AC Servo Motors

Series DSM5

Operating Manual

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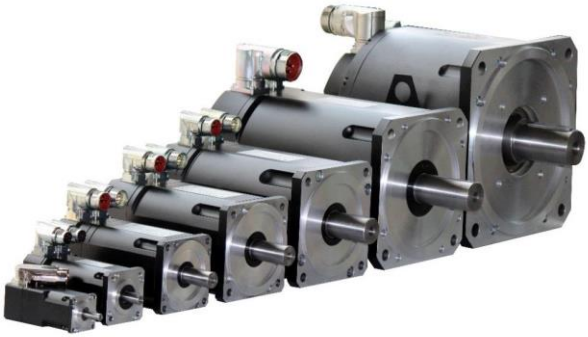
AC-Servo Motors Series DSM5

The DSM5 component series are AC servo motors that are equipped with the newest generation of magnetic technology. By request, the motors can be equipped with a resolver or absolute value encoder.

The most important features are:

- Temperature-optimized neodymium magnets
- 8-pin construction
- Sinusoidal EMF
- Integrated heat protection with PTC
- Rotatable angled plug
- Compact design, low weight
- IP65 with smooth surface
- High speed
- High efficiency
- Low cogging



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1 General

1.1 About this Handbook

This operating manual describes the AC motors of the DSM series. The motors are operated in combination with the servo amplifiers. It is therefore important to note that the entire system documentation consists of:

- The product handbook for the servo amplifier
- Online help for the initial startup of the servo amplifier software
- Accessories handbook
- Technical description of the motor series (this handbook)

1.2 Target Group

This handbook is directed toward the following requirements for trained personnel:

Transport: only by personnel trained in handling components sensitive to electrostatic discharge
Mech. installation: by personnel with training in machine building technology only
Electr. installation: by personnel trained in electrical technology only
Initial startup: by personnel with extensive training in electrical / drive technology

Technical personnel must be familiar with national installation norms and guidelines, as well as comply with them.

2 Basic Safety Guidelines

2.1 Symbols Used

The following symbols are used in the operator documentation for warning and danger messages, as well as informational notes:

DANGER	Identifies an immediate danger with high risk, which **will** lead to immediate death or serious injury if not avoided. Identifie un danger immédiat à haut risque, qui entraînera immédiatement la mort ou des blessures graves s'il n'est pas évité.
WARNING	Identifies a possible danger with a mid-level risk, which **can** lead to death or (serious) injury if not avoided. Indique un danger possible d'un risque moyen de décès ou de (graves) blessures si les consignes de sécurité ne sont pas respectées.
CAUTION	Identifies a low risk danger, which can lead to injury or property damage if not avoided. Indique un danger avec un niveau de risque faible des blessures légères ou des dommages matériels si les consignes de sécurité ne sont pas respectées.
	Warning, dangerous electrical voltage
	Provides user tips, informs of special features and identifies especially important information in the text.
	Danger for ESD-sensitive components. Les signes de danger pour les composants sensibles aux décharges électrostatiques.

2.2 Disclaimer

The contents of this document were prepared with the greatest care. However, deviations cannot be ruled out. This document is regularly checked and required corrections are included in the subsequent versions. The machine manufacturer is responsible for the proper assembly, as well as device configuration. The machine operator is responsible for safe handling, as well as proper operation.

The current document can be found on our website. If necessary, contact our support.

Subject to technical changes, which improve the performance of the devices. The following documentation is purely a product description. It does not guarantee properties under the warranty.

Please thoroughly read the corresponding data sheets, operating instructions and this system handbook before handling a product.

SIGMATEK GmbH & Co KG is not liable for damages caused through non-compliance with these instructions or applicable regulations.

The general and special safety instructions described in the following sections, as well as technical regulations, must therefore be observed.

3 Product Identification

3.1 Type Key

DSM522 . 2 0 9 6 . 26 62 66

- **Product:** DSM5 Synchronous motor self-cooling
- **Motor size:** Size 0-7
- **Motor length:** Length 1-4
- **Voltage configuration:** Winding Code 1-8
- **Brake:**
  - 0 without brake
  - 1 with brake 24 VDC
- **Options:**
  - 26 Smooth shaft
  - 62 Thin shaft 9x20 flange 40/63 (motor size 2 only)
  - 66 Shaft seal
  - Multi-response possible

  If 26 is not specified, the default shaft version with key is provided.
  If 62 is not specified, the default shaft diameter (11x23 with size 2) is provided.
- **Connector type:**
  - 6 M23 motor connector, M23 Encoder/Resolver
  - 9 M40 motor connector, M23 Encoder/Resolver
  - J ytec M15 round connector with size 0 ytec possible only

  If DSL encoders are used (W, Y), variant 6 with a single M23 round connector and variant 9 with a single M40 round connector are provided (single-cable solution).
  M40 motor connectors should be used for a continuous current larger than 20 A. Motors with an M40 connector are longer.
  ytec round connectors are available up to size 2 (continous current < 10 A).
- **Encoder system:**
  - 9 Resolver size 15 2p 7V 10kHz
  - W Sick encoder EKS36 17bit NO SIL, DSL
  - Y Sick encoder EKM36 18bit Multi-turn NO SIL, DSL
  - Z Sick encoder SKM36 Hiperface 128i PPT Multi-turn

  Motors with resolvers (9) have a different length than motors with encoders (W, Y, Z).
  The DSL variants (W, Y) are for single-cable solutions.
  The encoder system W, Y and Z are available by request with SIL2/SIL3 safety class.

Order example:

Example 1: DSM522.2096.266266
Motor type: DSM5, motor size 2, motor length 2, voltage configuration 2, without brake, resolver feedback, M23 round connector.
Special with smooth shaft, shaft diameter special with (Ø9j6x20mm) and additional ring seal.

Example 2: DSM522.11Z6
Motor type: DSM5, motor size 2, motor length 2, voltage configuration 1, with 24 V brake, Sick Hiperface encoder, M23 round connector.
Since no special versions are specified, the motor has a standard shaft with feather key groove, with the standard diameter (Ø 11j6 x 23mm).

4 Technical Description

4.1 Motor Construction

The synchronous servomotors of the DSM5 series are brushless rotary current motors for high-end servo applications. In combination with our digital servo amplifiers, AKM motors are especially suited for positioning tasks with industry robots, machine tools, transfer lines, etc. with high dynamic and stability requirements

The servomotors have permanent magnets in the rotor. The neodymium magnet material is a significant factor in the highly dynamic operation of these motors. The stator has a three-phase winding that is powered by the servo amplifier. The motor has no brushes; the commutation takes place in the servo amplifier electronically.

The windings temperature is monitored over temperature sensors in the stator windings and registered by the potential-free themistor (PTC, $\leq 550\ \Omega$ / $\geq 1330\ \Omega$).

As a standard feedback unit, a resolver is built into the motor. The servo amplifier evaluates the resolver setting of the rotors and supplies the motor with sinusoidal currents. The alternative feedback systems available require a partial modification of the motor length and cannot be retrofitted.

The motor is available with or without holding brakes. Retrofitting the brakes is not possible.

The motors are lacquered with matt black (RAL 9005) and are not resistant to solvents (Tn, thinner or similar).

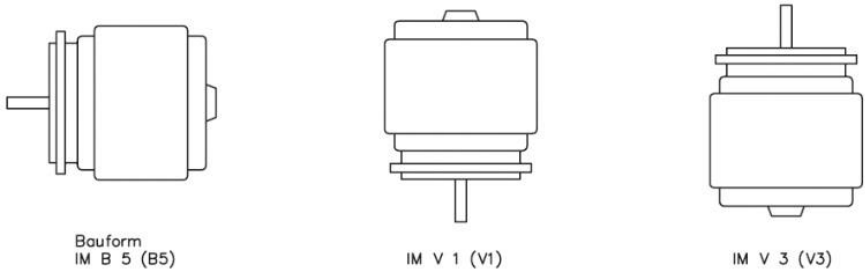
4.2 General Technical Data

Environmental temperature (at rated data)	5-40 °C with an installation height of up to 1000 m above NN
Permissible humidity (at rated data)	95 % relative humidity, non-condensing
Power reduction (Currents and torques)	1 %/K ranging from 40-50 °C at up to 1000 m above NN At installation heights above 1000 meters over NN and at 40 °C 6 % at 2000 m above NN 17 % at 3000 m above NN 30 % at 4000 m above NN 55 % at 5000 m above NN
Ball bearings lifespan	≥ 20,000 operating hours

4.3 Standard Equipment

4.3.1 Construction

The basic construction of the synchronous servomotors is the IM B5 configuration according to DIN EN 60034-7.



4.3.2 Shaft end A-side

The power is transmitted over the cylindrical shaft end A, fitting h6 bis j6 with threading and **feather key groove.** The life span of the bearings is 20,000 operating hours.

Radial Force
If driven by sprockets or a cam belt, a higher radial force is generated. The permissible rotation speed-dependent values on the shaft end can be seen in the diagrams. The maximum allowed values are listed in the technical data.

Axial Force
When mounting sprockets or pulleys on the shaft and operating angular gears, for example, axial forces are generated. The maximum allowed values are listed in the technical data.

Coupling
As an ideal clearance-free coupling element have double-conical collets possibly in conjunction with metal bellow couplings.

4.3.3 Flange

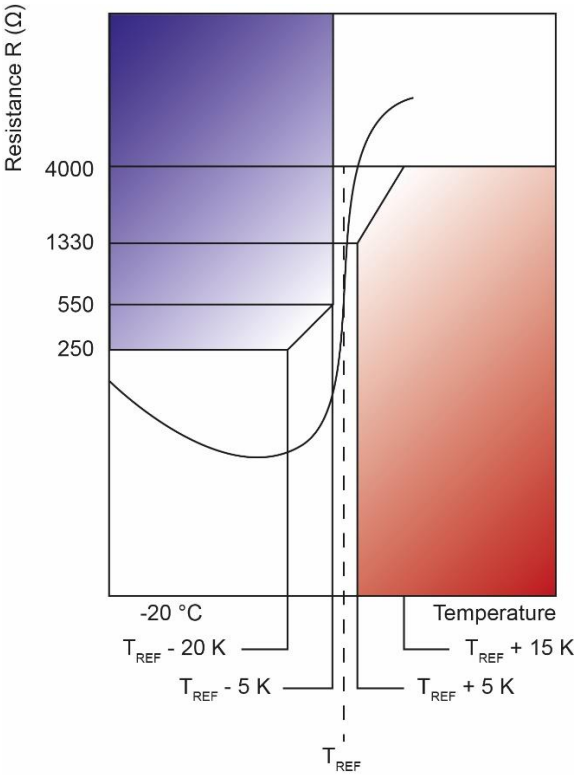
Flanged dimensions comply with the IEC standard, fitting j6 (: h7), precision complies with DIN 42955
Tolerance class: **N**

4.3.4 Protection type

The standard for naturally cooled motors is IP65 protection, shaft end IP64, with operational radial shaft ring seal IP65.

4.3.5 Protection

The motors of the DSM5 series are equipped with a single type PTC-130 thermal switch, they can be optionally equipped with KTY84 or PT1000 devices.



General characteristics
T_{REF} = 90 °C up to 190 °C

Temperature T [°C]	Resistance R According to DIN 44081	Measuring voltage [DC]
-20 °C up to T_{REF} -20 K	20 up to 250 Ω	=< 2.5 V-
T_{REF} -5 K	=< 550 Ω	=< 2.5 V-
T_{REF} +5 K	=< 1,330 Ω	=< 2.5 V-
T_{REF} +15 K	=< 4,000 Ω	=< 7.5 V- gepulst

Ueff = 2,500 V

4.3.6 Insulation Class

The motors comply with insulation class F according to IEC 85.

4.3.7 Vibration

The DSM5 motors are designed according to EN 60034-14 in vibration class N with half key, if available. The specified vibration is based on the motor only. Vibrations in the system via the installation can lead to an increase in this value.
Default: Vibration class N
Optional: Vibration class R

Vibration class	Rotation speed n [rpm]	Vibration speed limits [mm/s]	
		Sizes 0-6	Size 7
N	600 ≤ n ≤ 3600	1.8	2.8
R	600 ≤ n ≤ 1800	0.71	1.12
	1800 ≤ n ≤ 3600	1.12	1.8

4.3.8 Connection Technology

The Motors are equipped with angled connectors (straight connectors on the cable ends) for the power supply and encoder signals. The opposite connectors are not included in delivery. For the encoder lines, we offer prefabricated cables.

4.3.9 Holding brake

The DSM5 motors are optionally available with an integrated holding brake. The permanent magnet brake (24 VDC) engages when the rotor has no voltage.

WARNING	**With a hanging load (vertical axes), personnel safety can only be ensured with an additional, external mechanical brake.** **If the brake is disengaged, the rotor can move without residual torque!**
CAUTION	**The holding brakes are designed as idling brakes and not for continuous operation braking. With frequent operational braking, early wear and failure of the holding brake is probable.**

Integrated holding brakes increase the length of the motor.

The holding brakes are controlled directly by the servo amplifier (not personnel-safe!), the brake winding is then released in the servo amplifier - no additional circuit is required. Hereto, see the operating instructions for the servo amplifier.

4.3.10 Number of contacts

Motor	Number of contacts	Motor	Number of contacts	Motor	Number of contacts	Motor	Number of contacts
DSM5 Size 0	8	DSM5 Size 3	8	DSM5 Size 5	8	DSM5 Size 7	8
DSM5 Size 2	8	DSM5 Size 4	8	DSM5 Size 6	8		

4.4 Feedback Unit

Standard	Resolver	2-pin hollow shaft
Option	Hiperface Encoder, Multi-Turn	-: SKM 36 (optional as SIL)
Option	Hiperface DSL Encoder, Single-Turn	-: EKS 17-bit (optional as SIL)
Option	Hiperface DSL Encoder, Multi-Turn	-: EKM 18-bit (optional as SIL)

The motor length depends on the integrated feedback unit. Retrofitting is not possible.

When using encoders, caution must be taken to ensure the maximum operating temperature of the feedback unit does not exceed 110 °C.

4.4.1 Parameter Data for Hiperface DSL Encoders

Name	Type	Resolution 1	Resolution 2	Rotations	SIL2
EKS36	EKS36-2KF0B018A	18	9	0/1	Yes
EKS36	EKS36-0KF0B018A	18	-	0/1	No
EKS36	EKS36-0KF0B0S08	17	-	0/1	No
EKM36	EKM36-2KF0B018A	18	9	4096	Yes
EKM36	EKM36-0KF0B018A	18	-	4096	No

4.5 Selection Criteria

The rotary current servomotors are designed for operation with the servo amplifiers from the DIAS Drive series. Both units form a closed rotation speed or torque regulation circuit.

The most important selection criteria are:

- Standstill torque	$\mathbf{M_0}$	[Nm]
- Nominal rotation speed at nominal supply voltage.	$\mathbf{n_n}$	[min^{-1}]
- Inertial torque from the motor and load	**J**	[$kgcm^2$]
Effective torque (calculated)	$\mathbf{M_{rms}}$	[Nm]

When calculating the required motors and servo amplifiers, it is important to consider the static load and the dynamic load (acceleration/braking).

5 Mechanical Installation

5.1 Important Guidelines

Dimensional drawings can be found in the respective motor description.

Only qualified personnel with machine assembly knowledge may mount the motor.

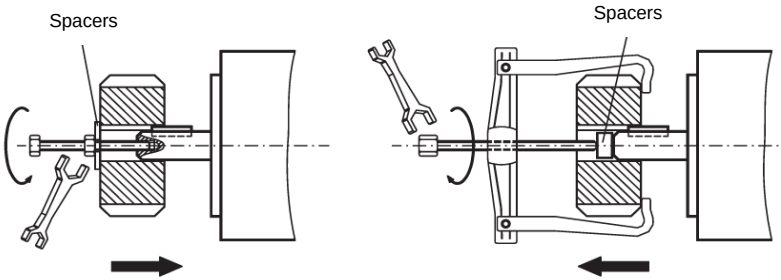
WARNING

Protect the motor from improper use. Especially during transporting and handling, the components may not be bent and/or the isolation clearance changed.

The mounting location must be free of conducting and aggressive material. For V3 mounting (shaft upwards), ensure that no fluids can enter the bearings. For encapsulation, our applications department should be consulted.

Ensure that the ventilation and/or motor vent is unrestricted and note the allowable ambient and flange temperatures. At environmental temperatures over 40 °C, our applications department should be consulted.

Servomotors are precision devices. The flange and shaft are especially vulnerable during storage and mounting. Avoid therefore brute force; precision requires sensitivity. To raise couplings, gear wheels or pulleys, the threading provided in the motor shaft must be used and the drive elements must be warmed as much as possible. Impacts or the application of force cause damage to the shaft and brake.
If a holding brake is available, the axial forces cannot be applied to the shaft!



Whenever possible, use clearance-free friction-lock collets or couplings Ensure the coupling is mounted correctly. Incorrect setting leads to impermissible vibrations and damage to the ball bearings and coupling.

When using cam belts it is important to ensure that the proper radial force is applied. High radial load on the shaft reduces the significantly lifespan of the motor.

Avoid axial loading on the motor shaft as much as possible. An axial load significantly reduces the life span of the motor.

Avoid mechanically over specified positioning of the motor shaft by rigid couplings and additional external positioning under all conditions.

Note the number of motor and resolver contacts and set the correct number of contacts according to the servo amplifier used. The incorrect setting, especially with small motors, can cause damage.

Check for compliance with the permissible radial and axial loads FR and FA. When using cam belt drives, the minimum permissible diameter of sprocket is calculated with the following equation:

$$d'_{\min} \geq \frac{M_0}{F_R} \times 2$$

6 Electrical Installation

6.1 Safety Guidelines

Only qualified personnel with training in electrical technology may wire the motor.

DANGER

Motors must always be mounted and wired while voltage-free. This means the operating voltage of the device, to which the motor should be connected, cannot be applied. Ensure that the connection to the control cabinet is safe (lock, warning signs, etc.). The individual voltages are applied for the first time with the initial startup.

Never disconnect the motor while voltage is present. After shutdown, the capacitors can maintain dangerously high residual loads up to 5 minutes after the supply voltage has been removed. Measure the voltage at the intermediate circuit and wait until it has sank below 40 V. Control and power connections can have a voltage even when the motor is not turning.

WARNING

The symbol for mass , found in all schematic plans, means that electric connection between the indicated device and the mounting panel in your control cabinet must be made over the largest possible surface. This connection should enable the dissipation of HF noise and should not be confused with the PE symbol (EN 60204 protection).

Follow the instruction in the schematic plans in the product handbook for the respective servo amplifier.

6.2 Electrical Installation Guide

Check the allocation of the servo amplifier and motor, and then compare the nominal voltage and current of the device. Connect the servo amplifier as shown in the connection diagram in the product handbook. The connection of the motor is shown starting from page 24.

Ensure that the motor and servo amplifier are properly connected to ground. The applicable EMC shielding and ground connection can be found in the product handbook of the respective servo amplifier. The mounting panel and motor housing must be connected to ground.

Power and control cables should be separated as much as possible (clearance > 20 cm). The electromagnetic stability of the system will then be improved. When using motor a power cable with integrated brake control wires. The shielding must be applied on both sides (see the product handbook for the servo amplifier).

Wiring:

- Lay power and control cables separately where possible
- Connect resolver or encoder
- Connect motor cables, motor choke close to servo amplifier
- Shielding connected to shielding terminals or EMC connecter on both ends.
- Connect motor holding brake
- Apply shielding on both ends

WARNING

All high-current lines must have a sufficient diameter in compliance with EN 60204. The recommended diameter can be found in the technical data.

The shielding must cover a large area (low ohmic) of the metallic connector housing and/or EMC dissipating cable fittings.

6.3 Motor Connection with Prefabricated Cables

WARNING Lay the wiring according to the current rules and standards.

For the power and feedback connection, use only our prefabricated shielded cables.

Apply the shielding as shown in the diagrams in the product handbook of the server amplifier.

Incorrect connected shielding lead directly to EMC noise.

The maximum length is defined in the product handbook of the respective servo amplifier.

Requirements for the wire material

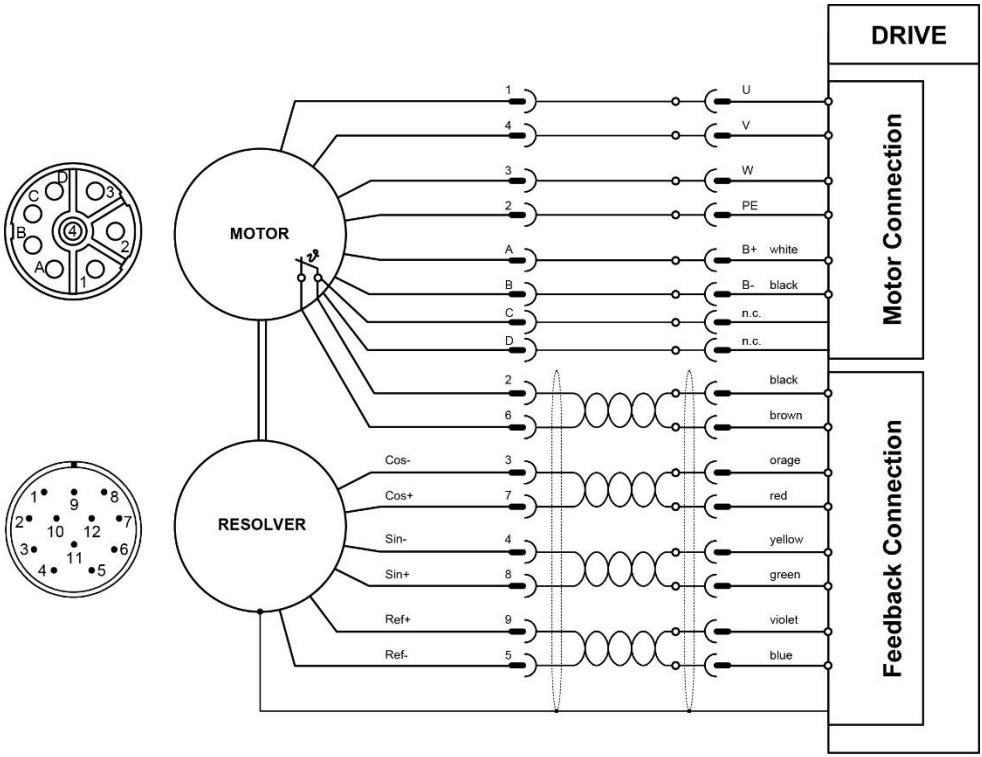
Capacity
Motor line: less than 150 pF/m
Feedback line: less than 120 pF/m

Technical data and type codes for prefabricated feedback cables (Encoder and motor cables)

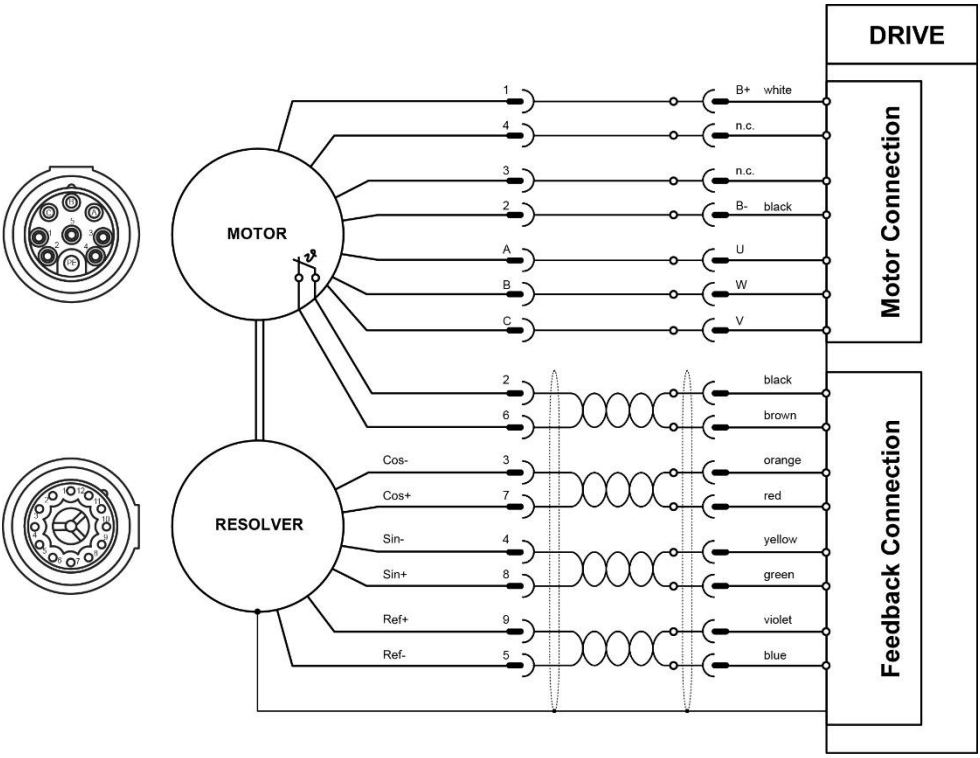
See chapter “9 Servo Motors and Encoder lines”

