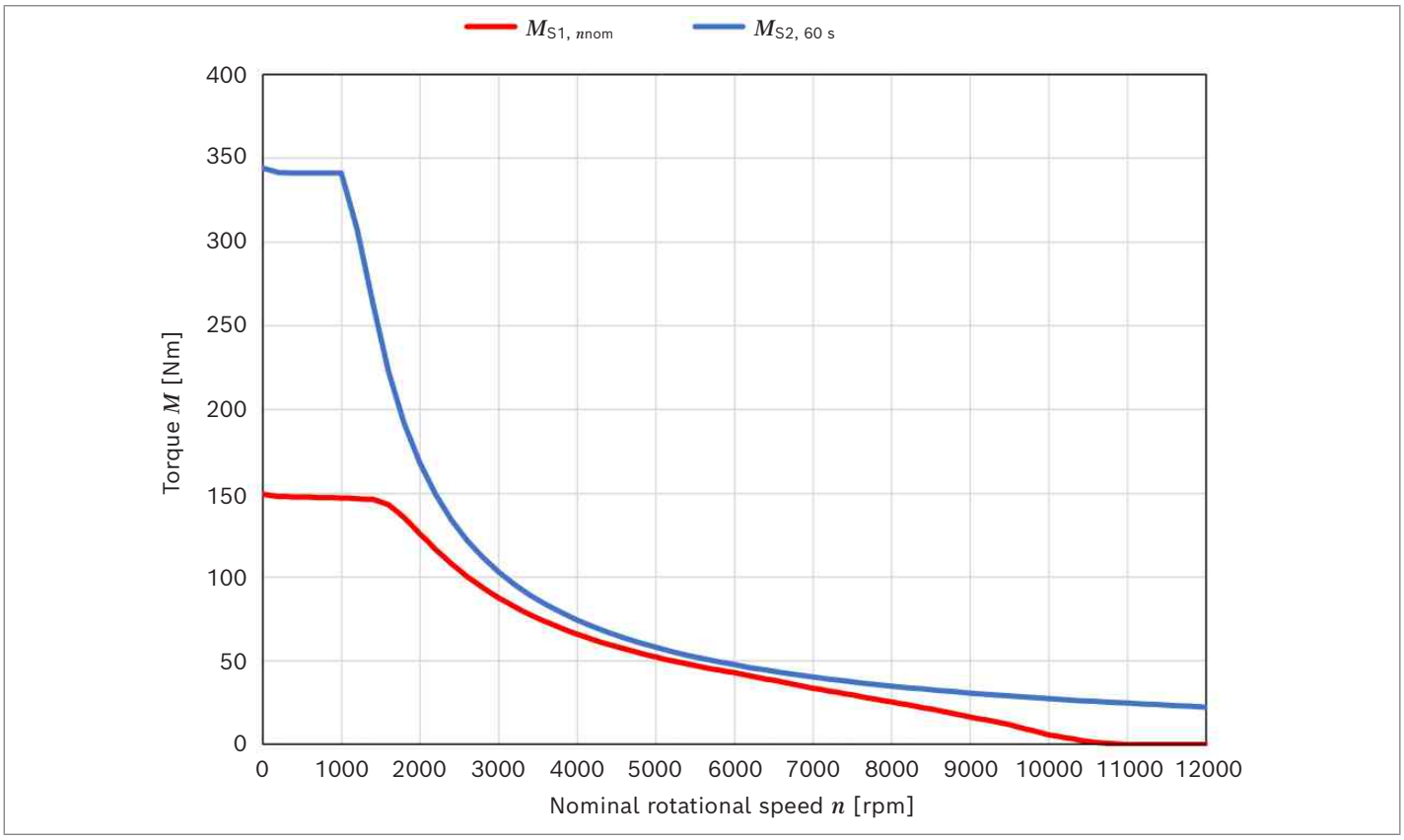
EMS1-10L15

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	148
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	37
Nominal rotational speed	n_{nom}	rpm	1500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	145
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	37
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	23
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	88.46
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	344
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	115
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	39
Maximum rotational speed	n_{max}	rpm	12000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	0
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	0
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	0
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	0.00
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	71
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	37
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	28
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	3720
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	89.82
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	19
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	48
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	104
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	48
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

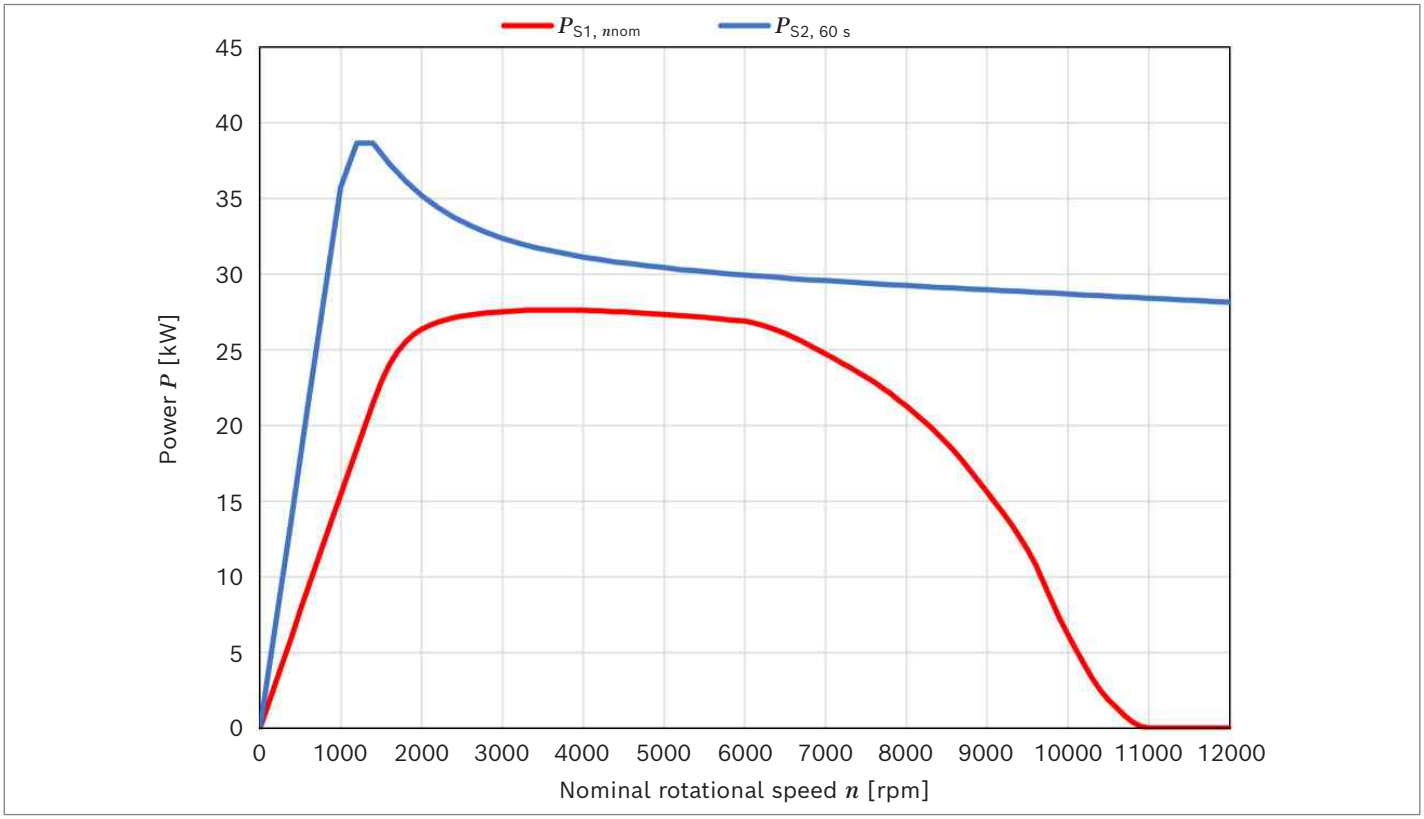
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	212.96
Torque constant at 25 °C	k_T	Nm / A_{RMS}	4.19
Synchronous inductance (d-axis) at rated current	L_d	mH	7.51
Synchronous inductance (q-axis) at rated current	L_q	mH	18.11
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.8893
Cogging torque (unskewed)	M_{cog}	Nm	2.88
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	4.65

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

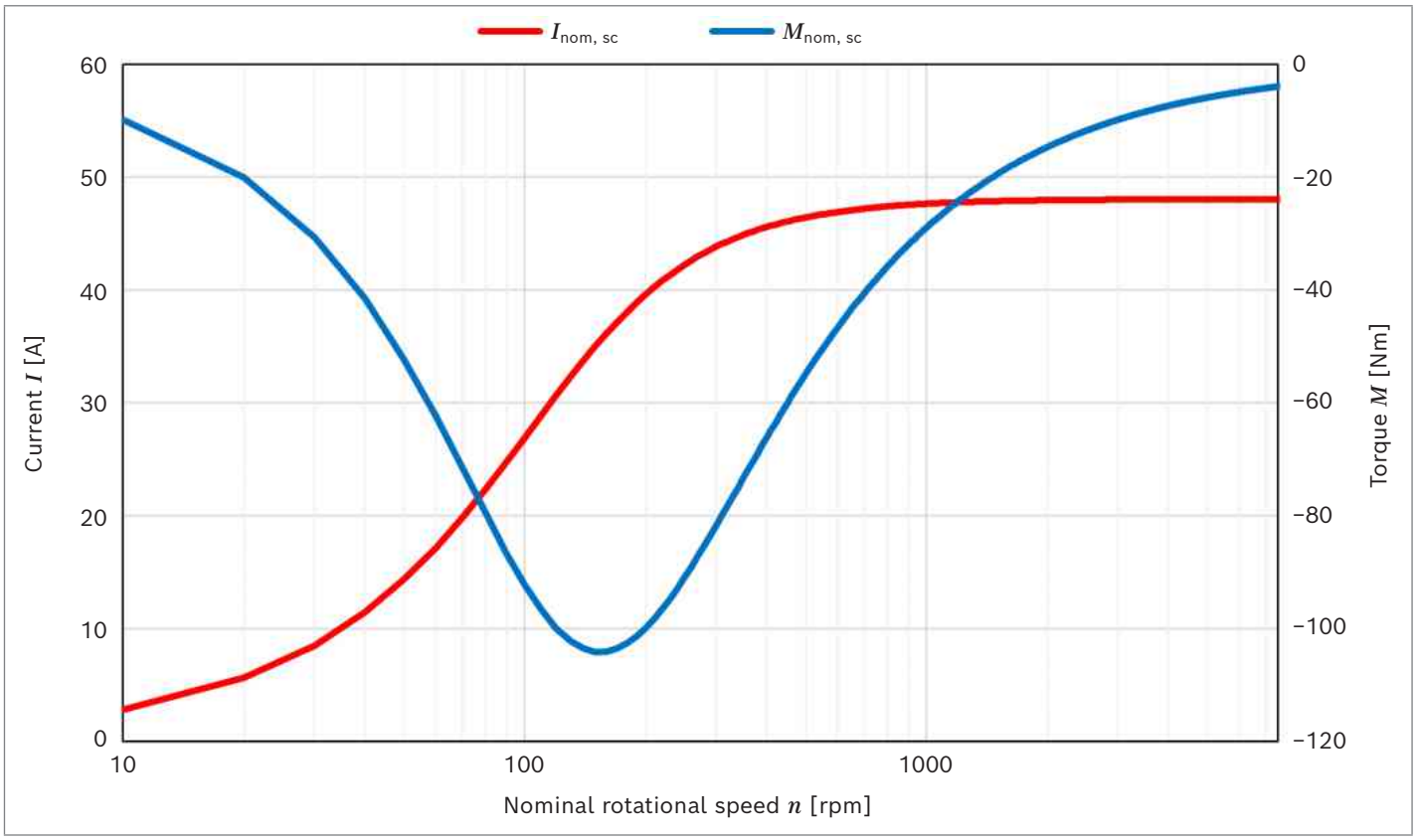
▼ Torque EMS1-10L15



▼ Power EMS1-10L15



▼ **Short circuit current and short circuit braking torque EMS1-10L15**



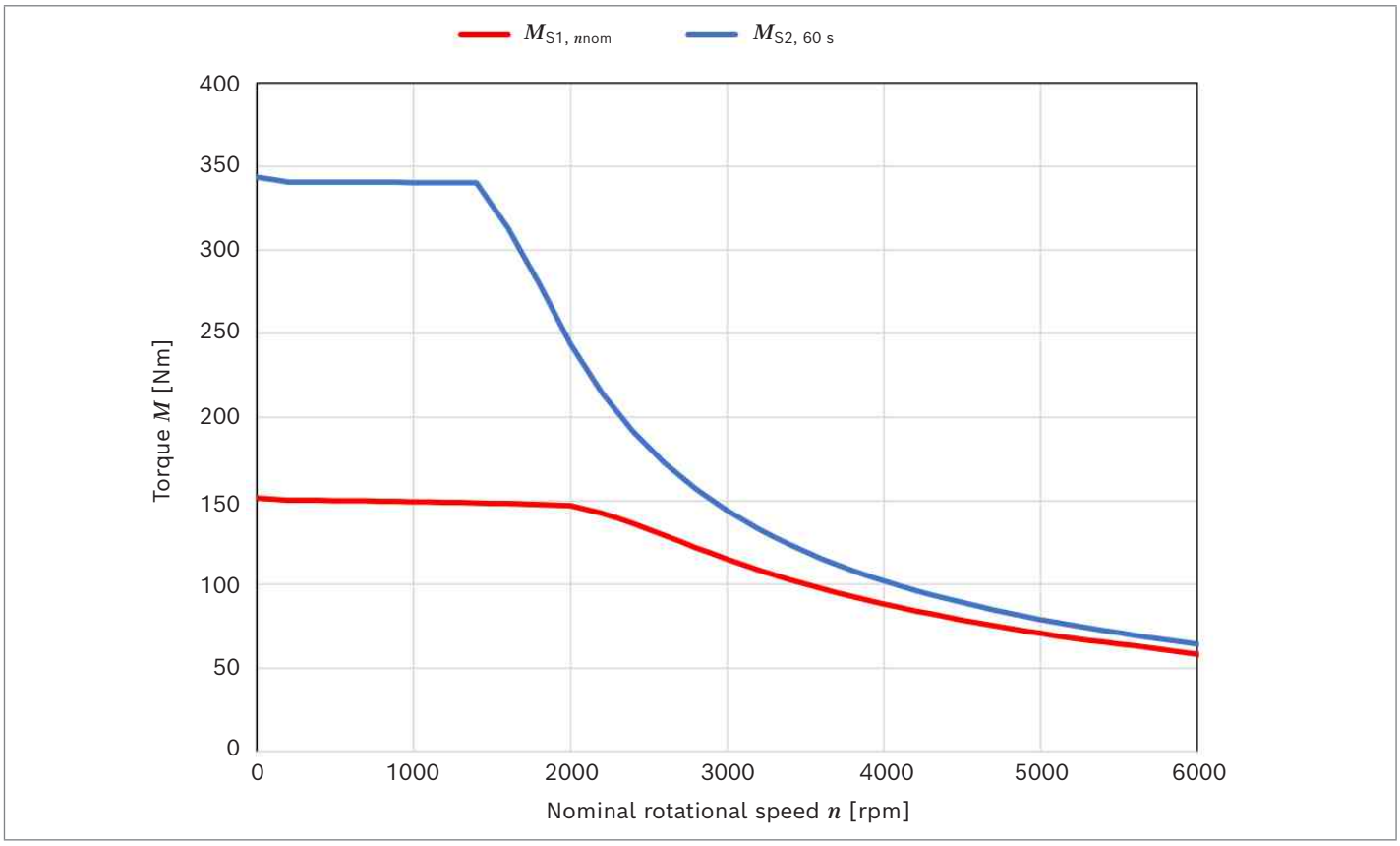
EMS1-10L20

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	150
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	49
Nominal rotational speed	n_{nom}	rpm	2000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	147
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	49
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	31
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	90.89
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	343
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	151
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	53
Maximum rotational speed	n_{max}	rpm	6000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	2
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	37
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	2
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	18.96
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	63
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	49
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	37
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	5580
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	91.90
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	14
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	63
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	104
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	63
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

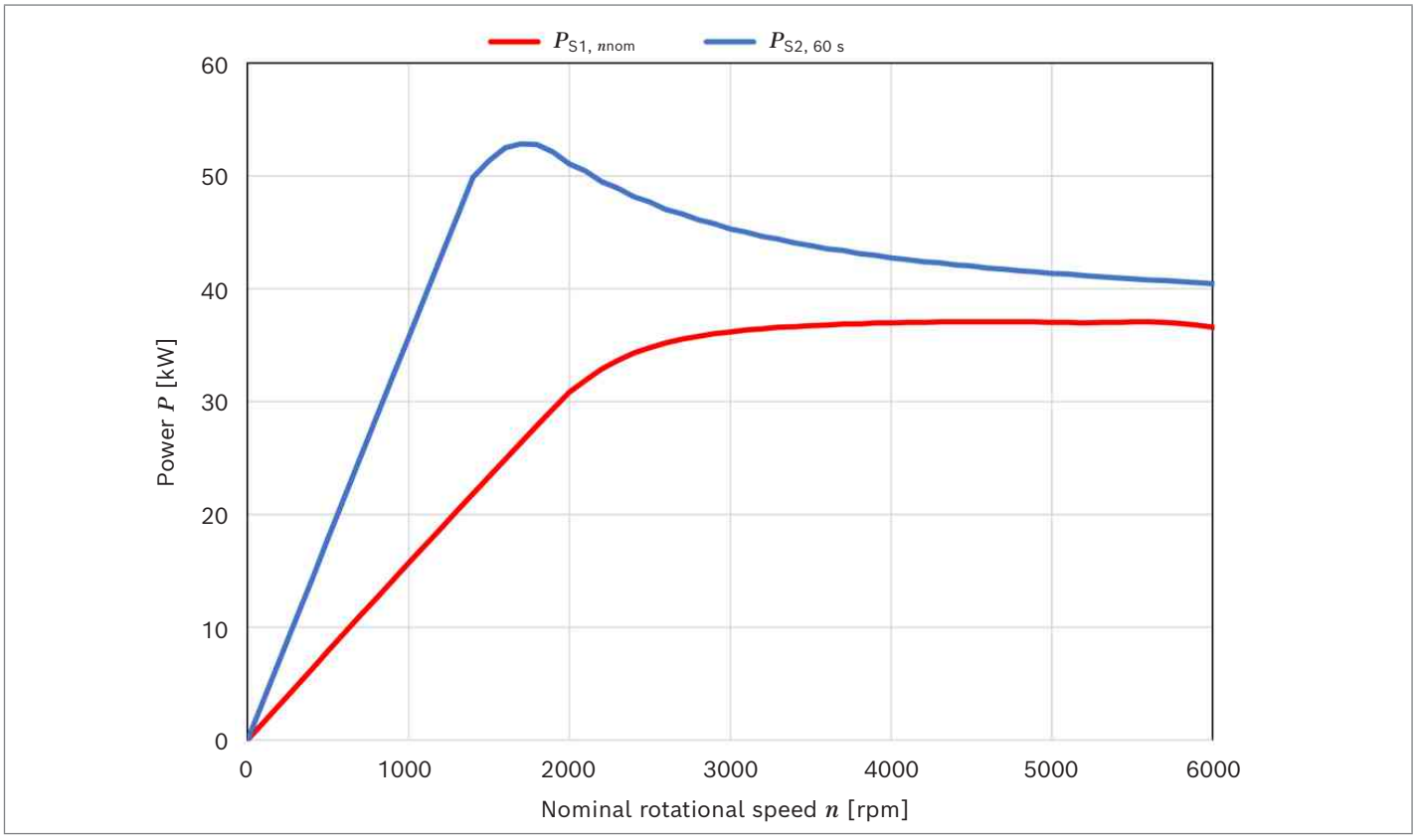
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	163.27
Torque constant at 25 °C	k_T	Nm / A_{RMS}	3.21
Synchronous inductance (d-axis) at rated current	L_d	mH	4.98
Synchronous inductance (q-axis) at rated current	L_q	mH	12.92
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.5114
Cogging torque (unskewed)	M_{cog}	Nm	2.88
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	4.86

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

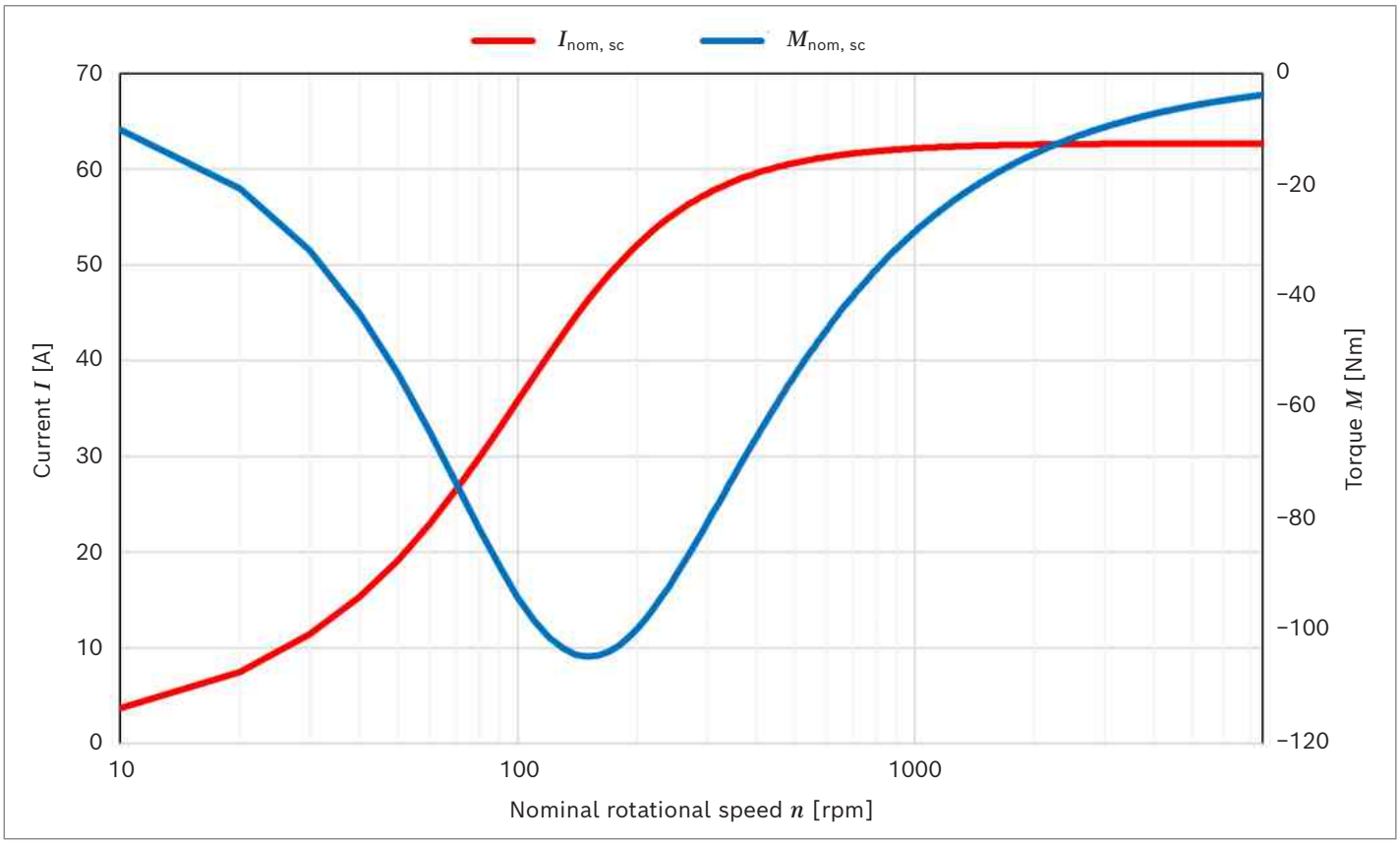
▼ **Torque EMS1-10L20**



▼ **Power EMS1-10L20**



▼ **Short circuit current and short circuit braking torque EMS1-10L20**



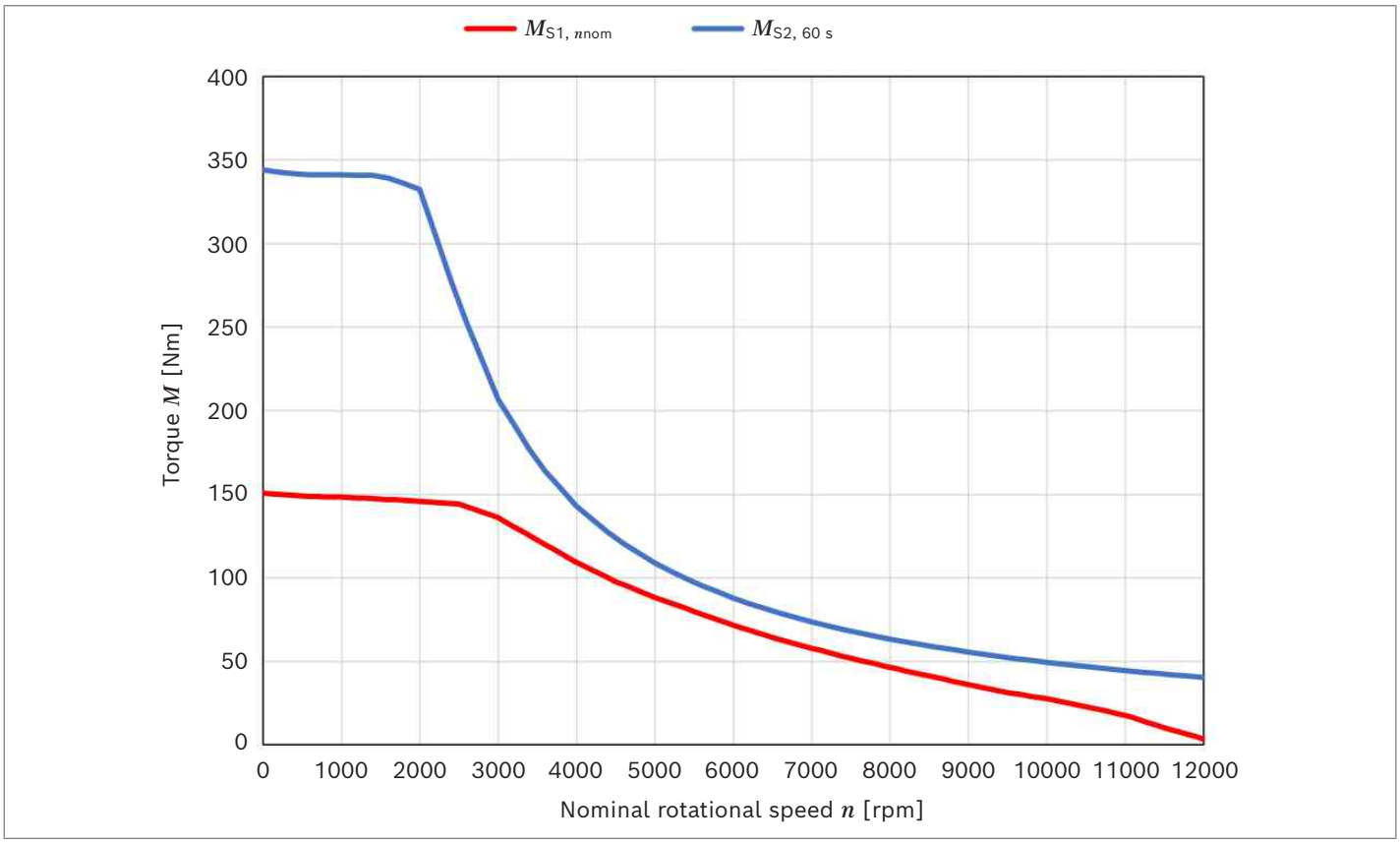
EMS1-10L25

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	150
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	63
Nominal rotational speed	n_{nom}	rpm	2500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	144
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	62
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	38
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	92.19
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	344
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	192
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	70
Maximum rotational speed	n_{max}	rpm	12000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	4
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	42
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	5
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	21.57
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	92
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	61
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	46
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	4800
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	93.18
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	12
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	80
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	104
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	80
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

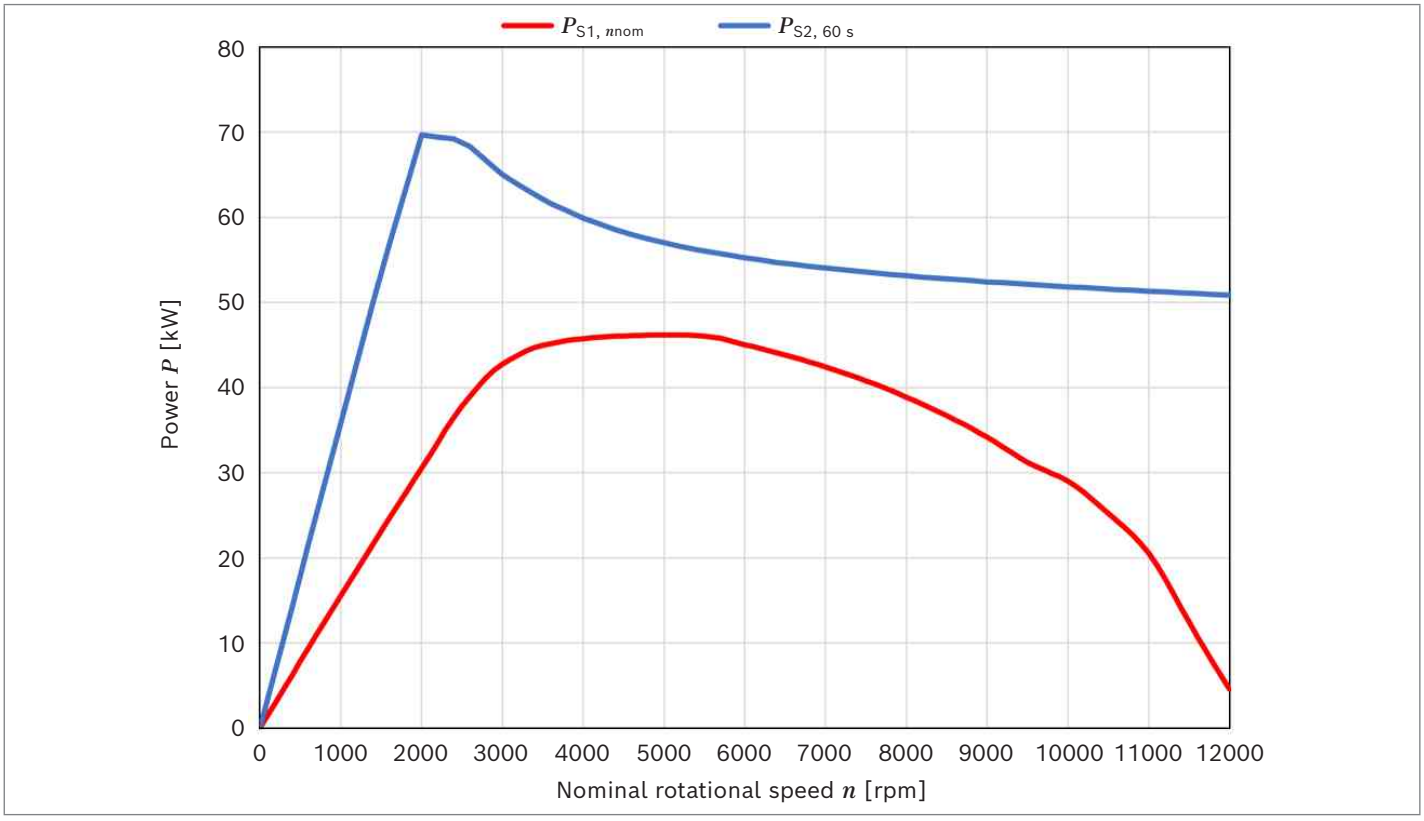
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	127.8
Torque constant at 25 °C	k_T	Nm / A_{RMS}	2.51
Synchronous inductance (d-axis) at rated current	L_d	mH	2.71
Synchronous inductance (q-axis) at rated current	L_q	mH	8.48
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.3161
Cogging torque (unskewed)	M_{cog}	Nm	2.88
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	4.54

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

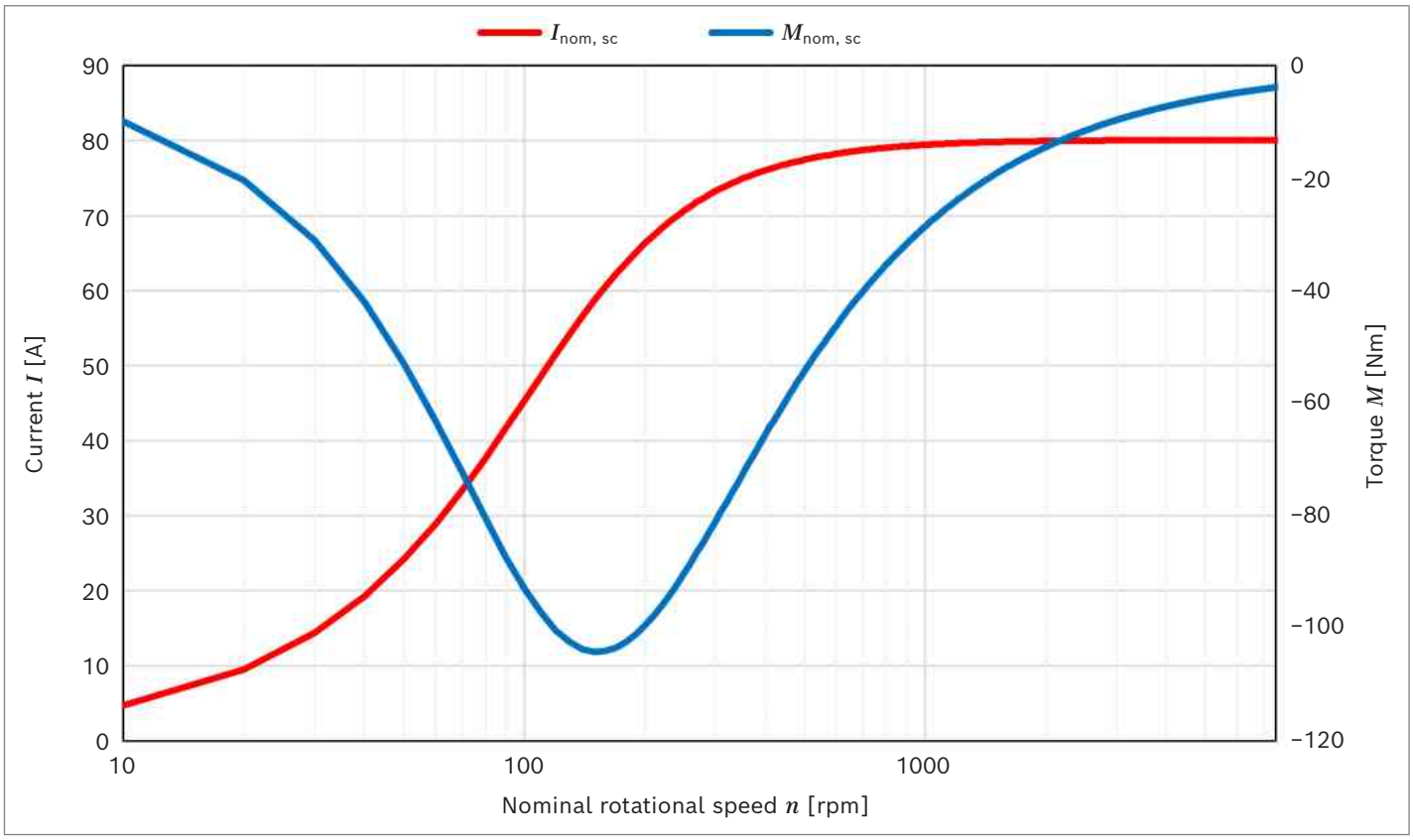
▼ Torque EMS1-10L25



▼ Power EMS1-10L25



▼ **Short circuit current and short circuit braking torque EMS1-10L25**



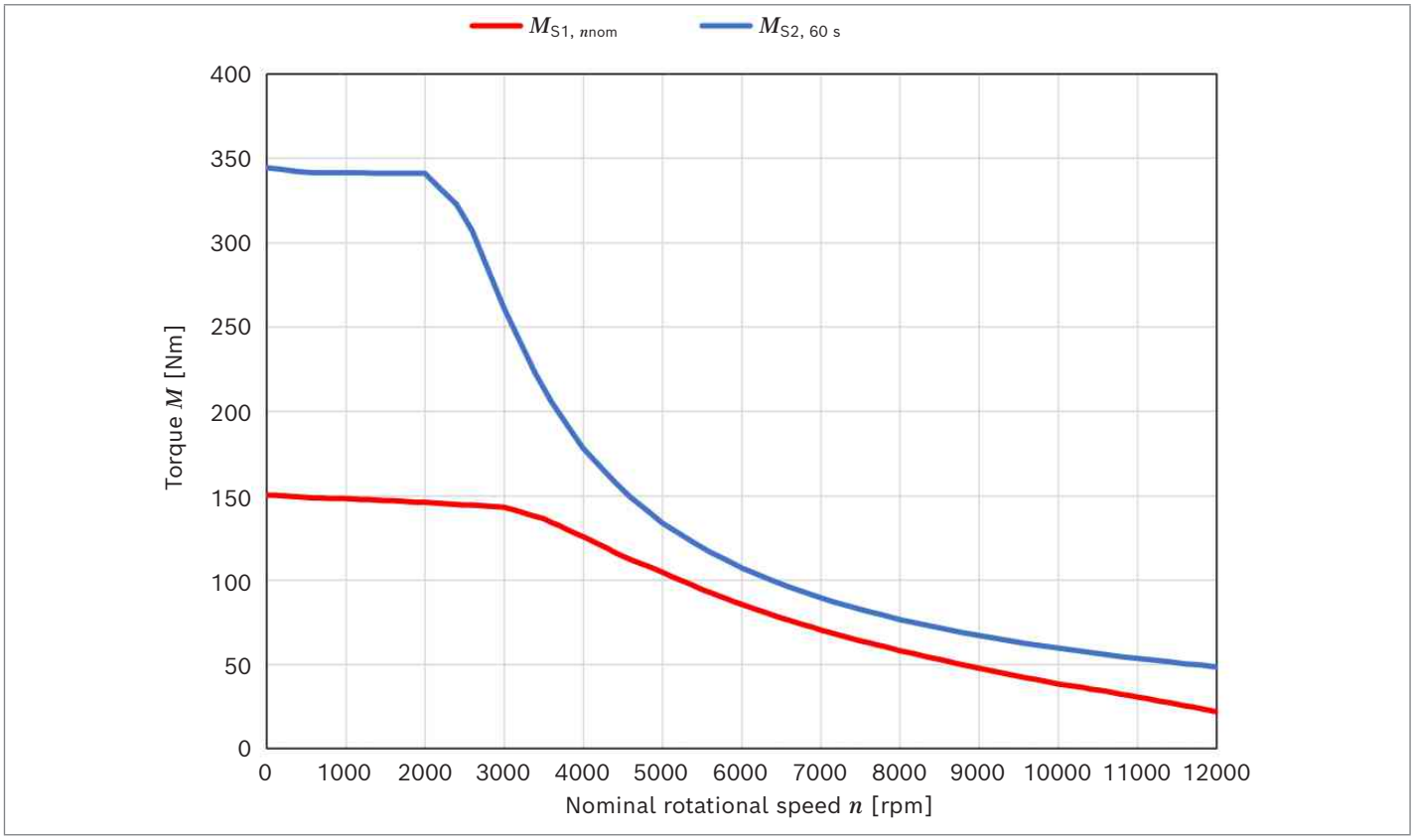
EMS1-10L30

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	150
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	74
Nominal rotational speed	n_{nom}	rpm	3000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	143
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	72
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	45
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	93.20
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	344
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	226
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	83
Maximum rotational speed	n_{max}	rpm	12000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	22
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	52
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	28
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	90.80
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	104
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	72
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	55
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	5040
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	94.35
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	10
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	94
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	104
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	94
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

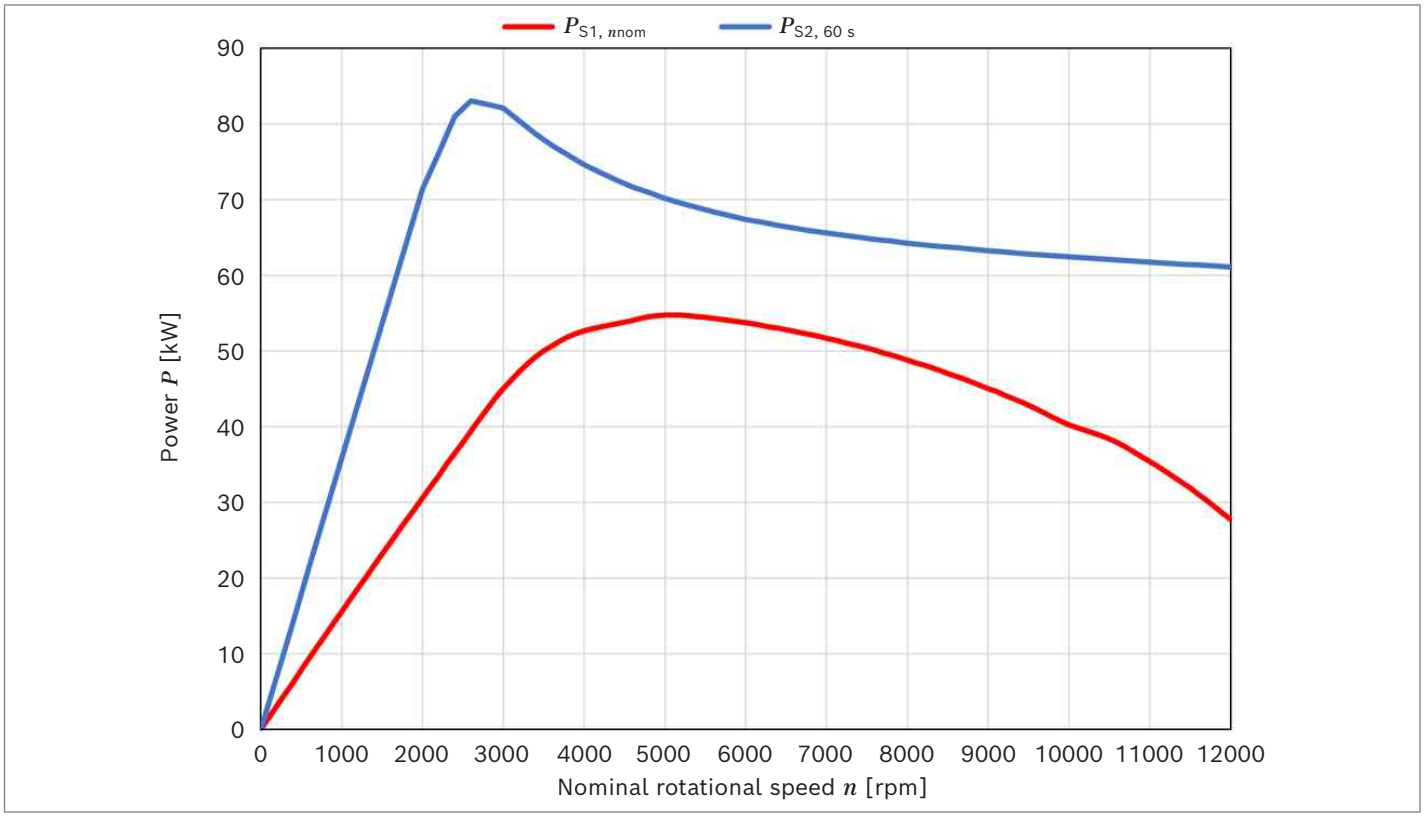
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	108.9
Torque constant at 25 °C	k_T	Nm / A_{RMS}	2.14
Synchronous inductance (d-axis) at rated current	L_d	mH	1.96
Synchronous inductance (q-axis) at rated current	L_q	mH	6.16
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.223
Cogging torque (unskewed)	M_{cog}	Nm	2.88
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	4.59

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

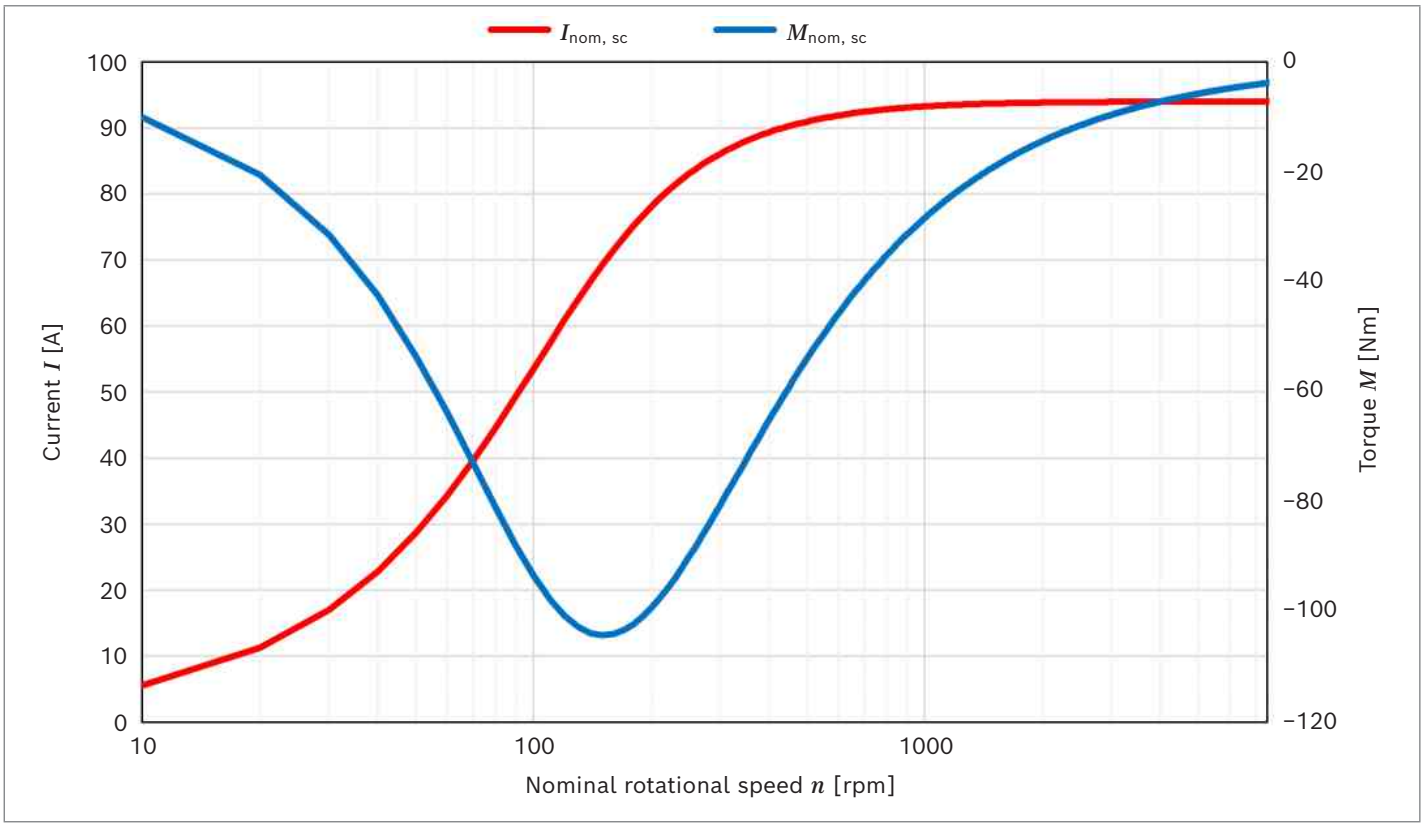
▼ **Torque EMS1-10L30**



▼ **Power EMS1-10L30**



▼ **Short circuit current and short circuit braking torque EMS1-10L30**



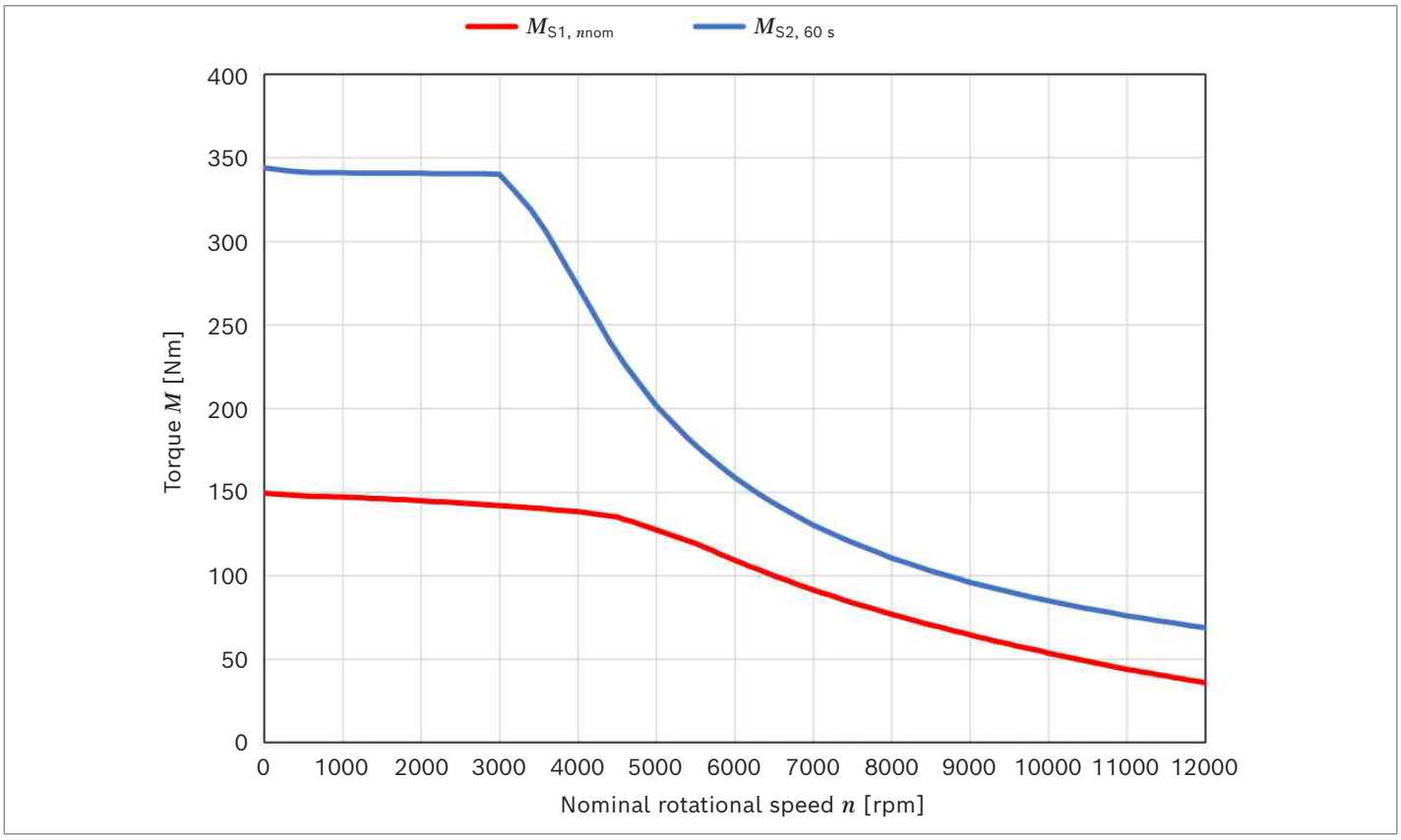
EMS1-10L40

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	149
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	99
Nominal rotational speed	n_{nom}	rpm	4000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	138
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	95
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	58
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	94.27
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	344
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	306
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	115
Maximum rotational speed	n_{max}	rpm	12000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	36
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	67
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	45
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	94.04
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	117
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	92
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	69
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	5640
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	95.30
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	7
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	127
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	104
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	127
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

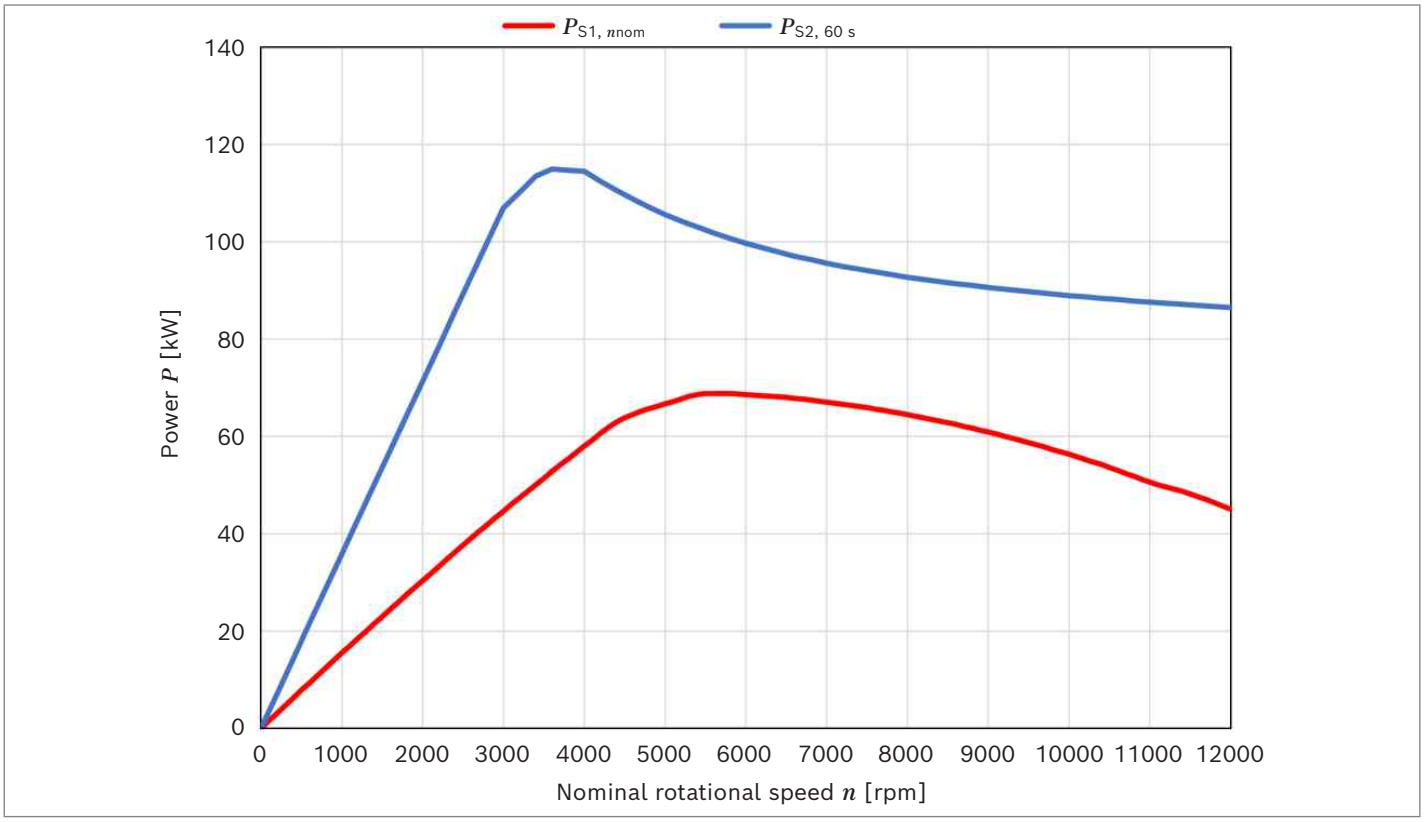
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	80.5
Torque constant at 25 °C	k_T	Nm / A_{RMS}	1.58
Synchronous inductance (d-axis) at rated current	L_d	mH	1.08
Synchronous inductance (q-axis) at rated current	L_q	mH	3.39
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.119
Cogging torque (unskewed)	M_{cog}	Nm	2.88
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	4.41

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

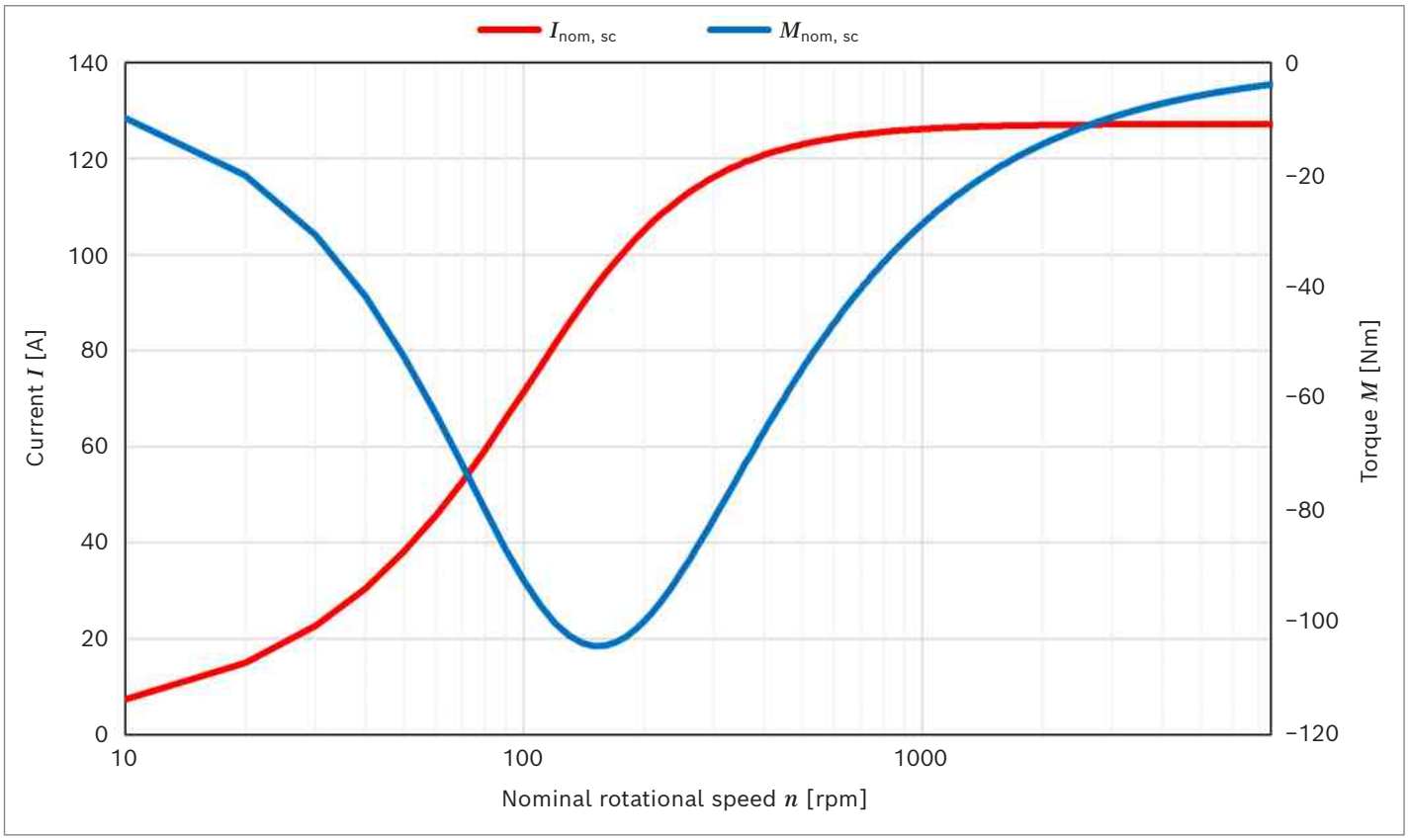
▼ Torque EMS1-10L40



▼ Power EMS1-10L40



▼ **Short circuit current and short circuit braking torque EMS1-10L40**



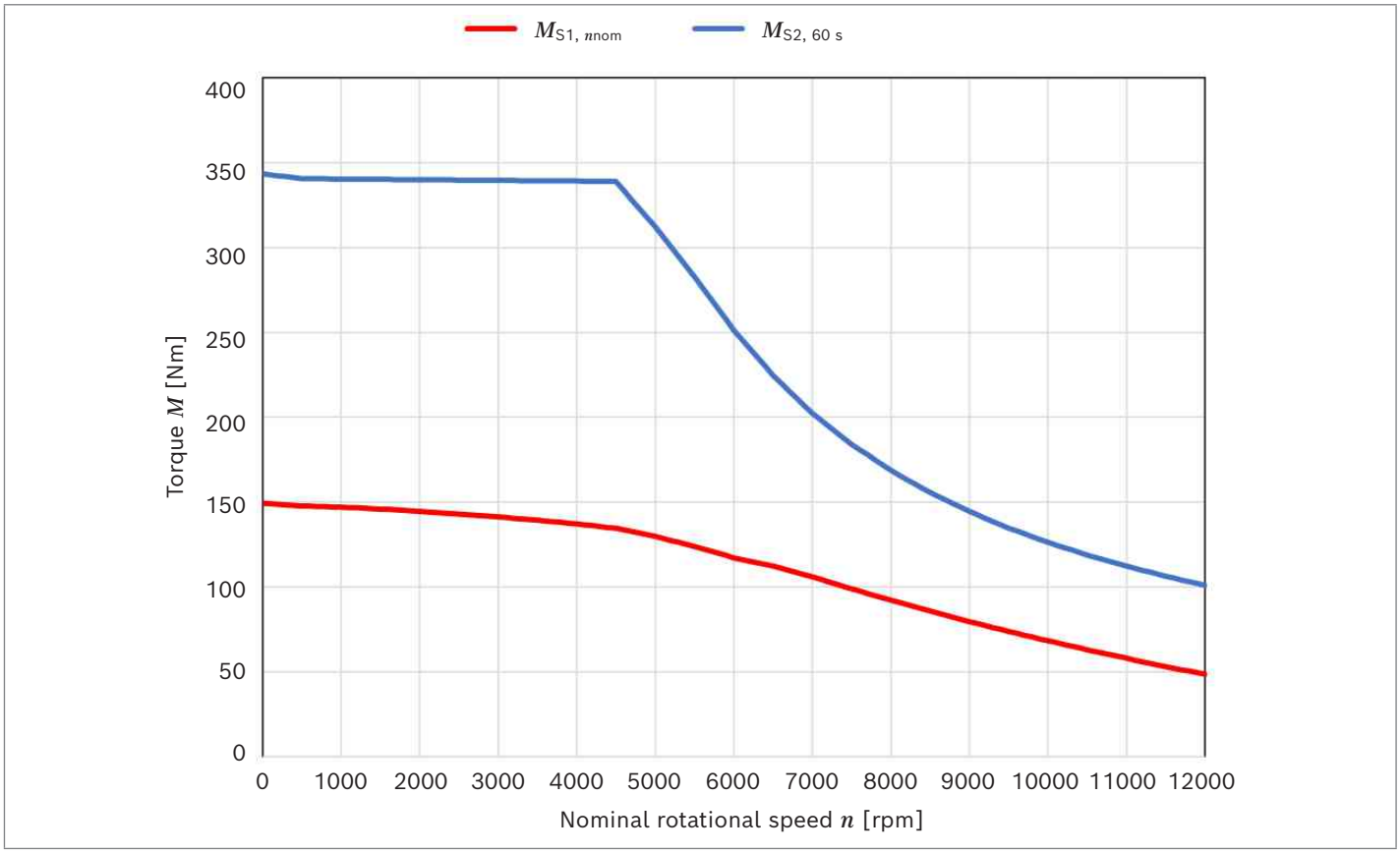
EMS1-10L60

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	149
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	140
Nominal rotational speed	n_{nom}	rpm	6000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	117
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	116
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	74
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	95.40
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	343
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	433
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	164
Maximum rotational speed	n_{max}	rpm	12000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	49
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	81
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	61
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	95.28
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	103
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	107
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	78
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	7200
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	95.84
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	5
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	180
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	104
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	180
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

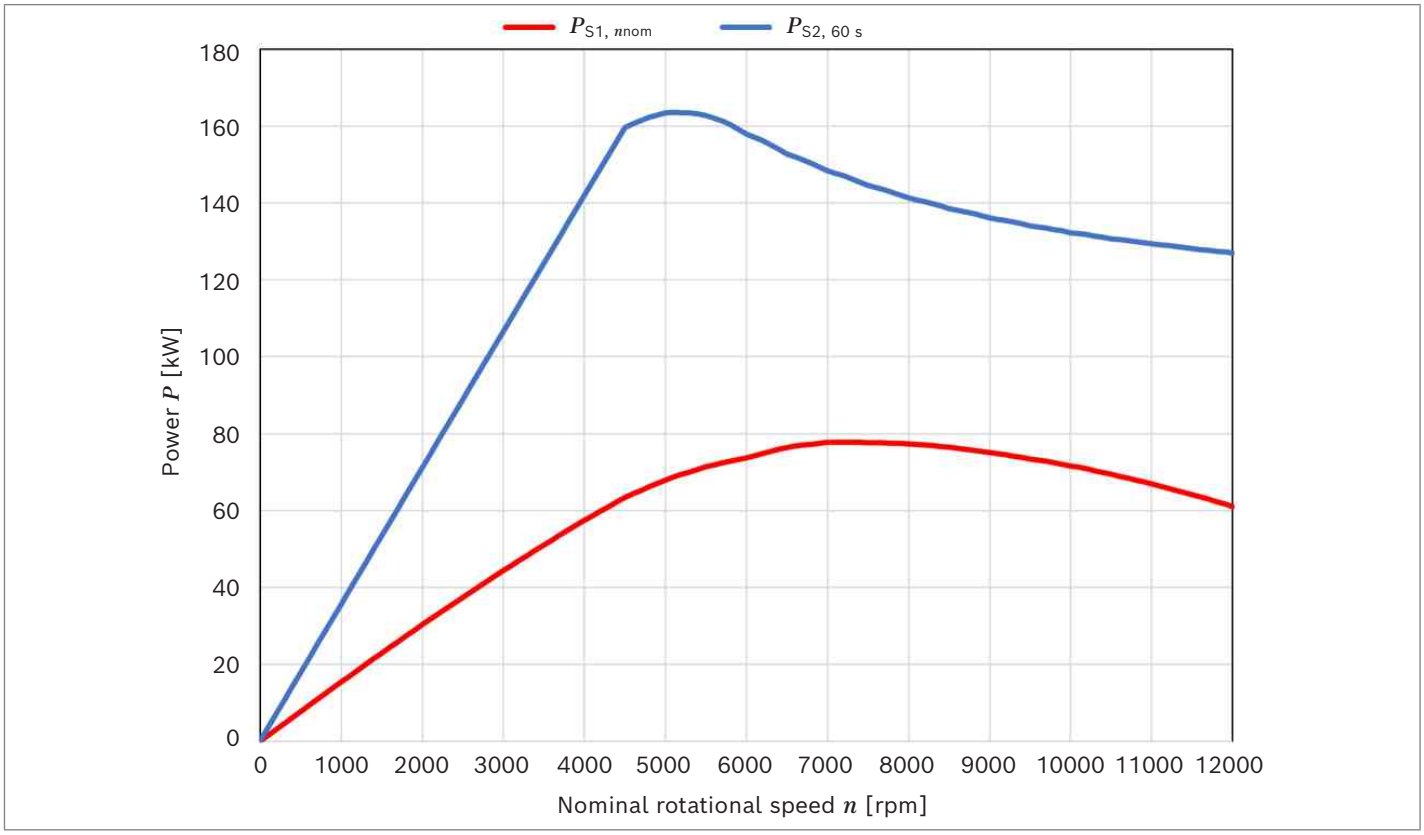
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	56.7
Torque constant at 25 °C	k_T	Nm / A_{RMS}	1.11
Synchronous inductance (d-axis) at rated current	L_d	mH	0.55
Synchronous inductance (q-axis) at rated current	L_q	mH	1.72
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.0634
Cogging torque (unskewed)	M_{cog}	Nm	2.88
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	3.78

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

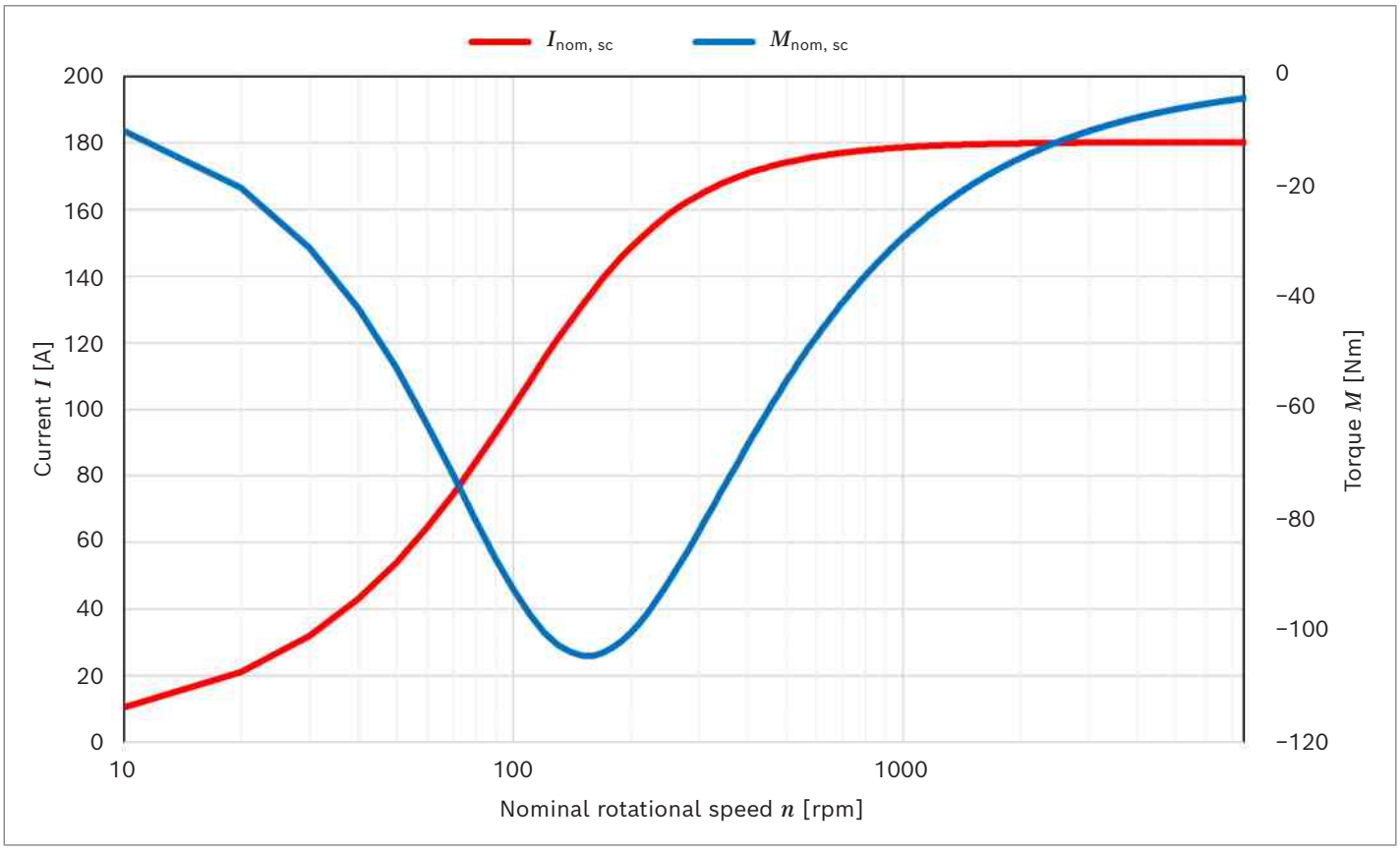
▼ **Torque EMS1-10L60**



▼ **Power EMS1-10L60**



▼ **Short circuit current and short circuit braking torque EMS1-10L60**



Technical data EMS1-13

General electrical properties

Parameter	Unit	EMS1-13					
		15	20	25	30	40	60
Nominal rotational speed	rpm	1500	2000	2500	3000	4000	6000
Maximum rotational speed	rpm		6000			10500	
Nominal voltage range	VDC	400 ... 750					
Operating DC voltage	VDC	270 ... 850					
Voltage range		HV_3 according to LV123					
Switching frequency	kHz	≥ 4					
Electrical connection		Star connection					

General mechanical properties

Parameter		Unit	EMS1-13			
			F	H	J	l
Weight	Internal splined shaft	kg	See chapter „Dimensions“			
	External spline shaft	kg	See chapter „Dimensions“			
Overall length		mm	398	448	498	548
Moment of inertia	Internal splined shaft	kgm^2	0.0424	0.0541	0.0658	0.0775
	External spline shaft	kgm^2	0.0424	0.0542	0.0659	0.0776
Center of gravity	Internal splined shaft	mm	X = 174 Y = 12.4 Z = −0.1	X = 199.4 Y = 10.8 Z = −0.16	X = 224.8 Y = 9.7 Z = −0.15	X = 249 Y = 8.6 Z = −0.1
	External spline shaft	mm	X = 175 Y = 12.5 Z = −0.2	X = 200 Y = 10.9 Z = −0.1	X = 225.9 Y = 9.7 Z = −0.15	X = 250 Y = 8.7 Z = −0.1

Mechanical interface

Parameter	
Motor mounting	
Motor flange (according to SAE J617)	SAE 5
External spline shaft (type code W2) for motor (according to DIN 5480)	W 40 × 2 × 18 × 9d
Pump mounting	
Pump flange (according to SAE J744)	C2, 45° steps C4, 45° steps C4/C2, 90° steps
Internal-splined shaft (type code N2) for pumps (according to ANSI B92.1)	N1 1/4 14T 12/24 DP
Gearbox mounting	
Gearbox flange (according to SAE J617)	SAE 5
Internal-splined shaft (type code N2) for gearboxes (according to ANSI B92.1)	N1 1/4 14T 12/24 DP

Cooling

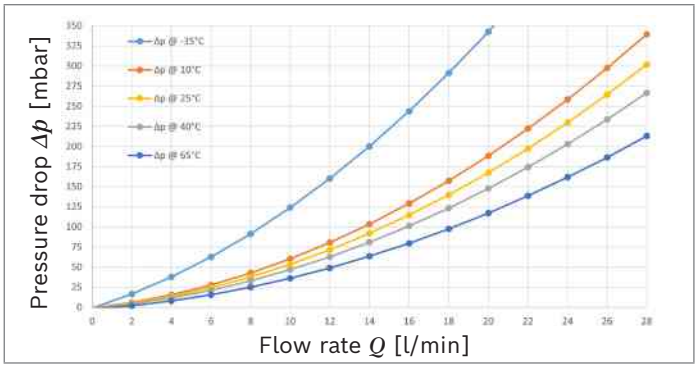
The table shows the operating conditions for the cooling liquid. Further information on motor cooling can be found in “Operating Instructions 96709-01-B”.