6.4 Connection Diagrams

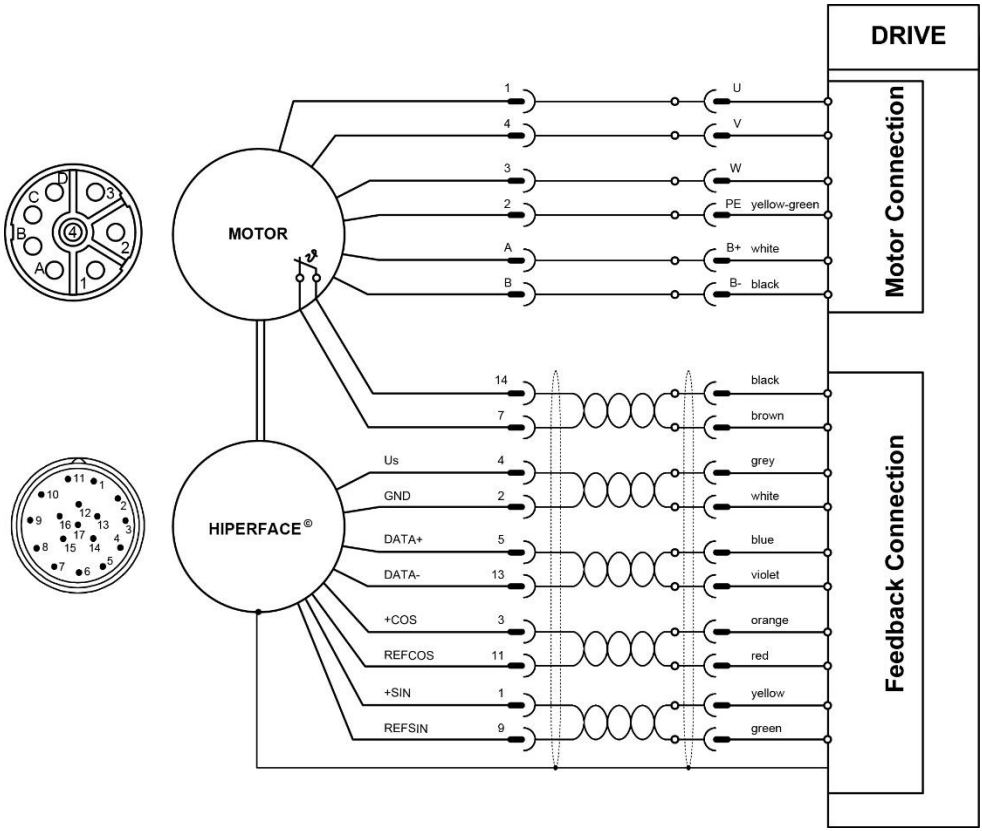
6.4.1 Connection Diagram for Motors with a Resolver M23 Connector



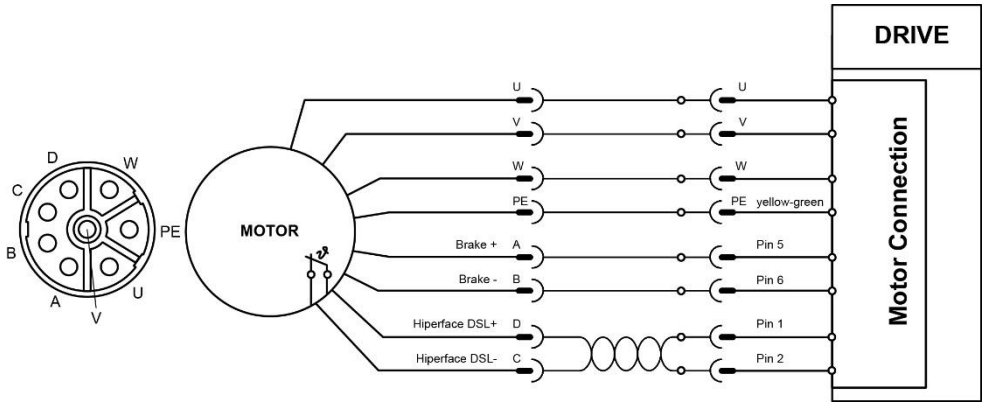
6.4.2 Connection Diagram for Motors with a Resolver Ytec Connector



6.4.3 Connection Diagram for Motors with HIPERFACE with M23 Connector



6.4.4 Connection Diagram for Motors with HIPERFACE DSL with M23 Connector



7 Initial Startup

7.1 Important Guidelines

DANGER

Only trained personnel with comprehensive knowledge in the areas of electro- and drive technology can perform the initial startup of the drive unit's servo amplifier/motor.

Ensure that all voltage-carrying connectors are protected against external contact. Dangerously high voltages up to 900 V may be present.

Never disconnect the motor while voltage is present. After shutdown, the capacitors in the servo amplifier can maintain dangerously high residual loads up to 5 minutes after the supply voltage has been removed.

The surface temperature of the motor can exceed 100 °C. Check (measure) the motor temperature and wait until the motor has cooled to 40 °C before touching it.

Ensure that undesired movement of the drive cannot endanger machines or people.

7.2 Guidelines for the Initial Startup

The initial startup process will be described generically. Depending on the application of the device, a different process may be practically required.

Check the mounting and alignment of the motor.
Ensure that the drive elements (coupling, gears, pulleys) are secure and set correctly (check that radial and axial force are within tolerance).

Check the wiring and connection on the motor and servo amplifier. Ensure that a proper ground connection is made.

Check whether that the holding brakes, if available, function properly. (Apply 24 V, brakes must then air).

Check whether the motor's rotor can be freely rotated (the brakes may first have to be aired). Listen for grinding sounds.

Ensure that all contact prevention measures for moving and voltage carrying components were taken.

Perform all system-specific and required tests.

Now start the drive according to the respective startup instructions for the servo amplifier being used.

For multi axial systems, start all servo amplifiers/motors in the drive unit.

7.3 Eliminating Noise

Depending on the facility conditions, noise can have several causes. Described below are the main causes of errors that affect the motor directly. Abnormalities that occur during regulation are mostly caused by incorrect parameter settings in servo amplifier. Review the documentation for the servo amplifier and the initial startup software.

In multi axial systems, additional unseen errors can exist.

Our applications department can help further with problems.

Error	possible error causes	Measures for Elimination Malfunctions
Motor does not spin	- Servo amplifier not released - Set value line interrupted - Motor phases inverted - Brake not released - Drive is mechanically blocked	- Generate ENABLE signal - Check set value line - Correct motor phases - Check brake control - Check mechanics
Motor "spins through"	- Motor phases inverted	- Correct motor phases
Motor vibrates	- Resolver cable shielding broken - Control gain too high	- Replace resolver line - Use motor default values
Error message Brakes	- Short in the voltage supply for the stop brakes - Motor holding brake defective	- Repair short-circuit - Exchange motor
Error message Output stage error	- Motor line has a short-circuit/ground short - Motor has a short circuit or a ground short	- Exchange cable - Exchange motor
Error message Resolver	- Resolver plug is connected incorrectly - Resolver cable is broken or crimped	- Check connector plug - Check cables
Error message Motor temperature	- Motor thermal switch has activated - Resolver plug is loose or the Resolver cable is broken	- Wait until the motor has cooled then find the cause for overheating. - Check the connectors, possibly install a new resolver cable
The brakes don't engage	- Required holding torque too high - Brake defective	- Check layout - Exchange motor
Brake does not open	- Power supply defective or incorrect - Required holding torque too high - Brake defective - Axial overload of the motor shaft	- Check dimensioning and voltage supply - Check and reduce axial load - Exchange motor

8 Technical Data

8.1 Term Definitions

Standstill torque M_0 [Nm]
At rotations speeds of n <100 min-1 and nominal conditions, the idle torque can be delivered over an unlimited time

Nominal torque M_n [Nm]
The nominal torque is delivered when the motor draws nominal current at the nominal speed. During continuous operation (S1), the nominal torque can be delivered for an unlimited time at nominal speed.

Standstill current I_{0rms} [A]
The idle current is the effective sinusoidal current value that the motor draws at n < 100 min^{-1}, in order to deliver the idling torque.

Peak Current (Pulse Current) I_{0max} [A]
The peak current (effective sinusoidal value) is approximately 5 times the idle current. The peak current of the servo amplifier used must be smaller.

Torque Constant K_{Trms} [Nm/A]
The torque constant indicates how much torque the motor generates in Nm with a 1 A effective sinusoidal current. M=I x K_T (to a maximum of I = 2 x I_0)

Voltage Constant K_{Erms} [mVmin]
The voltage constant indicates the effective sinusoidal value between the two terminals based on motor-induced EMK at 1000 rpm.

Rotor Inertial Torque J [kgcm²]
The constant J is a quantity for the motor's acceleration power. I0 generates, for example, an acceleration time t_b of 0 to 3000 min^{-1}:

$$t_b\,[s] = \frac{3000 \times 2\pi}{M_0 \times 60s} \times \frac{m^2}{10^4 \times cm^2} \times J \qquad \text{mit } M_0 \text{ in Nm und J in kgcm}^2$$

8.2 General Data

Insulation class	F, F and H Material
Protection class	IP65 (except shaft)
Environmental temperature, operating	0 ... +40 °C
Maximum temperature increase	100 °K with ,motor
Cooling	IC0041
Height (maximum)	1000 m above sea level
Insulation	according to UL conformity
Construction design	B5-V5
Mounting on flange	with 254x254x8
Performance data tolerances	up to ±10 %

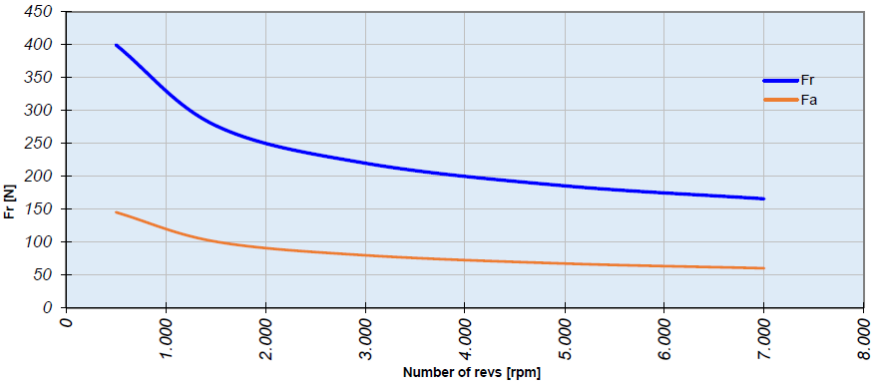
8.3 DSM5 Low Voltage

8.3.1 Performance Data

Data		Symbol [Unit]	DSM504		DSM505			
Winding code			3	4	3	4		
Electrical data								
	Standstill torque	M_0 [Nm]**	0.19		0.38			
	Standstill current	I_{0rms} [A]**	1.52	3	3	6.6		
	Max. nominal supply voltage	U_N [VAC]	480					
U_N = 24V	Nominal rotation speed	n_n [min-1]		2500		2500		
	Nominal torque*	Mn [Nm]		0.17		0.35		
	Nominal power	P_n [kW]		0.045		0.09		
	Rated current	I_n [A]		2.7		6.14		
U_N = 48V	Nominal rotation speed	n_n [min-1]	2000	6000	2,300	6,600		
	Nominal torque*	Mn [Nm]	0.16	0.16	0.35	0.3		
	Nominal power	P_n [kW]	0.03	0.1	0.08	0.21		
	Rated current	I_n [A]	1.31	2.5	2.69	5.26		
	Peak current	I_{0max} [A]	6.1	12	12	26		
	Peak torque	M_{0max} [Nm]	0.6		1.3			
	Torque constant	K_{Trms} \ [Nm/A]	0.122	0.063	0.13	0.057		
	Voltage constant	K_{Erms} [mVmin]	7.4	3.8	7.7	3.5		
	Winding resistance Ph-Ph	R_{20} [Ω]	6.8	1.87	2.4	0.54		
	Winding inductance Ph-Ph	L [mH]	2.6	0.71	1.25	0.26		
Mechanical Data								
	Rotor inertial torque	J [kgcm²]	0.037		0.061			
	Number of contacts		8					
	Thermal time constant	t_{TH} [min]	9		11			
	Weight standard	G [kg]	0.53		0.68			

* Measuring flange Aluminum 254mm * 254mm * 8mm
** Reduction:
with integrated brake reduction by 10 %.
with integrated encoder reduction by 6 %
For motors with an encoder and brake, only the higher value applies.

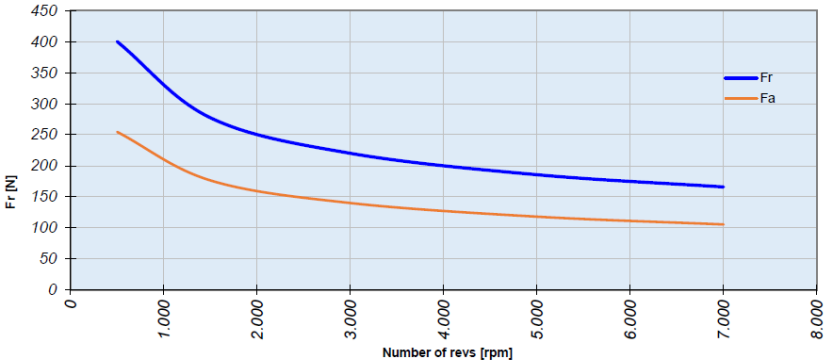
Radial and axial shaft load



Data		Symbol [Unit]	DSM521			DSM522		
Winding code			3	4	5	4	5	
Electrical data								
	Standstill torque	M_0 [Nm]**	0.7			1.4		
	Standstill current	I_{0rms} [A]**	3.3	5.3	7.1	8.5	10	
	Max. nominal supply voltage	U_N [VAC]	480			480		
U_N = 24V	Nominal rotation speed	n_n [min-1]			1,300	1000	1000	
	Nominal torque*	Mn [Nm]			0.6	1.2	1.2	
	Nominal power	P_n [kW]			0.08	0.126	0.126	
	Rated current	I_n [A]			6.0	7.27	9.0	
U_N = 48V	Nominal rotation speed	n_n [min-1]	1,400	2500	3500	2,300	3000	
	Nominal torque*	Mn [Nm]	0.6	0.6	0.6	1.1	1.1	
	Nominal power	P_n [kW]	0.09	0.16	0.22	0.26	0.346	
	Rated current	I_n [A]	2.73	4.62	6.00	6.66	8.33	
	Peak current	I_{0max} [A]	13	22	28	32	40	
	Peak torque	M_{0max} [Nm]	2.4	2.3	2.4	4.8	4.9	
	Torque constant	K_{Trms} \ [Nm/A]	0.22	0.13	0.1	0.165	0.132	
	Voltage constant	K_{Erms} [mVmin]	13	8	6	10	8	
	Winding resistance Ph-Ph	R_{20} [Ω]	2.1	0.9	0.57	0.43	0.31	
	Winding inductance Ph-Ph	L [mH]	2.5	1.3	0.72	0.77	0.47	
Mechanical Data								
	Rotor inertial torque	J [kgcm²]	0.13			0.23		
	Number of contacts		8			8		
	Thermal time constant	t_{TH} [min]	16			19		
	Weight standard	G [kg]	1.2			1.7		

* Measuring flange Aluminum 254mm * 254mm * 8mm
** Reduction:
with integrated brake reduction by 10 %.
with integrated encoder reduction by 6 %
For motors with an encoder and brake, only the higher value applies.

Radial and axial shaft load

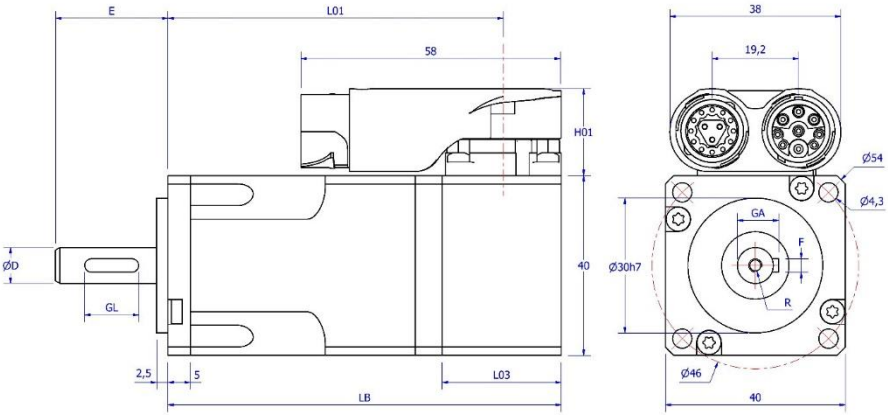


8.3.2 Brake Data

Data	Symbol (Unit)	Size 0	Size 2
Stop torque at 20 °C	M_{BR} [Nm]	0.4	2
Connection voltage	U_{BR} [VDC]	24 ± 6 %	24 ± 6 %
Electrical power	P_{BR} [W]	6	11
Inertial torque	J_{BR} [kgcm²]	0.00114	0.1
Release delay time	t_{BRH} [ms]	32	8
Application delay time	t_{BRL} [ms]	25	25
Brake weight	G_{BR} [kg]	0.2	0.3
Typical play	[°mech.]	0	0
Switching energy	E [mJ]	4	8

8.3.3 Mechanical Dimensions

8.3.3.1 Size 0



Dimension in mm

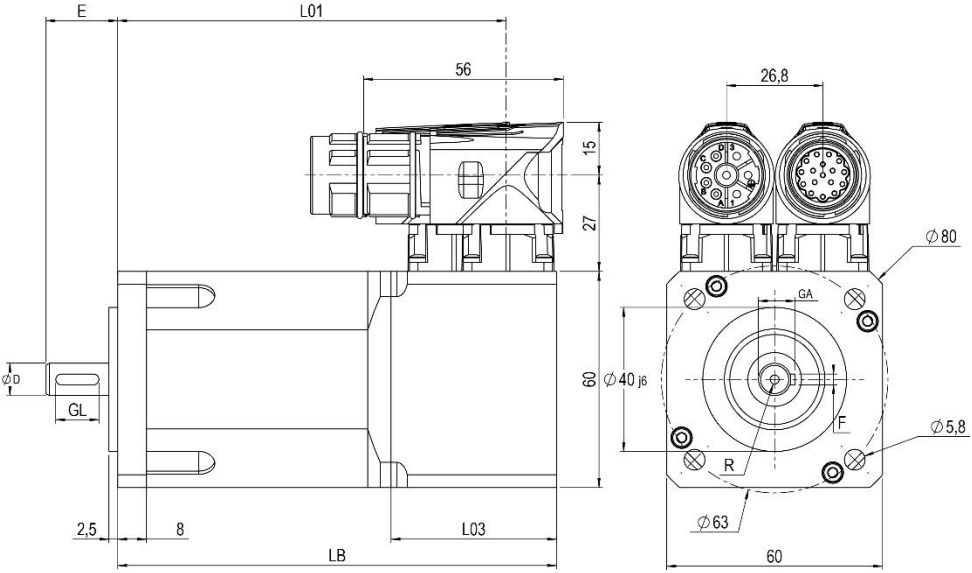
Encoder	Resolver			Hiperface		
Dimension of	LB	L01	L03	LB	L01	L03
DSM5.04	87.5	74.5	26.5	104	91	43
DSM5.05	105.5	92.5		122	109	
DSM5.04 brake	119.5	106.5		136	123	
DSM5.05 brake	137.5	124.5		154	141	

Shaft dimension in mm

In addition to the standard shaft with parallel key, a smooth shaft is also available. See product key.

Shaft	
D	8h6
E	25
GL	12
GA	9.2
F	3
R	M3x8

8.3.3.2 Size 2



Dimension in mm

Encoder	Resolver			Hiperface		
Dimension of	LB	L01	L03	LB	L01	L03
DSM5.21	104	90	28	122	106	46
DSM5.22	132	118		150	134	
DSM5.21 brake	134.5	120.4		152.4	136.4	
DSM5.22 brake	162.4	148.4		180.4	164.4	

Shaft dimension in mm

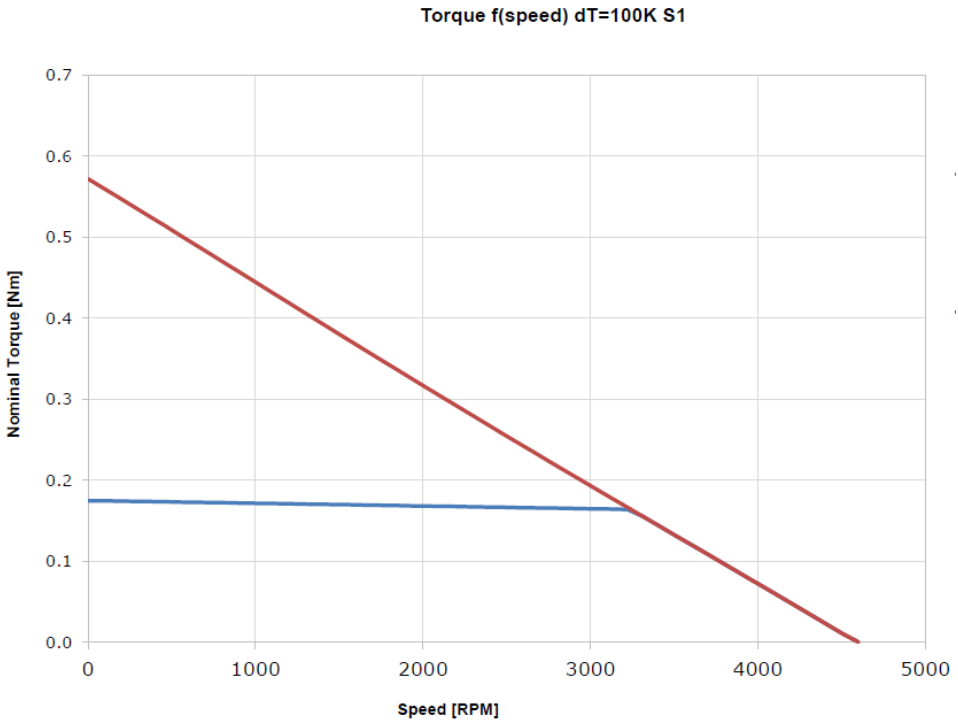
In addition to the standard shaft with parallel key, a smooth shaft is also available. See product key.

Shaft		
D	9j6 (Option 62)	11j6 (Standard)
E	20	23
GL	12	15
GA	10.2	12.5
F	3	4
R		M4x10

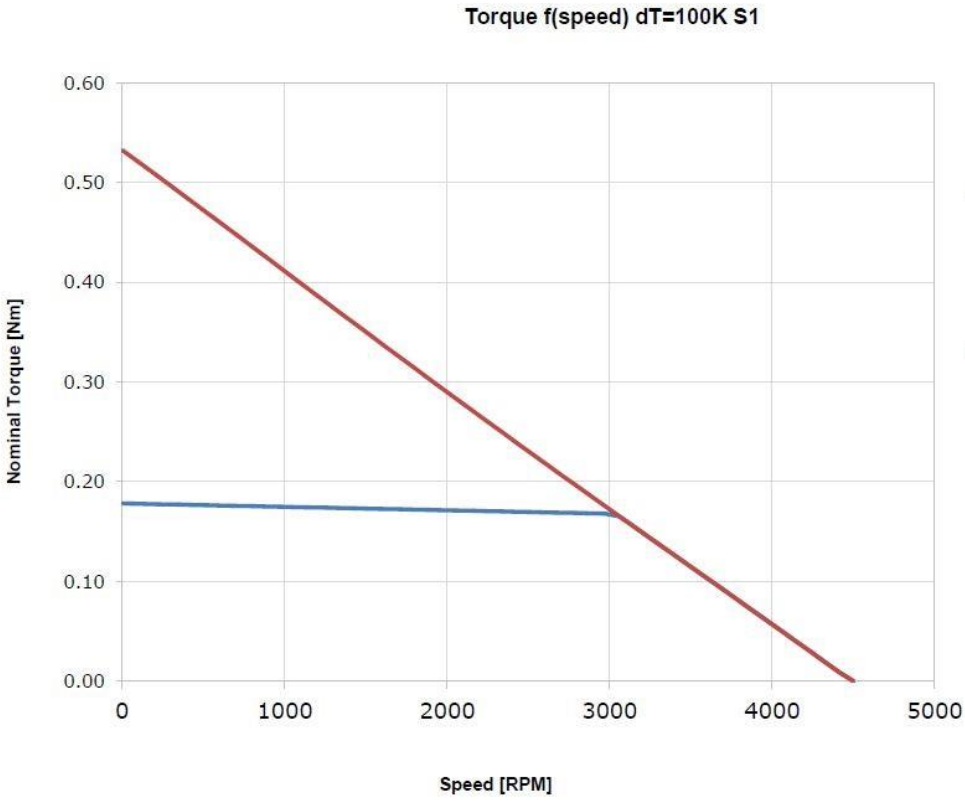
8.3.4 Motor Characteristics

Blue line: Rated torque
Red line: Peak torque

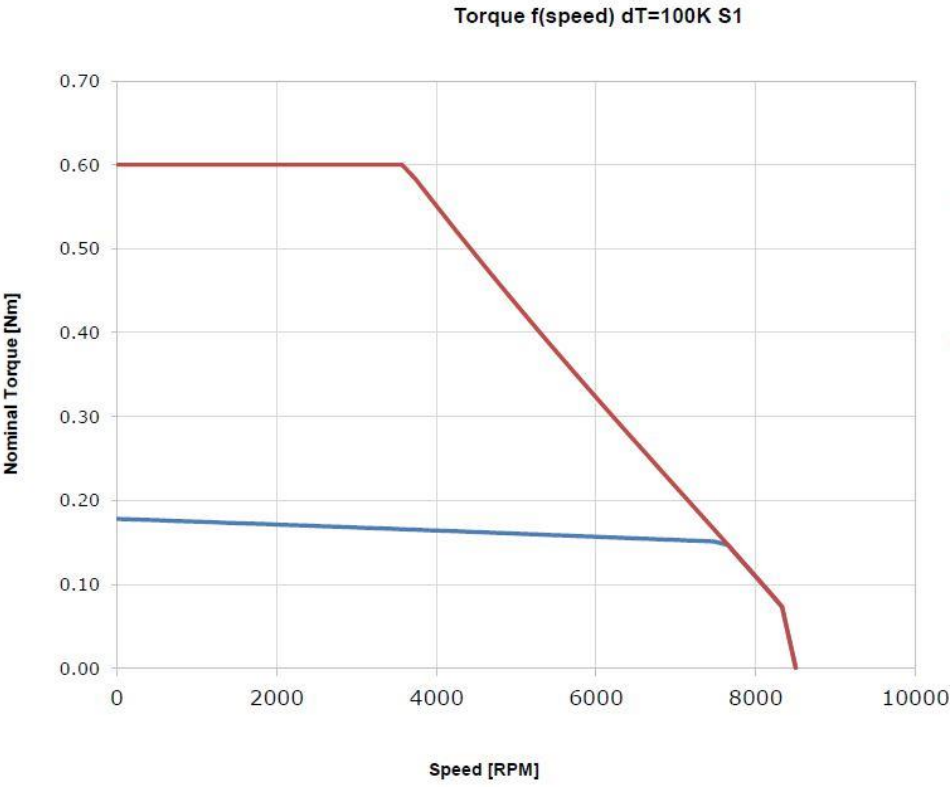
DSM504.3 48 V



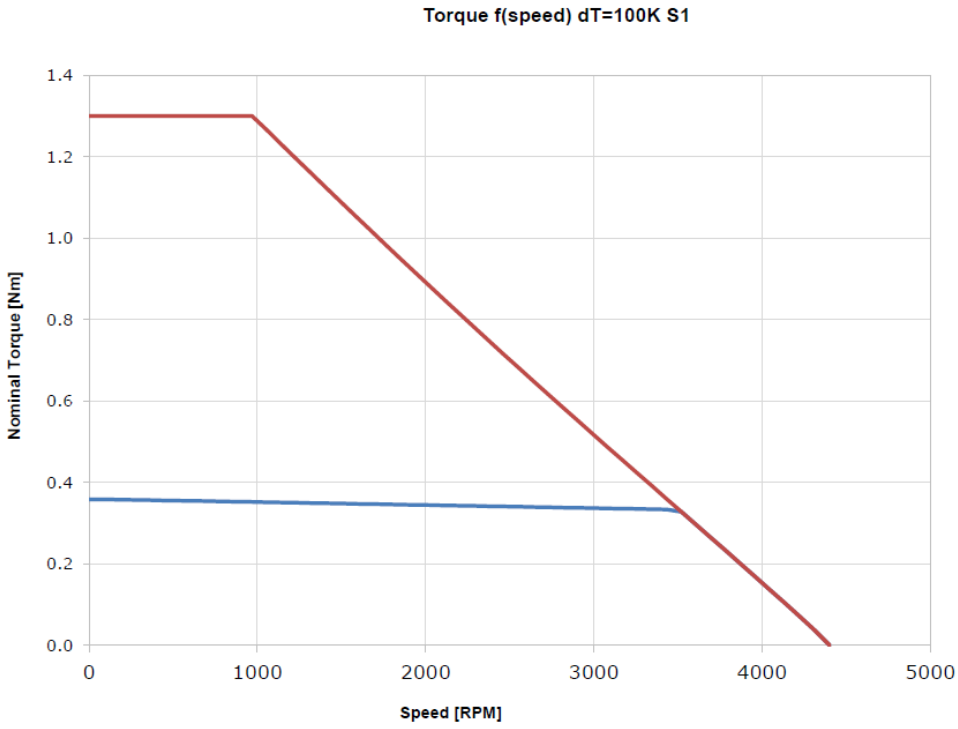
DSM504.4 24 V


Torque f(speed) dT=100K S1
Nominal Torque [Nm]
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0
1000
2000
3000
4000
5000
Speed [RPM]

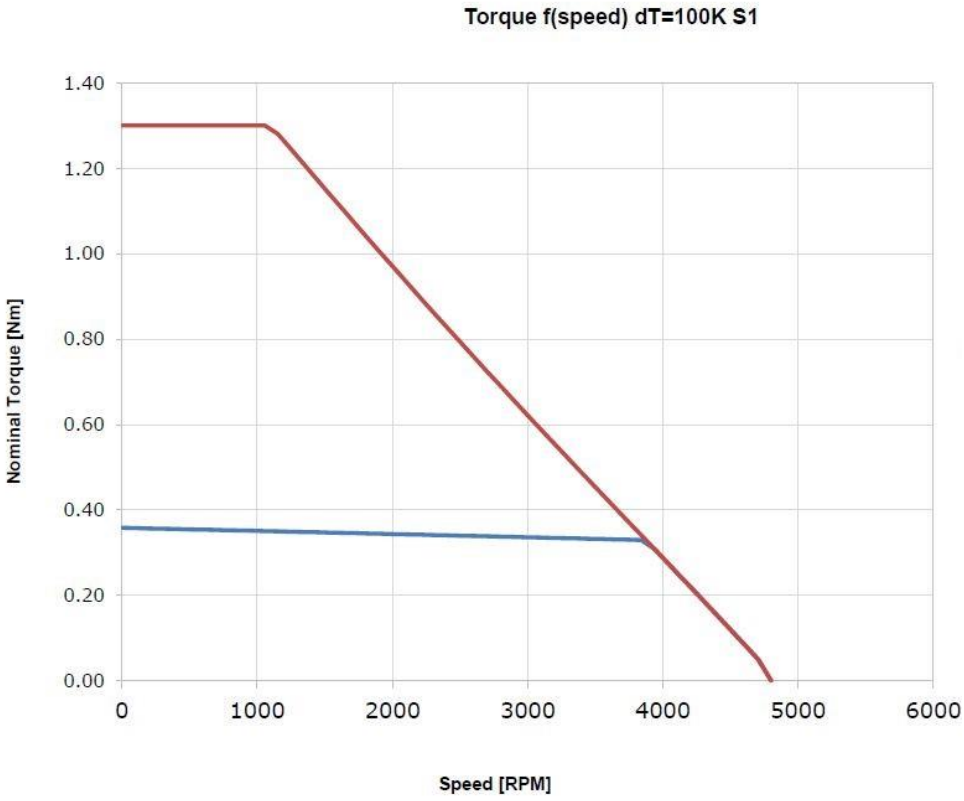
DSM504.4 48 V


Torque f(speed) dT=100K S1
Nominal Torque [Nm]
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0
2000
4000
6000
8000
10000
Speed [RPM]

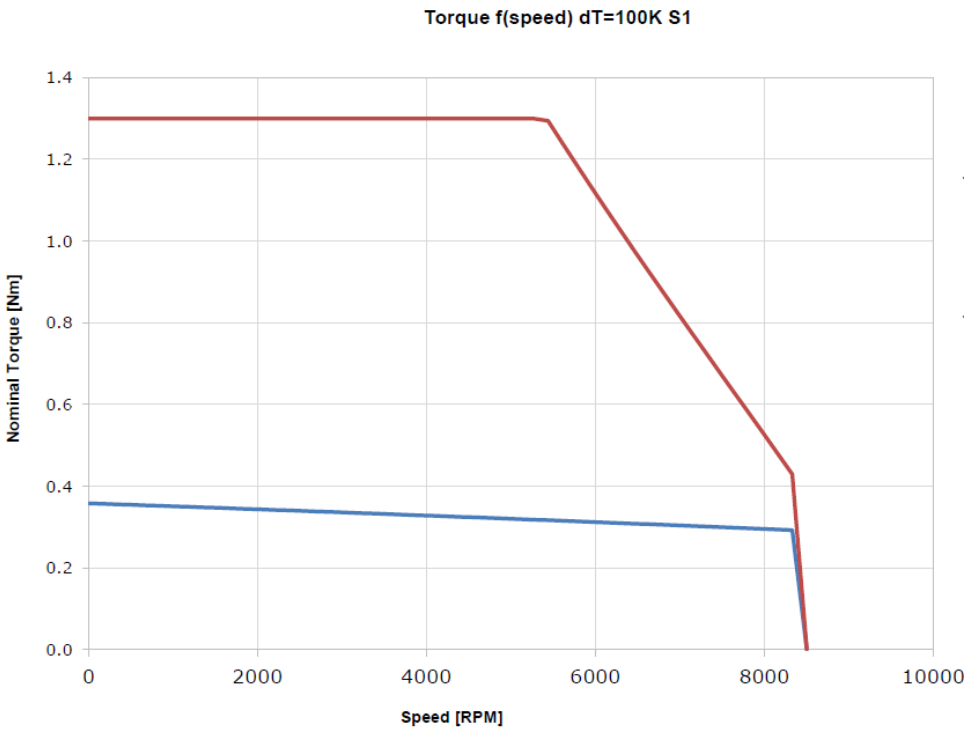
DSM505.3 48 V


Torque f(speed) dT=100K S1
Nominal Torque [Nm]
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
1000
2000
3000
4000
5000
Speed [RPM]

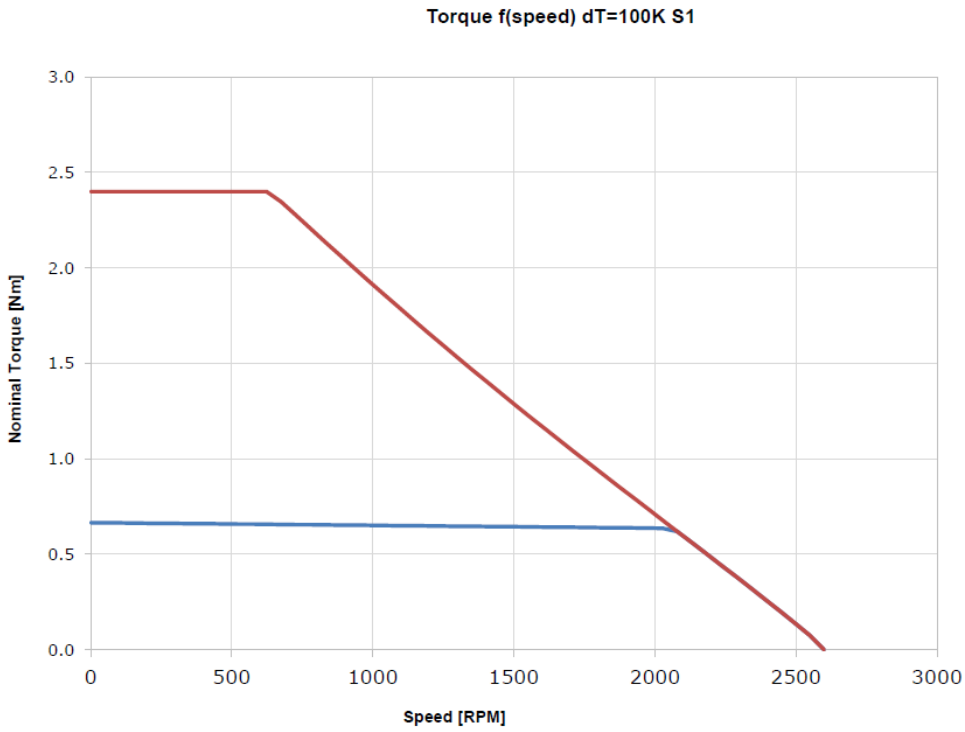
DSM505.4 24 V


Torque f(speed) dT=100K S1
Nominal Torque [Nm]
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0
1000
2000
3000
4000
5000
6000
Speed [RPM]

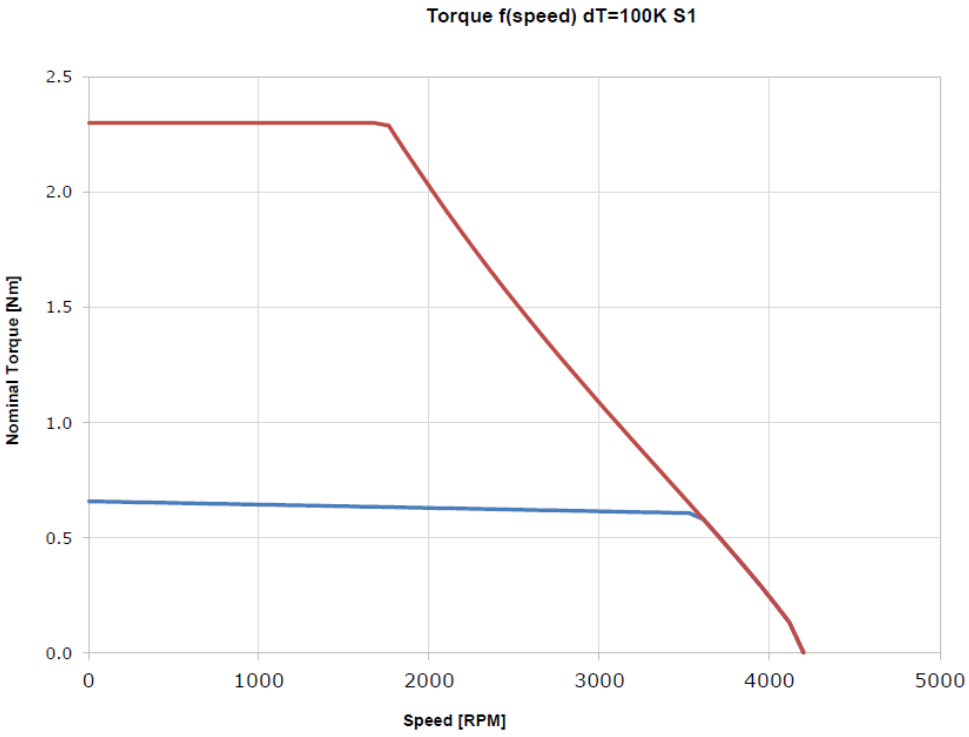
DSM505.4 48 V


Torque f(speed) dT=100K S1
Nominal Torque [Nm]
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
2000
4000
6000
8000
10000
Speed [RPM]

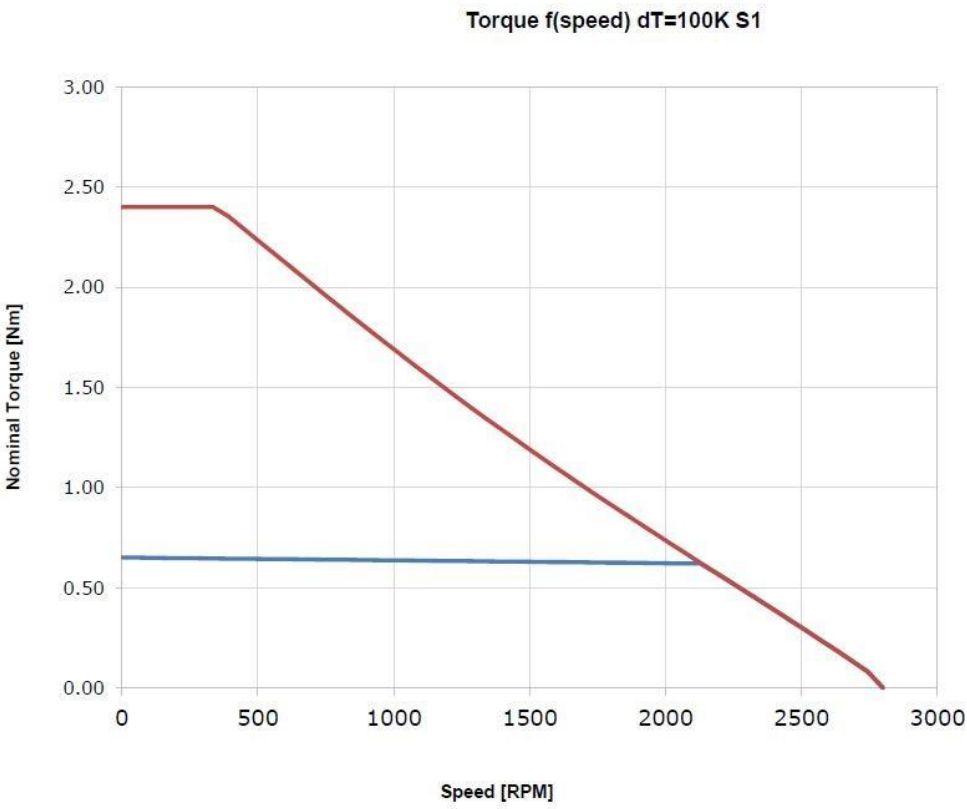
DSM521.3 48 V


Torque f(speed) dT=100K S1
Nominal Torque [Nm]
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
500
1000
1500
2000
2500
3000
Speed [RPM]

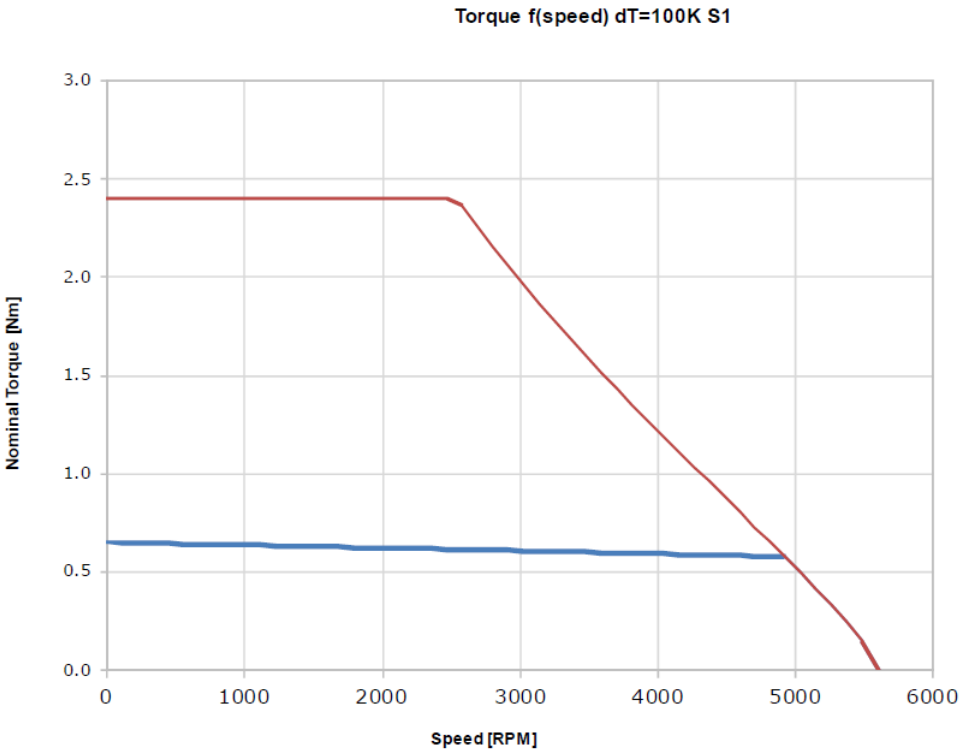
DSM521.4 48 V


Torque f(speed) dT=100K S1
Nominal Torque [Nm]
2.5
2.0
1.5
1.0
0.5
0.0
0
1000
2000
3000
4000
5000
Speed [RPM]

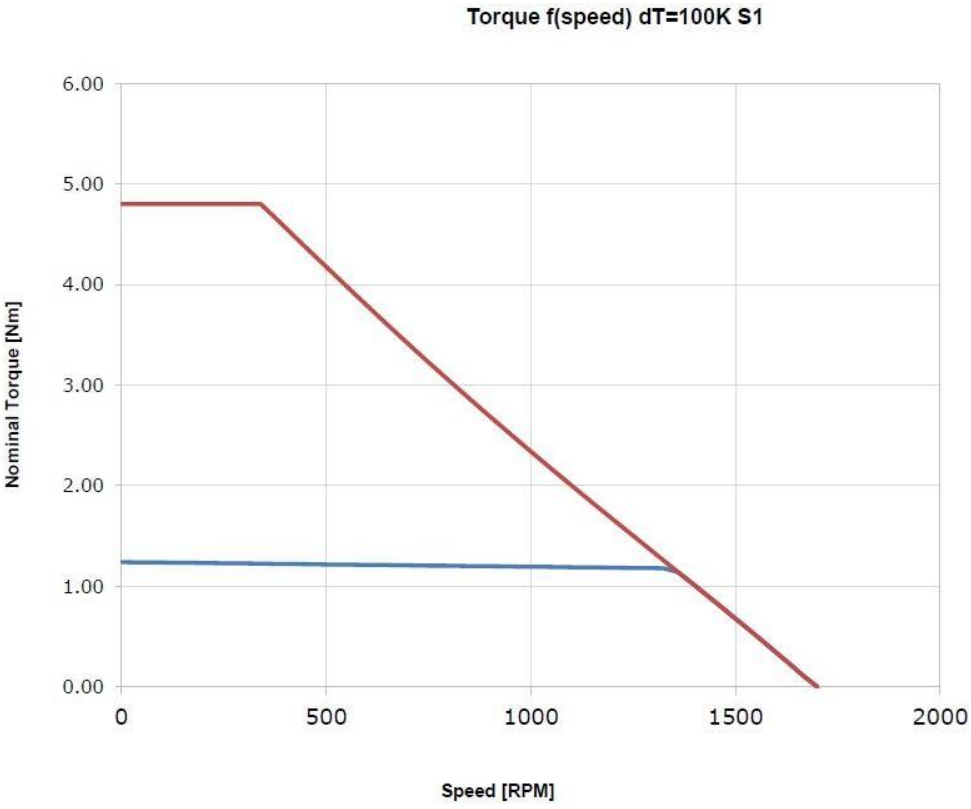
DSM521.5 24 V


Torque f(speed) dT=100K S1
Nominal Torque [Nm]
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0
500
1000
1500
2000
2500
3000
Speed [RPM]