Parameter			Symbol	Unit	Value
Standard cooling liquid					Water:glycol 50:50 – Glysantin G40
Nominal flow rate			Q_{min}	l/min	20
Maximum inlet pressure			p_{max}	bar	6
Inlet temperature			T_{Inlet}	°C	Minimum –37 °C Maximum 65 °C
Cooling liquid volume	Length	F	V_{liquid}	l	1.4
		H	V_{liquid}	l	1.6
		J	V_{liquid}	l	1.8
		L	V_{liquid}	l	2.0
Coolant channels material					Aluminum, cast iron
Coolant connection					2 × G1/2" according to ISO 1179-1
Heat class according to IEC 60034-1					H

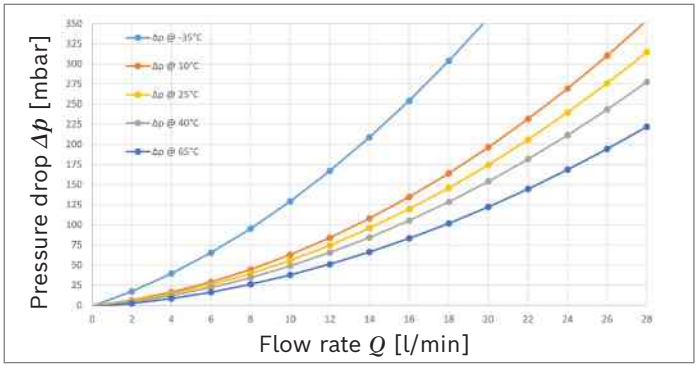
Pressure drop

The following graphs show the pressure drop at a 50:50 water to glycol ratio depending on the flow rate and the temperature of the cooling liquid

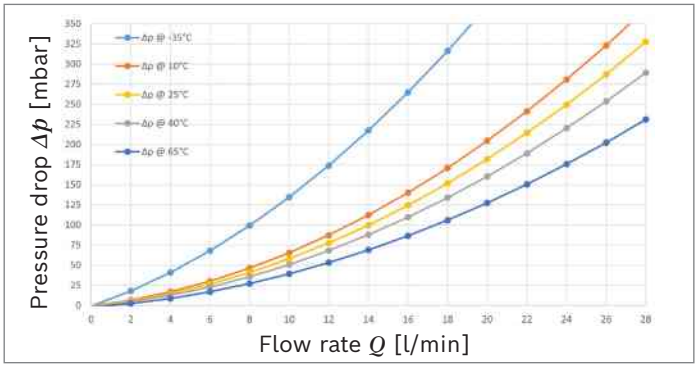
▼ EMS1-13F



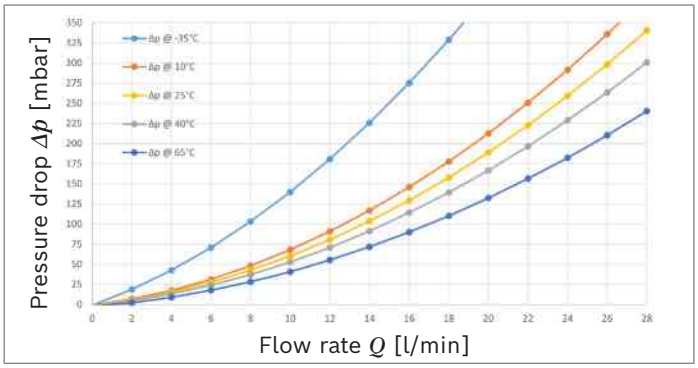
▼ EMS1-13H



▼ EMS1-13J



▼ EMS1-13L



Power data EMS1-13

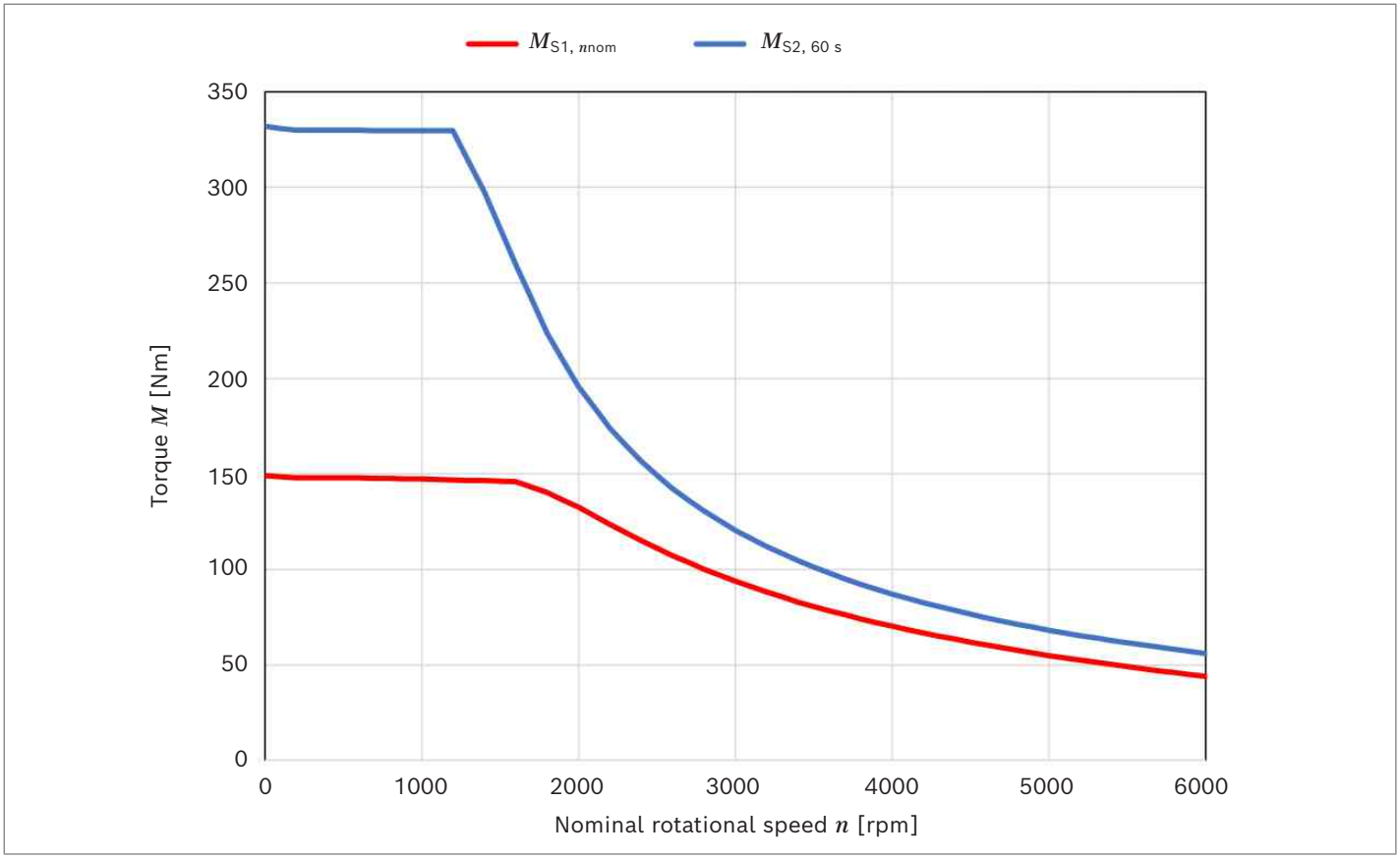
EMS1-13F15

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	148
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	39
Nominal rotational speed	n_{nom}	rpm	1500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	146
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	39
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	23
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	90.62
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	332
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	99
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	44
Maximum rotational speed	n_{max}	rpm	6000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	1
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	8
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	2
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	17.75
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	81
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	39
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	30
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	3480
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	92.14
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	19
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	57
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	123
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	57
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

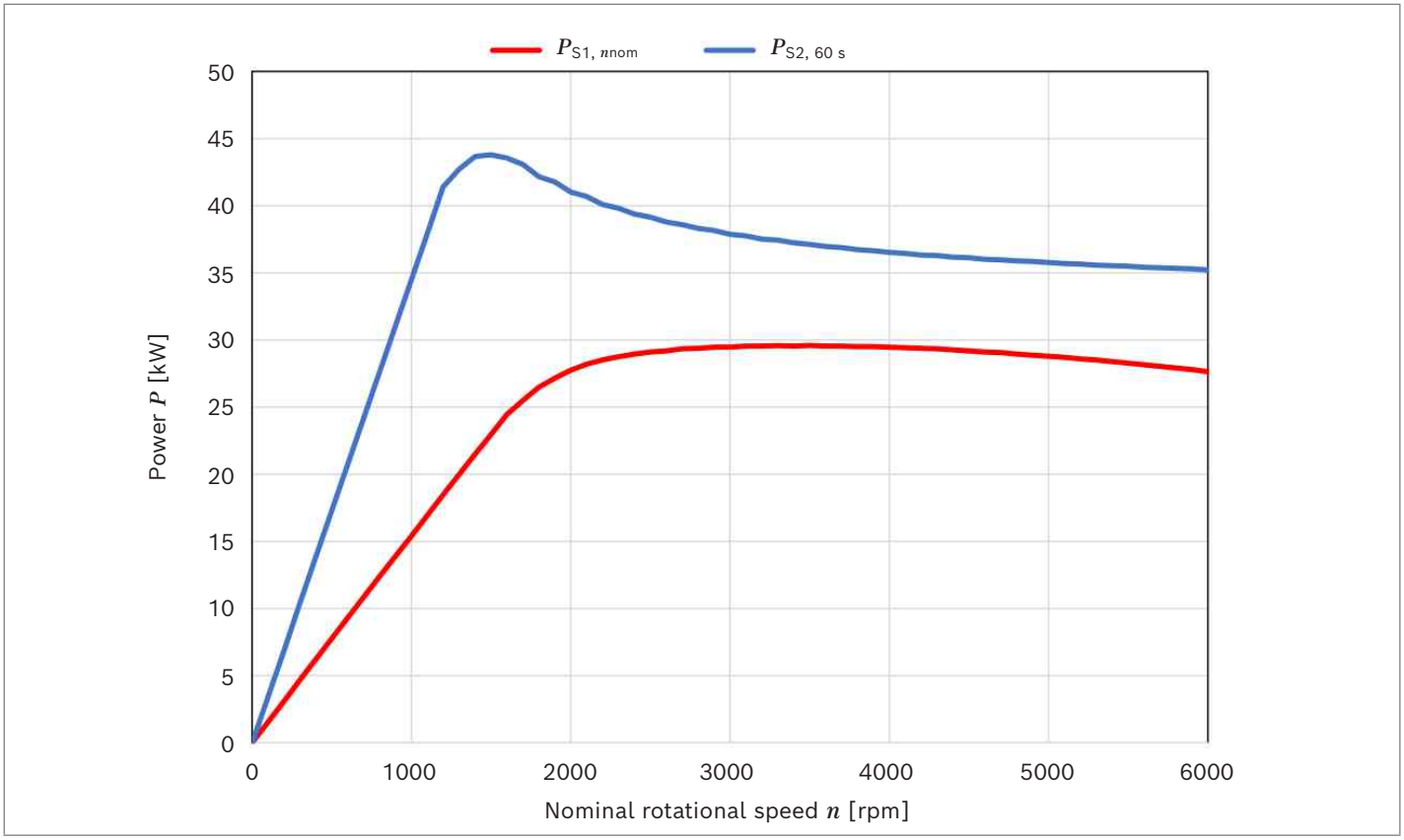
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	221.6
Torque constant at 25 °C	k_T	Nm / A_{RMS}	4.16
Synchronous inductance (d-axis) at rated current	L_d	mH	5.37
Synchronous inductance (q-axis) at rated current	L_q	mH	13.91
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.598
Cogging torque (unskewed)	M_{cog}	Nm	0.63
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	1.79

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

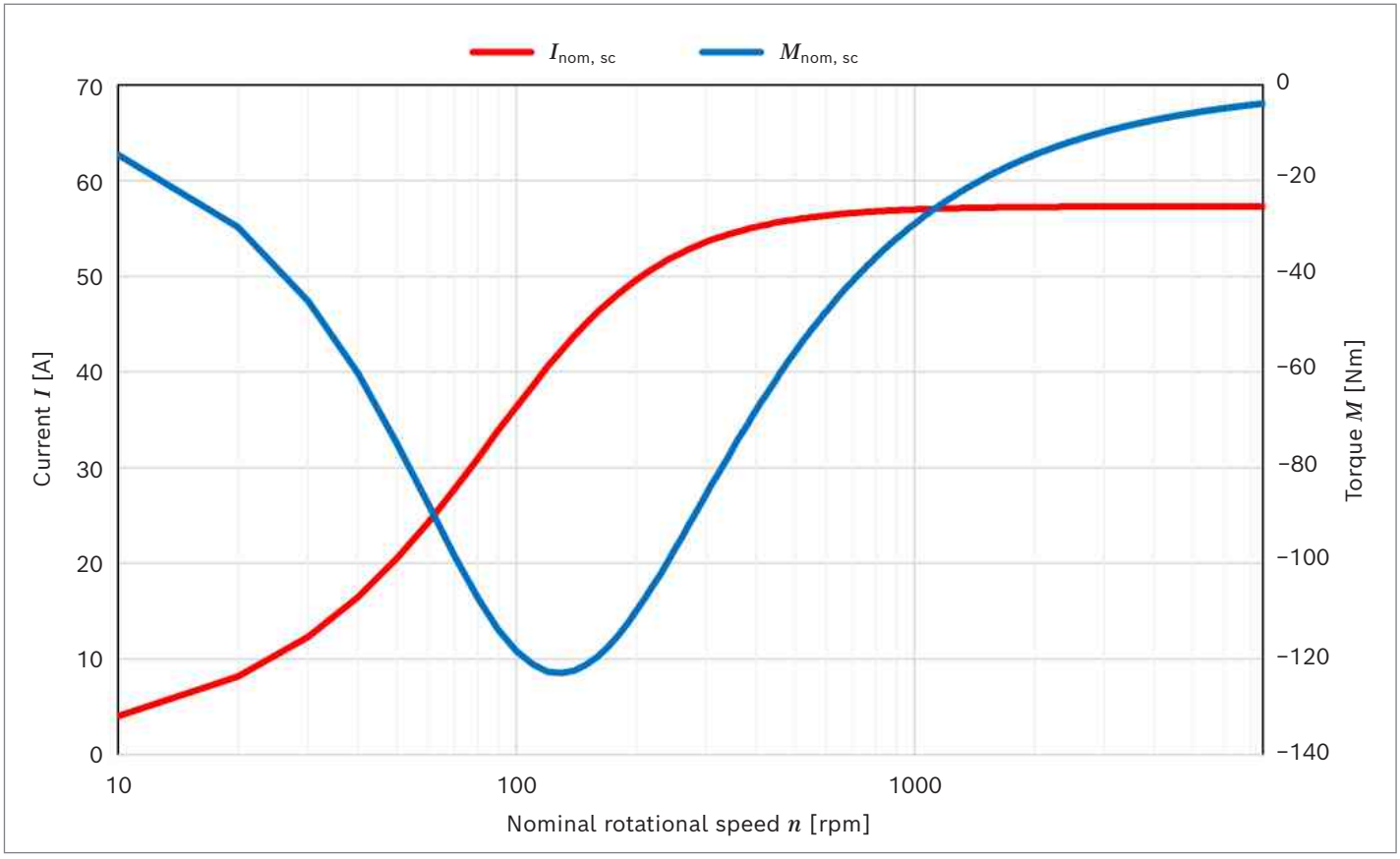
▼ Torque EMS1-13F15



▼ Power EMS1-13F15



▼ **Short circuit current and short circuit braking torque EMS1-13F15**



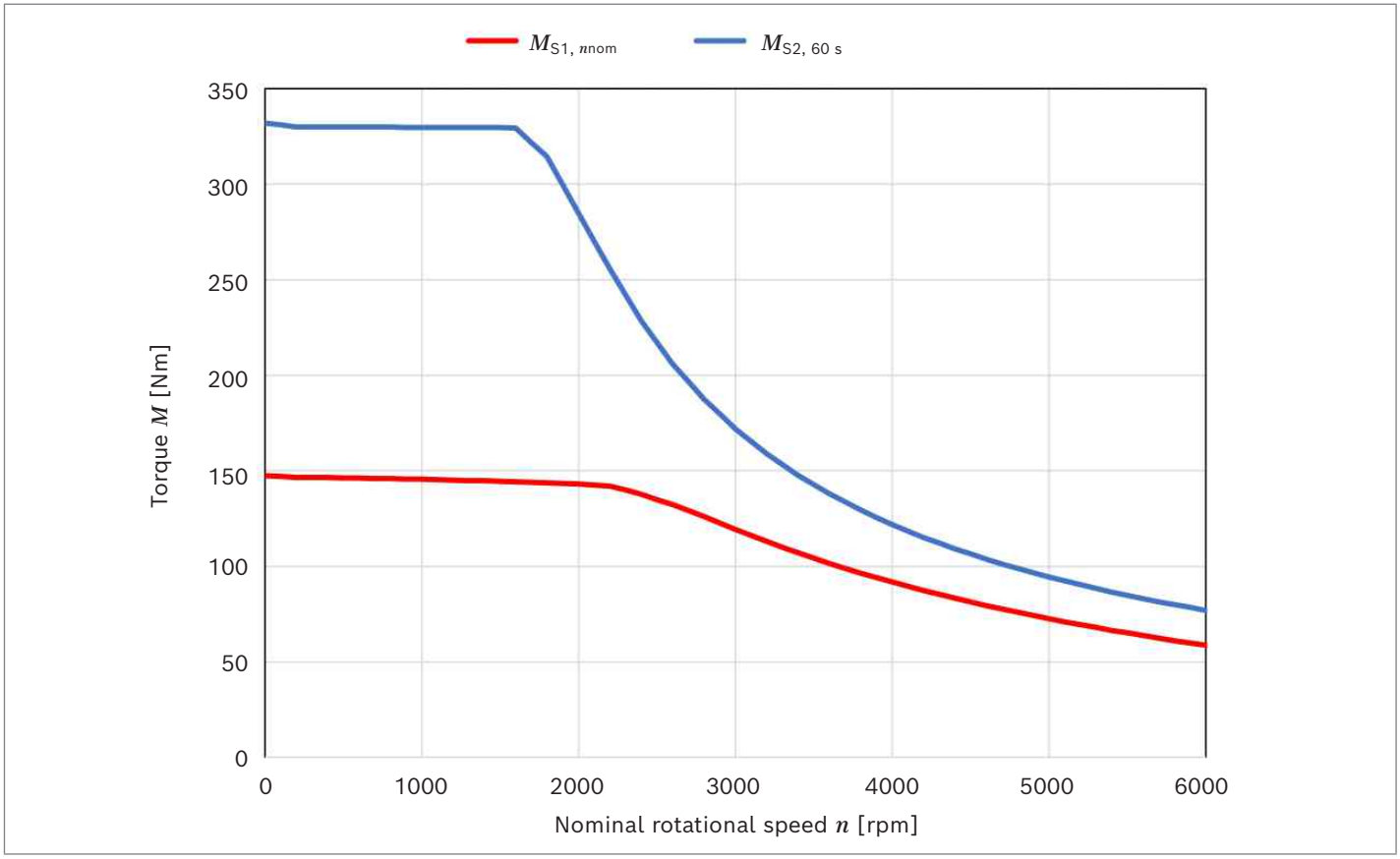
EMS1-13F20

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	146
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	51
Nominal rotational speed	n_{nom}	rpm	2000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	143
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	50
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	30
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	92.46
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	332
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	131
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	60
Maximum rotational speed	n_{max}	rpm	6000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	6
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	42
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	7
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	56.52
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	90
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	50
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	38
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	4080
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	93.65
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	15
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	76
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	123
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	76
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

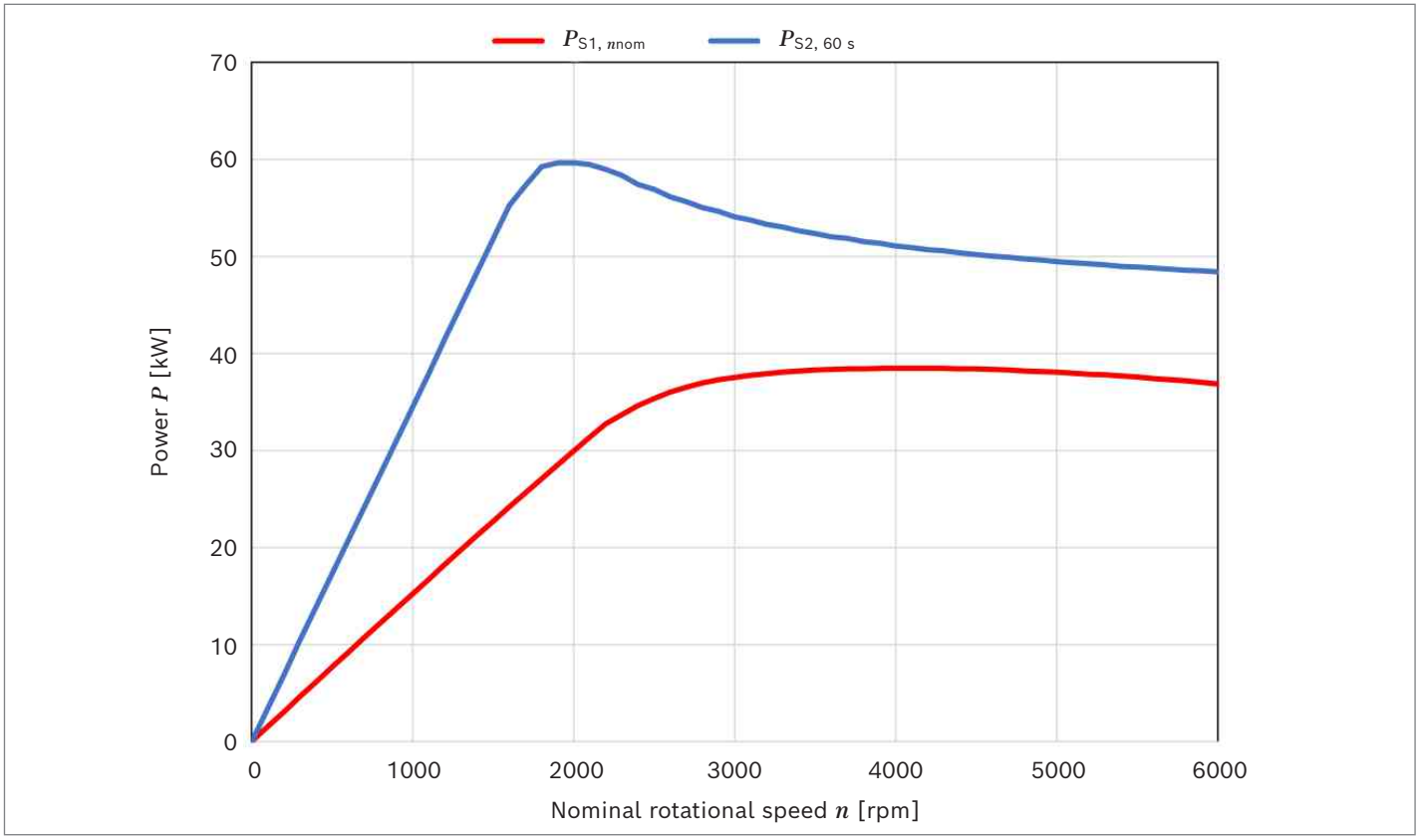
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	161.4
Torque constant at 25 °C	k_T	Nm / A_{RMS}	3.09
Synchronous inductance (d-axis) at rated current	L_d	mH	3.99
Synchronous inductance (q-axis) at rated current	L_q	mH	10.61
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.3648
Cogging torque (unskewed)	M_{cog}	Nm	0.63
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	1.63

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

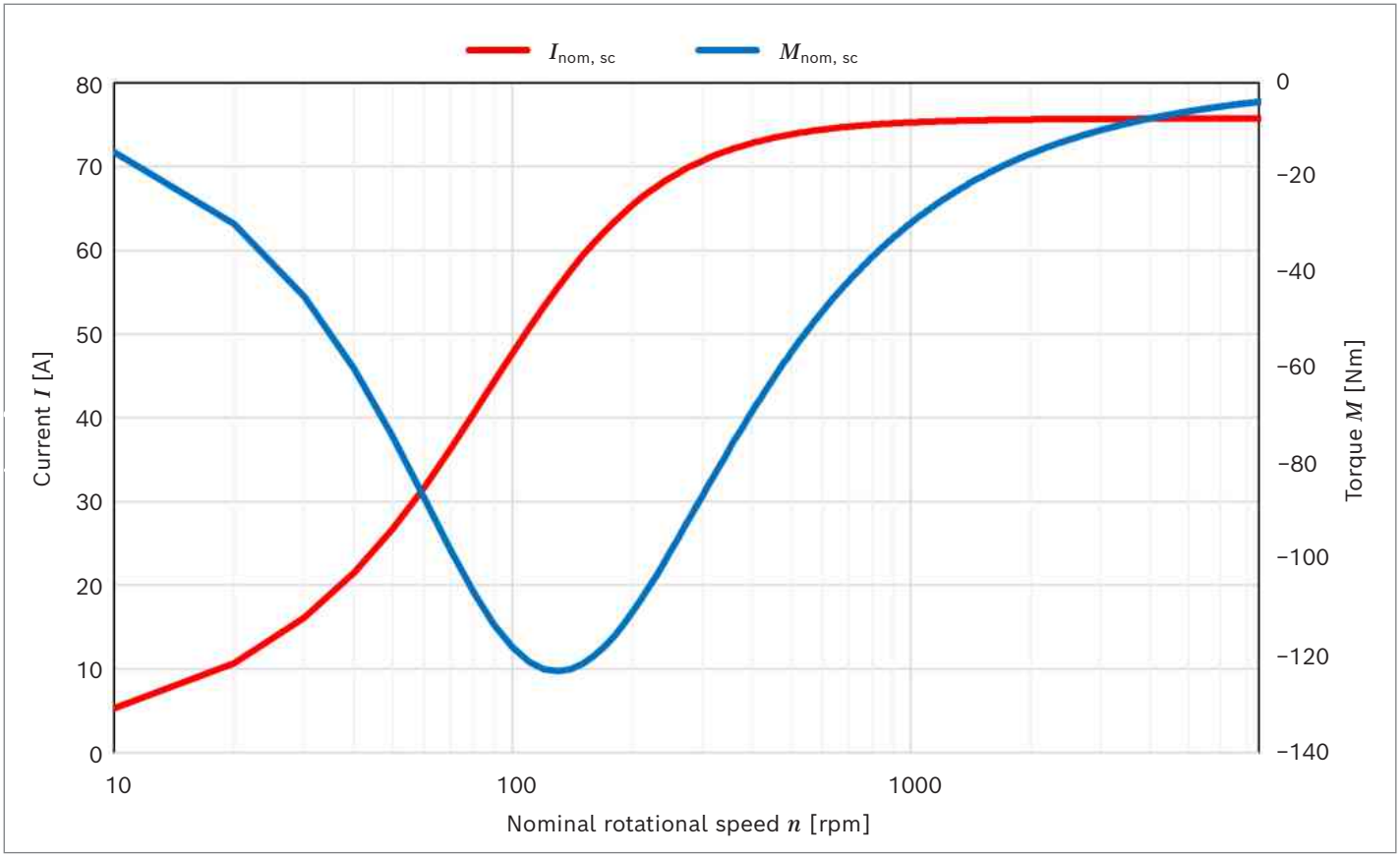
▼ **Torque EMS1-13F20**



▼ **Power EMS1-13F20**



▼ **Short circuit current and short circuit braking torque EMS1-13F20**



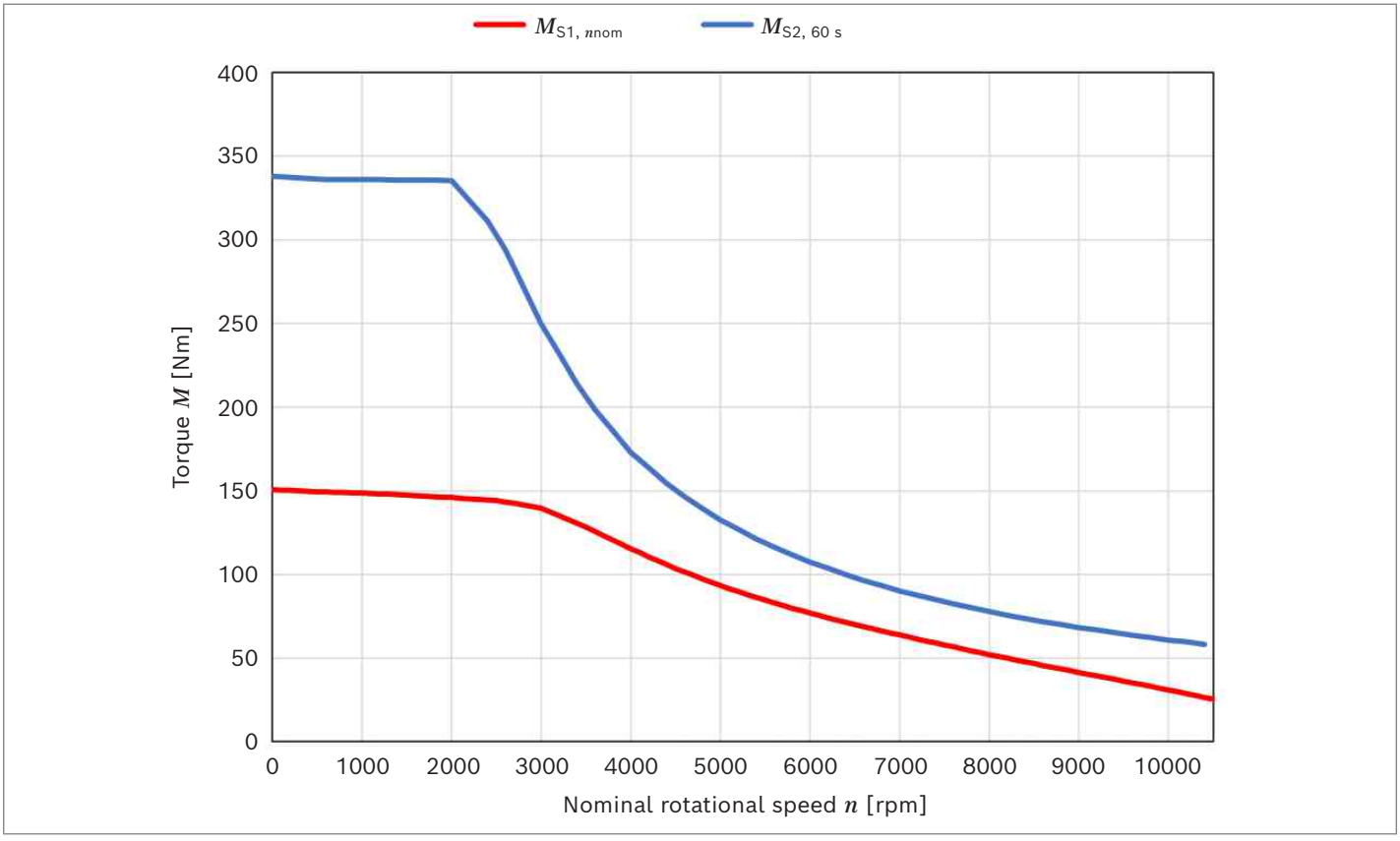
EMS1-13F25

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	150
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	66
Nominal rotational speed	n_{nom}	rpm	2500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	144
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	65
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	38
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	93.46
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	338
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	167
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	80
Maximum rotational speed	n_{max}	rpm	10500
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	25
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	53
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	28
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	90.62
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	99
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	63
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	49
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	4725
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	94.58
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	12
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	96
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	123
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	96
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

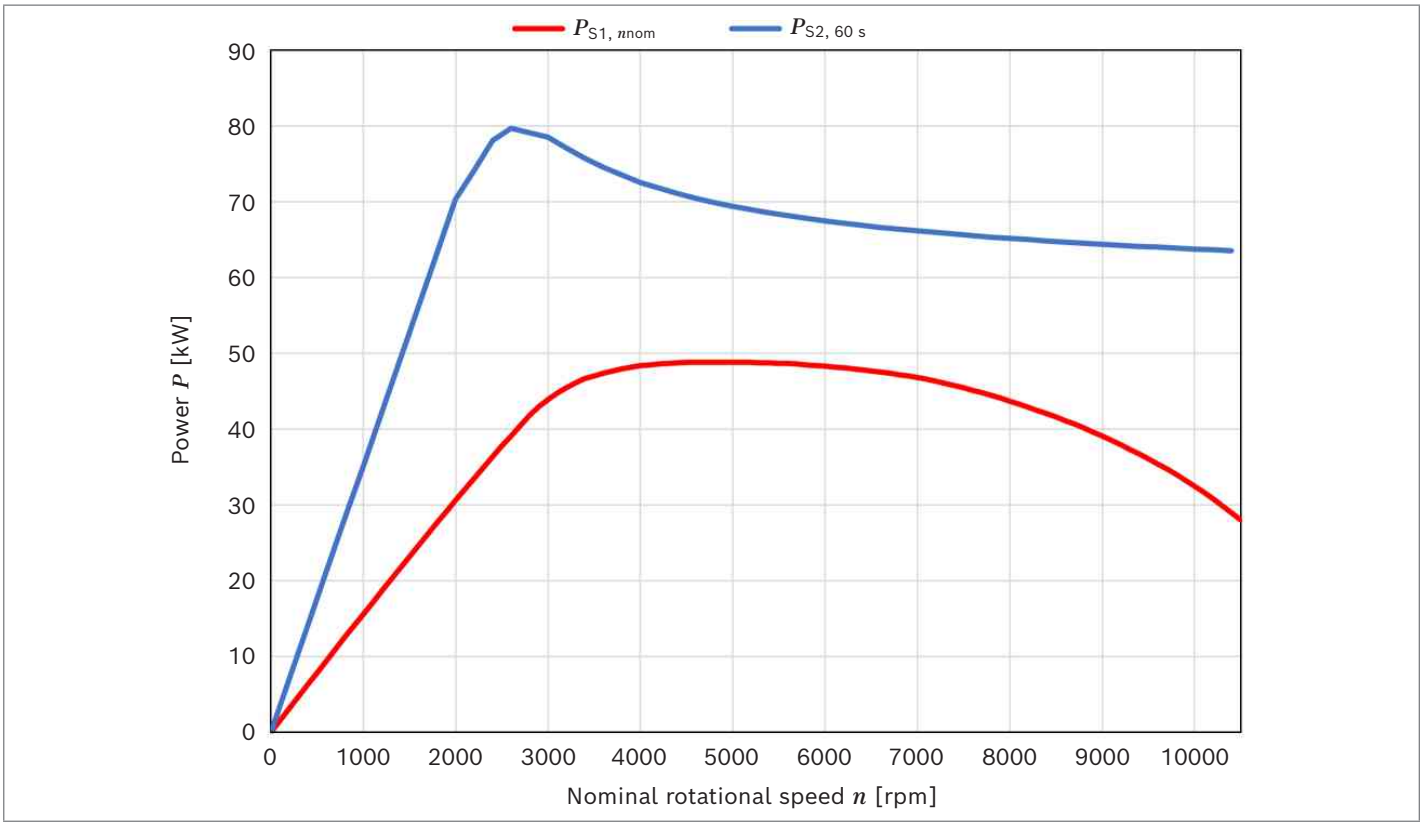
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	128.9
Torque constant at 25 °C	k_T	Nm / A_{RMS}	2.42
Synchronous inductance (d-axis) at rated current	L_d	mH	3
Synchronous inductance (q-axis) at rated current	L_q	mH	6.5
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.2263
Cogging torque (unskewed)	M_{cog}	Nm	0.63
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	1.77

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

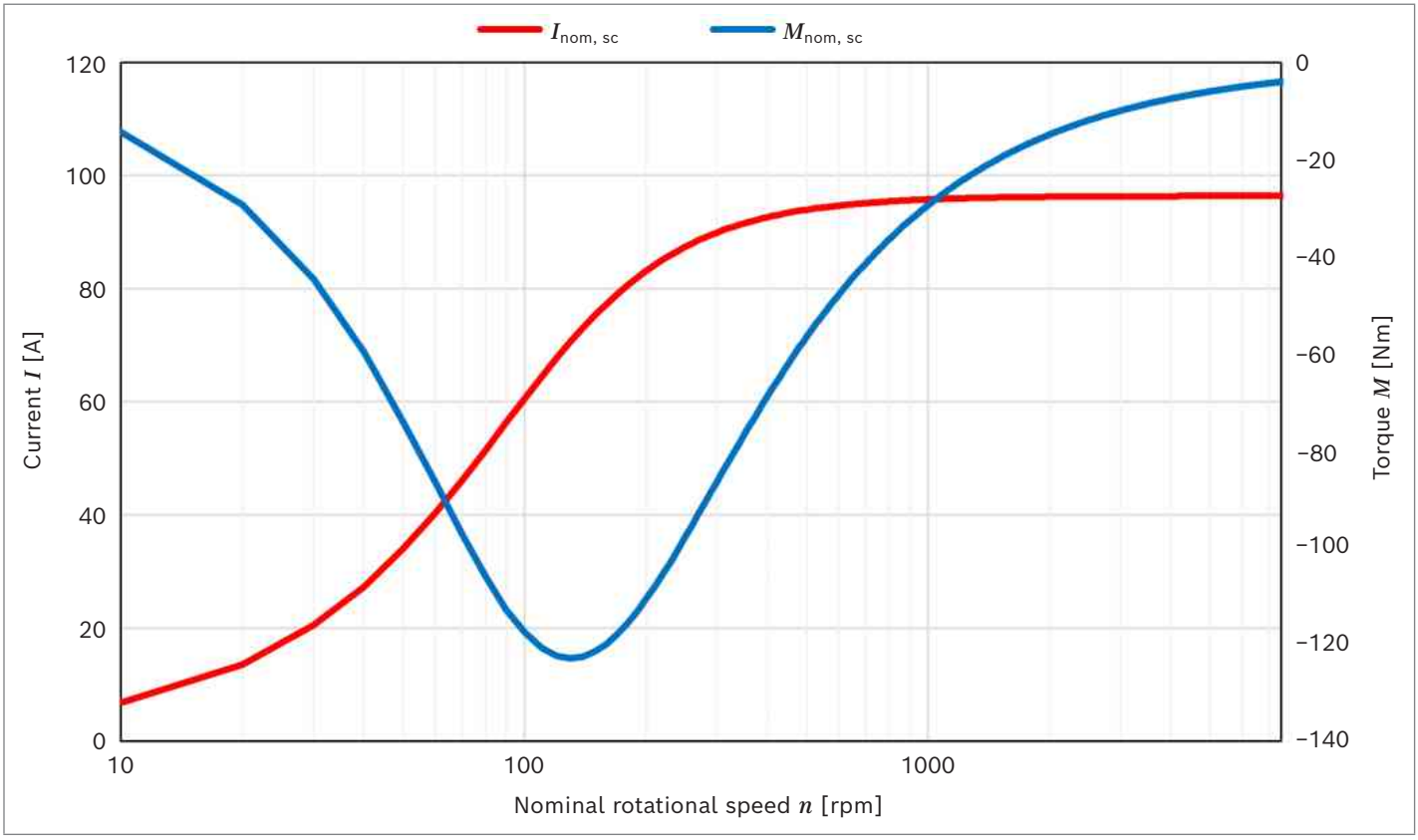
▼ Torque EMS1-13F25



▼ Power EMS1-13F25



▼ **Short circuit current and short circuit braking torque EMS1-13F25**



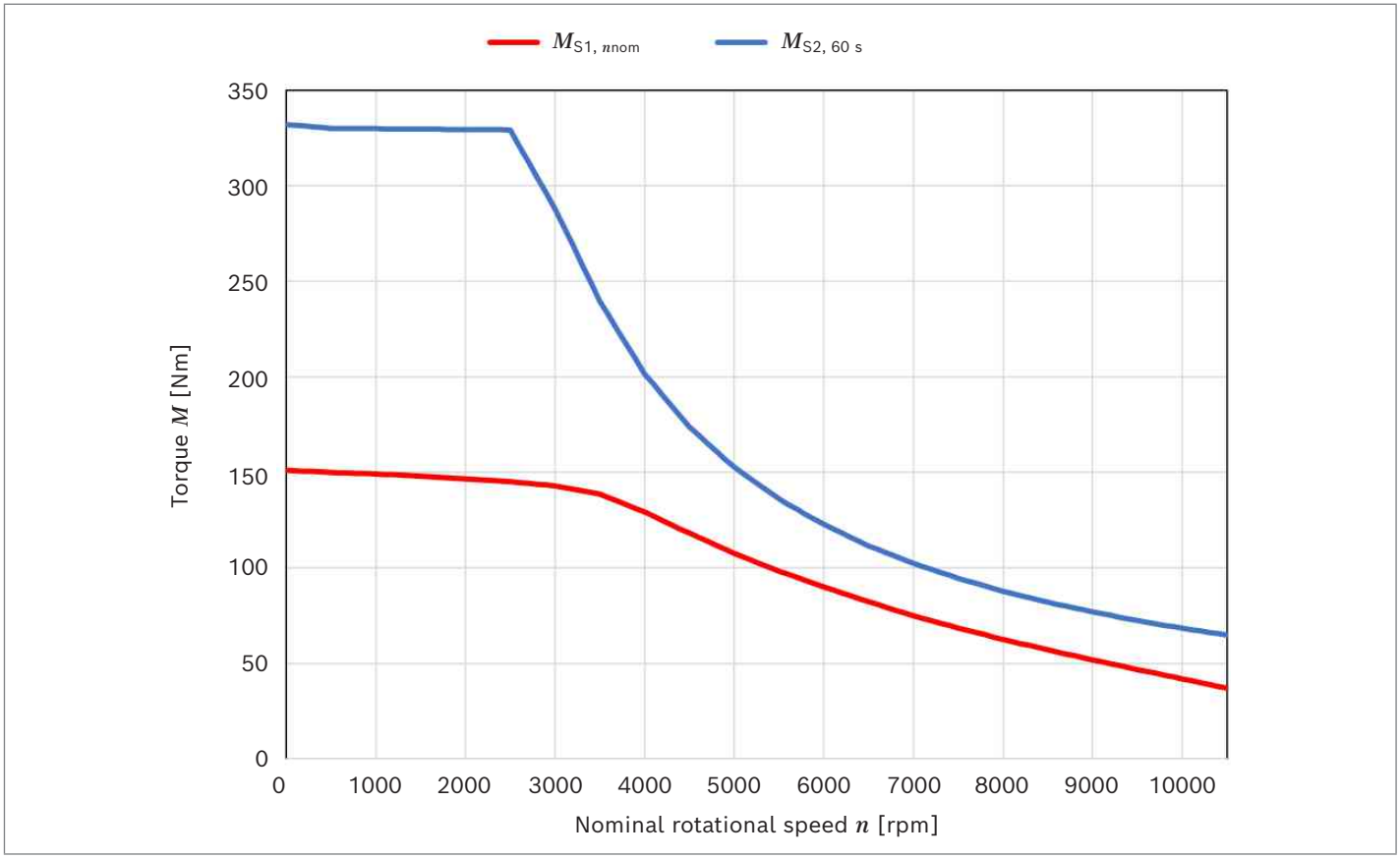
EMS1-13F30

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	151
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	76
Nominal rotational speed	n_{nom}	rpm	3000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	143
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	75
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	45
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	94.27
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	332
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	193
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	90
Maximum rotational speed	n_{max}	rpm	10500
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	37
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	62
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	41
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	93.50
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	94
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	73
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	57
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	5775
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	95.09
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	10
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	112
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	123
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	112
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

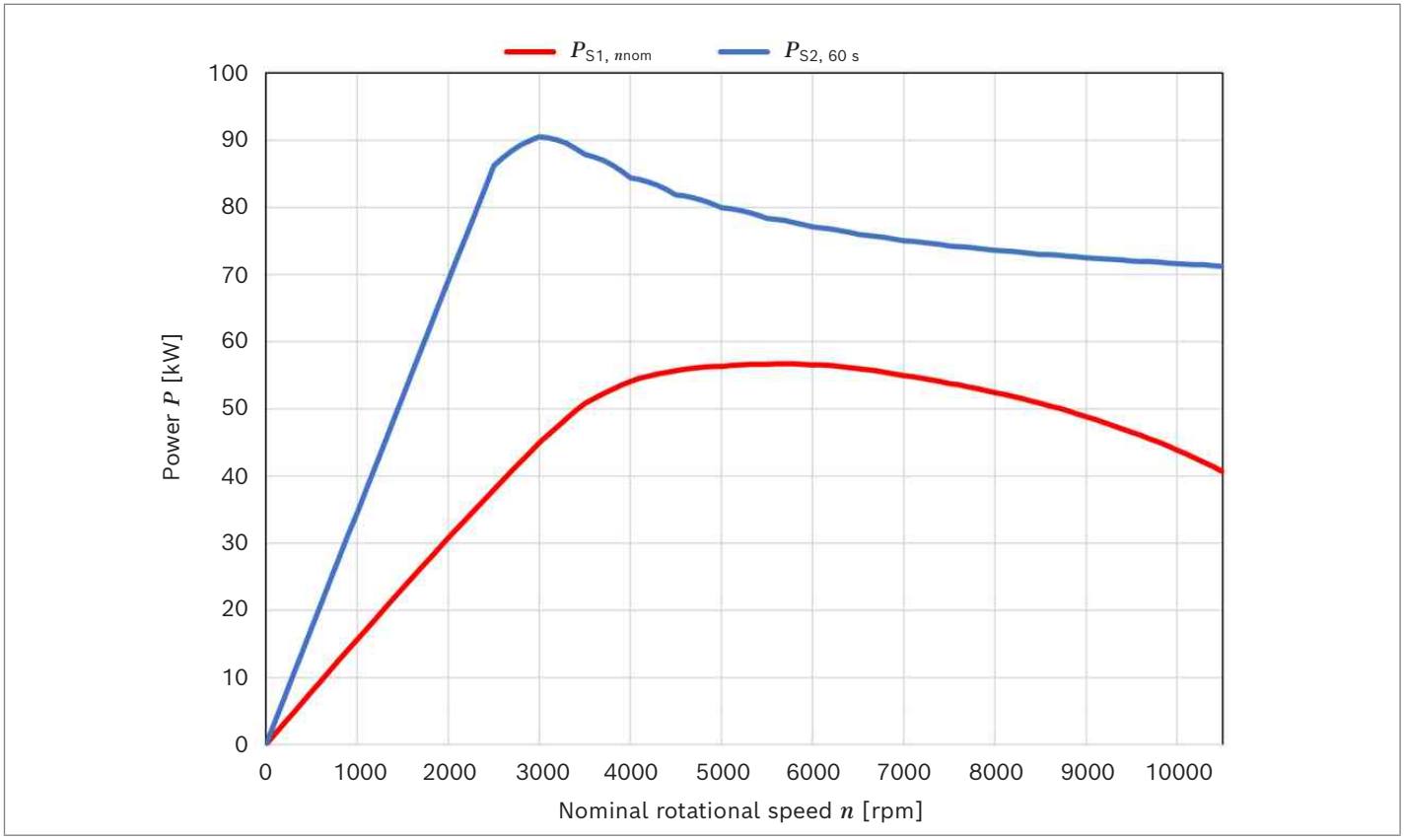
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	106.2
Torque constant at 25 °C	k_T	Nm / A_{RMS}	2.01
Synchronous inductance (d-axis) at rated current	L_d	mH	1.7
Synchronous inductance (q-axis) at rated current	L_q	mH	4.7
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.1667
Cogging torque (unskewed)	M_{cog}	Nm	0.63
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	1.74

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

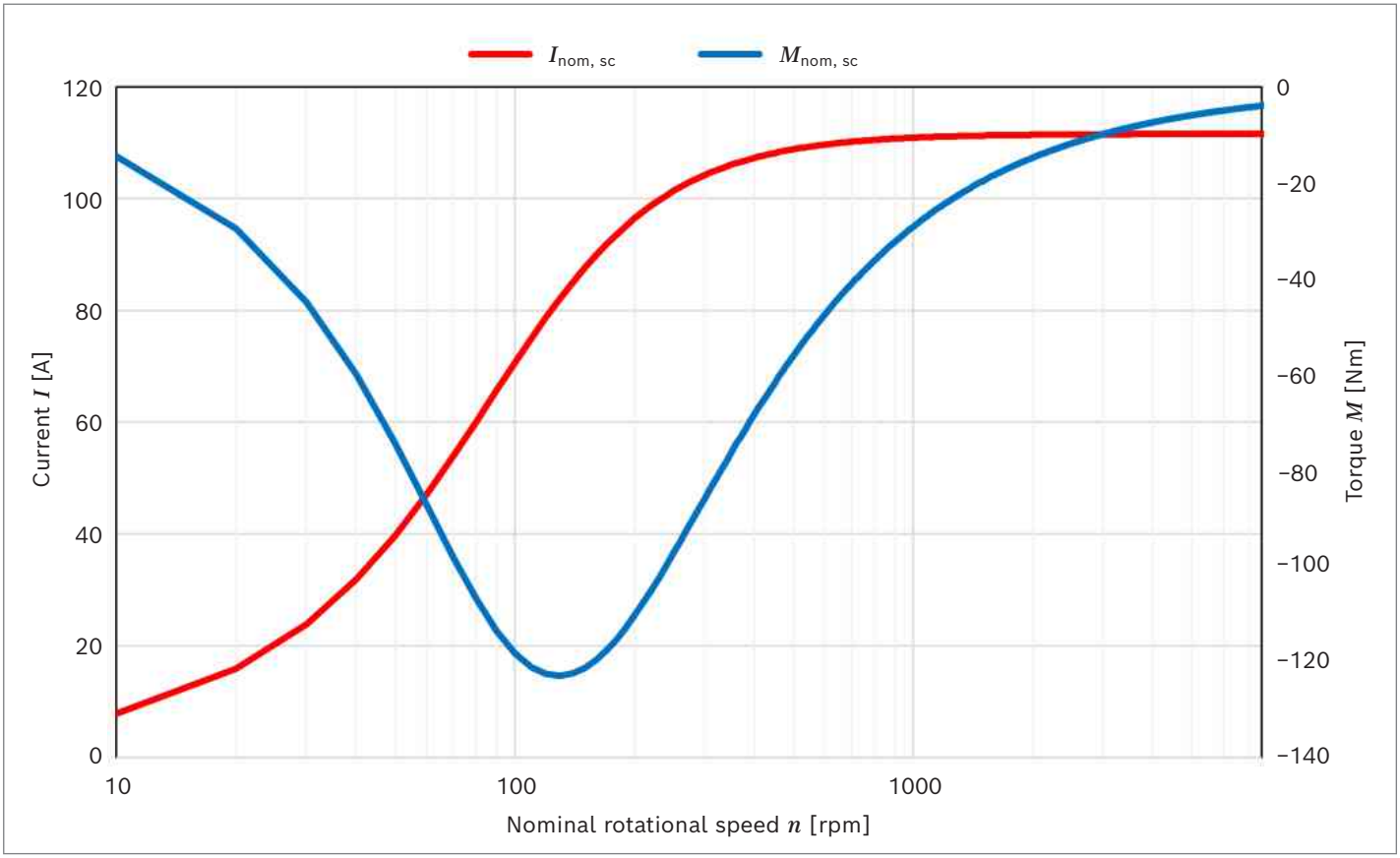
▼ **Torque EMS1-13F30**



▼ **Power EMS1-13F30**



▼ Short circuit current and short circuit braking torque EMS1-13F30



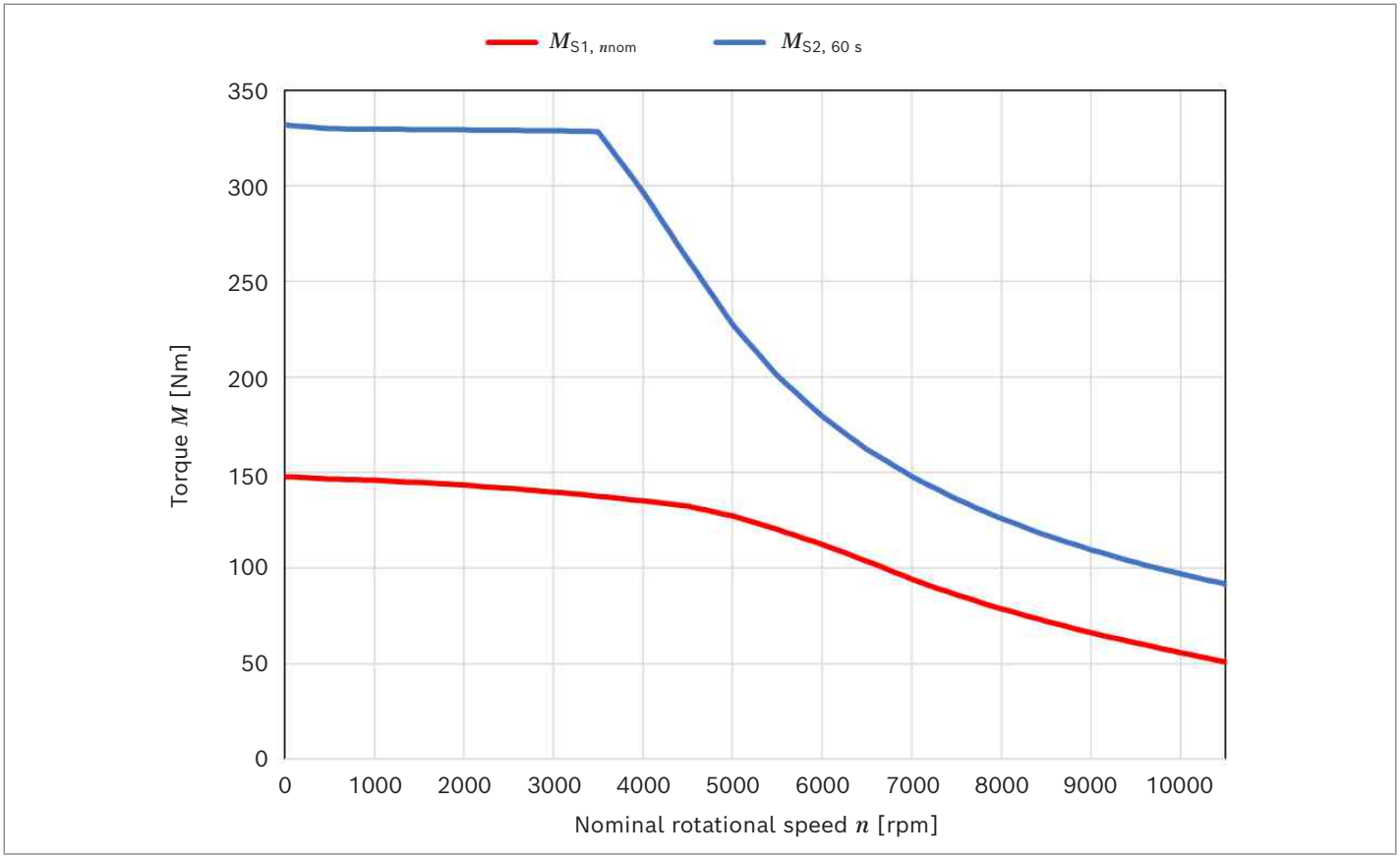
EMS1-13F40

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	147
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	101
Nominal rotational speed	n_{nom}	rpm	4000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	135
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	97
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	57
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	95.16
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	332
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	262
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	124
Maximum rotational speed	n_{max}	rpm	10500
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	51
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	76
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	56
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	95.13
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	109
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	92
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	71
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	6195
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	95.88
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	7
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	151
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	123
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	151
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

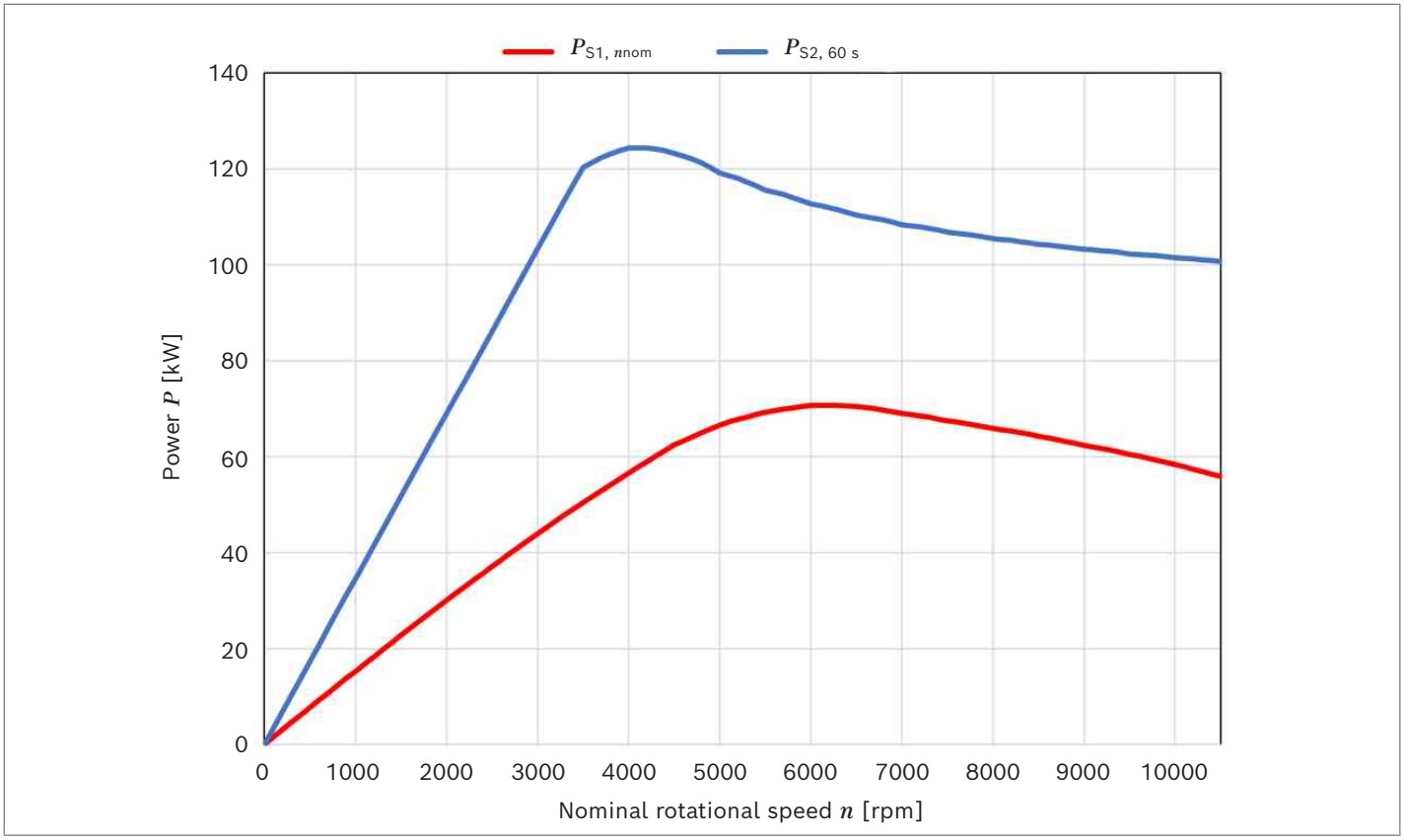
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	75.7
Torque constant at 25 °C	k_T	Nm / A_{RMS}	1.56
Synchronous inductance (d-axis) at rated current	L_d	mH	1
Synchronous inductance (q-axis) at rated current	L_q	mH	2.09
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.091
Cogging torque (unskewed)	M_{cog}	Nm	0.63
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	1.33

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

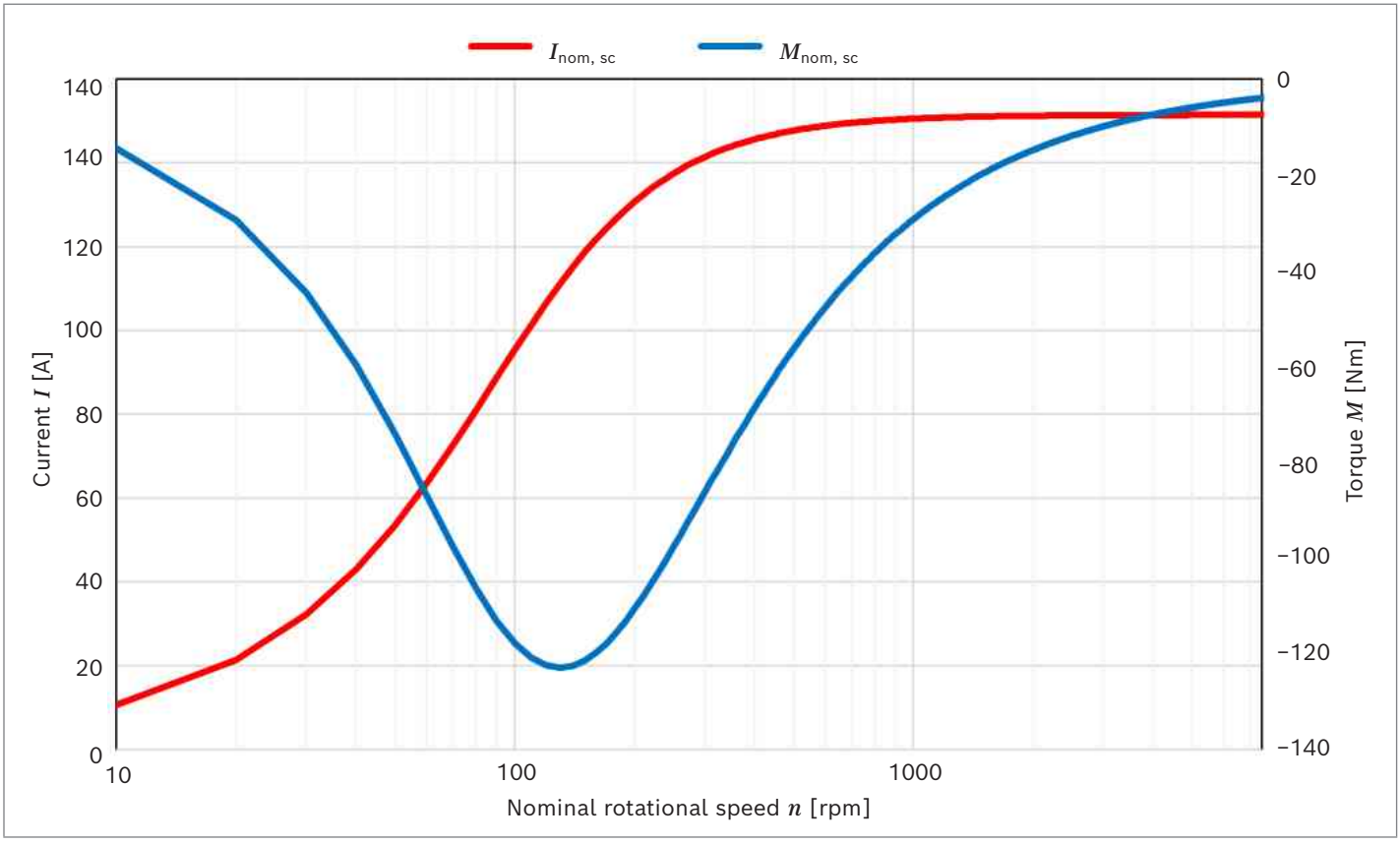
▼ Torque EMS1-13F40



▼ Power EMS1-13F40



▼ **Short circuit current and short circuit braking torque EMS1-13F40**



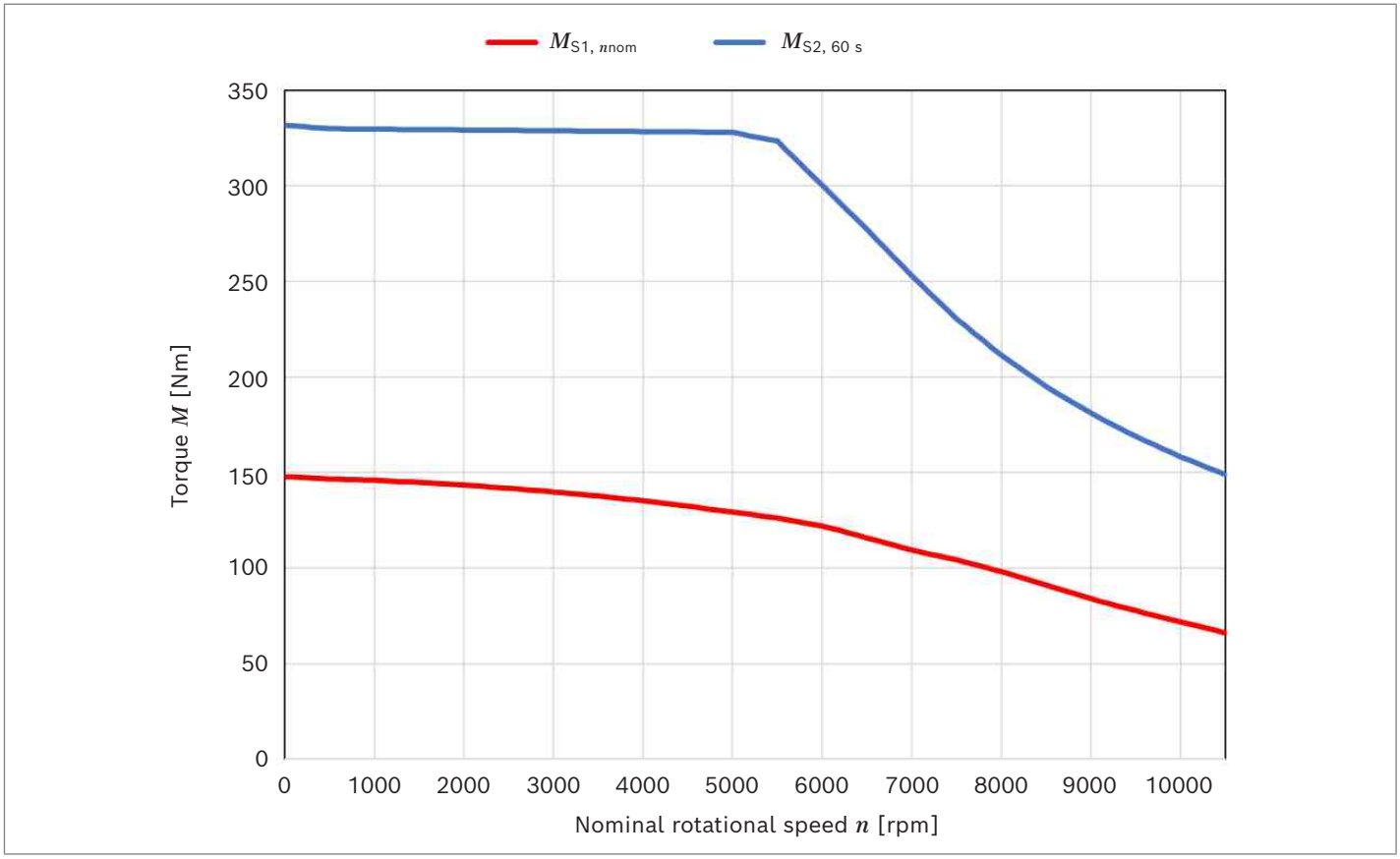
EMS1-13F60

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	147
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	152
Nominal rotational speed	n_{nom}	rpm	6000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	122
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	134
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	77
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	95.88
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	332
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	392
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	189
Maximum rotational speed	n_{max}	rpm	10500
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	66
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	93
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	73
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	96.01
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	98
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	113
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	82
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	7980
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	96.23
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	5
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	227
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	123
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	227
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

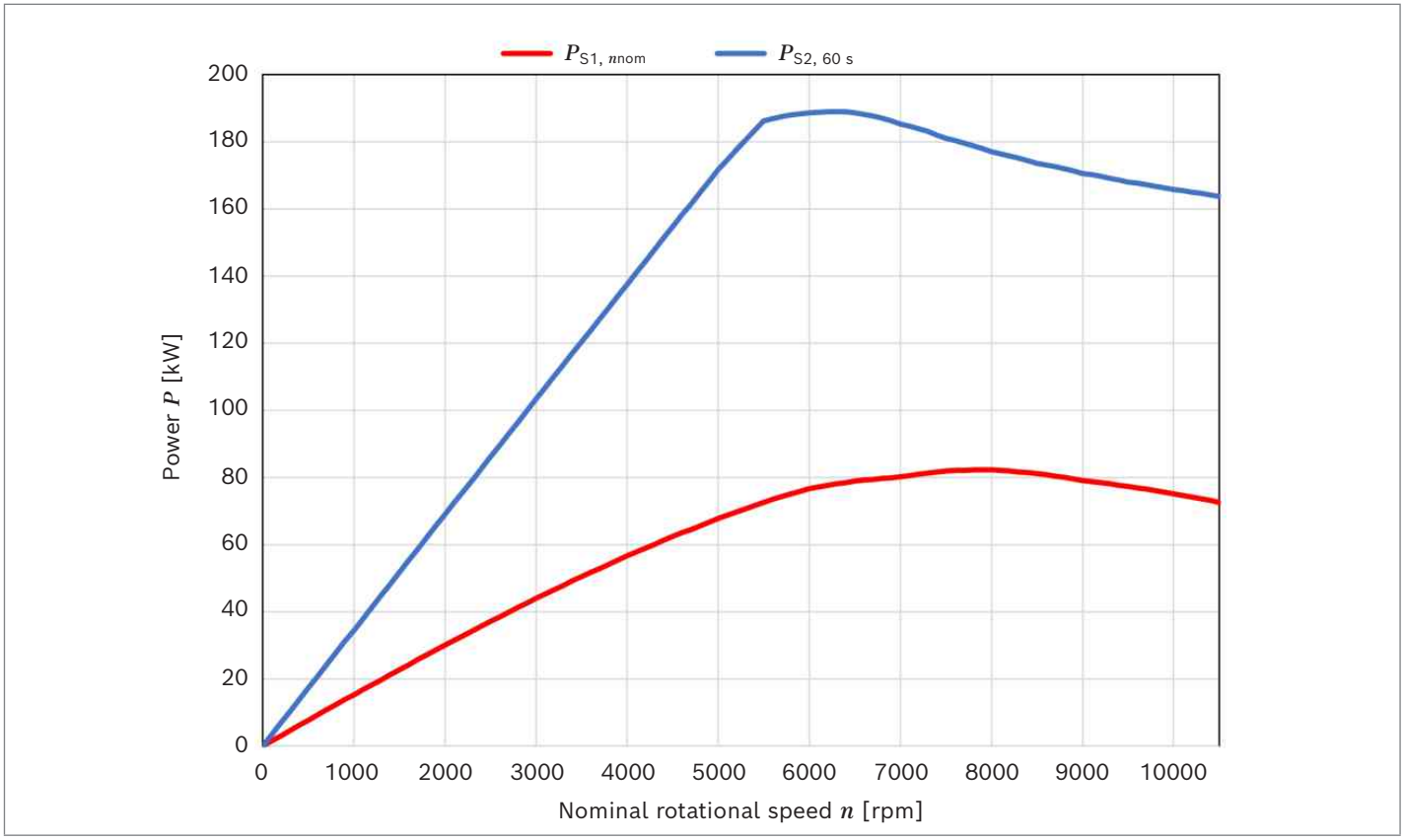
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	55.1
Torque constant at 25 °C	k_T	Nm / A_{RMS}	1.04
Synchronous inductance (d-axis) at rated current	L_d	mH	0.57
Synchronous inductance (q-axis) at rated current	L_q	mH	1.18
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.0405
Cogging torque (unskewed)	M_{cog}	Nm	0.63
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	0.96

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

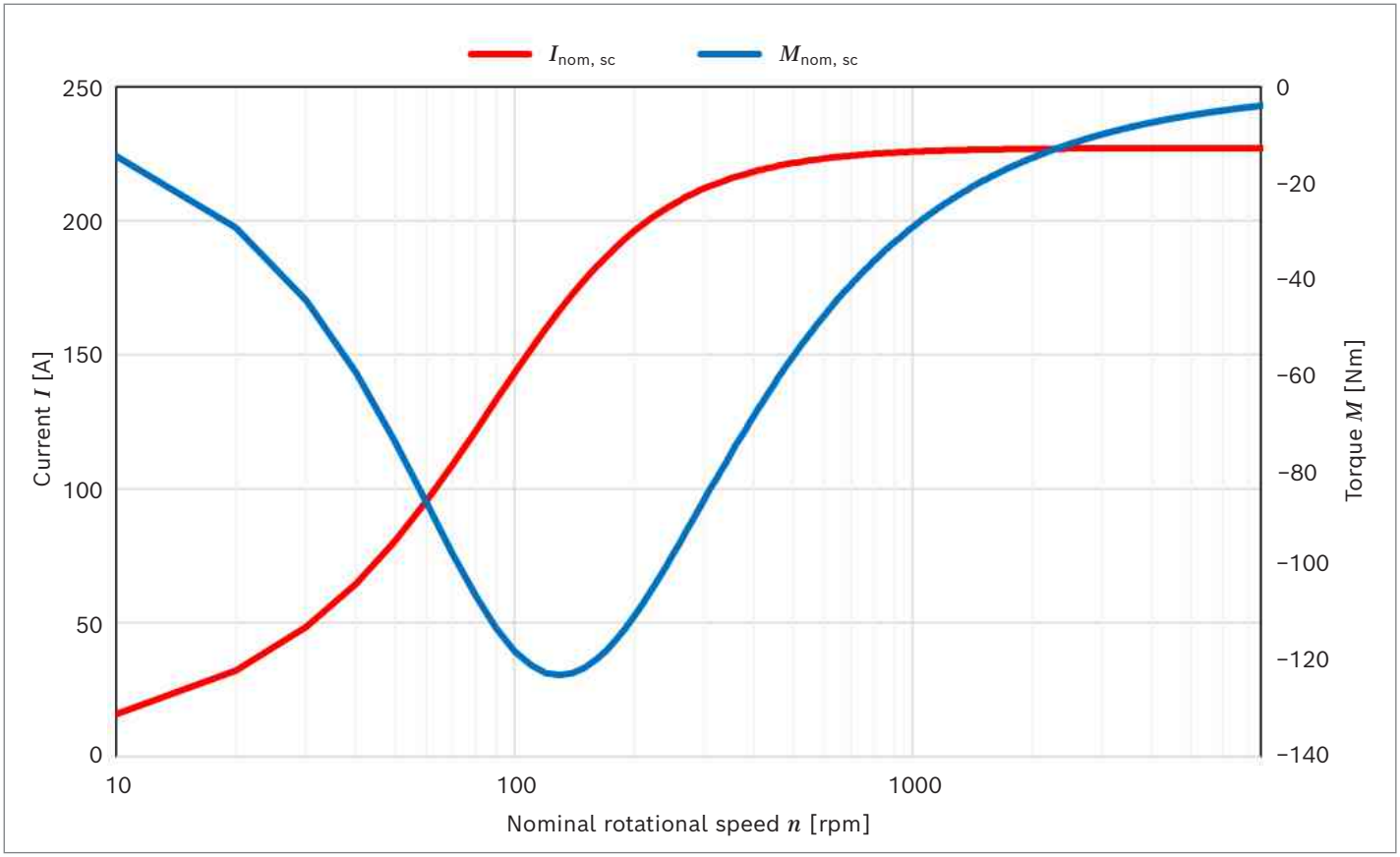
▼ **Torque EMS1-13F60**



▼ **Power EMS1-13F60**



▼ Short circuit current and short circuit braking torque EMS1-13F60



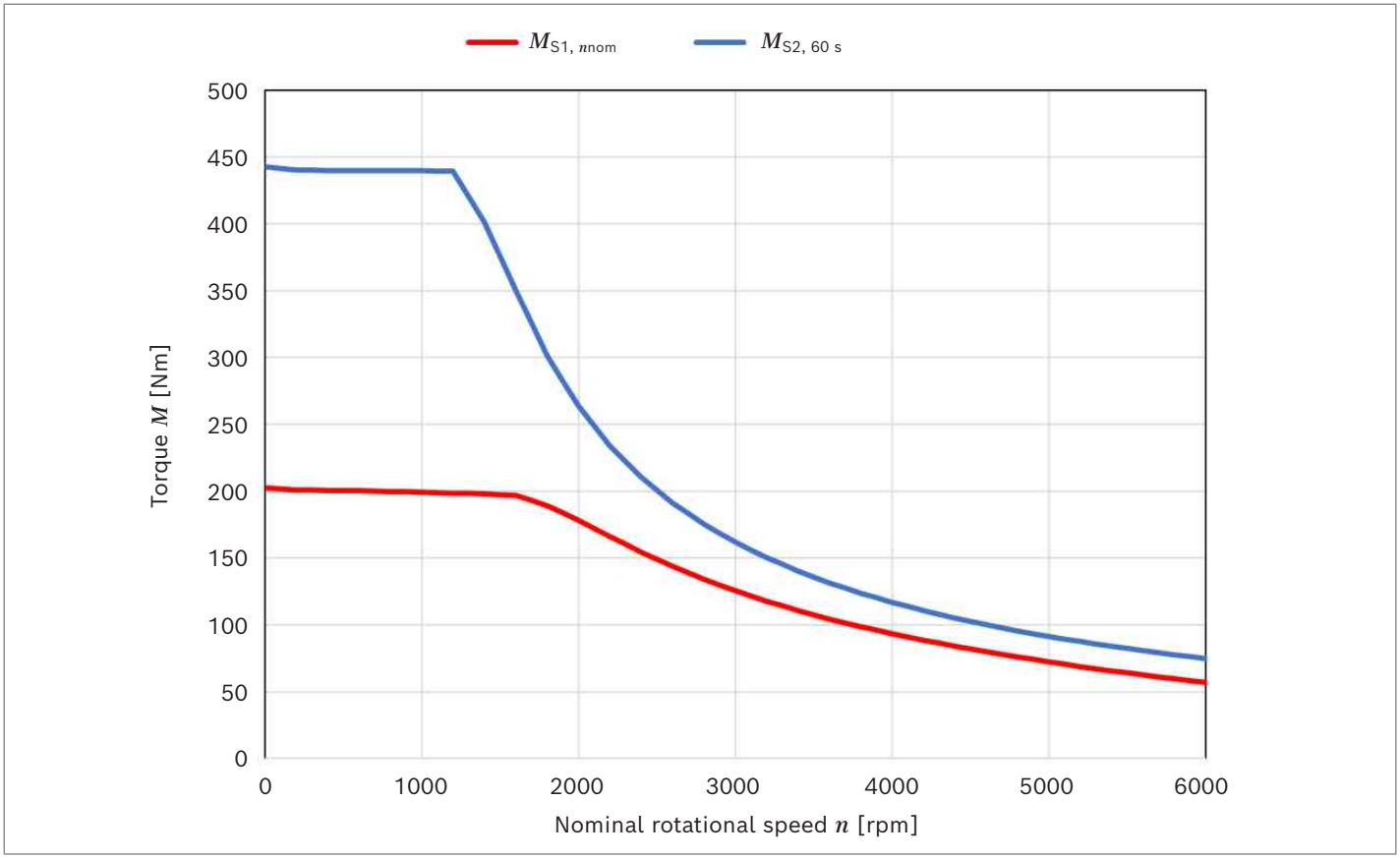
EMS1-13H15

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	201
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	52
Nominal rotational speed	n_{nom}	rpm	1500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	197
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	52
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	31
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	91.41
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	443
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	131
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	59
Maximum rotational speed	n_{max}	rpm	6000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	0
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	0
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	0
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	0.00
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	114
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	52
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	39
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	3300
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	92.76
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	24
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	76
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	165
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	76
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

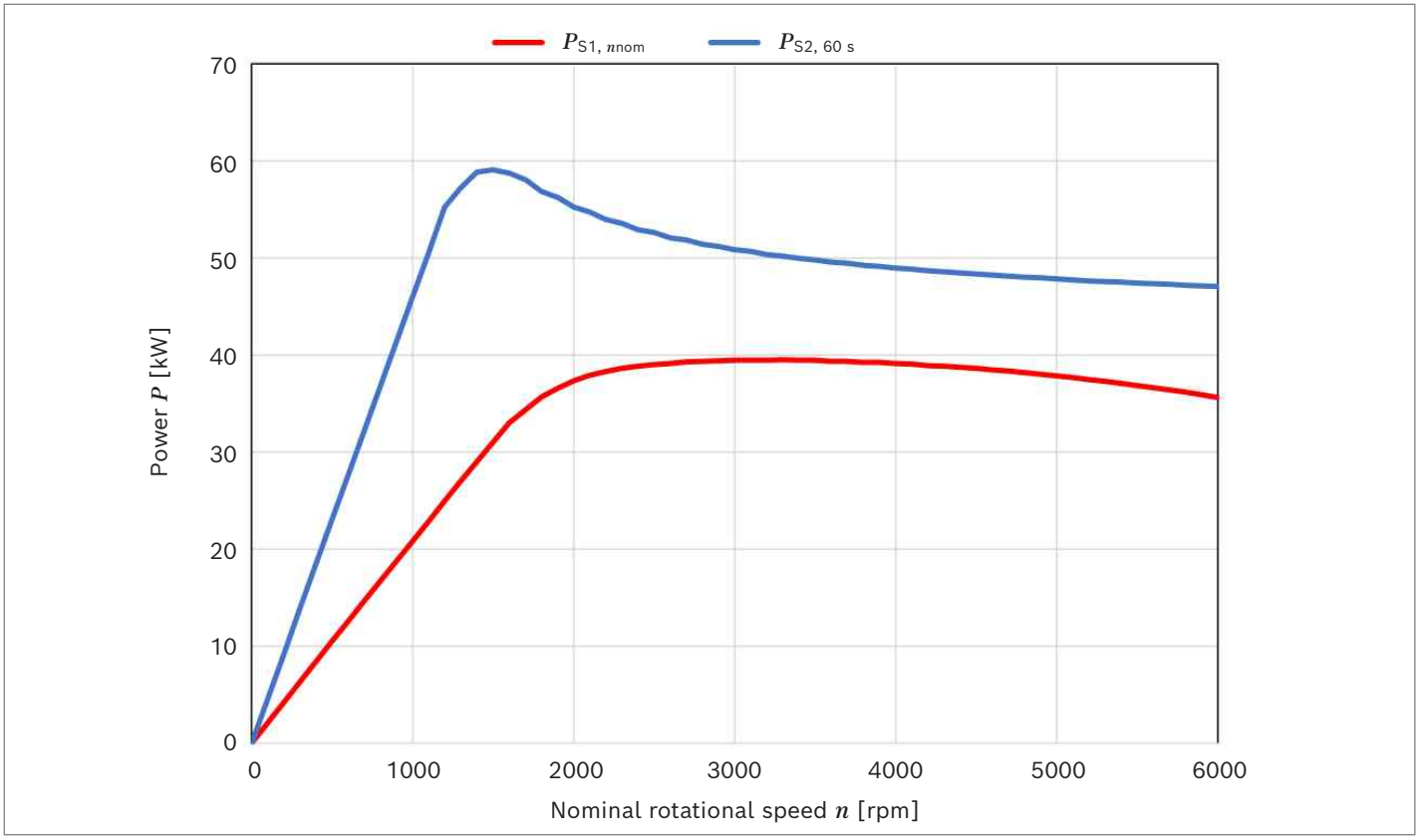
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	219.29
Torque constant at 25 °C	k_T	Nm / A_{RMS}	4.14
Synchronous inductance (d-axis) at rated current	L_d	mH	4.91
Synchronous inductance (q-axis) at rated current	L_q	mH	11.27
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.4266
Cogging torque (unskewed)	M_{cog}	Nm	0.85
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	2.57

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

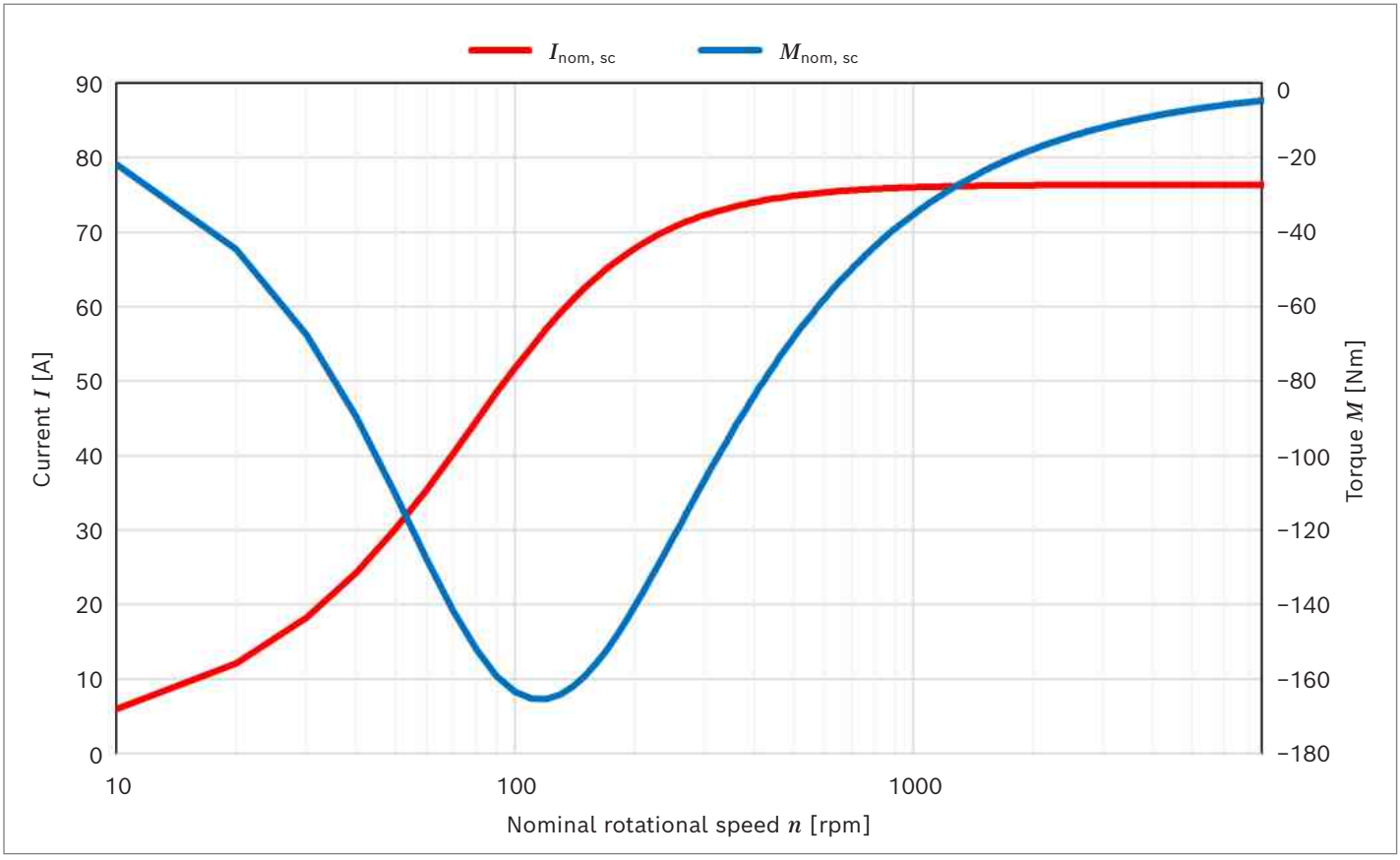
▼ Torque EMS1-13H15



▼ Power EMS1-13H15



▼ **Short circuit current and short circuit braking torque EMS1-13H15**



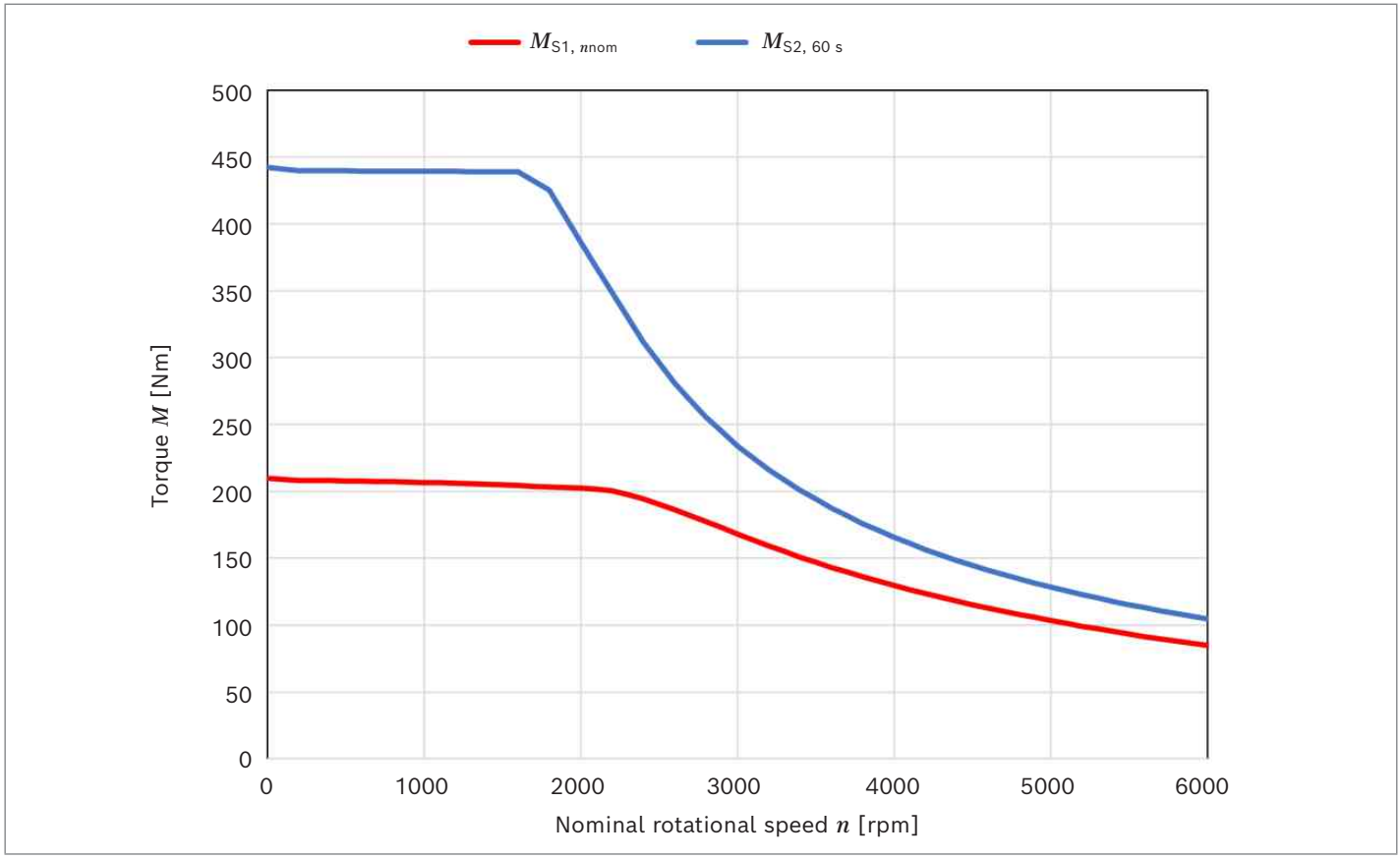
EMS1-13H20

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	208
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	72
Nominal rotational speed	n_{nom}	rpm	2000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	202
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	71
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	42
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	92.96
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	442
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	174
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	81
Maximum rotational speed	n_{max}	rpm	6000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	15
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	58
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	17
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	81.28
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	120
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	70
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	54
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	4320
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	94.09
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	18
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	102
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	165
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	102
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

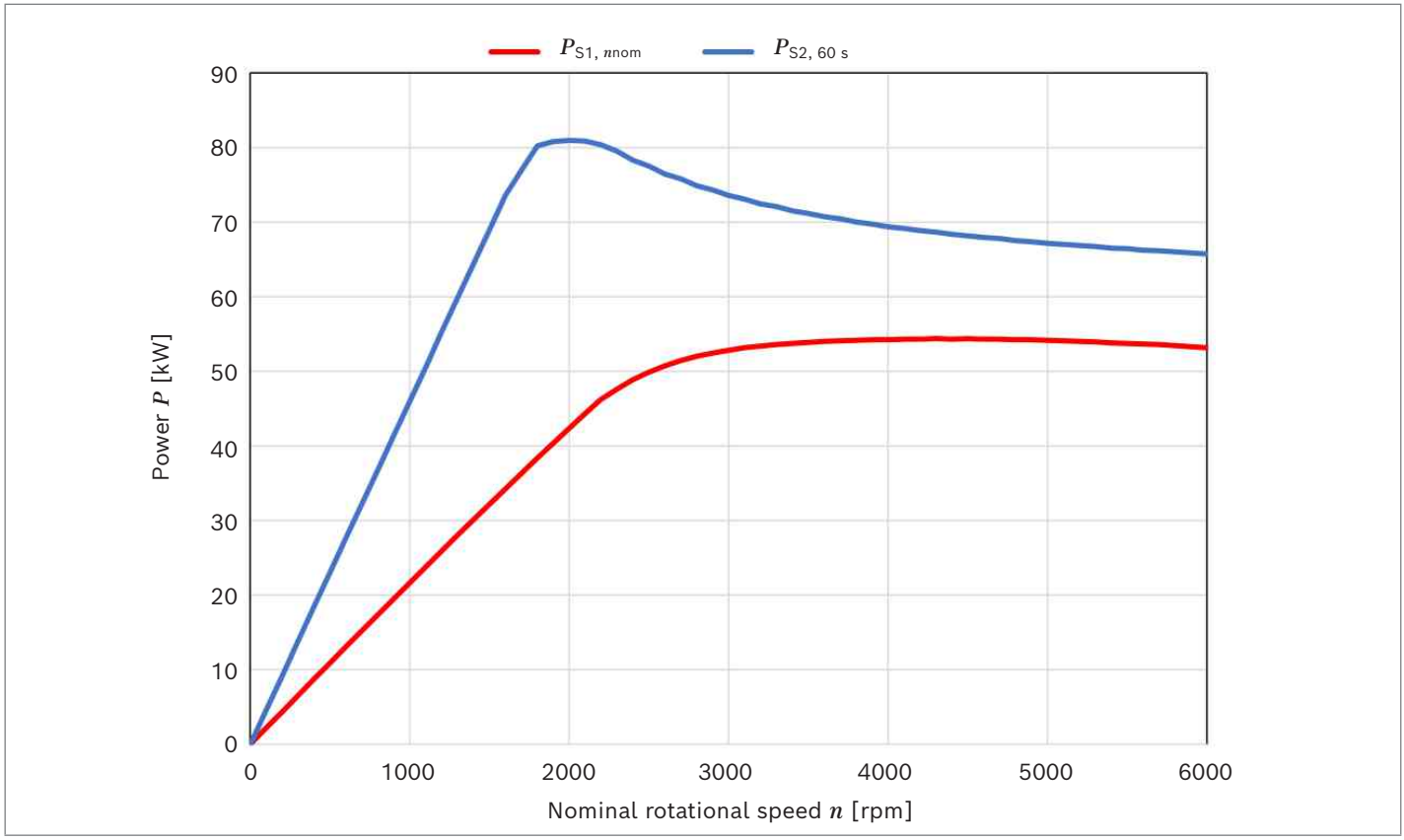
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	161.4
Torque constant at 25 °C	k_T	Nm / A_{RMS}	3.08
Synchronous inductance (d-axis) at rated current	L_d	mH	3.3
Synchronous inductance (q-axis) at rated current	L_q	mH	8
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.246
Cogging torque (unskewed)	M_{cog}	Nm	0.85
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	3.04

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

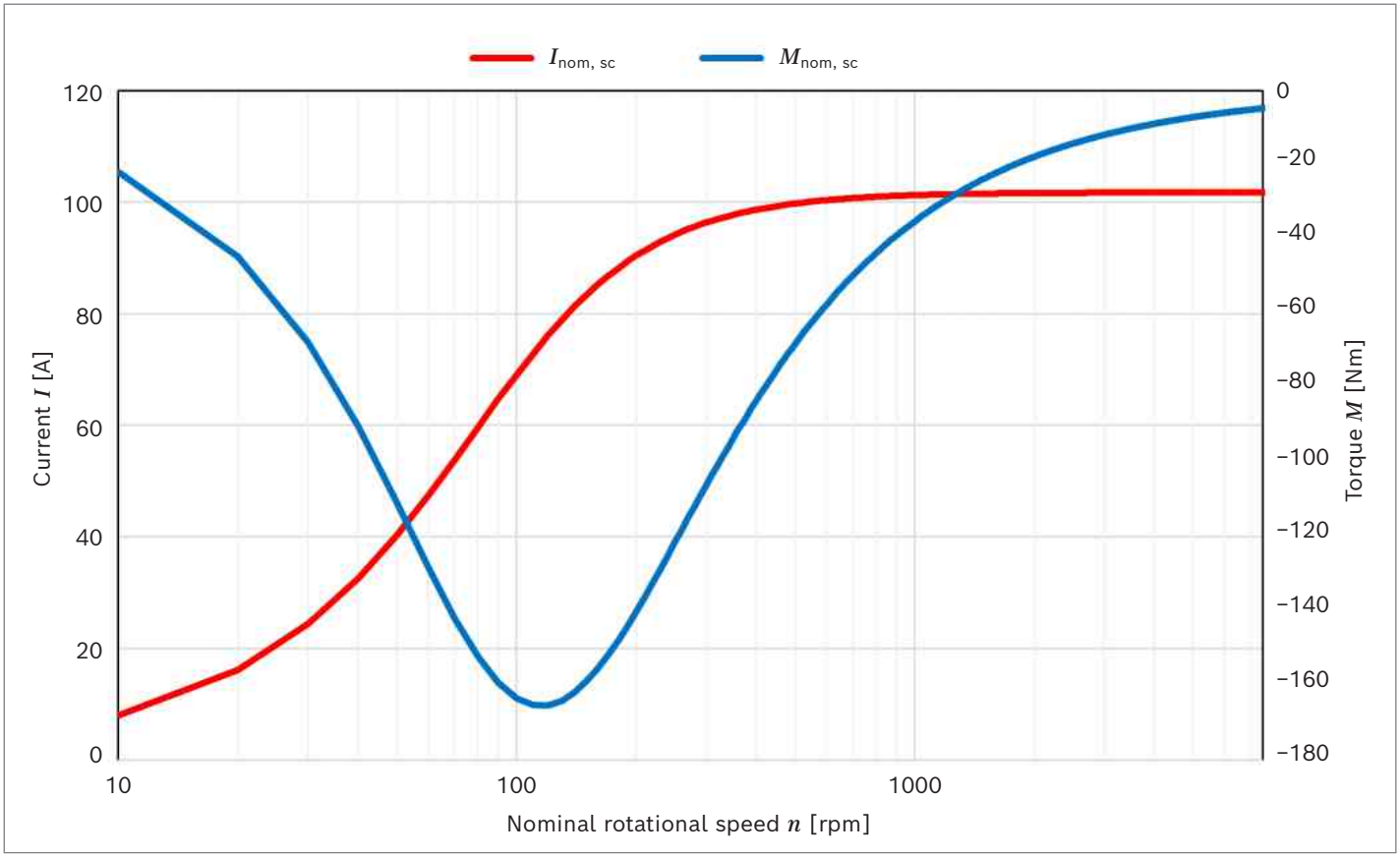
▼ **Torque EMS1-13H20**



▼ **Power EMS1-13H20**



▼ Short circuit current and short circuit braking torque EMS1-13H20



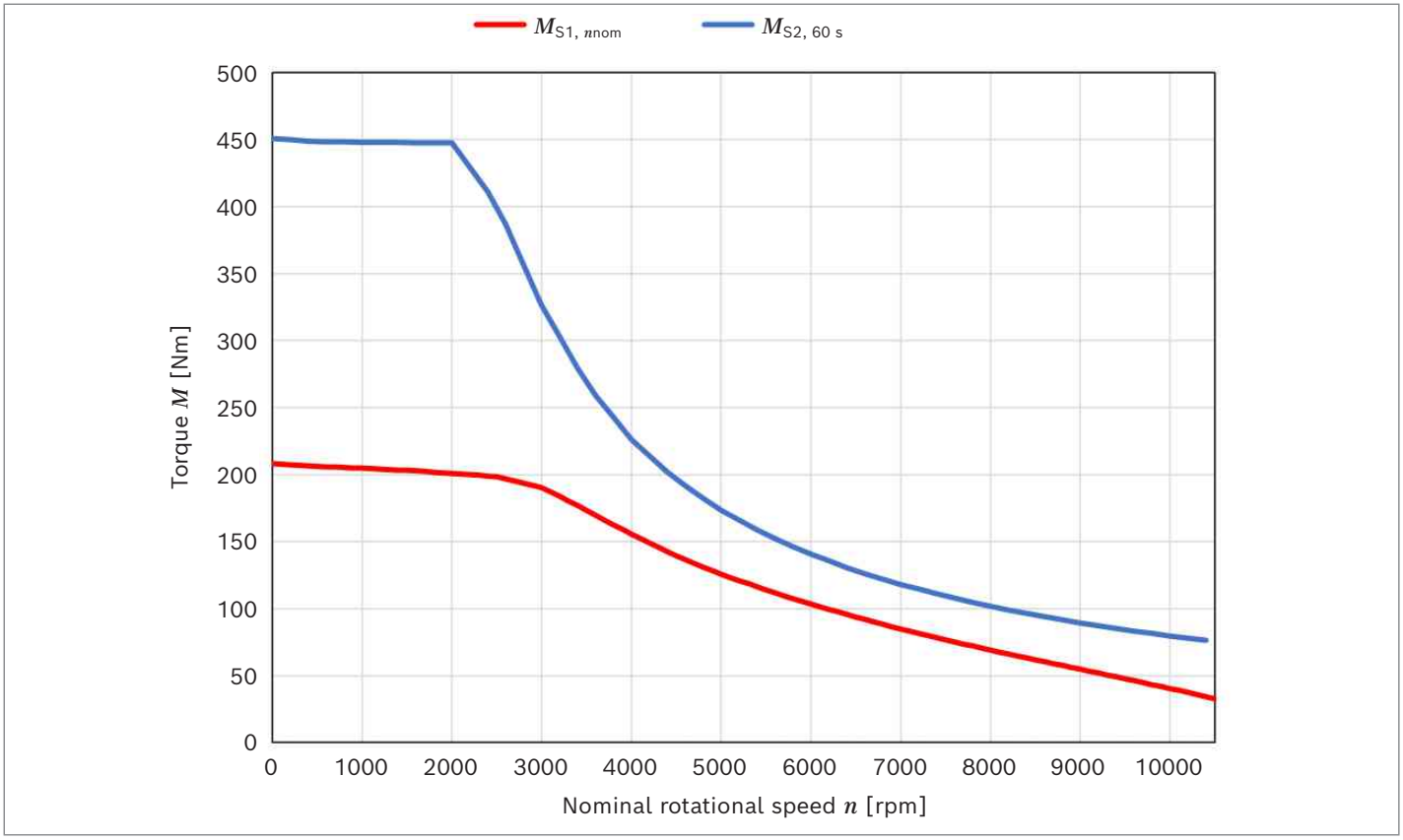
EMS1-13H25

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	207
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	88
Nominal rotational speed	n_{nom}	rpm	2500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	199
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	86
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	52
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	94.02
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	451
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	215
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	105
Maximum rotational speed	n_{max}	rpm	10500
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	33
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	69
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	36
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	91.25
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	130
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	85
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	66
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	4830
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	94.93
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	14
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	126
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	165
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	126
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

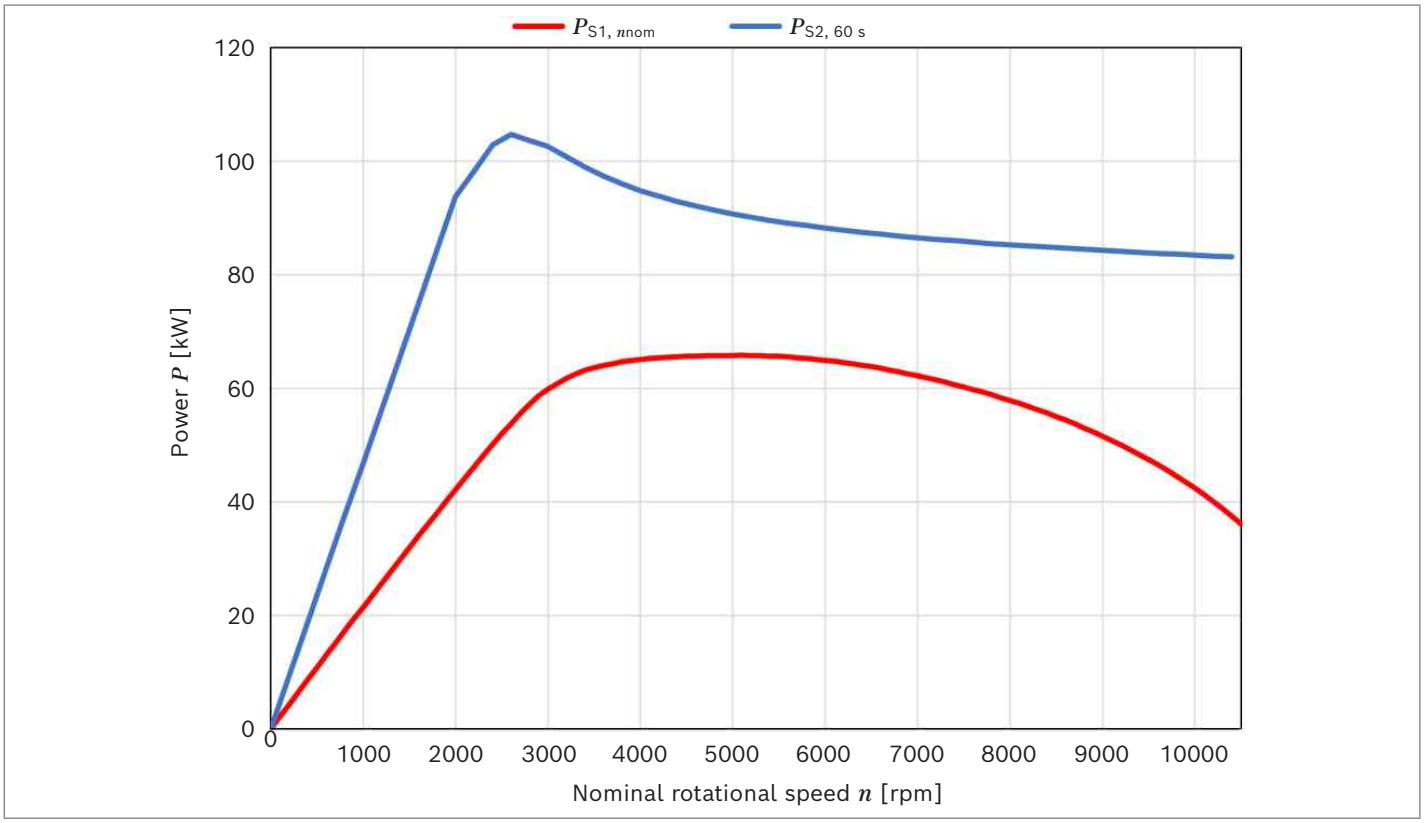
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	133.7
Torque constant at 25 °C	k_T	Nm / A_{RMS}	2.53
Synchronous inductance (d-axis) at rated current	L_d	mH	2.5
Synchronous inductance (q-axis) at rated current	L_q	mH	5.2
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.1576
Cogging torque (unskewed)	M_{cog}	Nm	0.85
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	2.83

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

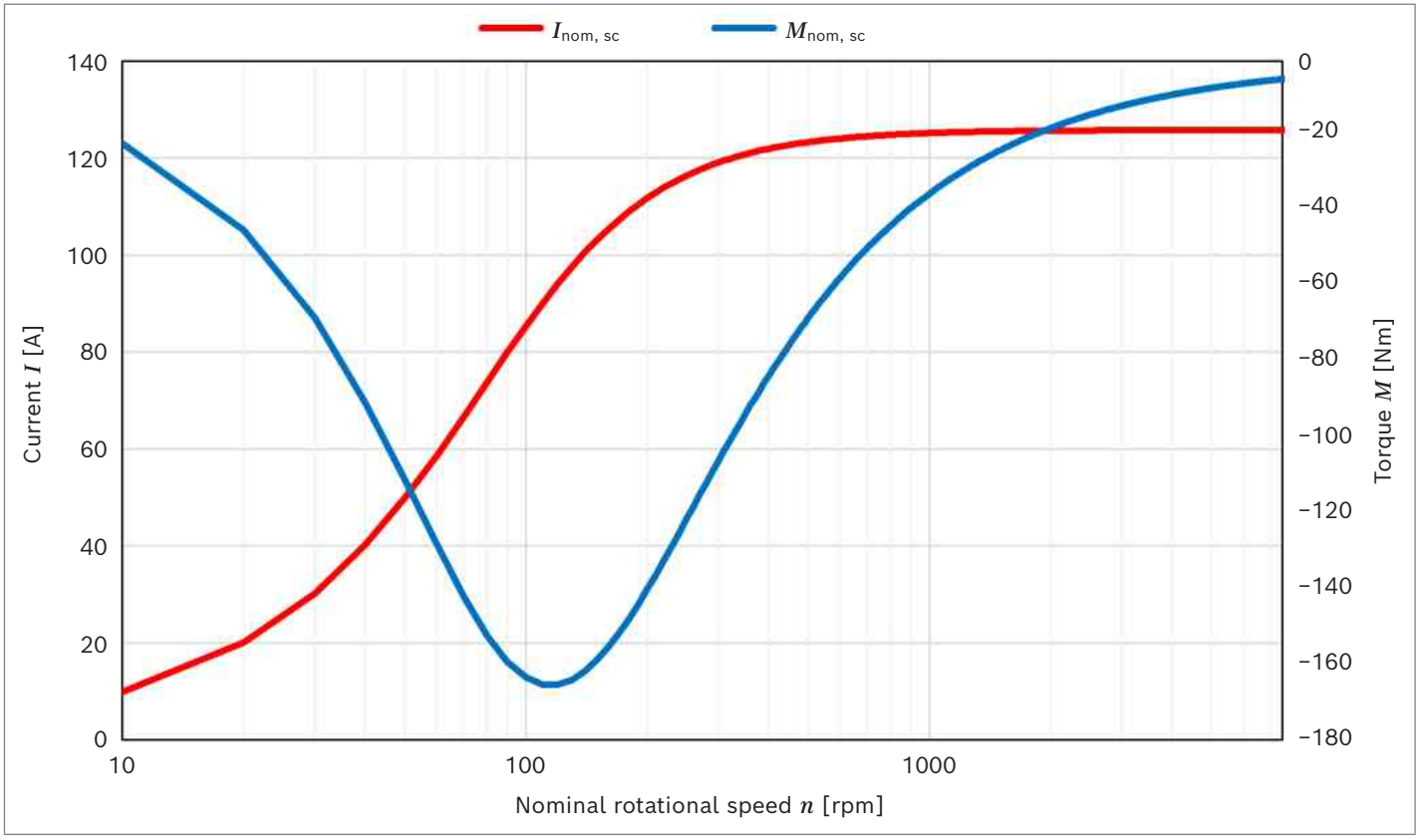
▼ Torque EMS1-13H25



▼ Power EMS1-13H25



▼ **Short circuit current and short circuit braking torque EMS1-13H25**



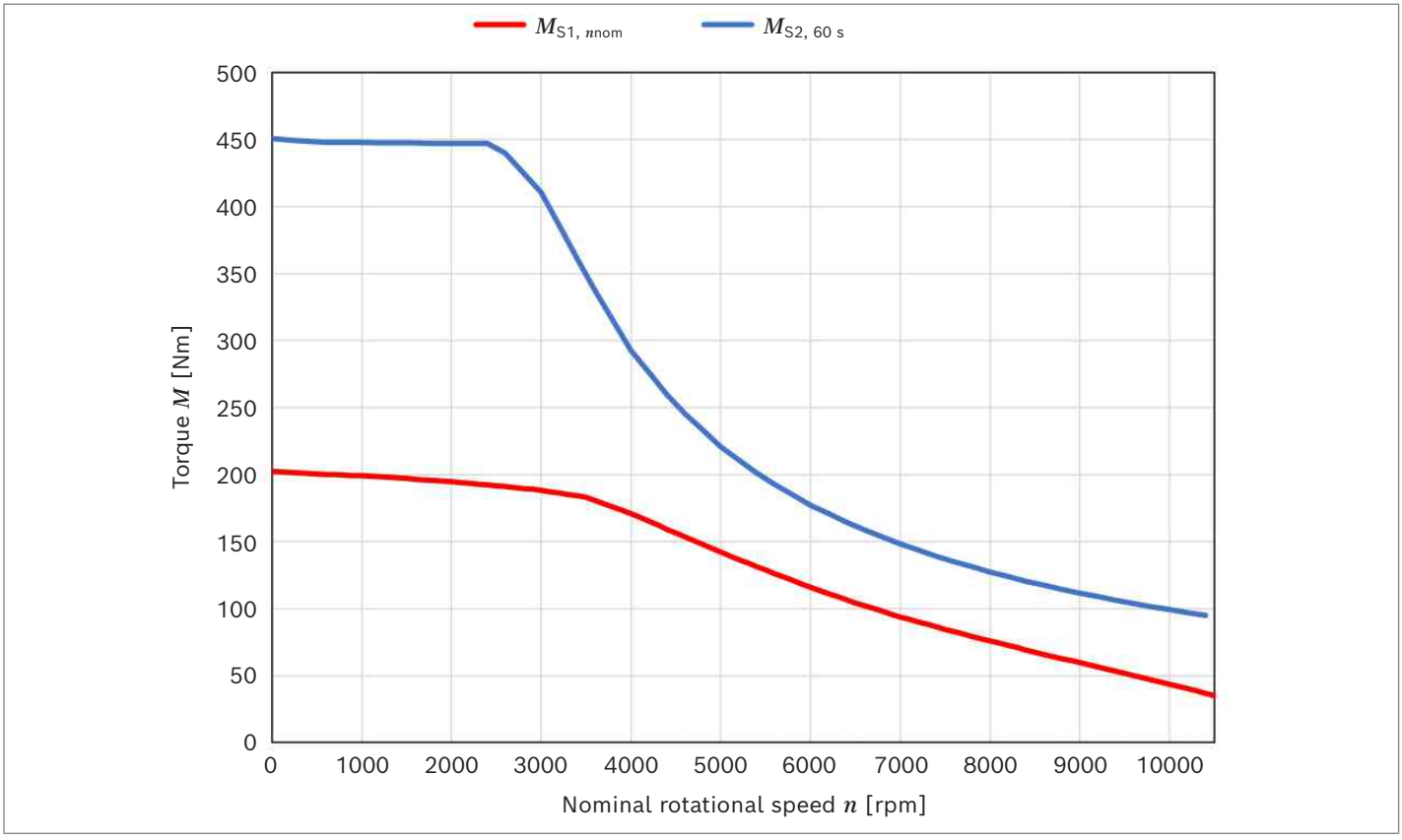
EMS1-13H30

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	202
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	104
Nominal rotational speed	n_{nom}	rpm	3000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	188
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	100
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	59
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	94.69
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	451
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	262
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	129
Maximum rotational speed	n_{max}	rpm	10500
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	35
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	74
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	39
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	91.47
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	138
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	96
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	74
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	5145
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	95.39
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	12
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	153
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	165
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	153
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

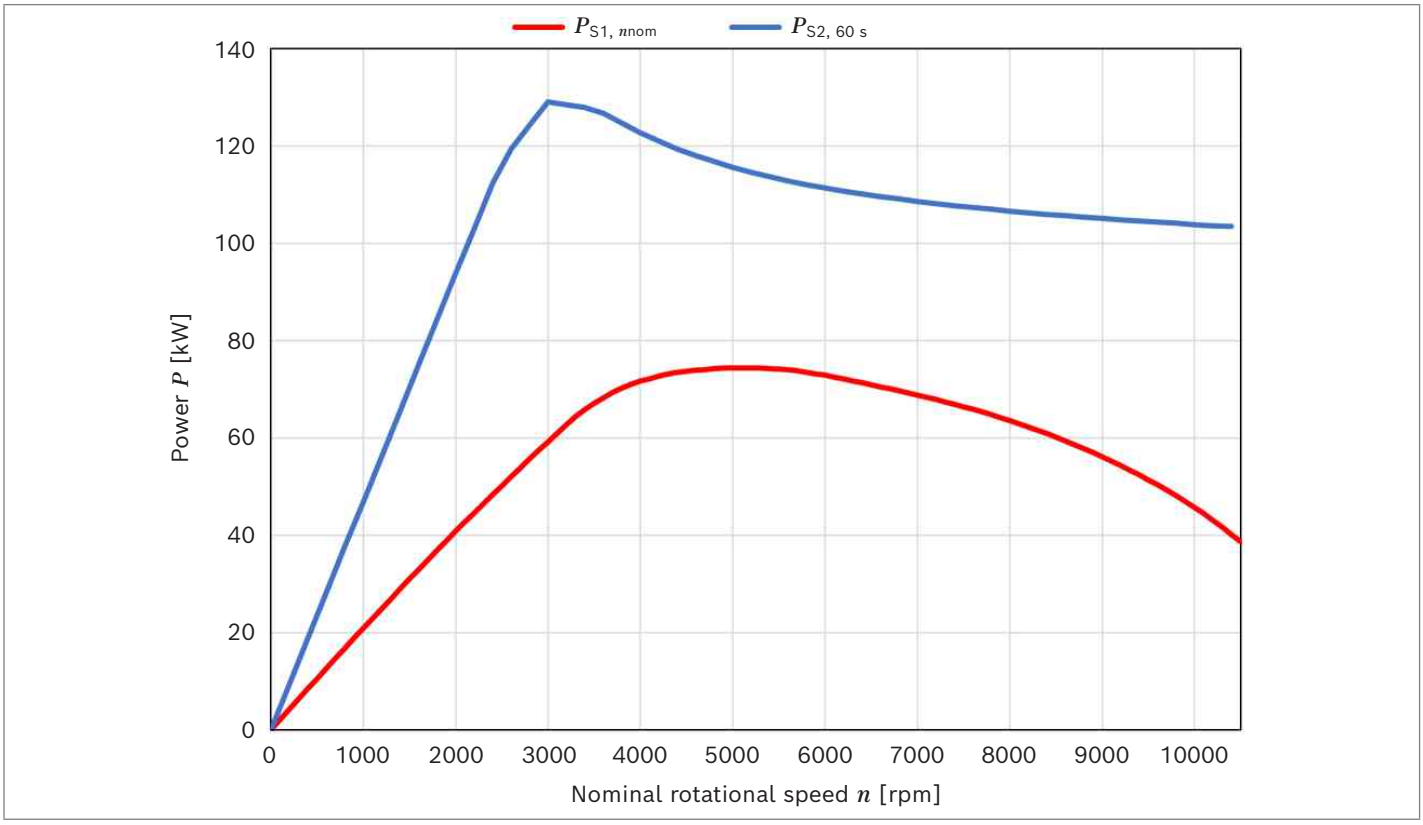
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	107.6
Torque constant at 25 °C	k_T	Nm / A_{RMS}	2.01
Synchronous inductance (d-axis) at rated current	L_d	mH	1.69
Synchronous inductance (q-axis) at rated current	L_q	mH	3.53
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.1087
Cogging torque (unskewed)	M_{cog}	Nm	0.85
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	2.18

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

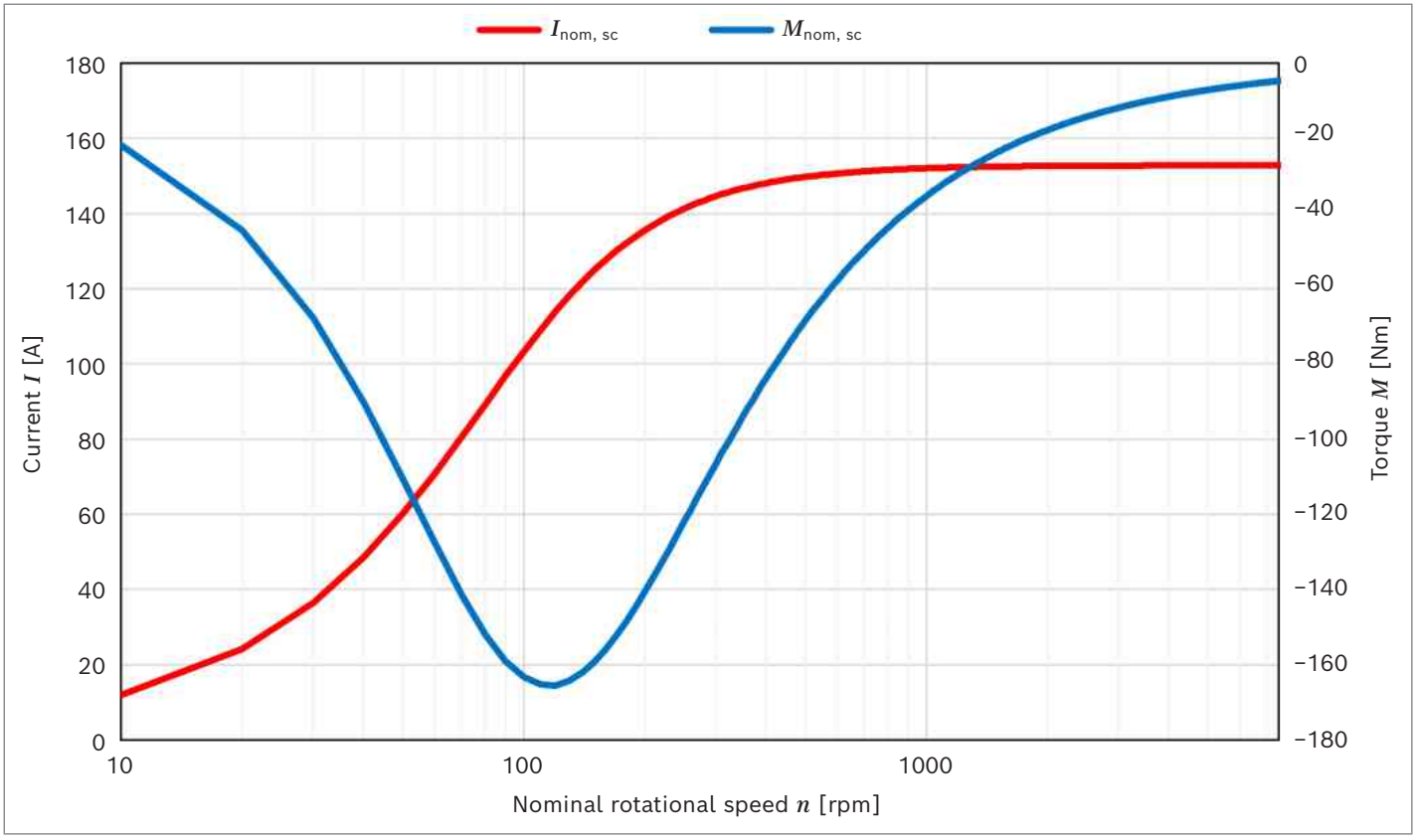
▼ **Torque EMS1-13H30**



▼ **Power EMS1-13H30**



▼ Short circuit current and short circuit braking torque EMS1-13H30



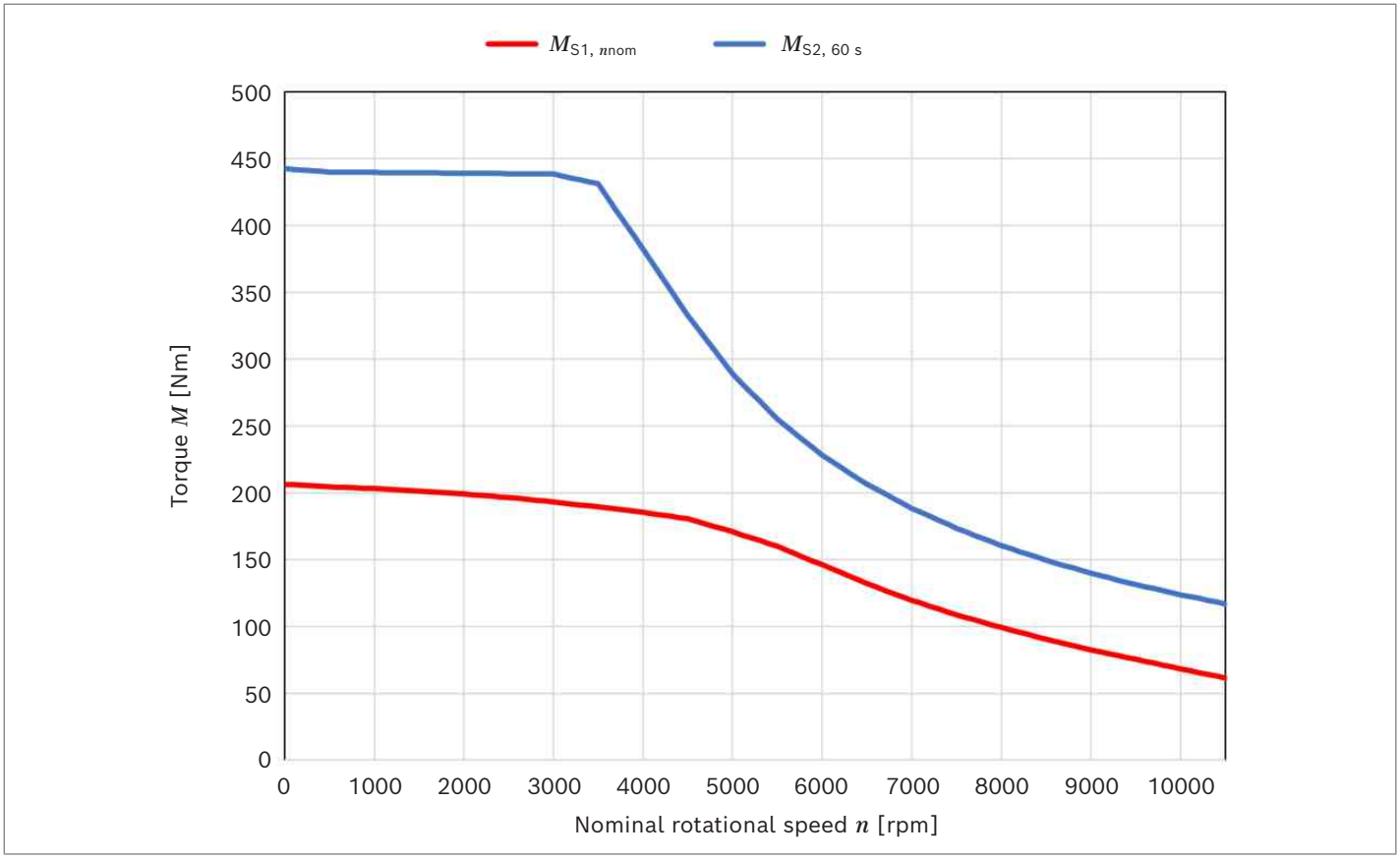
EMS1-13H40

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	206
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	135
Nominal rotational speed	n_{nom}	rpm	4000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	185
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	127
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	78
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	95.46
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	443
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	333
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	160
Maximum rotational speed	n_{max}	rpm	10500
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	61
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	96
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	68
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	95.06
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	155
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	122
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	92
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	5670
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	96.01
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	9
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	194
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	165
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	194
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

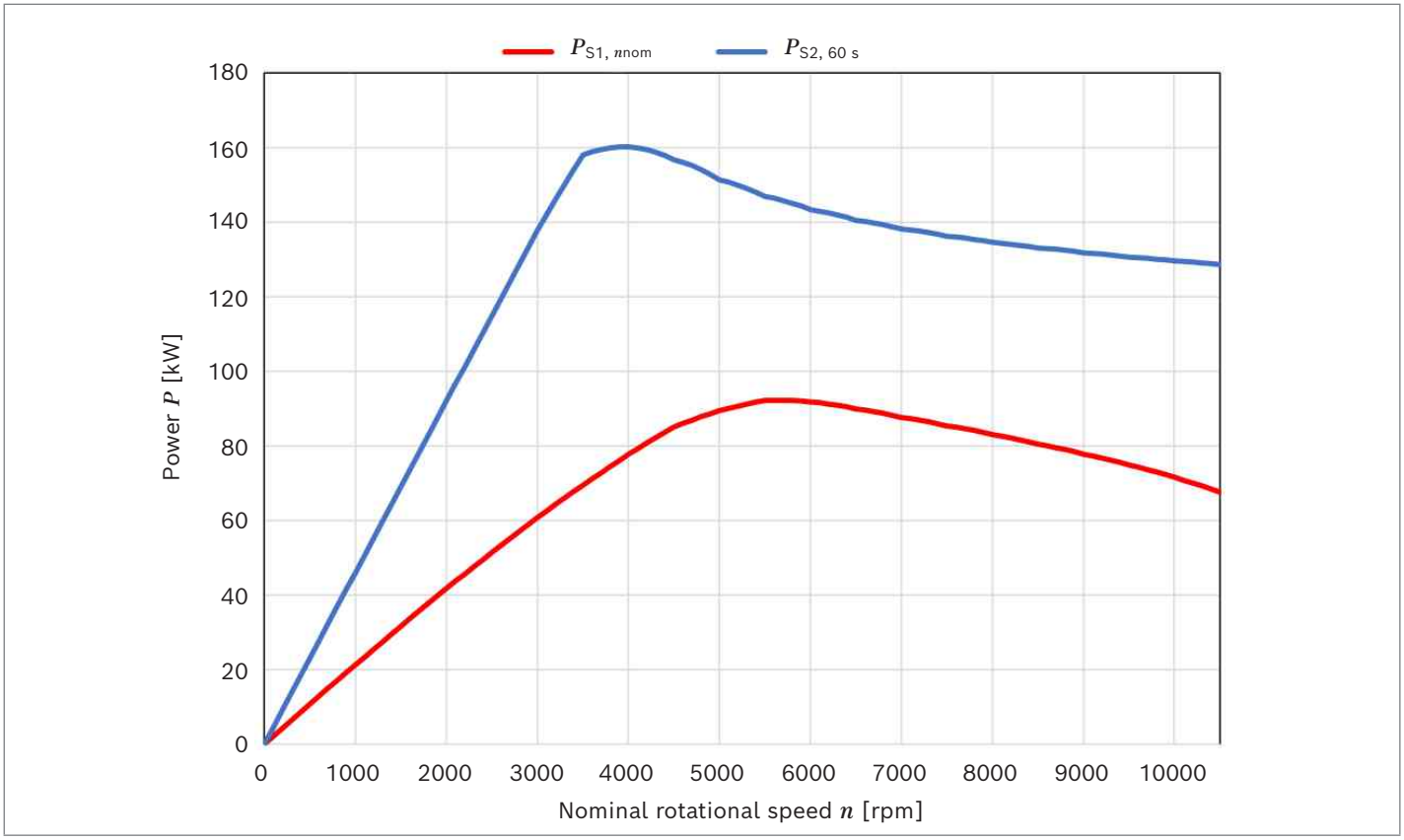
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	86.2
Torque constant at 25 °C	k_T	Nm / A_{RMS}	1.62
Synchronous inductance (d-axis) at rated current	L_d	mH	0.76
Synchronous inductance (q-axis) at rated current	L_q	mH	2.28
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.067
Cogging torque (unskewed)	M_{cog}	Nm	0.85
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	2.17

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

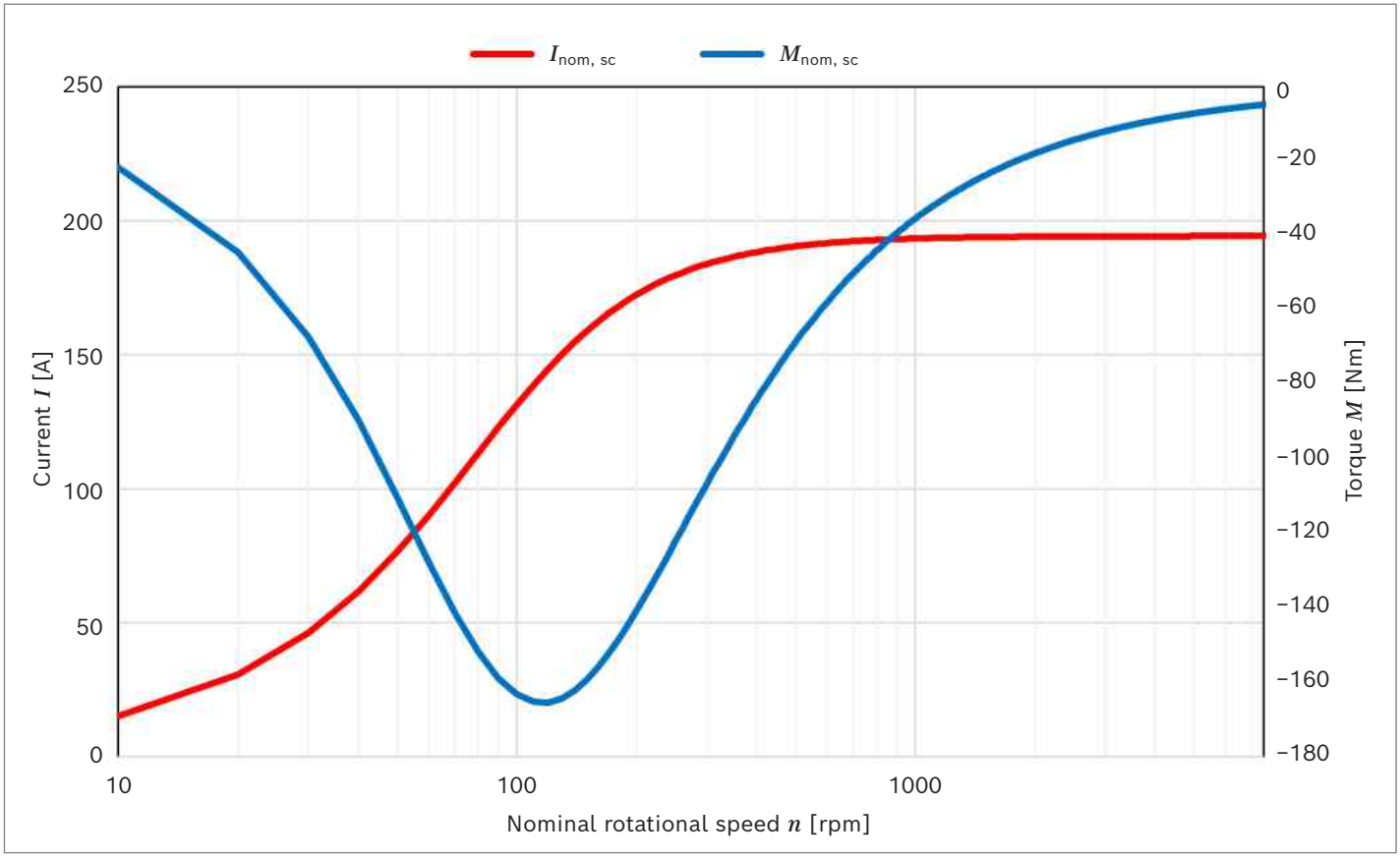
▼ Torque EMS1-13H40



▼ Power EMS1-13H40



▼ **Short circuit current and short circuit braking torque EMS1-13H40**



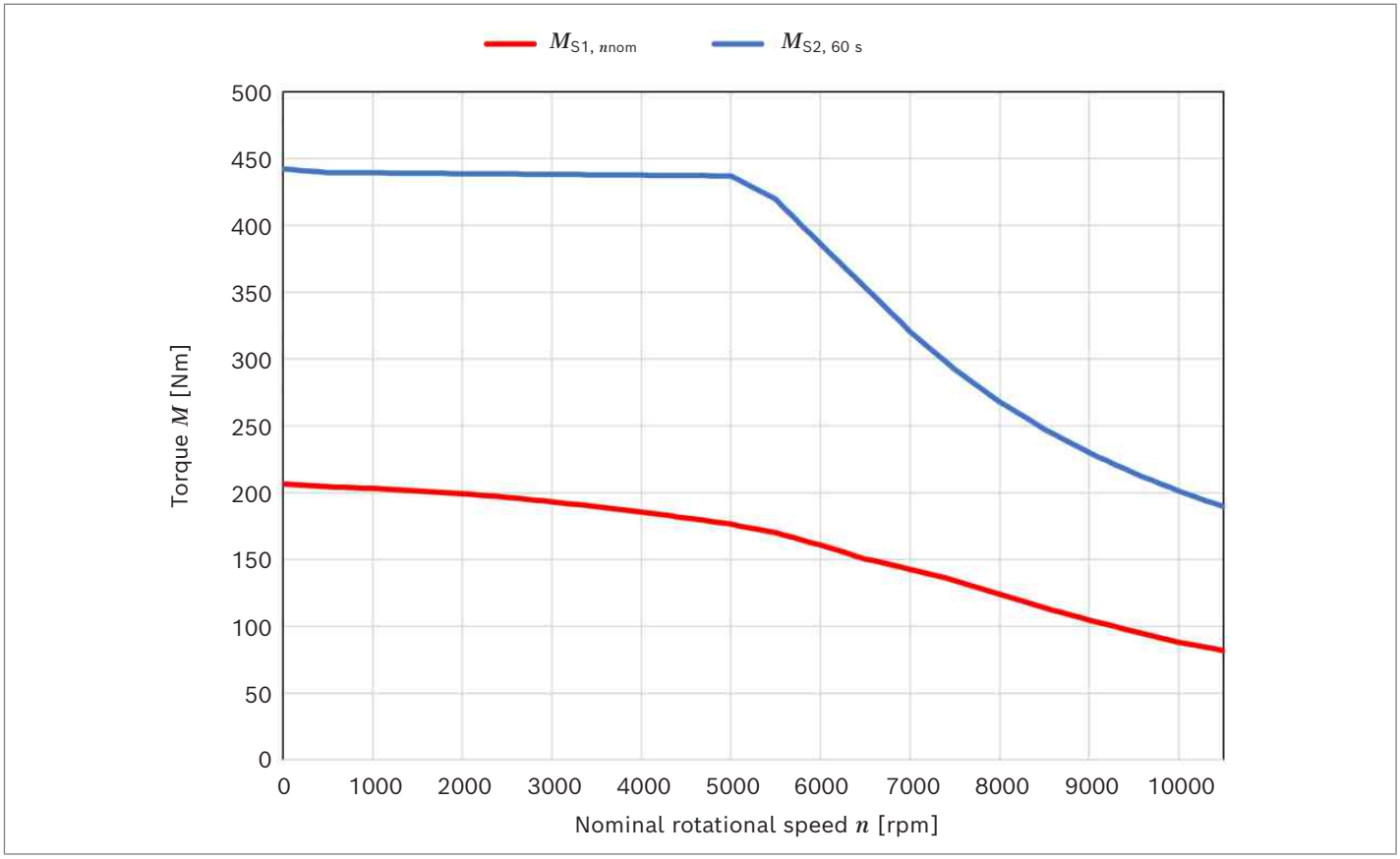
EMS1-13H60

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	206
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	202
Nominal rotational speed	n_{nom}	rpm	6000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	161
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	168
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	101
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	96.17
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	442
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	499
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	243
Maximum rotational speed	n_{max}	rpm	10500
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	82
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	115
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	90
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	96.06
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	135
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	147
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	105
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	7455
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	96.36
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	6
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	292
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	165
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	292
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

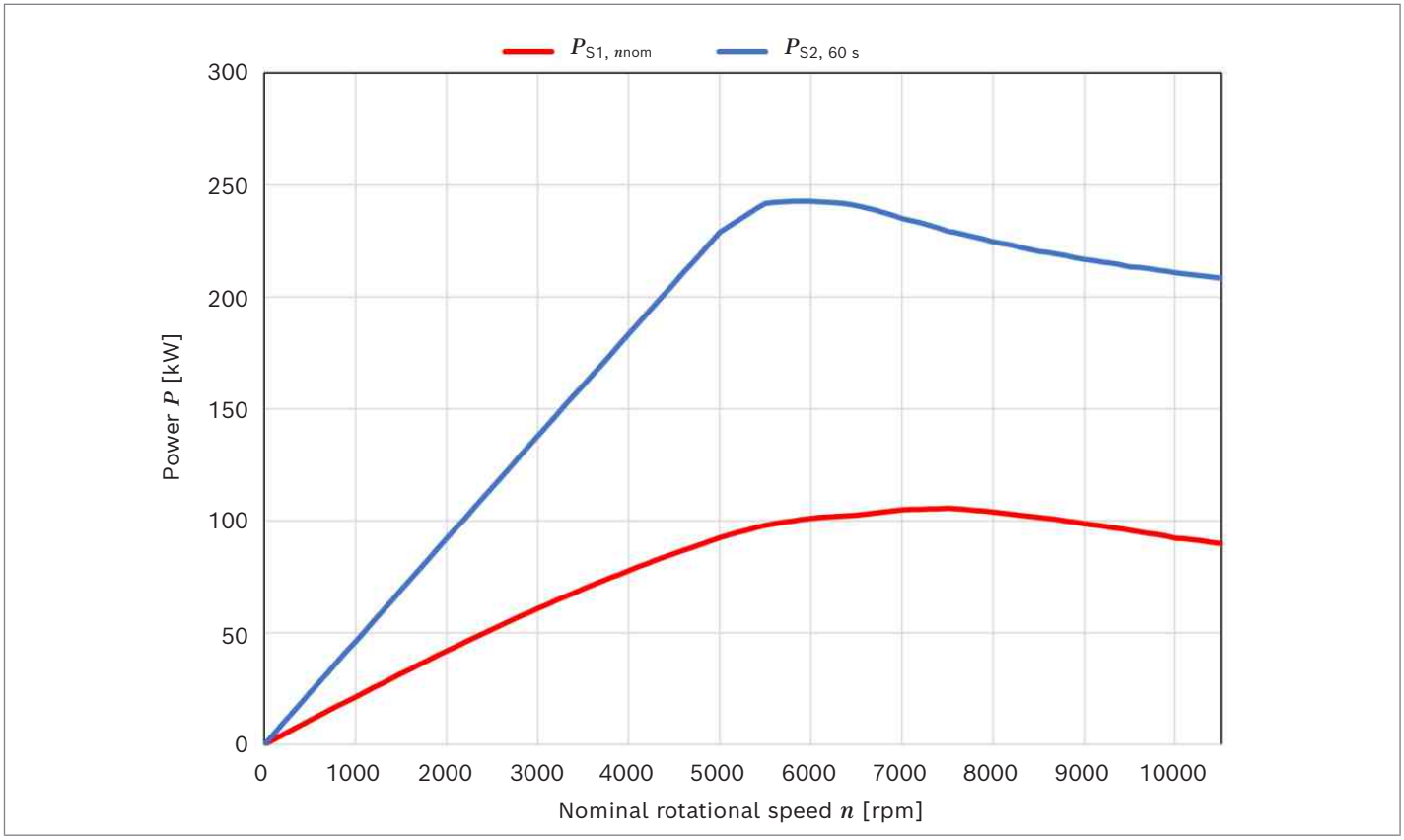
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	56.4
Torque constant at 25 °C	k_T	Nm / A_{RMS}	1.08
Synchronous inductance (d-axis) at rated current	L_d	mH	0.36
Synchronous inductance (q-axis) at rated current	L_q	mH	0.97
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.03
Cogging torque (unskewed)	M_{cog}	Nm	0.85
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	1.33

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

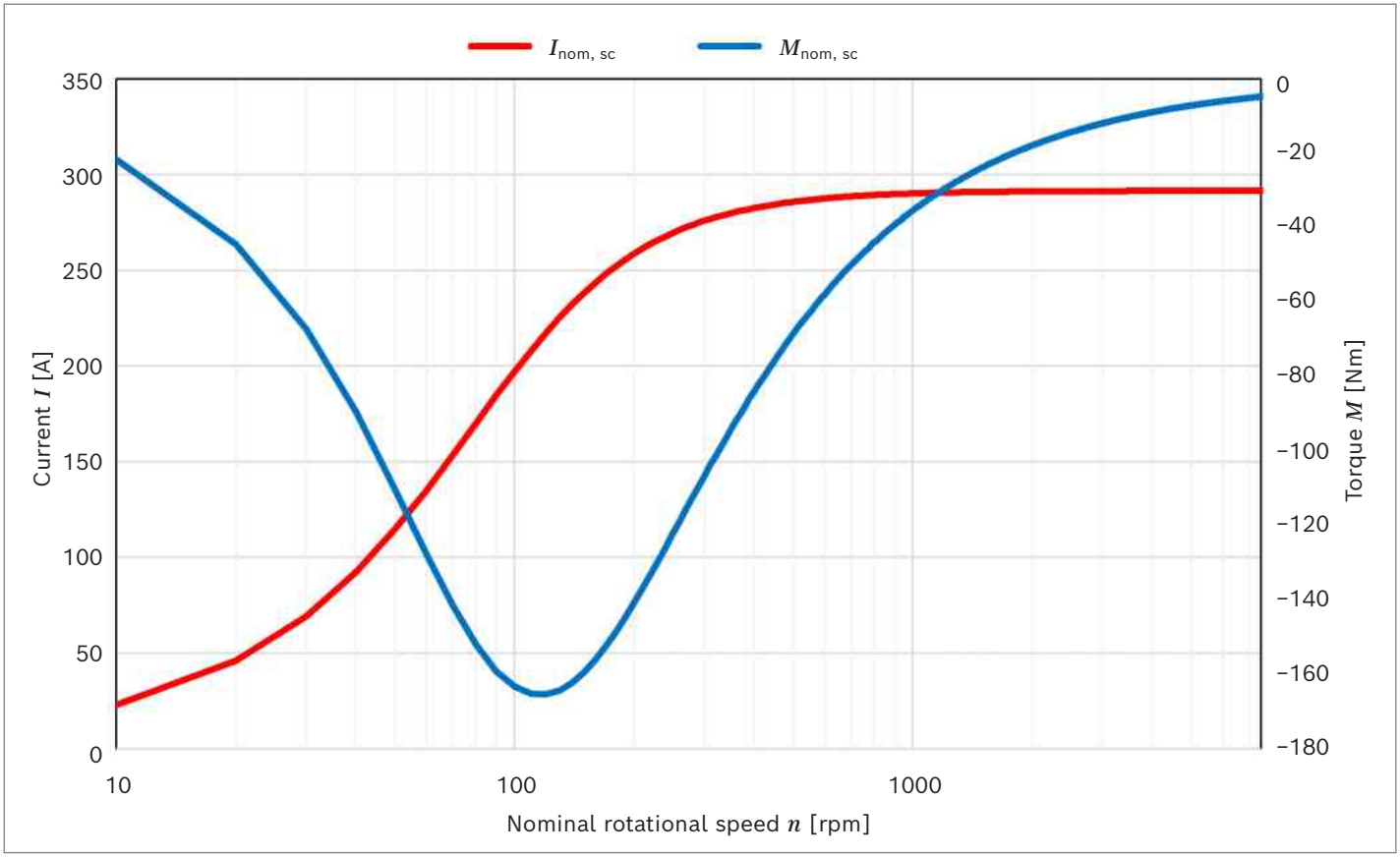
▼ **Torque EMS1-13H60**



▼ **Power EMS1-13H60**



▼ Short circuit current and short circuit braking torque EMS1-13H60



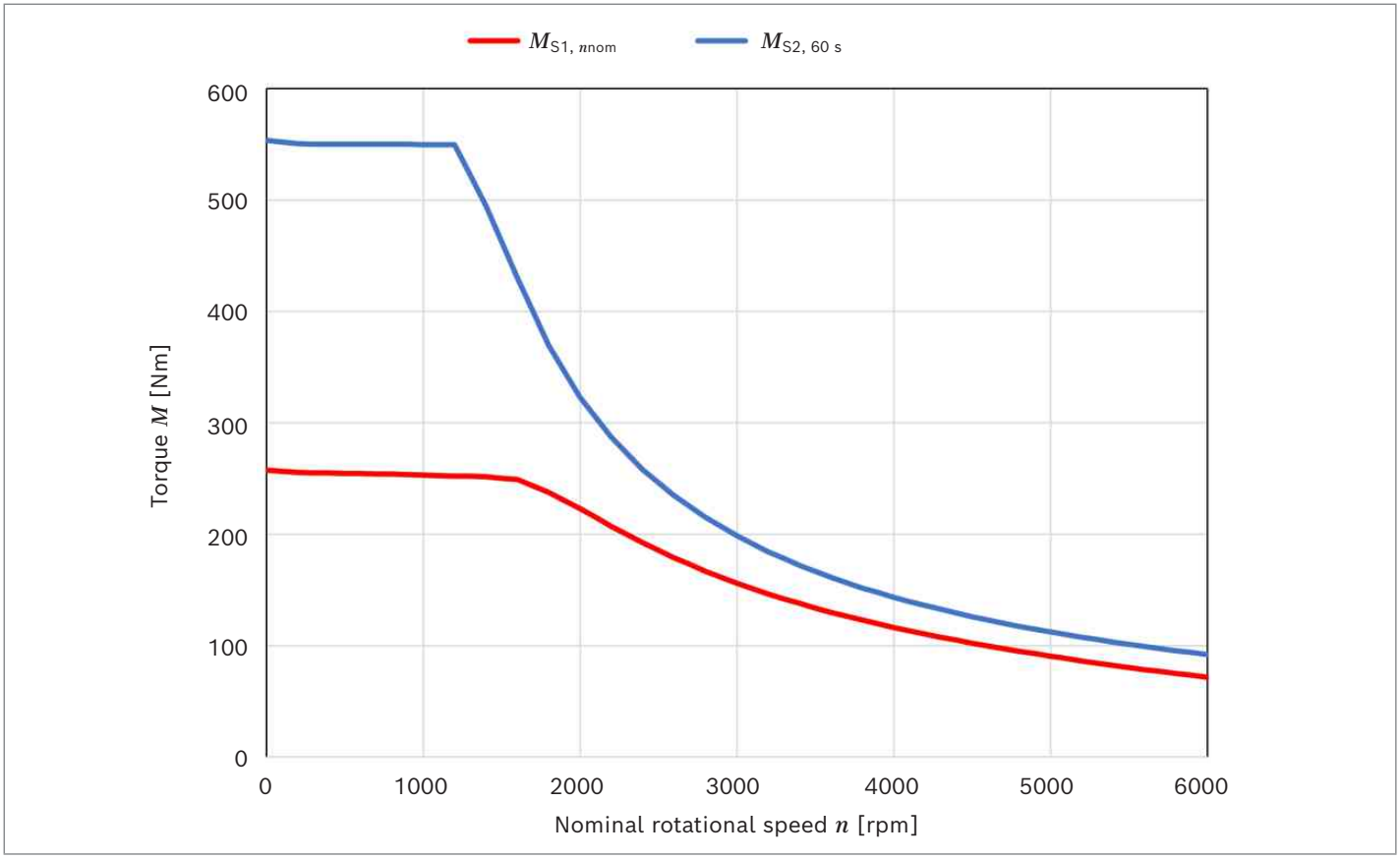
EMS1-13J15

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	255
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	64
Nominal rotational speed	n_{nom}	rpm	1500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	250
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	64
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	39
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	91.98
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	553
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	159
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	73
Maximum rotational speed	n_{max}	rpm	6000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	0
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	0
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	0
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	0.00
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	142
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	64
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	49
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	3300
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	93.15
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	27
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	93
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	208
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	93
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

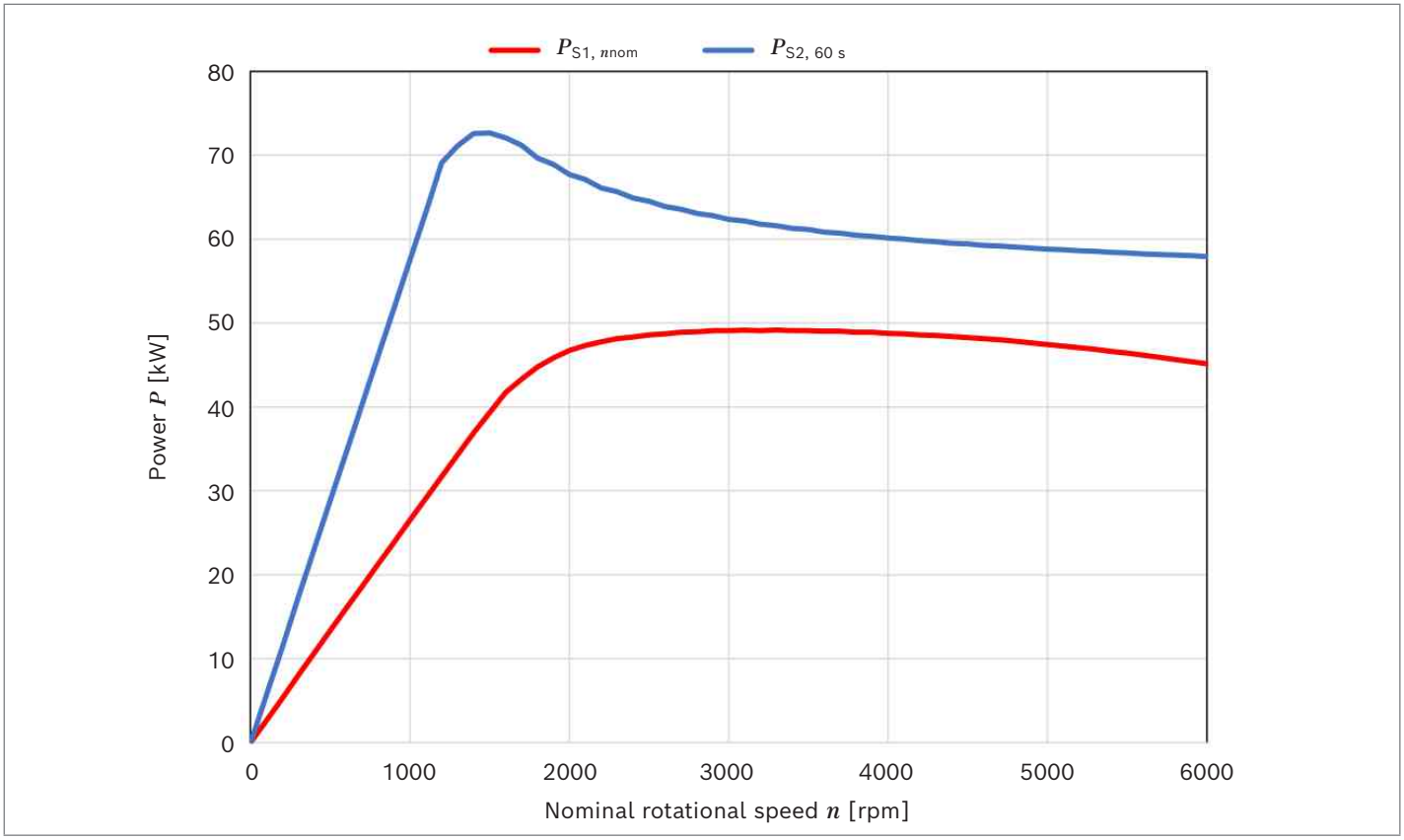
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	225.2
Torque constant at 25 °C	k_T	Nm / A_{RMS}	4.25
Synchronous inductance (d-axis) at rated current	L_d	mH	4.11
Synchronous inductance (q-axis) at rated current	L_q	mH	12.27
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.331
Cogging torque (unskewed)	M_{cog}	Nm	1.06
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	3.51

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

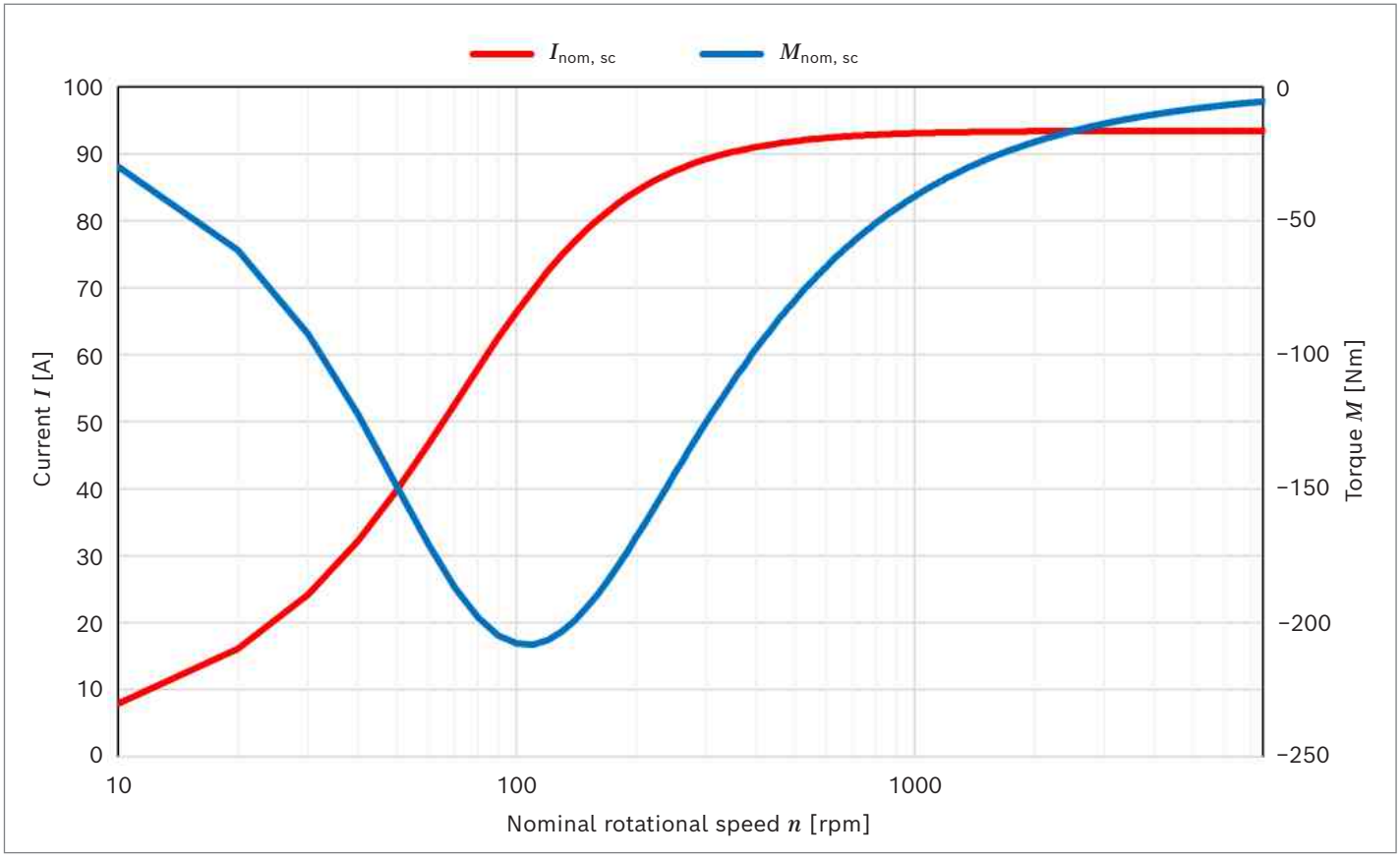
▼ Torque EMS1-13J15



▼ Power EMS1-13J15



▼ **Short circuit current and short circuit braking torque EMS1-13J15**



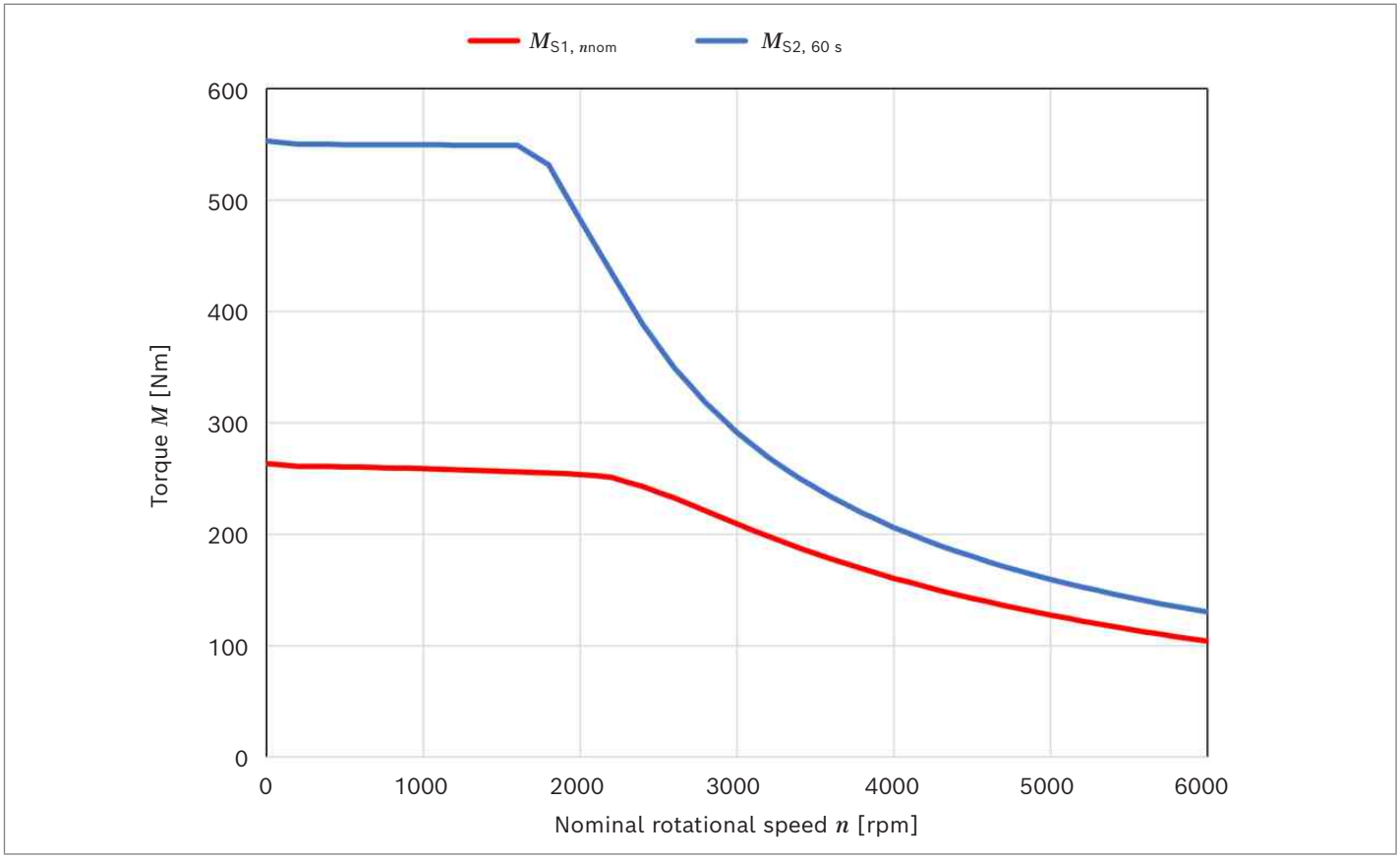
EMS1-13J20

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	261
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	89
Nominal rotational speed	n_{nom}	rpm	2000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	254
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	88
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	53
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	93.43
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	553
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	215
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	101
Maximum rotational speed	n_{max}	rpm	6000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	7
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	69
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	8
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	22.20
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	158
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	87
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	67
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	4080
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	94.44
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	21
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	126
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	208
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	126
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

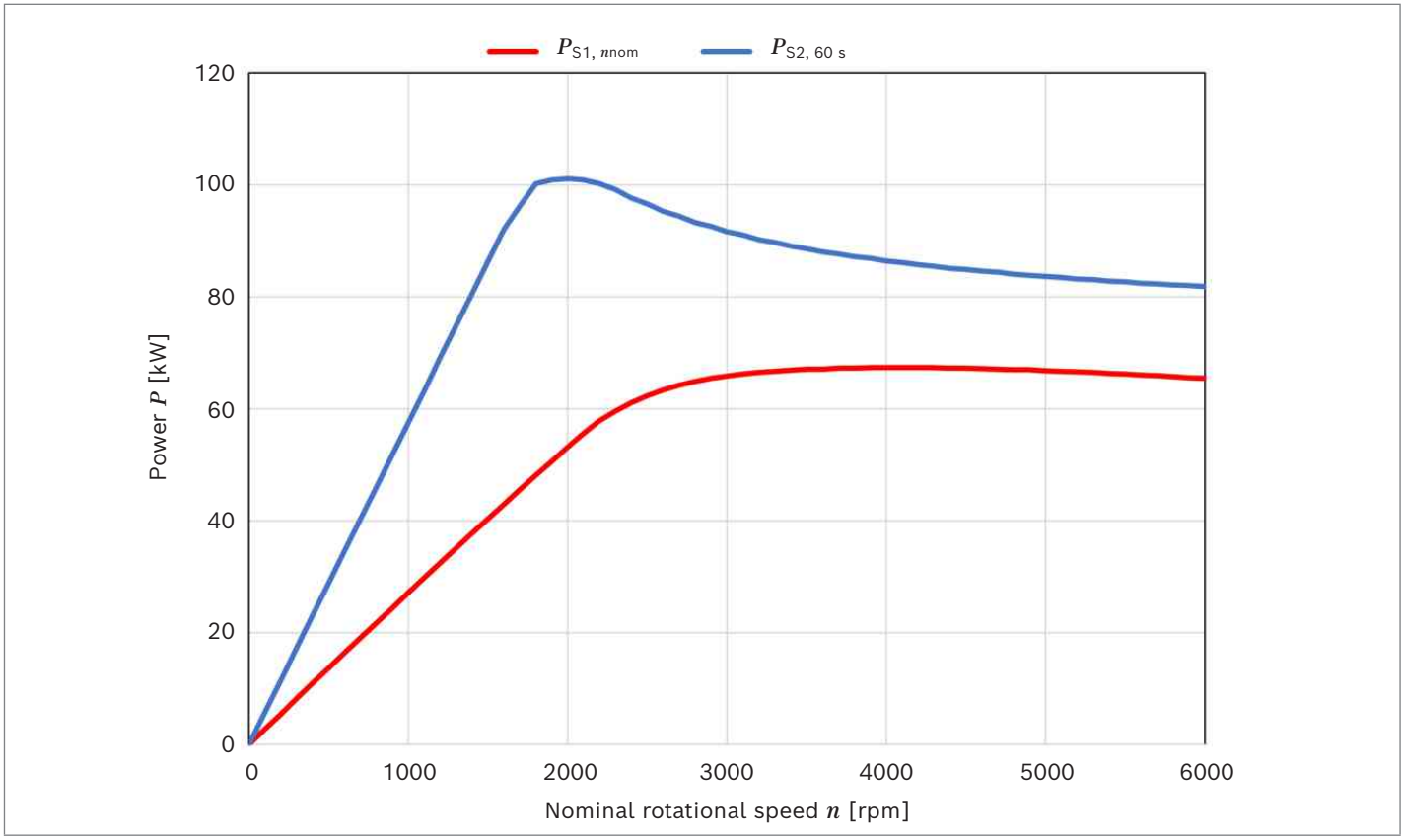
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	167.2
Torque constant at 25 °C	k_T	Nm / A_{RMS}	3.17
Synchronous inductance (d-axis) at rated current	L_d	mH	3.1
Synchronous inductance (q-axis) at rated current	L_q	mH	6.5
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.1816
Cogging torque (unskewed)	M_{cog}	Nm	1.06
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	3.85

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

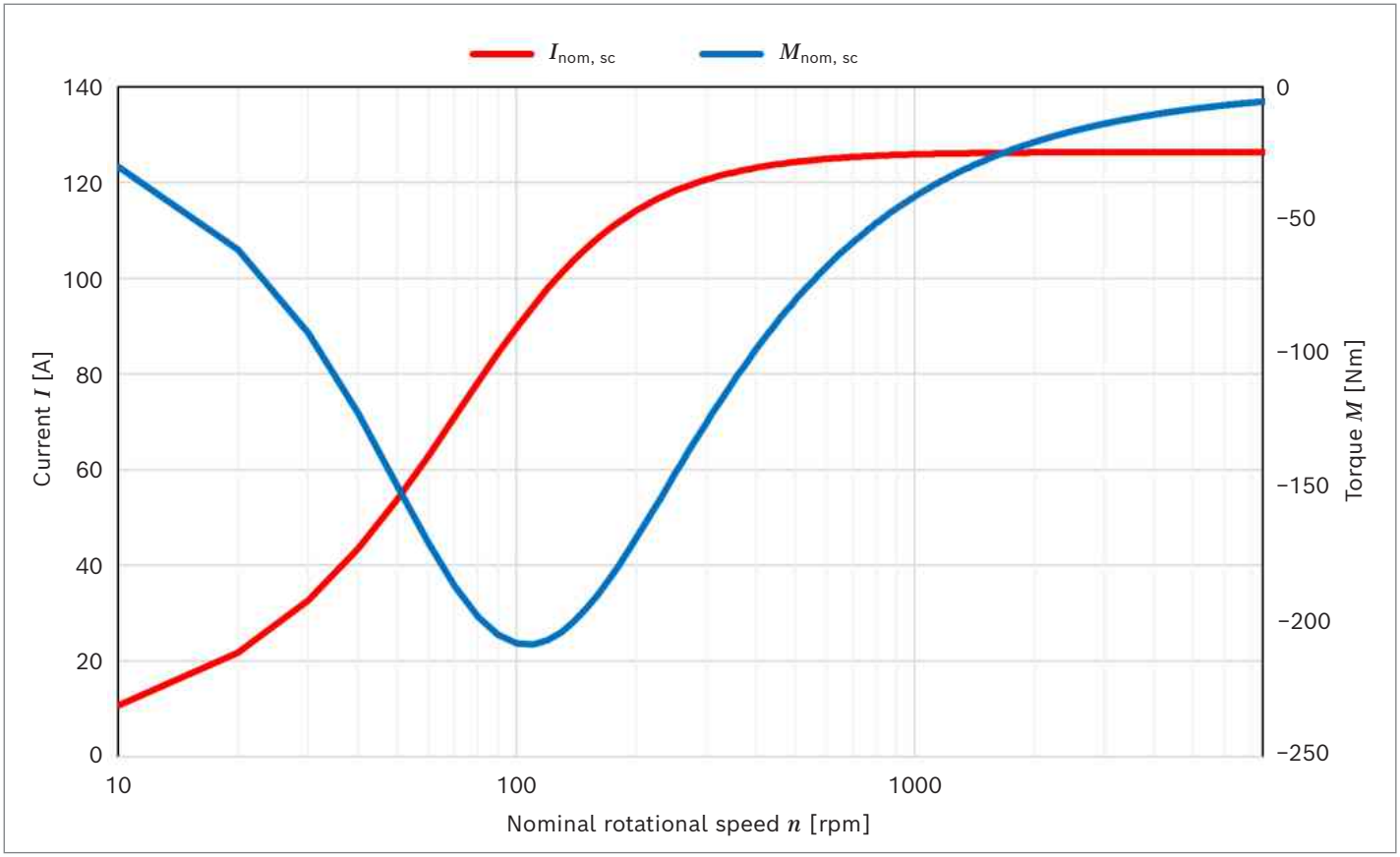
▼ **Torque EMS1-13J20**



▼ **Power EMS1-13J20**



▼ Short circuit current and short circuit braking torque EMS1-13J20



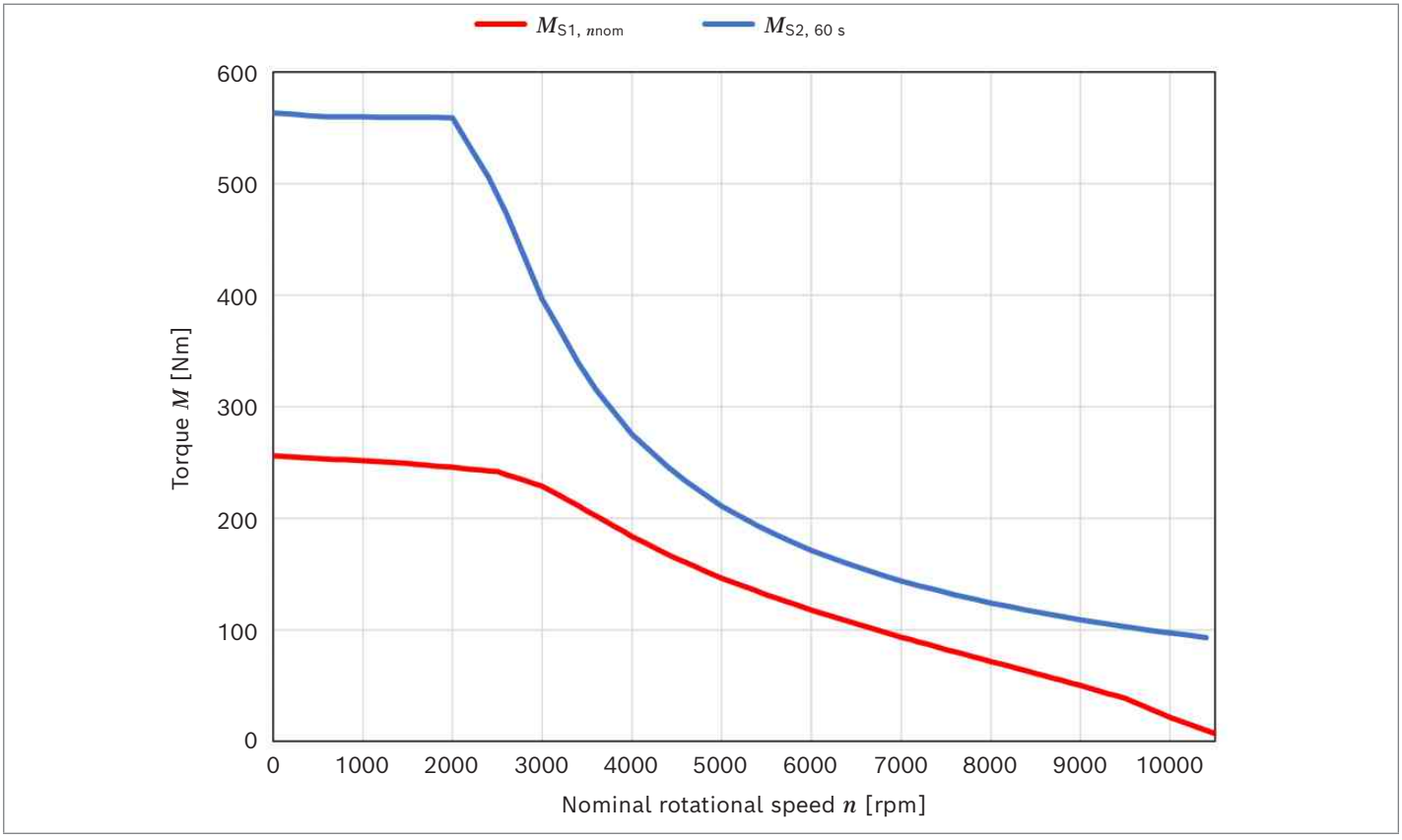
EMS1-13J25

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	255
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	105
Nominal rotational speed	n_{nom}	rpm	2500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	242
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	102
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	63
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	94.39
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	563
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	262
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	128
Maximum rotational speed	n_{max}	rpm	10500
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	7
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	76
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	8
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	22.20
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	172
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	100
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	77
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	4305
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	95.06
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	17
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	153
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	208
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	154
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

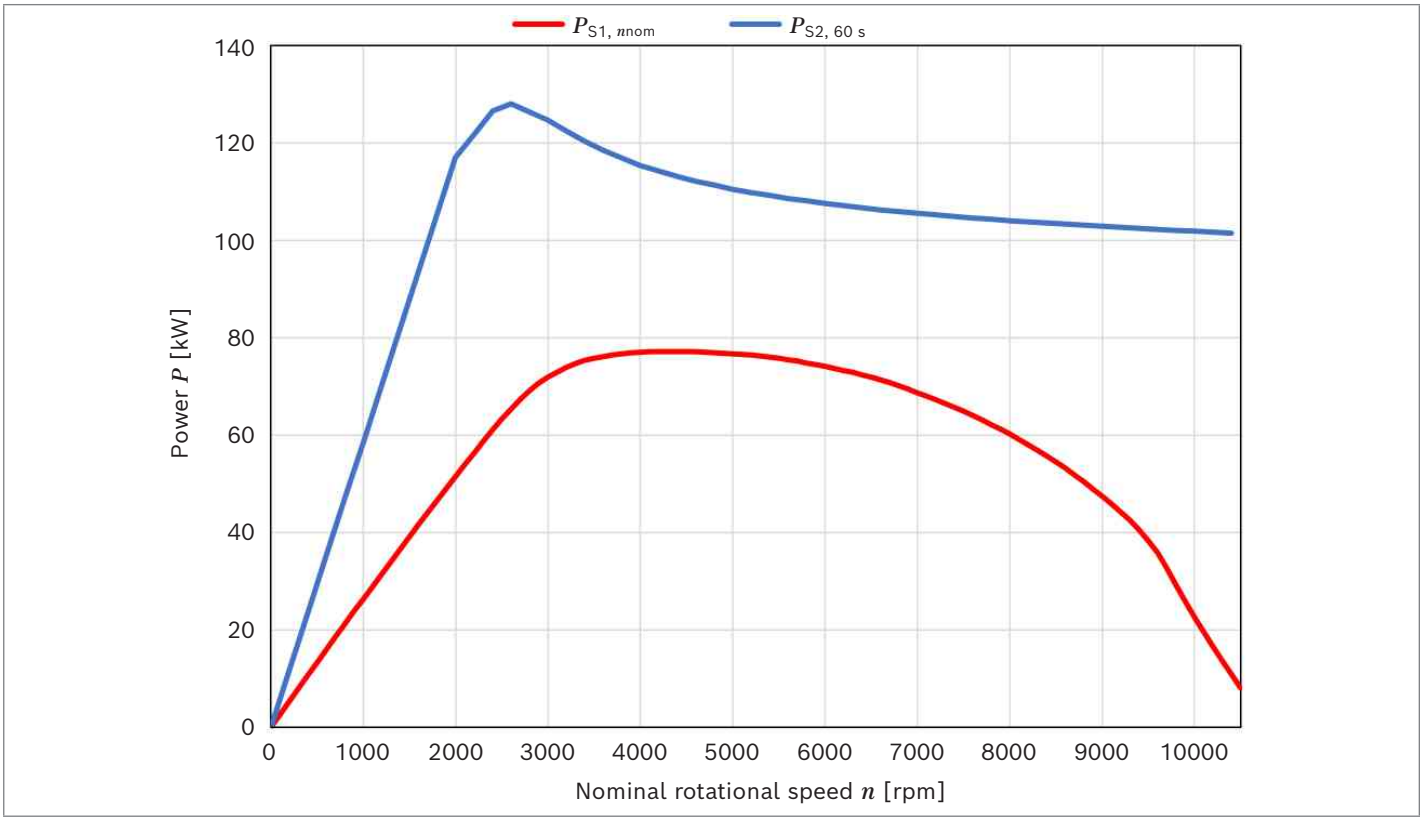
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	134.5
Torque constant at 25 °C	k_T	Nm / A_{RMS}	2.57
Synchronous inductance (d-axis) at rated current	L_d	mH	1.1
Synchronous inductance (q-axis) at rated current	L_q	mH	2.5
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.1252
Cogging torque (unskewed)	M_{cog}	Nm	1.06
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	3.08