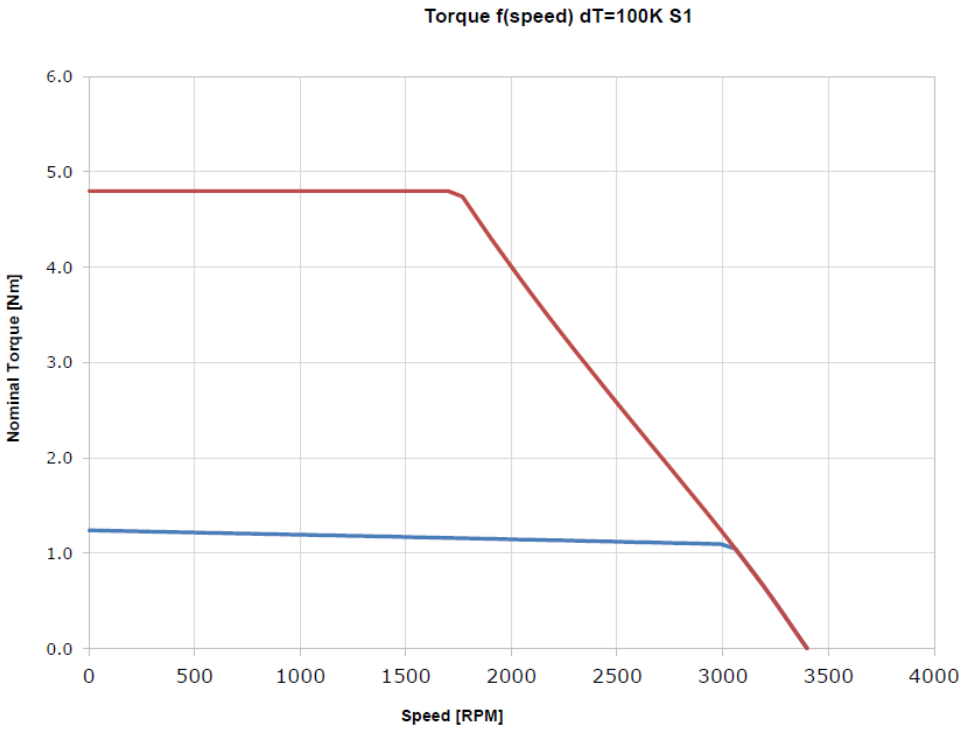
DSM521.5 48 V


Torque f(speed) dT=100K S1
Nominal Torque [Nm]
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
1000
2000
3000
4000
5000
6000
Speed [RPM]

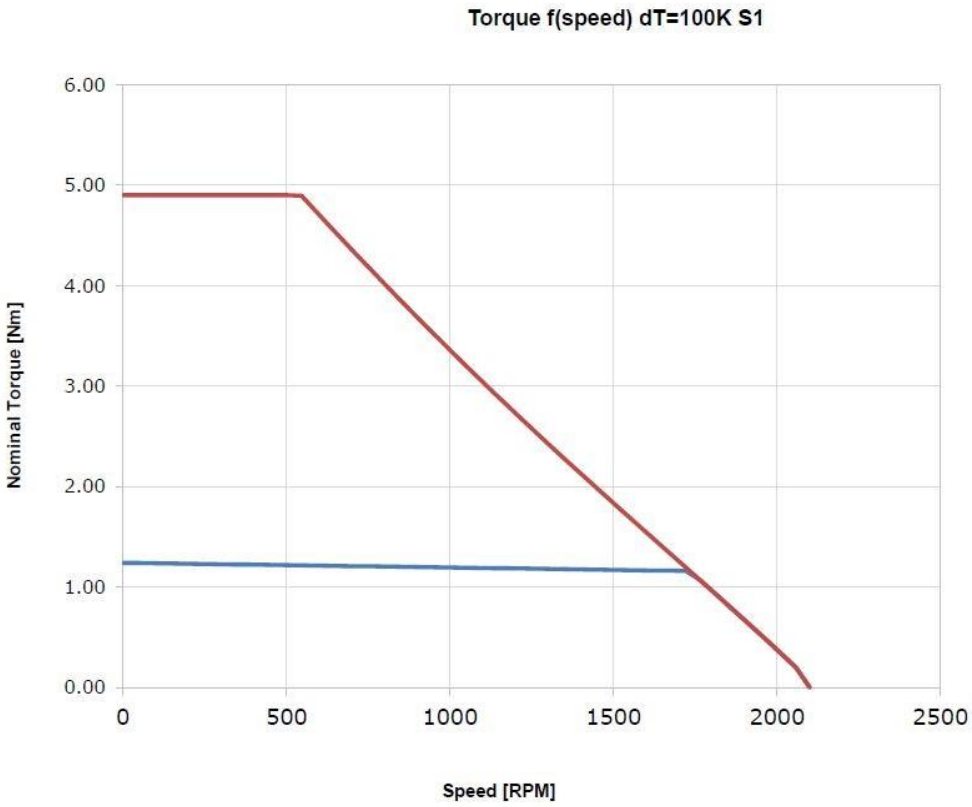
DSM522.4 24 V


Torque f(speed) dT=100K S1
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Nominal Torque [Nm]
0
500
1000
1500
2000
Speed [RPM]

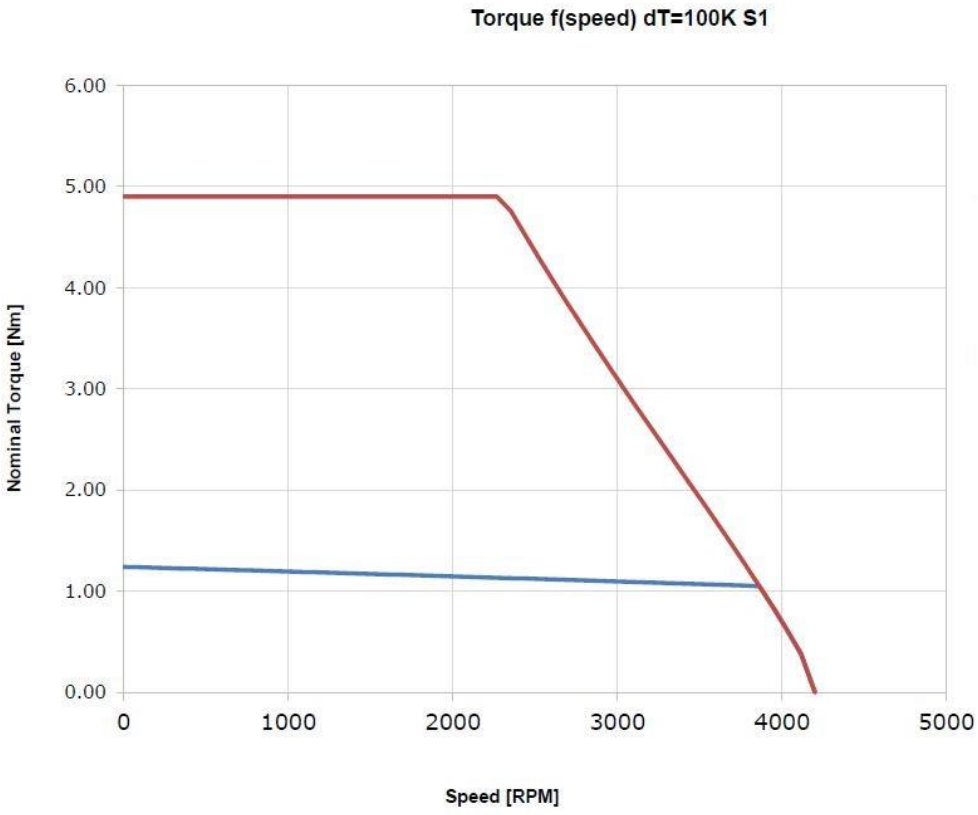
DSM522.4 48 V


Torque f(speed) dT=100K S1
Nominal Torque [Nm]
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
500
1000
1500
2000
2500
3000
3500
4000
Speed [RPM]

DSM522.5 24 V


Torque f(speed) dT=100K S1
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Nominal Torque [Nm]
0
500
1000
1500
2000
2500
Speed [RPM]

DSM522.5 48 V


Torque f(speed) dT=100K S1
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Nominal Torque [Nm]
0
1000
2000
3000
4000
5000
Speed [RPM]

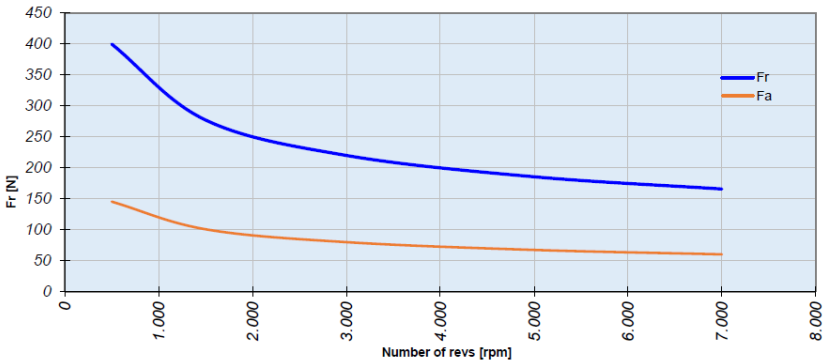
8.4 DSM5 Size 0

8.4.1 Performance Data

Data		Symbol [Unit]	DSM504	DSM505
Winding code			1	1
Electrical data				
	Standstill torque	M_0 [Nm]**	0.19	0.38
	Standstill current	I_{0rms} [A]**	0.78	1.21
	Max. nominal supply voltage	U_N [VAC]	480	
U_N = 230V	Nominal rotation speed	n_n [min-1]	8000	8000
	Nominal torque*	Mn [Nm]	0.15	0.29
	Nominal power	P_n [kW]	0.126	0.243
	Rated current	I_n [A]	0.60	0.09
	Peak current	I_{0max} [A]	3,1	4.8
	Peak torque	M_{0max} [Nm]	0.6	1.3
	Torque constant	K_{Trms} \ [Nm/A]	0.24	0.31
	Voltage constant	K_{Erms} [mVmin]	14.7	19
	Winding resistance Ph-Ph	R_{20} [Ω]	27	14
	Winding inductance Ph-Ph	L [mH]	11	7.9
Mechanical Data				
	Rotor inertial torque	J [kgcm²]	0.037	0.061
	Number of contacts		8	8
	Thermal time constant	t_{TH} [min]	9	11
	Weight standard	G [kg]	0.53	0.68

* Measuring flange Aluminum 254mm * 254mm * 8mm
** Reduction:
with integrated brake reduction by 10 %.
with integrated encoder reduction by 6 %
For motors with an encoder and brake, only the higher value applies.

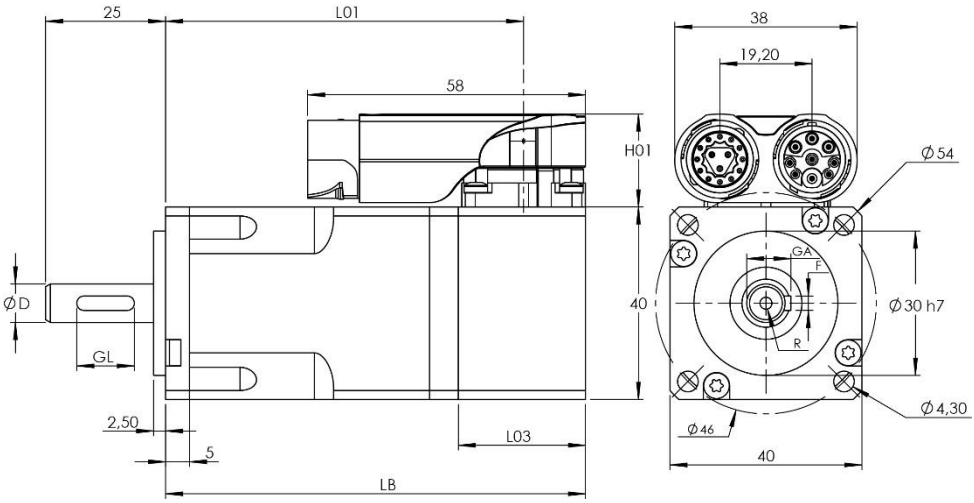
Radial and axial shaft load



8.4.2 Brake Data

Data	Symbol (Unit)	Value
Stop torque at 20 °C	M_{BR} [Nm]	0.4
Connection voltage	U_{BR} [VDC]	24 ± 6 %
Electrical power	P_{BR} [W]	6
Inertial torque	J_{BR} [kgcm²]	0.00114
Release delay time	t_{BRH} [ms]	32
Application delay time	t_{BRL} [ms]	25
Brake weight	G_{BR} [kg]	0.2
Typical play	[°mech.]	0
Switching energy	E [mJ]	4

8.4.3 Mechanical Dimensions



Dimension in mm

Encoder	Resolver			Hiperface		
Dimension of	LB	L01	L03	LB	L01	L03
DSM5.04	87.5	74.5	26.5	104	91	43
DSM5.05	105.5	92.5		122	109	
DSM5.04 brake	119.5	106.5		136	123	
DSM5.05 brake	137.5	124.5		154	141	

Shaft dimension in mm

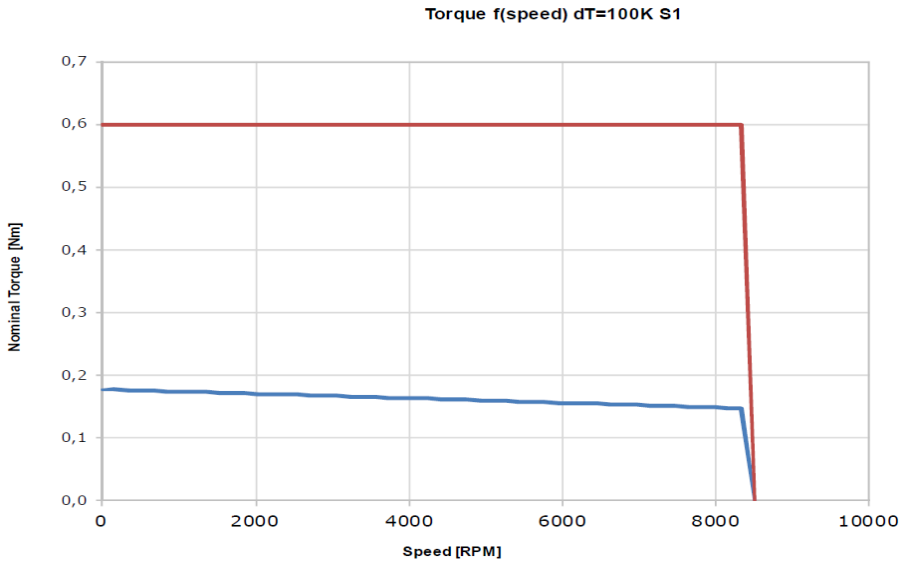
In addition to the standard shaft with parallel key, a smooth shaft is also available. See product key.

Shaft	
D	8h6
E	25
GL	12
GA	9.2
F	3
R	M3x8

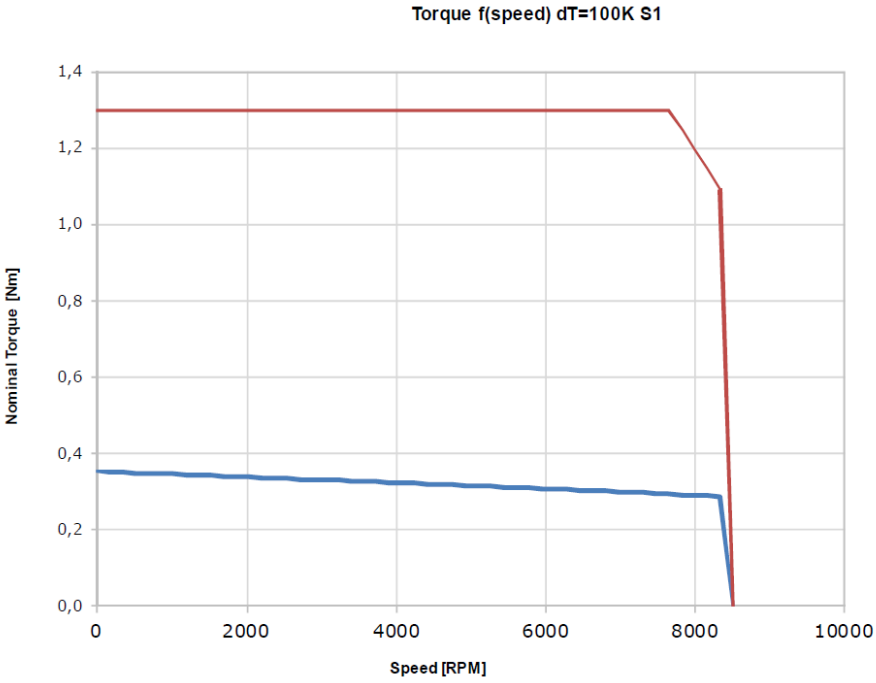
8.4.4 Motor Characteristics

Blue line: Rated torque
Red line: Peak torque

DSM504.1 230 V



DSM505.1 230 V



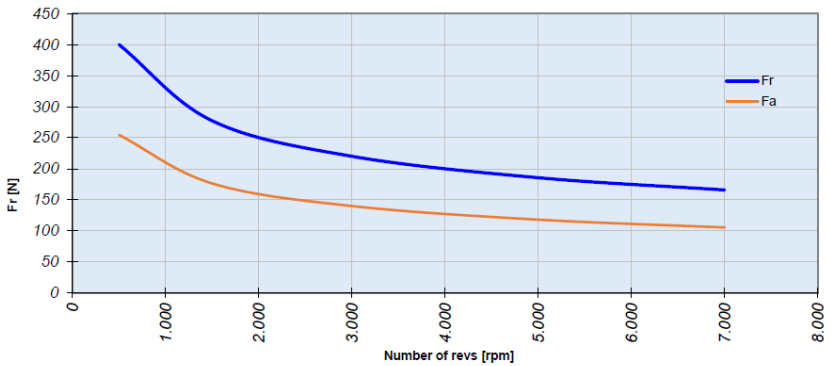
8.5 DSM5 Size 2

8.5.1 Performance Data

Data		Symbol [Unit]	DSM521		DSM522			
Winding code			1	2	1	2		
Electrical data								
	Standstill torque	M_0 [Nm]**	0.7		1.4			
	Standstill current	I_{0rms} [A]**	1.57	0.96	2.8	1.73		
	Max. nominal supply voltage	U_N [VAC]	480					
U_N = 230V	Nominal rotation speed	n_n [min-1]	6,200	3600	6,300	3,900		
	Nominal torque*	Mn [Nm]	0.58	0.65	0,9	1.1		
	Nominal power	P_n [kW]	0.38	0.25	0.59	0.45		
	Rated current	I_n [A]	1.29	0.89	1.80	1.34		
U_N = 400V	Nominal rotation speed	n_n [min-1]	8000	6000	8000	6000		
	Nominal torque*	Mn [Nm]	0.52	0.6	0.8	1		
	Nominal power	P_n [kW]	0.44	0.38	0.67	0.63		
	Rated current	I_n [A]	1.16	0.82	1.60	1.22		
	Peak current	I_{0max} [A]	6.4	3.9	11	6.6		
	Peak torque	M_{0max} [Nm]	2.4		4.6	4.6		
	Torque constant	K_{Trms} \ [Nm/A]	0.45	0.73	0.5	0.81		
	Voltage constant	K_{Erms} [mVmin]	27	44	30	49		
	Winding resistance Ph-Ph	R_{20} [Ω]	8.6	23	3.2	8.4		
	Winding inductance Ph-Ph	L [mH]	10	27	5.6	13		
Mechanical Data								
	Rotor inertial torque	J [kgcm²]	0.13		0.23			
	Number of contacts		8		8			
	Thermal time constant	t_{TH} [min]	16		19			
	Weight standard	G [kg]	1.2		1.7			

* Measuring flange Aluminum 254mm * 254mm * 8mm
** Reduction:
with integrated brake reduction by 10 %.
with integrated encoder reduction by 6 %
For motors with an encoder and brake, only the higher value applies.

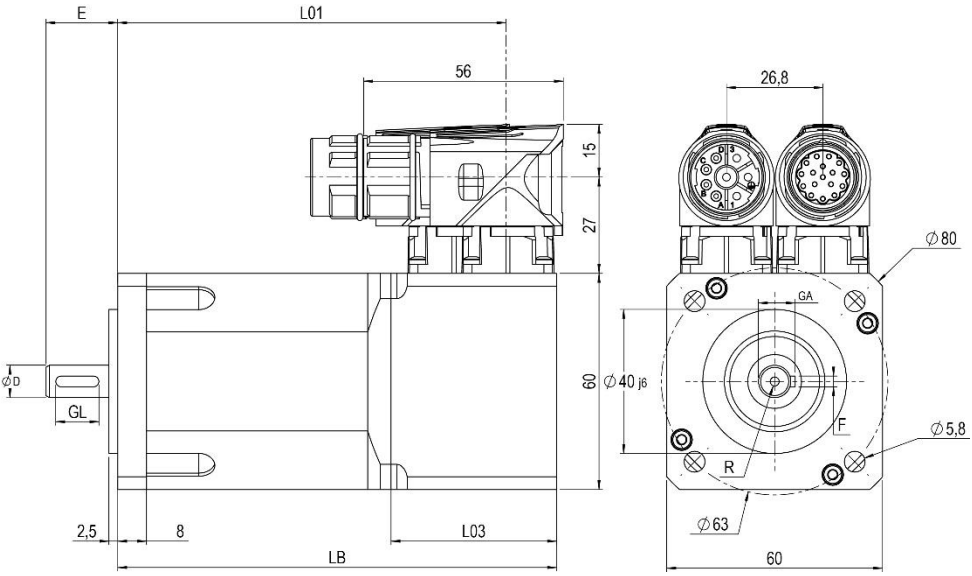
Radial and axial shaft load



8.5.2 Brake Data

Data	Symbol (Unit)	Value
Stop torque at 20 °C	M_{BR} [Nm]	2
Connection voltage	U_{BR} [VDC]	24 ± 6 %
Electrical power	P_{BR} [W]	11
Inertial torque	J_{BR} [kgcm²]	0.1
Release delay time	t_{BRH} [ms]	8
Application delay time	t_{BRL} [ms]	25
Brake weight	G_{BR} [kg]	0.3
Typical play	[°mech.]	0
Switching energy	E [mJ]	8

8.5.3 Mechanical Dimensions



Dimension in mm

Encoder	Resolver			Hiperface		
Dimension of	LB	L01	L03	LB	L01	L03
DSM5.21	104	90	28	122	106	46
DSM5.22	132	118		150	134	
DSM5.21 brake	134.5	120.4		152.4	136.4	
DSM5.22 brake	162.4	148.4		180.4	164.4	

Shaft dimension in mm

In addition to the standard shaft with parallel key, a smooth shaft is also available. See product key.