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

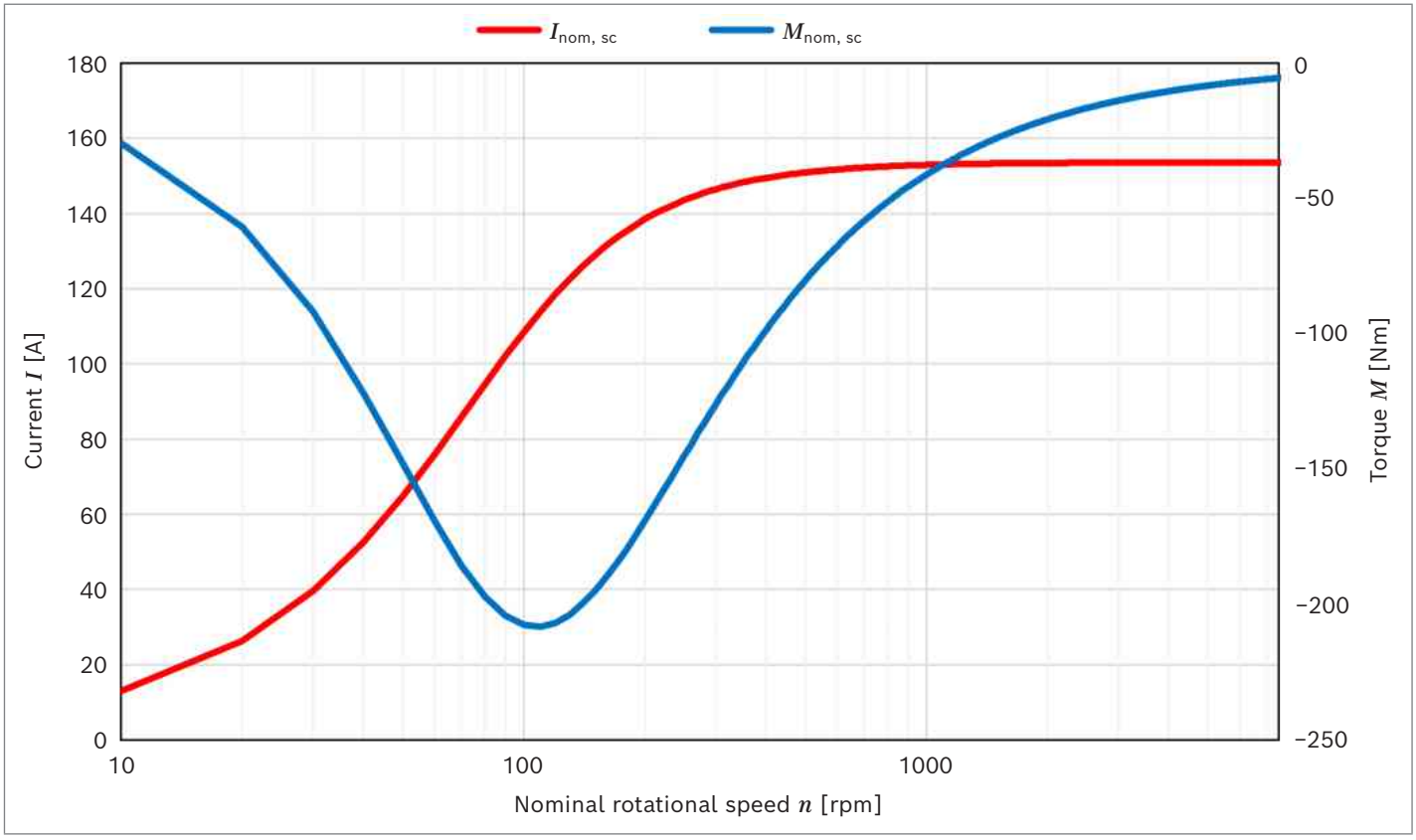
▼ Torque EMS1-13J25



▼ Power EMS1-13J25



▼ **Short circuit current and short circuit braking torque EMS1-13J25**



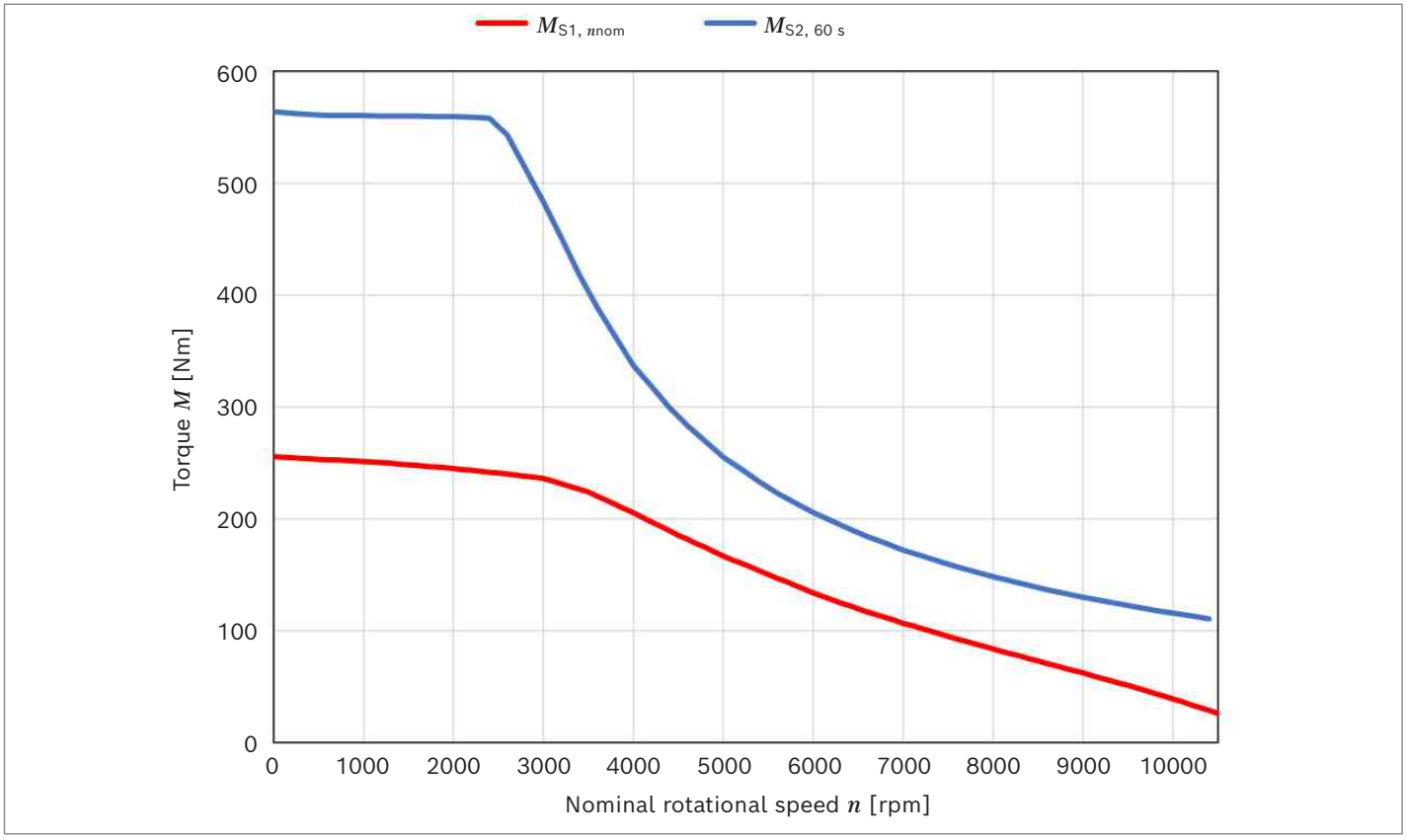
EMS1-13J30

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	255
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	122
Nominal rotational speed	n_{nom}	rpm	3000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	236
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	117
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	74
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	94.96
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	564
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	306
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	152
Maximum rotational speed	n_{max}	rpm	10500
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	26
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	84
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	29
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	86.21
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	177
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	113
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	88
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	4725
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	95.43
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	14
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	179
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	208
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	179
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

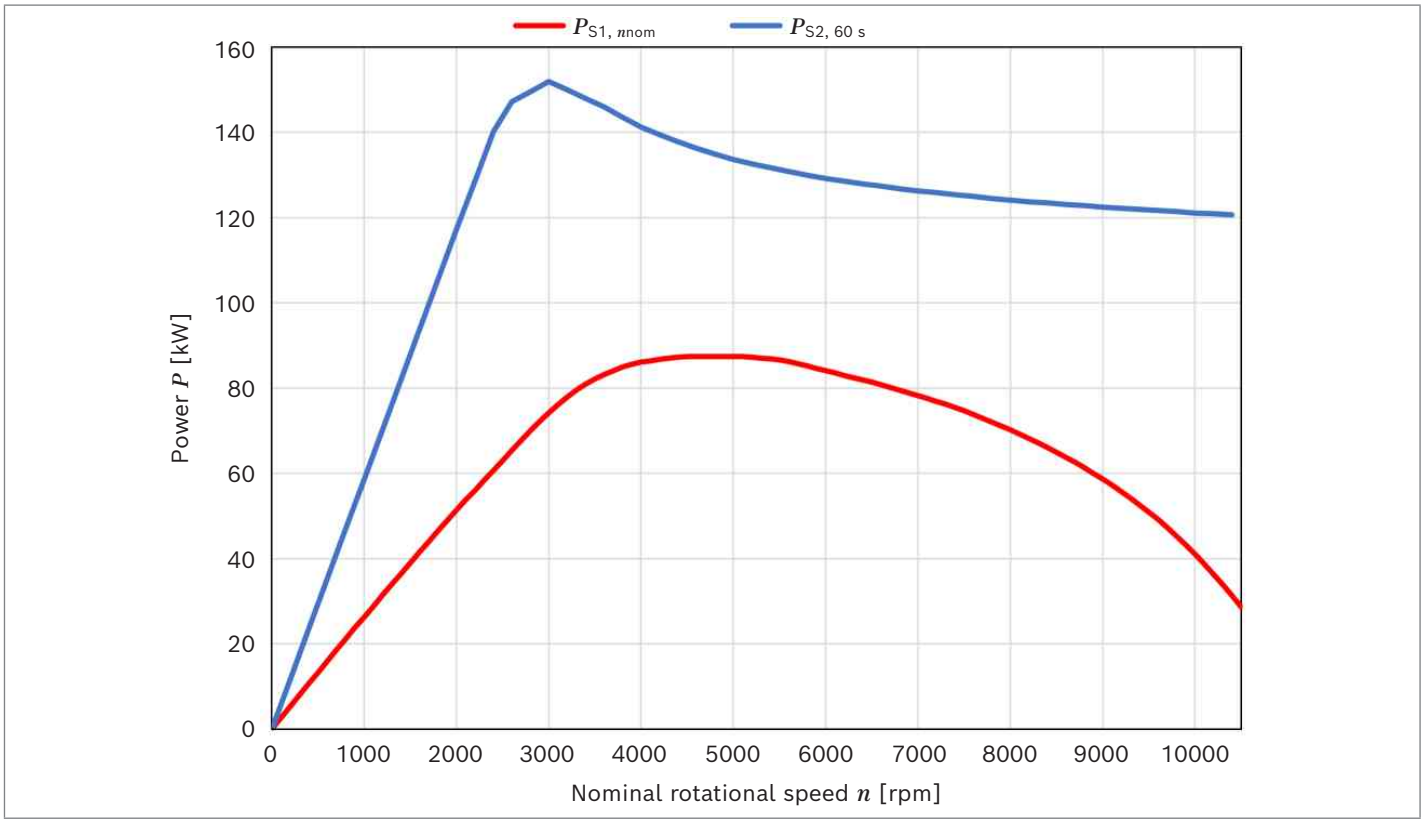
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	118
Torque constant at 25 °C	k_T	Nm / A_{RMS}	2.05
Synchronous inductance (d-axis) at rated current	L_d	mH	1.4
Synchronous inductance (q-axis) at rated current	L_q	mH	3.2
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.0915
Cogging torque (unskewed)	M_{cog}	Nm	1.06
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	2.81

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

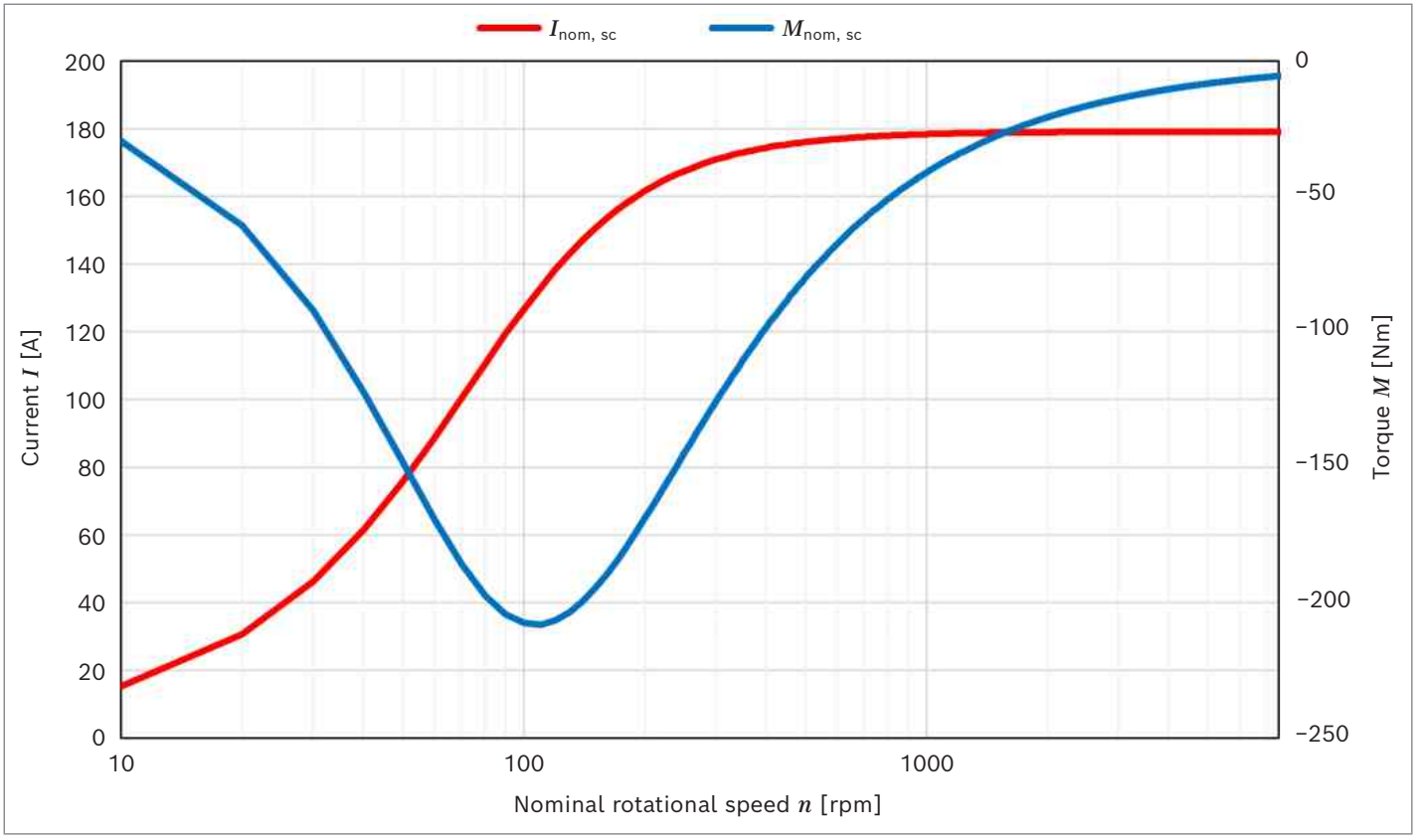
▼ **Torque EMS1-13J30**



▼ **Power EMS1-13J30**



▼ Short circuit current and short circuit braking torque EMS1-13J30



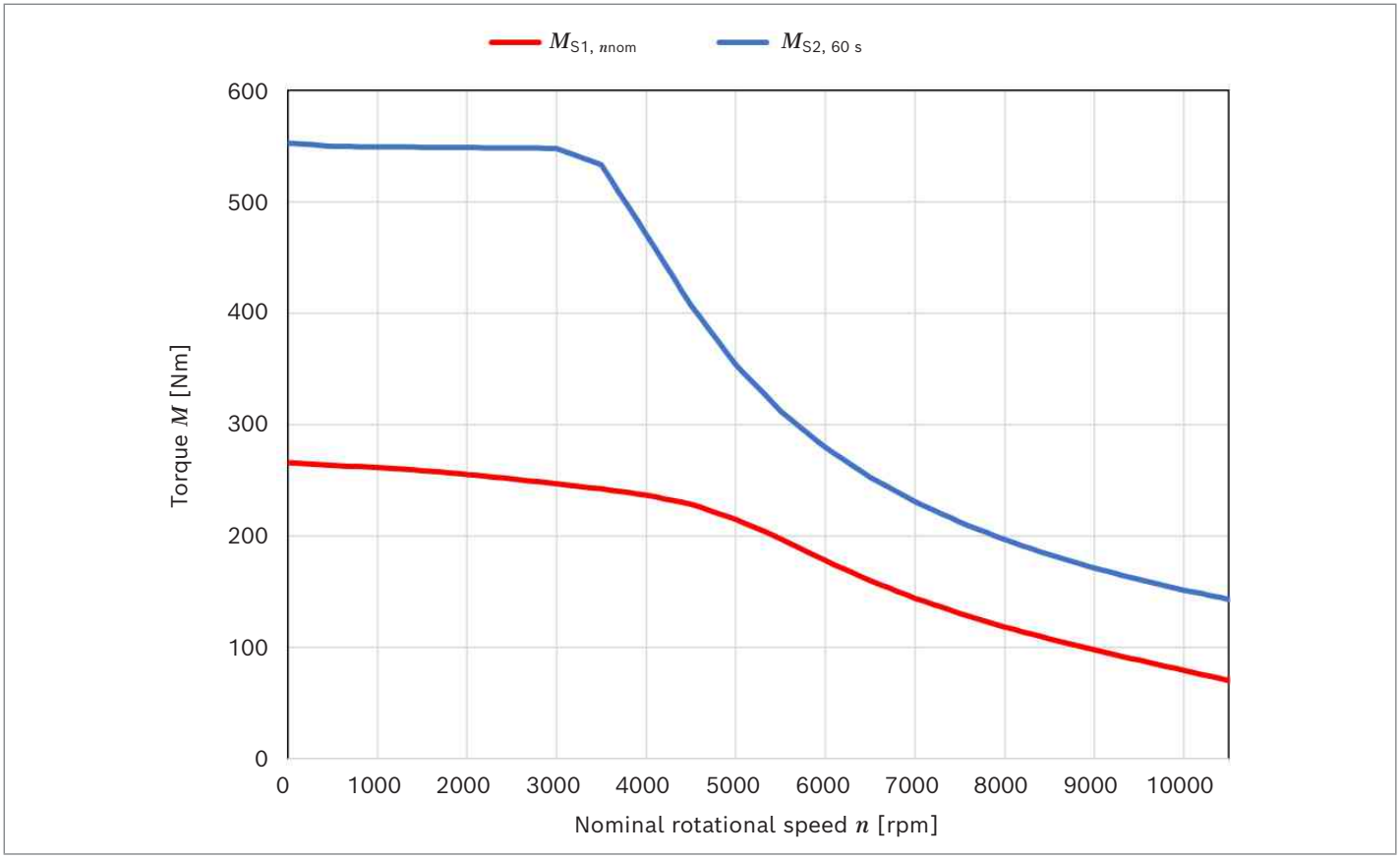
EMS1-13J40

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	265
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	170
Nominal rotational speed	n_{nom}	rpm	4000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	237
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	158
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	99
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	95.65
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	553
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	407
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	197
Maximum rotational speed	n_{max}	rpm	10500
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	70
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	114
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	77
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	94.89
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	199
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	151
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	114
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	5460
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	96.18
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	10
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	239
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	208
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	239
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

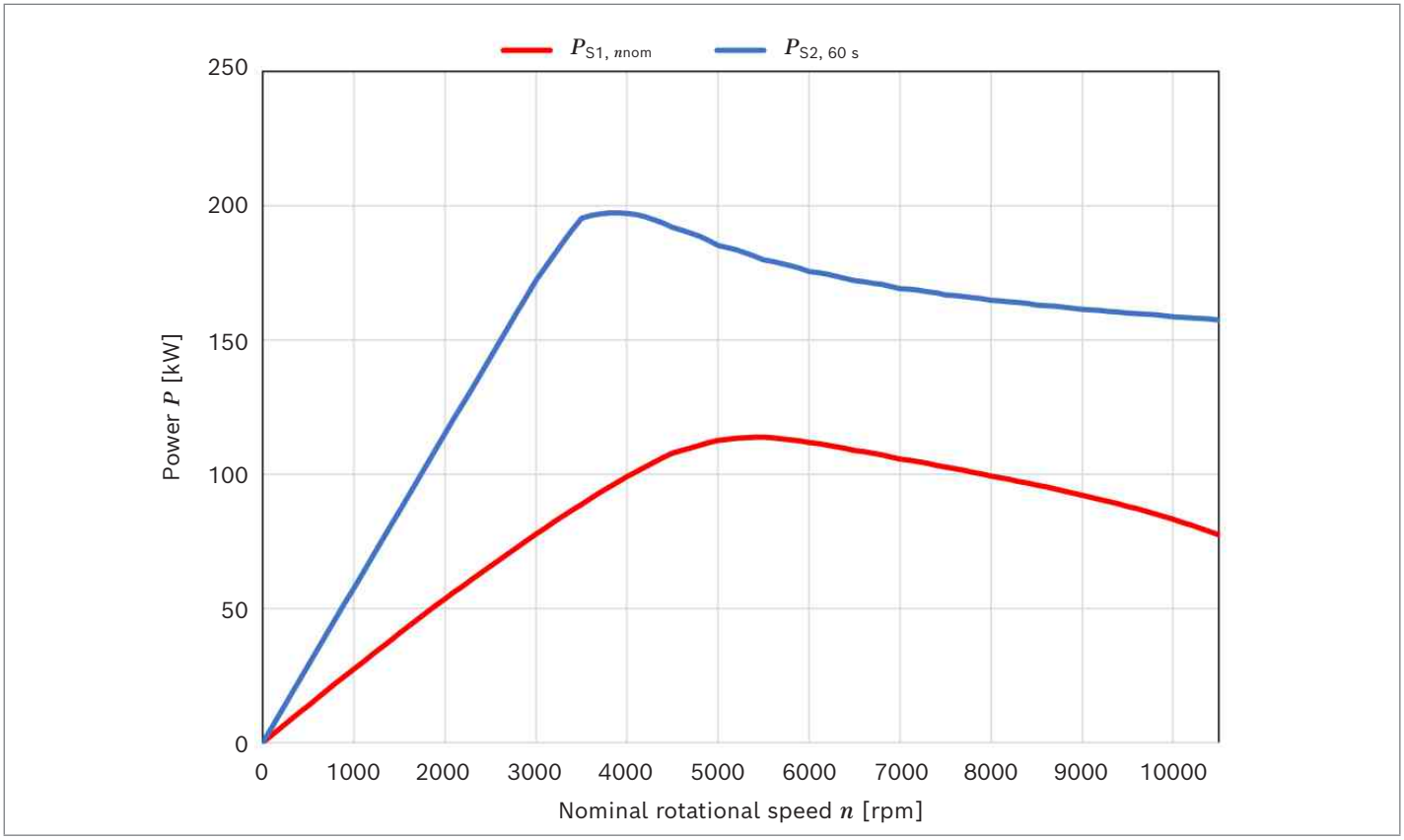
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	88.5
Torque constant at 25 °C	k_T	Nm / A_{RMS}	1.68
Synchronous inductance (d-axis) at rated current	L_d	mH	0.88
Synchronous inductance (q-axis) at rated current	L_q	mH	1.82
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.0511
Cogging torque (unskewed)	M_{cog}	Nm	1.06
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	3.1

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

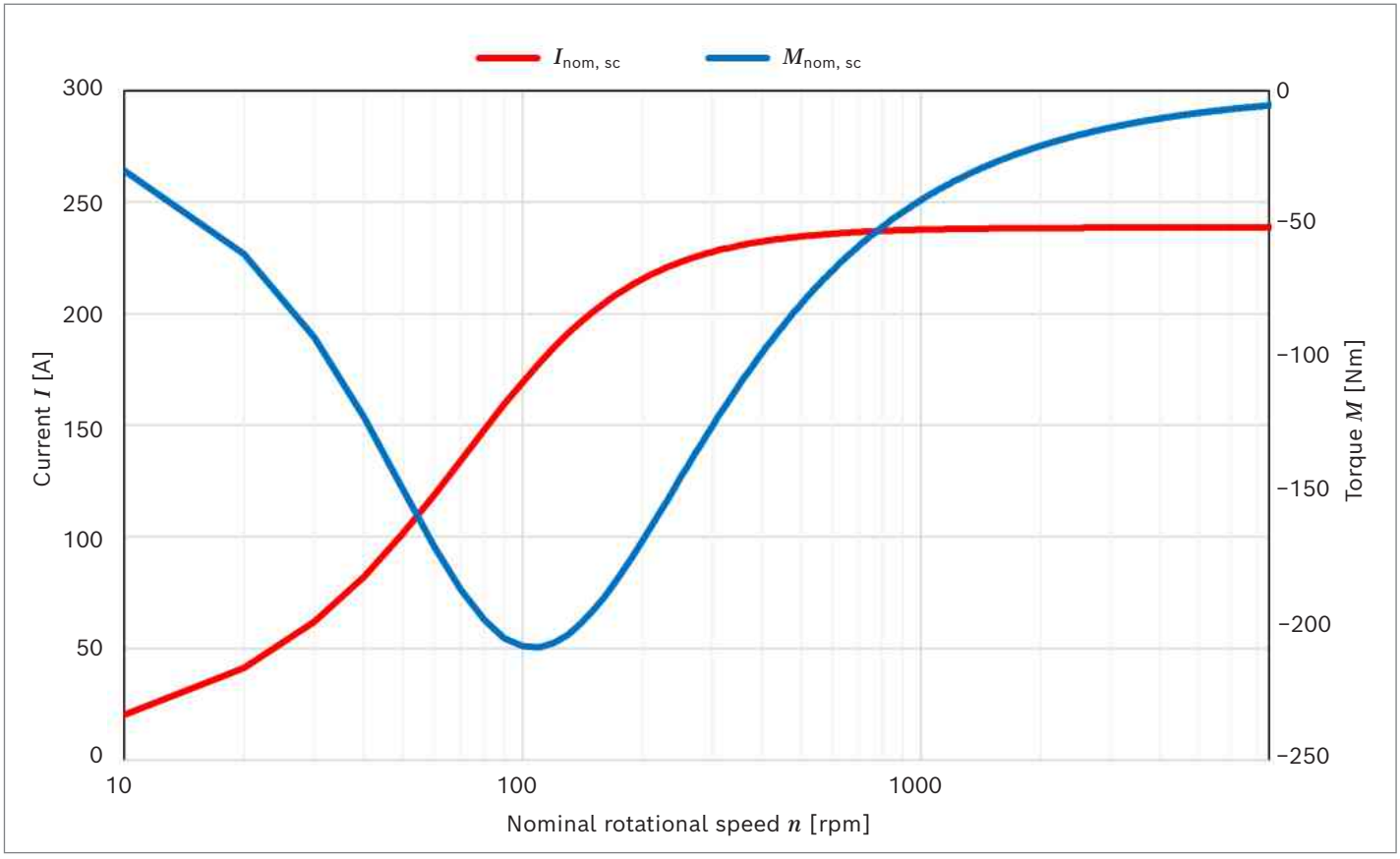
▼ Torque EMS1-13J40



▼ Power EMS1-13J40



▼ **Short circuit current and short circuit braking torque EMS1-13J40**



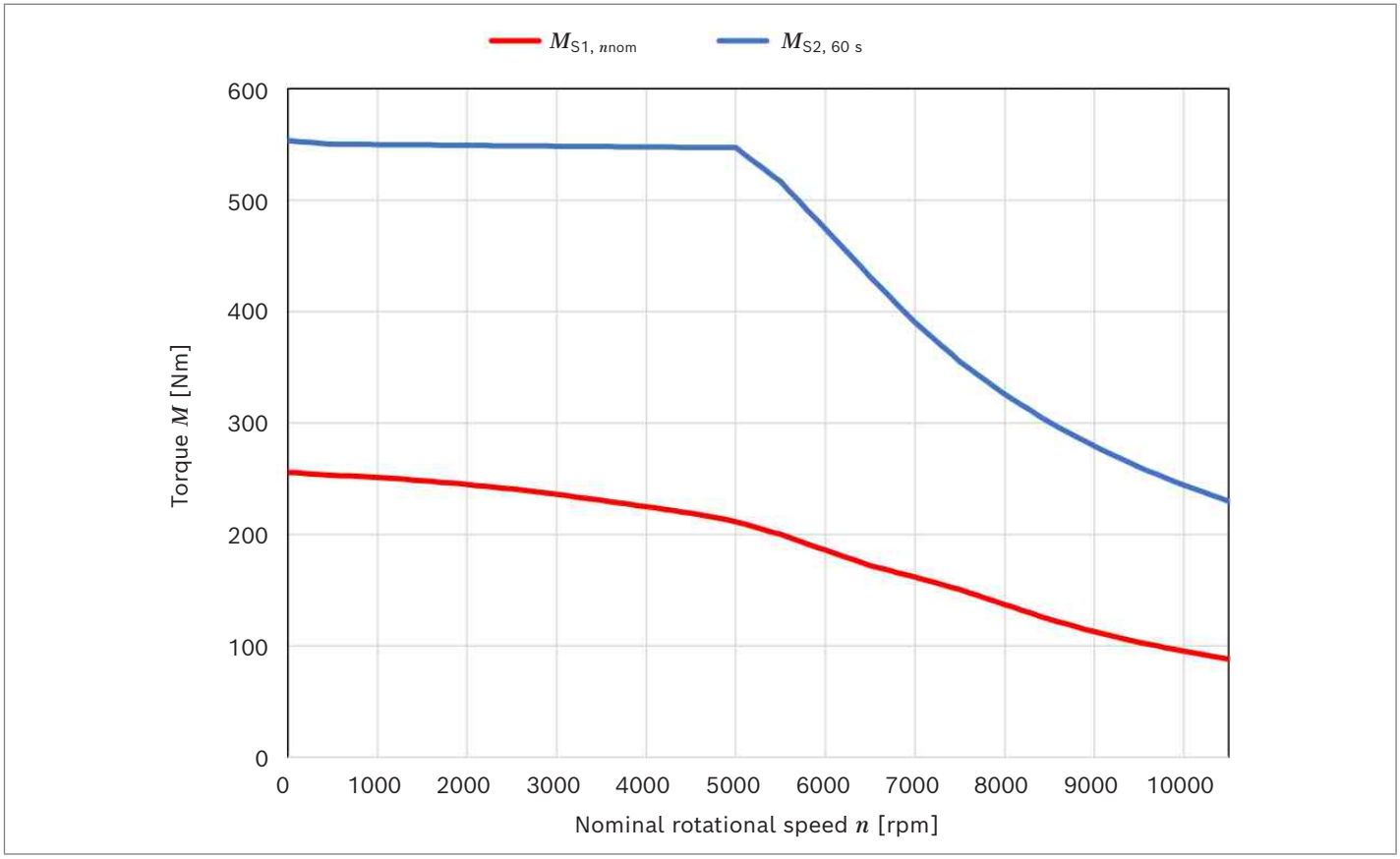
EMS1-13J60

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	255
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	245
Nominal rotational speed	n_{nom}	rpm	6000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	186
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	191
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	117
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	96.14
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	553
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	611
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	298
Maximum rotational speed	n_{max}	rpm	10500
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	88
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	127
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	97
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	95.65
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	159
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	168
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	119
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	7140
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	96.22
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	7
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	358
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	208
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	358
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

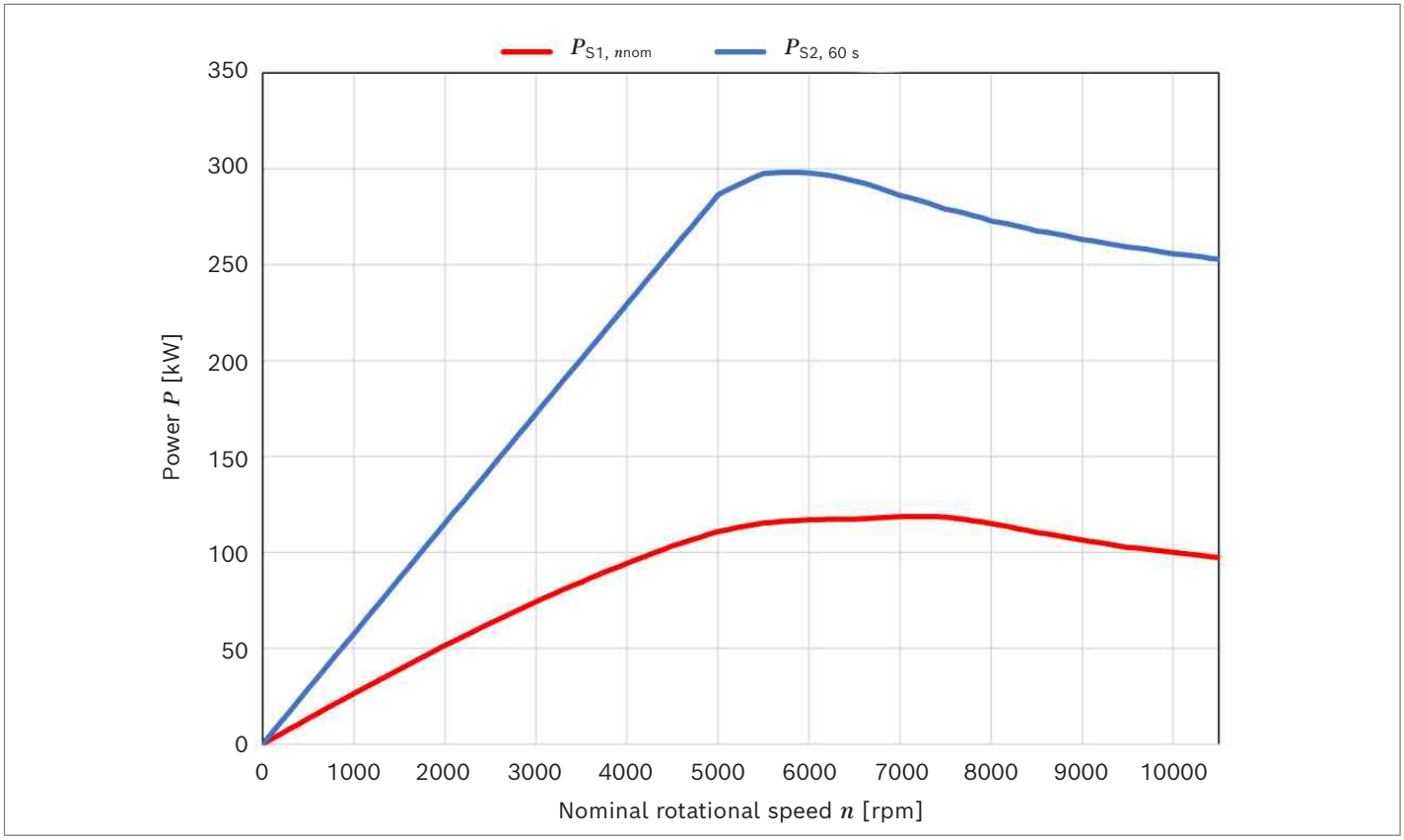
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	52.4
Torque constant at 25 °C	k_T	Nm / A_{RMS}	0.99
Synchronous inductance (d-axis) at rated current	L_d	mH	0.32
Synchronous inductance (q-axis) at rated current	L_q	mH	0.9
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.0229
Cogging torque (unskewed)	M_{cog}	Nm	1.06
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	1.54

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

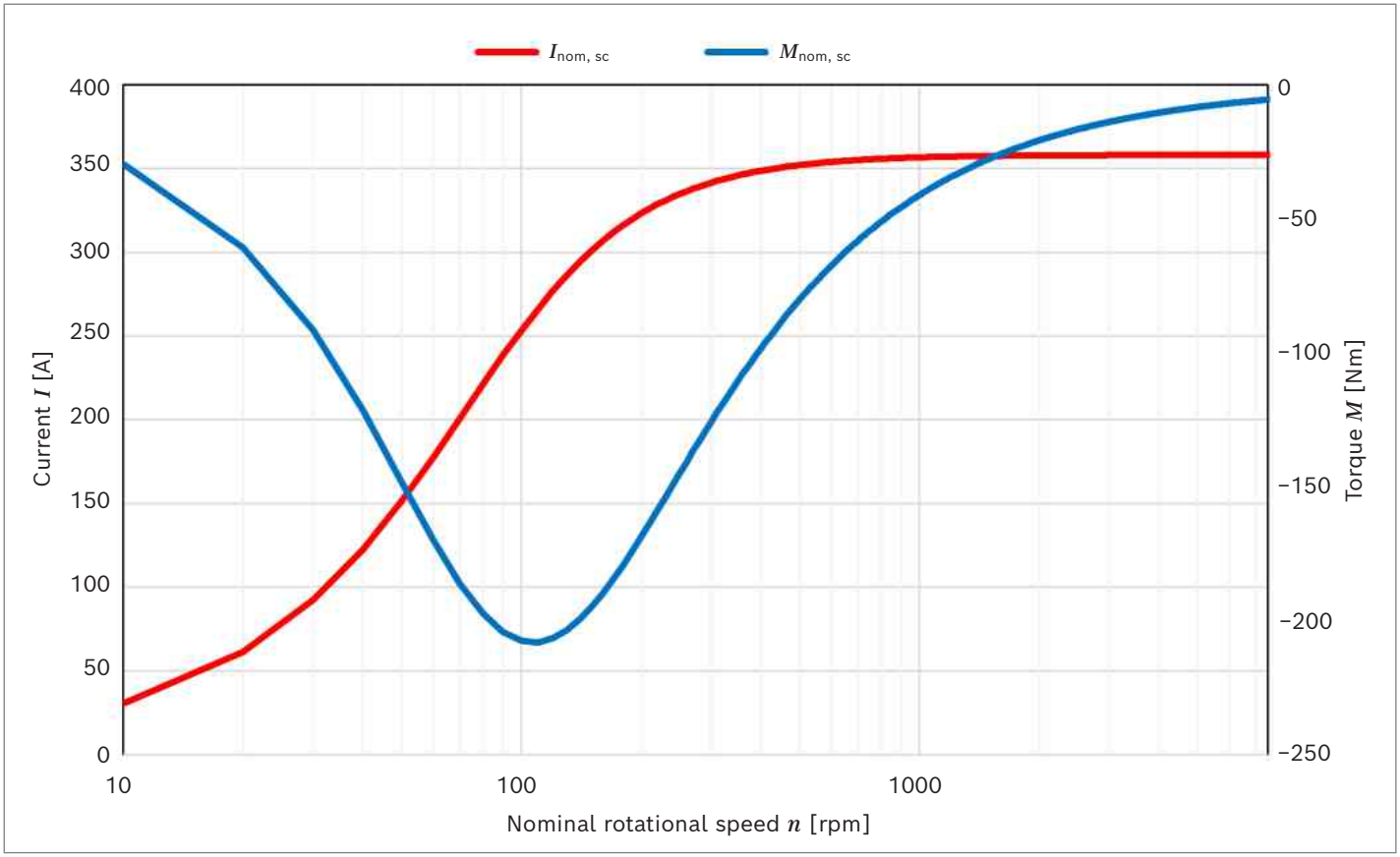
▼ **Torque EMS1-13J60**



▼ **Power EMS1-13J60**



▼ Short circuit current and short circuit braking torque EMS1-13J60



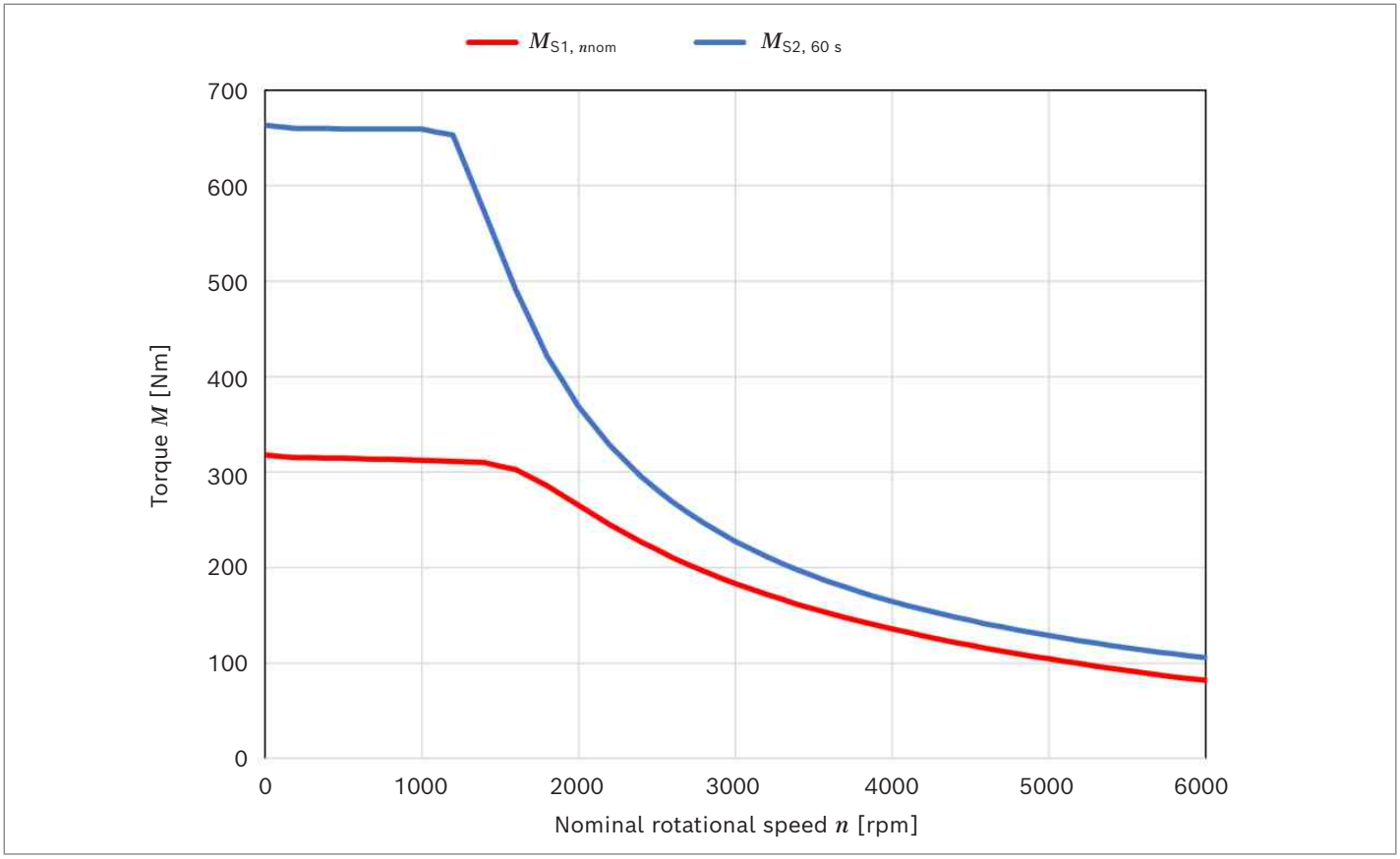
EMS1-13L15

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	315
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	76
Nominal rotational speed	n_{nom}	rpm	1500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	306
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	76
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	48
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	92.17
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	664
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	183
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	84
Maximum rotational speed	n_{max}	rpm	6000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	0
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	0
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	0
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	0.00
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	176
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	75
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	58
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	3120
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	93.04
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	31
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	108
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	251
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	108
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

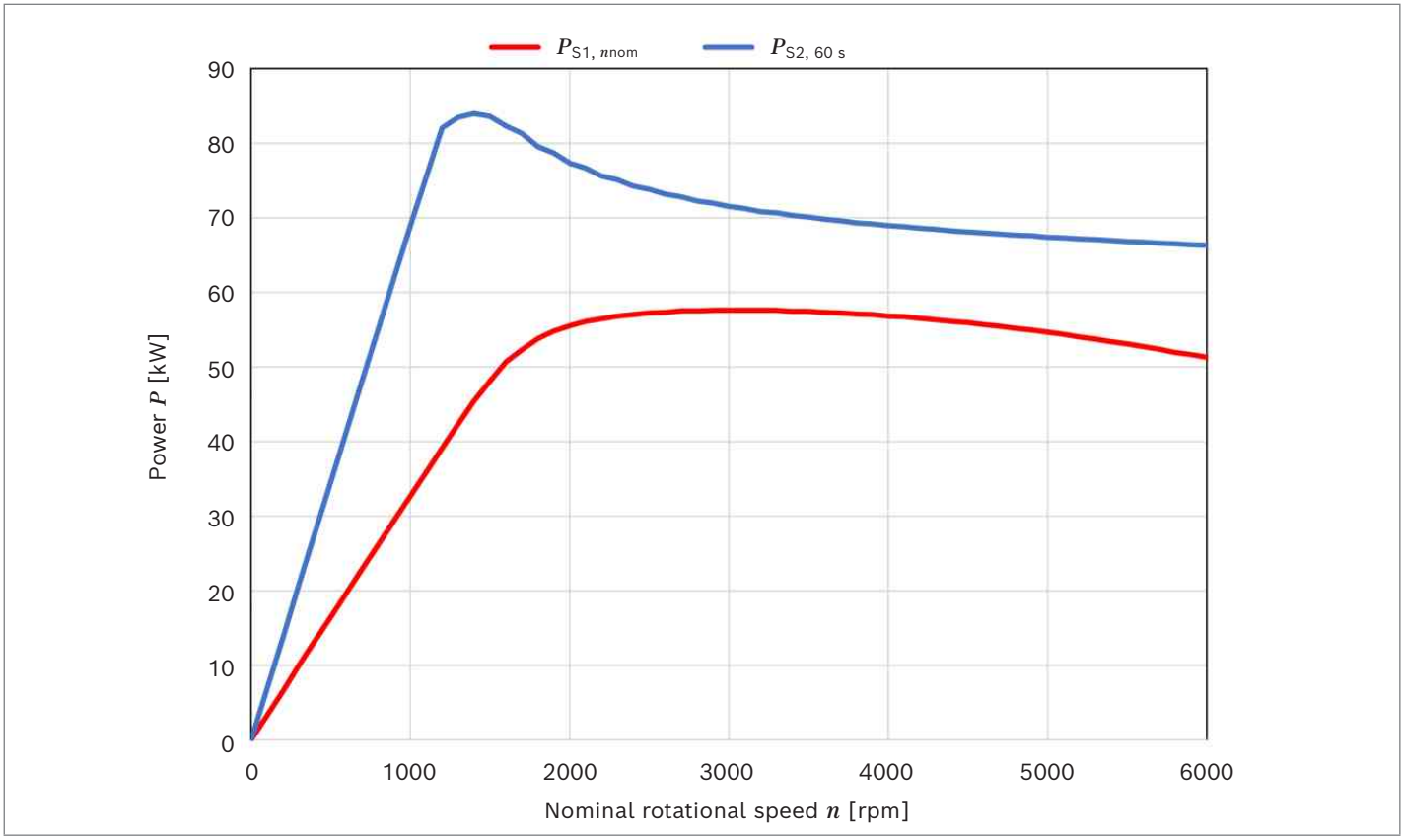
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	235
Torque constant at 25 °C	k_T	Nm / A_{RMS}	4.44
Synchronous inductance (d-axis) at rated current	L_d	mH	3.7
Synchronous inductance (q-axis) at rated current	L_q	mH	11.03
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.2856
Cogging torque (unskewed)	M_{cog}	Nm	1.27
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	4.85

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

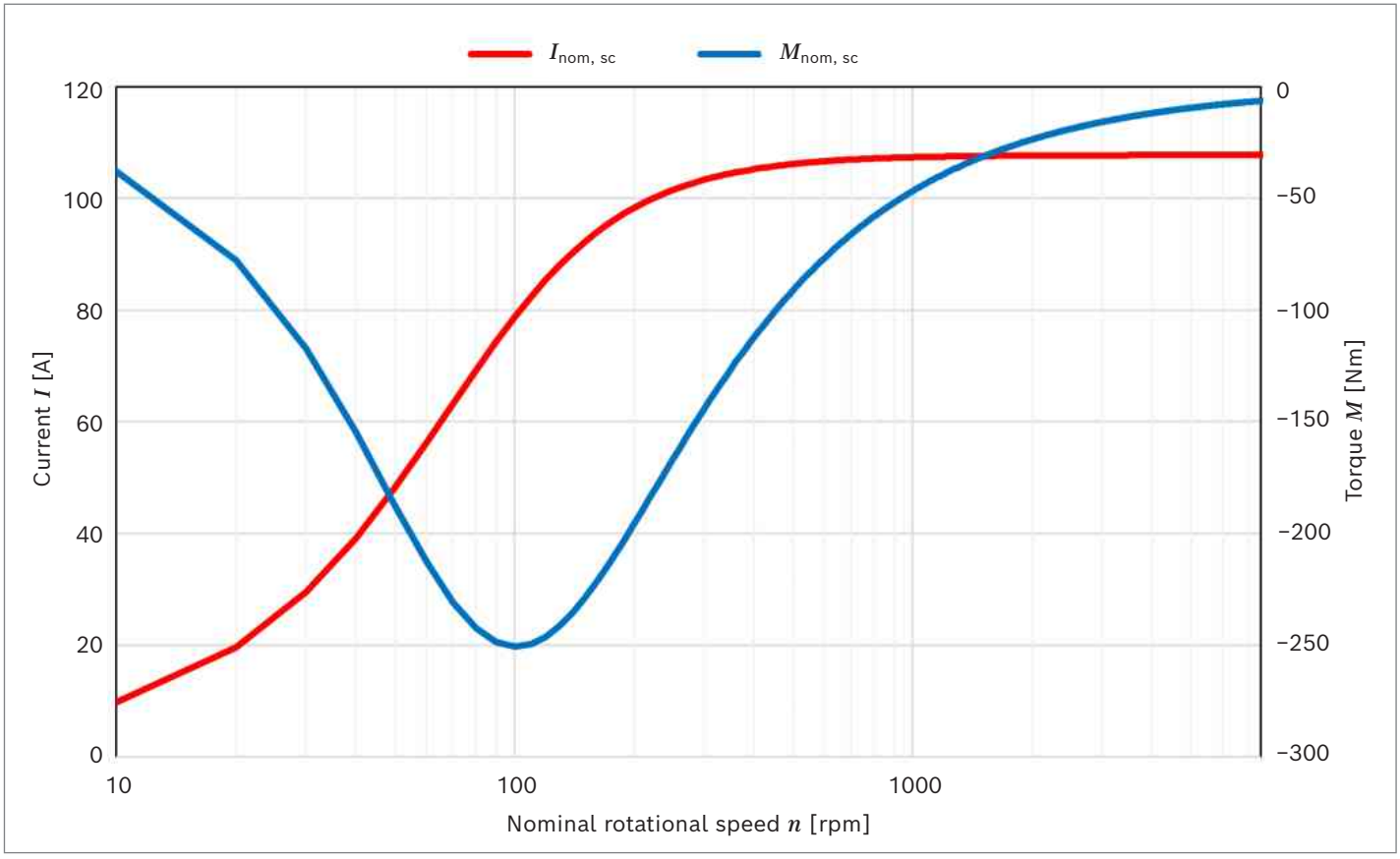
▼ Torque EMS1-13L15



▼ Power EMS1-13L15



▼ **Short circuit current and short circuit braking torque EMS1-13L15**



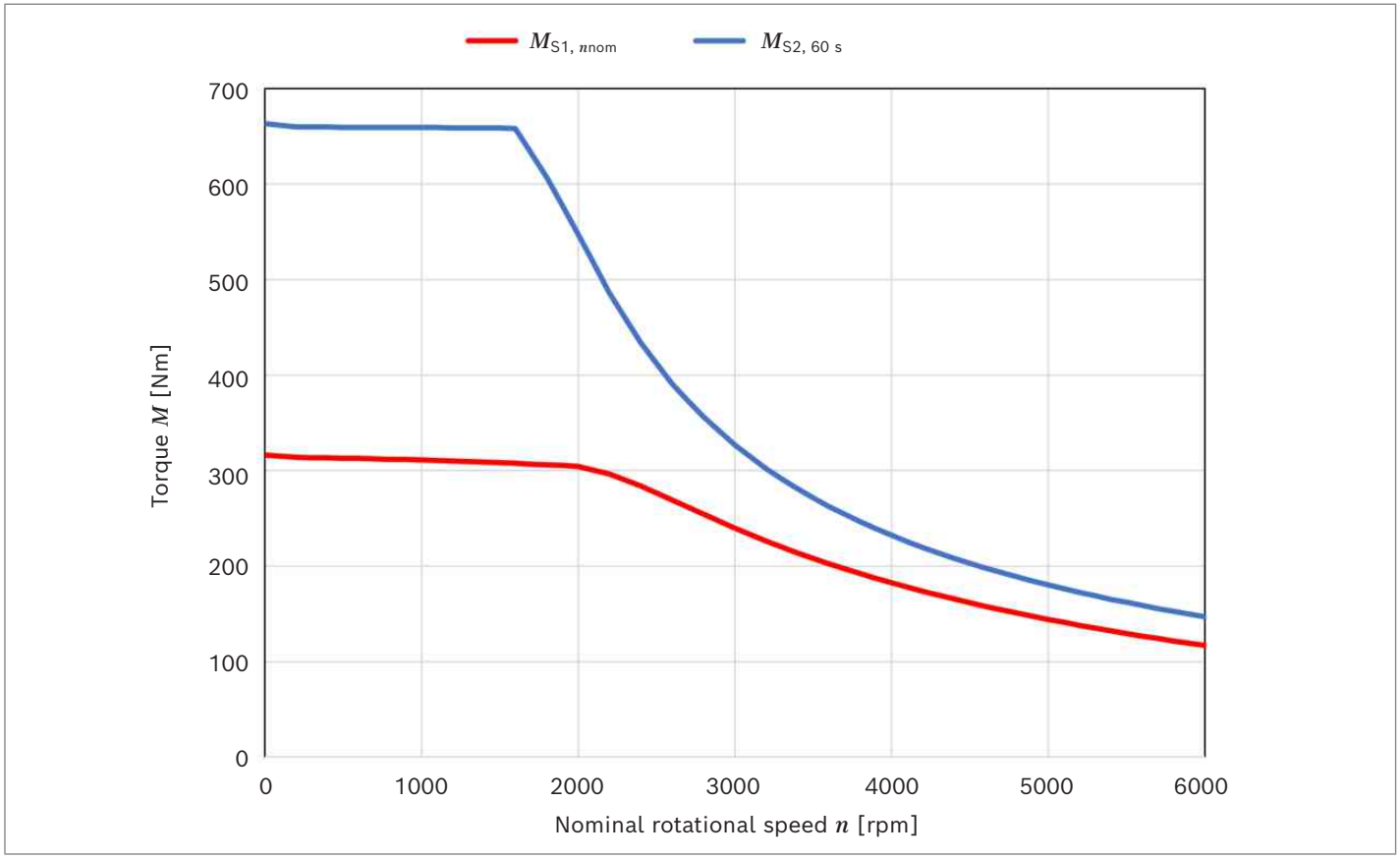
EMS1-13L20

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	314
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	101
Nominal rotational speed	n_{nom}	rpm	2000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	305
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	100
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	64
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	93.71
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	663
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	244
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	115
Maximum rotational speed	n_{max}	rpm	6000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	3
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	19
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	4
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	19.08
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	187
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	99
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	77
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	3900
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	94.44
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	24
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	144
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	251
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	144
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

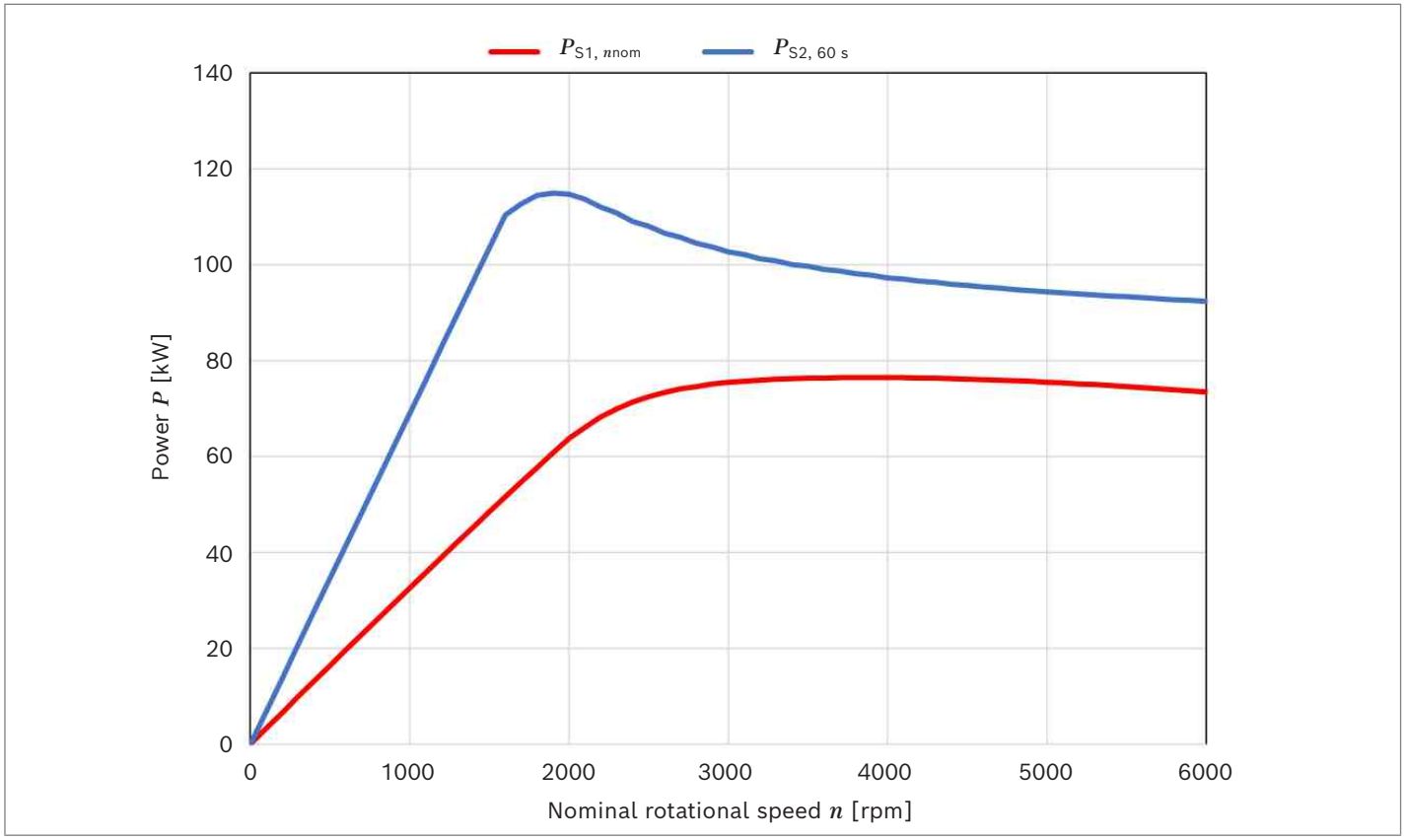
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	165.2
Torque constant at 25 °C	k_T	Nm / A_{RMS}	3.13
Synchronous inductance (d-axis) at rated current	L_d	mH	2.1
Synchronous inductance (q-axis) at rated current	L_q	mH	4.3
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.1621
Cogging torque (unskewed)	M_{cog}	Nm	1.27
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	4.62

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

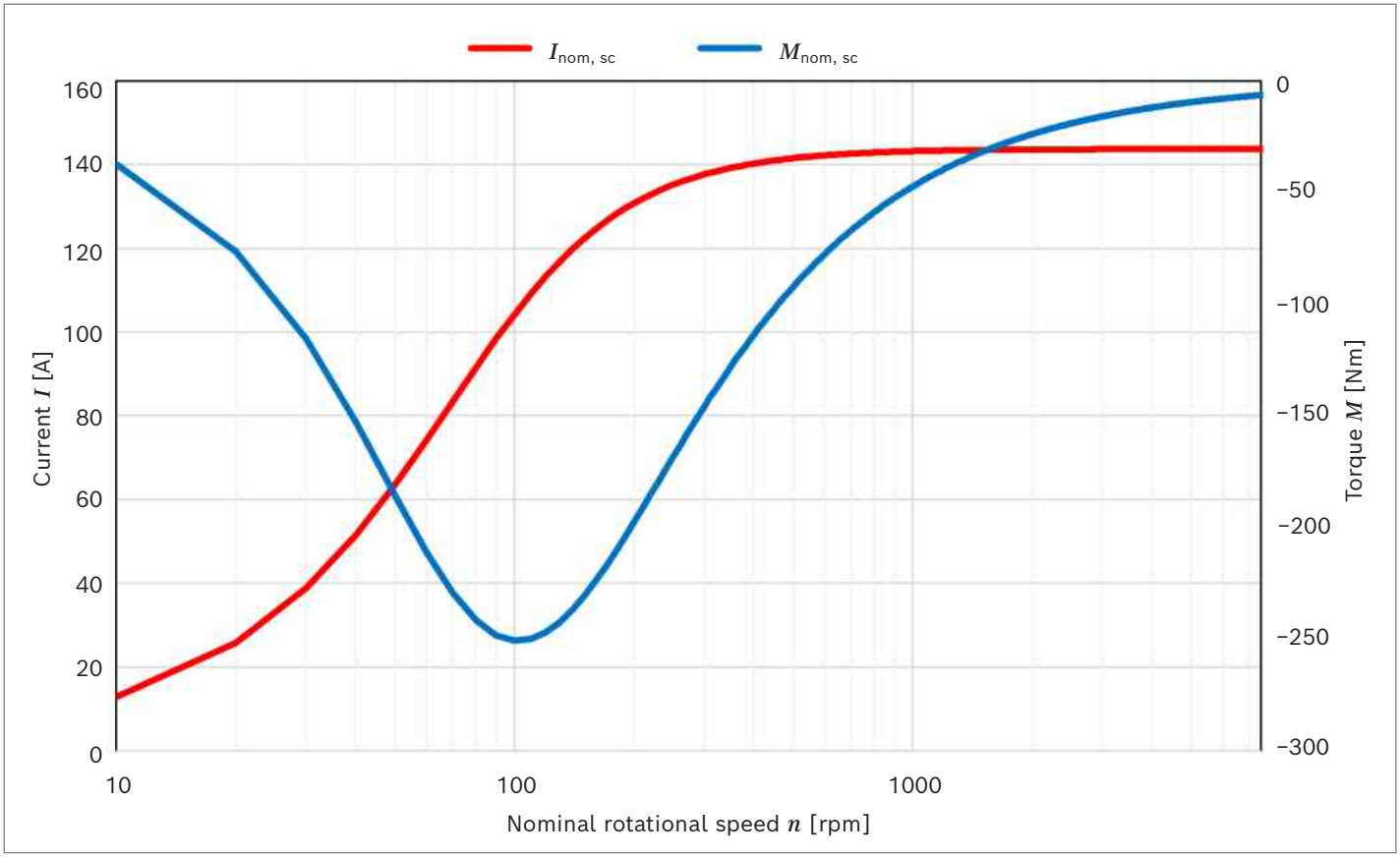
▼ **Torque EMS1-13L20**



▼ **Power EMS1-13L20**



▼ Short circuit current and short circuit braking torque EMS1-13L20



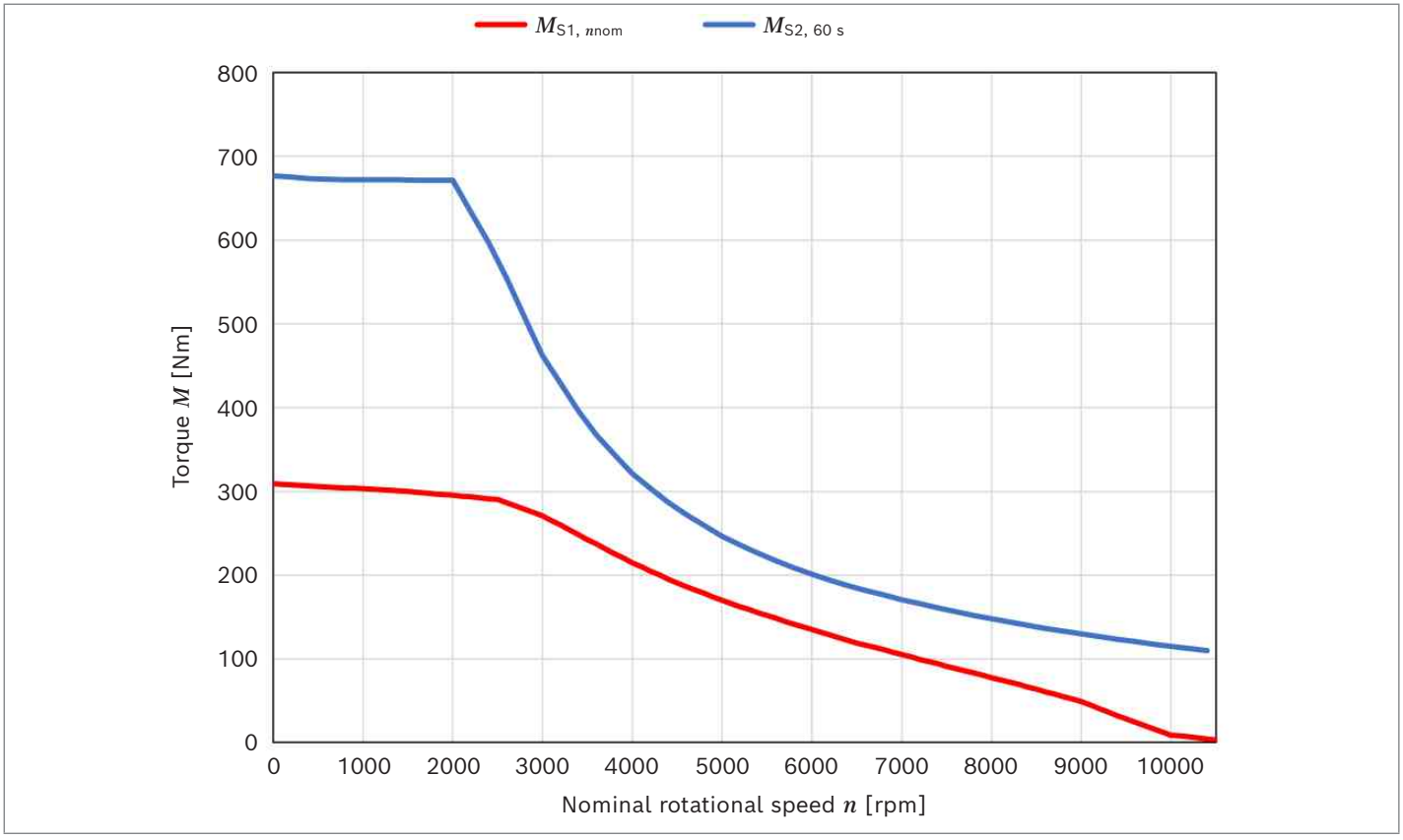
EMS1-13L25

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	308
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	123
Nominal rotational speed	n_{nom}	rpm	2500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	290
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	119
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	76
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	94.62
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	677
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	306
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	150
Maximum rotational speed	n_{max}	rpm	10500
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	3
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	21
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	4
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	18.95
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	205
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	116
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	90
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	4200
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	95.14
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	19
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	180
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	251
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	180
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

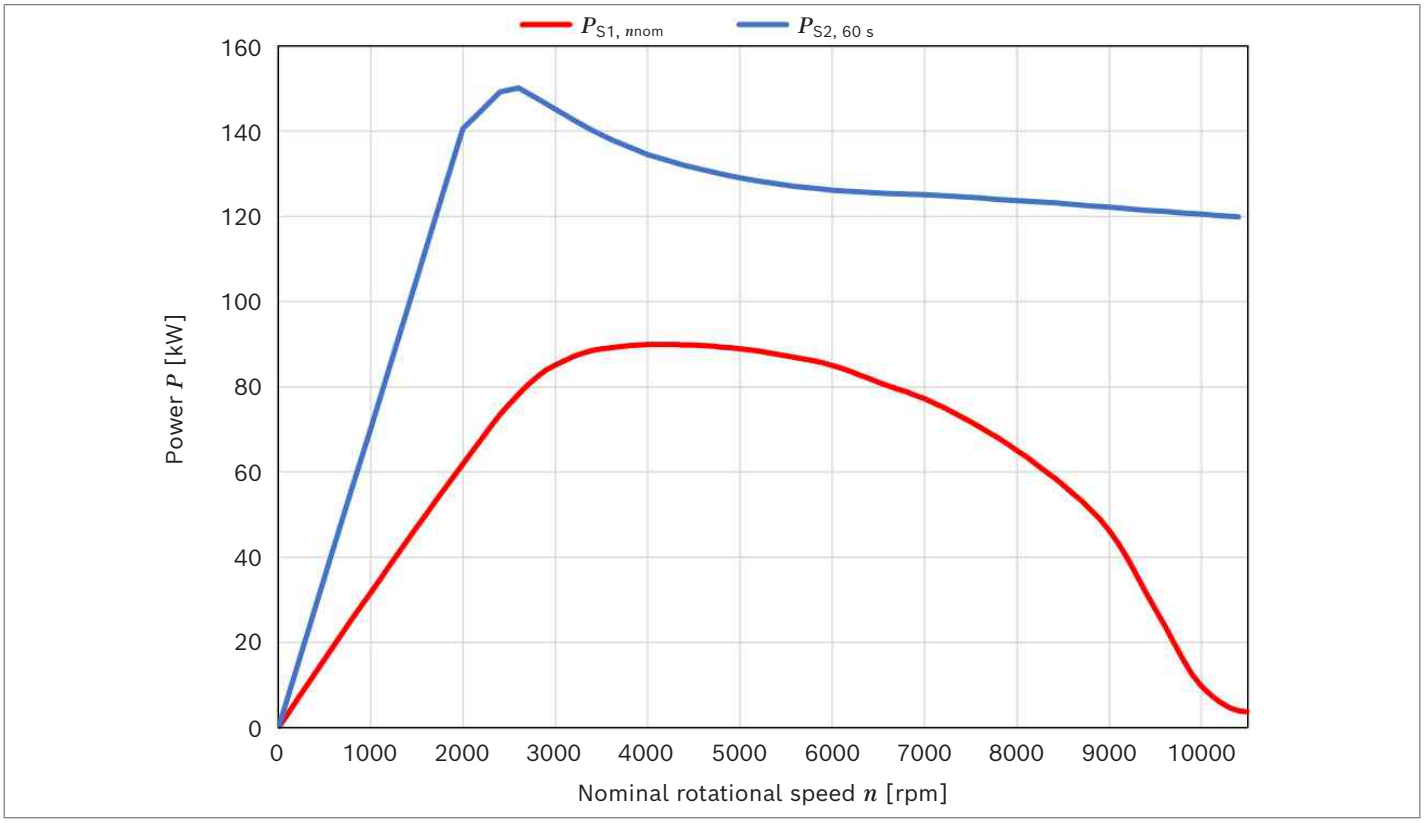
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	129.8
Torque constant at 25 °C	k_T	Nm / A_{RMS}	2.46
Synchronous inductance (d-axis) at rated current	L_d	mH	1.35
Synchronous inductance (q-axis) at rated current	L_q	mH	2.6
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.1037
Cogging torque (unskewed)	M_{cog}	Nm	1.27
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	3.74

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

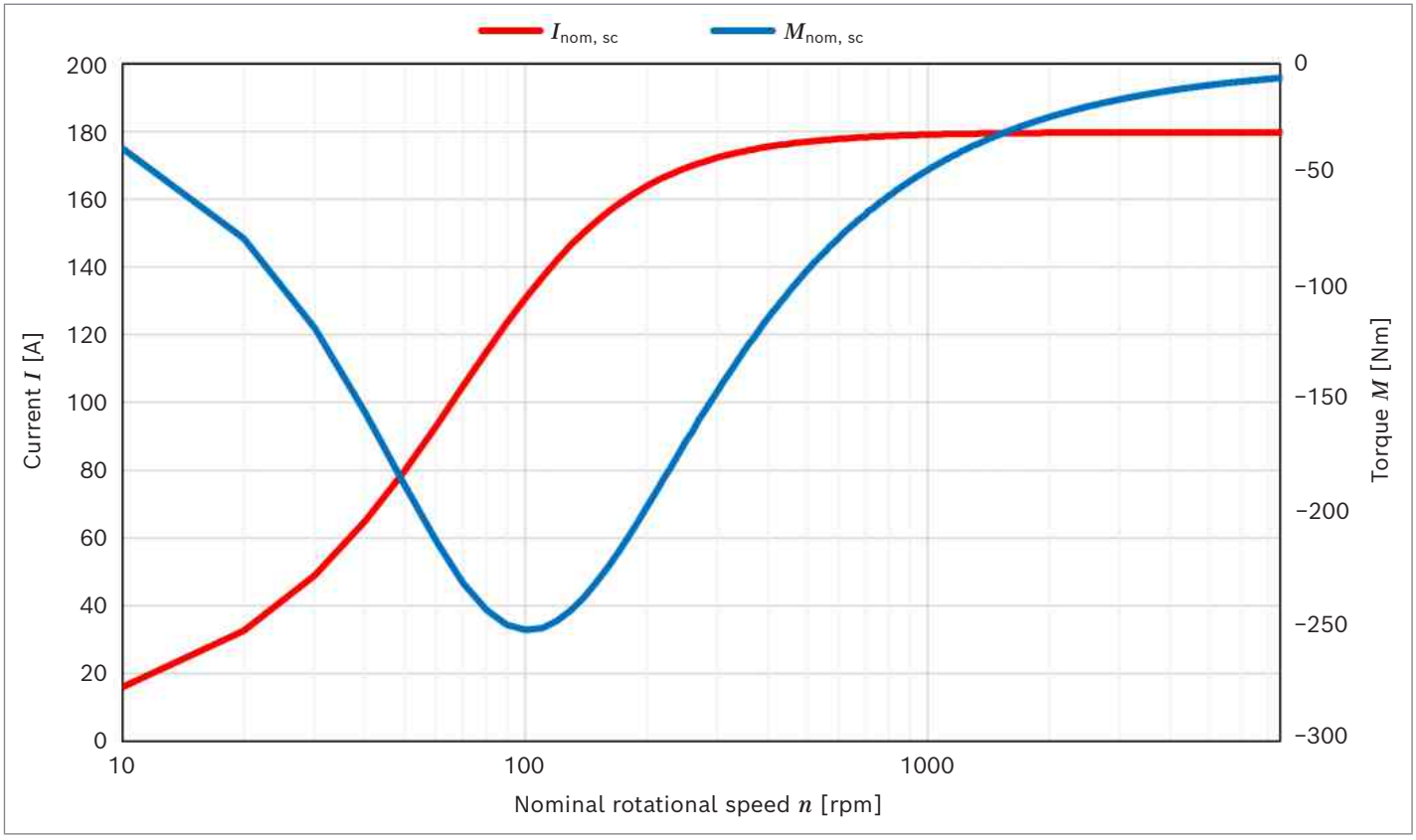
▼ Torque EMS1-13L25



▼ Power EMS1-13L25



▼ **Short circuit current and short circuit braking torque EMS1-13L25**



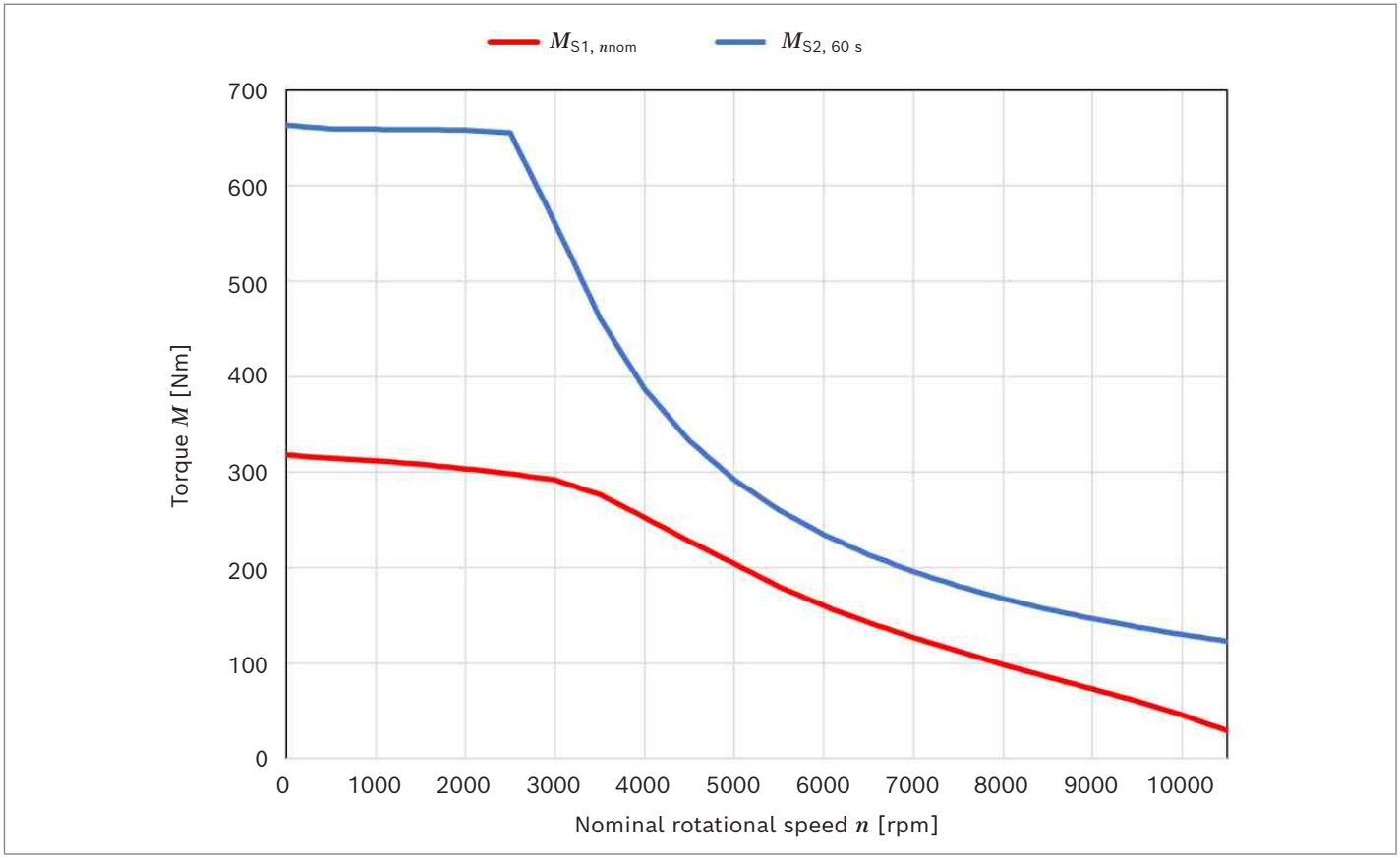
EMS1-13L30

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	317
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	152
Nominal rotational speed	n_{nom}	rpm	3000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	292
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	145
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	92
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	95.08
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	663
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	366
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	176
Maximum rotational speed	n_{max}	rpm	10500
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	29
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	100
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	32
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	85.52
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	217
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	139
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	107
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	4725
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	95.52
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	16
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	216
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	251
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	216
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

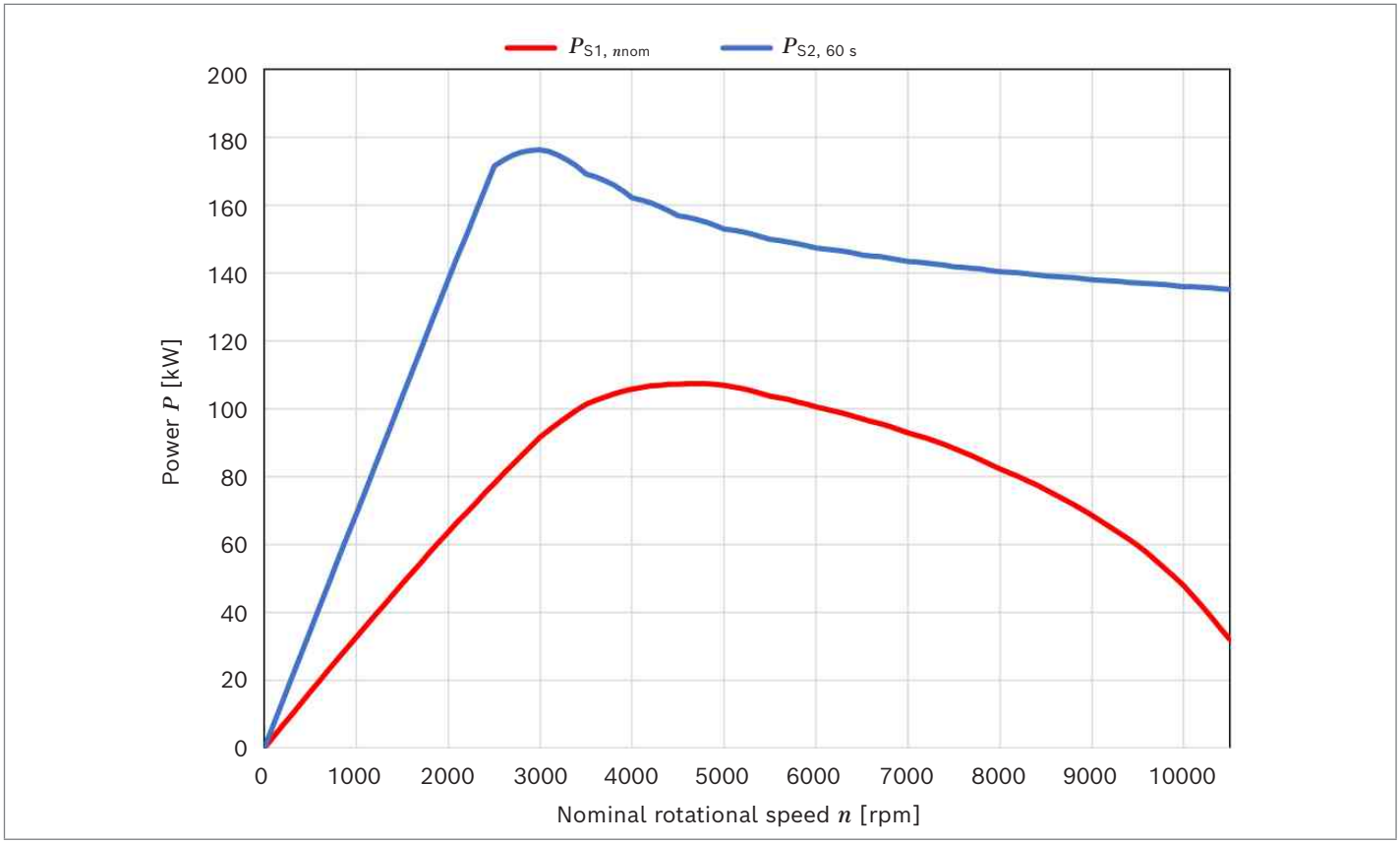
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	110.1
Torque constant at 25 °C	k_T	Nm / A_{RMS}	2.09
Synchronous inductance (d-axis) at rated current	L_d	mH	0.95
Synchronous inductance (q-axis) at rated current	L_q	mH	2
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.0721
Cogging torque (unskewed)	M_{cog}	Nm	1.27
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	4.04