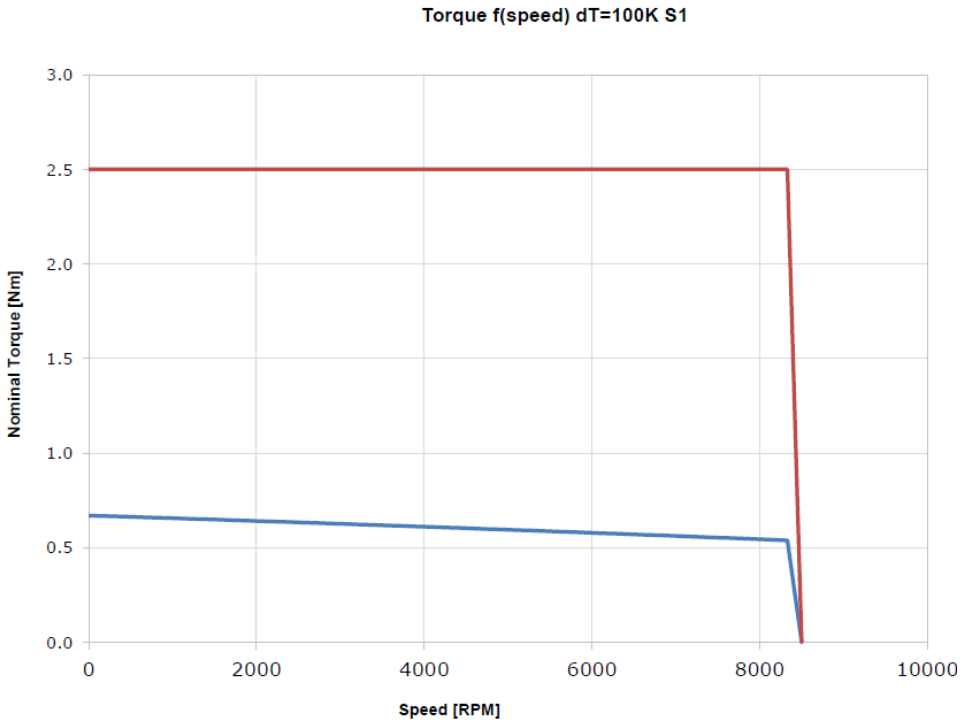
Shaft		
D	9j6 (Option 62)	11j6 (Standard)
E	20	23
GL	12	15
GA	10.2	12.5
F	3	4
R	-	M4x10

8.5.4 Motor Characteristics

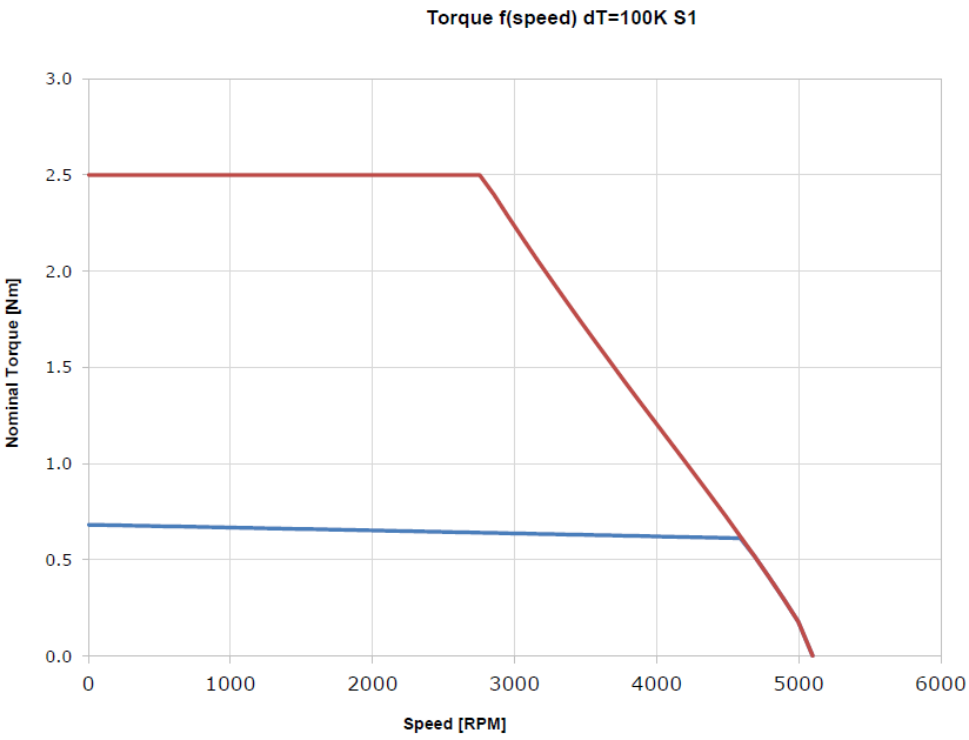
Blue line: Rated torque
Red line: Peak torque

DSM521.1 230 V

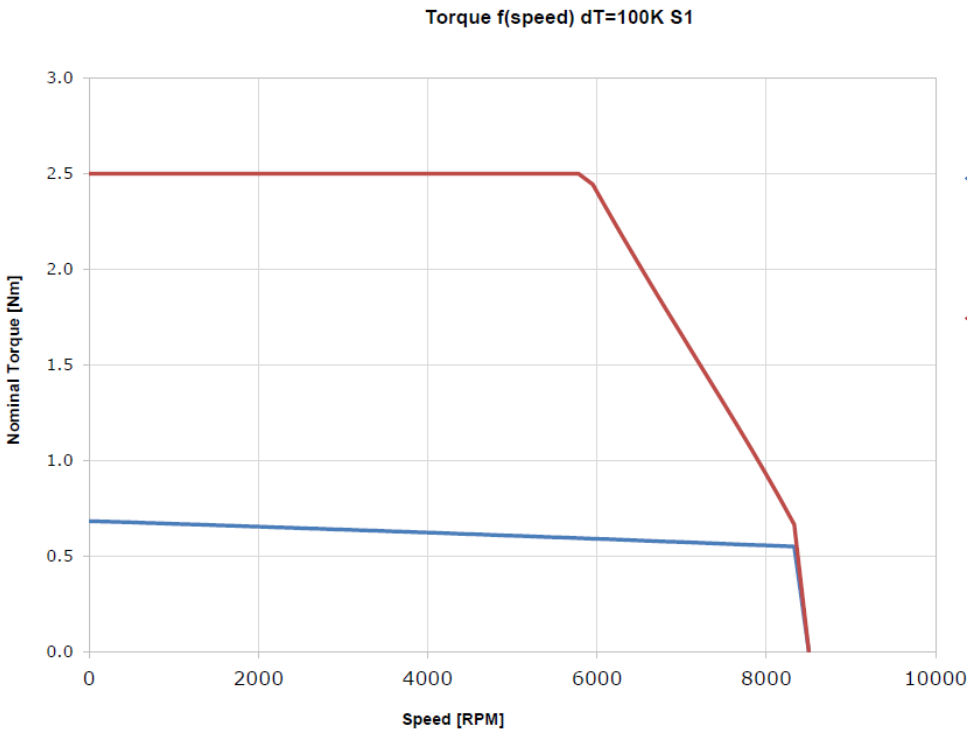
DSM521.1 400 V



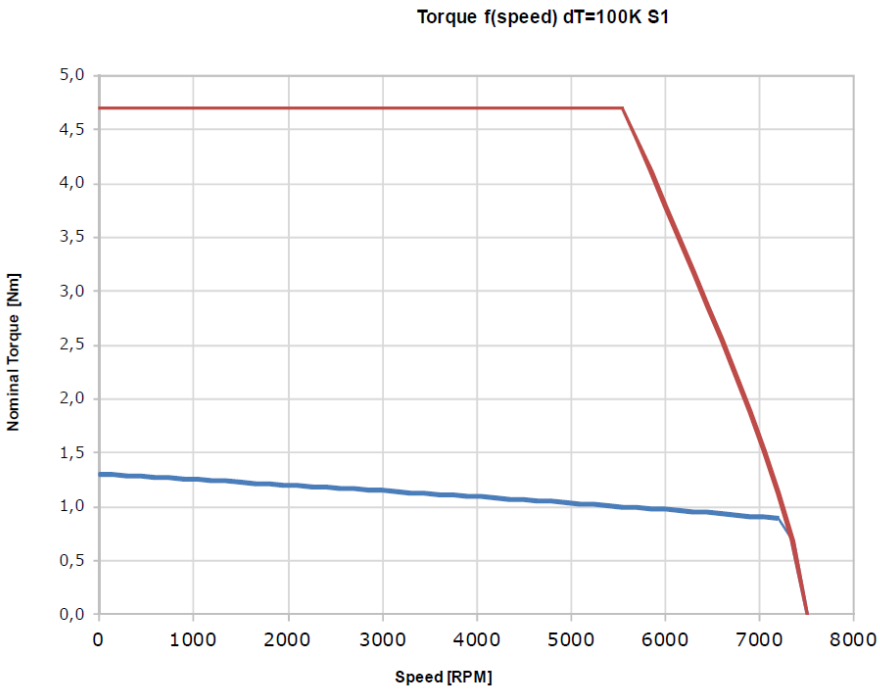
DSM521.2 230 V



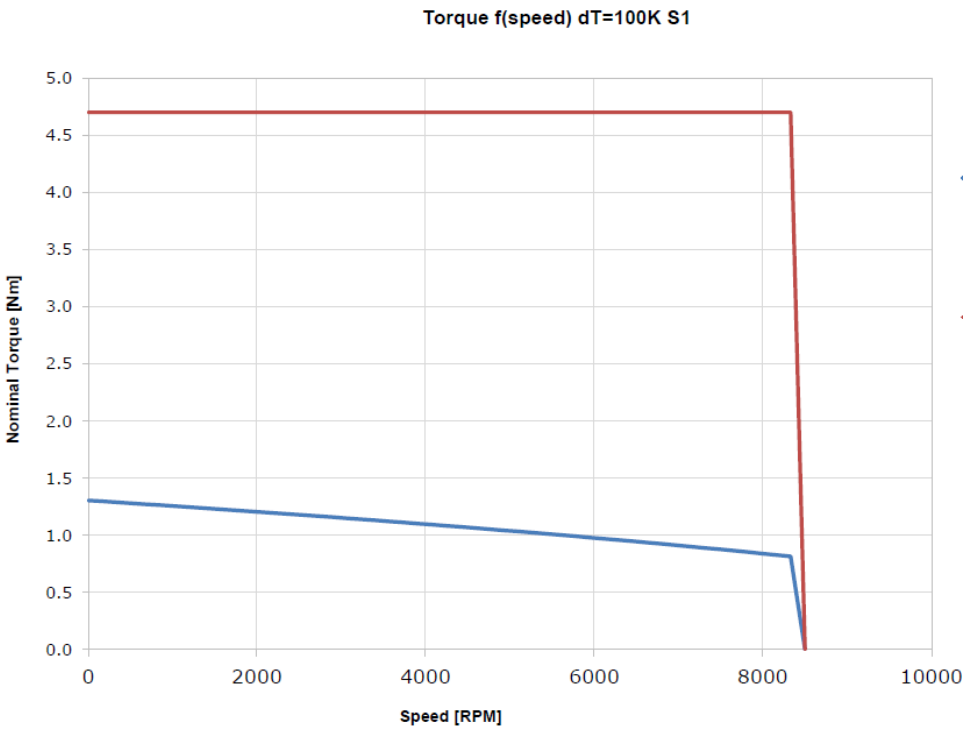
DSM521.2 400 V



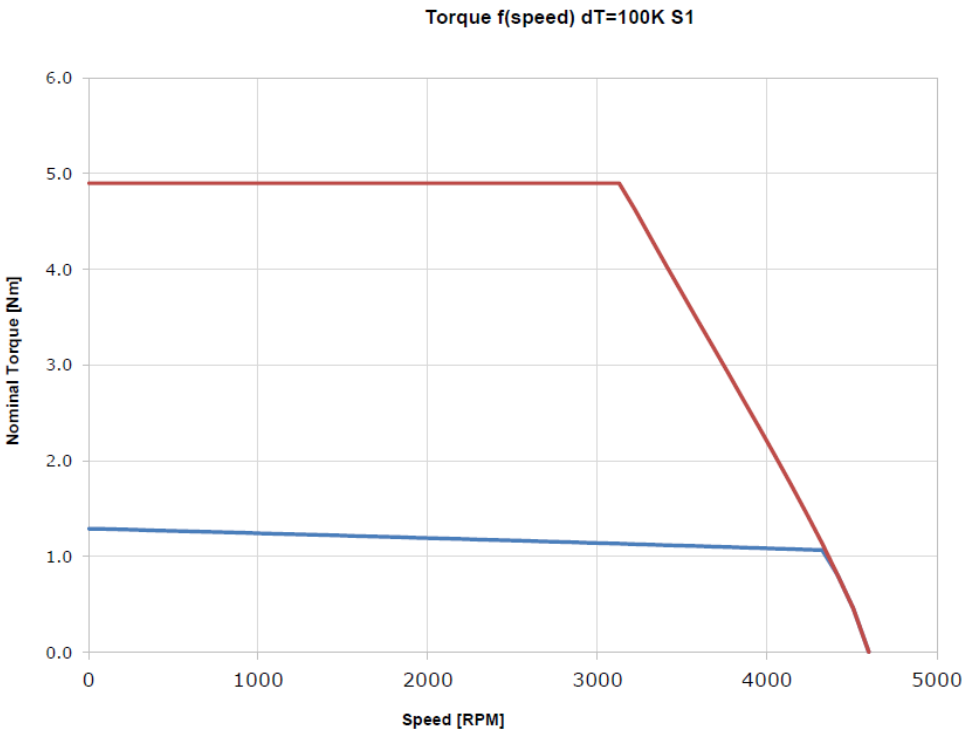
DSM522.1 230 V



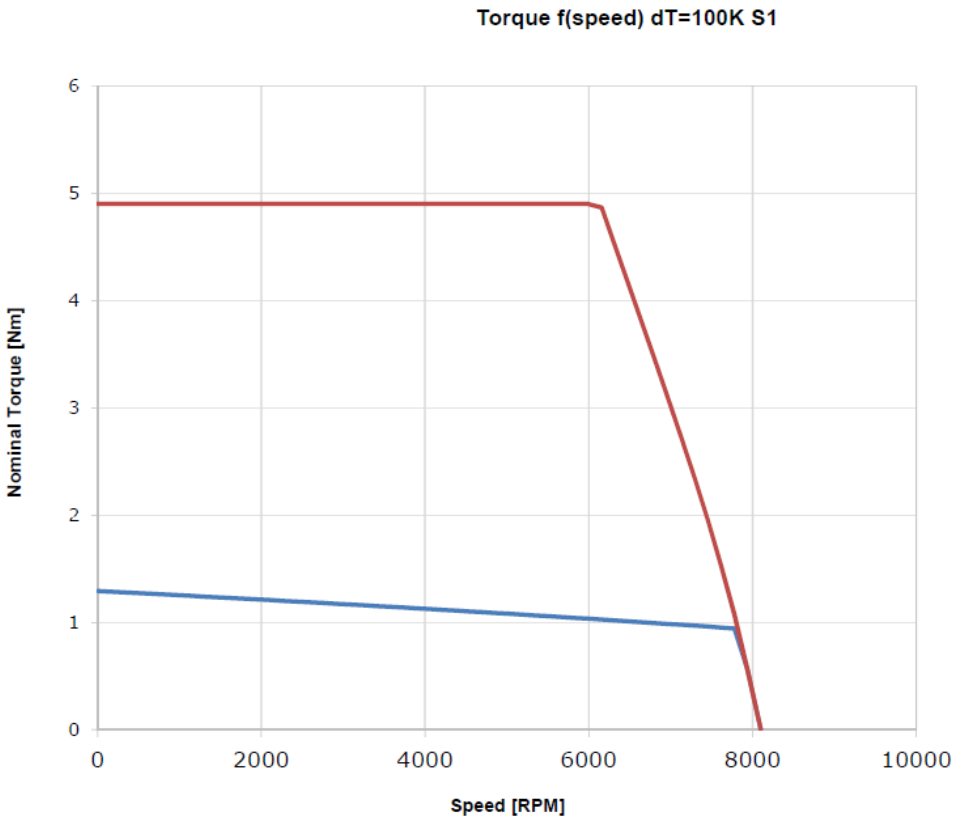
DSM522.1 400 V



DSM522.2 230 V



DSM522.2 400 V



8.6 DSM5 Size 3

8.6.1 Performance Data

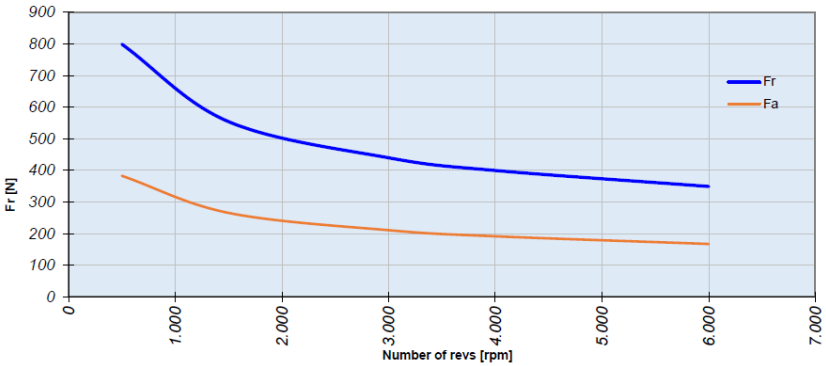
Data		Symbol [Unit]	DSM531			DSM532		
Winding code			1	2	3	1	2	8
Electrical data								
	Standstill torque	M_0 [Nm]**	1.5			2.9		
	Standstill current	I_{0rms} [A]**	1.65	1.1	2.6	3.2	2	5.2
	Max. nominal supply voltage	U_N [VAC]	480					
U_N = 230V	Nominal rotation speed	n_n [min-1]	3,100	1800	5000	3200	1900	5400
	Nominal torque*	Mn [Nm]	1.22	1.38	1.11	2.31	2.5	2.05
	Nominal power	P_n [kW]	0.4	0.26	0.58	0.77	0.5	1.16
	Rated current	I_n [A]	1.34	0.97	1.91	2.54	1.72	3.66
U_N = 400V	Nominal rotation speed	n_n [min-1]	6000	3500	6500	6000	3500	6500
	Nominal torque*	Mn [Nm]	1.1	1.3	1.08	1.95	2.3	1.89
	Nominal power	P_n [kW]	0.69	0.48	0.74	1.23	0.84	1.29
	Rated current	I_n [A]	1.21	0.92	1.86	2.14	1.59	3.38
	Peak current	I_{0max} [A]	6.6	4	13	12.8	8	21
	Peak torque	M_{0max} [Nm]	5.1	4.8	6.4	10		
	Torque constant	K_{Trms} \ [Nm/A]	0.91	1.42	0.58	0.91	1.46	0.56
	Voltage constant	K_{Erms} [mVmin]	55	86	35	55	88	34
	Winding resistance Ph-Ph	R_{20} [Ω]	9	23	4	3.4	8.3	1.3
	Winding inductance Ph-Ph	L [mH]	16	35	6.3	7	18	2.7
Mechanical Data								
	Rotor inertial torque	J [kgcm²]	0.92			1.72		
	Number of contacts		8			8		
	Thermal time constant	t_{TH} [min]	30			40		
	Weight standard	G [kg]	2.4			3.5		

* Measuring flange Aluminum 254mm * 254mm * 8mm
** Reduction:
with integrated brake reduction by 10 %.
with integrated encoder reduction by 6 %
For motors with an encoder and brake, only the higher value applies.

	Data	Symbol [Unit]	DSM533			DSM534		
			1	2	4	1	2	4
Electrical data								
	Standstill torque	M_0 [Nm]**	4.2			5.3		
	Standstill current	I_{0rms} [A]**	4.6	2.9	7.1	5.8	3.4	8
	Max. nominal supply voltage	U_N [VAC]	480					
U_N = 230V	Nominal rotation speed	n_n [min-1]	3,300	2000	5200	3,300	1900	4,700
	Nominal torque*	Mn [Nm]	3.22	3.6	2.83	4	4.4	3.56
	Nominal power	P_n [kW]	1.113	0.75	1.54	1.38	0.88	1.75
	Rated current	I_n [A]	3.54	2.48	4.80	4.40	2.86	5.39
U_N = 400V	Nominal rotation speed	n_n [min-1]	6000	3500	6500	5000	3000	5000
	Nominal torque*	Mn [Nm]	2.65	3.35	2.53	3.6	4.1	3.08
	Nominal power	P_n [kW]	1.665	1.228	1.722	1.885	1.288	1.613
	Rated current	I_n [A]	2.91	2.31	4.29	3.96	2.66	4.67
	Peak current	I_{0max} [A]	18	11	28	23	14	32
	Peak torque	M_{0max} [Nm]	14			18		
	Torque constant	K_{Trms} \ [Nm/A]	0.91	1.46	0.6	0.91	1.54	0.66
	Voltage constant	K_{Erms} [mVmin]	55	88	36	55	93	40
	Winding resistance Ph-Ph	R_{20} [Ω]	1.9	5	0.86	1.4	4	0.67
	Winding inductance Ph-Ph	L [mH]	4.5	12	2	3.5	11	1.6
Mechanical Data								
	Rotor inertial torque	J [kgcm²]	2.53			3.33		
	Number of contacts		8			8		
	Thermal time constant	t_{TH} [min]	45			50		
	Weight standard	G [kg]	4.6			5.7		

* Measuring flange Aluminum 254mm * 254mm * 8mm
** Reduction:
with integrated brake reduction by 10 %.
with integrated encoder reduction by 6 %
For motors with an encoder and brake, only the higher value applies.

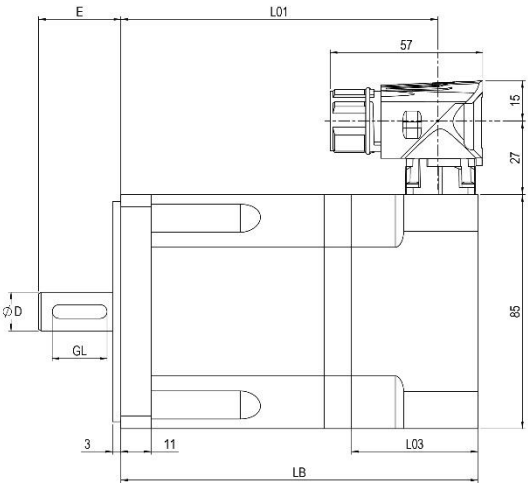
Radial and axial shaft load

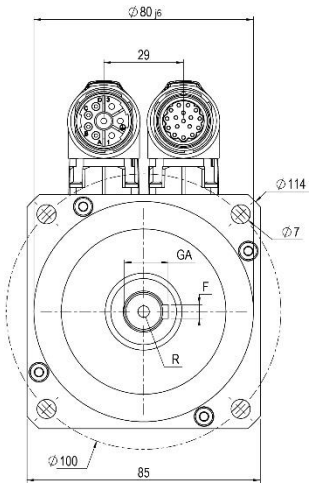


8.6.2 Brake Data

Data	Symbol (Unit)	Value
Stop torque at 20 °C	M_{BR} [Nm]	9
Connection voltage	U_{BR} [VDC]	24 ± 6 %
Electrical power	P_{BR} [W]	18
Inertial torque	J_{BR} [kgcm²]	0.6
Release delay time	t_{BRH} [ms]	20
Application delay time	t_{BRL} [ms]	40
Brake weight	G_{BR} [kg]	1.0
Typical play	[°mech.]	0
Switching energy	E [mJ]	23

8.6.3 Mechanical Dimensions





Dimension in mm

Encoder	Resolver			Hiperface		
Dimension of	LB	L01	L03	LB	L01	L03
DSM5.31	115	101	31	130	116	46
DSM5.32	145	131		160	146	
DSM5.33	175	161		190	176	
DSM5.34	205	191		220	206	
DSM5.31 brake	163	149		178	164	
DSM5.32 brake	193	179		208	194	
DSM5.33 Brake	223	209		238	224	
DSM5.34 Brake	253	283		268	254	

Shaft dimension in mm

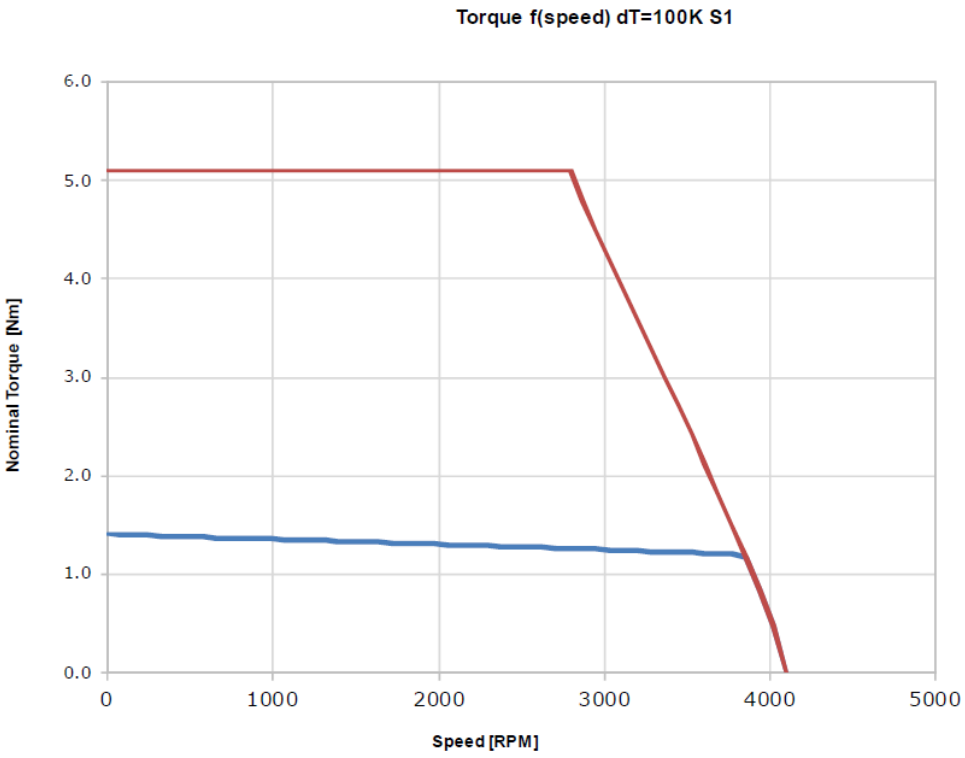
In addition to the standard shaft with parallel key, a smooth shaft is also available. See product key.

Shaft	
D	14j6
E	30
GL	20
GA	16
F	5
R	M5x15

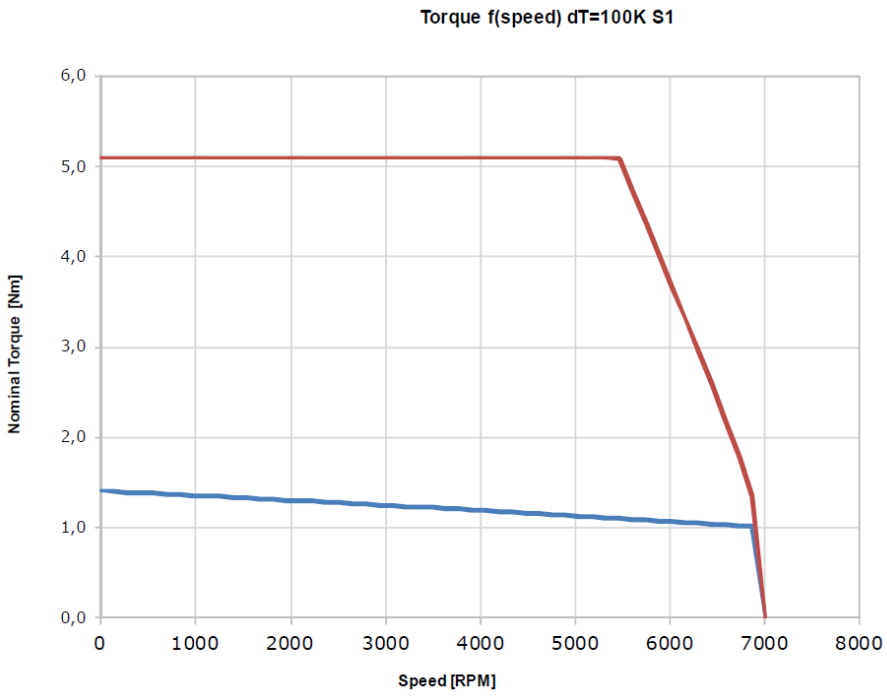
8.6.4 Motor Characteristics

Blue line: Rated torque
Red line: Peak torque

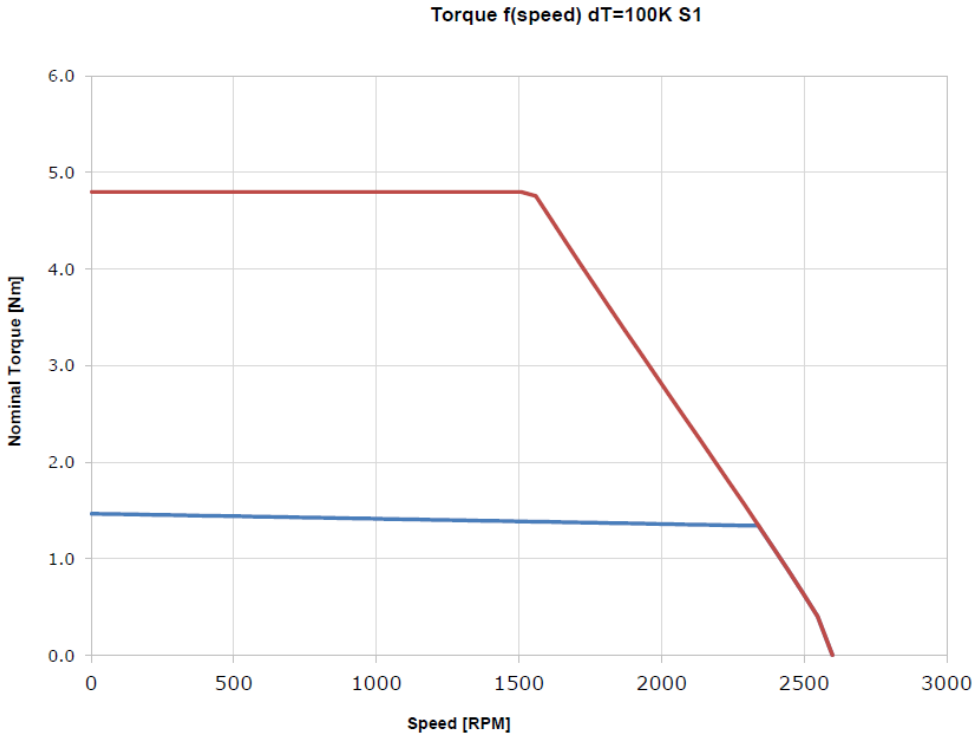
DSM531.1 230 V



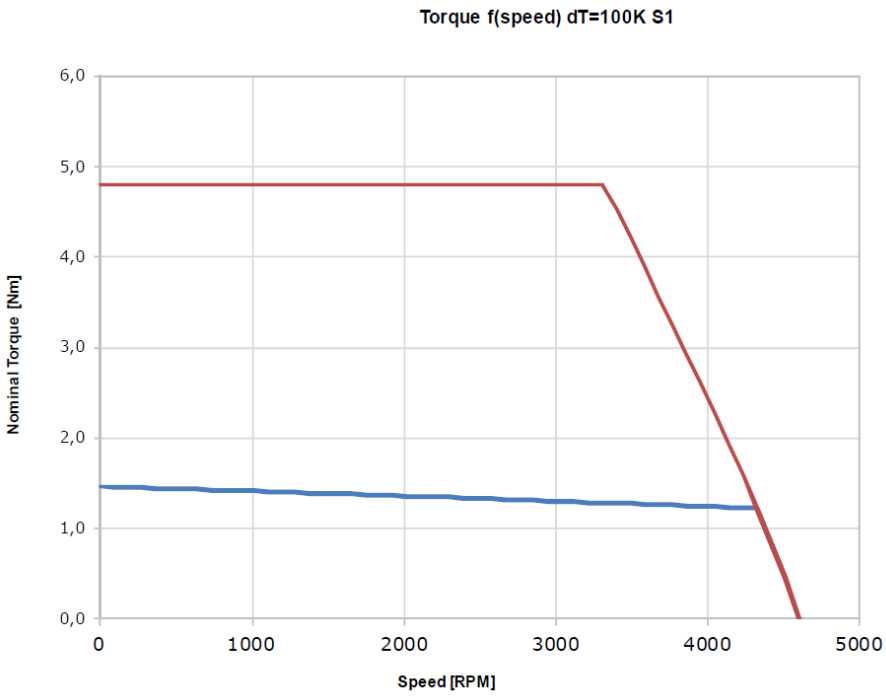
DSM531.1 400 V



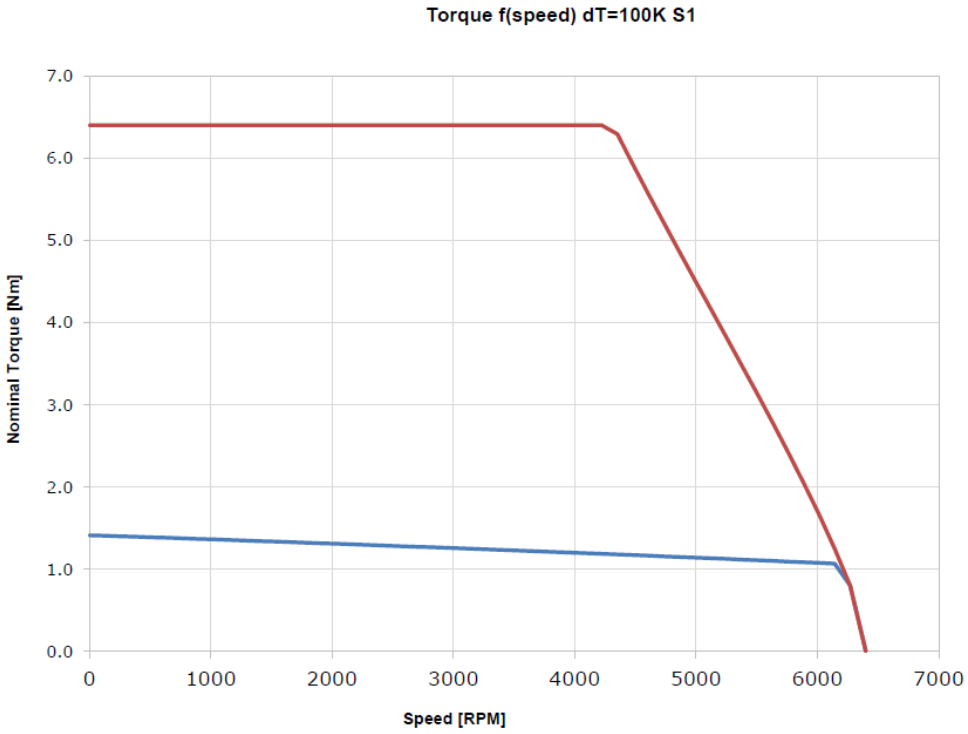
DSM531.2 230 V



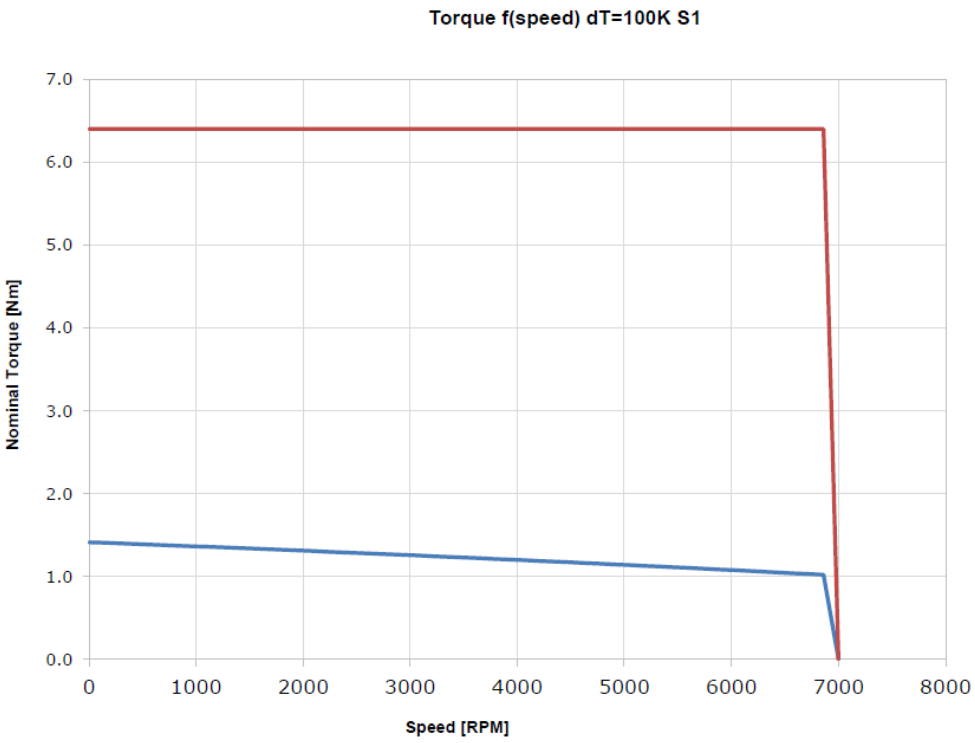
DSM531.2 400 V



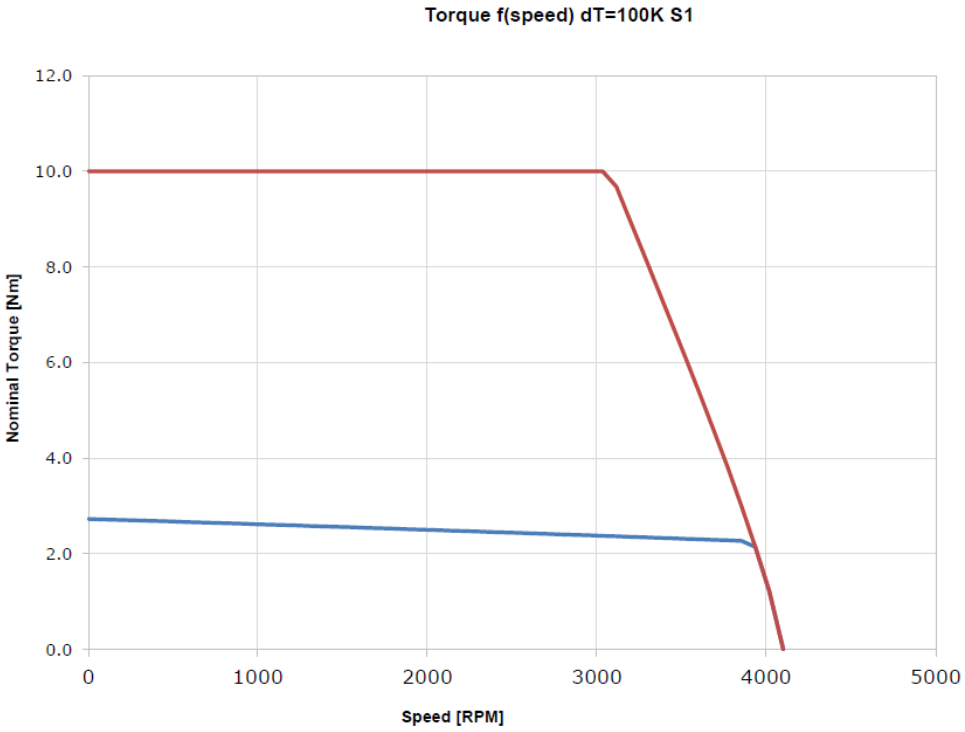
DSM531.3 230 V



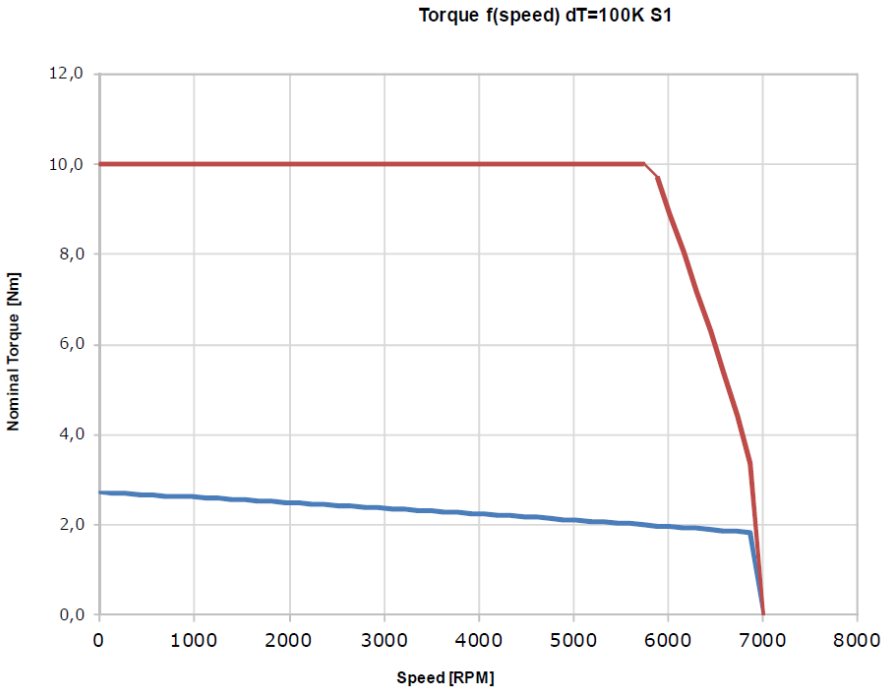
DSM531.3 400 V



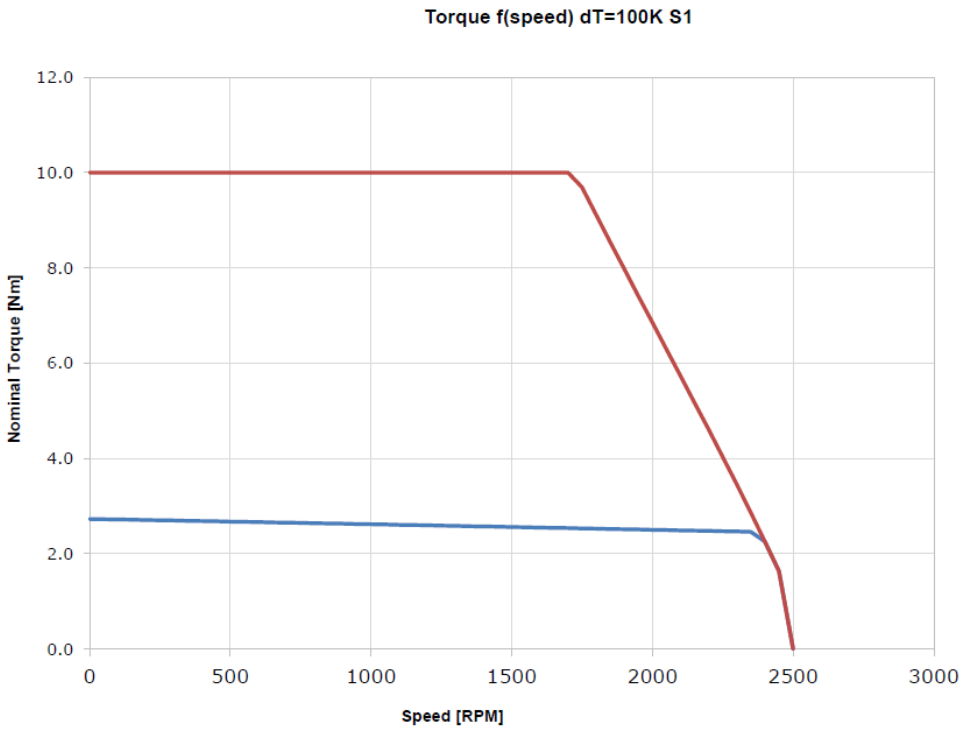
DSM532.1 230 V



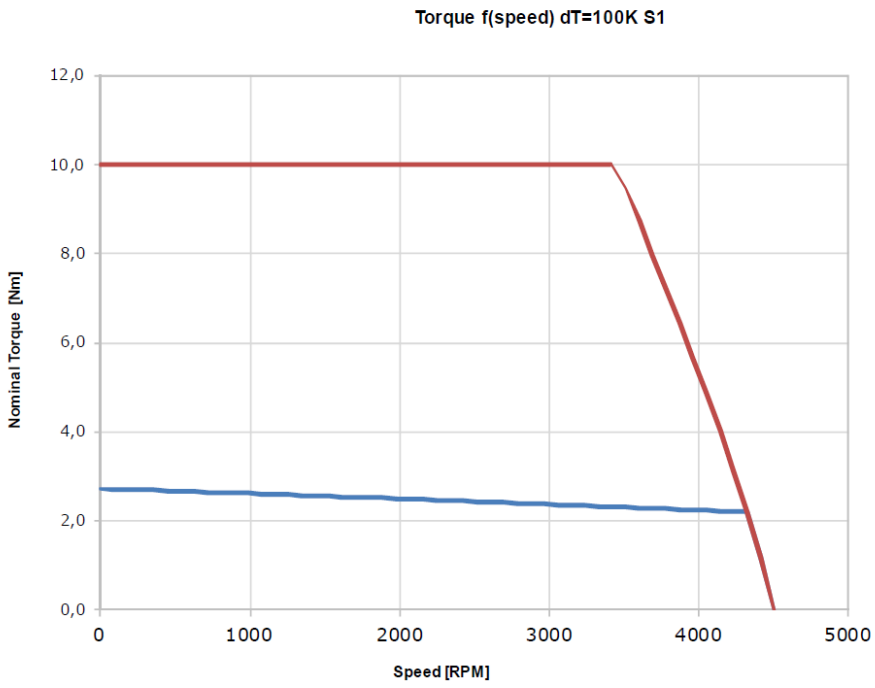
DSM532.1 400 V



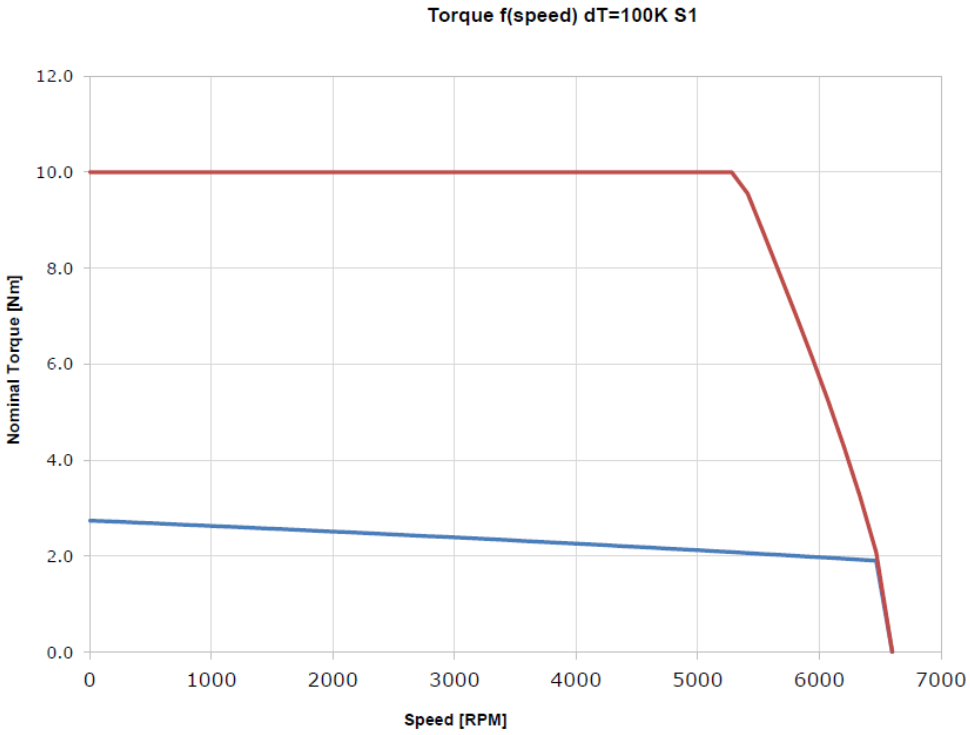
DSM532.2 230 V



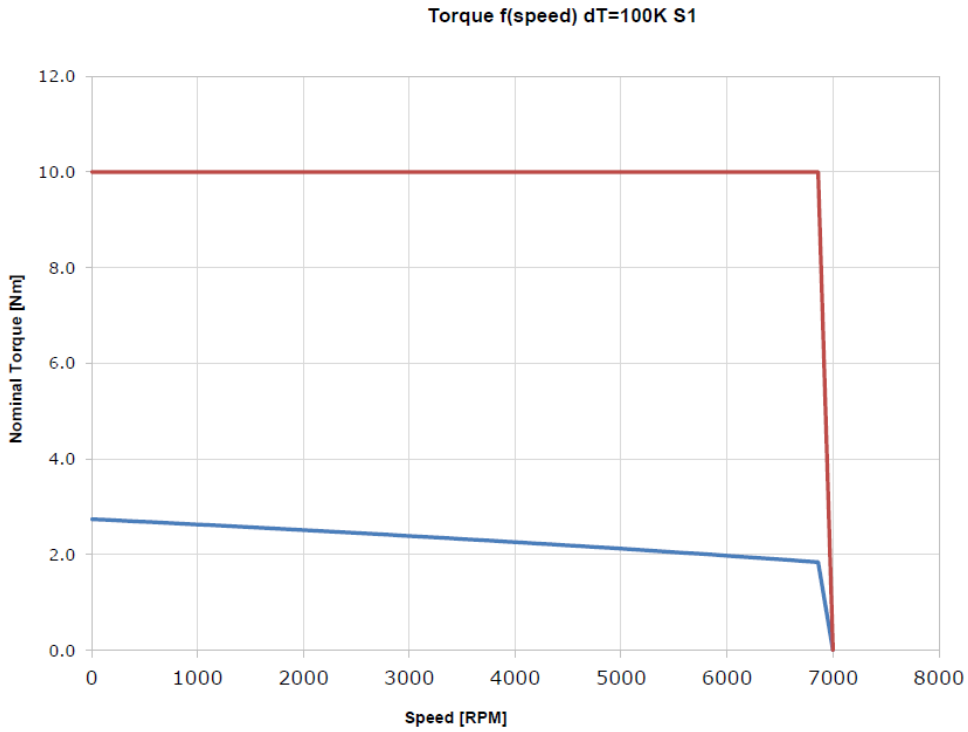
DSM532.2 400 V



DSM532.8 230 V

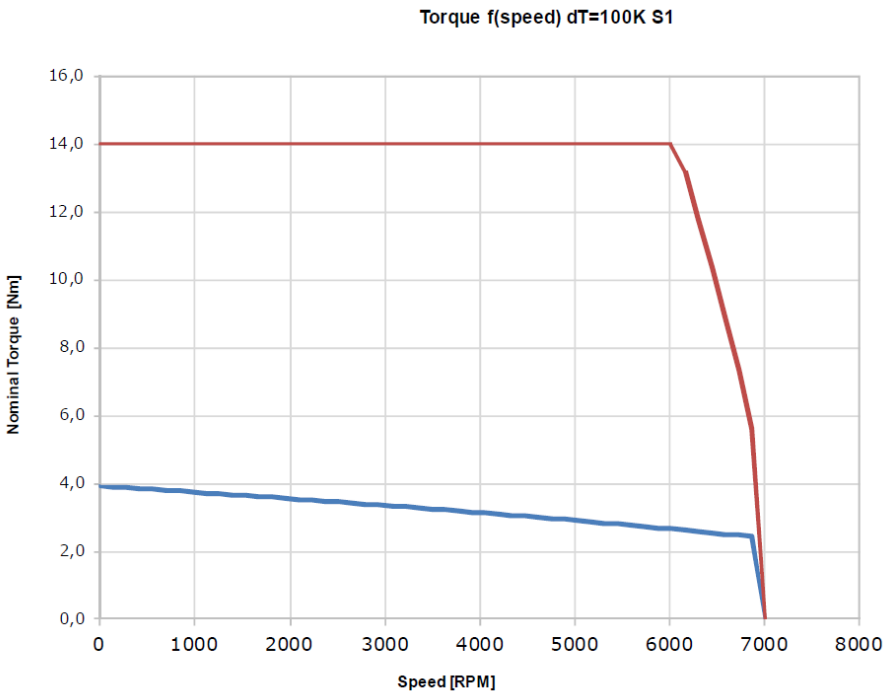


DSM532.8 400 V

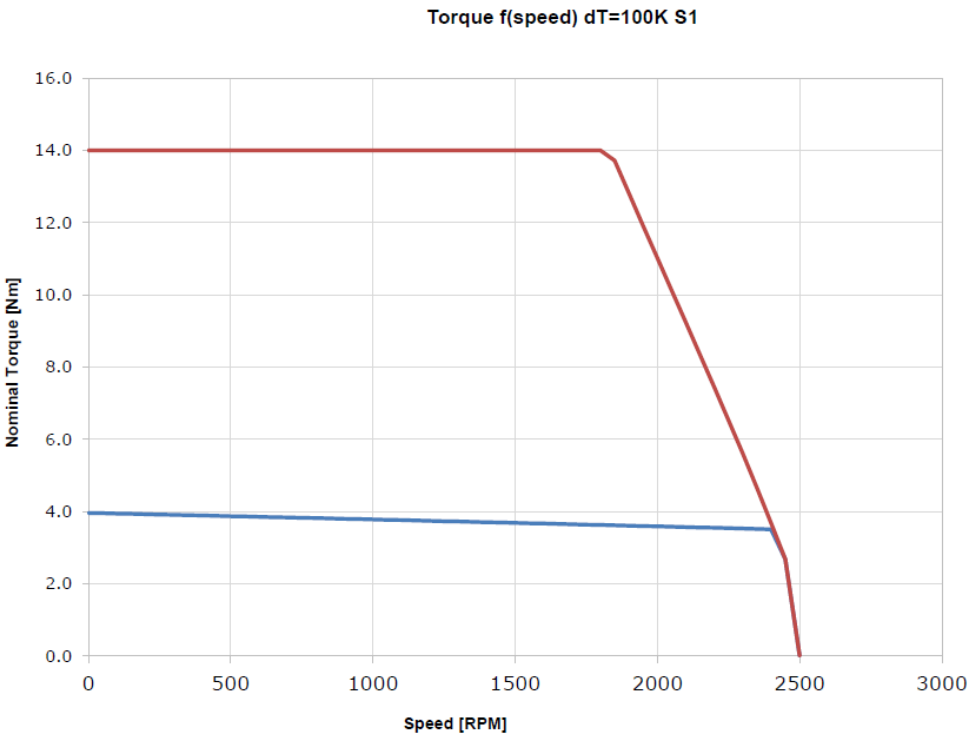


DSM533.1 230 V

DSM533.1 400 V

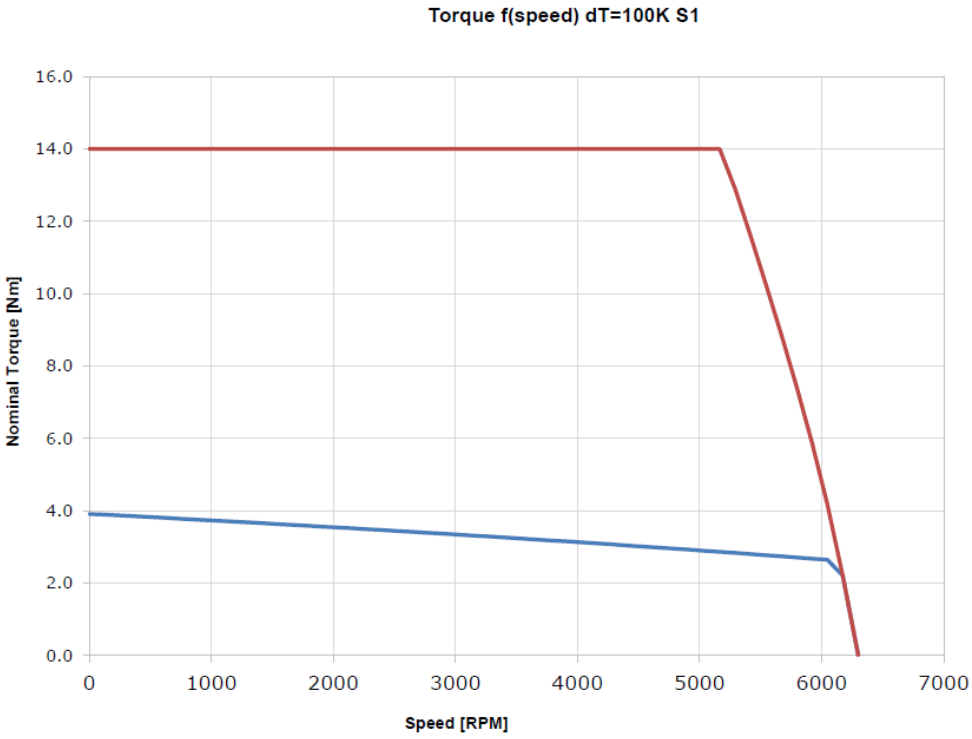


DSM533.2 230 V

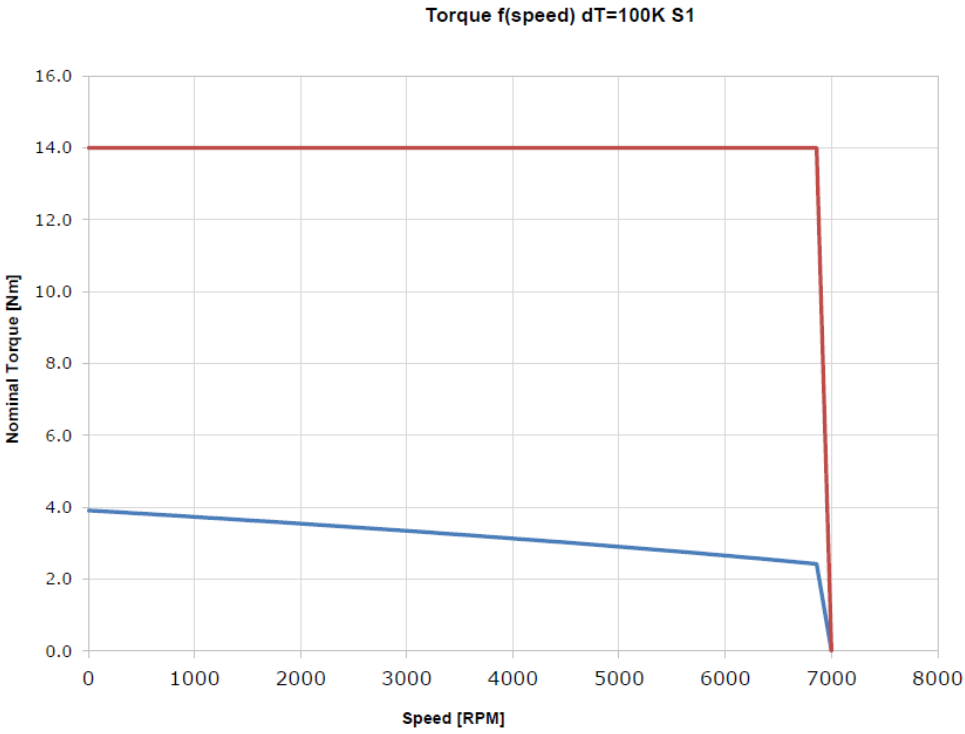


DSM533.2 400 V

DSM533.4 230 V

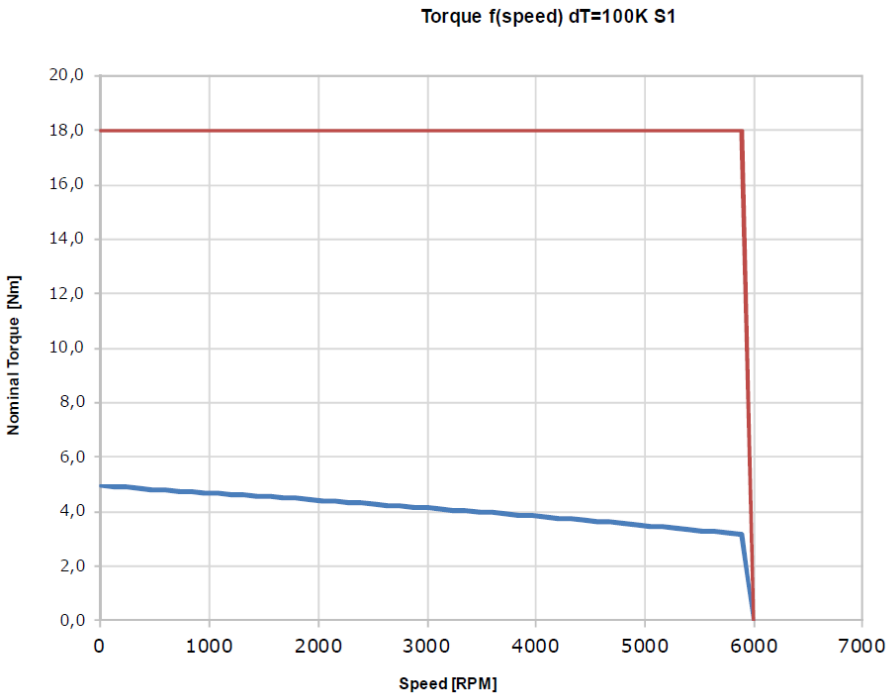


DSM533.4 400 V

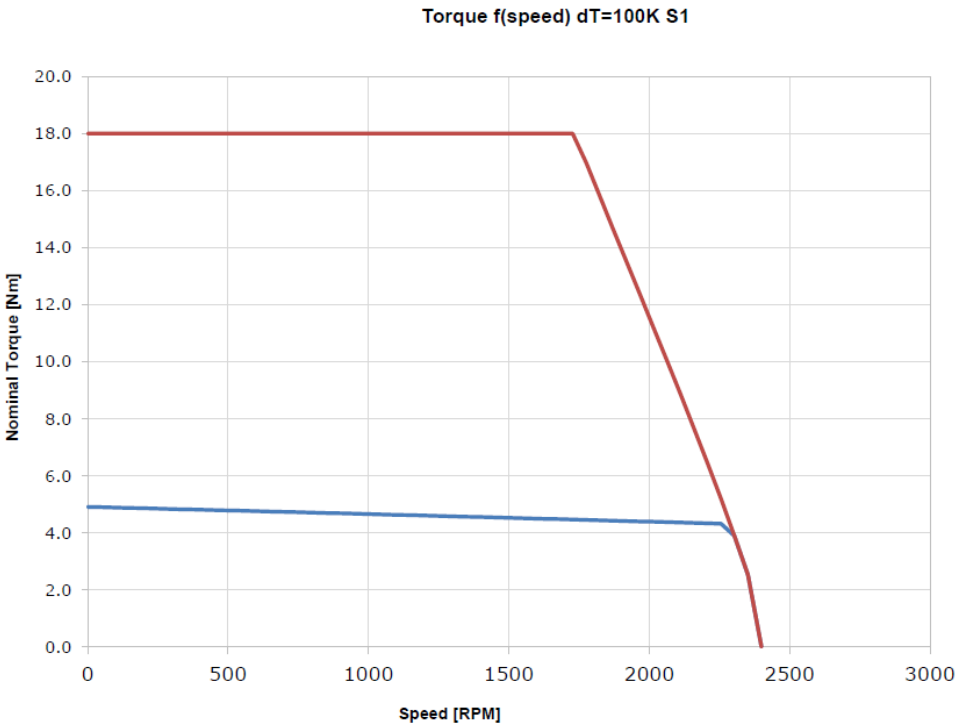


DSM534.1 230 V

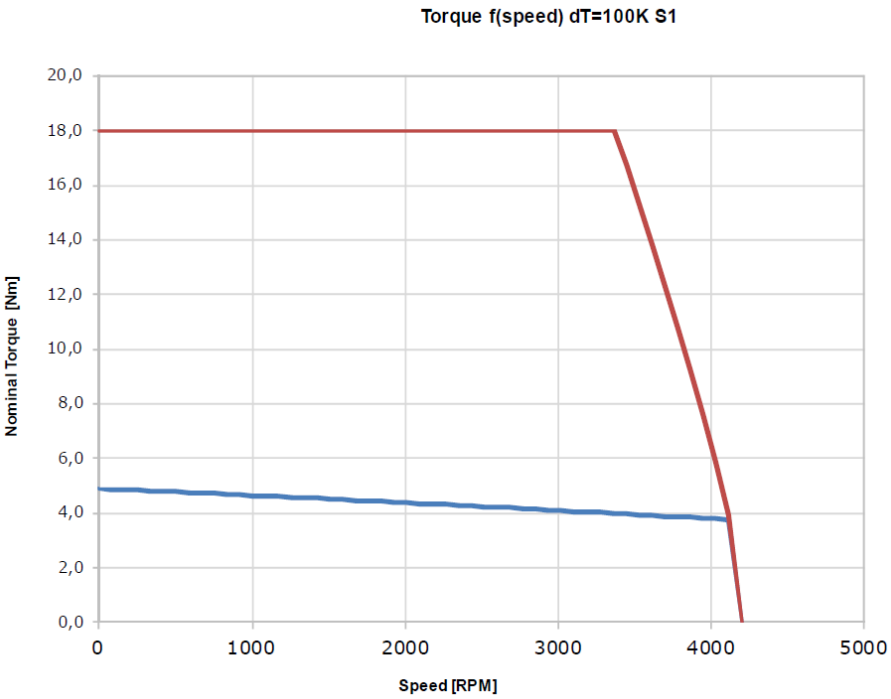
DSM534.1 400 V



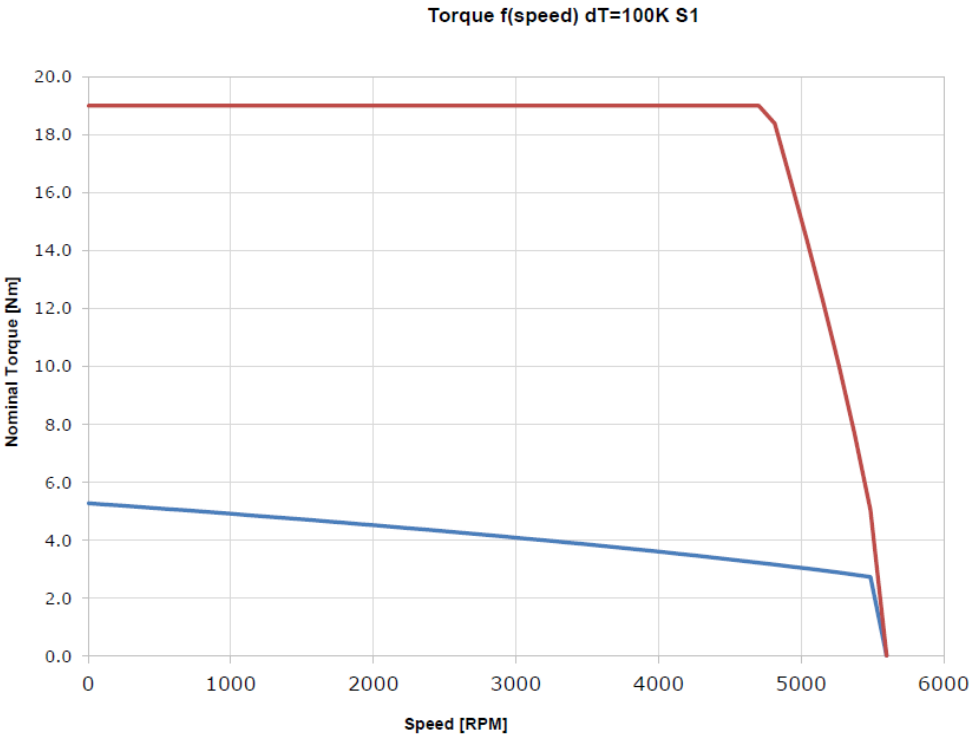
DSM534.2 230 V



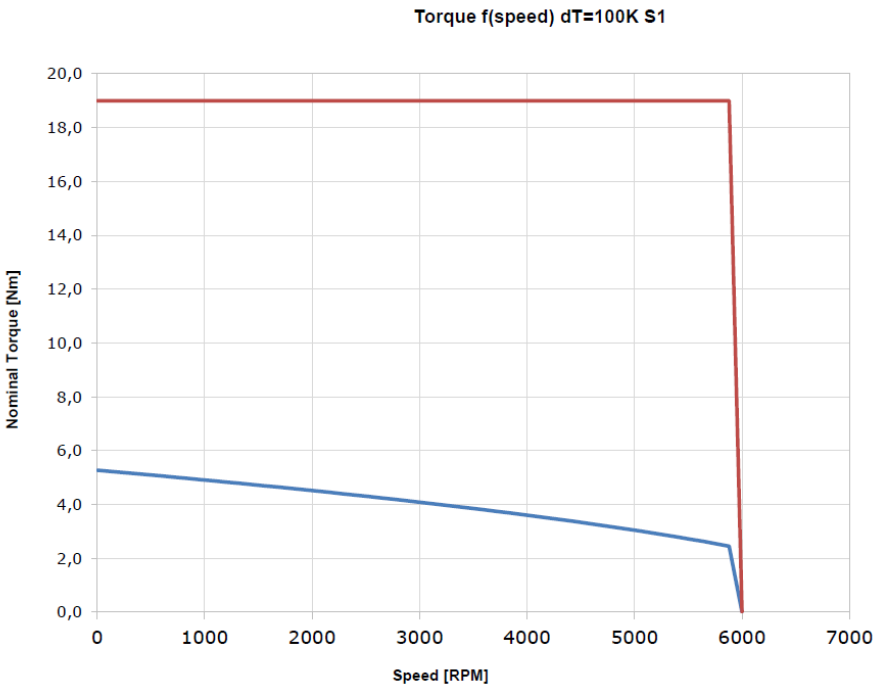
DSM534.2 400 V



DSM534.4 230 V



DSM534.4 400 V



8.7 DSM5 Size 4

8.7.1 Performance Data

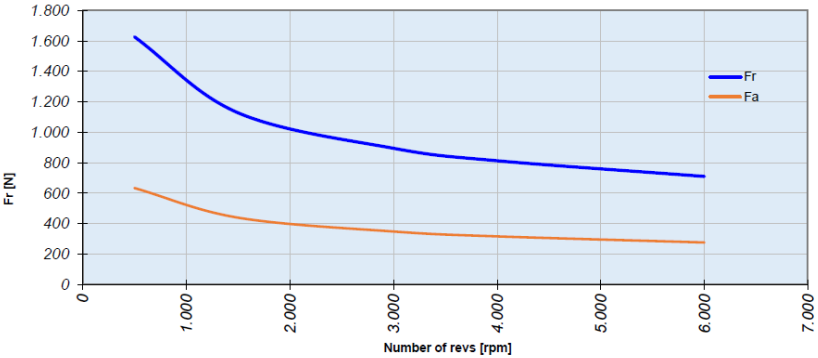