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

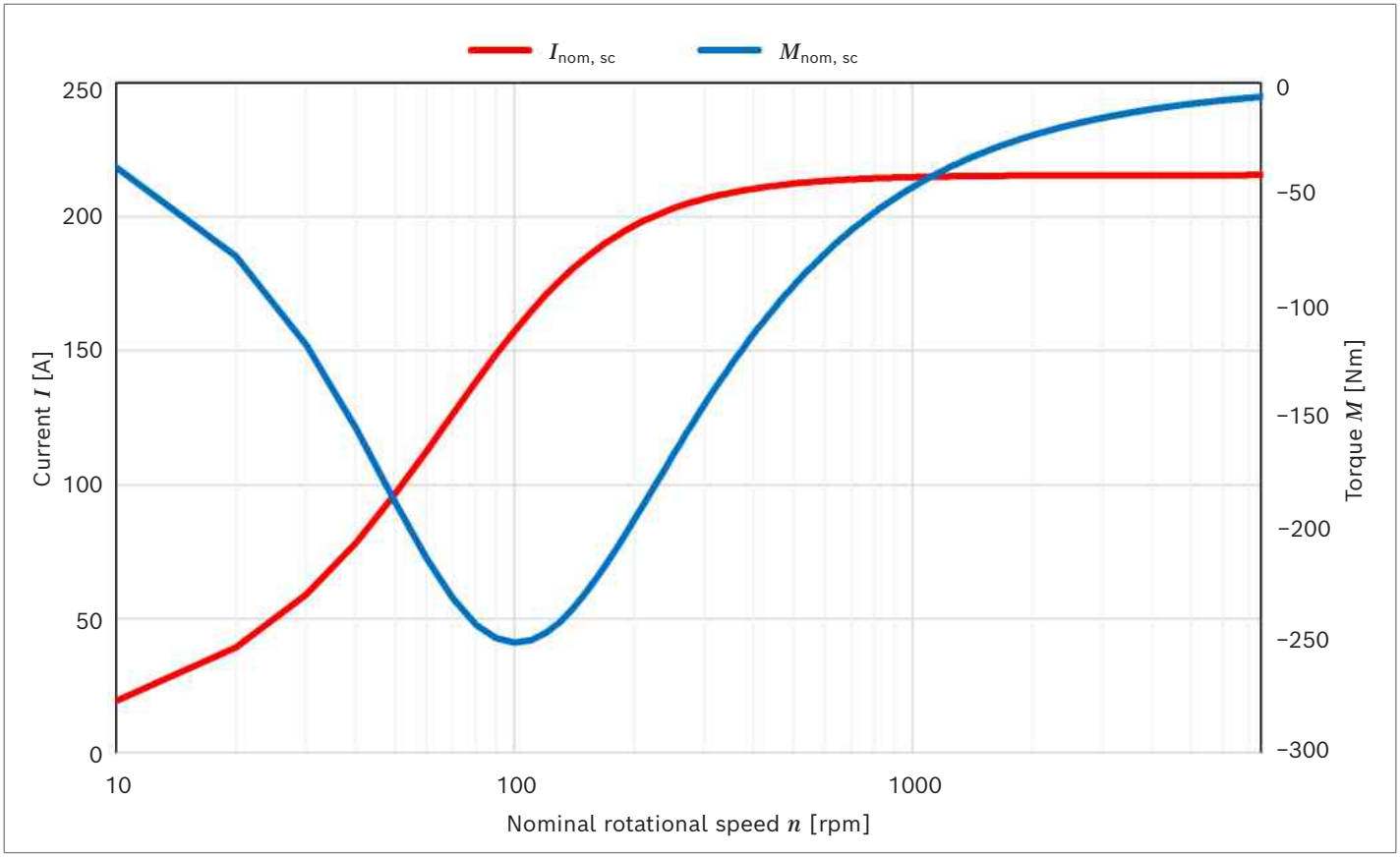
▼ **Torque EMS1-13L30**



▼ **Power EMS1-13L30**



▼ Short circuit current and short circuit braking torque EMS1-13L30



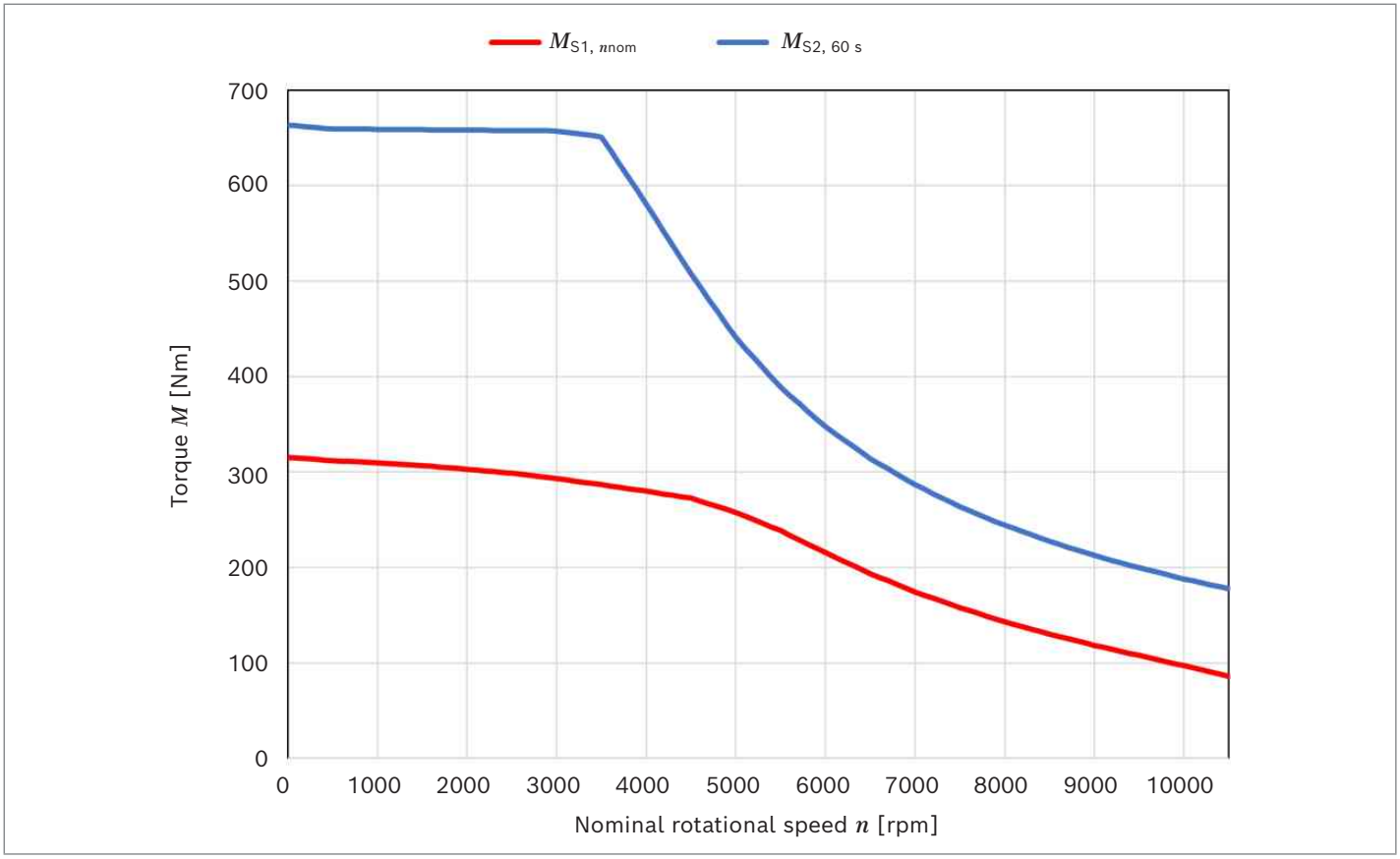
EMS1-13L40

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	314
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	206
Nominal rotational speed	n_{nom}	rpm	4000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	280
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	191
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	117
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	95.84
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	663
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	499
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	243
Maximum rotational speed	n_{max}	rpm	10500
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	86
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	138
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	95
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	95.24
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	240
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	183
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	137
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	5460
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	96.37
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	12
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	294
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	251
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	294
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

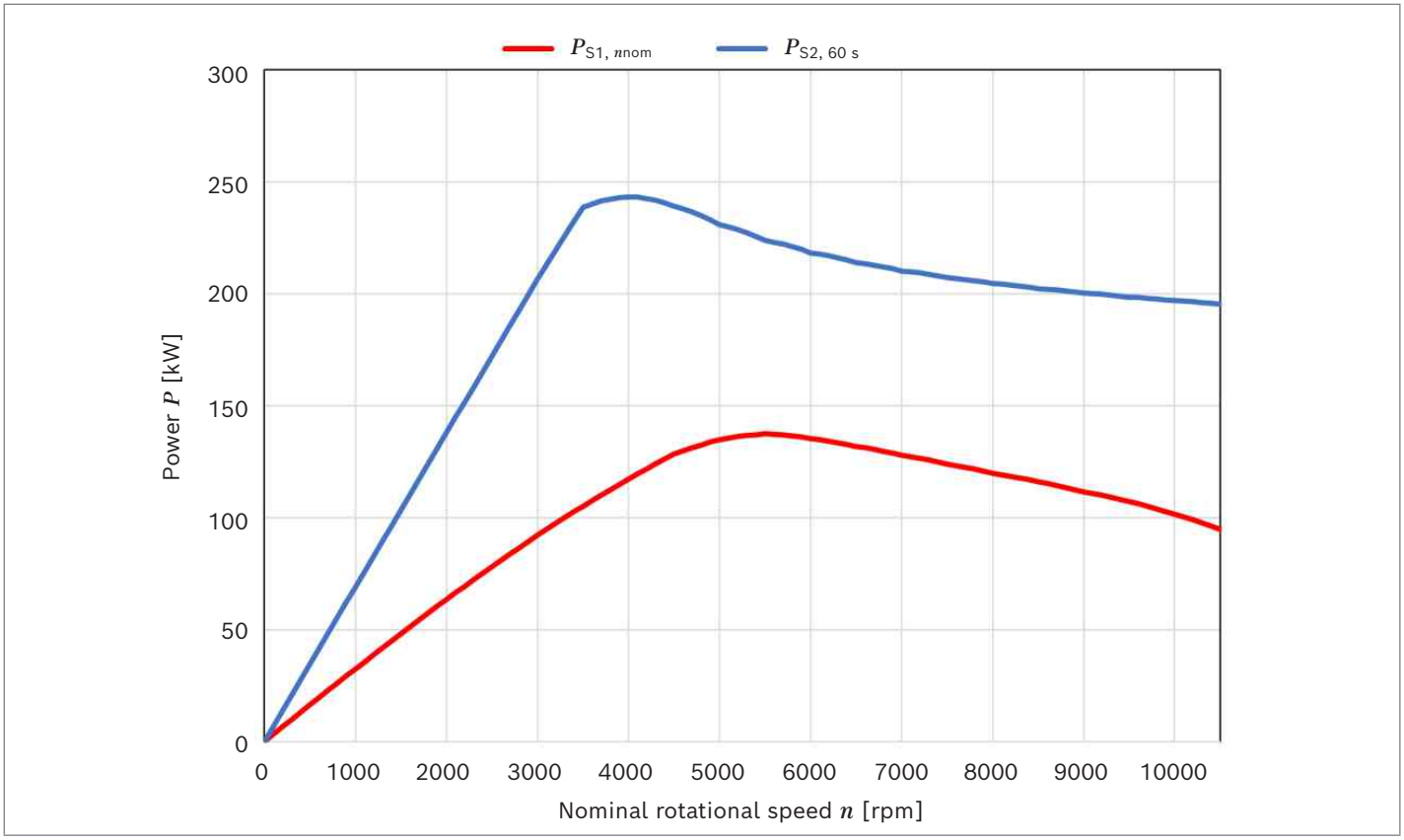
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	82.6
Torque constant at 25 °C	k_T	Nm / A_{RMS}	1.56
Synchronous inductance (d-axis) at rated current	L_d	mH	0.5
Synchronous inductance (q-axis) at rated current	L_q	mH	1.2
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.0387
Cogging torque (unskewed)	M_{cog}	Nm	1.27
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	3.43

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

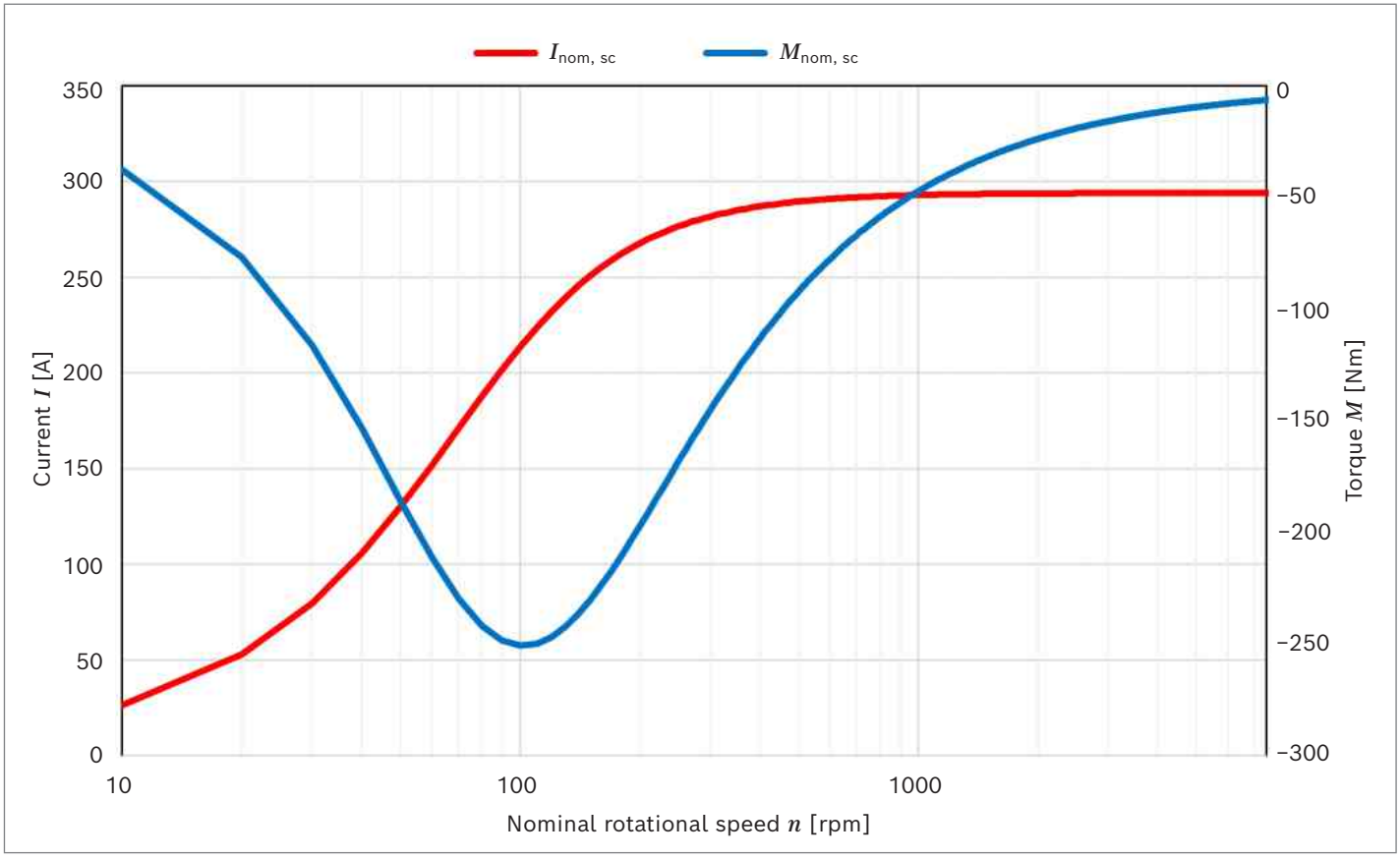
▼ Torque EMS1-13L40



▼ Power EMS1-13L40



▼ **Short circuit current and short circuit braking torque EMS1-13L40**



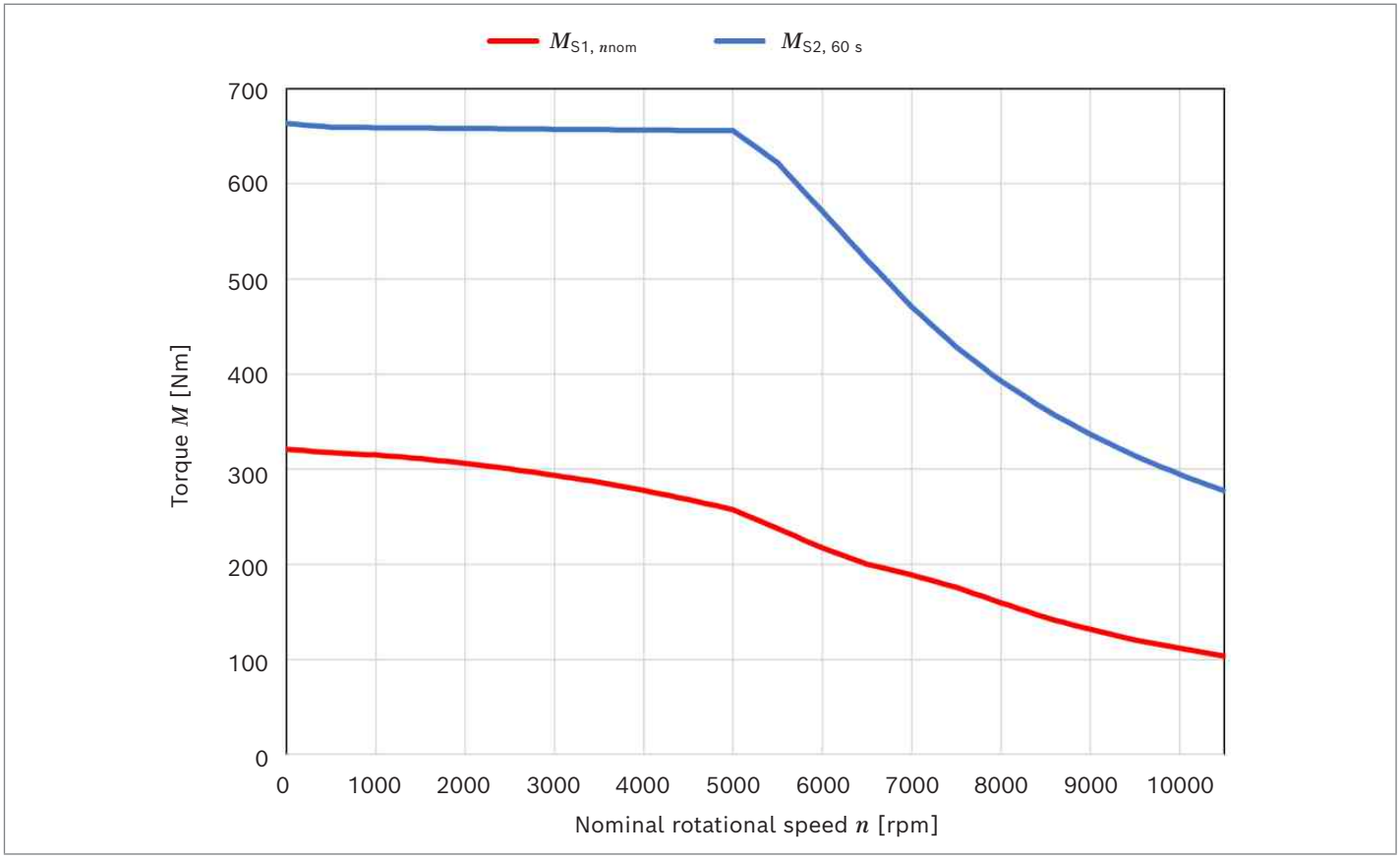
EMS1-13L60

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	319
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	304
Nominal rotational speed	n_{nom}	rpm	6000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	217
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	223
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	136
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	96.15
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	663
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	732
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	359
Maximum rotational speed	n_{max}	rpm	10500
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	103
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	149
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	114
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	95.69
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	188
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	199
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	139
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	7035
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	96.26
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	8
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	431
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	251
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	431
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

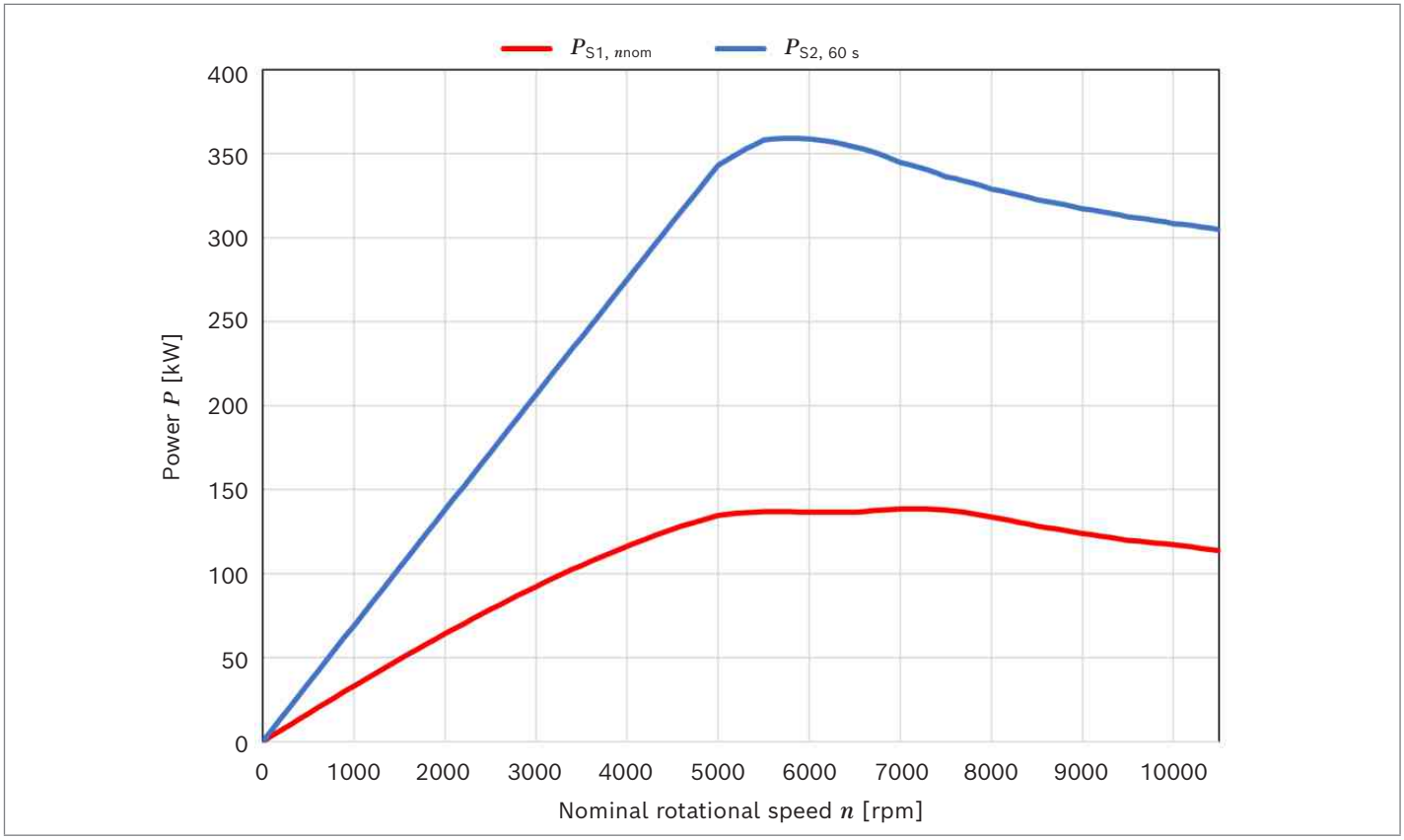
Electric	Symbol	Unit	Value
Number of poles			6
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	53.5
Torque constant at 25 °C	k_T	Nm / A_{RMS}	1.04
Synchronous inductance (d-axis) at rated current	L_d	mH	0.24
Synchronous inductance (q-axis) at rated current	L_q	mH	0.56
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.018
Cogging torque (unskewed)	M_{cog}	Nm	1.27
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	2.43

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

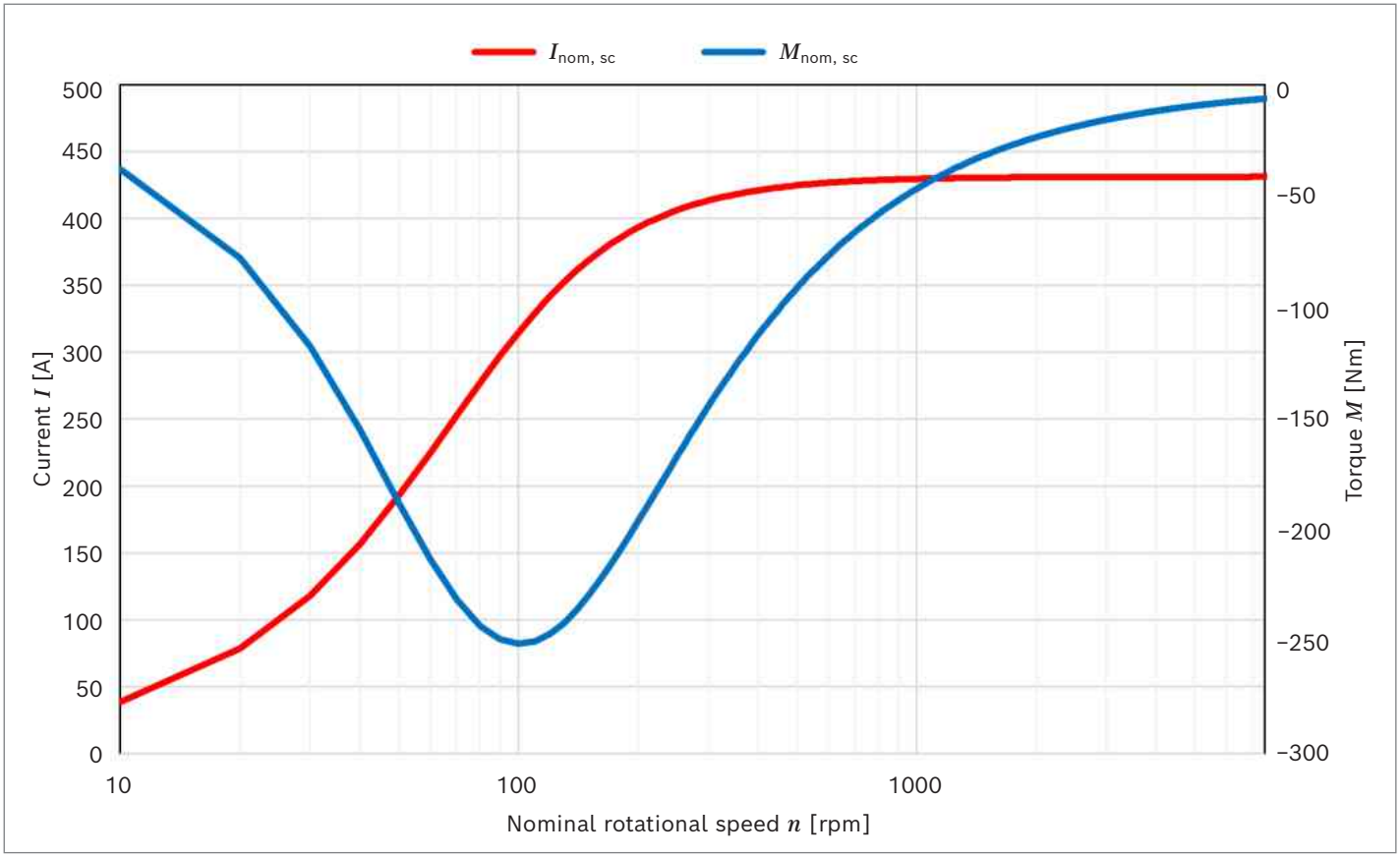
▼ **Torque EMS1-13L60**



▼ **Power EMS1-13L60**



▼ Short circuit current and short circuit braking torque EMS1-13L60



Technical data EMS1-20

General electrical properties

Parameter	Unit	EMS1-20			
		10	15	20	25
Nominal rotational speed	rpm	1000	1500	2000	2500
Maximum rotational speed	rpm	4000			
Nominal voltage range	VDC	400 ... 750			
Operating DC voltage	VDC	270 ... 850			
Voltage range		HV_3 according to LV123			
Switching frequency	kHz	≥ 4			
Electrical connection		Star connection			

General mechanical properties

Parameter		Unit	EMS1-20			
			F	H	J	l
Weight	Internal splined shaft	kg	See chapter „Dimensions“			
	External spline shaft	kg	See chapter „Dimensions“			
Overall length		mm	438	498	558	618
Moment of inertia	Internal splined shaft	kgm^2	0.407	0.535	0.664	0.792
	External spline shaft	kgm^2	0.408	0.536	0.665	0.793
Center of gravity	Internal splined shaft	mm	X = 193 Y = 8.3 Z = −0.05	X = 223 Y = 7 Z = −0.04	X = 252.5 Y = 6.0 Z = −0.03	X = 282 Y = 5.2 Z = −0.03
	External spline shaft	mm	X = 192 Y = 8.2 Z = −0.05	X = 222 Y = 6.9 Z = −0.04	X = 251.8 Y = 6.0 Z = −0.03	X = 281 Y = 5.3 Z = −0.03

Mechanical interface

Parameter	
Motor mounting	
Motor flange (according to SAE J617)	SAE 2
External spline shaft (type code W4) for motor (according to DIN 5480)	W55 × 2 × 26 × 8c
Pump mounting	
Pump flange (according to SAE J744)	D4, 45° steps
Internal-splined shaft (type code N4) for pumps (according to ANSI B92.1)	N1 3/4 13T 8/16 DP

Cooling

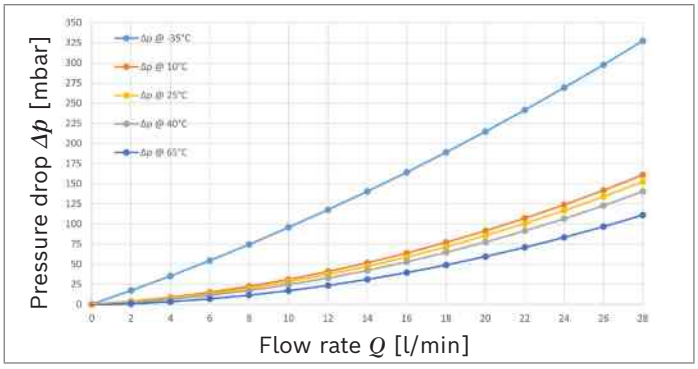
The table shows the operating conditions for the cooling liquid. Further information on motor cooling can be found in “Operating Instructions 96709-01-B”.

Parameter			Symbol	Unit	Value
Standard cooling liquid					Water:glycol 50:50 – Glysantin G40
Nominal flow rate			Q_{min}	l/min	20
Maximum inlet pressure			p_{max}	bar	6
Inlet temperature			T_{Inlet}	°C	Minimum –37 °C Maximum 65 °C
Cooling liquid volume	Length	F	V_{liquid}	l	2.5
		H	V_{liquid}	l	2.9
		J	V_{liquid}	l	3.3
		L	V_{liquid}	l	3.7
Coolant channels material					Aluminum, cast iron
Coolant connection					2 × G1/2" according to ISO 1179-1
Heat class according to IEC 60034-1					H

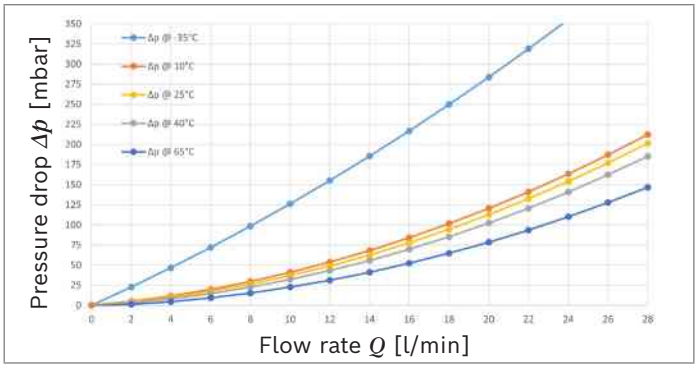
Pressure drop

The following graphs show the pressure drop at a 50:50 water to glycol ratio depending on the flow rate and the temperature of the cooling liquid

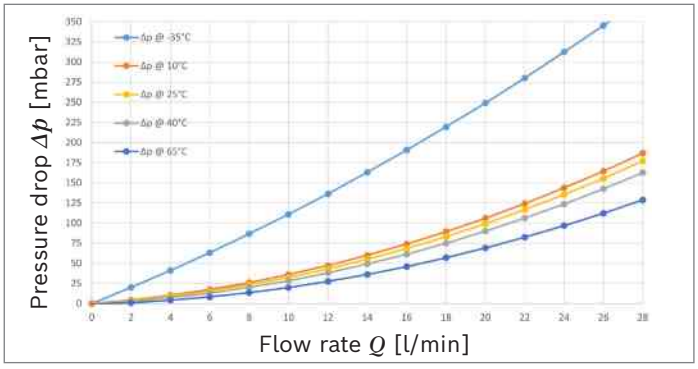
▼ EMS1-20F



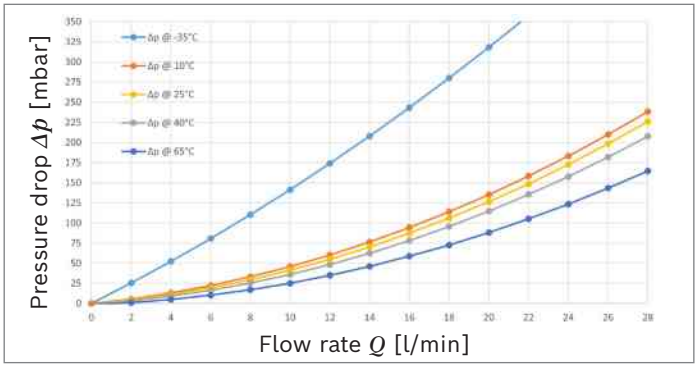
▼ EMS1-20J



▼ EMS1-20H



▼ EMS1-20L



Power data EMS1-20

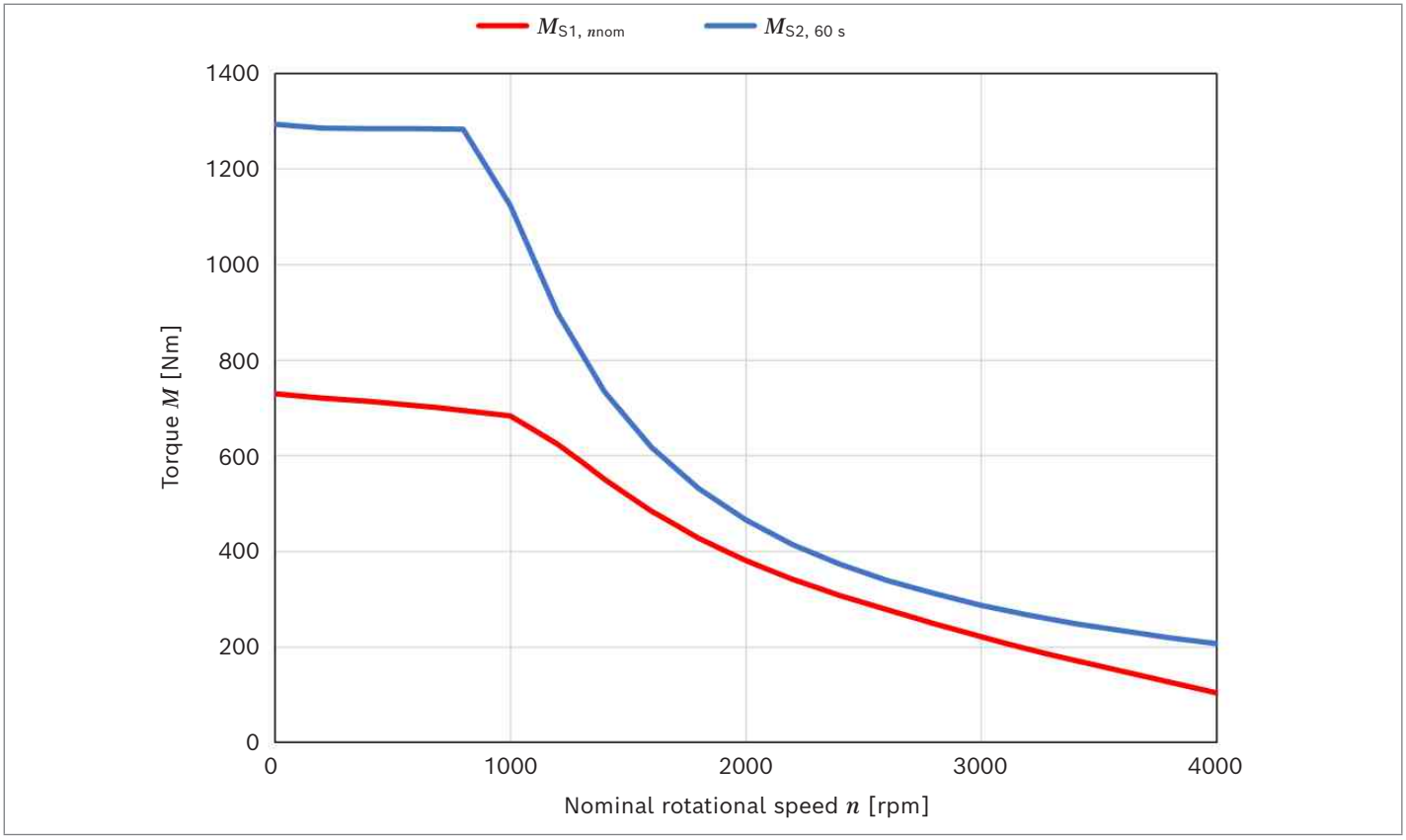
EMS1-20F10

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	721
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	119
Nominal rotational speed	n_{nom}	rpm	1000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	683
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	114
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	72
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	93.99
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	1294
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	259
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	118
Maximum rotational speed	n_{max}	rpm	4000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	104
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	75
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	44
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	89.22
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	511
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	110
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	81
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	1520
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	94.38
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	31
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	133
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	463
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	133
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

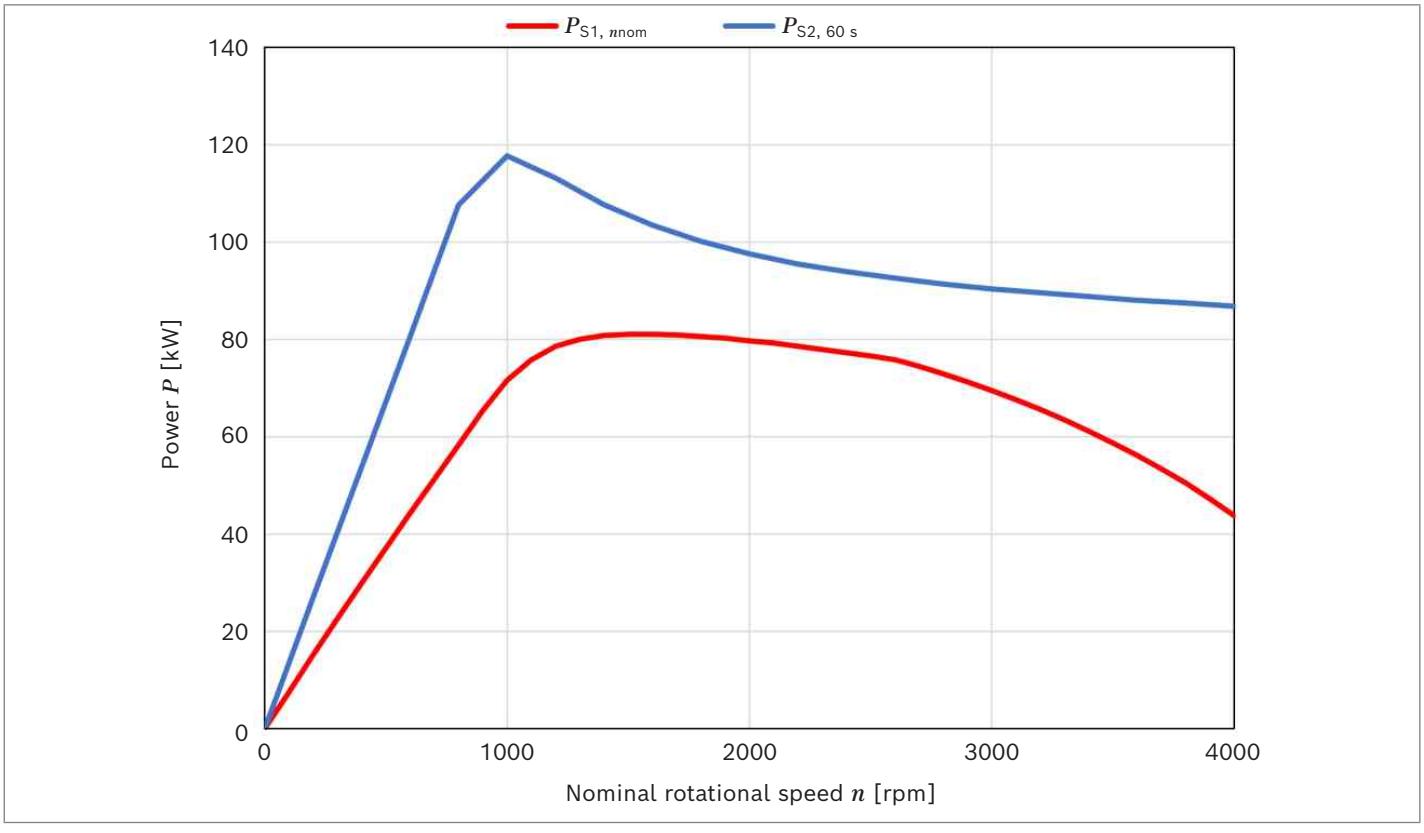
Electric	Symbol	Unit	Value
Number of poles			8
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	337.2
Torque constant at 25 °C	k_T	Nm / A_{RMS}	6.5
Synchronous inductance (d-axis) at rated current	L_d	mH	4.5
Synchronous inductance (q-axis) at rated current	L_q	mH	10
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.1229
Cogging torque (unskewed)	M_{cog}	Nm	19.69
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	31.72

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

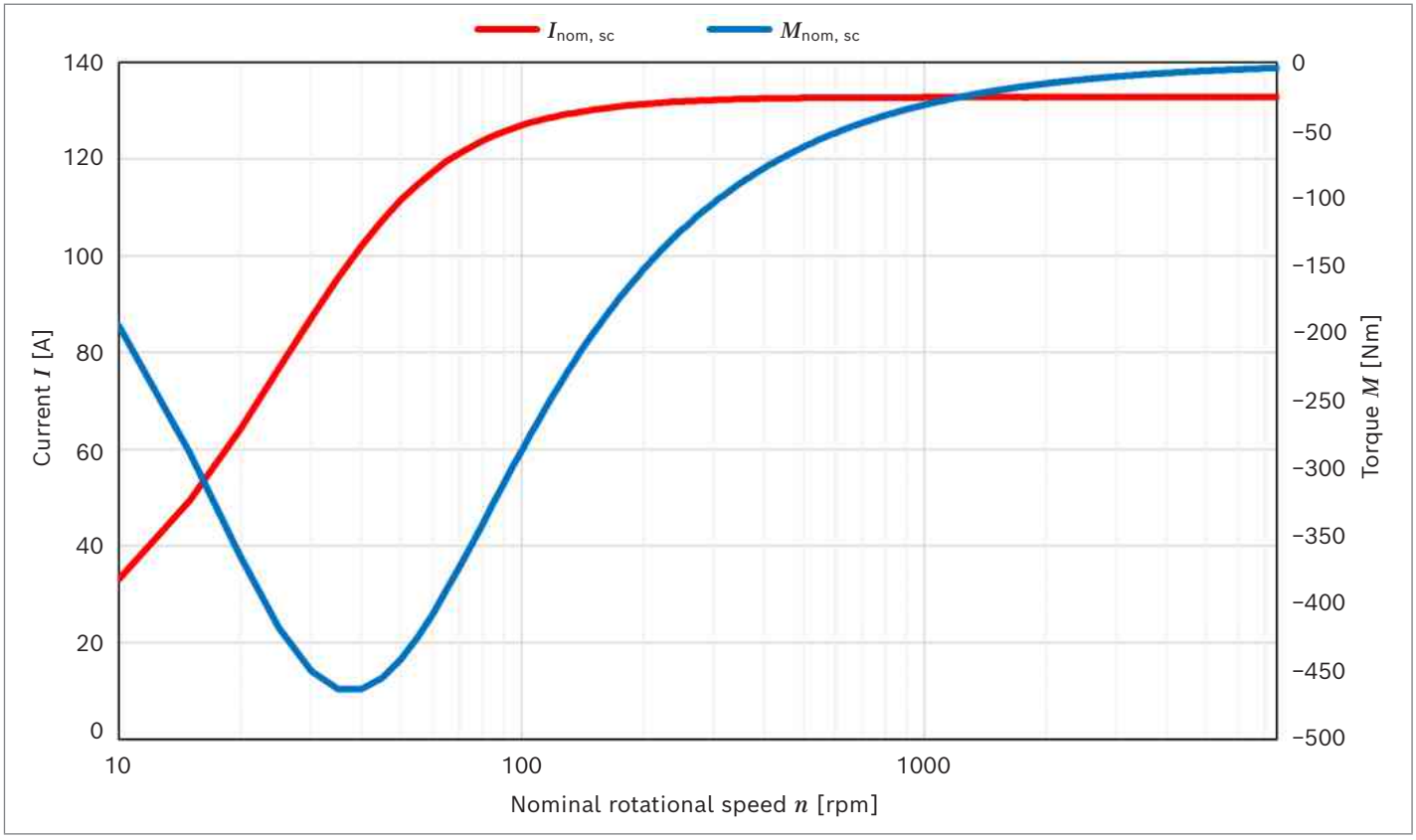
▼ Torque EMS1-20F10



▼ Power EMS1-20F10



▼ **Short circuit current and short circuit braking torque EMS1-20F10**



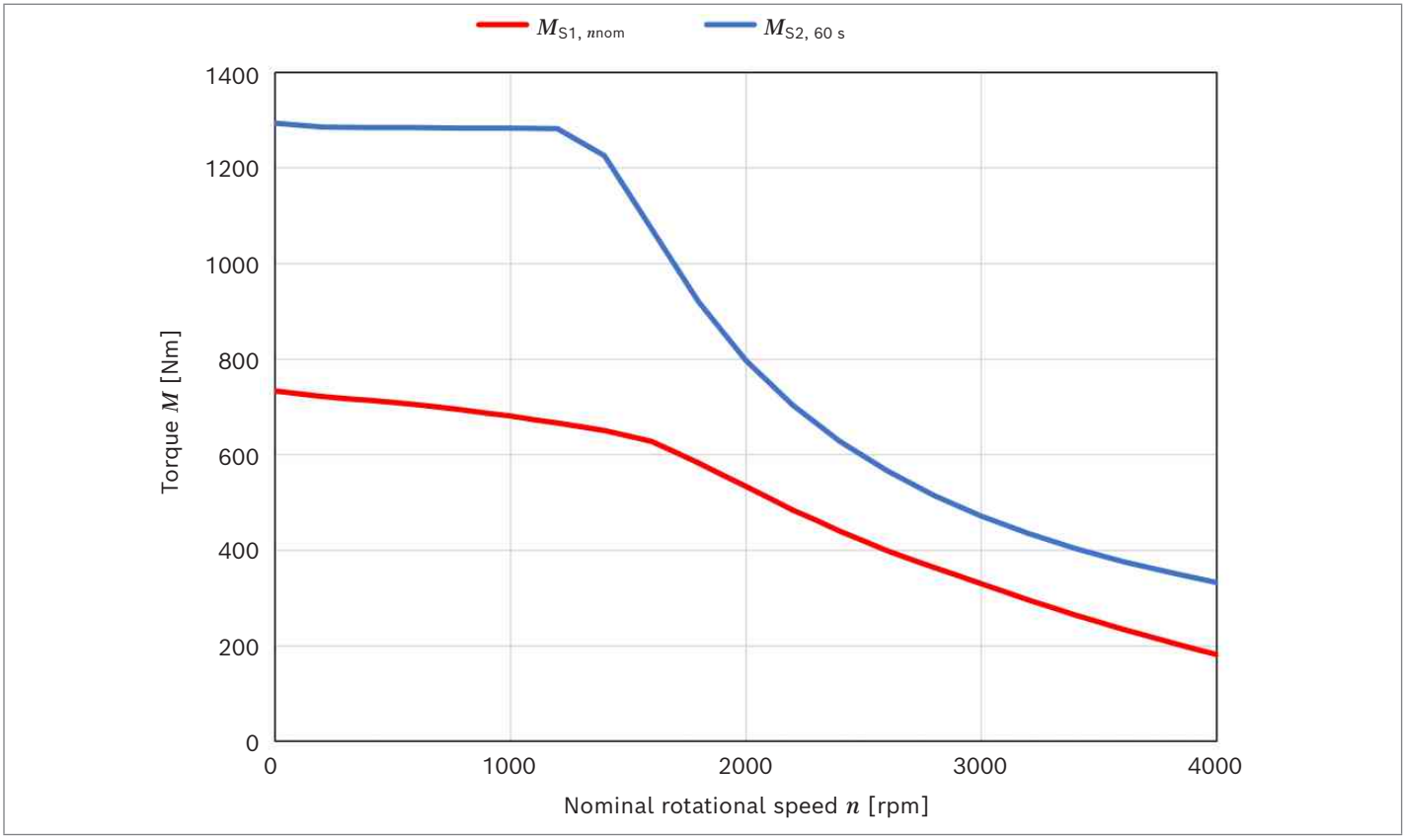
EMS1-20F15

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	722
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	179
Nominal rotational speed	n_{nom}	rpm	1500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	639
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	161
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	100
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	95.22
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	1294
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	388
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	181
Maximum rotational speed	n_{max}	rpm	4000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	182
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	106
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	76
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	93.14
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	514
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	151
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	112
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	2080
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	95.42
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	21
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	199
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	463
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	199
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

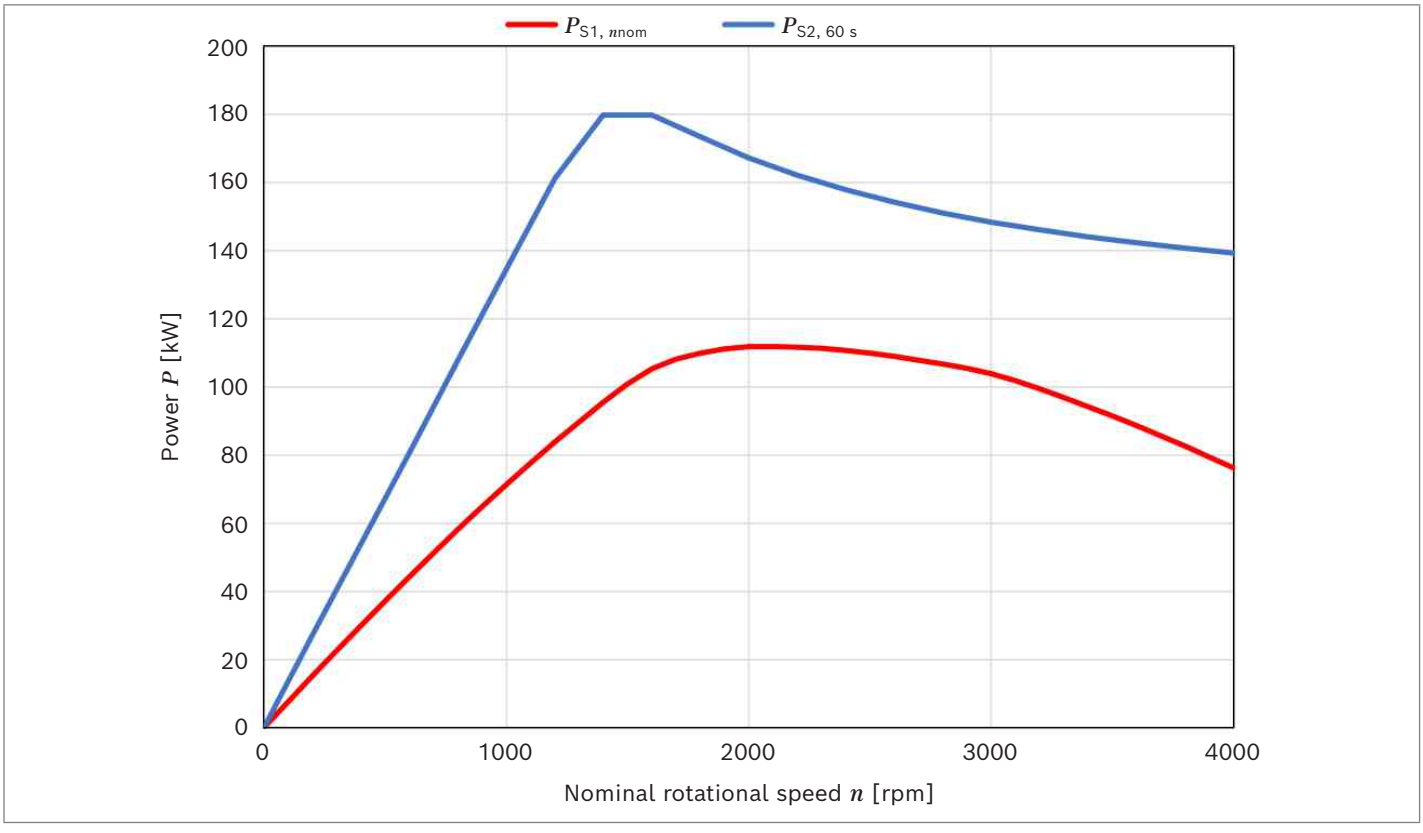
Electric	Symbol	Unit	Value
Number of poles			8
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	227.9
Torque constant at 25 °C	k_T	Nm / A_{RMS}	4.33
Synchronous inductance (d-axis) at rated current	L_d	mH	1.39
Synchronous inductance (q-axis) at rated current	L_q	mH	4.27
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.055
Cogging torque (unskewed)	M_{cog}	Nm	19.69
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	28.89

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

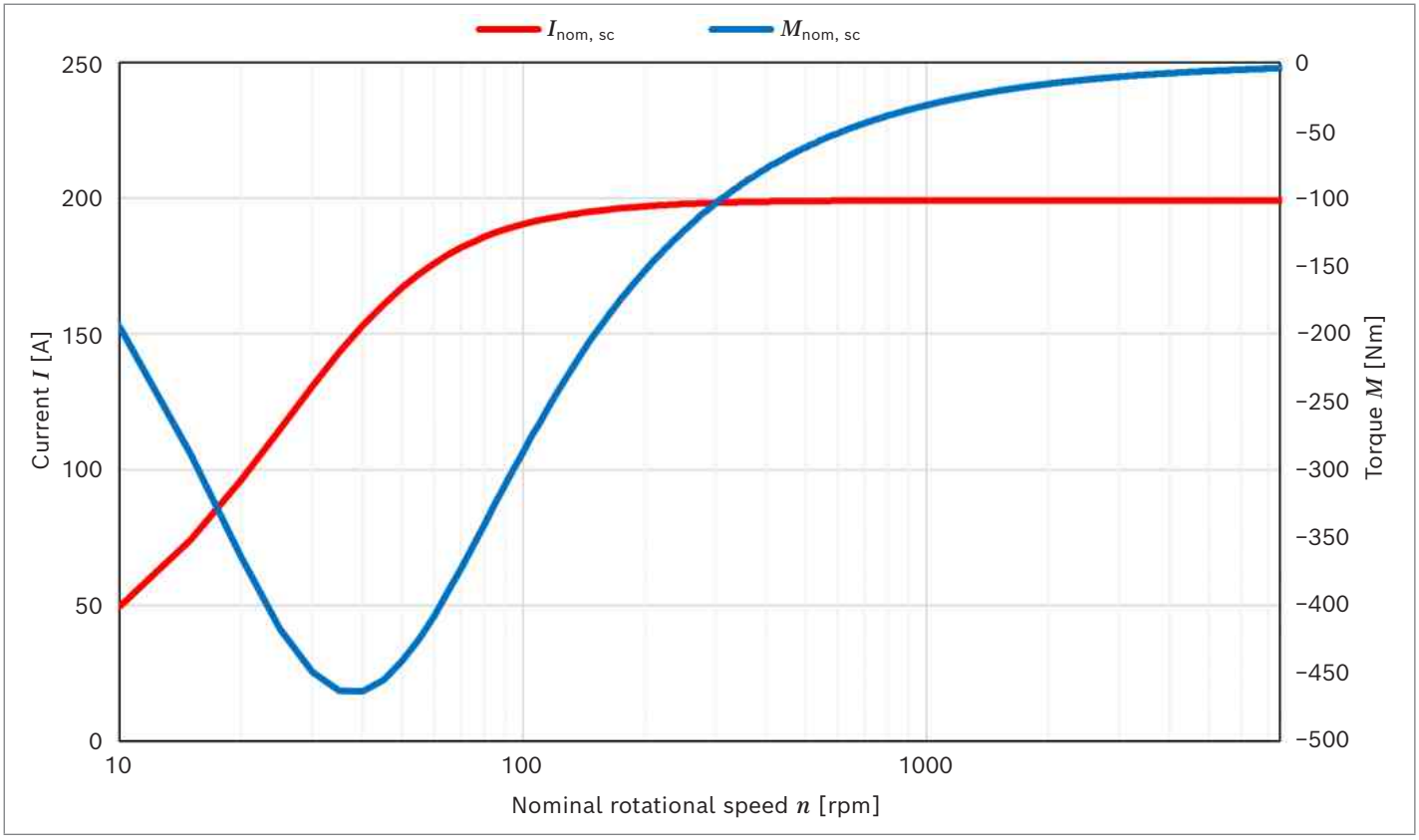
▼ **Torque EMS1-20F15**



▼ **Power EMS1-20F15**



▼ Short circuit current and short circuit braking torque EMS1-20F15



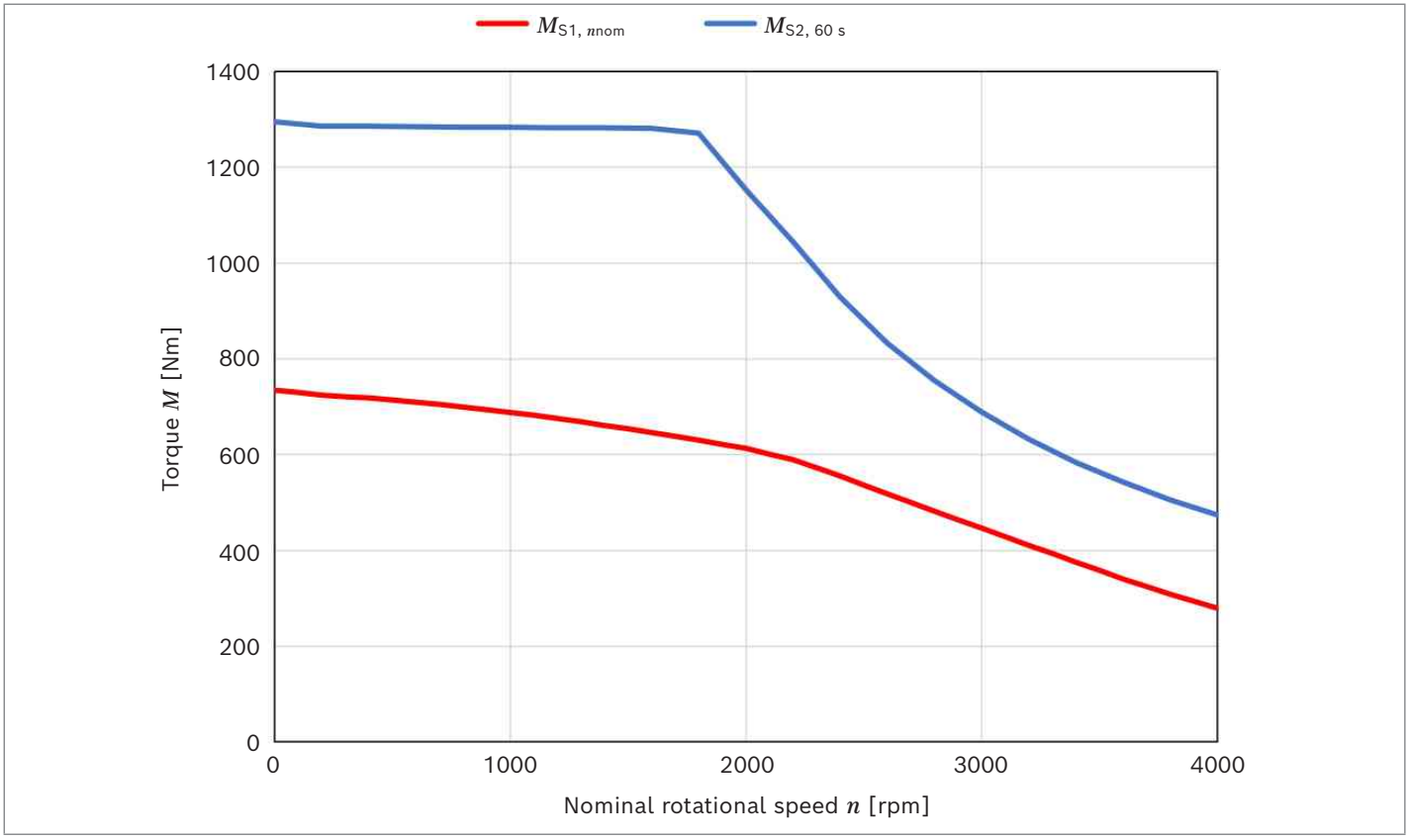
EMS1-20F20

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	725
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	240
Nominal rotational speed	n_{nom}	rpm	2000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	613
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	206
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	128
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	95.86
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	1295
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	518
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	242
Maximum rotational speed	n_{max}	rpm	4000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	280
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	150
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	117
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	95.18
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	497
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	190
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	141
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	2720
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	95.96
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	16
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	266
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	463
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	266
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

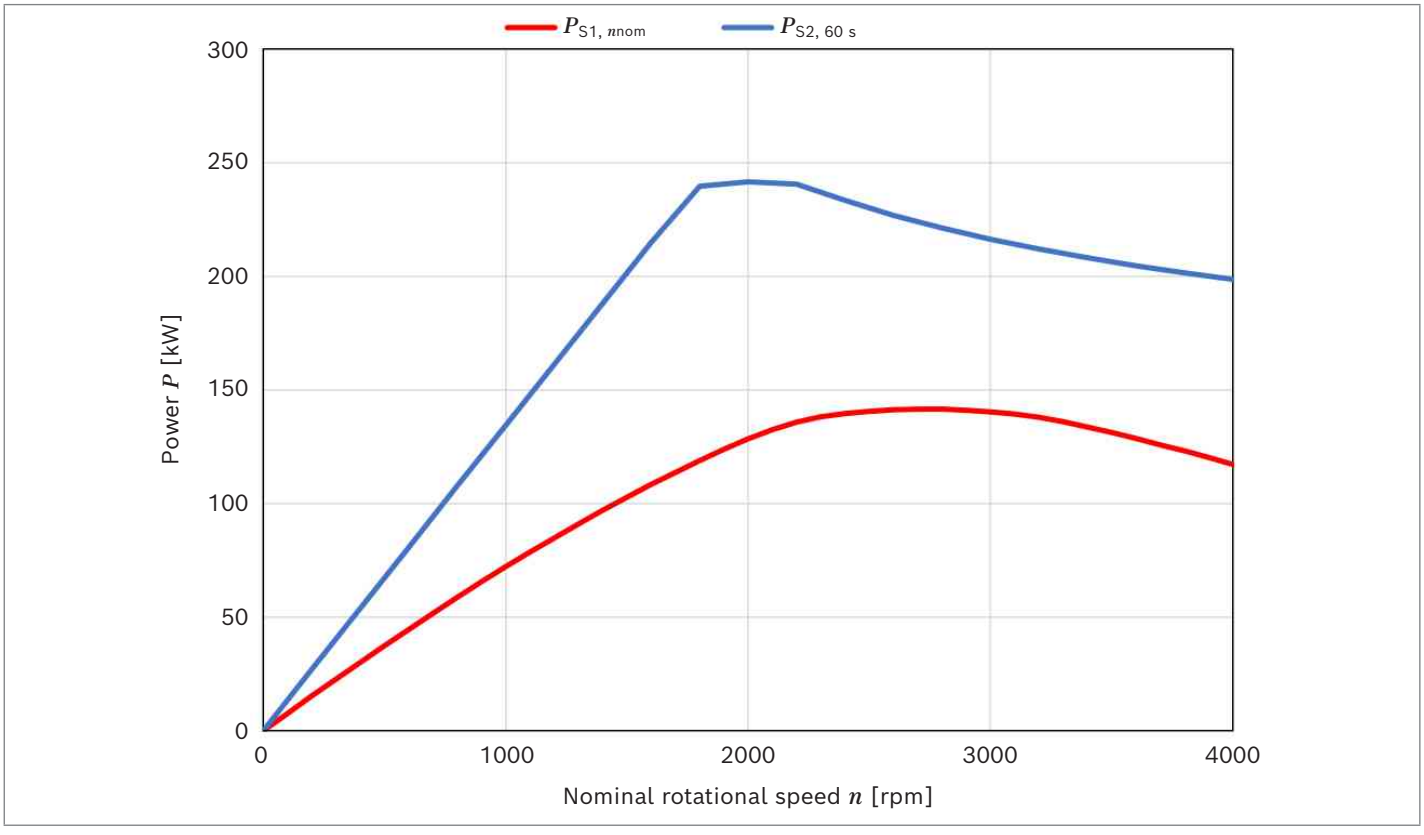
Electric	Symbol	Unit	Value
Number of poles			8
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	168.6
Torque constant at 25 °C	k_T	Nm / A_{RMS}	3.43
Synchronous inductance (d-axis) at rated current	L_d	mH	1.1
Synchronous inductance (q-axis) at rated current	L_q	mH	3.25
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.0307
Cogging torque (unskewed)	M_{cog}	Nm	19.69
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	27.34

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

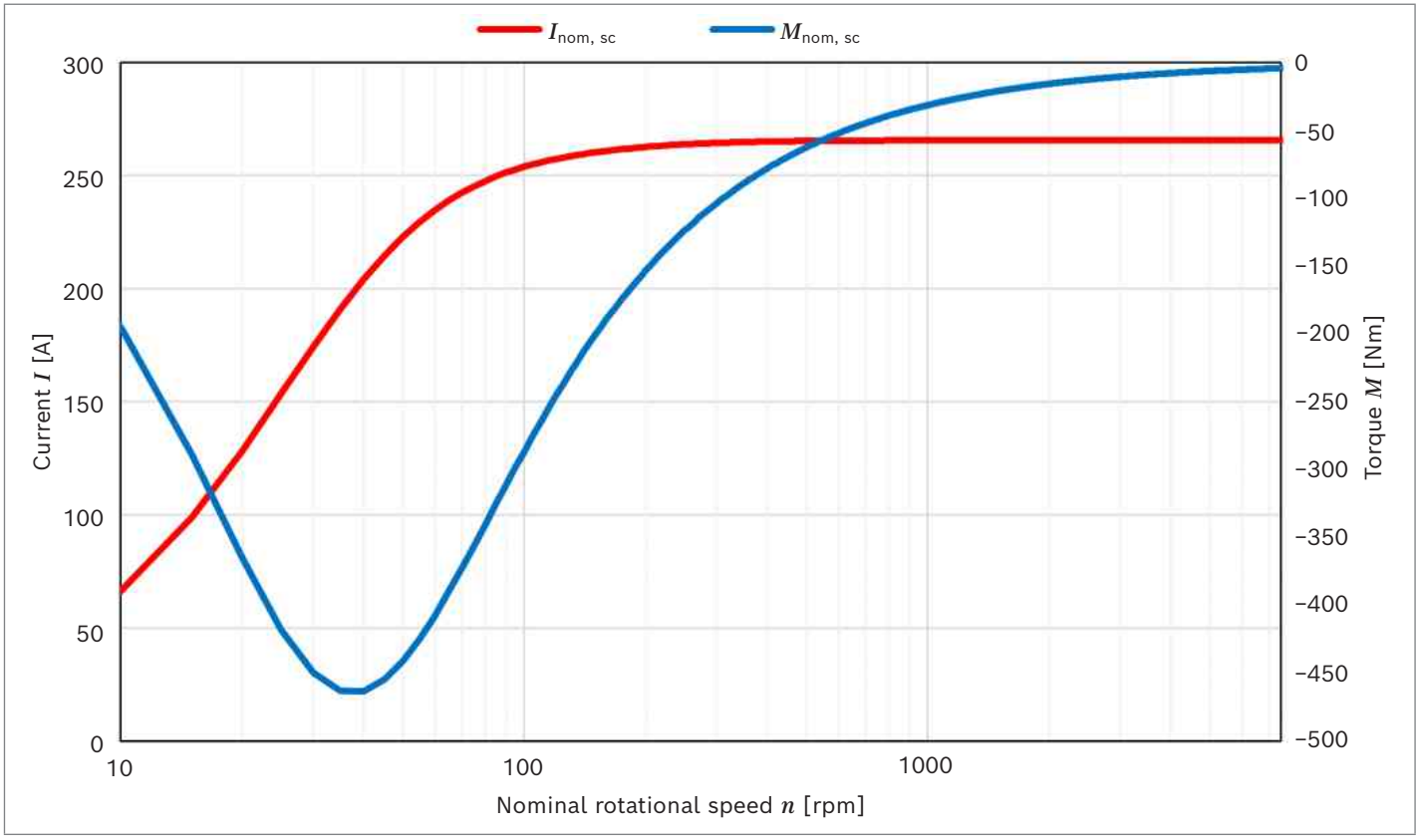
▼ Torque EMS1-20F20



▼ Power EMS1-20F20



▼ **Short circuit current and short circuit braking torque EMS1-20F20**



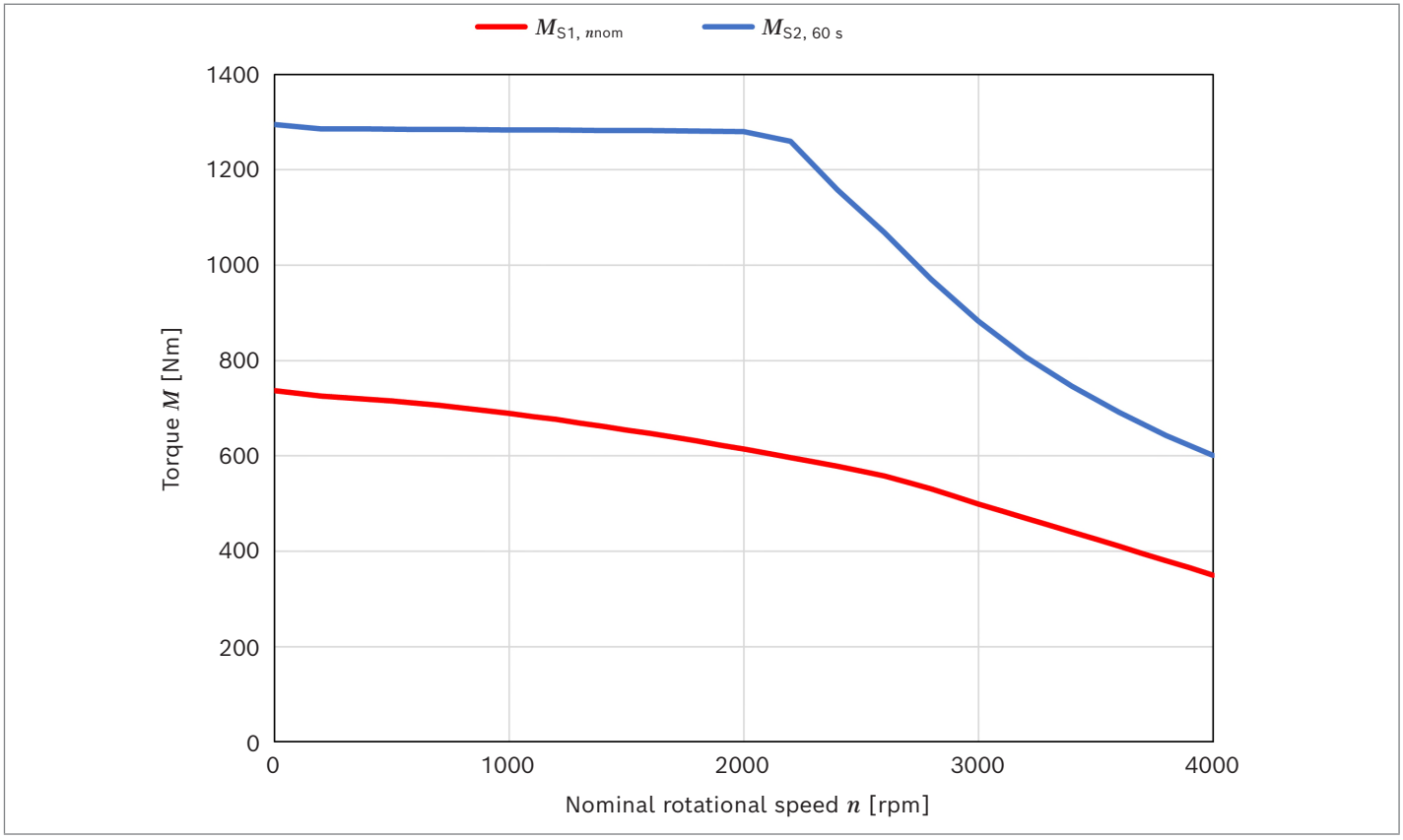
EMS1-20F25

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	726
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	288
Nominal rotational speed	n_{nom}	rpm	2500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	568
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	231
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	149
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	96.10
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	1295
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	621
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	291
Maximum rotational speed	n_{max}	rpm	4000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	350
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	187
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	146
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	95.73
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	470
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	211
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	157
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	3200
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	96.09
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	13
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	319
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	463
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	319
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

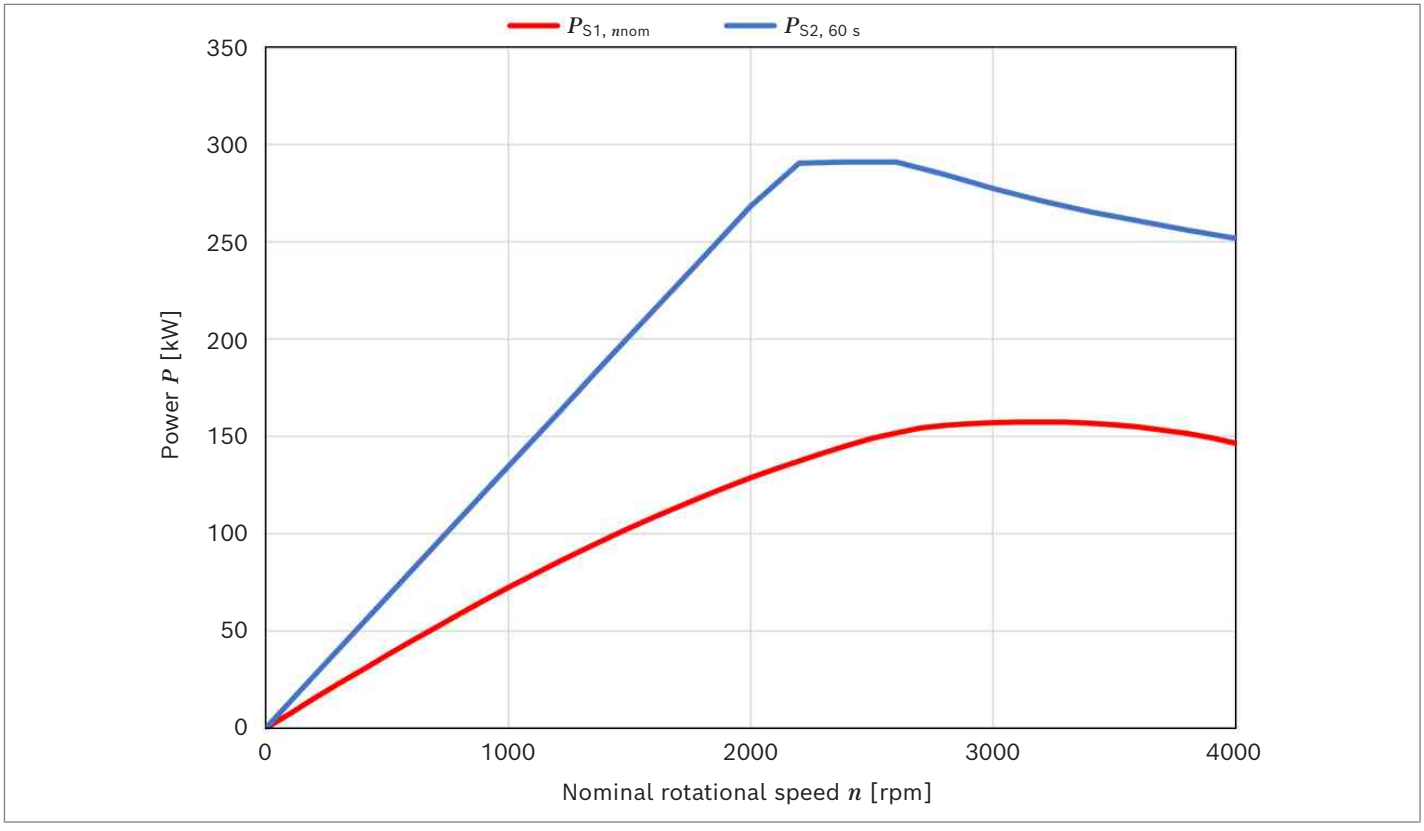
Electric	Symbol	Unit	Value
Number of poles			8
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	140.5
Torque constant at 25 °C	k_T	Nm / A_{RMS}	2.71
Synchronous inductance (d-axis) at rated current	L_d	mH	0.8
Synchronous inductance (q-axis) at rated current	L_q	mH	1.7
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.0212
Cogging torque (unskewed)	M_{cog}	Nm	19.69
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	24.56

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

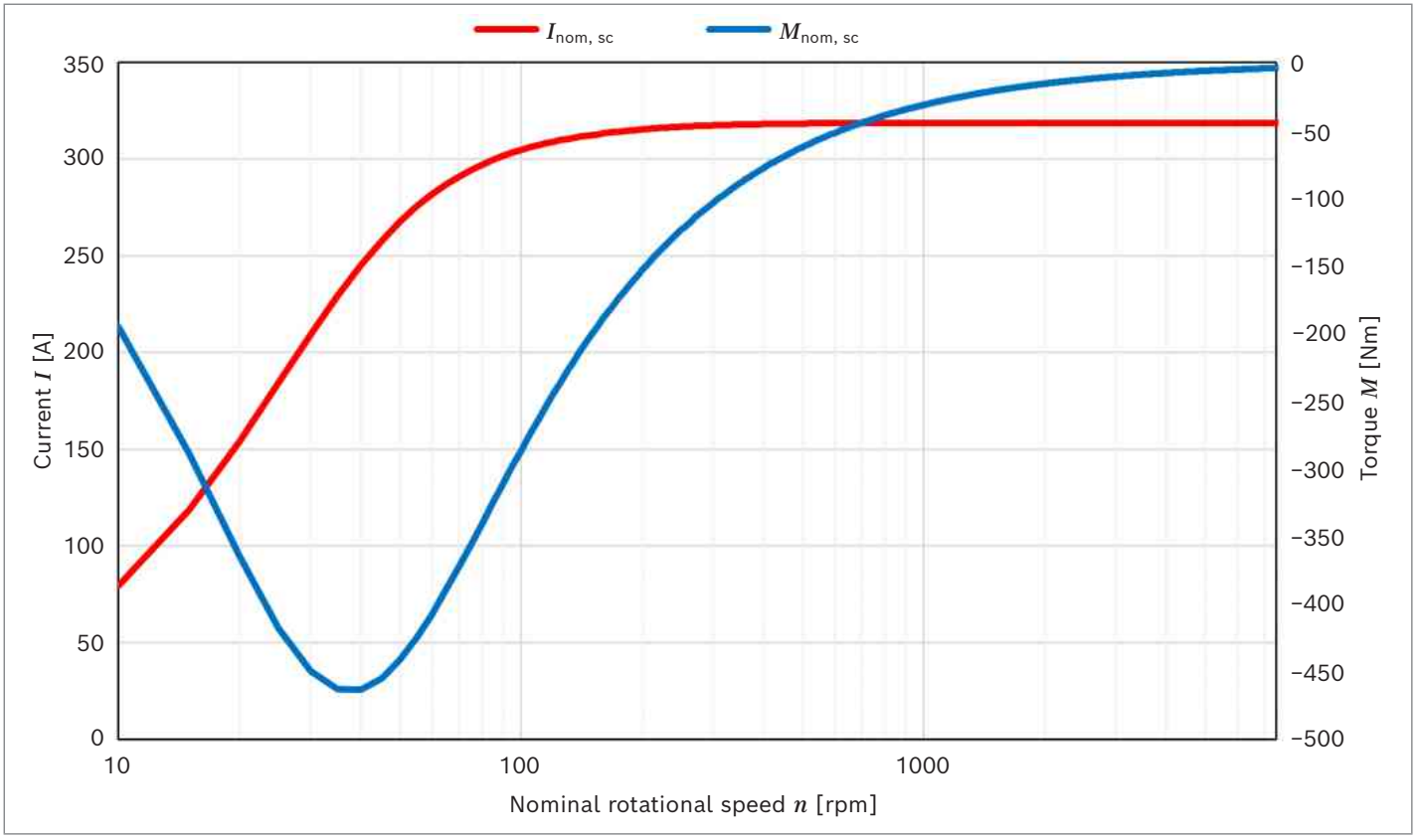
▼ **Torque EMS1-20F25**



▼ **Power EMS1-20F25**



▼ Short circuit current and short circuit braking torque EMS1-20F25



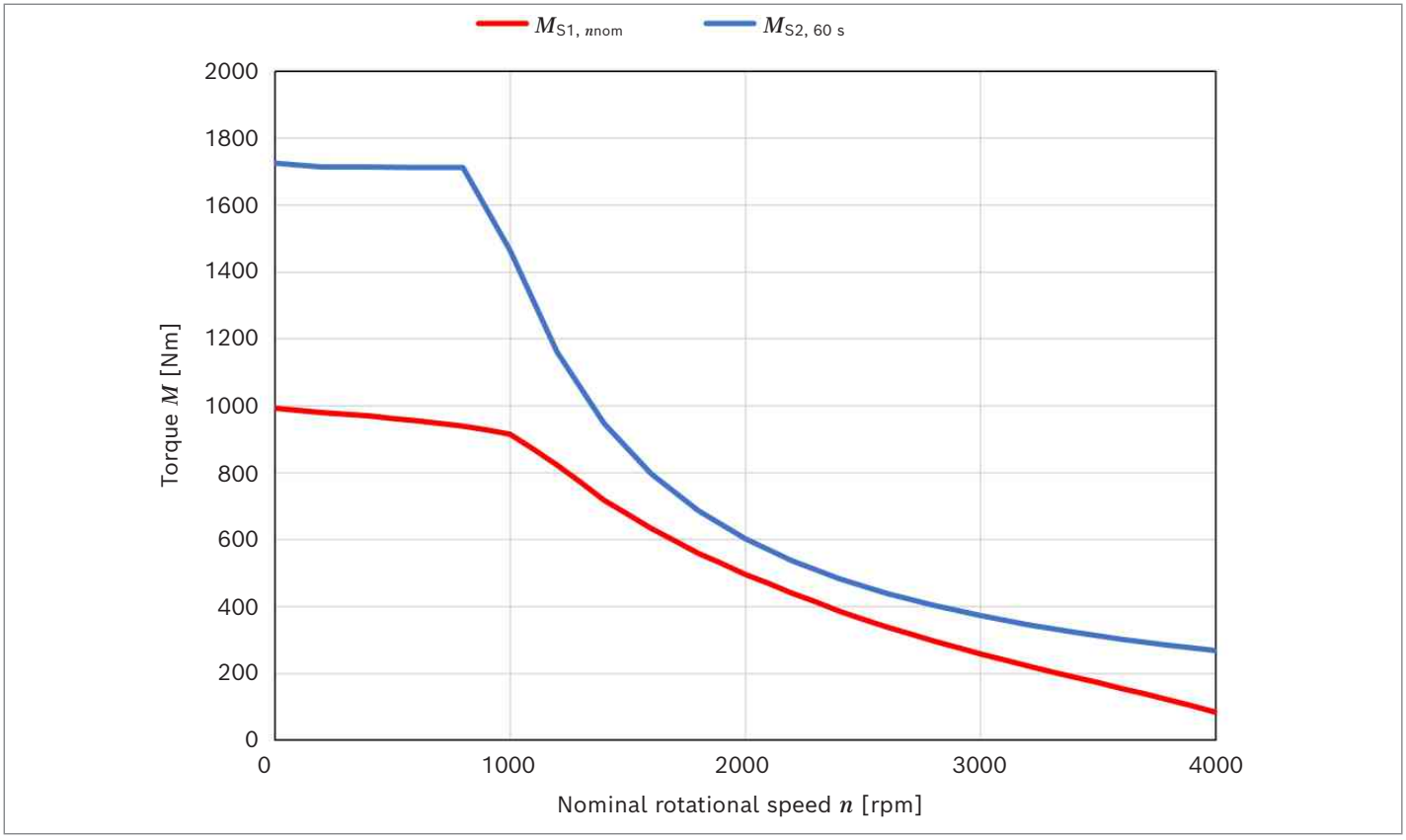
EMS1-20H10

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	980
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	157
Nominal rotational speed	n_{nom}	rpm	1000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	915
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	148
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	96
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	94.44
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	1726
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	332
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	154
Maximum rotational speed	n_{max}	rpm	4000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	84
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	90
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	35
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	84.29
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	603
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	141
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	106
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	1680
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	94.55
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	37
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	172
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	623
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	172
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

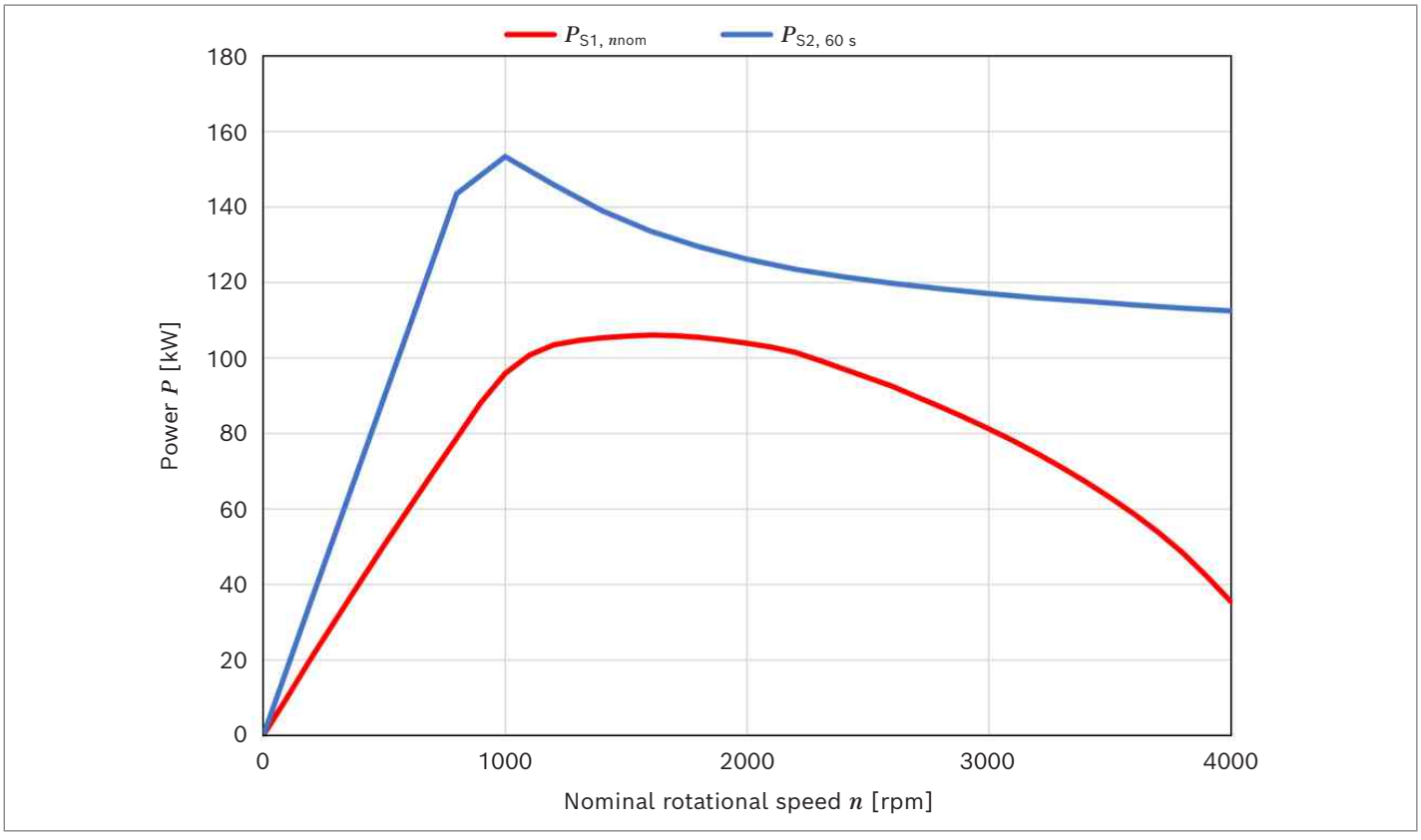
Electric	Symbol	Unit	Value
Number of poles			8
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	351.6
Torque constant at 25 °C	k_T	Nm / A_{RMS}	7.01
Synchronous inductance (d-axis) at rated current	L_d	mH	3.18
Synchronous inductance (q-axis) at rated current	L_q	mH	11
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.087
Cogging torque (unskewed)	M_{cog}	Nm	26.26
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	42.36

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

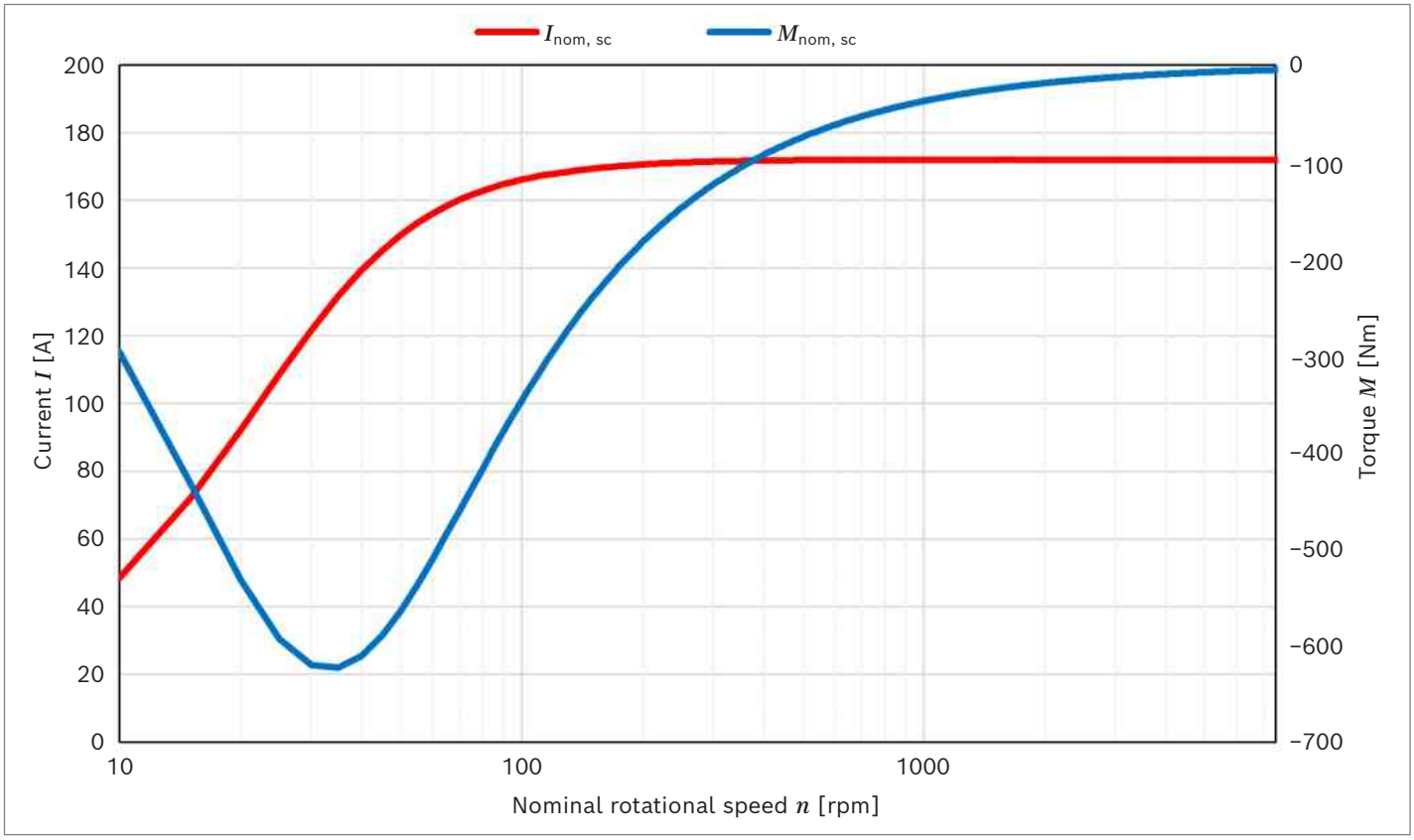
▼ Torque EMS1-20H10



▼ Power EMS1-20H10



▼ **Short circuit current and short circuit braking torque EMS1-20H10**

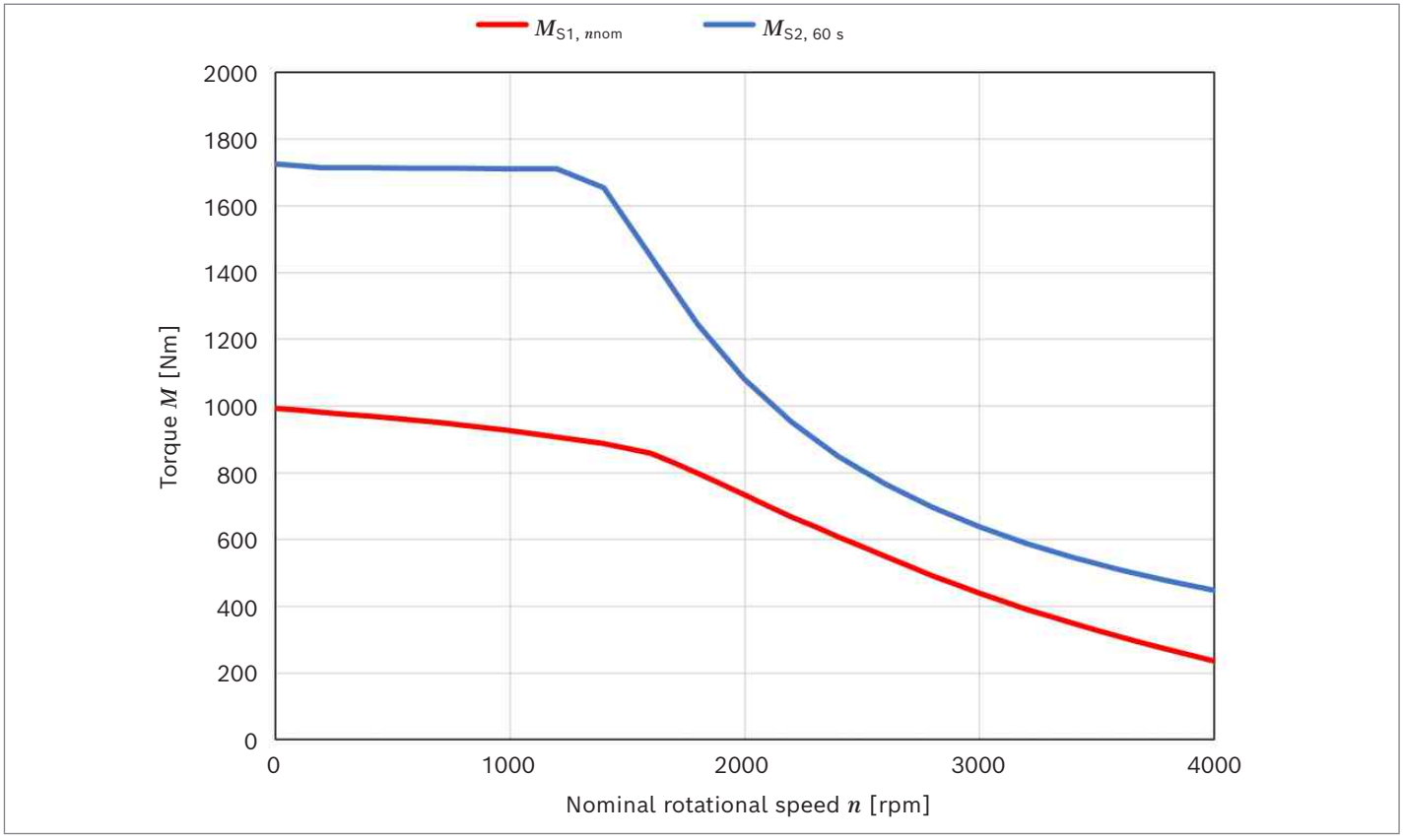


EMS1-20H15

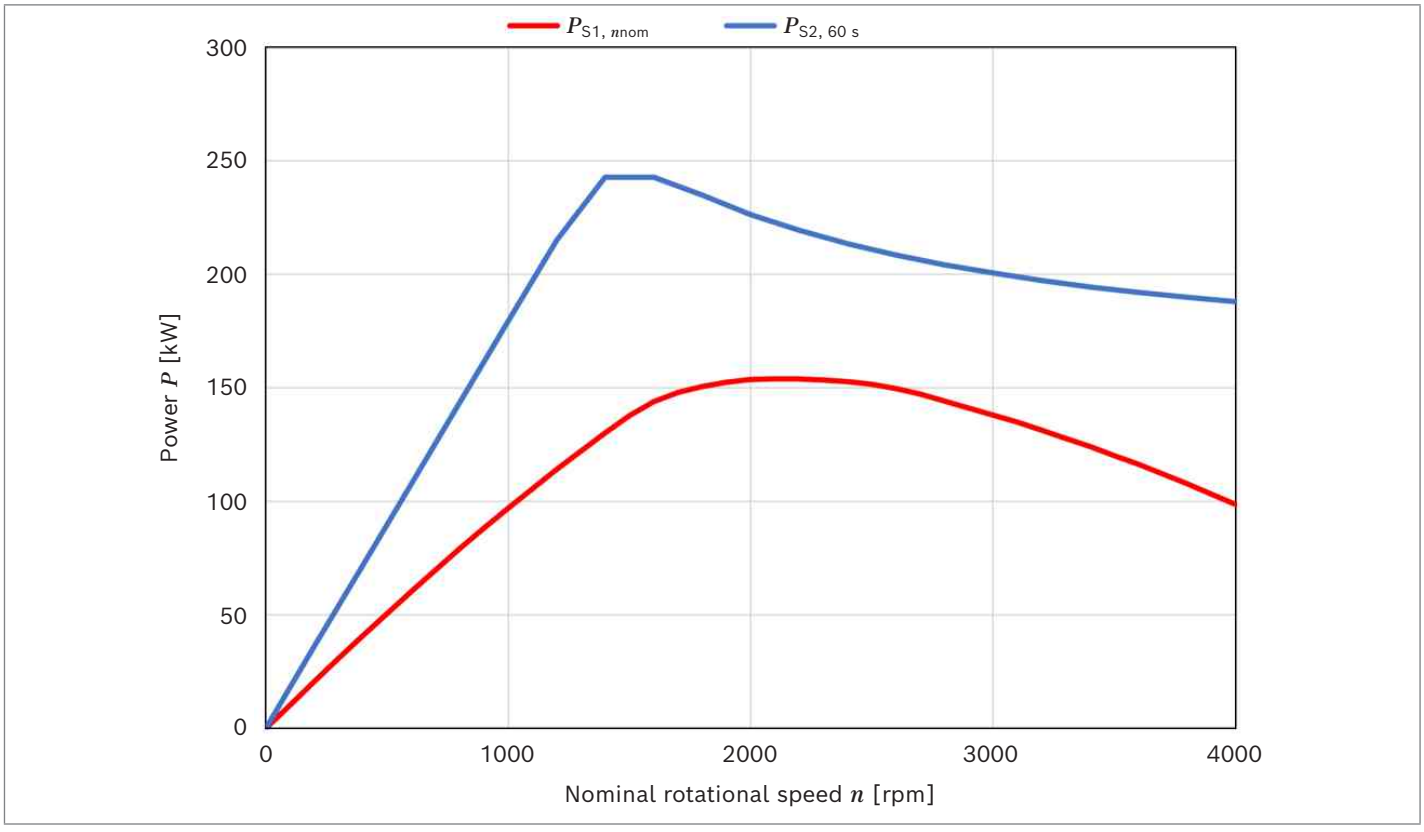
Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	981
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	244
Nominal rotational speed	n_{nom}	rpm	1500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	872
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	221
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	137
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	95.63
S2 for 60s torque (maximum torque)[1)]	$M_{S2,\ 60\ s}$	Nm	1689
S2 for 60s current (maximum current)[1)]	$I_{S2,\ 60\ s}$	A_{RMS}	518
S2 for 60s power (maximum power)[1)]	$P_{S2,\ 60\ s}$	kW	234
Maximum rotational speed	n_{max}	rpm	4000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	235
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	138
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	99
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	93.89
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	694
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	207
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	154
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	2120
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	95.81
Short circuit braking torque at nominal rotational speed[2)]	$M_{nom,\ sc}$	Nm	25
Short circuit current at nominal speed[2)]	$I_{nom,\ sc}$	A_{RMS}	267
Maximum short circuit braking torque[2)]	$M_{max,\ sc}$	Nm	625
Maximum short circuit current[2)]	$I_{max,\ sc}$	A_{RMS}	267
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

Electric	Symbol	Unit	Value
Number of poles			8
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	224.8
Torque constant at 25 °C	k_T	Nm / A_{RMS}	4.33
Synchronous inductance (d-axis) at rated current	L_d	mH	1.25
Synchronous inductance (q-axis) at rated current	L_q	mH	2.8
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.0361
Cogging torque (unskewed)	M_{cog}	Nm	26.26
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	40.23

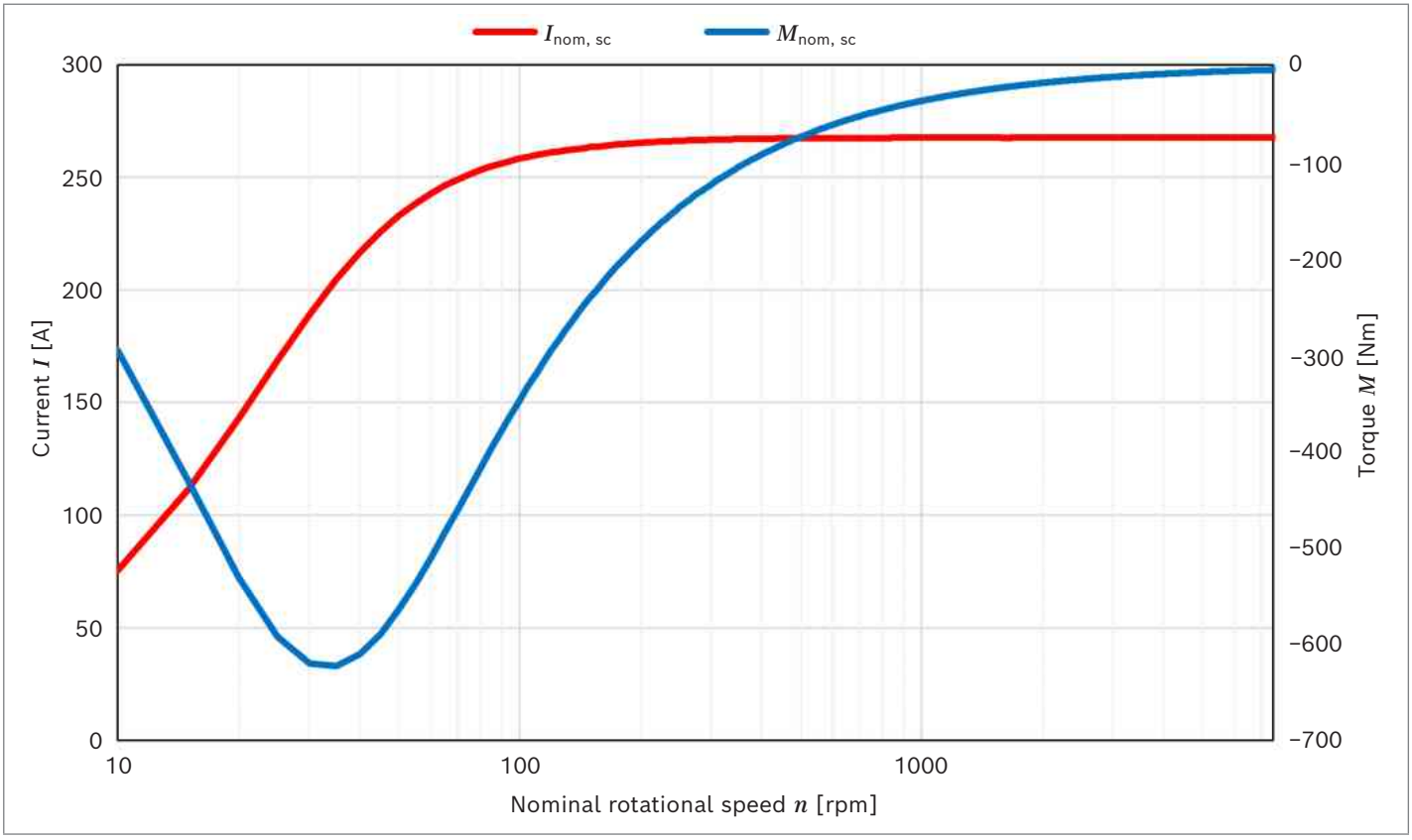
▼ **Torque EMS1-20H15**



▼ **Power EMS1-20H15**



▼ Short circuit current and short circuit braking torque EMS1-20H15



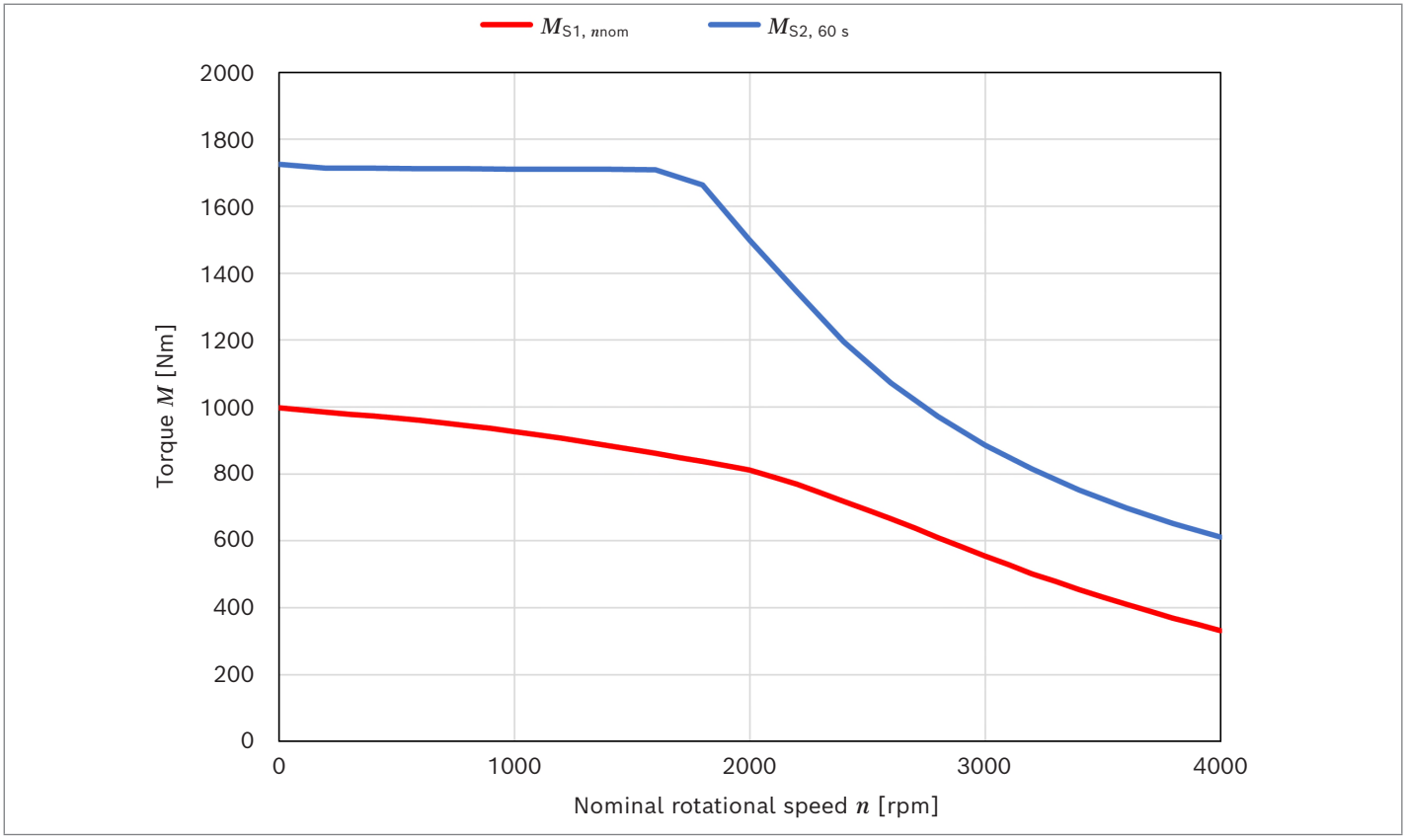
EMS1-20H20

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	984
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	315
Nominal rotational speed	n_{nom}	rpm	2000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	812
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	264
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	170
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	96.06
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	1726
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	665
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	315
Maximum rotational speed	n_{max}	rpm	4000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	331
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	180
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	139
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	95.14
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	676
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	246
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	181
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	2560
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	96.09
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	19
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	344
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	623
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	344
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

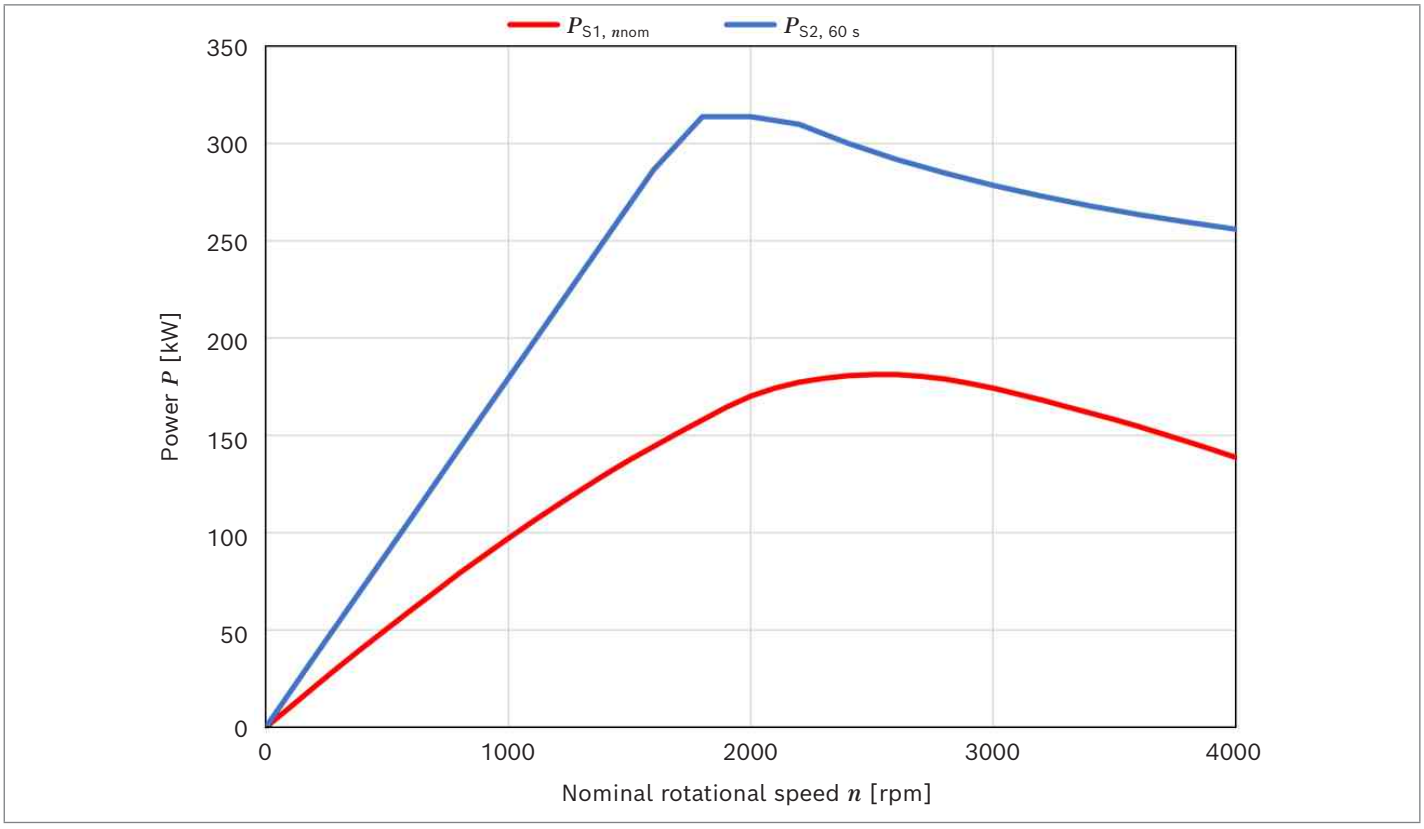
Electric	Symbol	Unit	Value
Number of poles			8
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	173.9
Torque constant at 25 °C	k_T	Nm / A_{RMS}	3.35
Synchronous inductance (d-axis) at rated current	L_d	mH	0.9
Synchronous inductance (q-axis) at rated current	L_q	mH	2.02
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.0215
Cogging torque (unskewed)	M_{cog}	Nm	26.26
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	36.35

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

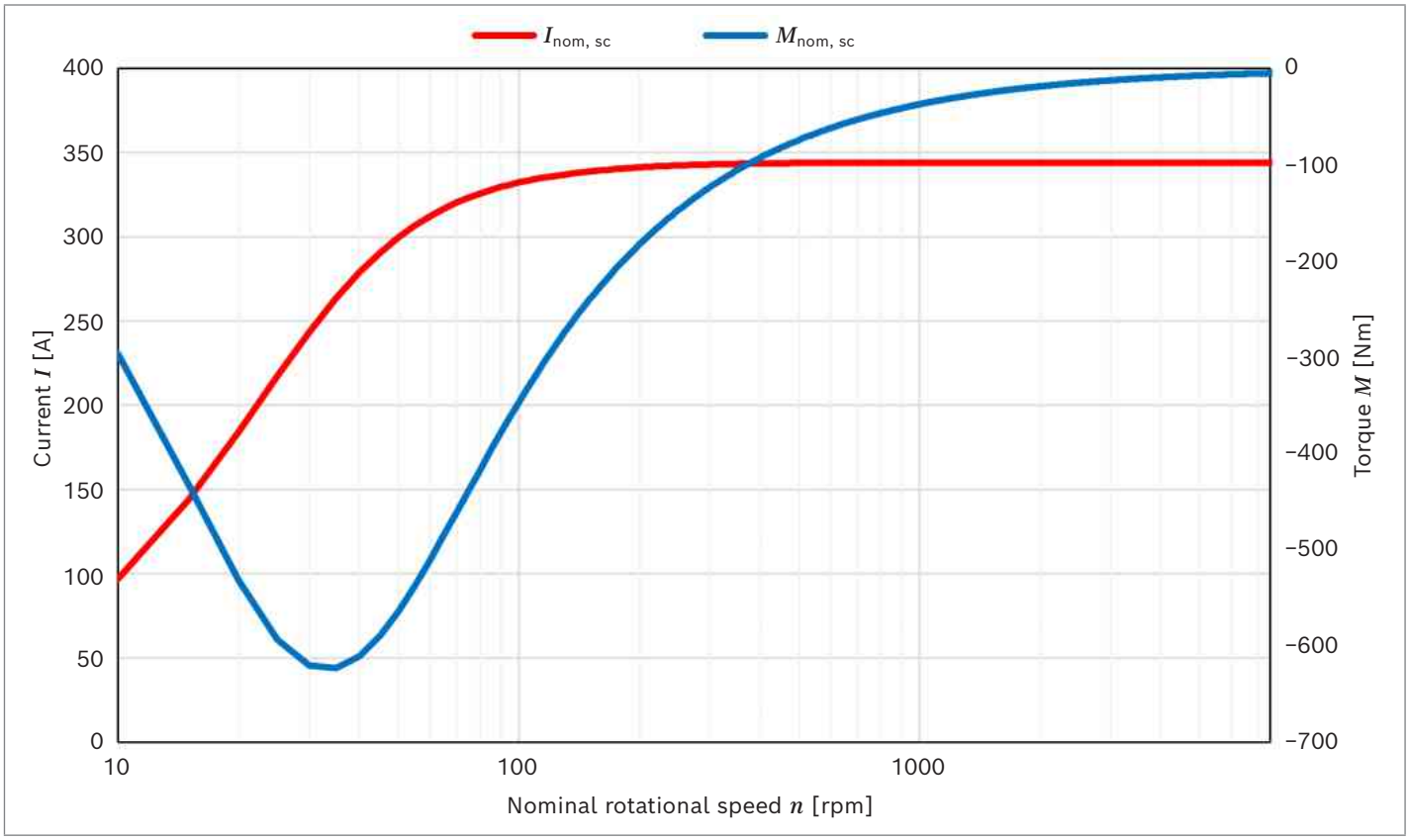
▼ Torque EMS1-20H20



▼ Power EMS1-20H20



▼ **Short circuit current and short circuit braking torque EMS1-20H20**



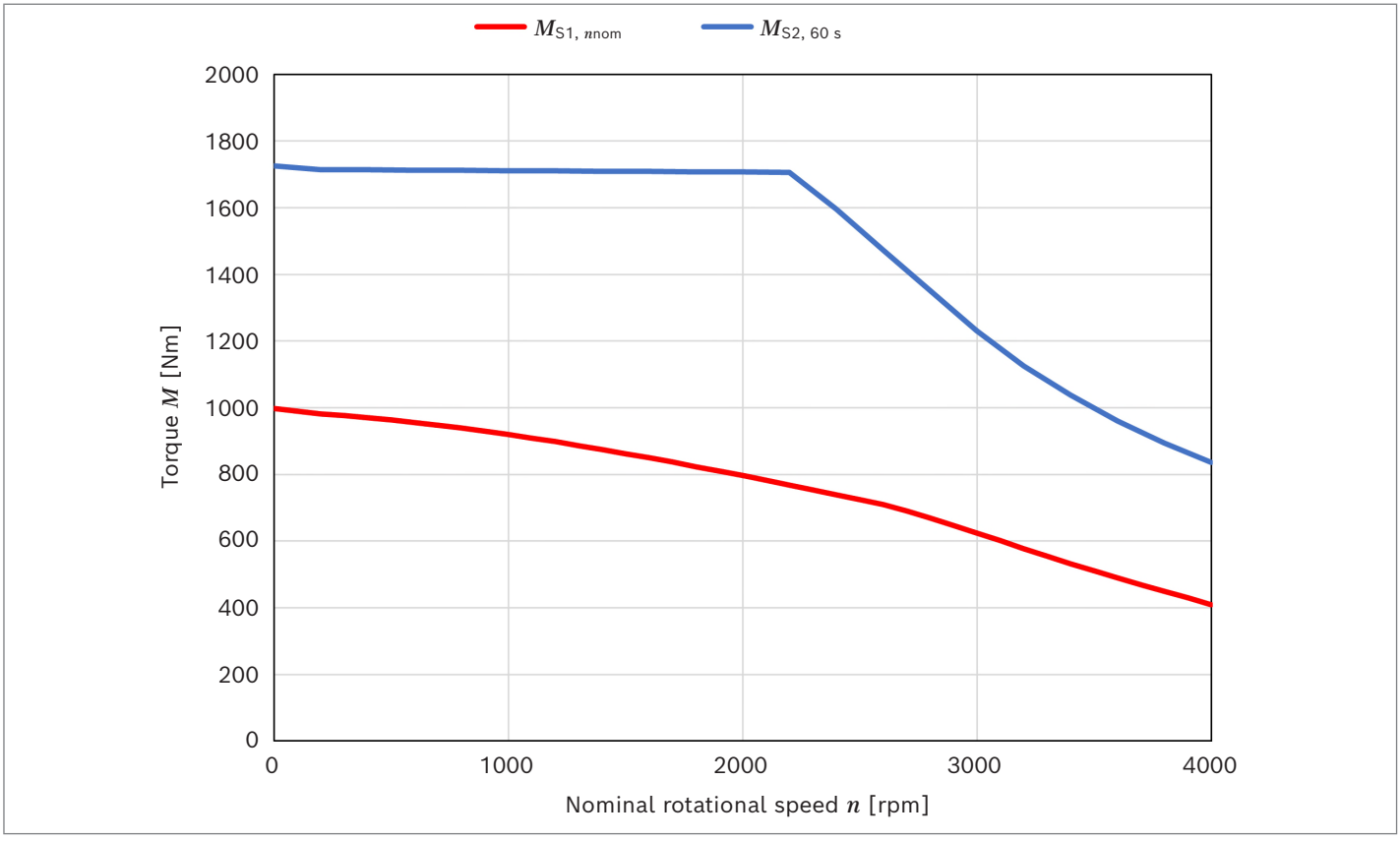
EMS1-20H25

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	982
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	399
Nominal rotational speed	n_{nom}	rpm	2500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	724
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	302
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	190
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	96.12
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	1726
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	847
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	402
Maximum rotational speed	n_{max}	rpm	4000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	410
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	219
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	172
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	95.72
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	651
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	280
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	196
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	2880
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	96.19
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	15
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	438
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	623
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	438
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

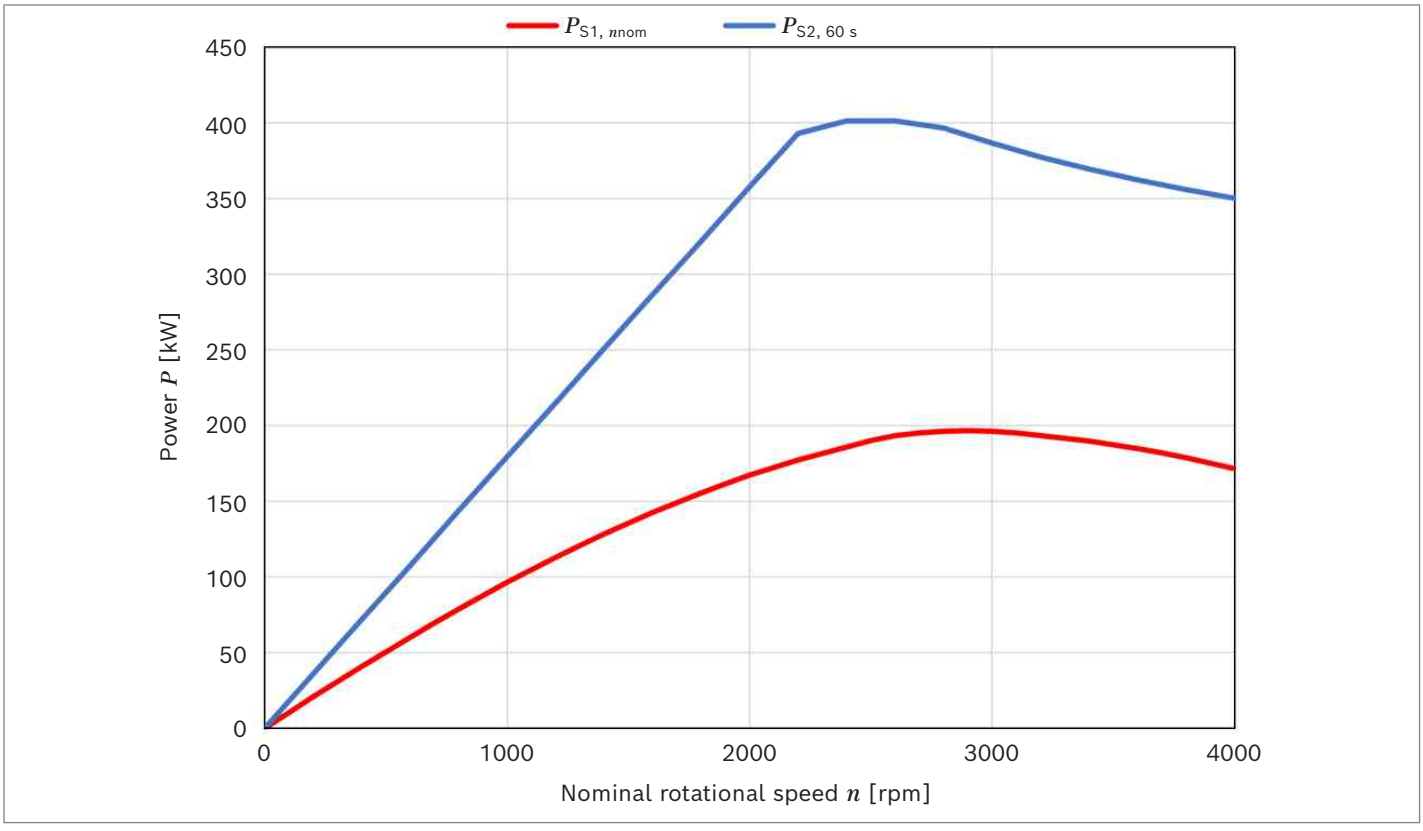
Electric	Symbol	Unit	Value
Number of poles			8
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	138
Torque constant at 25 °C	k_T	Nm / A_{RMS}	2.66
Synchronous inductance (d-axis) at rated current	L_d	mH	0.33
Synchronous inductance (q-axis) at rated current	L_q	mH	0.97
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.0134
Cogging torque (unskewed)	M_{cog}	Nm	26.26
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	30.98

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

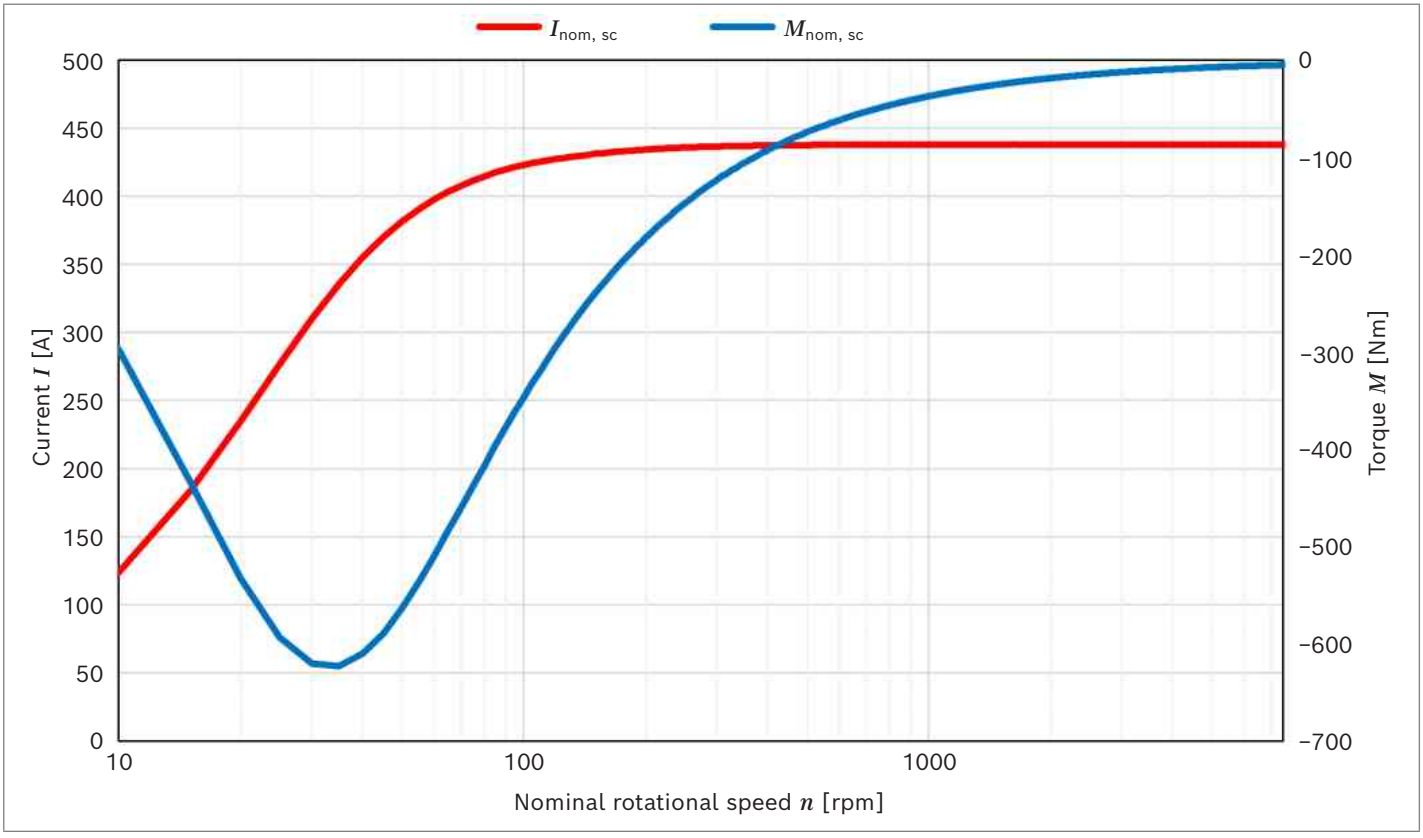
▼ **Torque EMS1-20H25**



▼ **Power EMS1-20H25**



▼ **Short circuit current and short circuit braking torque EMS1-20H25**



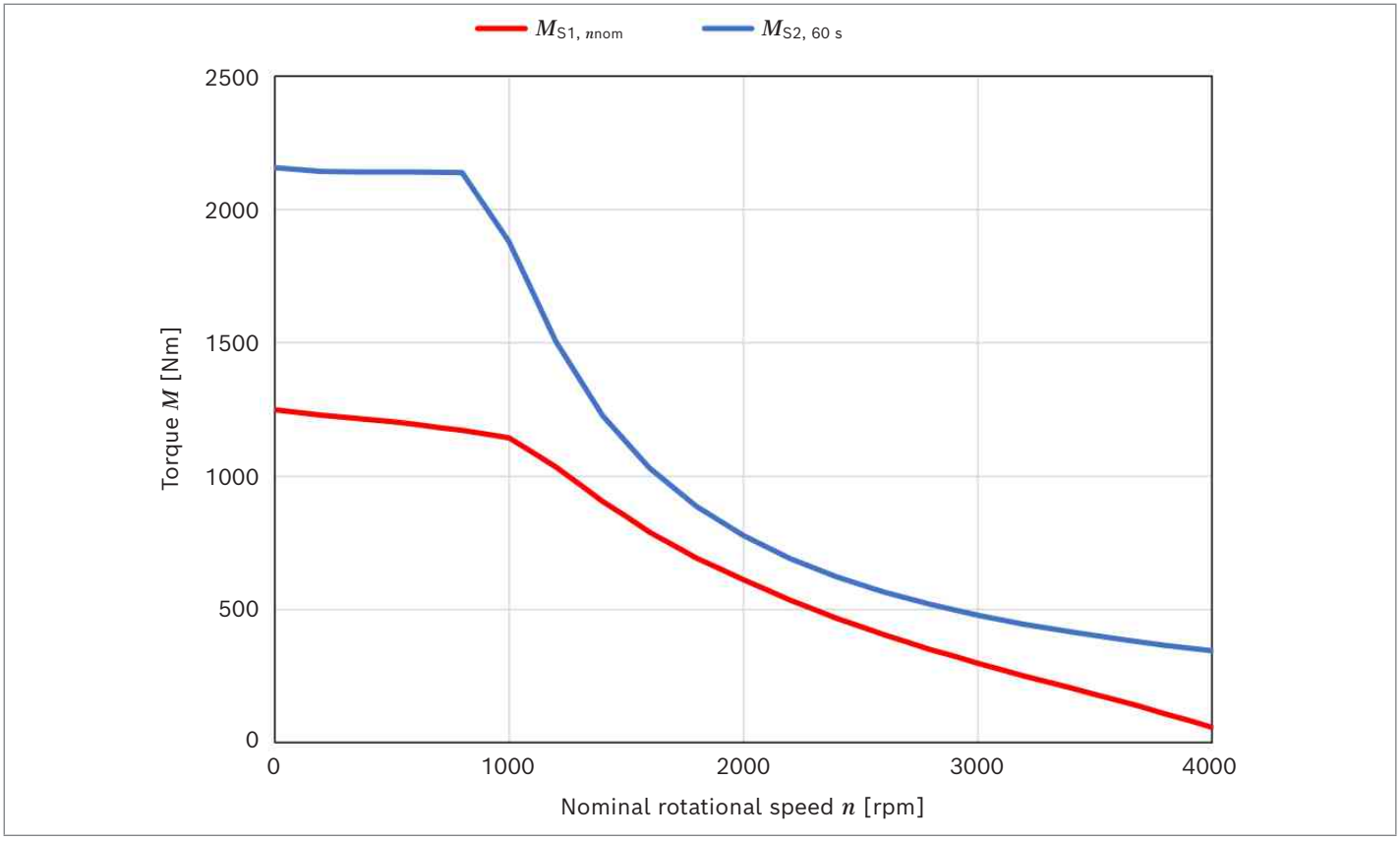
EMS1-20J10

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	1229
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	200
Nominal rotational speed	n_{nom}	rpm	1000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	1143
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	188
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	120
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	94.77
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	2111
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	423
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	189
Maximum rotational speed	n_{max}	rpm	4000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	58
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	106
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	24
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	73.24
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	859
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	179
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	133
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	1480
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	94.94
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	43
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	220
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	787
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	220
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

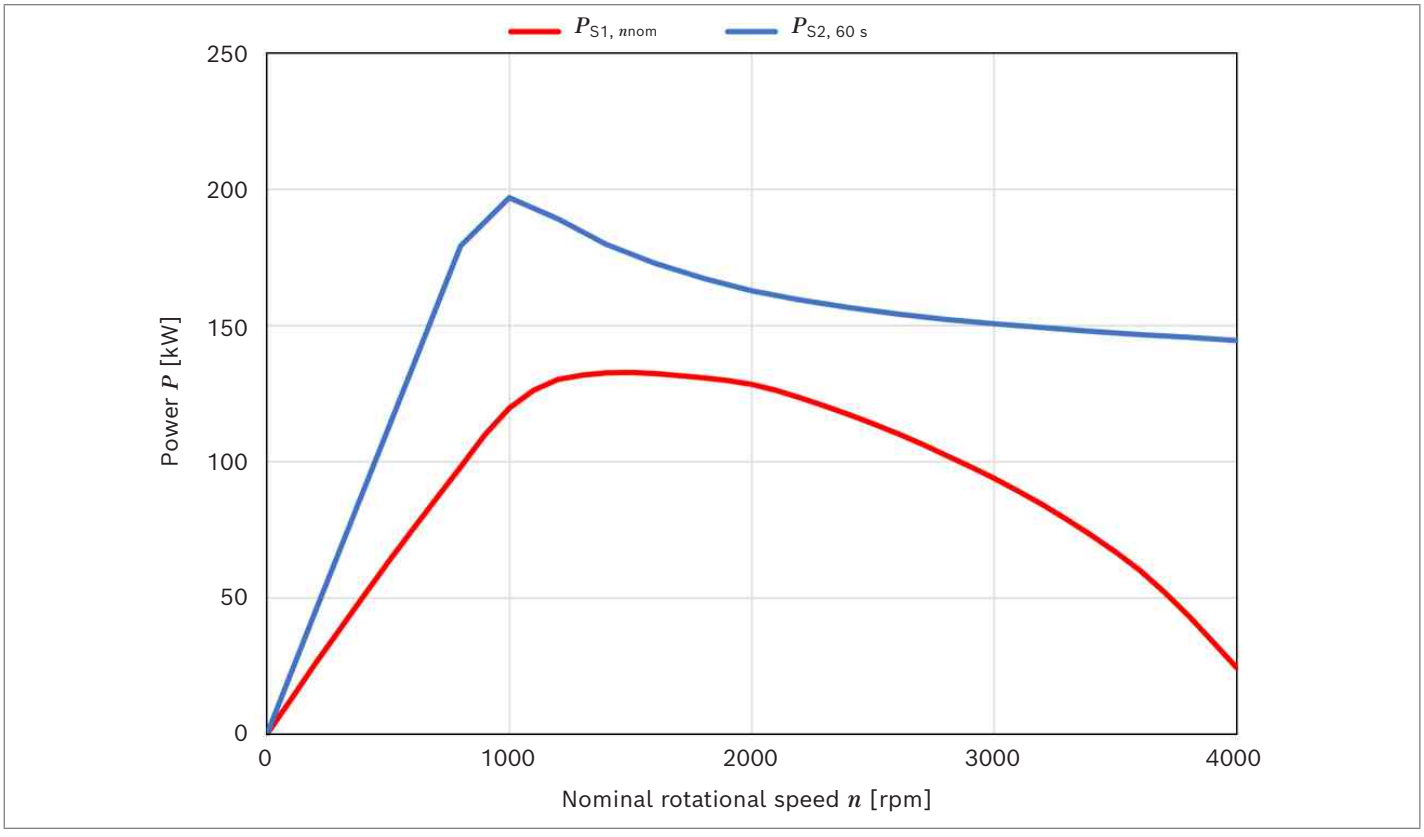
Electric	Symbol	Unit	Value
Number of poles			8
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	348.2
Torque constant at 25 °C	k_T	Nm / A_{RMS}	6.6
Synchronous inductance (d-axis) at rated current	L_d	mH	1.9
Synchronous inductance (q-axis) at rated current	L_q	mH	5.8
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.062
Cogging torque (unskewed)	M_{cog}	Nm	32.82
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	52.7

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

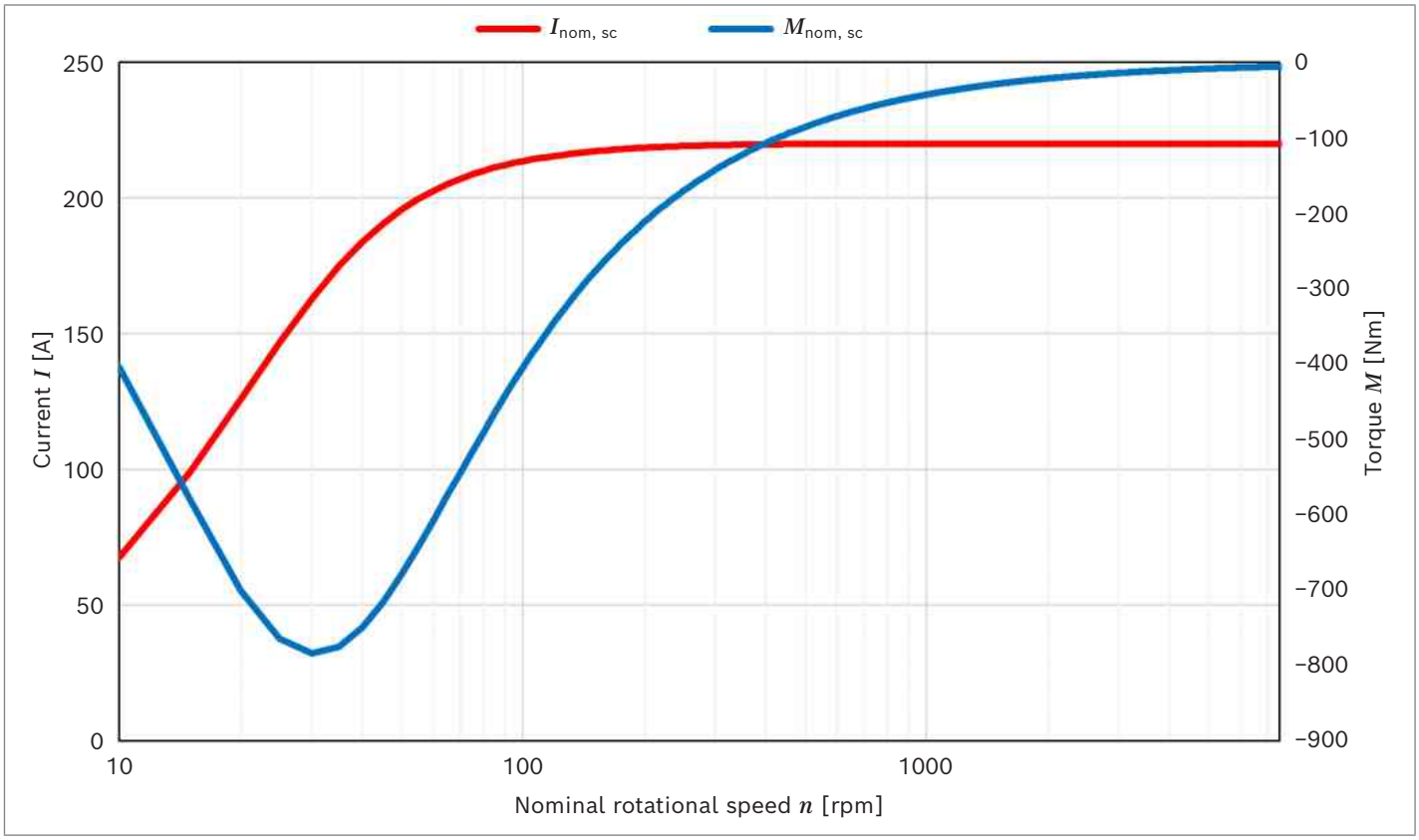
▼ Torque EMS1-20J10



▼ Power EMS1-20J10



▼ **Short circuit current and short circuit braking torque EMS1-20J10**



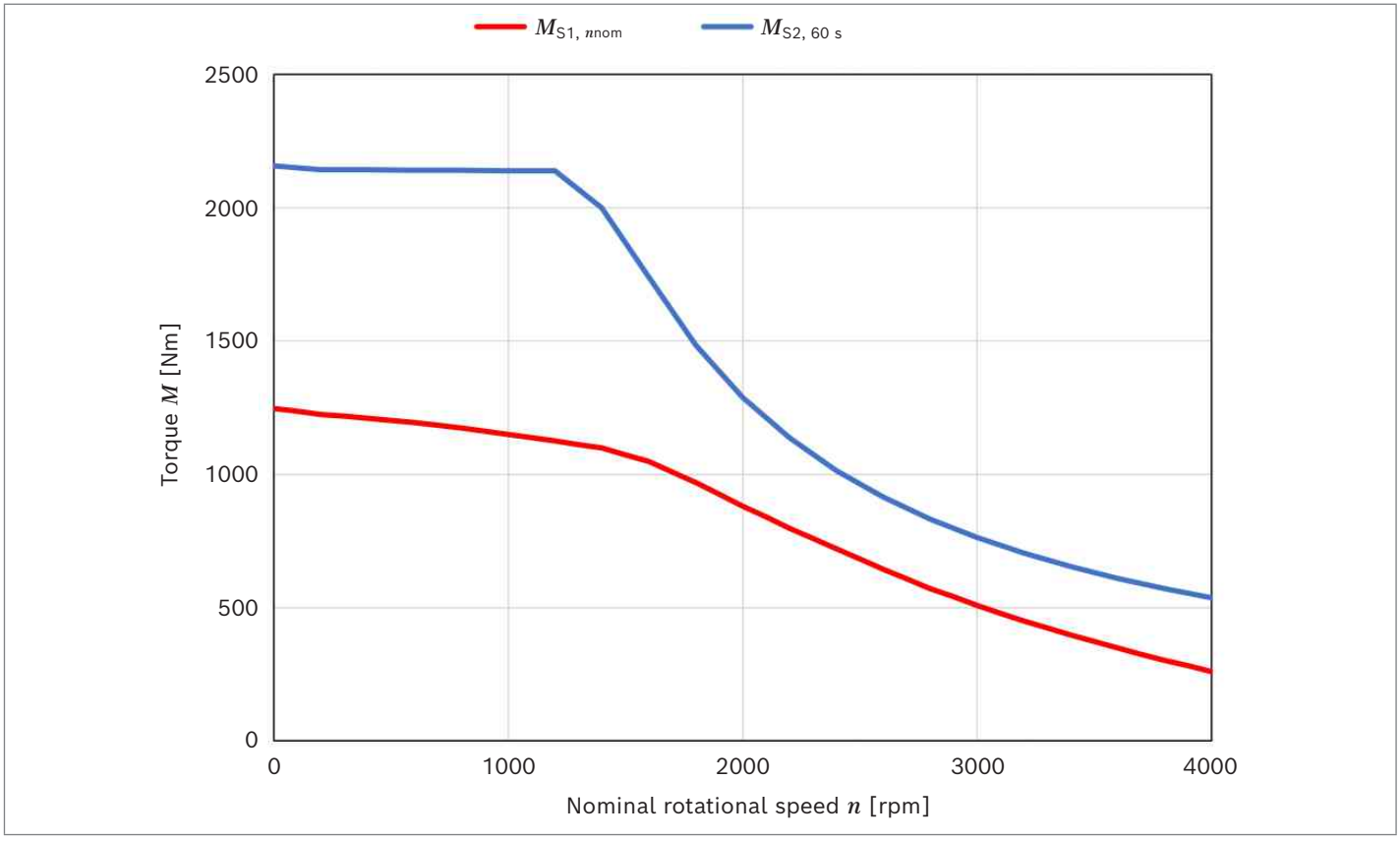
EMS1-20J15

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	1225
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	292
Nominal rotational speed	n_{nom}	rpm	1500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	1074
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	262
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	169
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	95.85
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	2158
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	621
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	294
Maximum rotational speed	n_{max}	rpm	4000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	260
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	161
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	109
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	93.63
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	849
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	247
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	185
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	2080
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	95.92
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	29
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	323
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	785
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	323
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

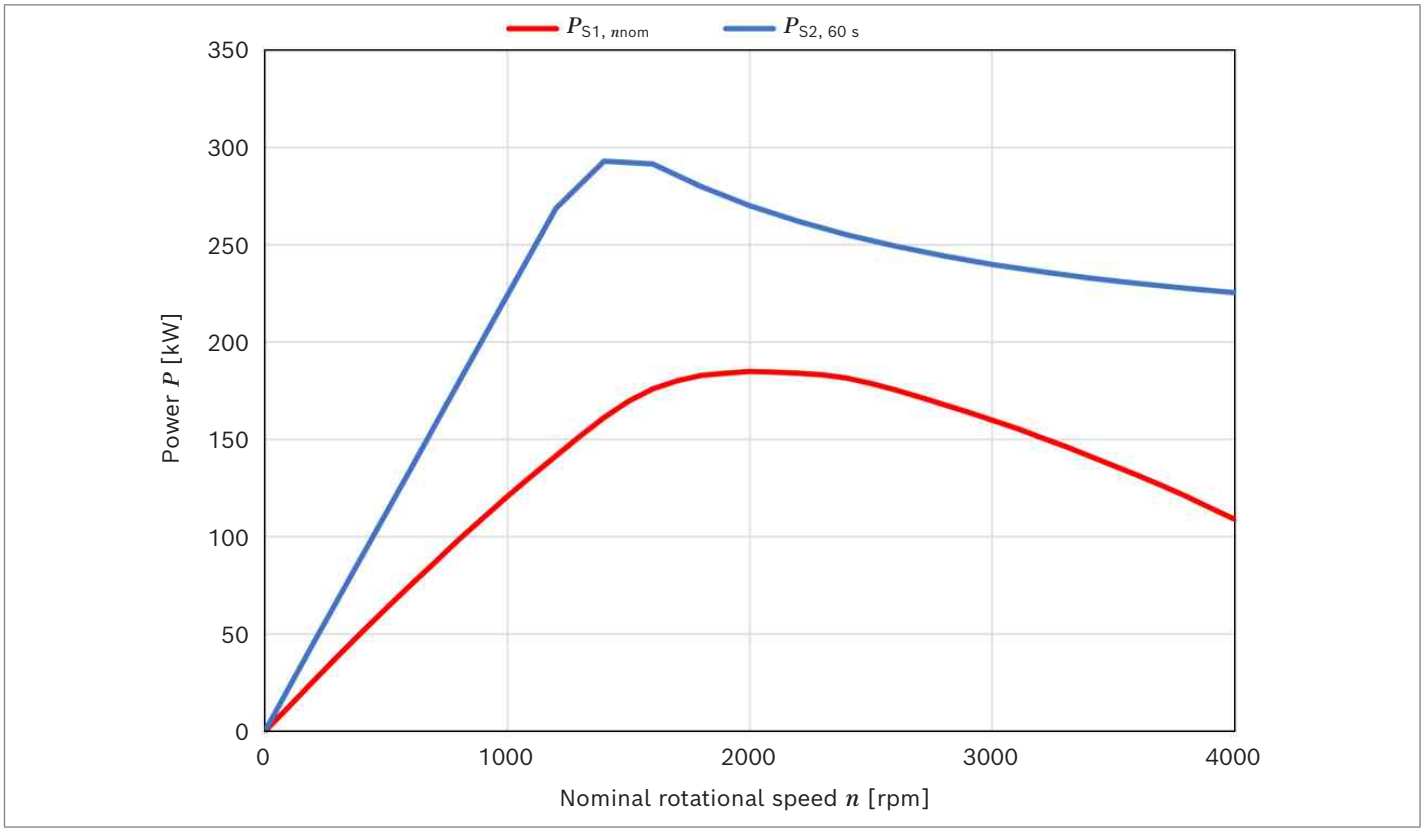
Electric	Symbol	Unit	Value
Number of poles			8
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	232.9
Torque constant at 25 °C	k_T	Nm / A_{RMS}	4.49
Synchronous inductance (d-axis) at rated current	L_d	mH	1.1
Synchronous inductance (q-axis) at rated current	L_q	mH	2.9
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.029
Cogging torque (unskewed)	M_{cog}	Nm	32.82
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	49.36

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

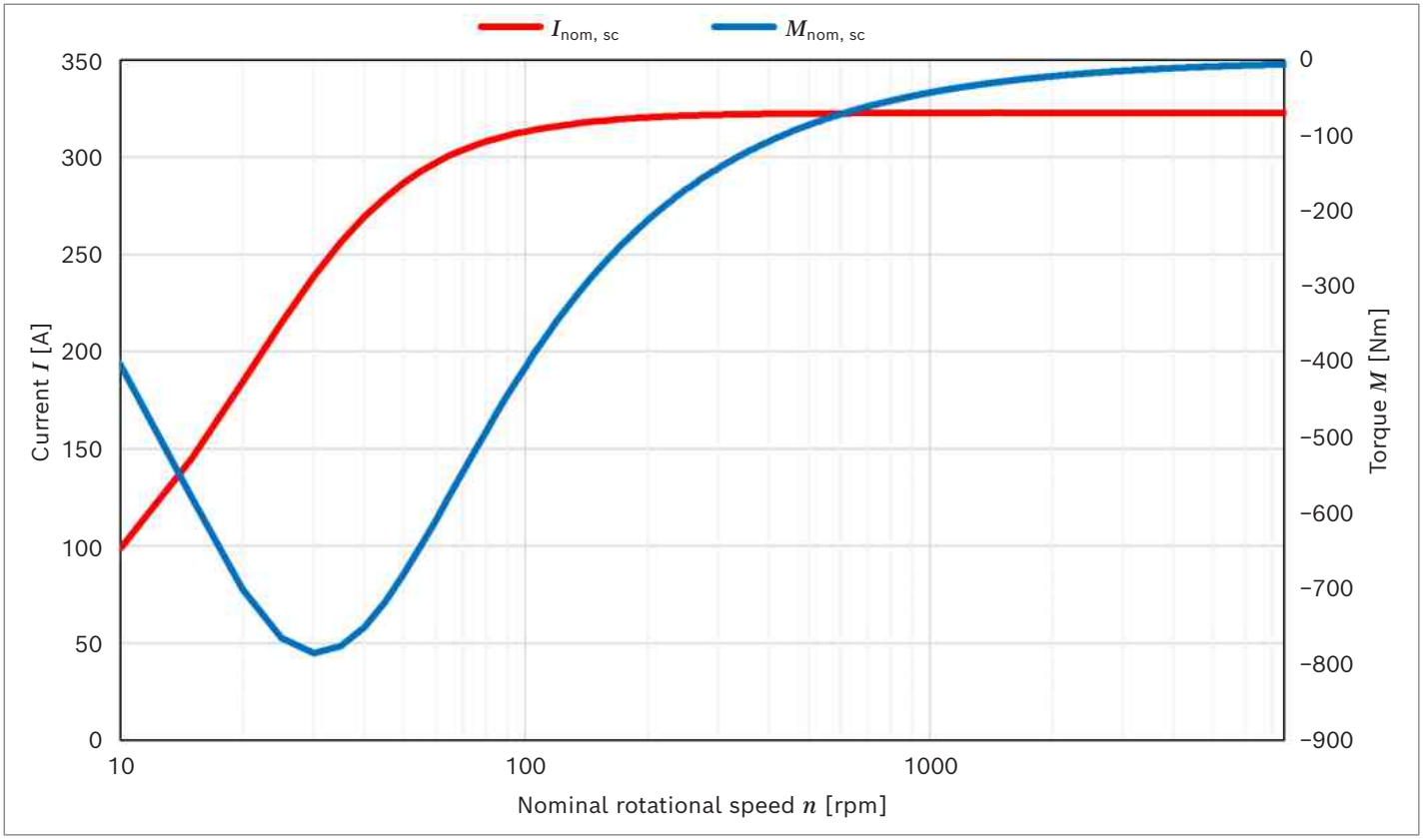
▼ **Torque EMS1-20J15**



▼ **Power EMS1-20J15**



▼ Short circuit current and short circuit braking torque EMS1-20J15



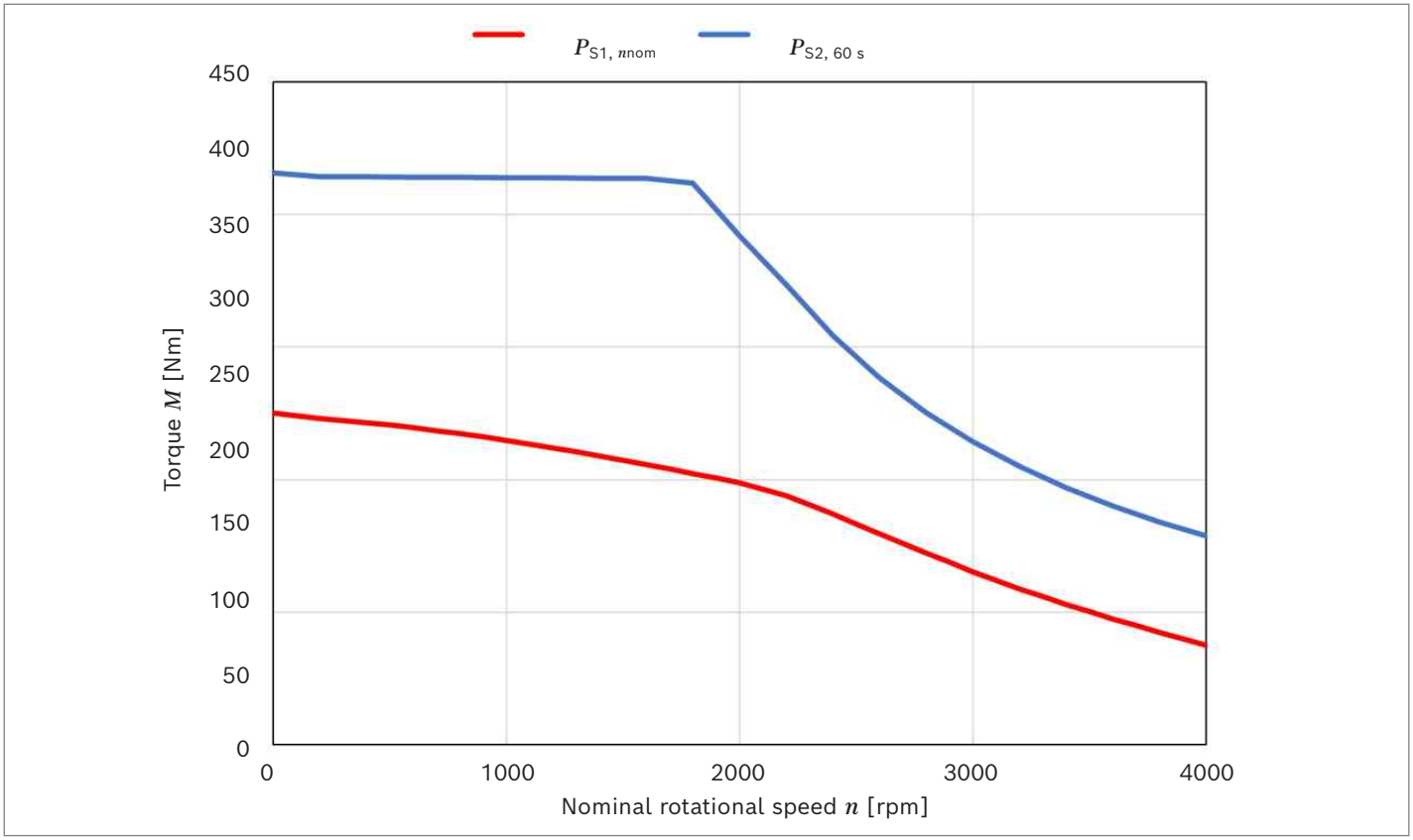
EMS1-20J20

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	1231
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	400
Nominal rotational speed	n_{nom}	rpm	2000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	989
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	328
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	207
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	96.14
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	2157
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	847
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	402
Maximum rotational speed	n_{max}	rpm	4000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	376
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	207
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	158
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	95.07
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	870
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	305
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	219
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	2400
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	96.22
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	21
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	440
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	785
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	440
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

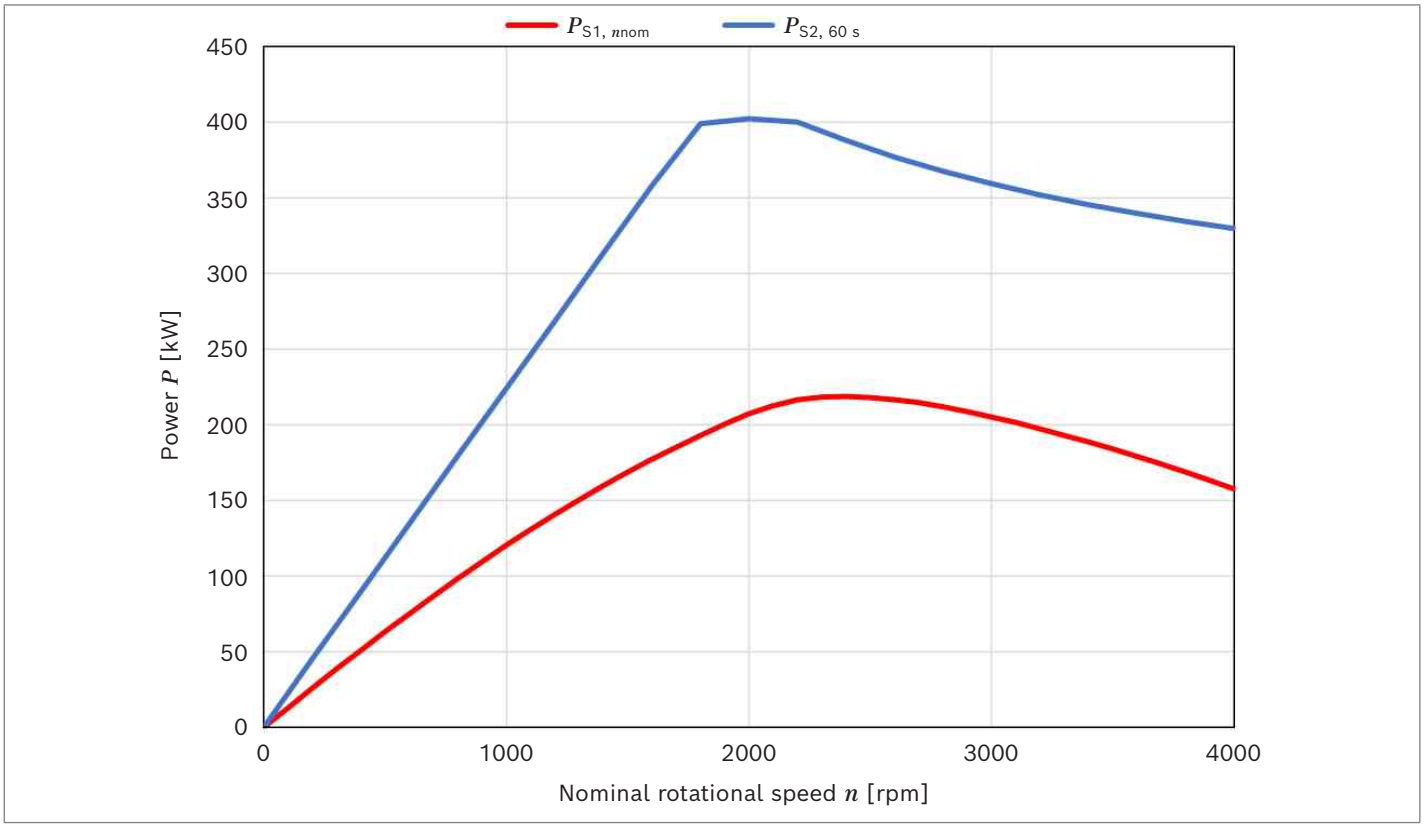
Electric	Symbol	Unit	Value
Number of poles			8
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	171.7
Torque constant at 25 °C	k_T	Nm / A_{RMS}	3.31
Synchronous inductance (d-axis) at rated current	L_d	mH	0.6
Synchronous inductance (q-axis) at rated current	L_q	mH	1.3
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.0154
Cogging torque (unskewed)	M_{cog}	Nm	32.82
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	43.92

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

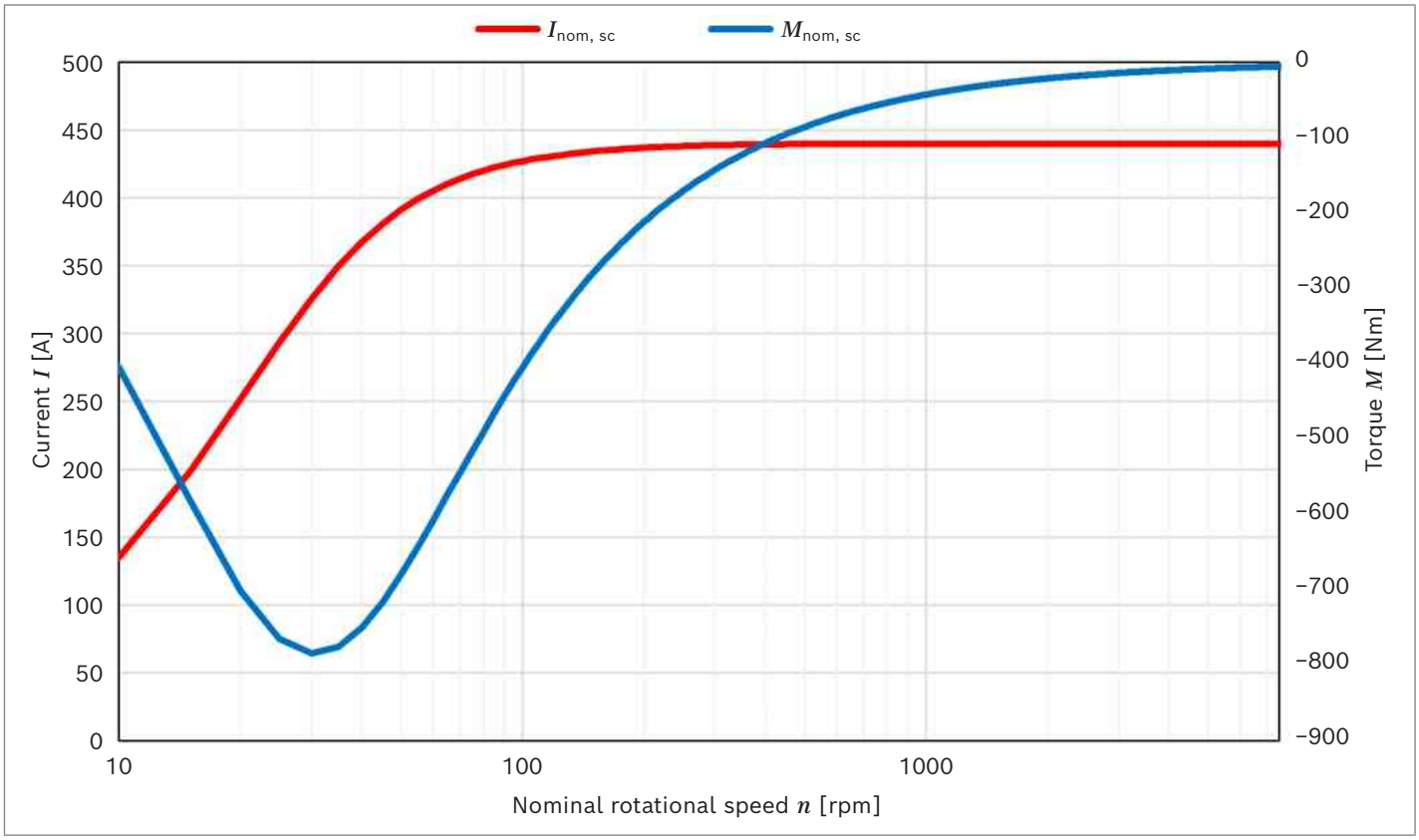
▼ Torque EMS1-20J20



▼ Power EMS1-20J20



▼ **Short circuit current and short circuit braking torque EMS1-20J20**



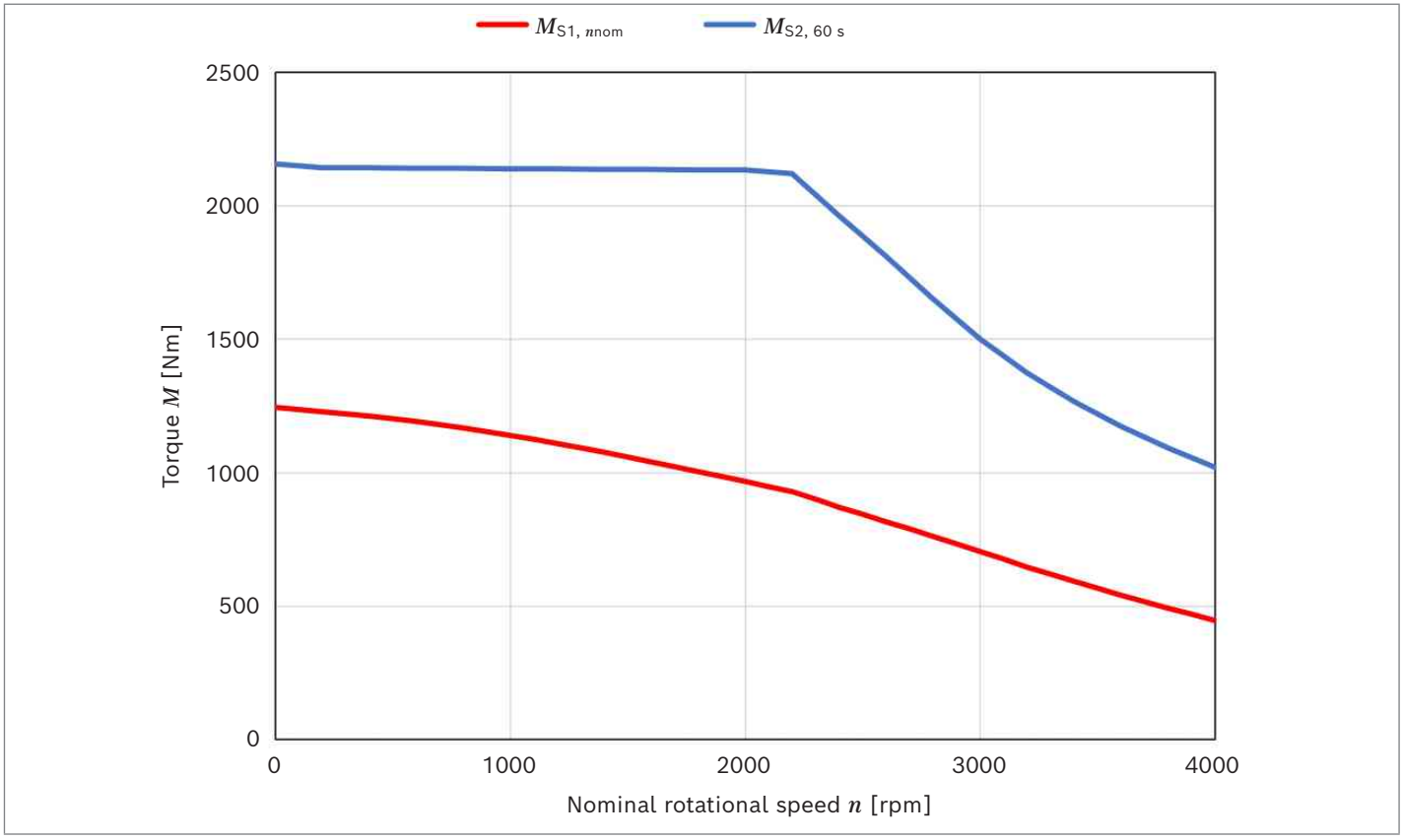
EMS1-20J25

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	1229
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	489
Nominal rotational speed	n_{nom}	rpm	2500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	835
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	341
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	219
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	96.15
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	2111
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	1035
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	472
Maximum rotational speed	n_{max}	rpm	4000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	432
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	232
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	181
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	95.43
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	763
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	317
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	221
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	2760
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	96.18
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	17
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	537
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	787
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	537
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