Data		Symbol [Unit]	DSM541			DSM542		
Winding code			1	2	3	1	2	4
Electrical data								
	Standstill torque	M_0 [Nm]**	4			7.6		
	Standstill current	I_{0rms} [A]**	4.4	2.5	5.4	7.8	4.7	2.8
	Max. nominal supply voltage	U_N [VAC]	480					
U_N = 230V	Nominal rotation speed	n_n [min-1]	3200	1800	4,100	3200	1800	1000
	Nominal torque*	Mn [Nm]	3.21	3.46	3.17	5.84	6.43	6.72
	Nominal power	P_n [kW]	1.08	0.65	1.36	1.96	1.21	0.70
	Rated current	I_n [A]	3.53	2.18	4.34	5.96	3.97	2.46
U_N = 400V	Nominal rotation speed	n_n [min-1]	6000	3000	6000	5000	3000	1900
	Nominal torque*	Mn [Nm]	2.7	3.35	2.77	5	6	6.38
	Nominal power	P_n [kW]	1.7	1.05	1.74	2.62	1.89	1.27
	Rated current	I_n [A]	2.97	2.11	3.79	5.10	3.70	2.34
	Peak current	I_{0max} [A]	18	10	23	32	19	11
	Peak torque	M_{0max} [Nm]	14			26		26
	Torque constant	K_{Trms} \ [Nm/A]	0.91	1.59	0.73	0.98	1.62	2.73
	Voltage constant	K_{Erms} [mVmin]	55	96	44.4	59	98	165
	Winding resistance Ph-Ph	R_{20} [Ω]	2.3	6.9	1.34	0.95	2.7	6.6
	Winding inductance Ph-Ph	L [mH]	5.6	16	3.3	2.9	7.5	19
Mechanical Data								
	Rotor inertial torque	J [kgcm²]	5			9.6		
	Number of contacts		8			8		
	Thermal time constant	t_{TH} [min]	40			54		
	Weight standard	G [kg]	5.6			8.5		

* Measuring flange Aluminum 305mm * 305mm * 15mm
** Reduction:
with integrated brake reduction by 10 %.
with integrated encoder reduction by 6 %
For motors with an encoder and brake, only the higher value applies.