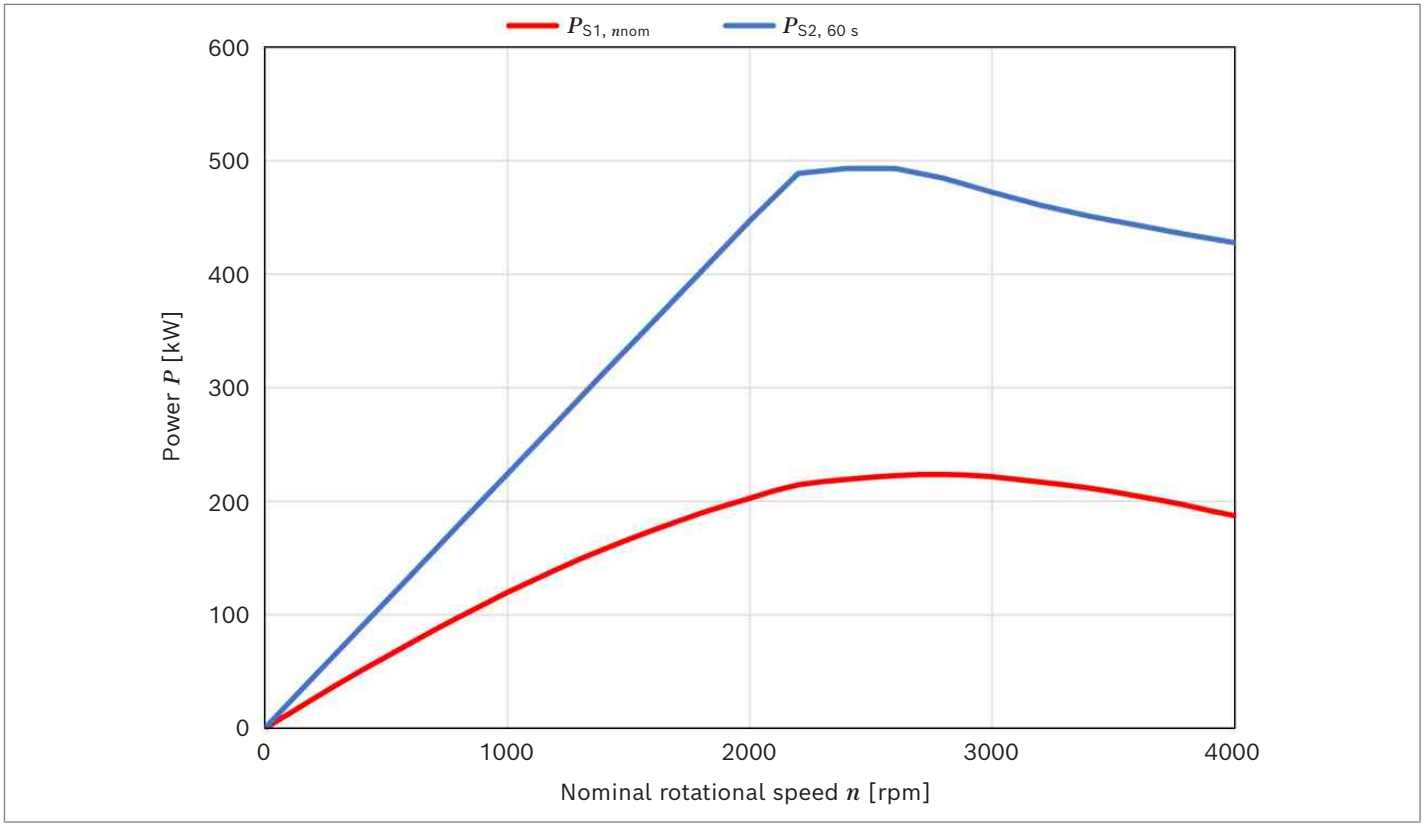
Electric	Symbol	Unit	Value
Number of poles			8
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	142.4
Torque constant at 25 °C	k_T	Nm / A_{RMS}	2.71
Synchronous inductance (d-axis) at rated current	L_d	mH	0.33
Synchronous inductance (q-axis) at rated current	L_q	mH	1.06
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.0104
Cogging torque (unskewed)	M_{cog}	Nm	32.82
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	35.32

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

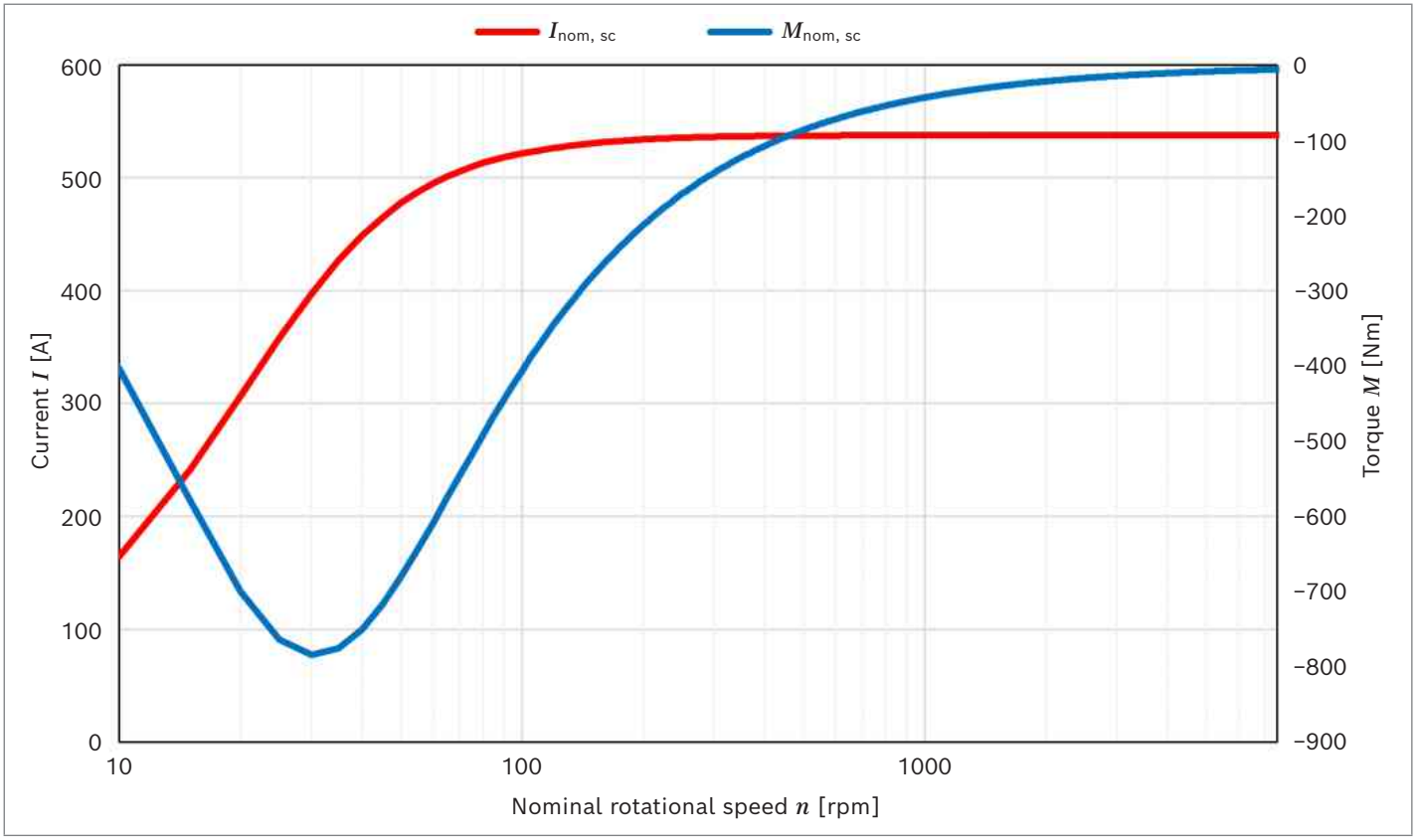
▼ **Torque EMS1-20J25**



▼ **Power EMS1-20J25**



▼ Short circuit current and short circuit braking torque EMS1-20J25



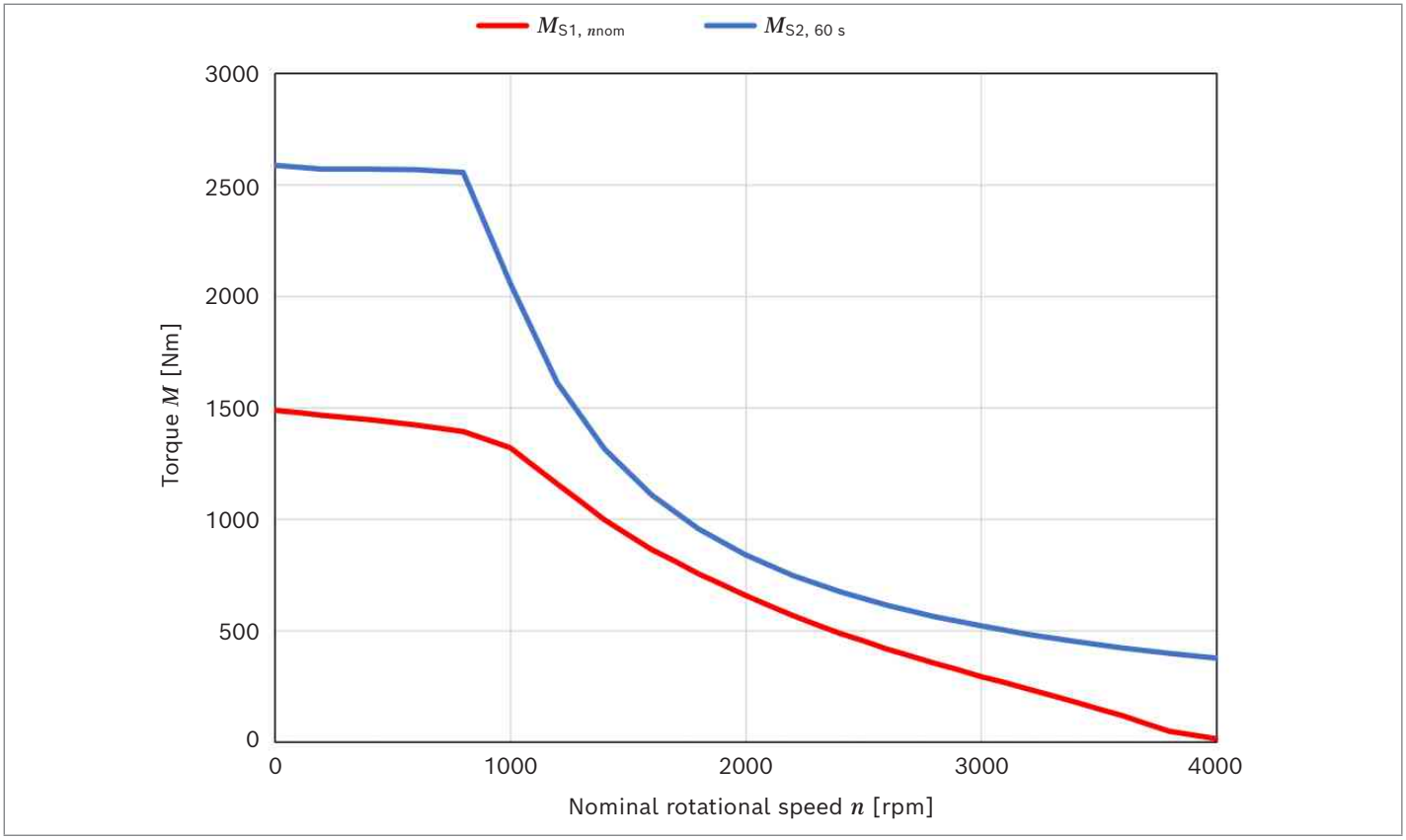
EMS1-20L10

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	1467
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	219
Nominal rotational speed	n_{nom}	rpm	1000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	1321
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	205
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	138
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	94.91
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	2588
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	466
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	218
Maximum rotational speed	n_{max}	rpm	4000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	16
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	118
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	7
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	19.22
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	1095
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	199
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	147
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	1280
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	94.96
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	49
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	243
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	944
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	243
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

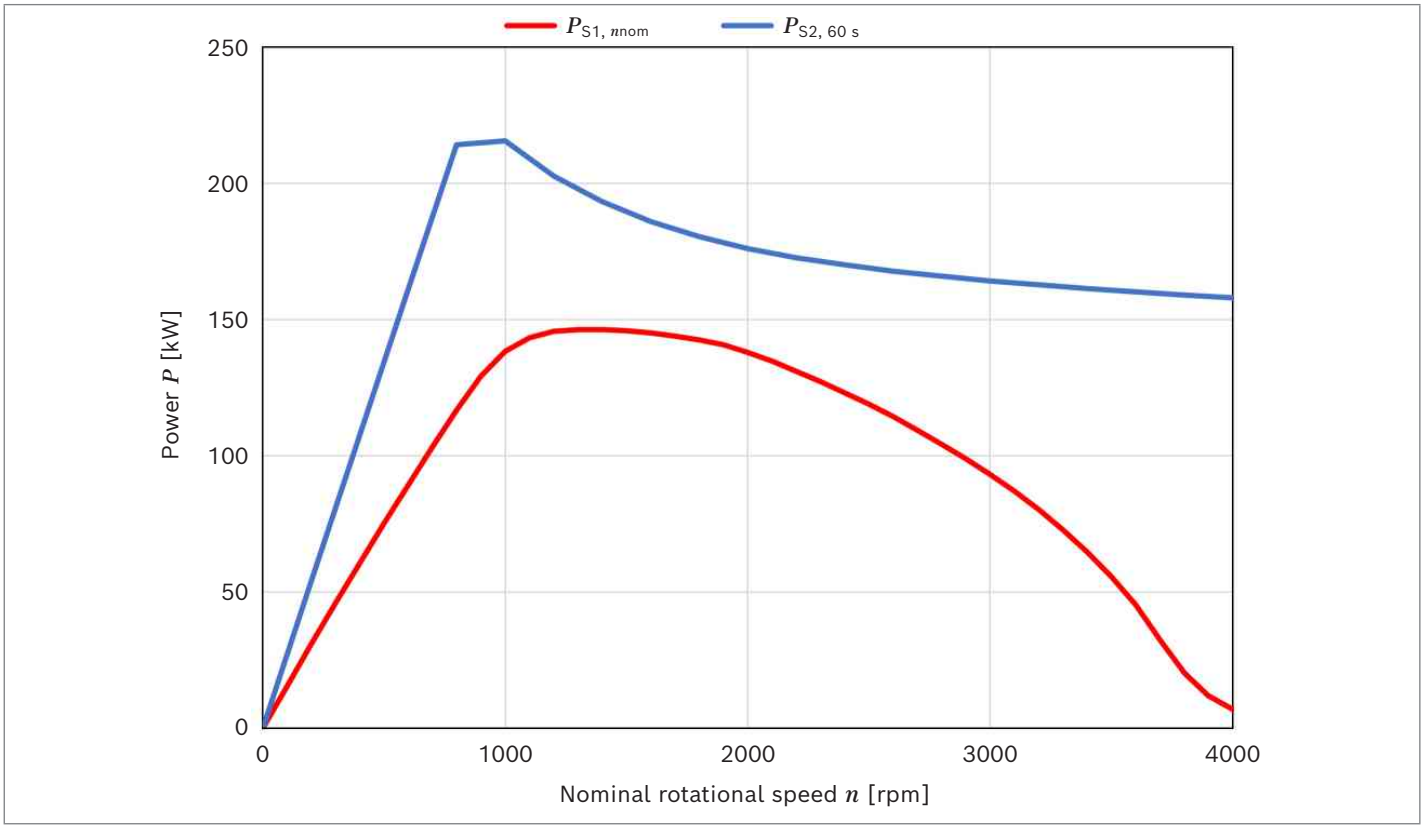
Electric	Symbol	Unit	Value
Number of poles			8
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	374.7
Torque constant at 25 °C	k_T	Nm / A_{RMS}	7.22
Synchronous inductance (d-axis) at rated current	L_d	mH	2.7
Synchronous inductance (q-axis) at rated current	L_q	mH	6
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.0567
Cogging torque (unskewed)	M_{cog}	Nm	39.39
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	62.32

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

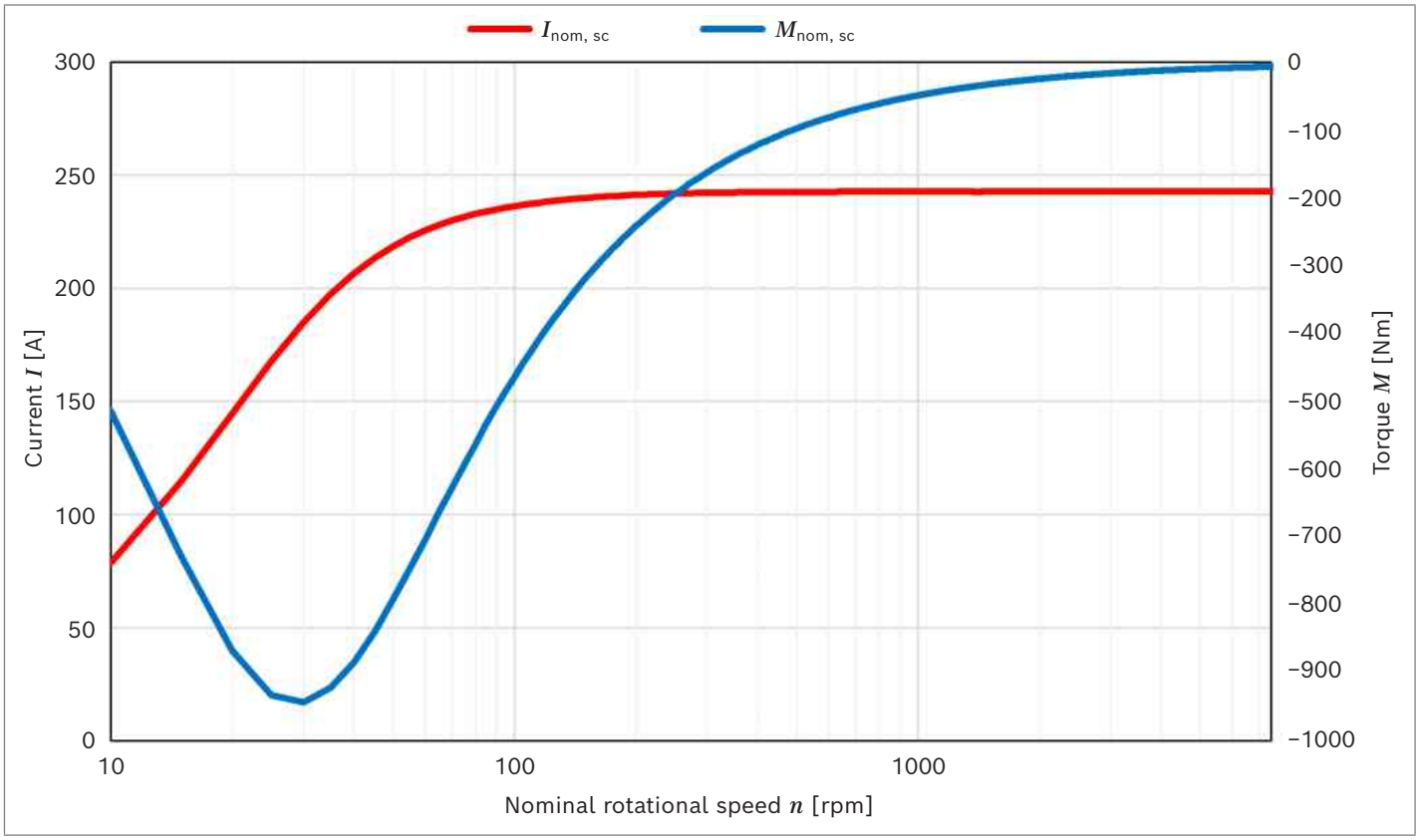
▼ Torque EMS1-20L10



▼ Power EMS1-20L10



▼ **Short circuit current and short circuit braking torque EMS1-20L10**



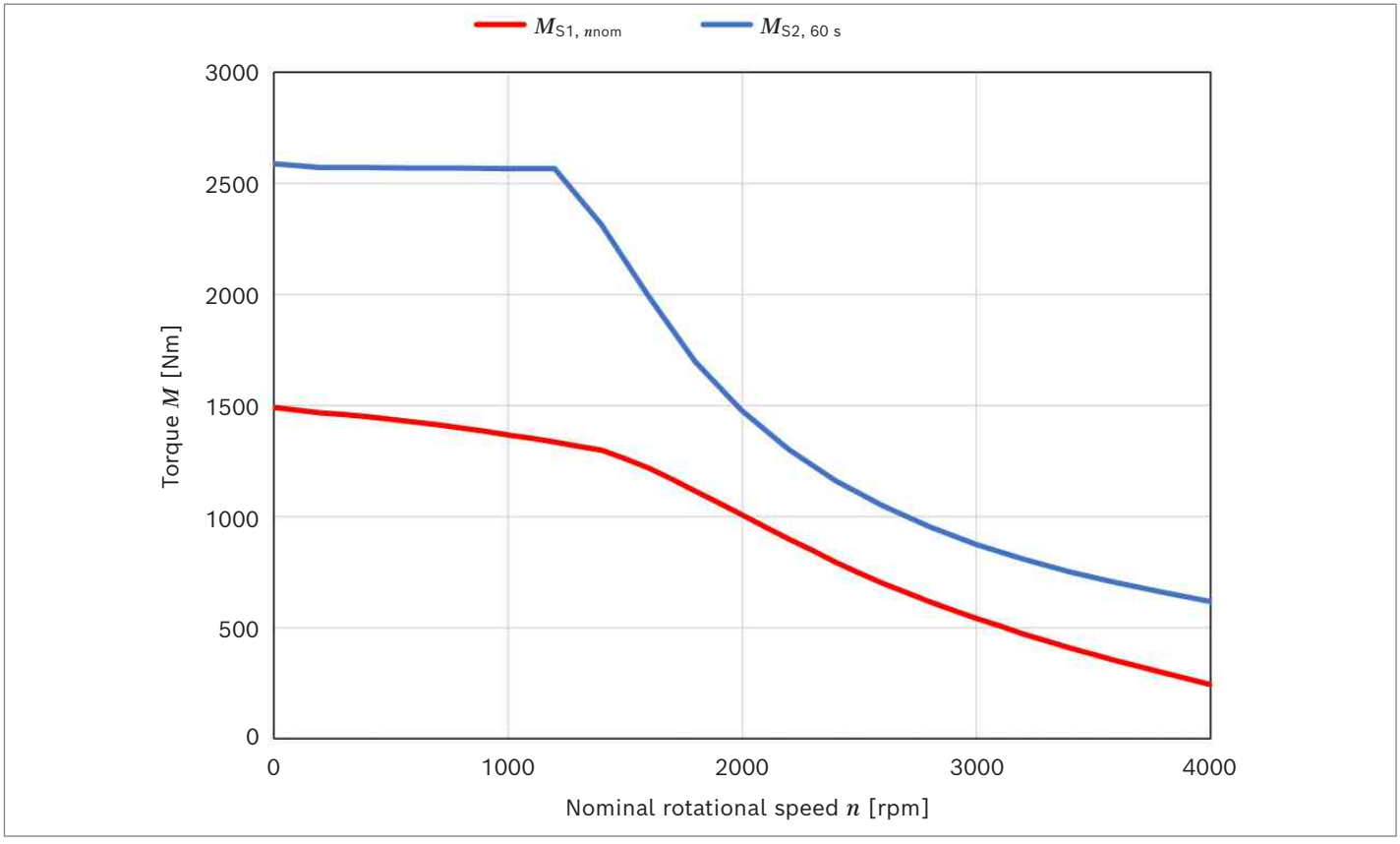
EMS1-20L15

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	1468
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	336
Nominal rotational speed	n_{nom}	rpm	1500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	1260
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	299
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	198
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	95.94
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	2589
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	716
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	339
Maximum rotational speed	n_{max}	rpm	4000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	245
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	171
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	103
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	92.54
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	1051
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	284
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	211
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	1920
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	95.97
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	33
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	373
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	944
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	373
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

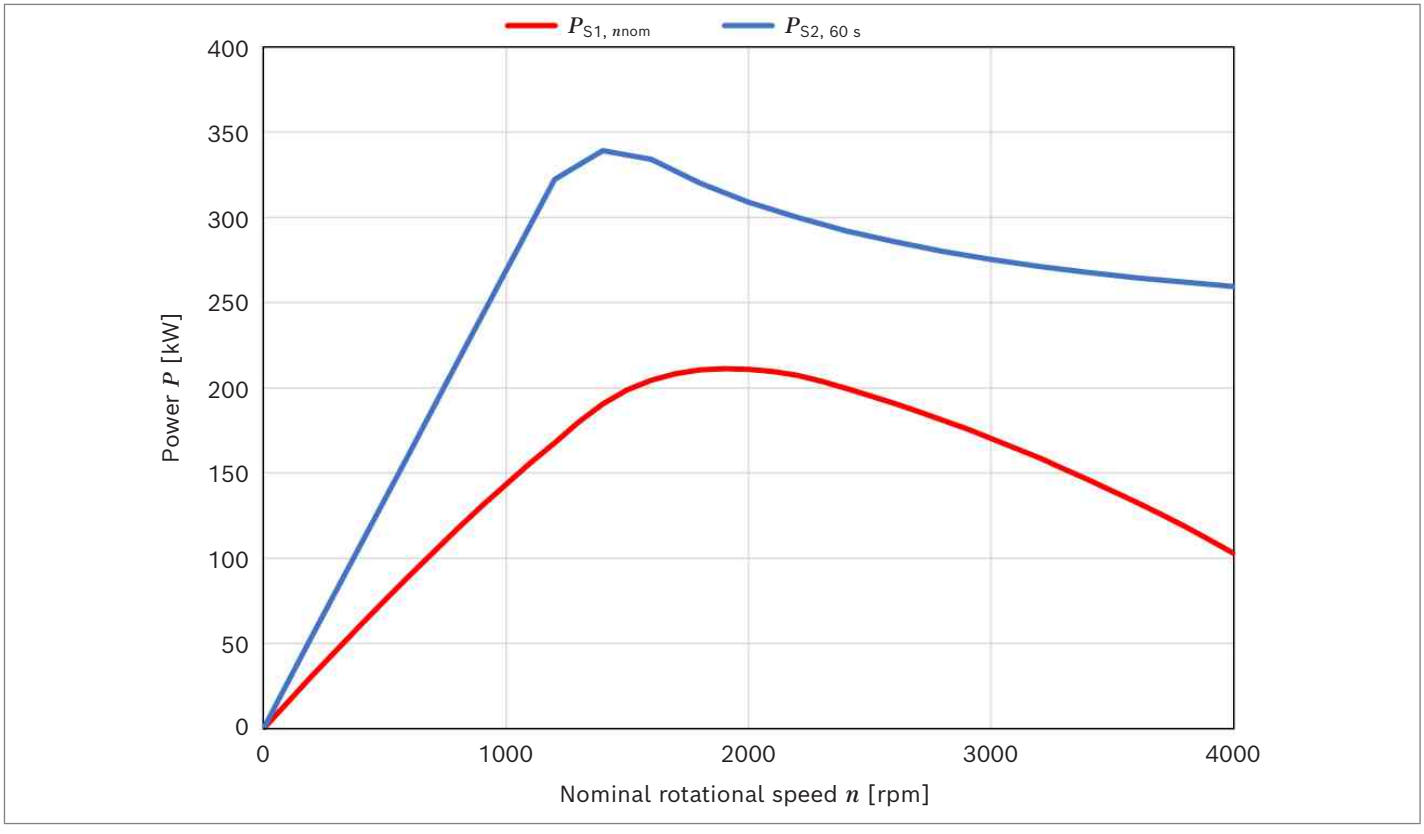
Electric	Symbol	Unit	Value
Number of poles			8
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	246.9
Torque constant at 25 °C	k_T	Nm / A_{RMS}	4.69
Synchronous inductance (d-axis) at rated current	L_d	mH	0.8
Synchronous inductance (q-axis) at rated current	L_q	mH	2.48
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.0244
Cogging torque (unskewed)	M_{cog}	Nm	39.39
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	58.22

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

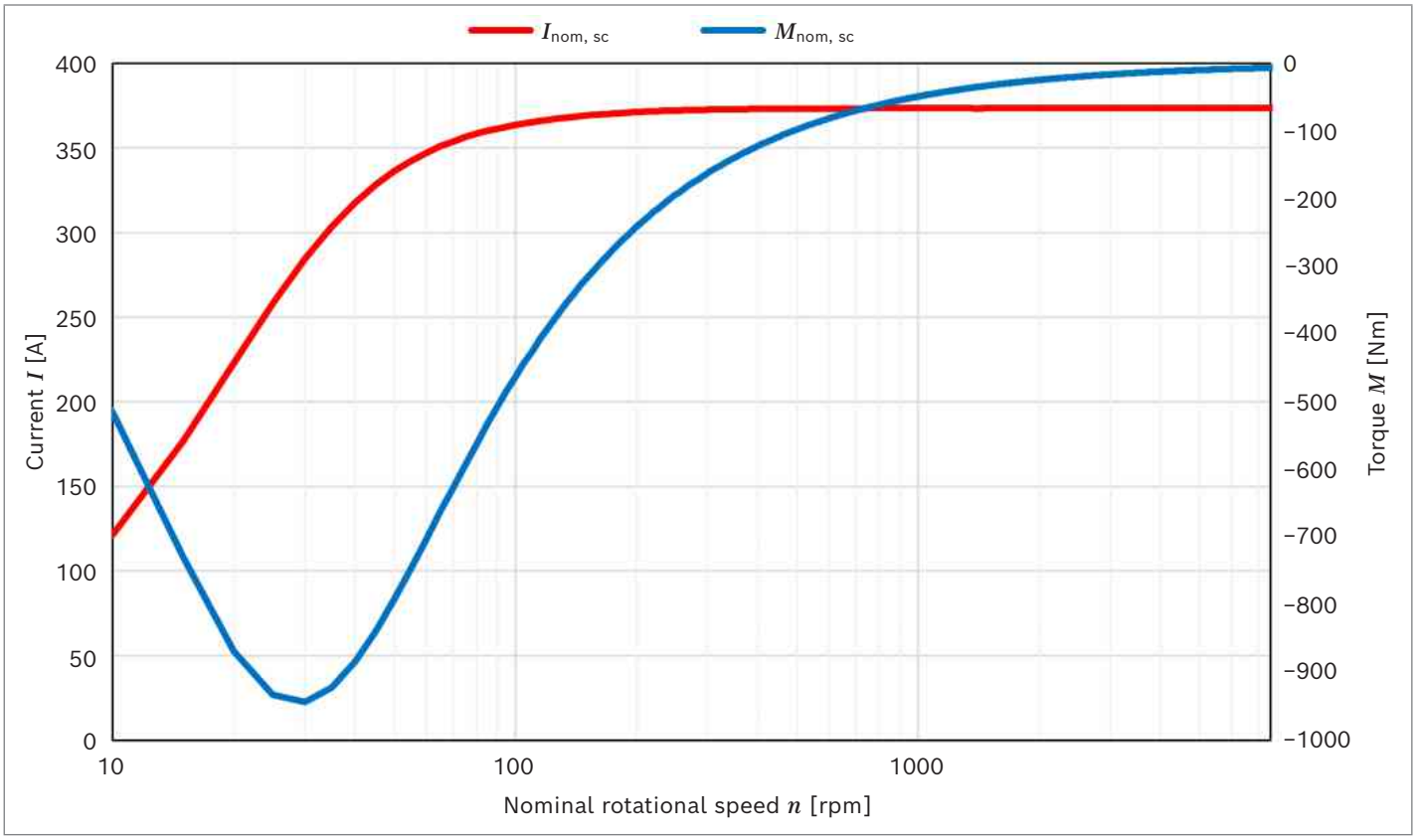
▼ **Torque EMS1-20L15**



▼ **Power EMS1-20L15**



▼ Short circuit current and short circuit braking torque EMS1-20L15



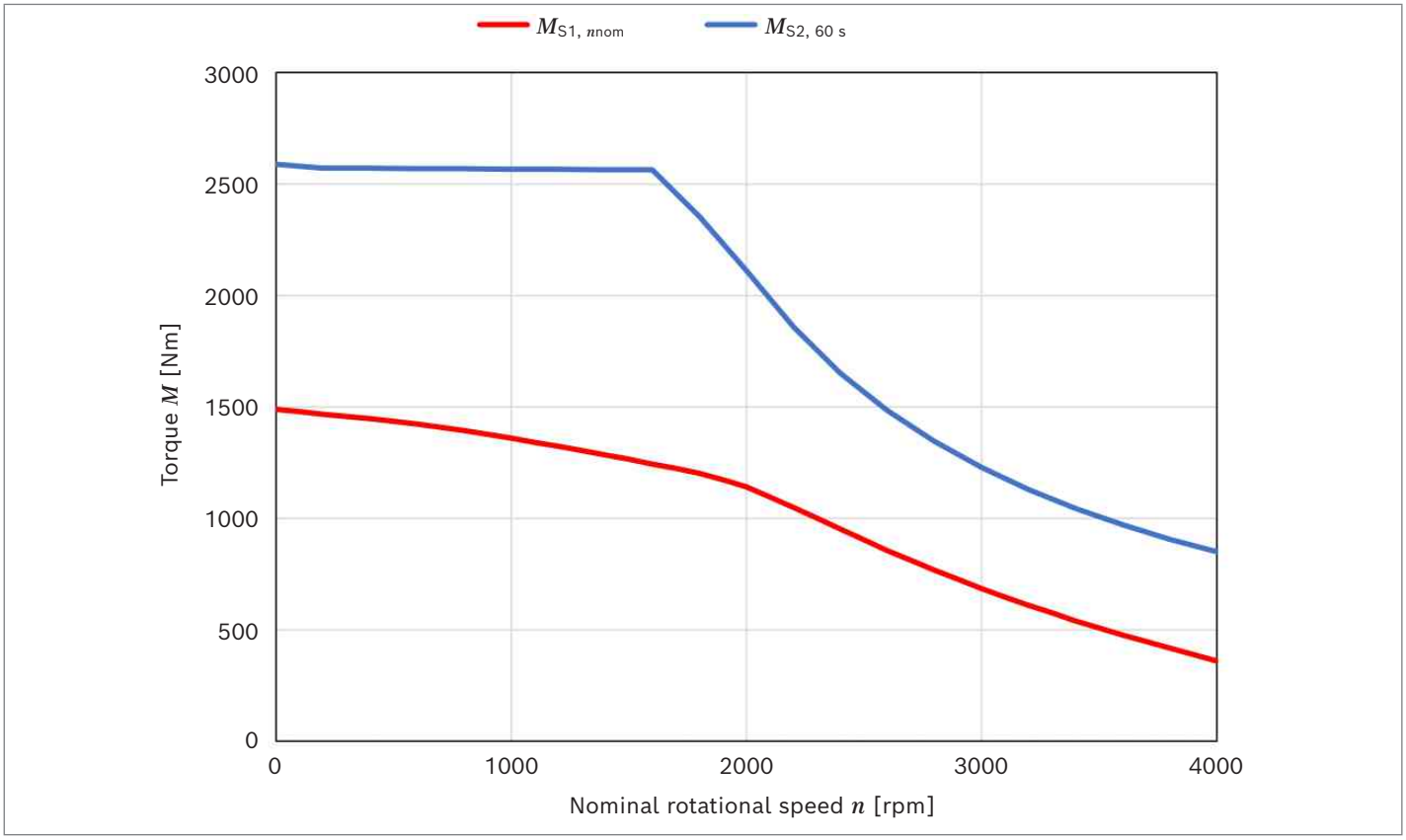
EMS1-20L20

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	1467
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	437
Nominal rotational speed	n_{nom}	rpm	2000
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	1143
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	354
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	239
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	96.21
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	2589
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	931
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	444
Maximum rotational speed	n_{max}	rpm	4000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	362
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	211
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	152
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	94.47
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	1050
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	337
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	242
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	2200
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	96.24
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	24
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	485
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	944
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	485
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

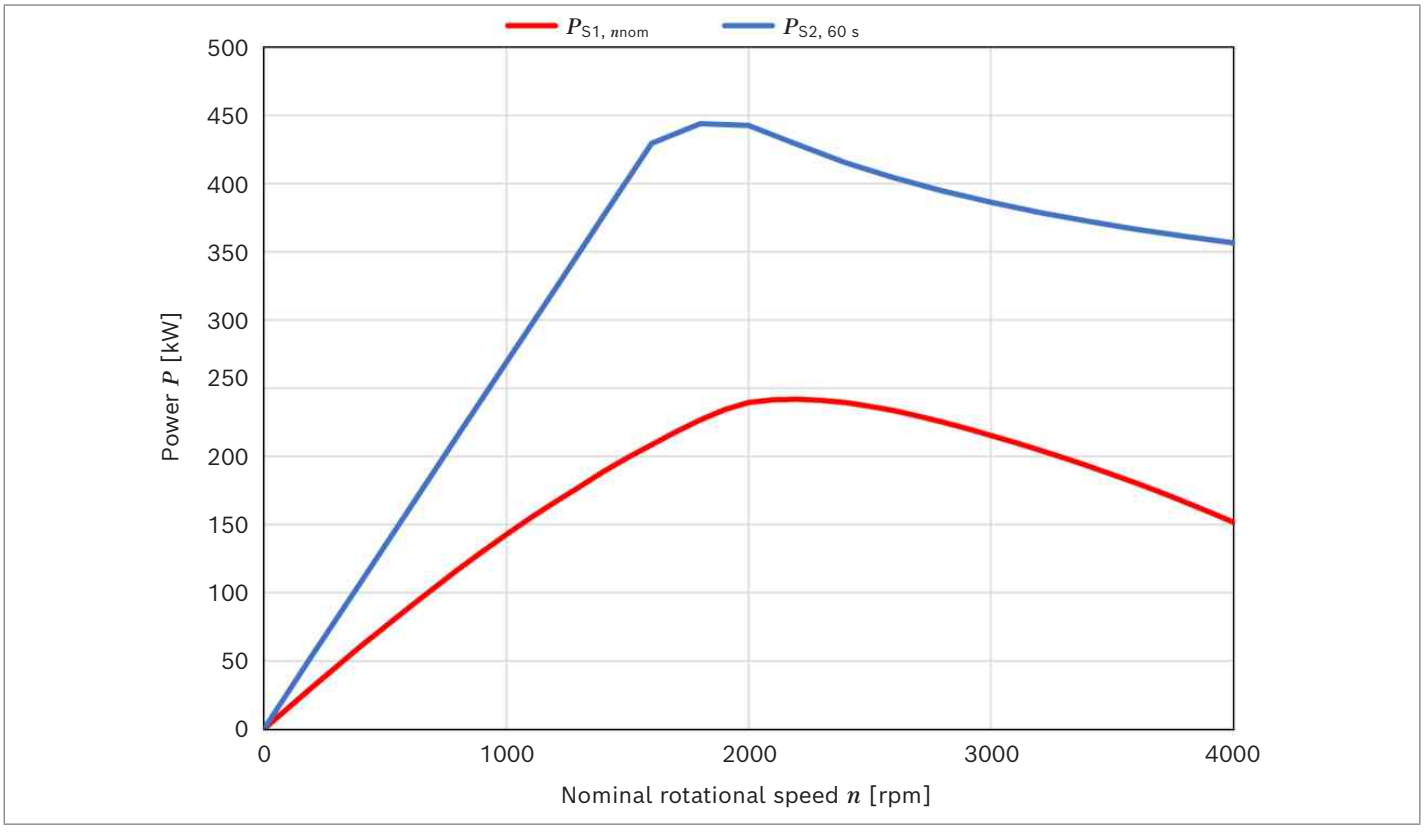
Electric	Symbol	Unit	Value
Number of poles			8
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	189.9
Torque constant at 25 °C	k_T	Nm / A_{RMS}	3.61
Synchronous inductance (d-axis) at rated current	L_d	mH	0.48
Synchronous inductance (q-axis) at rated current	L_q	mH	1.52
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.0144
Cogging torque (unskewed)	M_{cog}	Nm	39.39
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	50.86

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

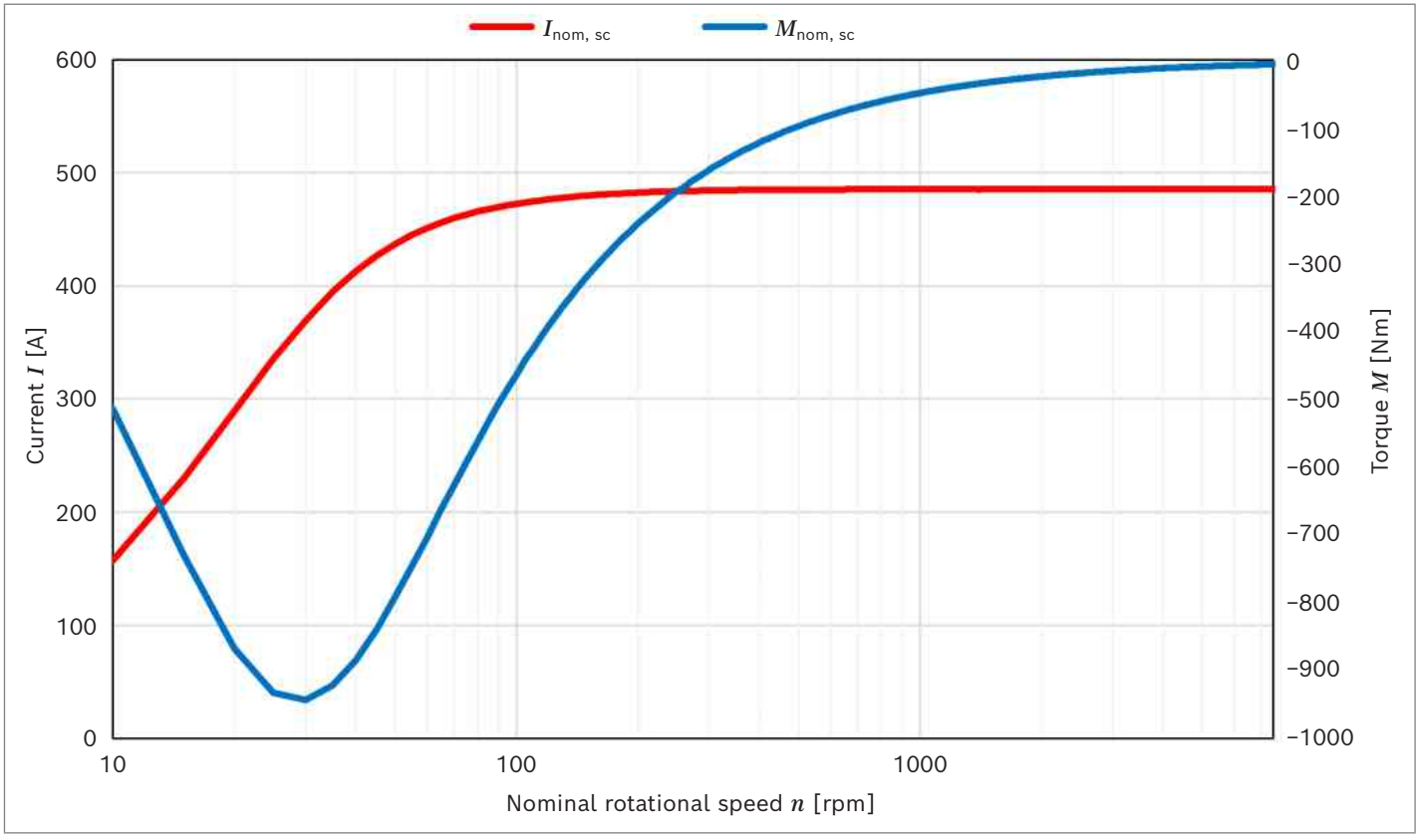
▼ Torque EMS1-20L20



▼ Power EMS1-20L20



▼ **Short circuit current and short circuit braking torque EMS1-20L20**



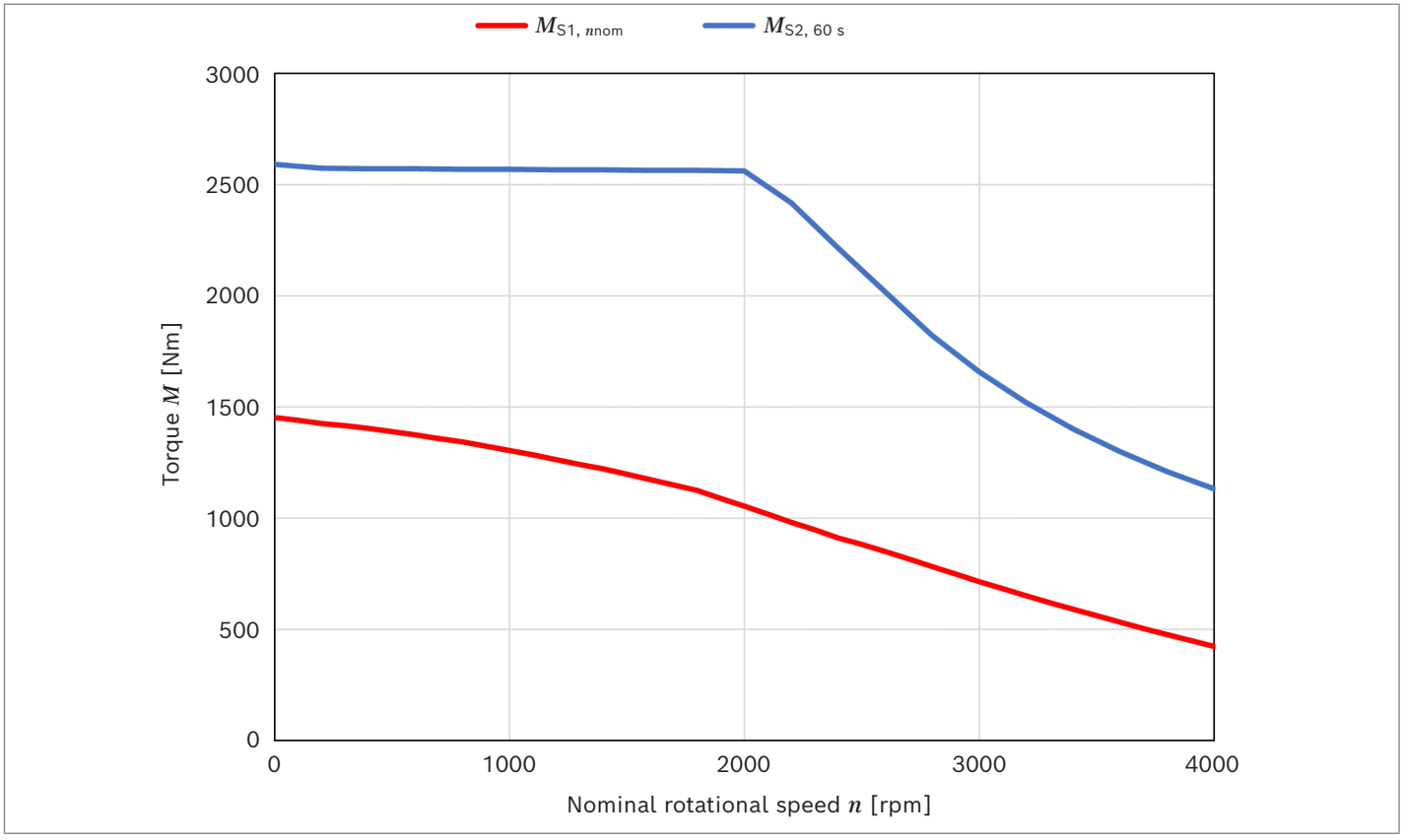
EMS1-20L25

Designation	Symbol	Unit	Value
S1 continuous torque at 200 rpm	$M_{S1,\ low\ rotational\ speed}$	Nm	1426
S1 continuous current at 200 rpm	$I_{S1,\ low\ rotational\ speed}$	A_{RMS}	523
Nominal rotational speed	n_{nom}	rpm	2500
S1 continuous torque at n_{nom}	$M_{S1,\ nnom}$	Nm	881
S1 continuous current at n_{nom}	$I_{S1,\ nnom}$	A_{RMS}	301
S1 continuous power at n_{nom}	$P_{S1,\ nnom}$	kW	231
S1 continuous efficiency at n_{nom}	$\eta_{S1,\ nnom}$	%	96.26
S2 for 60s torque (maximum torque)[1]	$M_{S2,\ 60\ s}$	Nm	2590
S2 for 60s current (maximum current)[1]	$I_{S2,\ 60\ s}$	A_{RMS}	1165
S2 for 60s power (maximum power)[1]	$P_{S2,\ 60\ s}$	kW	558
Maximum rotational speed	n_{max}	rpm	4000
S1 continuous torque at n_{max}	$M_{S1,\ nmax}$	Nm	424
S1 continuous current at n_{max}	$I_{S1,\ nmax}$	A_{RMS}	284
S1 continuous power at n_{max}	$P_{S1,\ max}$	kW	177
S1 continuous efficiency at n_{max}	$\eta_{S1,\ nmax}$	%	95.21
S1 continuous torque at $P_{S1,\ max}$	$M_{S1,\ Pmax}$	Nm	850
S1 continuous current at $P_{S1,\ max}$	$I_{S1,\ Pmax}$	A_{RMS}	305
S1 continuous power at $P_{S1,\ max}$	$P_{S1,\ Pmax}$	kW	232
S1 continuous speed at $P_{S1,\ max}$	$n_{S1,\ Pmax}$	%	2600
S1 continuous efficiency at $P_{S1,\ max}$	$\eta_{S1,\ Pmax}$	%	96.27
Short circuit braking torque at nominal rotational speed[2]	$M_{nom,\ sc}$	Nm	20
Short circuit current at nominal speed[2]	$I_{nom,\ sc}$	A_{RMS}	607
Maximum short circuit braking torque[2]	$M_{max,\ sc}$	Nm	944
Maximum short circuit current[2]	$I_{max,\ sc}$	A_{RMS}	607
DC supply voltage	V_{DC}	V	700
Voltage for motor phases (outer conductor-outer conductor – RMS)	V_{LL}	V_{RMS}	475

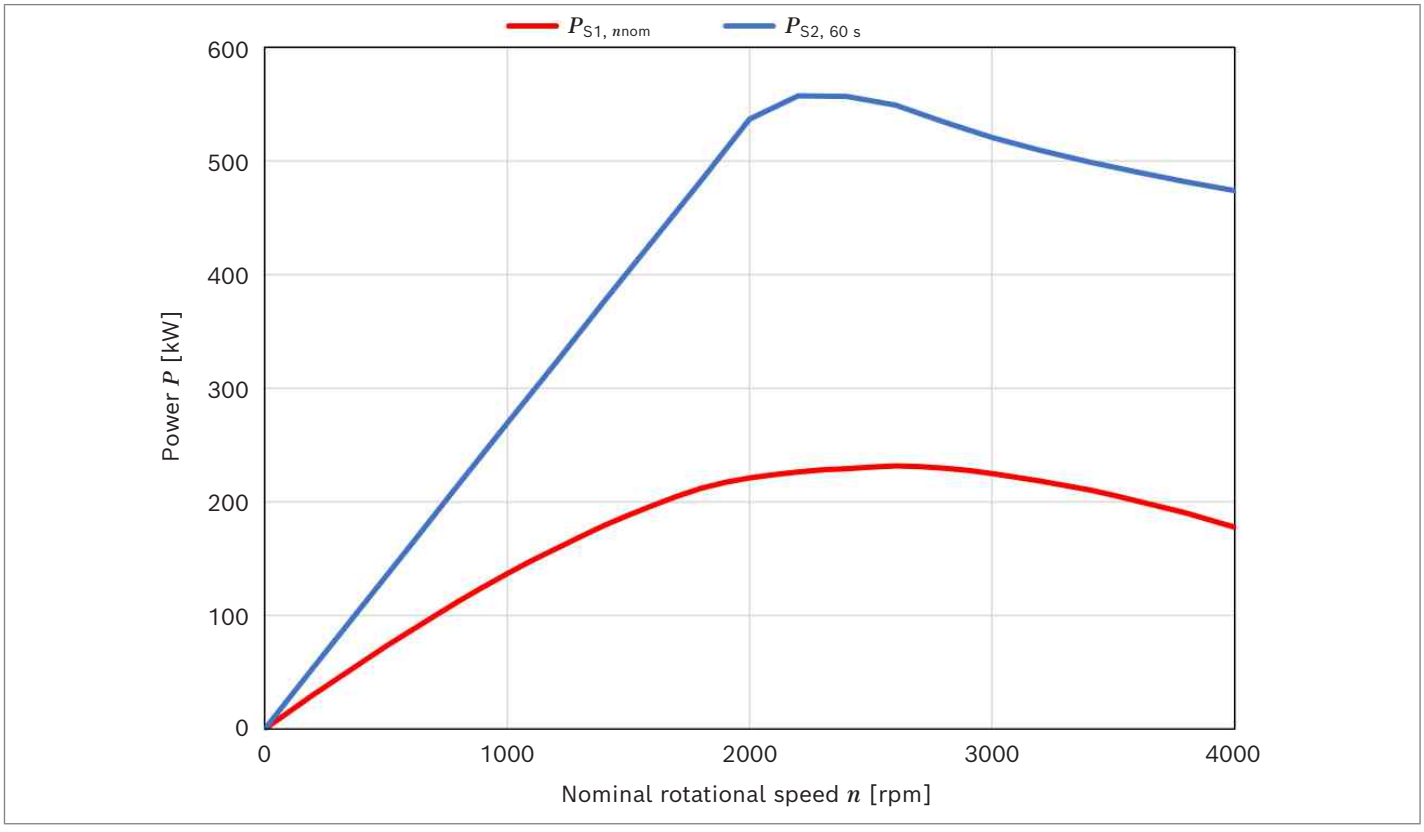
Electric	Symbol	Unit	Value
Number of poles			8
Phase-phase voltage constant at 20 °C	k_{EMK}	V_{RMS} / 1000 rpm	149.3
Torque constant at 25 °C	k_T	Nm / A_{RMS}	2.71
Synchronous inductance (d-axis) at rated current	L_d	mH	0.45
Synchronous inductance (q-axis) at rated current	L_q	mH	1.1
Stator winding resistance (phase) at 20 °C	R_{LL}	Ω	0.0092
Cogging torque (unskewed)	M_{cog}	Nm	38.41
Torque ripple	$M_{Pk\text{-}Pk}$	Nm	31.6

1) For the S2 calculation, the starting temperature of the components is assumed to be 25 °C.
2) Magnet temperature at 20 °C

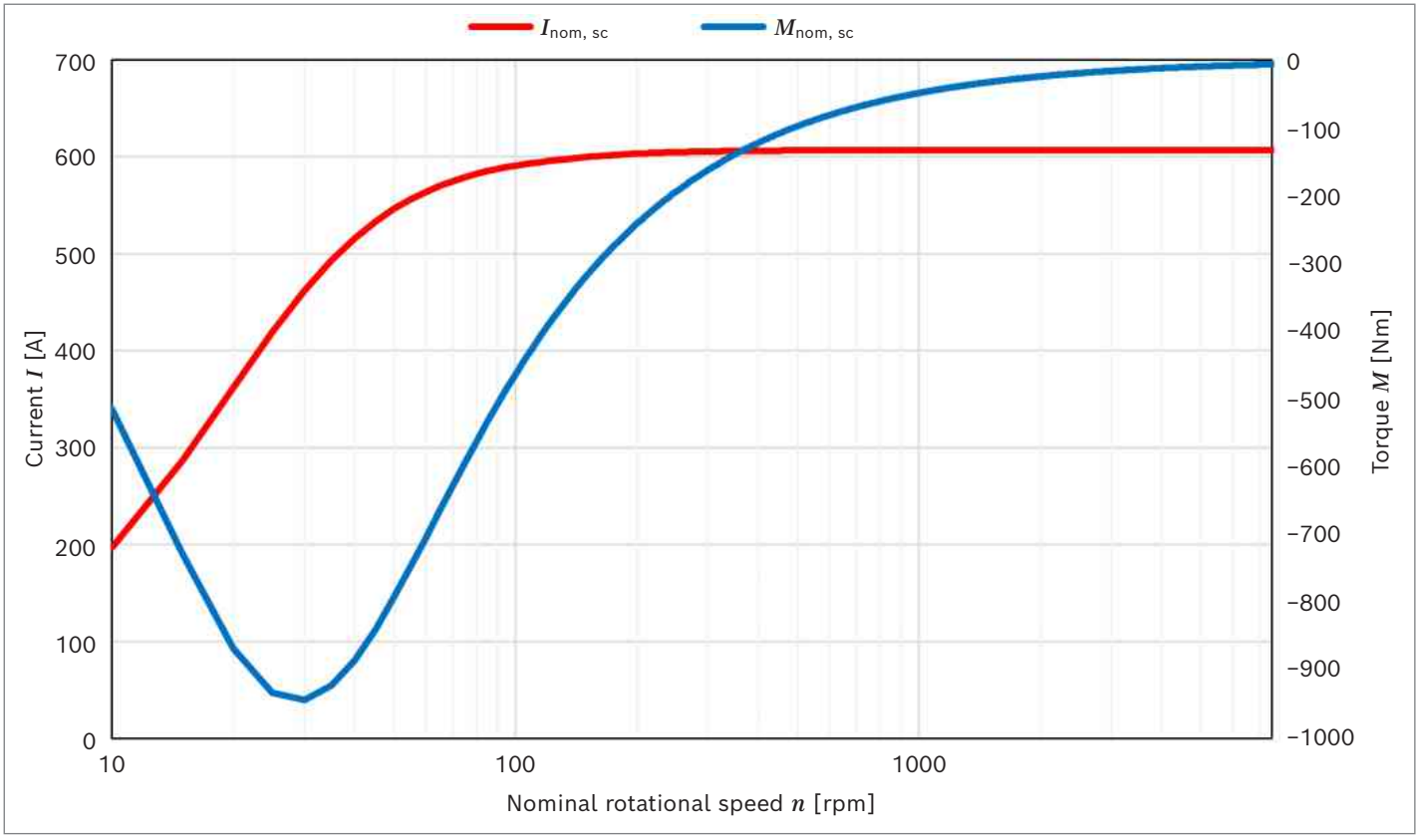
▼ **Torque EMS1-20L25**



▼ **Power EMS1-20L25**



▼ Short circuit current and short circuit braking torque EMS1-20L25



Sensors

Resolver

The built-in resolver detects the position of the rotor. This position is used by the corresponding inverter to calculate the motor rotational speed and to correctly set the stator currents.

Parameter	Unit	EMS1-10	EMS1-13	EMS1-20
Ambient temperature	°C	–40 ... 150	–40 ... 150	–40 ... 150
Storage temperature	°C	–40 ... 80	–40 ... 80	–40 ... 80
Excitation voltage	V_{RMS}	7	7	7
Excitation frequency	kHz	10	10	10
Ohmic output load (symmetrical)	kΩ	(450)[2)]	(450)[2)]	(450)[2)]
Output capacitance	µF	(100)[2)]	(100)[2)]	(100)[2)]
Polarity		3 poles	3 poles	4 poles
Gear ratio		0.286 ±10%	0.286 ±10%	0.286 ±10%
Input impedance at 10 kHz, 7 V_{RMS}	Ω	75 ±12%	75 ±12%	75 ±12%
Sine output impedance at 10 kHz, 7 V_{RMS}	Ω	On request	On request	175±20%
Cosine output impedance at 10 kHz, 7 V_{RMS}	Ω	On request	On request	175±20%
Angle error range		<120 arc minutes (degrees)	<120 arc minutes (degrees)	<120 arc minutes (degrees)
Phase shift	°	±15	±15	±15
Maximum operating speed	rpm	20000	20000	20000

Temperature sensor

The eLION motors have two PT1000 temperature sensors for thermal protection. One PT1000 is used to measure the stator winding temperature and the second PT1000 is used to measure the inlet temperature of the cooling liquid.

Notice

Due to their thermal inertia, the sensors are not able to follow rapid changes in the winding temperature. In this case, please note the maximum permissible current and the thermal motor model of the inverter EDS1.

▼ PT1000 characteristics

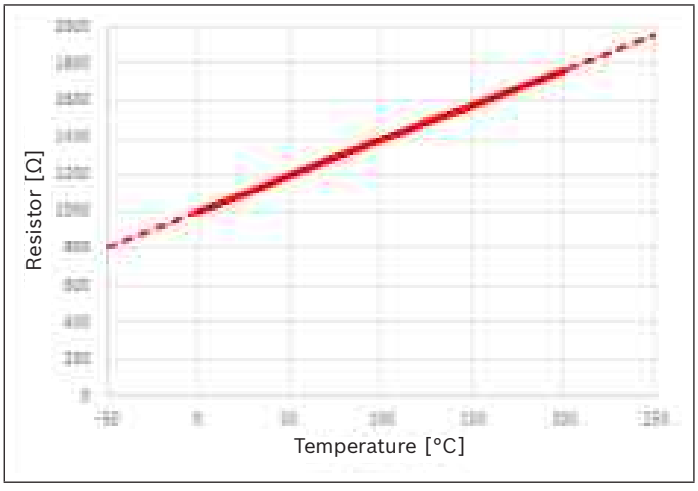
With the PT1000 temperature sensors, the temperature of the winding and the cooling liquid can be constantly monitored. We recommend setting the winding warning temperature to 145 °C and the switch-off temperature to 175 °C.

Type	Unit	S2
Sensor		PT1000
Measuring range	°C	0 ... 200
R_0	Ω	1000
Temperature tolerance	K	±5 (B)
Recommended measuring current	mA	< 1
Dielectric insulation strength	kV	2

▼ Resistance table PT1000

Temperature [°C]	R [Ω]
0	1000
25	1097
50	1194
75	1290
100	1385
125	1480
150	1573
175	1666
200	1759

▼ Resistance characteristic curve PT1000



Electrical connections

Terminal box

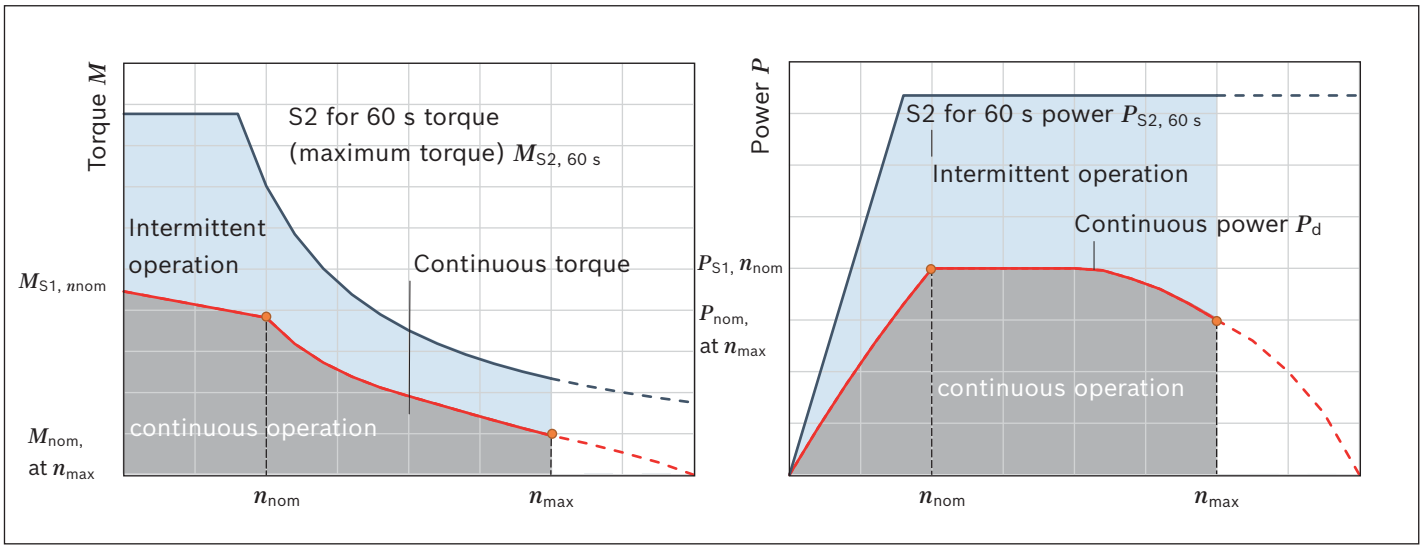
See operating instructions 96709-01-B

XG23, LV motor encoder and temperature connector

See operating instructions 96709-01-B

Operating ranges and characteristic curves

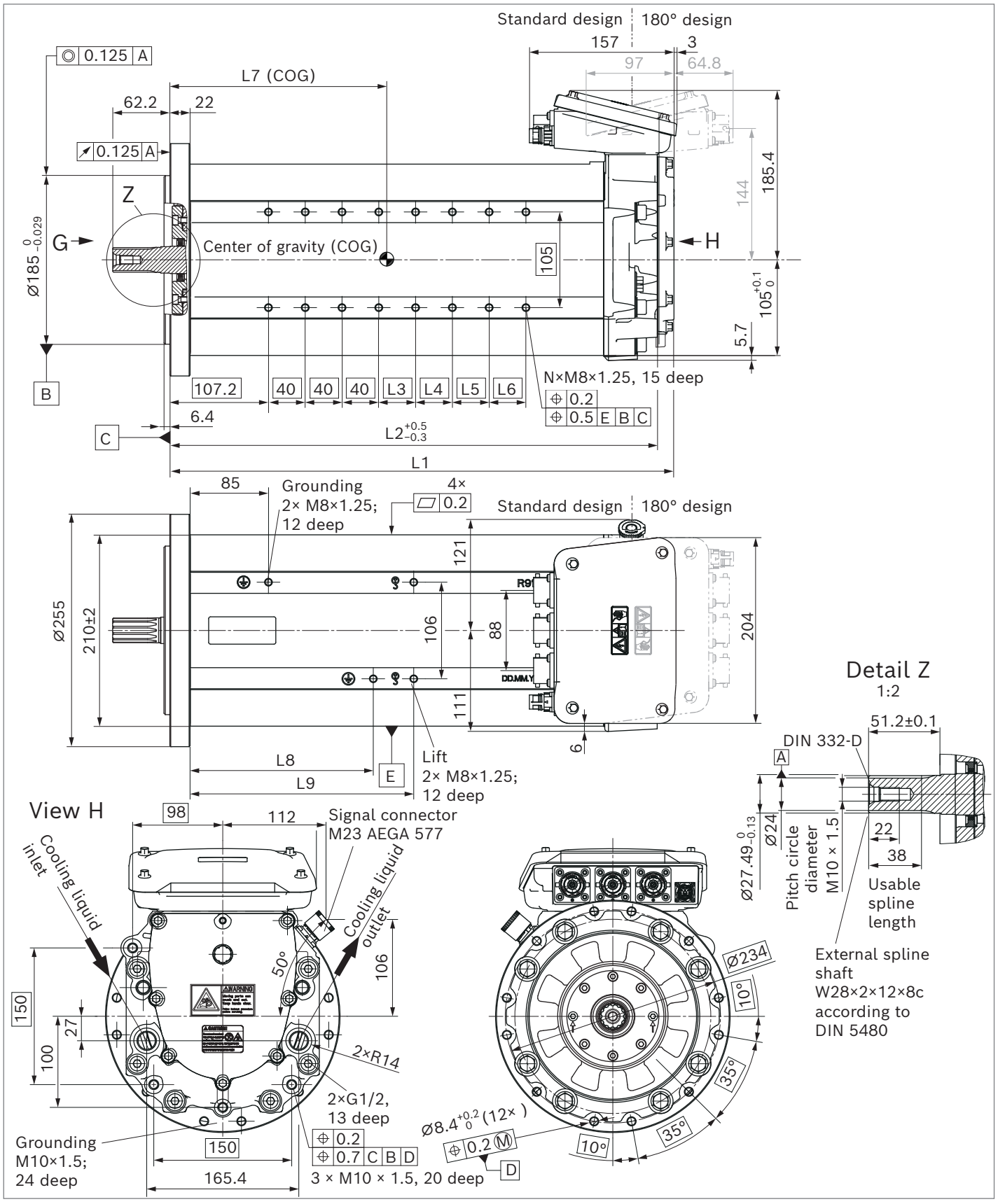
▼ **Motor operating ranges (EM)**



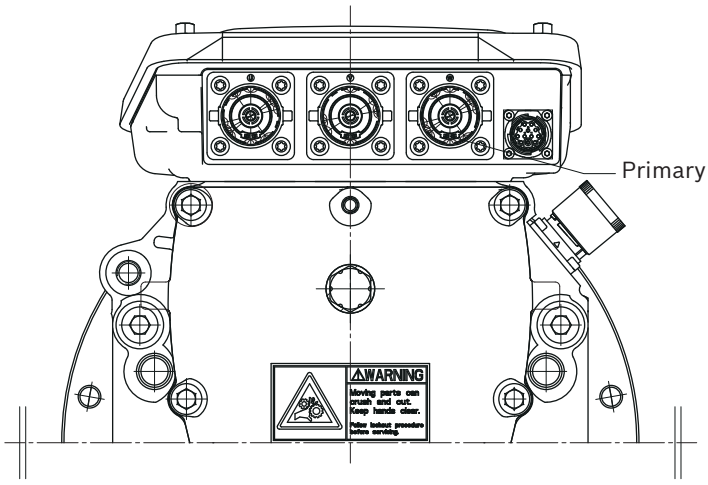
- S1 continuous torque $M_{S1,\ nnom}$ [Nm]:
  Continuous torque available at nominal rotational speed n_{nom} and a cooling liquid inlet temperature of 65 °C.
- Operating modes:
  The operating modes of electric motor generators are defined according to VDE 0530 "Rules for motor generators". Operation includes the specification of the motor generator load including duration, sequence and, if applicable, starting, electrical braking, idling, and interruptions.
  - S1 (continuous operation according to DIN EN 60034-1):
    Operation under constant load, the duration of which is sufficient to achieve the thermally stationary state.
  - S3 (periodic intermittent operation according to DIN 60034-1):
    Periodic intermittent operation comprises a sequence of similar cycles at constant nominal load and standstill period. The start-up current has no measurable effect on the temperature increase. The relative duty cycle is equal to the load time divided by (load time plus standstill period) multiplied by 100%.
  - Continuous operation:
    Operation under constant load. In this mode, the motor generator does not reach the thermally stationary state. The torque and power are therefore lower than in S1 operation, as a temporary overload reserve is maintained.
  - Intermittent operation
    Operating points that cause damage and excessive wear in the long term, and are therefore limited in their permissible duration.
- Continuous torque:
  Torque that is constantly available (see "Continuous operation").
- S2 for 60 s torque $M_{S2,\ 60\ s}$ [Nm]:
  Temporary maximum torque applied at operating temperature with nominal load. $M_{S2,\ 60\ s}$ is defined according to ECE R85 with a component start-up temperature of 25 °C and a coolant inlet temperature of 65 °C. After that, the machine can only be operated with a torque that is not above the continuous torque. If a torque higher than the continuous torque is requested again, the motor load must be lower than the continuous torque to allow the motor to cool down. The lower the load on the motor, the shorter the cooling time. This limitation is for thermal reasons.
- Maximum rotational speed n_{max} [rpm]:
  Maximum mechanically permissible rotational speed of the motor. Limiting factors for EMS1 motors are the maximum permissible bearing speeds to maintain the service life of the motor.
- Nominal rotational speed n_{nom} [rpm]:
  Rotational speed specified by the manufacturer for the specifications of the nominal data on the name plate. The rotational speed is achieved at a DC voltage of 700 V.

Dimensions

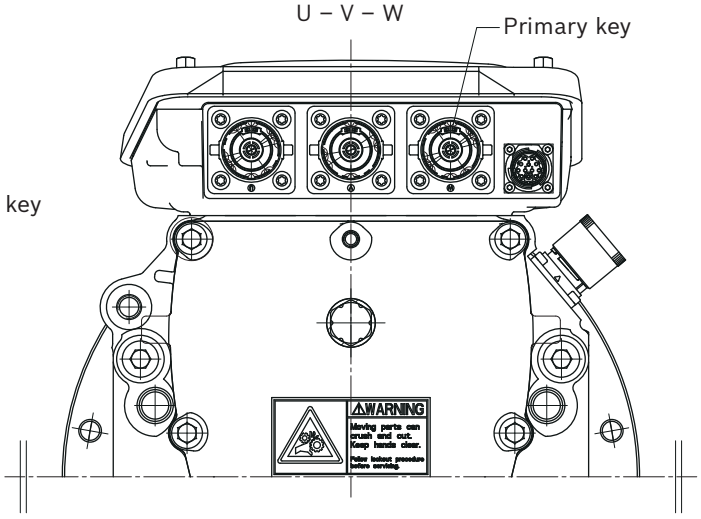
▼ **EMS1-10 with single connector, external-splined shaft W28×2×12×8c, compact motor flange (W1M7 variant)**



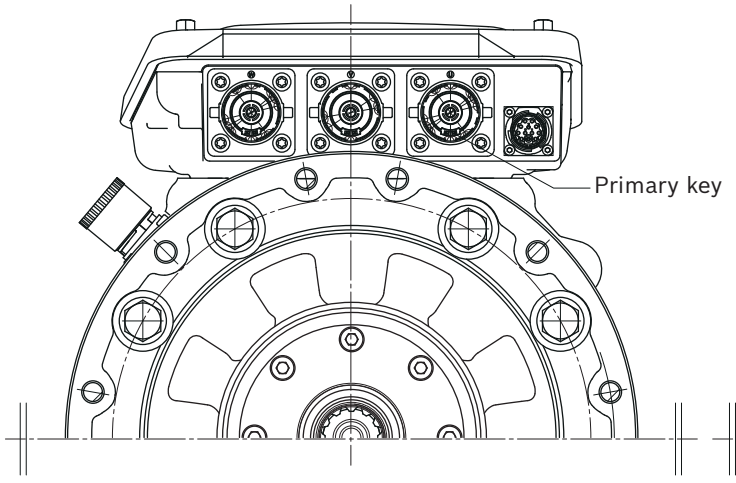
180° design
Single connector C3
U.V.W. motor output for downward angled or straight connection in B-shield direction
– XXC3 –
U – V – W



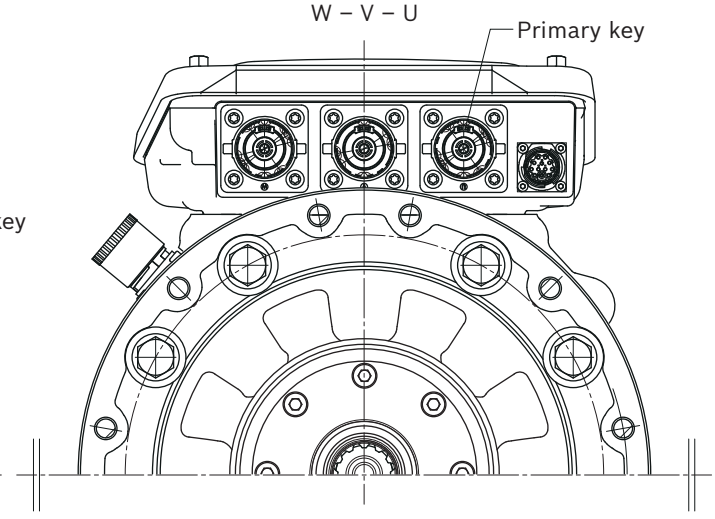
180° design
Single connector C4
U.V.W. motor output for upward angled connection in B-shield direction
– XXC4 –
U – V – W



Standard design
Single connector C1
W.V.U. motor output for straight connection in A-shield direction
– XXC1 –
W – V – U

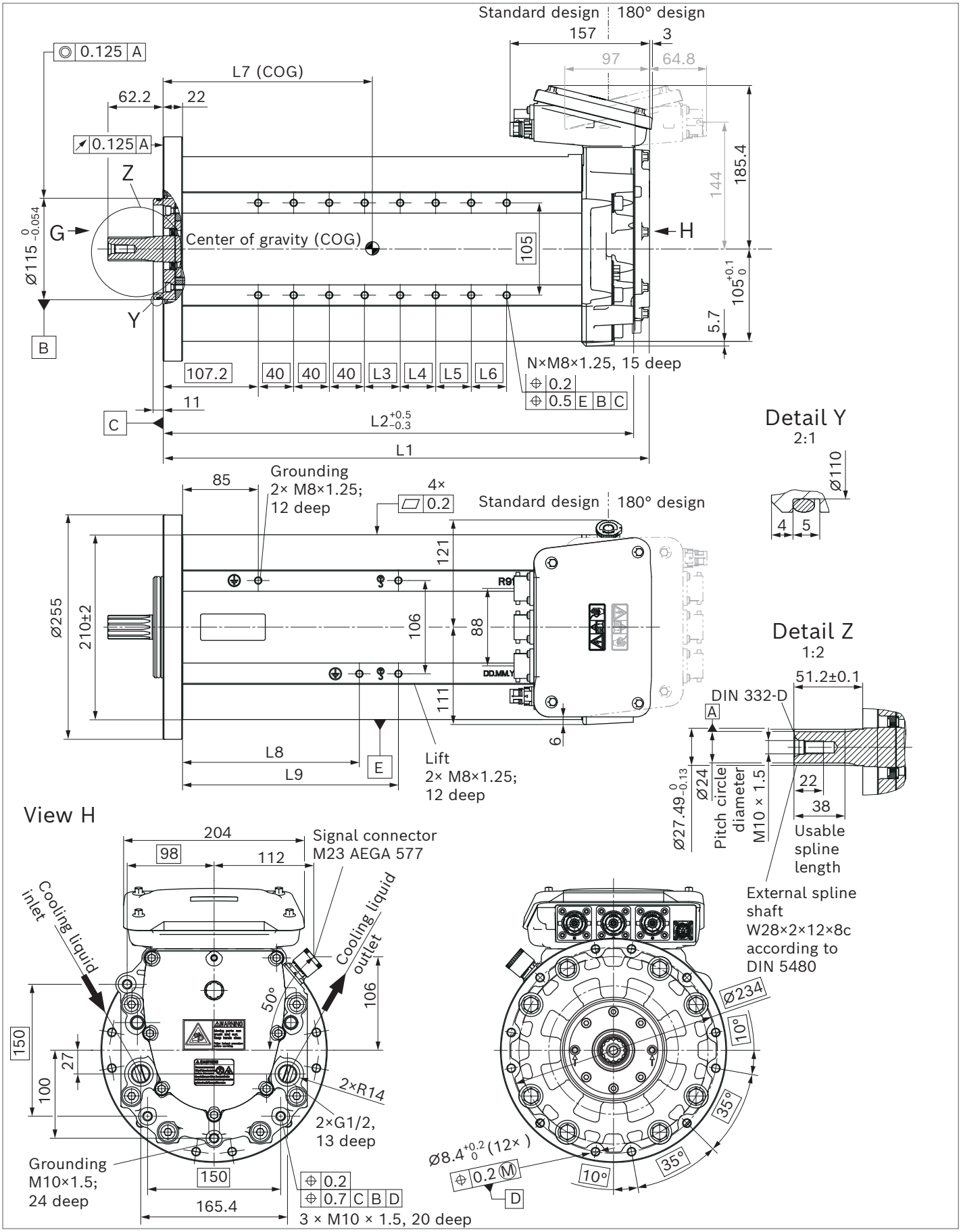


Standard design
Single connector C2
W.V.U. motor output for upward angled connection in A-shield direction
– XXC2 –
W – V – U

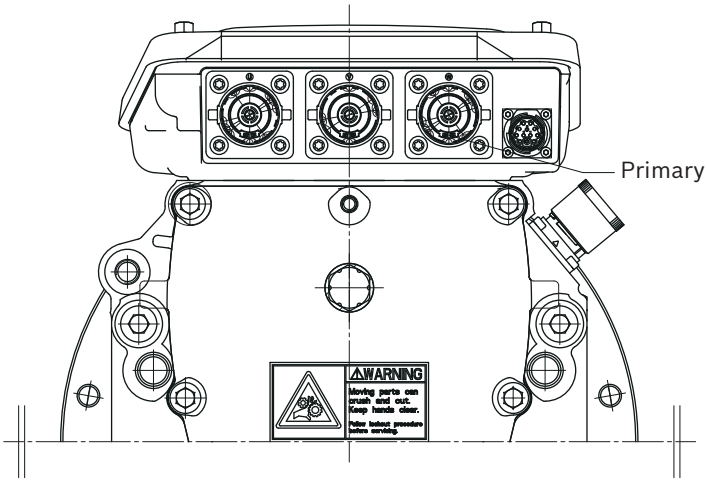


	L1	L2	L3	L4	L5	L6	L7	L8	L9	N	m
EMS1–10F–XX–CX–W1M7	398	379.75	–	–	–	–	189	85	169.5	4	58 kg
EMS1–10H–XX–CX–W1M7	448	429.75	40	–	–	–	214	85	194	5	66 kg
EMS1–10J–XX–CX–W1M7	498	479.75	40	40	30	–	240	174	218	7	74 kg
EMS1–10L–XX–CX–W1M7	548	529.75	40	40	40	40	265	199	243	8	82 kg

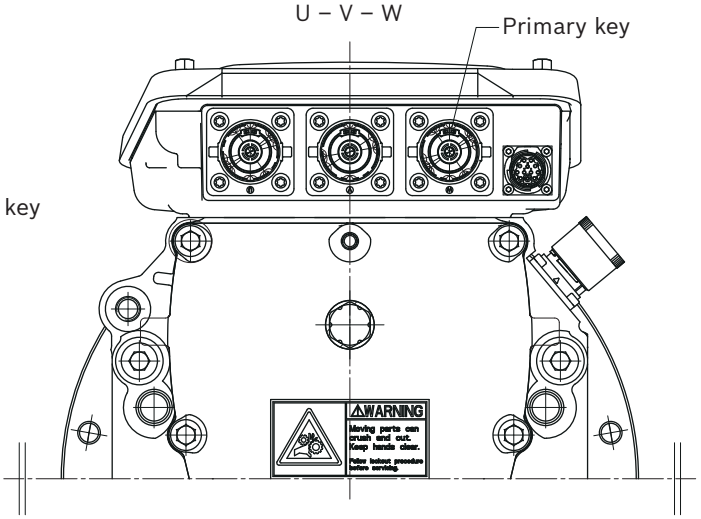
▼ **EMS1-10 with single connector, external-splined shaft W28×2×12×8c for motors and compact gearbox flange (W1G2 variant)**



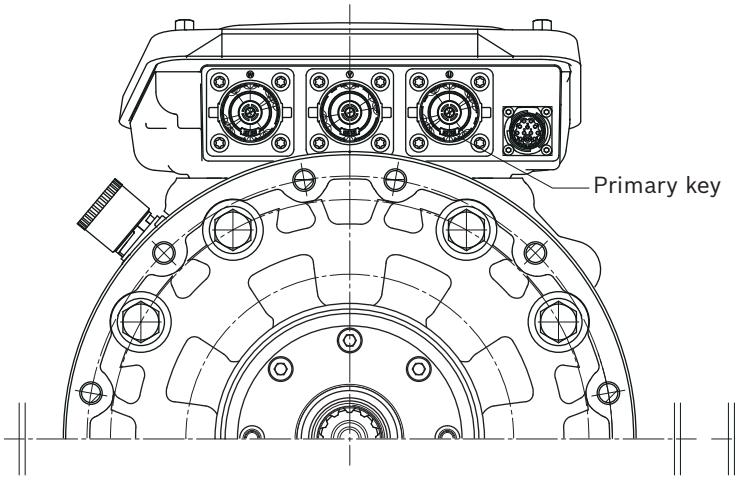
180° design
Single connector C3
U.V.W. motor output for downward angled or straight connection in B-shield direction
– XXC3 –
U – V – W



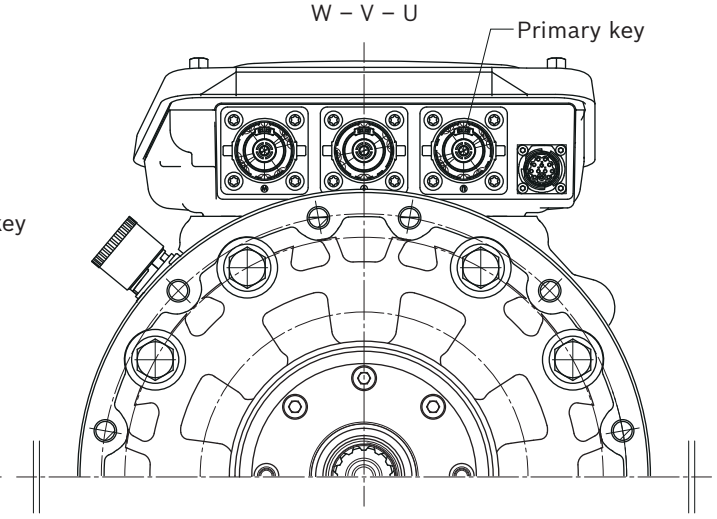
180° design
Single connector C4
U.V.W. motor output for upward angled connection in B-shield direction
– XXC4 –
U – V – W



Standard design
Single connector C1
W.V.U. motor output for straight connection in A-shield direction
– XXC1 –
W – V – U

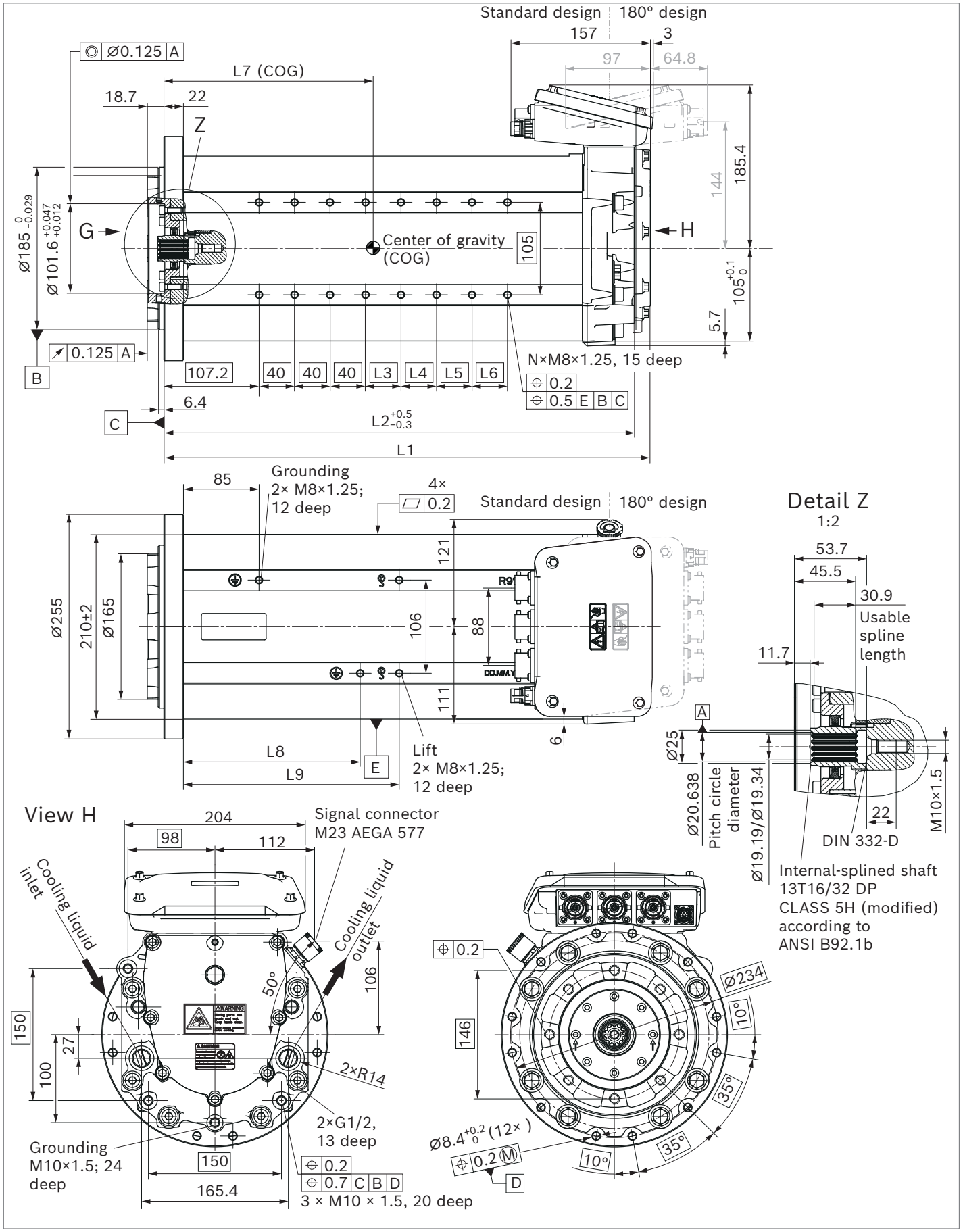


Standard design
Single connector C2
W.V.U. motor output for upward angled connection in A-shield direction
– XXC2 –
W – V – U

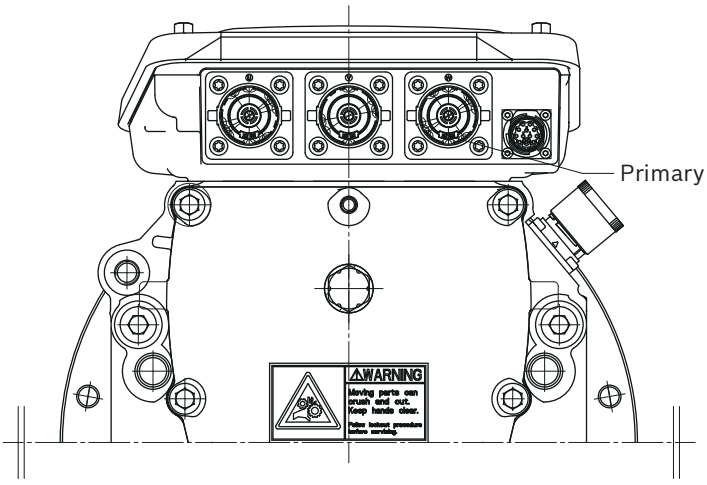


	L1	L2	L3	L4	L5	L6	L7	L8	L9	N	m
EMS1–10F–XX–CX–W1G2	398	379.75	–	–	–	–	189	85	169.5	4	58 kg
EMS1–10H–XX–CX–W1G2	448	429.75	40	–	–	–	214	85	194	5	66 kg
EMS1–10J–XX–CX–W1G2	498	479.75	40	40	30	–	240	174	218	7	74 kg
EMS1–10L–XX–CX–W1G2	548	529.75	40	40	40	40	265	199	243	8	82 kg

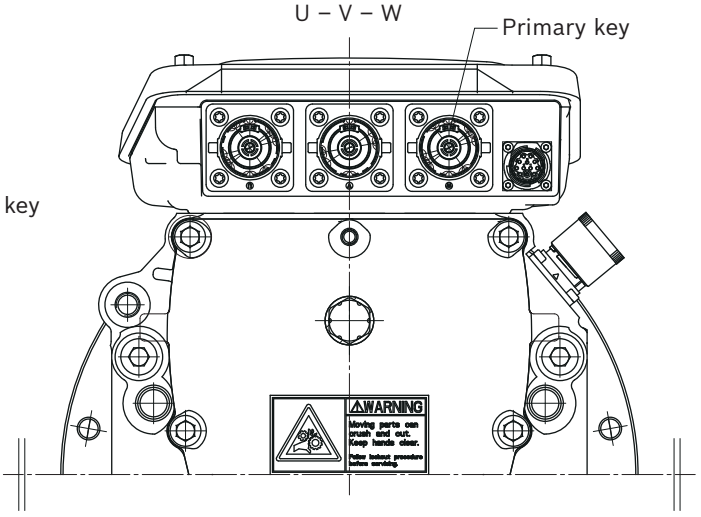
▼ **EMS1-10 with single connector, internal-splined shaft 13T 16/32 DP, pump flange 101-2 (B) (45°-steps, variant N1P2)**



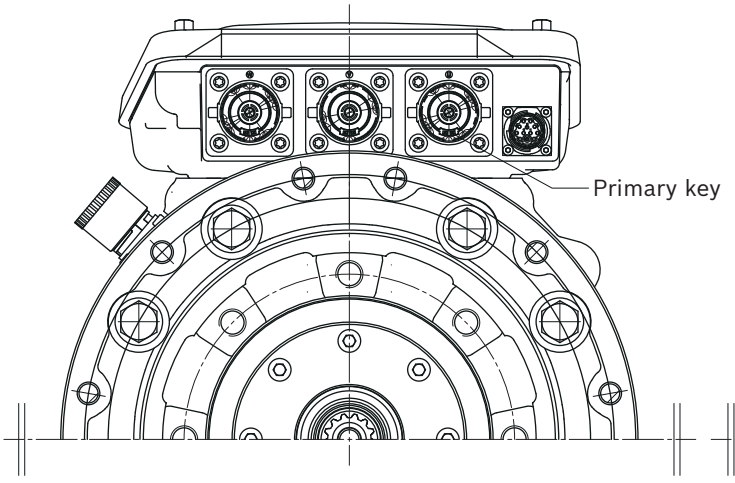
180° design
Single connector C3
U.V.W. motor output for downward angled or straight connection in B-shield direction
– XXC3 –
U – V – W



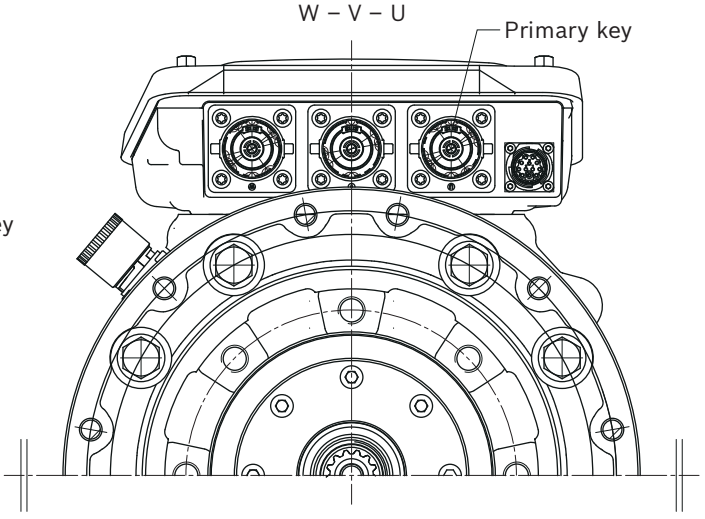
180° design
Single connector C4
U.V.W. motor output for upward angled connection in B-shield direction
– XXC4 –
U – V – W



Standard design
Single connector C1
W.V.U. motor output for straight connection in A-shield direction
– XXC1 –
W – V – U

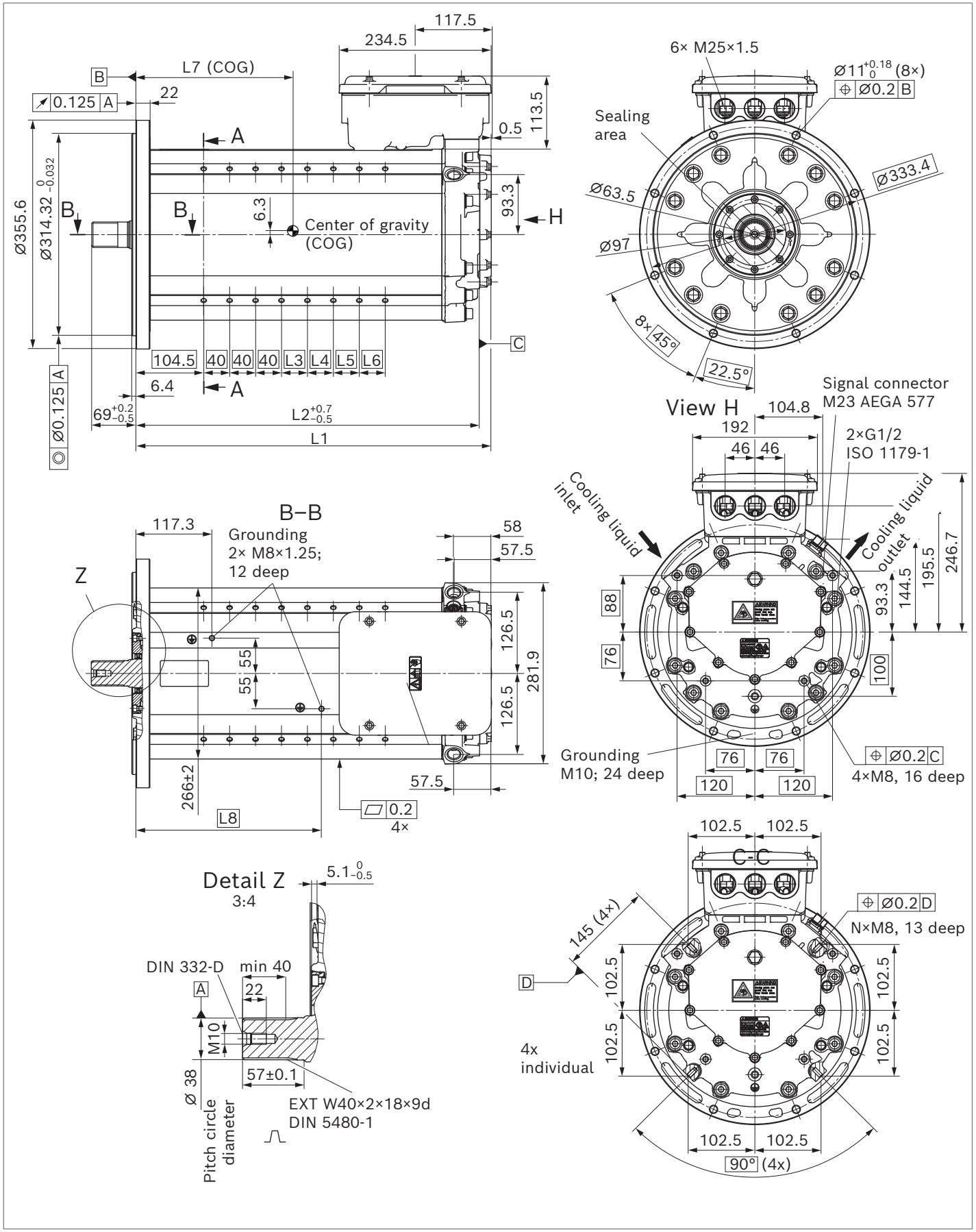


Standard design
Single connector C2
W.V.U. motor output for upward angled connection in A-shield direction
– XXC2 –
W – V – U



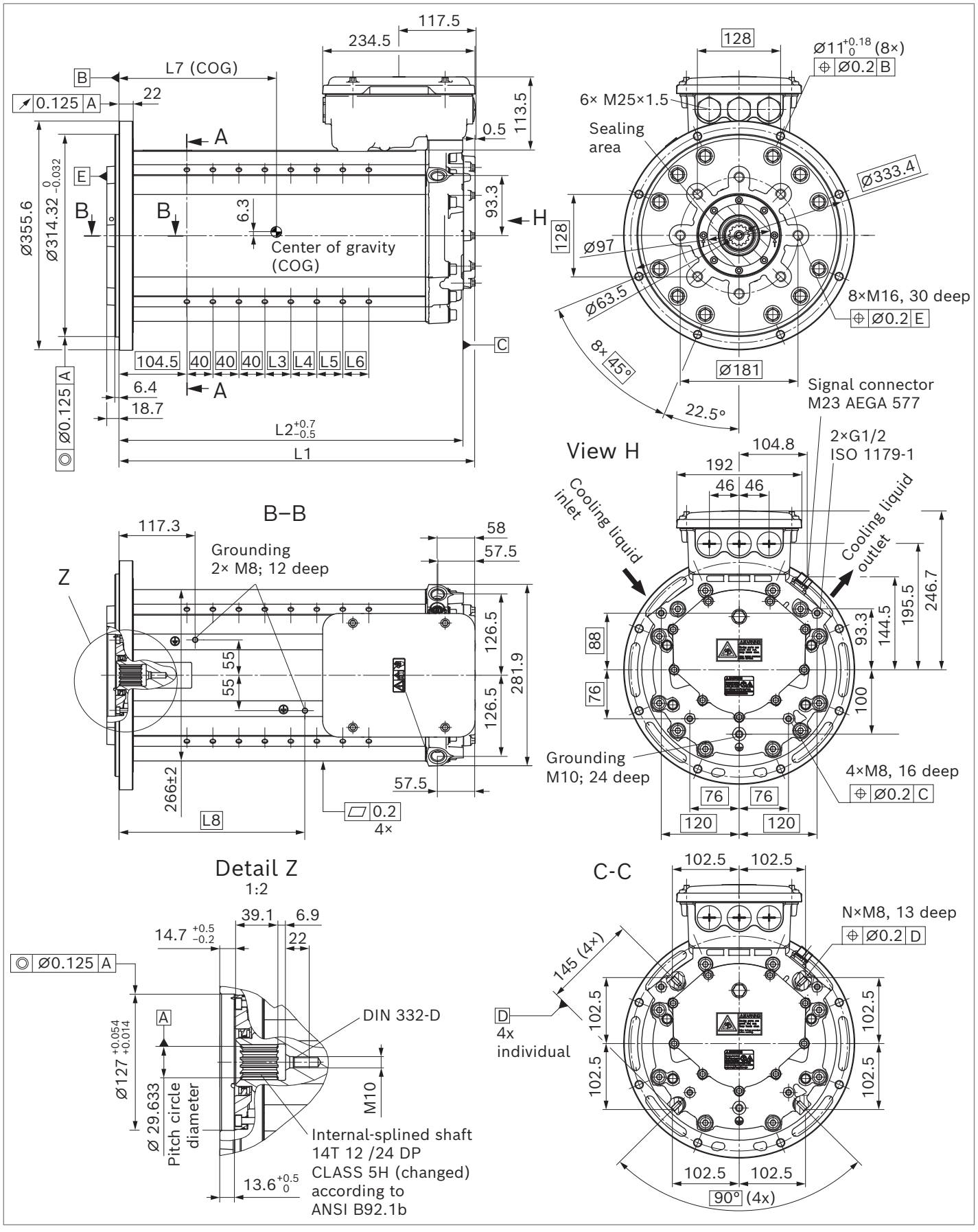
	L1	L2	L3	L4	L5	L6	L7	L8	L9	N	m
EMS1–10F–XX–CX–N1P2	398	379.75	–	–	–	–	185	85	169.5	4	60 kg
EMS1–10H–XX–CX–N1P2	448	429.75	40	–	–	–	210	85	194	5	68 kg
EMS1–10J–XX–CX–N1P2	498	479.75	40	40	30	–	236	174	218	7	76 kg
EMS1–10L–XX–CX–N1P2	548	529.75	40	40	40	40	261	199	243	8	84 kg

▼ **EMS1-13 with terminal box, external spline shaft W40×2×18×9d, motor flange SAE 5 (variant W2M5)**



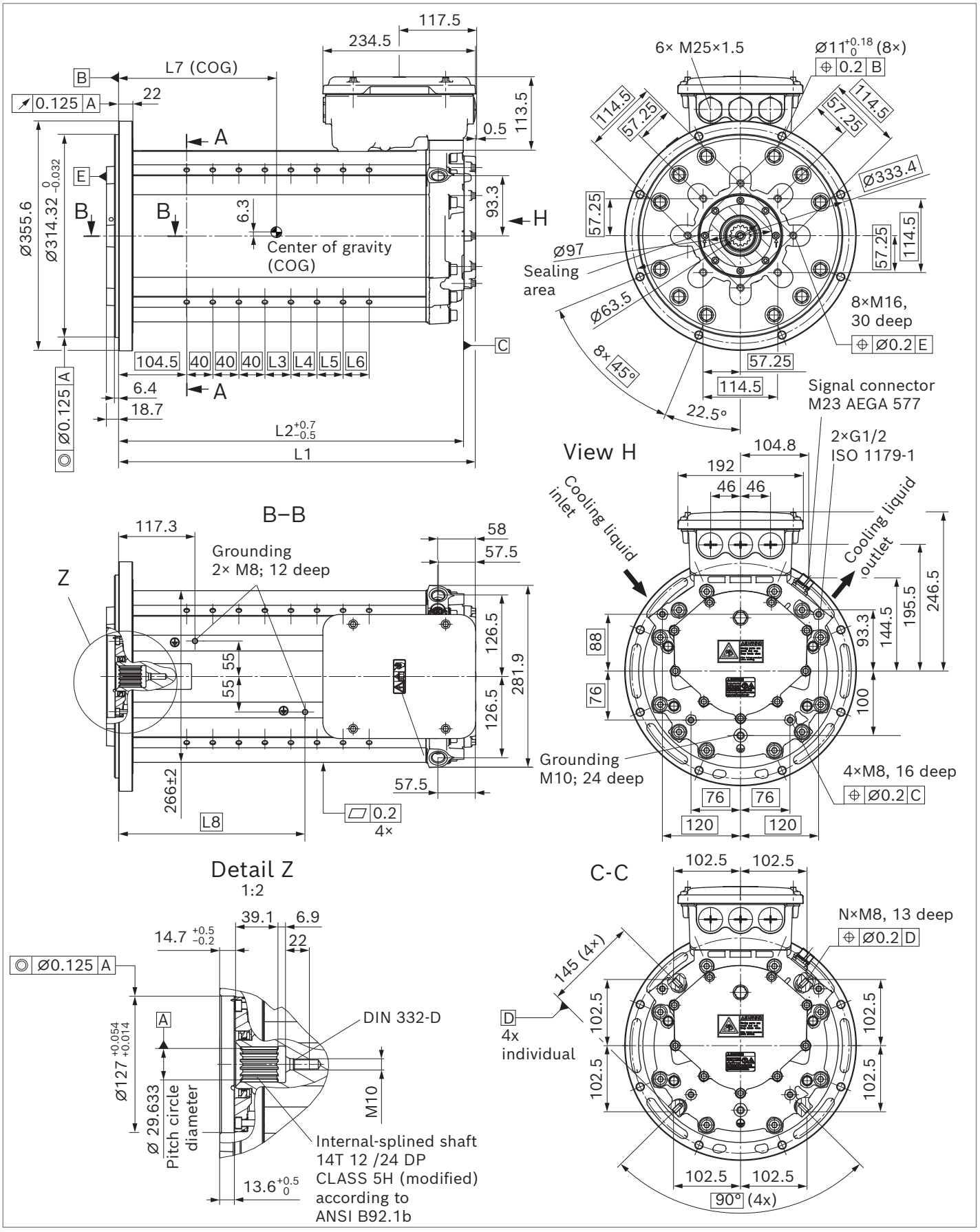
	L1	L2	L3	L4	L5	L6	L7	L8	N	m
EMS1–13F–XX–RSAB–W2M5	398	380	–	–	–	–	174	136.3	16	98 kg
EMS1–13H–XX–RSAB–W2M5	448	430	40	–	–	–	199	186.3	20	111 kg
EMS1–13J–XX–RSAB–W2M5	498	480	40	40	–	–	225	236.3	24	125 kg
EMS1–13L–XX–RSAB–W2M5	548	530	40	40	40	40	250	286.3	32	139 kg

▼ **EMS1-13 with terminal box, internal-splined shaft 14T 12/24 DP, pump flange 127-2 (C) (45° steps, variant N2P3)**



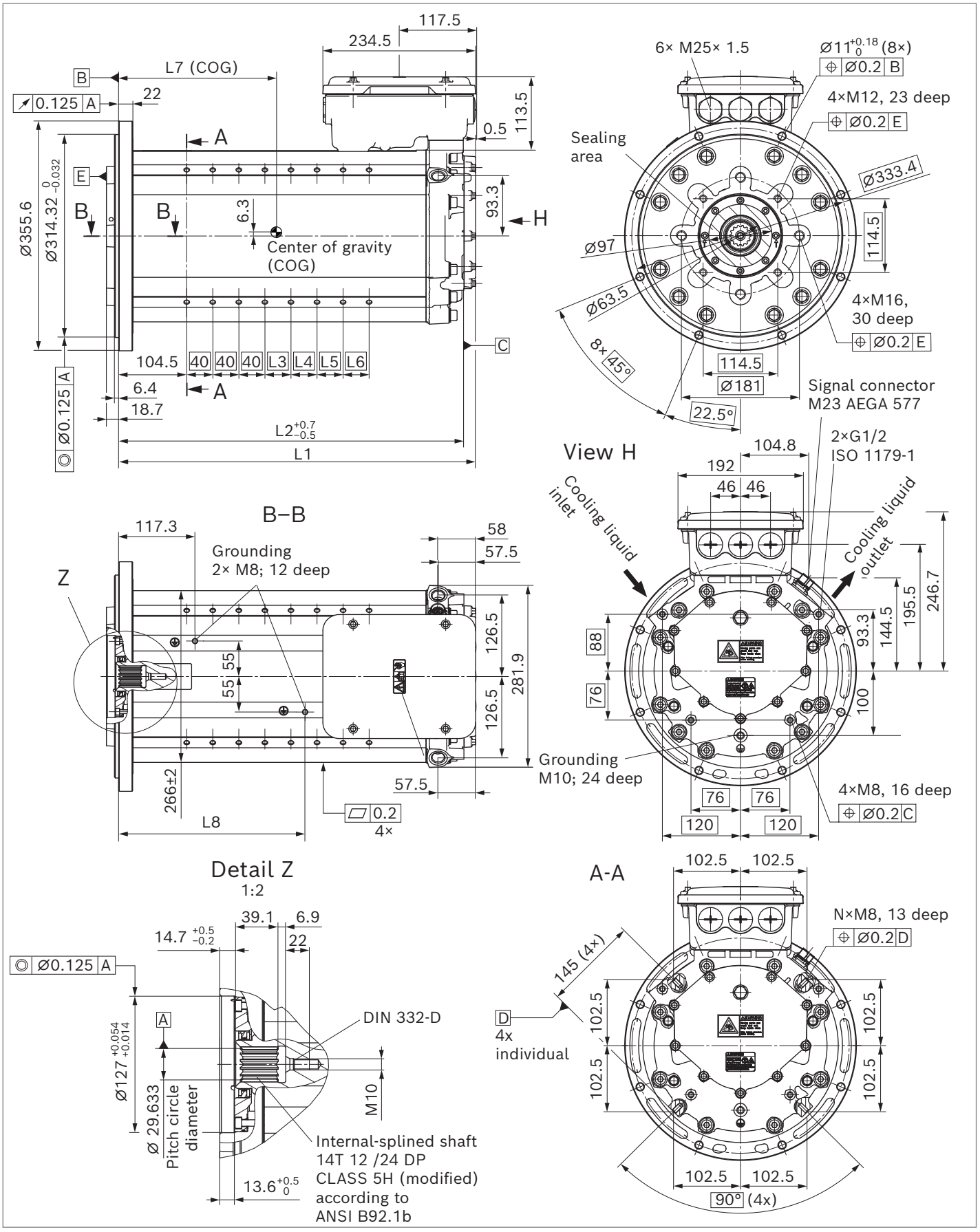
	L1	L2	L3	L4	L5	L6	L7	L8	N	m
EMS1–13F–XX–RSAB–N2P3	398	380	–	–	–	–	173	136.3	16	98 kg
EMS1–13H–XX–RSAB–N2P3	448	430	40	–	–	–	198	186.3	20	112 kg
EMS1–13J–XX–RSAB–N2P3	498	480	40	40	–	–	224	236.3	24	126 kg
EMS1–13L–XX–RSAB–N2P3	548	530	40	40	40	40	250	286.3	32	139 kg

▼ EMS1-13 with terminal box, internal-splined shaft 14T 12/24 DP, pump flange 127-4 (C) (45° steps, variant N2P4)



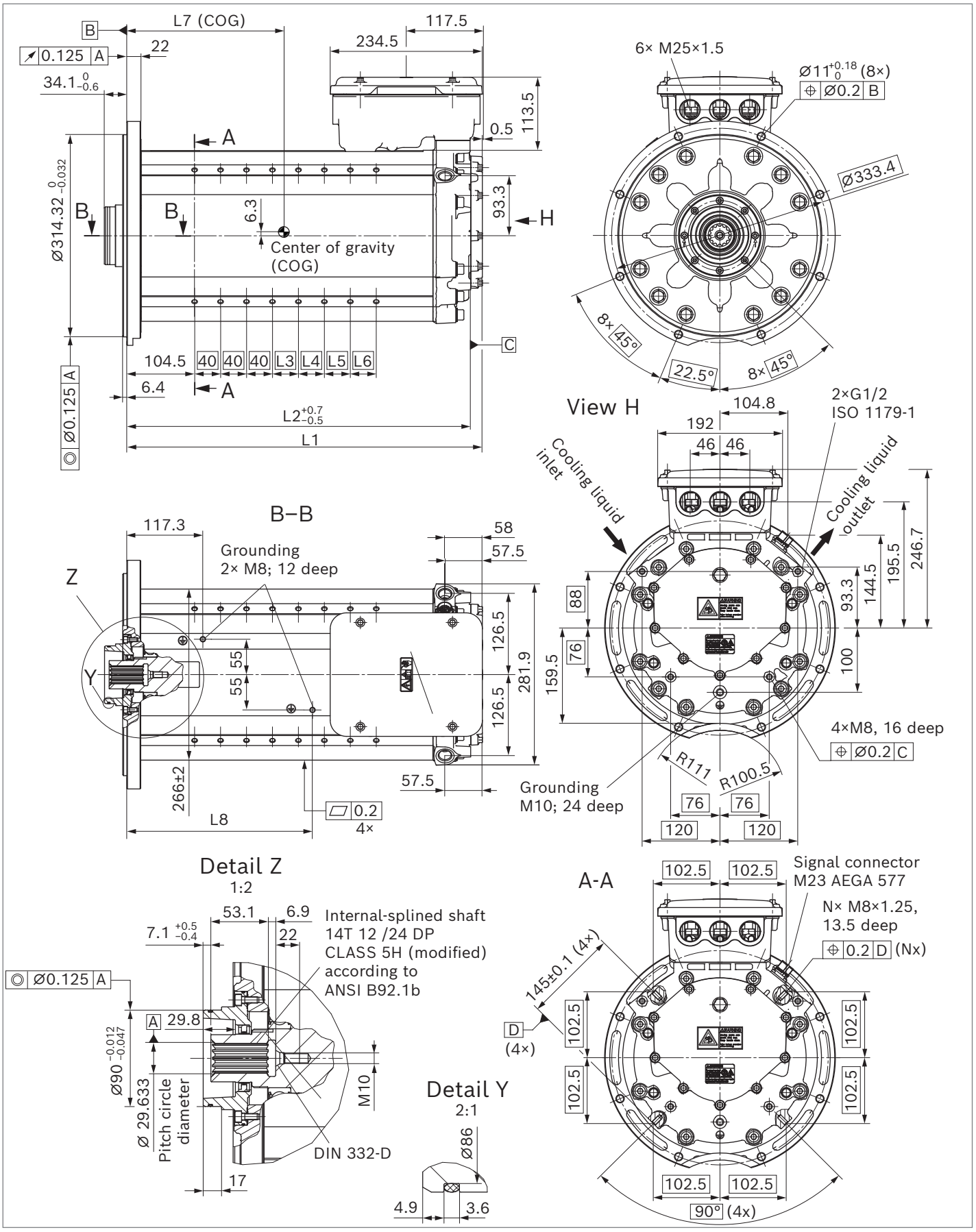
	L1	L2	L3	L4	L5	L6	L7	L8	N	m
EMS1–13F–XX–RSAB–N2P4	398	380	–	–	–	–	173	136.3	16	98 kg
EMS1–13H–XX–RSAB–N2P4	448	430	40	–	–	–	198	186.3	20	112 kg
EMS1–13J–XX–RSAB–N2P4	498	480	40	40	–	–	224	236.3	24	126 kg
EMS1–13L–XX–RSAB–N2P4	548	530	40	40	40	40	250	286.3	32	139 kg

▼ **EMS1-13 with single connector, internal-splined shaft 14T 12/24 DP, pump flange 127-2/127-4 (C) (90° steps, variant N2P5)**



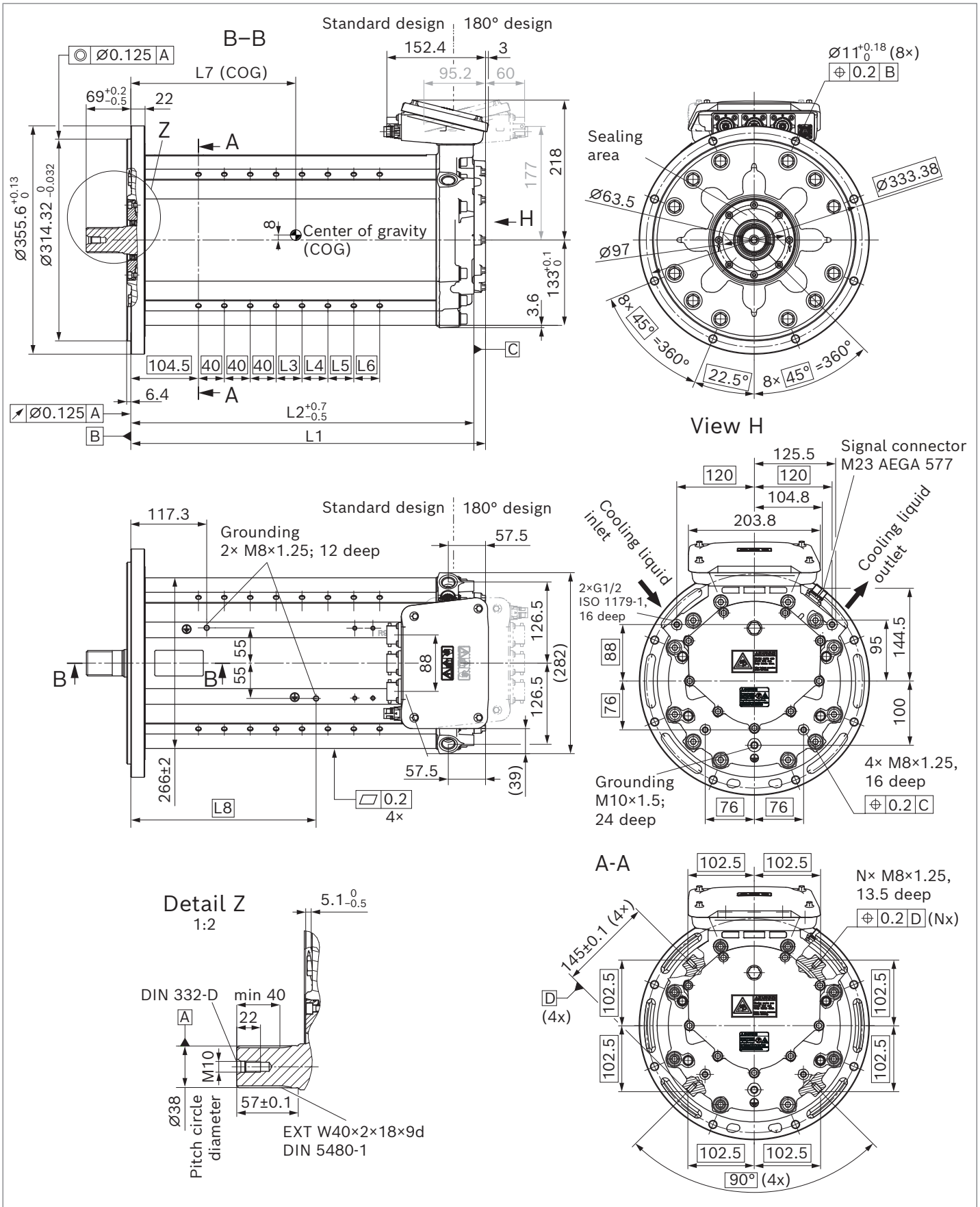
	L1	L2	L3	L4	L5	L6	L7	L8	N	m
EMS1–13F–XX–RSAB–N2P5	398	380	–	–	–	–	173	136.3	16	98 kg
EMS1–13H–XX–RSAB–N2P5	448	430	40	–	–	–	198	186.3	20	112 kg
EMS1–13J–XX–RSAB–N2P5	498	480	40	40	–	–	224	236.3	24	126 kg
EMS1–13L–XX–RSAB–N2P5	548	530	40	40	40	40	250	286.3	32	139 kg

▼ **EMS1-13 with terminal box, internal-splined shaft 14T 12/24 DP, gearbox flange SAE 5 (variant N6G3)**

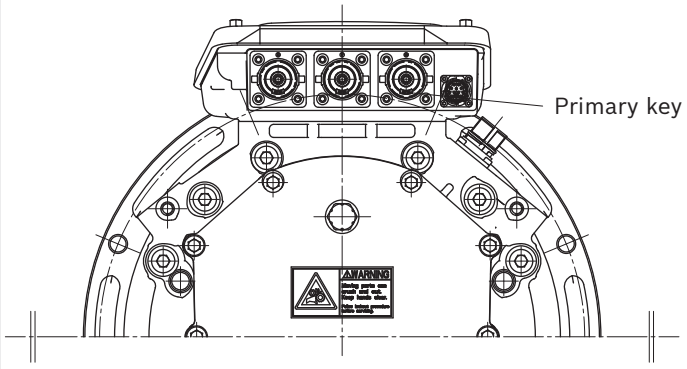


	L1	L2	L3	L4	L5	L6	L7	L8	N	m
EMS1–13F–XX–RSAB–N6G3	398	380	–	–	–	–	174	136.3	16	98 kg
EMS1–13H–XX–RSAB–N6G3	448	430	40	–	–	–	199	186.3	20	111 kg
EMS1–13J–XX–RSAB–N6G3	498	480	40	40	–	–	225	236.3	24	125 kg
EMS1–13L–XX–RSAB–N6G3	548	530	40	40	40	40	250	286.3	32	139 kg

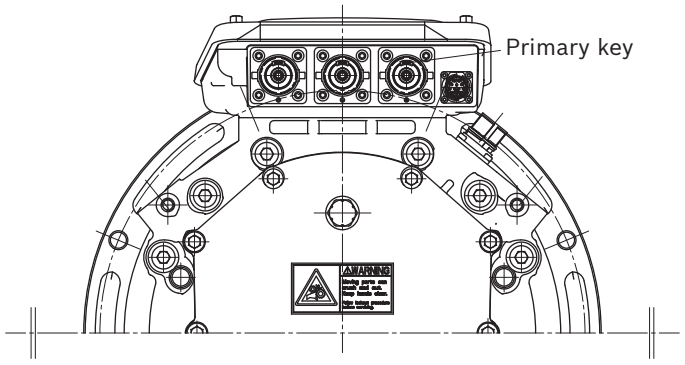
▼ **EMS1-13 with single connector, external spline shaft W40×2×18×9d, motor flange SAE 5 (variant W2M5)**



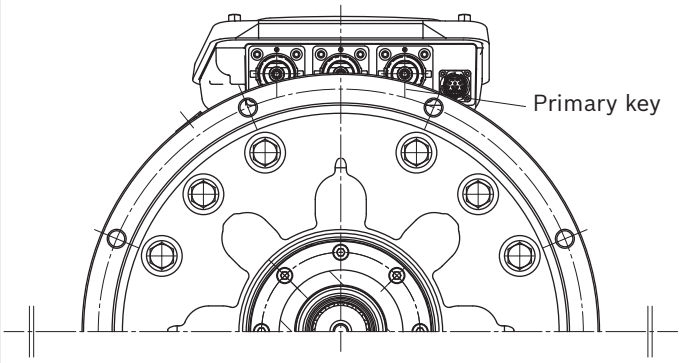
180° design
Single connector C3
U.V.W. motor output for downward angled or straight connection in B-shield direction
– XXC3 –
U – V – W



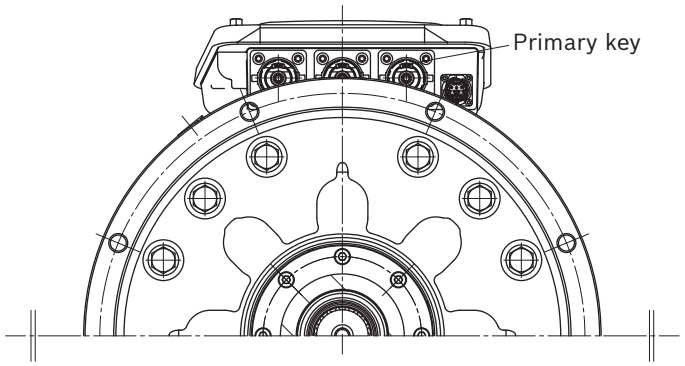
180° design
Single connector C4
U.V.W. motor output for upward angled connection in B-shield direction
– XXC4 –
U – V – W



Standard design
Single connector C1
W.V.U. motor output for straight connection in A-shield direction
– XXC1 –
W – V – U

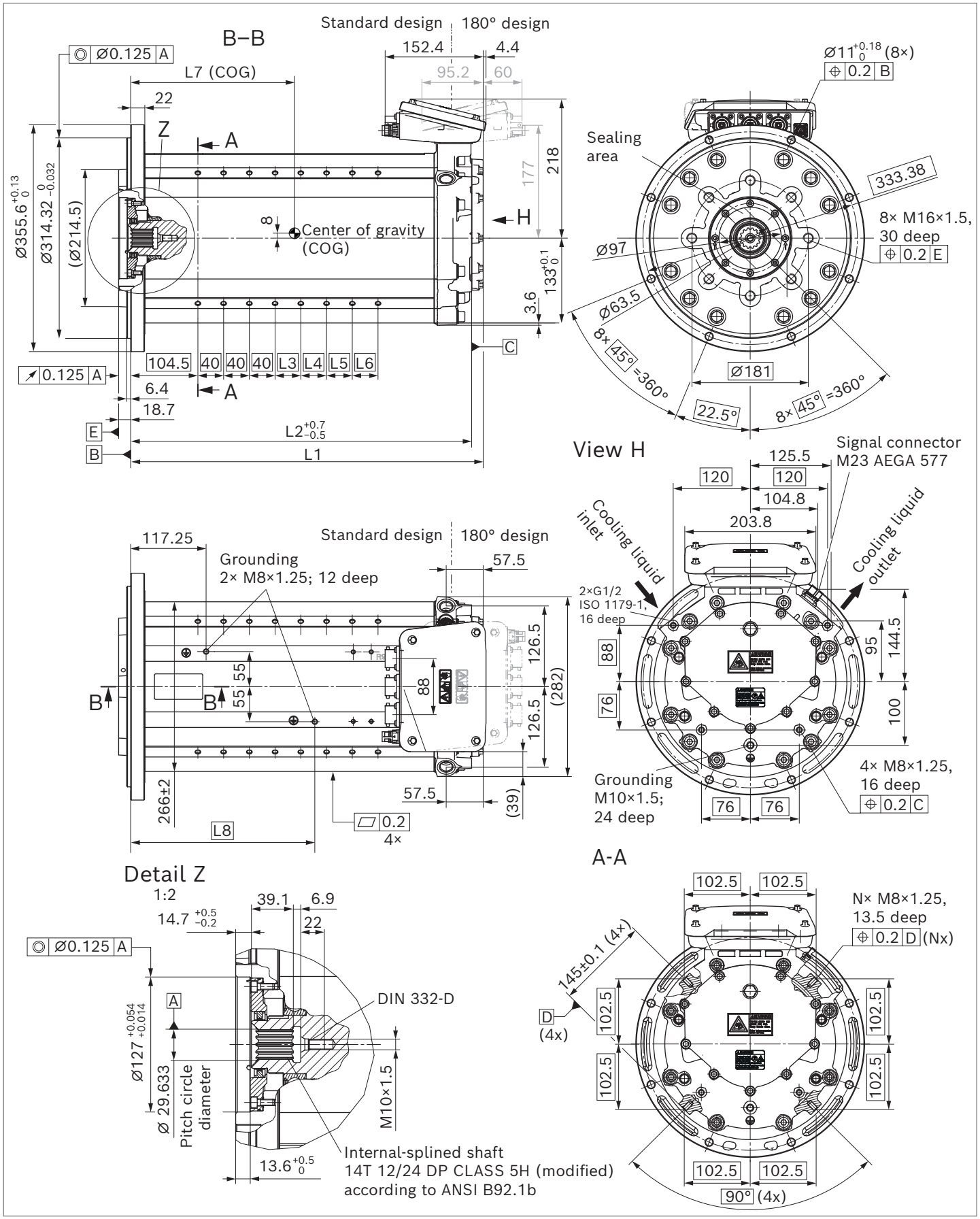


Standard design
Single connector C2
W.V.U. motor output for upward angled connection in A-shield direction
– XXC2 –
W – V – U

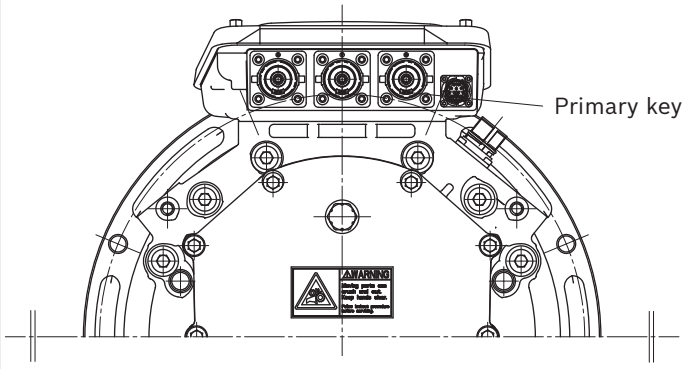


	L1	L2	L3	L4	L5	L6	L7	L8	N	m
EMS1–13F–XX–CX–W2M5	398	380	–	–	–	–	173	136.3	16	98 kg
EMS1–13H–XX–CX–W2M5	448	430	40	–	–	–	198	186.3	20	115 kg
EMS1–13J–XX–CX–W2M5	498	480	40	40	–	–	224	236.3	24	126 kg
EMS1–13L–XX–CX–W2M5	548	530	40	40	40	40	250	286.3	32	139 kg

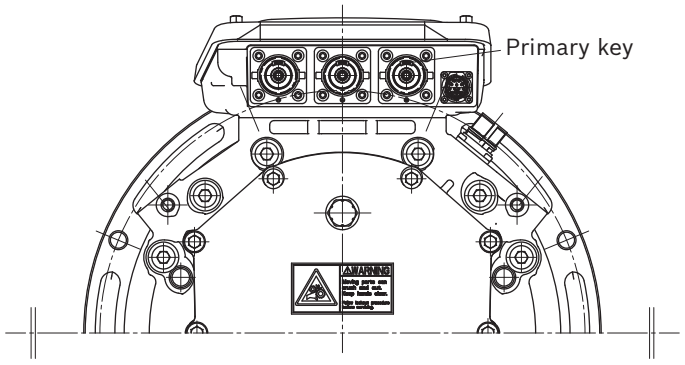
▼ **EMS1-13 with single connector, internal-splined shaft 14T 12/24 DP, pump flange 127-2 (C) (45° steps, variant N2P3)**



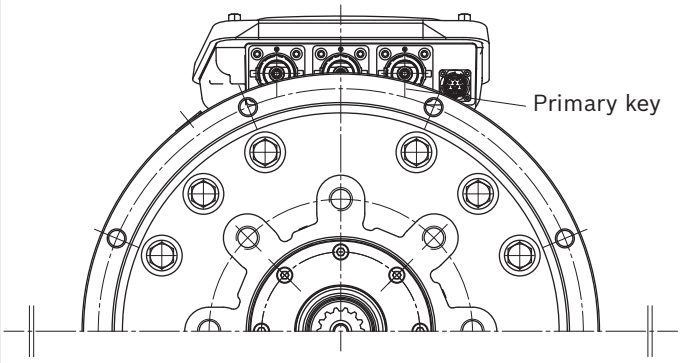
180° design
Single connector C3
U.V.W. motor output for downward angled or straight connection in B-shield direction
– XXC3 –
U – V – W



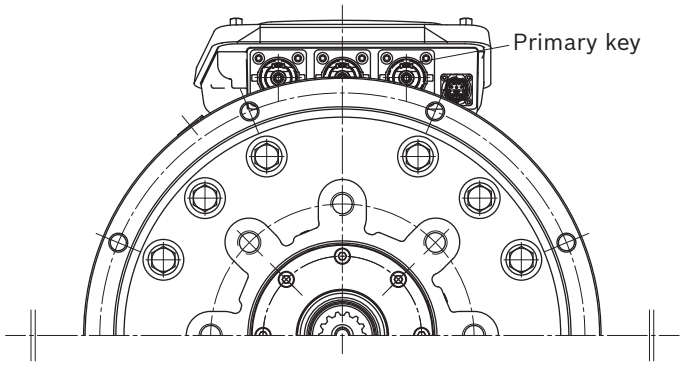
180° design
Single connector C4
U.V.W. motor output for upward angled connection in B-shield direction
– XXC4 –
U – V – W



Standard design
Single connector C1
W.V.U. motor output for straight connection in A-shield direction
– XXC1 –
W – V – U

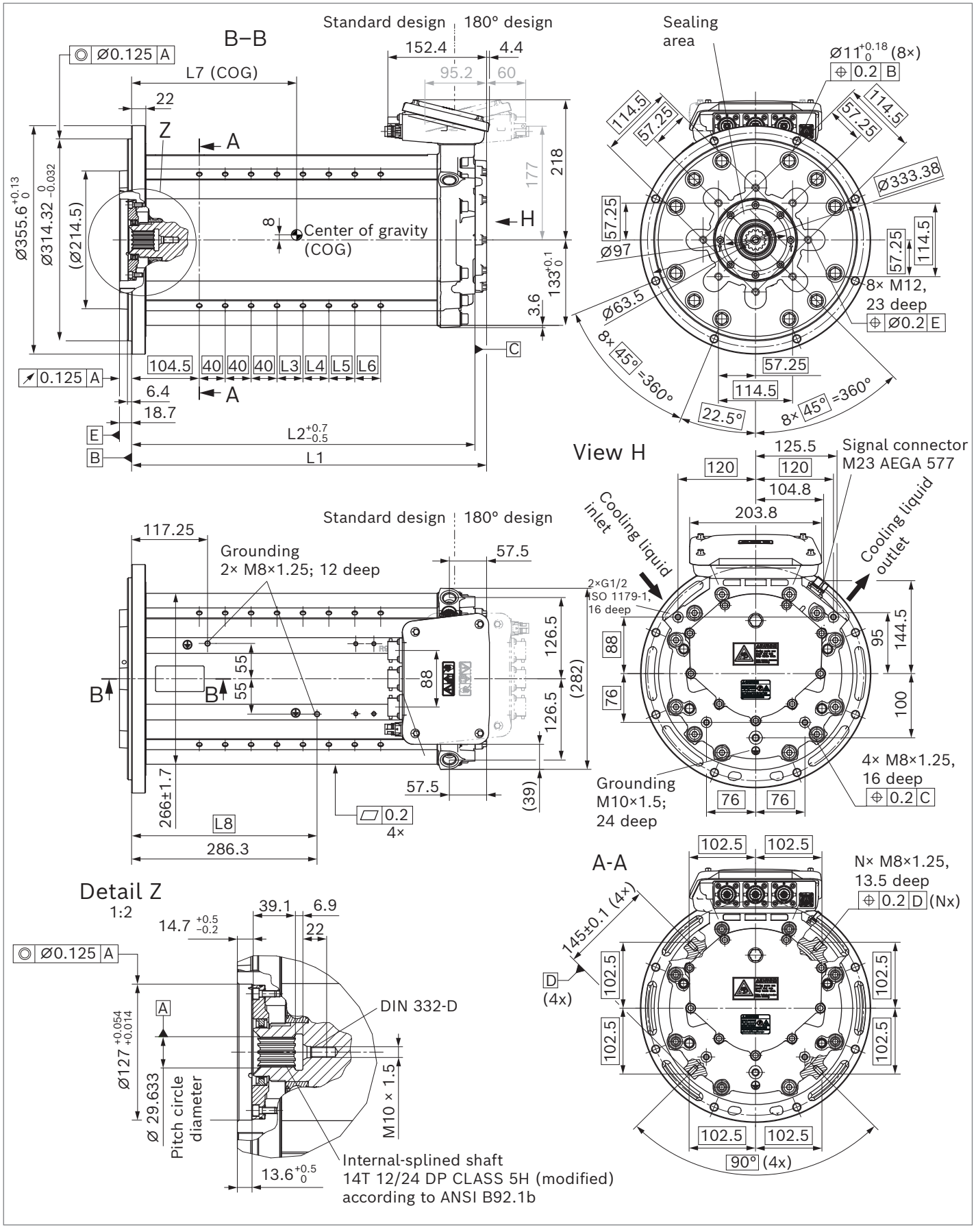


Standard design
Single connector C2
W.V.U. motor output for upward angled connection in A-shield direction
– XXC2 –
W – V – U

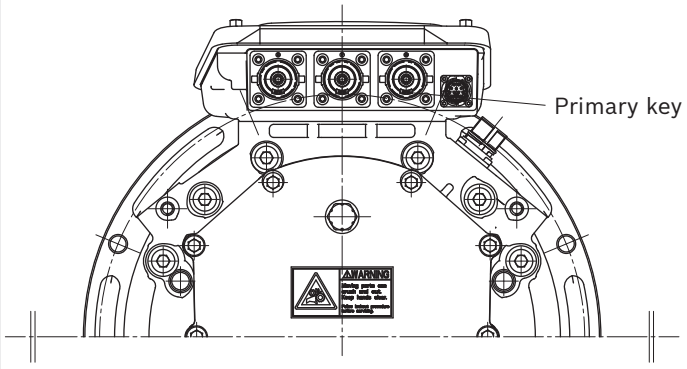


	L1	L2	L3	L4	L5	L6	L7	L8	N	m
EMS1–13F–XX–CX–N2P3	398	380	–	–	–	–	179	136.3	16	104 kg
EMS1–13H–XX–CX–N2P3	448	430	40	–	–	–	205	186.3	20	117 kg
EMS1–13J–XX–CX–N2P3	498	480	40	40	–	–	231	236.3	24	130 kg
EMS1–13L–XX–CX–N2P3	548	530	40	40	40	40	257	286.3	32	143 kg

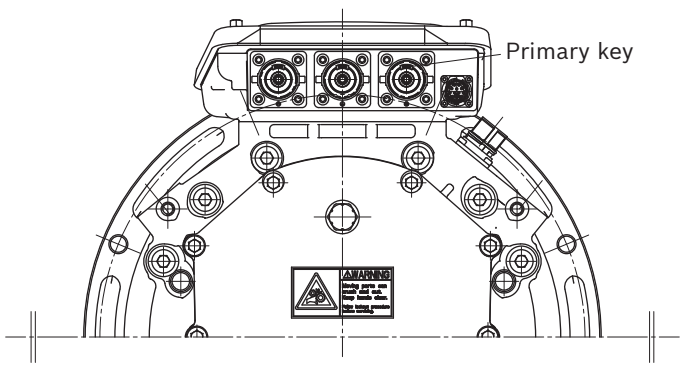
▼ **EMS1-13 with single connector, internal-splined shaft 14T 12/24 DP, pump flange 127-4 (C) (45° steps, variant N2P4)**



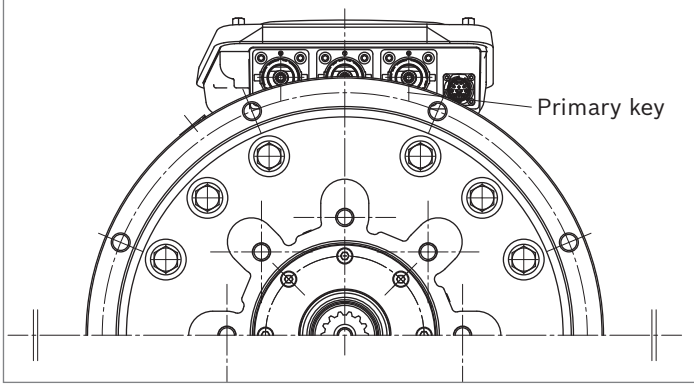
180° design
Single connector C3
U.V.W. motor output for downward angled or straight connection in B-shield direction
– XXC3 –
U – V – W



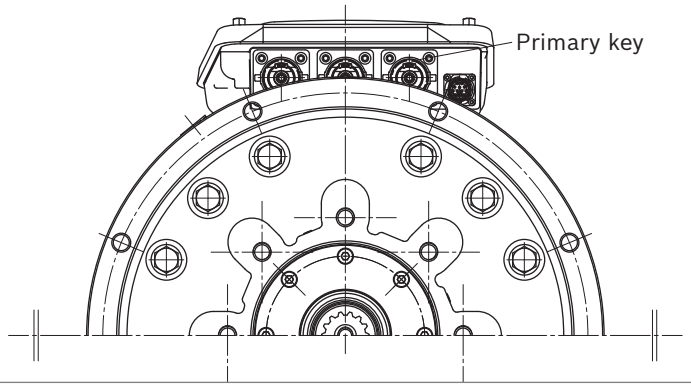
180° design
Single connector C4
U.V.W. motor output for upward angled connection in B-shield direction
– XXC4 –
U – V – W



Standard design
Single connector C1
W.V.U. motor output for straight connection in A-shield direction
– XXC1 –
W – V – U

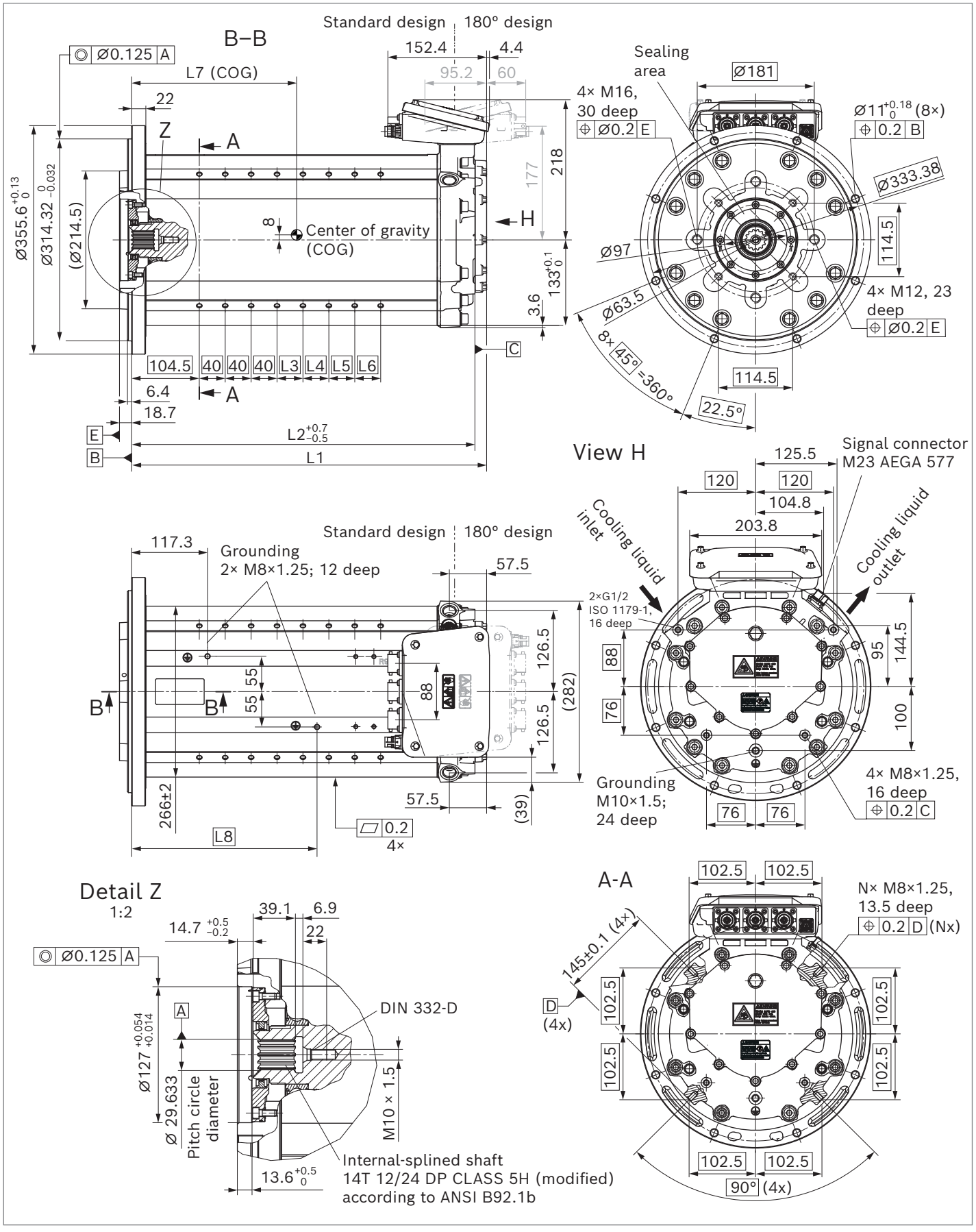


Standard design
Single connector C2
W.V.U. motor output for upward angled connection in A-shield direction
– XXC2 –
W – V – U

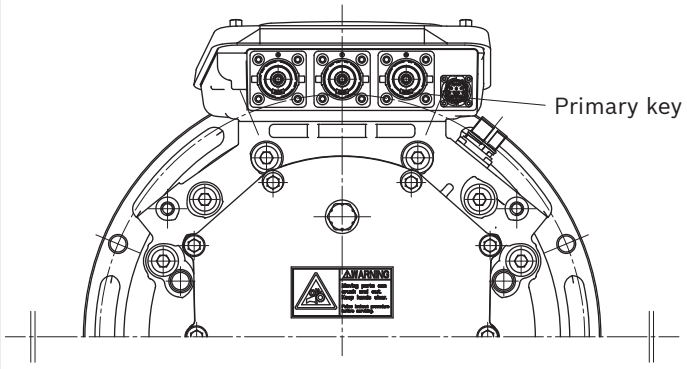


	L1	L2	L3	L4	L5	L6	L7	L8	N	m
EMS1–13F–XX–CX–N2P4	398	380	–	–	–	–	179	136.3	16	104 kg
EMS1–13H–XX–CX–N2P4	448	430	40	–	–	–	205	186.3	20	117 kg
EMS1–13J–XX–CX–N2P4	498	480	40	40	–	–	231	236.3	24	130 kg
EMS1–13L–XX–CX–N2P4	548	530	40	40	40	40	257	286.3	32	143 kg

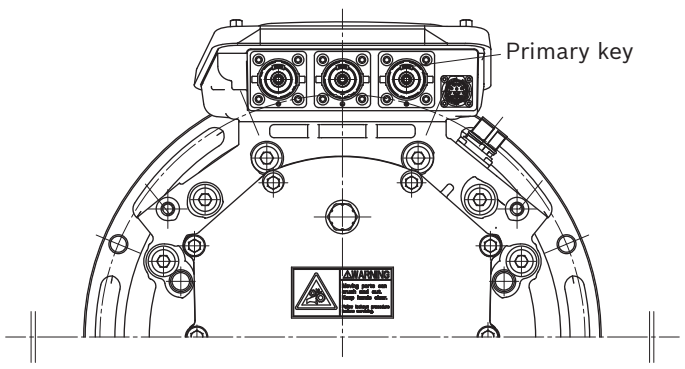
▼ **EMS1-13 with single connector, internal-splined shaft 14T 12/24 DP, pump flange 127-2/127-4 (C) (90° steps, variant N2P5)**



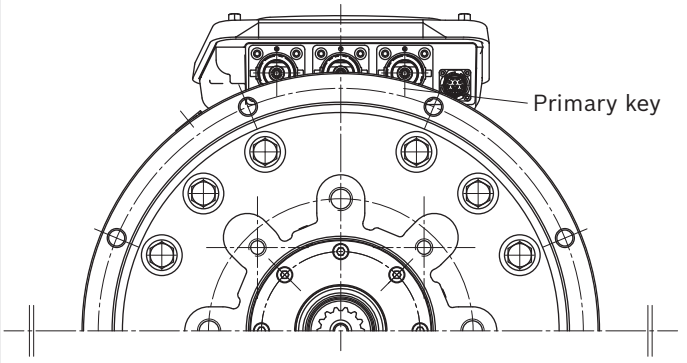
180° design
Single connector C3
U.V.W. motor output for downward angled or straight connection in B-shield direction
– XXC3 –
U – V – W



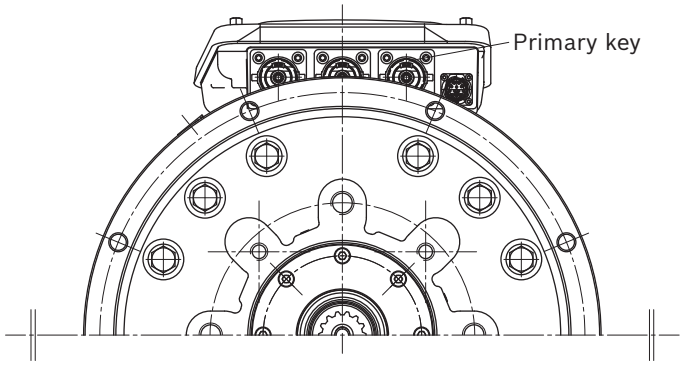
180° design
Single connector C4
U.V.W. motor output for upward angled connection in B-shield direction
– XXC4 –
U – V – W



Standard design
Single connector C1
W.V.U. motor output for straight connection in A-shield direction
– XXC1 –
W – V – U

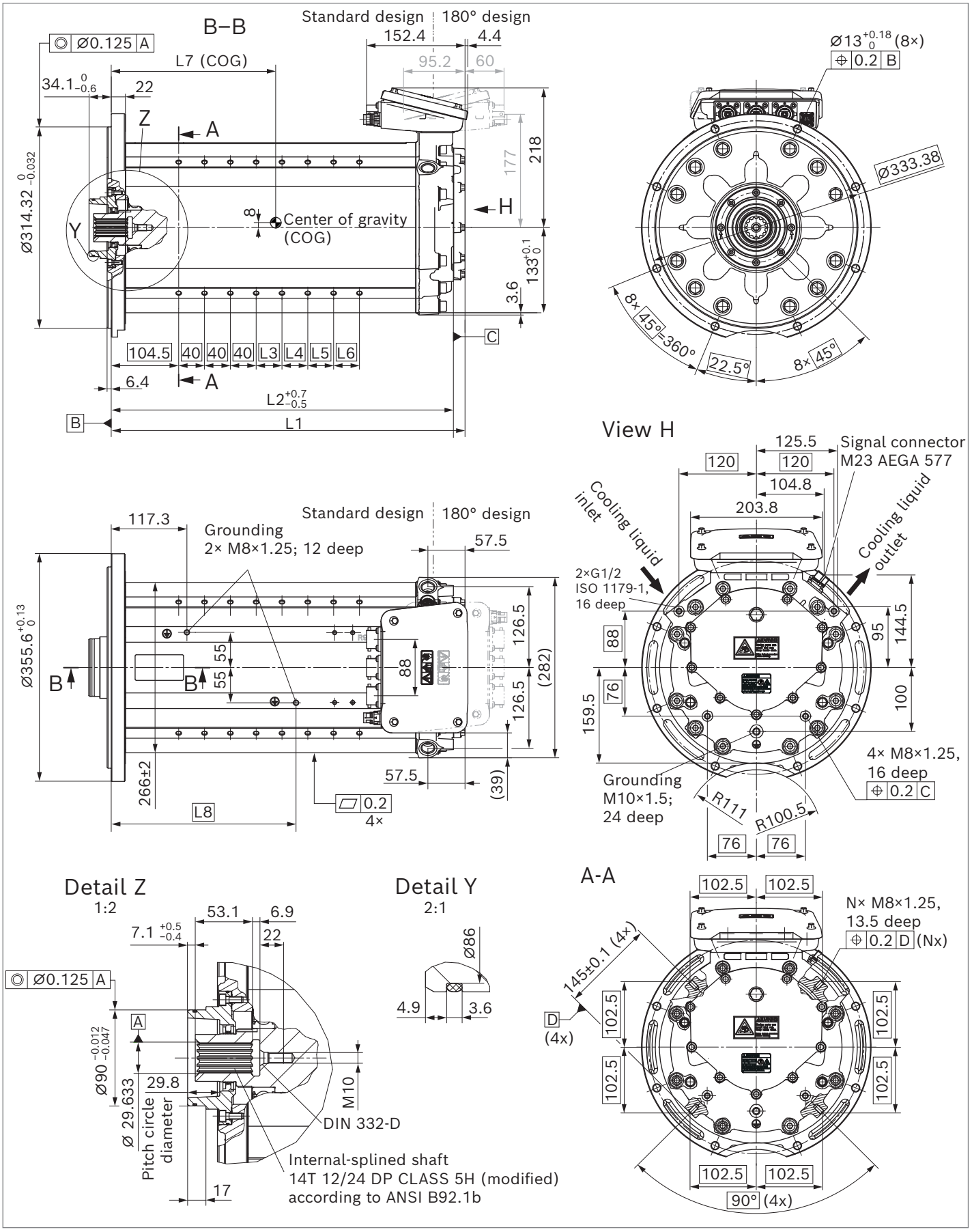


Standard design
Single connector C2
W.V.U. motor output for upward angled connection in A-shield direction
– XXC2 –
W – V – U

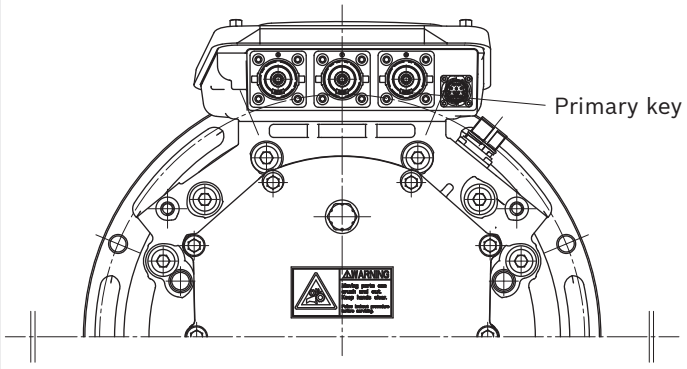


	L1	L2	L3	L4	L5	L6	L7	L8	N	m
EMS1–13F–XX–CX–N2P5	398	380	–	–	–	–	179	136.3	16	104 kg
EMS1–13H–XX–CX–N2P5	448	430	40	–	–	–	205	186.3	20	117 kg
EMS1–13J–XX–CX–N2P5	498	480	40	40	–	–	231	236.3	24	130 kg
EMS1–13L–XX–CX–N2P5	548	530	40	40	40	40	257	286.3	32	143 kg

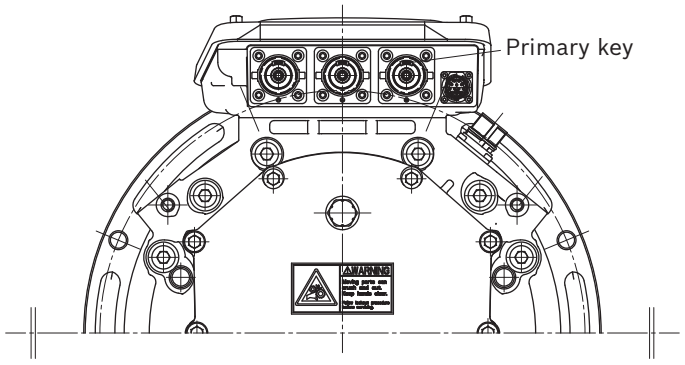
▼ **EMS1-13 with single connector, internal-splined shaft 14T 12/24 DP, gearbox flange SAE 5 (variant N6G3)**



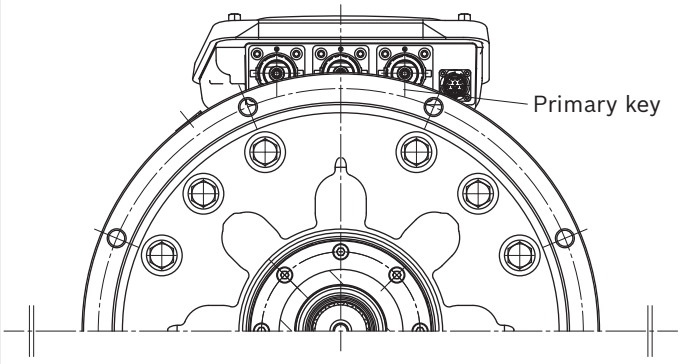
180° design
Single connector C3
U.V.W. motor output for downward angled or straight connection in B-shield direction
– XXC3 –
U – V – W



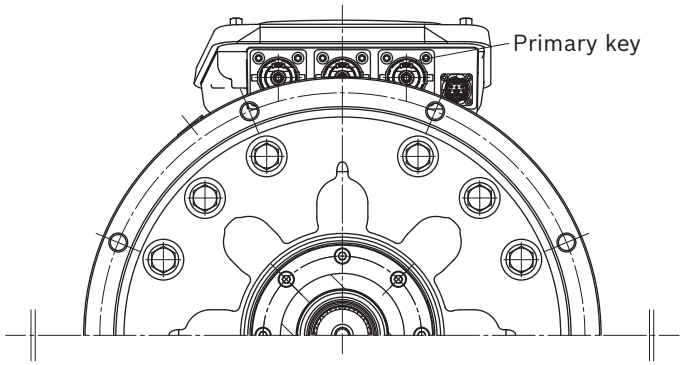
180° design
Single connector C4
U.V.W. motor output for upward angled connection in B-shield direction
– XXC4 –
U – V – W



Standard design
Single connector C1
W.V.U. motor output for straight connection in A-shield direction
– XXC1 –
W – V – U

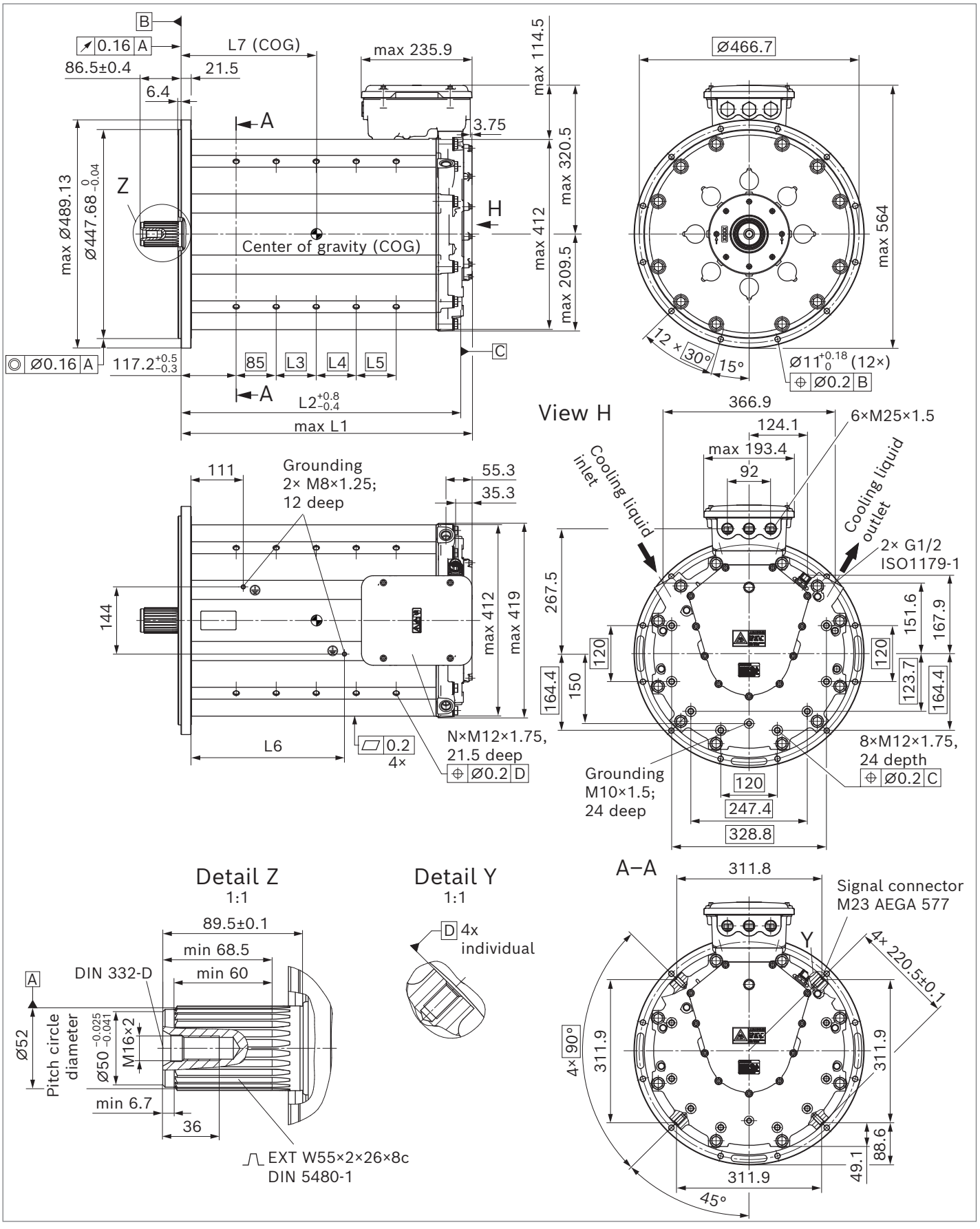


Standard design
Single connector C2
W.V.U. motor output for upward angled connection in A-shield direction
– XXC2 –
W – V – U



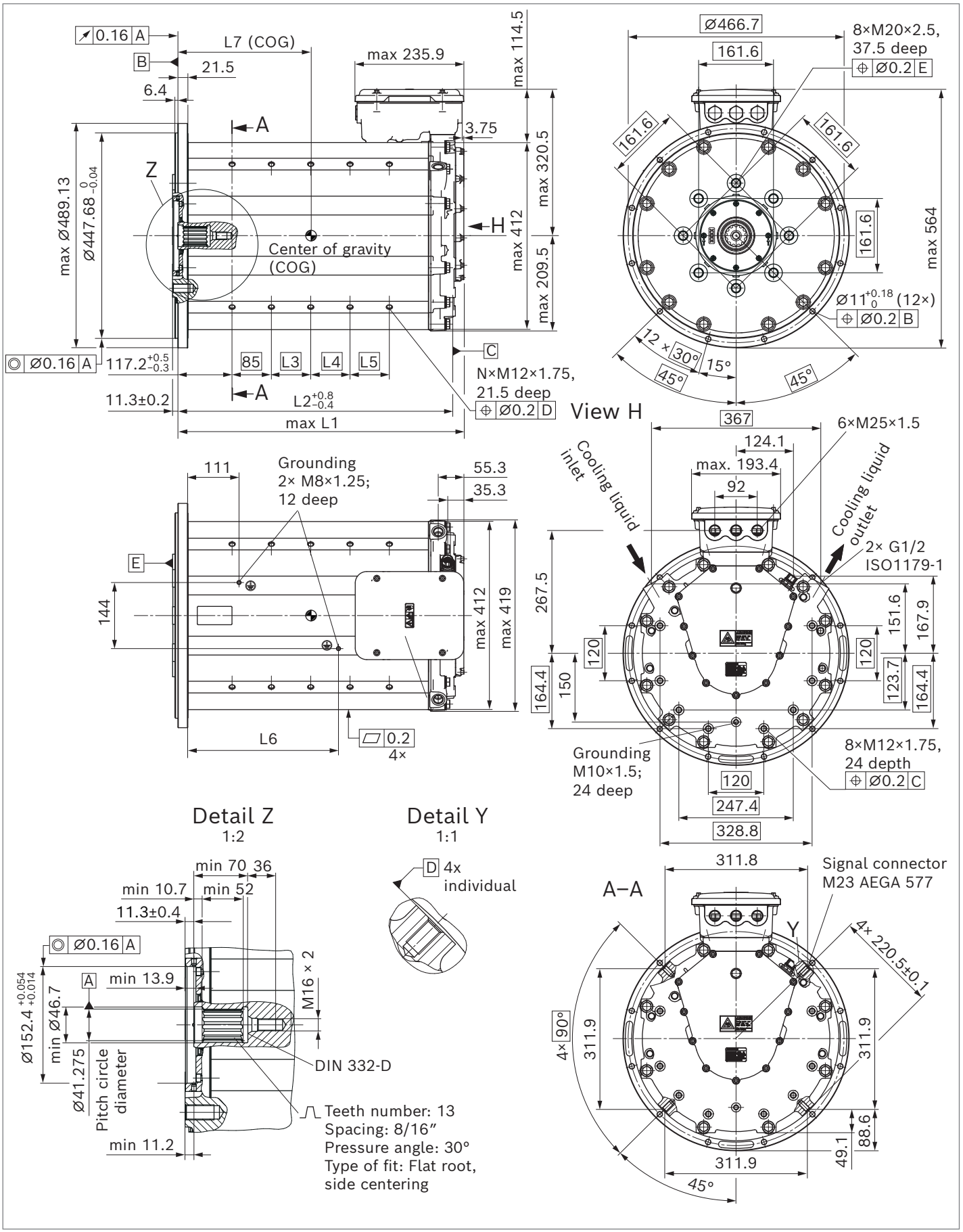
	L1	L2	L3	L4	L5	L6	L7	L8	N	m
EMS1–13F–XX–CX–N6G3	398	380	–	–	–	–	179	136.3	16	104 kg
EMS1–13H–XX–CX–N6G3	448	430	40	–	–	–	205	186.3	20	117 kg
EMS1–13J–XX–CX–N6G3	498	480	40	40	–	–	231	236.3	24	130 kg
EMS1–13L–XX–CX–N6G3	548	530	40	40	40	40	257	286.3	32	143 kg

▼ **EMS1-20 with terminal box, externally toothed shaft W55×2×26×8c, motor flange SAE 2 (variant W4M2)**



	L1	L2	L3	L4	L5	L6	L7	N	m
EMS1–20F–XX–RSAB–W4M2	437.5	417.3	75	–	–	142.3	198	12	232 kg
EMS1–20H–XX–RSAB–W4M2	498.5	478.2	85	50	–	203.2	228	16	275 kg
EMS1–20J–XX–RSAB–W4M2	559.5	539.1	85	85	–	264.1	258	16	320 kg
EMS1–20L–XX–RSAB–W4M2	620.0	600.0	85	85	85	325.0	288	20	362 kg

▼ EMS1-20 with terminal box, internal-splined shaft 13T 8/16 DP, motor flange SAE 2 (variant N4P6)



	L1	L2	L3	L4	L5	L6	L7	N	m
EMS1–20F–XX–RSAB–N4P6	437.5	417.3	75	–	–	142.3	199	12	231 kg
EMS1–20H–XX–RSAB–N4P6	498.5	478.2	85	50	–	203.2	229	16	274 kg
EMS1–20J–XX–RSAB–N4P6	559.5	539.1	85	85	–	264.1	259	16	319 kg
EMS1–20L–XX–RSAB–N4P6	620.0	600.0	85	85	85	325.0	289	20	361 kg

Mounting type

See “Operating Instructions 96709-01-B”

General

- Read the corresponding "Operating Instructions 96709-01-B" completely and thoroughly before using the motor. If necessary, this can be requested from Bosch Rexroth.
- Despite the greatest care being taken when compiling this document, it is impossible to consider all feasible applications. If information for your specific application is missing, please contact Bosch Rexroth.
- For further information about the motor, visit www.boschrexroth.com/elion-motors.

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