Data		Symbol [Unit]	DSM543					
			1	2	3			
Electrical data								
	Standstill torque	M_0 [Nm]**	11.3					
	Standstill current	I_{0rms} [A]**	12	7	17			
	Max. nominal supply voltage	U_N [VAC]	480					
U_N = 230V	Nominal rotation speed	n_n [min-1]	3,300	1800	4,800			
	Nominal torque*	Mn [Nm]	8.56	9.54	7.29			
	Nominal power	P_n [kW]	2.96	1.80	3.66			
	Rated current	I_n [A]	8.73	5.89	10.72			
U_N = 400V	Nominal rotation speed	n_n [min-1]	5000	3000	6000			
	Nominal torque*	Mn [Nm]	7.5	8.8	6.27			
	Nominal power	P_n [kW]	3.927	2.764	3.94			
	Rated current	I_n [A]	7.65	5.43	9.22			
	Peak current	I_{0max} [A]	48	29	68			
	Peak torque	M_{0max} [Nm]	40	39				
	Torque constant	K_{Trms} \ [Nm/A]	0.98	1.62	0.68			
	Voltage constant	K_{Erms} [mVmin]	59	98	41			
	Winding resistance Ph-Ph	R_{20} [Ω]	0.5	1.5	0.24			
	Winding inductance Ph-Ph	L [mH]	1.6	4.9	0,9			
Mechanical Data								
	Rotor inertial torque	J [kgcm²]	14					
	Number of contacts		8					
	Thermal time constant	t_{TH} [min]	65					
	Weight standard	G [kg]	11.4					

* Measuring flange Aluminum 305mm * 305mm * 15mm
** Reduction:
with integrated brake reduction by 10 %.
with integrated encoder reduction by 6 %
For motors with an encoder and brake, only the higher value applies.

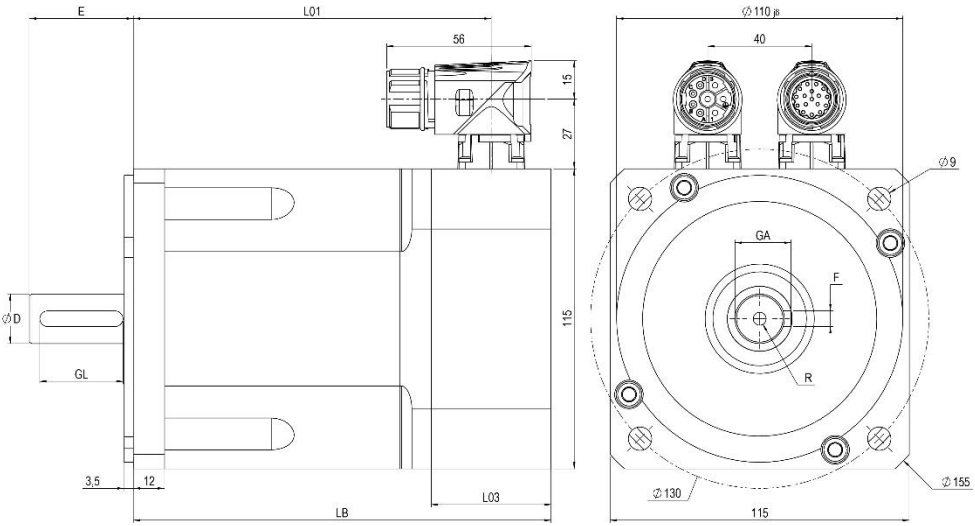
Radial and axial shaft load



8.7.2 Brake Data

Data	Symbol (Unit)	Value
Stop torque at 20 °C	M_{BR} [Nm]	18
Connection voltage	U_{BR} [VDC]	24 ± 6
Electrical power	P_{BR} [W]	24
Inertial torque	J_{BR} [kgcm²]	2.4
Release delay time	t_{BRH} [ms]	25
Application delay time	t_{BRL} [ms]	50
Brake weight	G_{BR} [kg]	1.4
Typical play	[°mech.]	0
Switching energy	E [mJ]	38

8.7.3 Mechanical Dimensions



Dimension in mm

Encoder	Resolver			Hiperface		
Dimension of	LB	L01	L03	LB	L01	L03
DSM5.41	146.5	123.5	32	160.5	137.5	46
DSM5.42	186.5	163.5		200.5	177.5	
DSM5.43	226.5	203.5		240.5	217.5	
DSM5.41 Brake	195.5	172.5		209.5	186.6	
DSM5.42 Brakes	235.5	212.5		249.5	226.5	
DSM5.43 Brakes	275.5	232.5		289.5	246.5	

Shaft dimension in mm

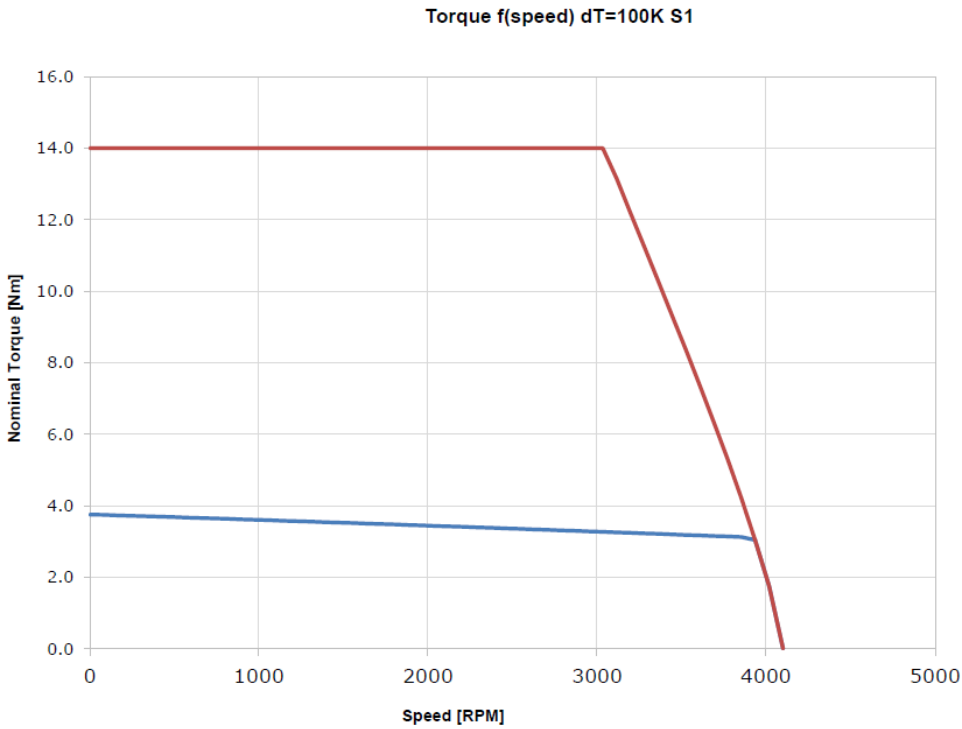
In addition to the standard shaft with parallel key, a smooth shaft is also available. See product key.

Shaft	
D	19j6
E	40
GL	32
GA	21.5
F	6
R	M6x16

8.7.4 Motor Characteristics

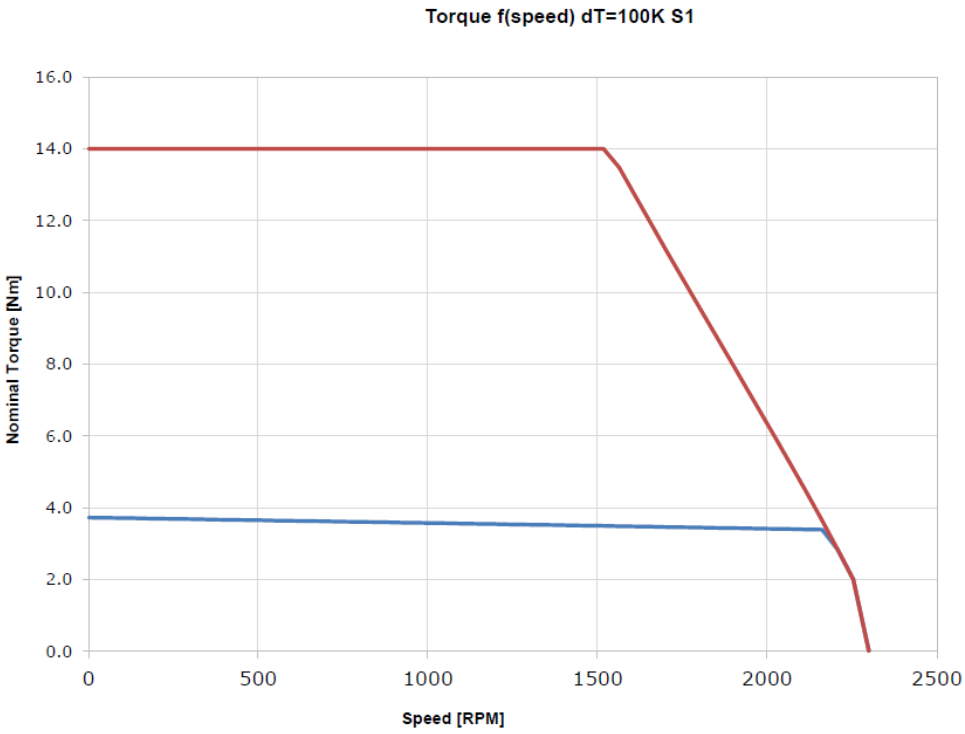
Blue line: Rated torque
Red line: Peak torque

DSM541.1 230 V



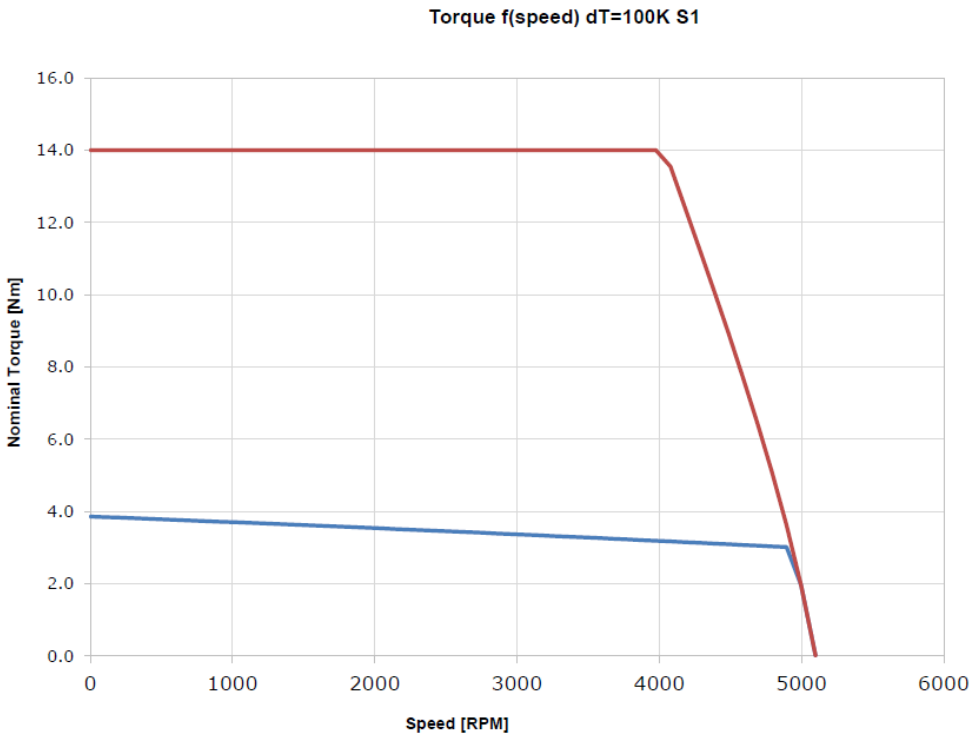
DSM541.1 400 V

DSM541.2 230 V

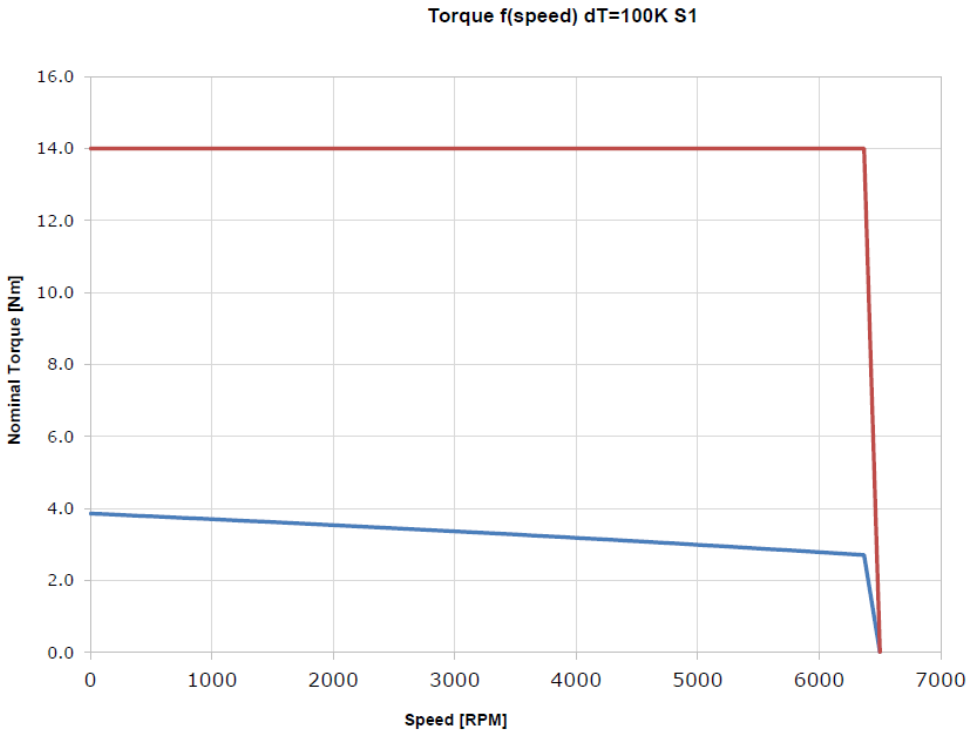


DSM541.2 400 V

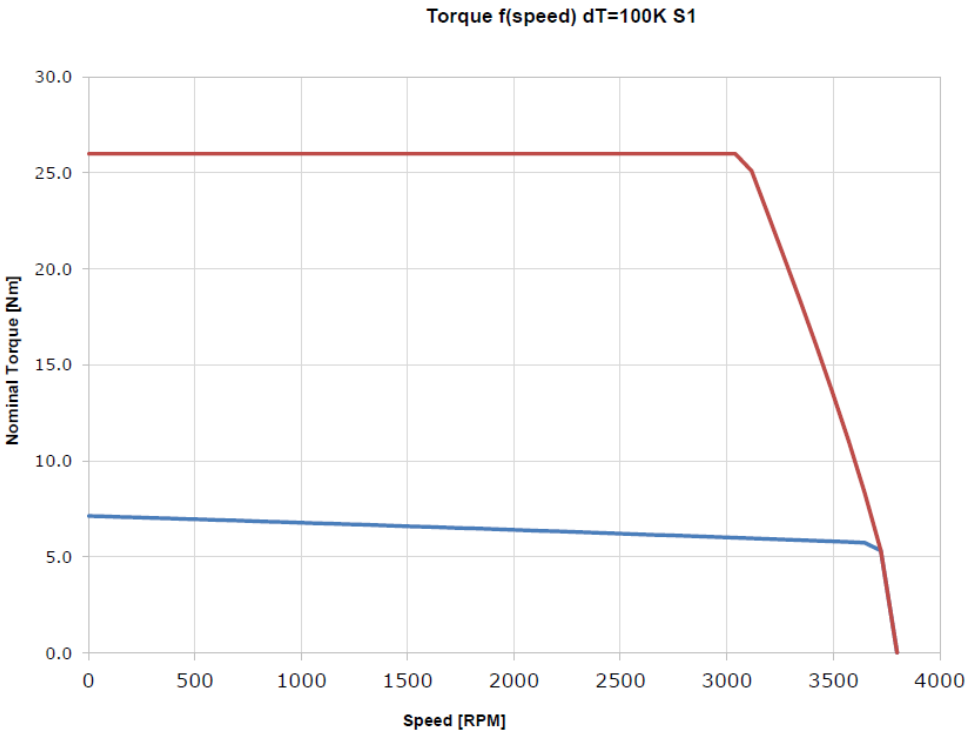
DSM541.3 230 V



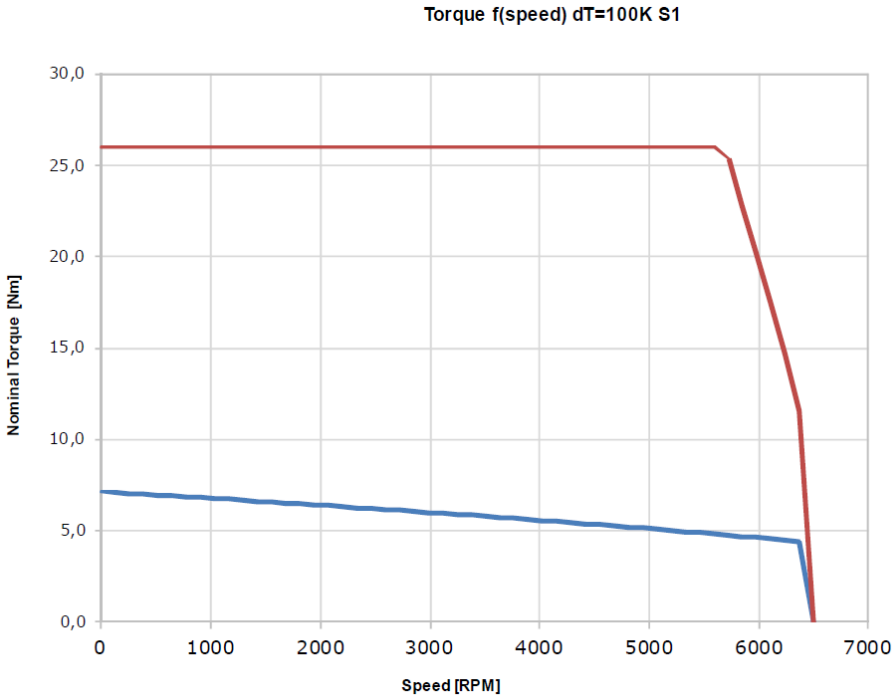
DSM541.3 400 V



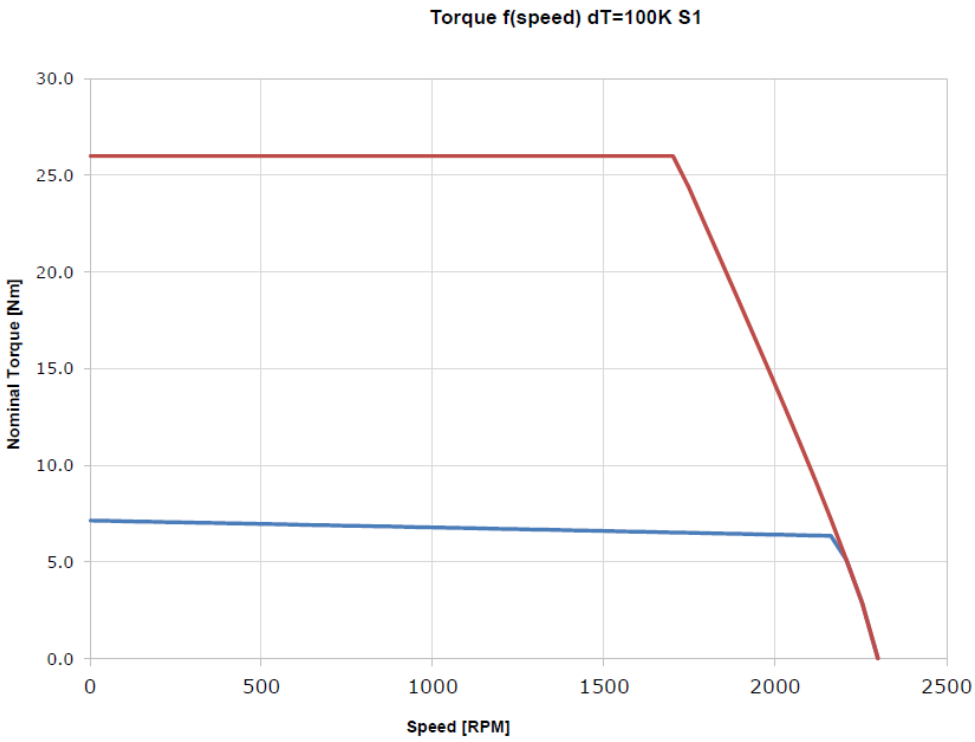
DSM542.1 230 V



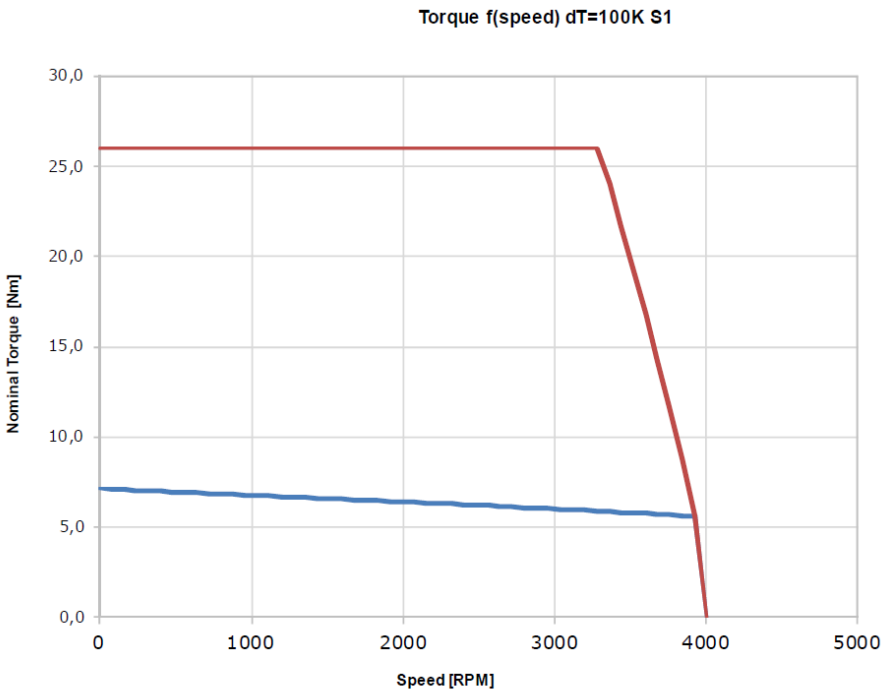
DSM542.1 400 V



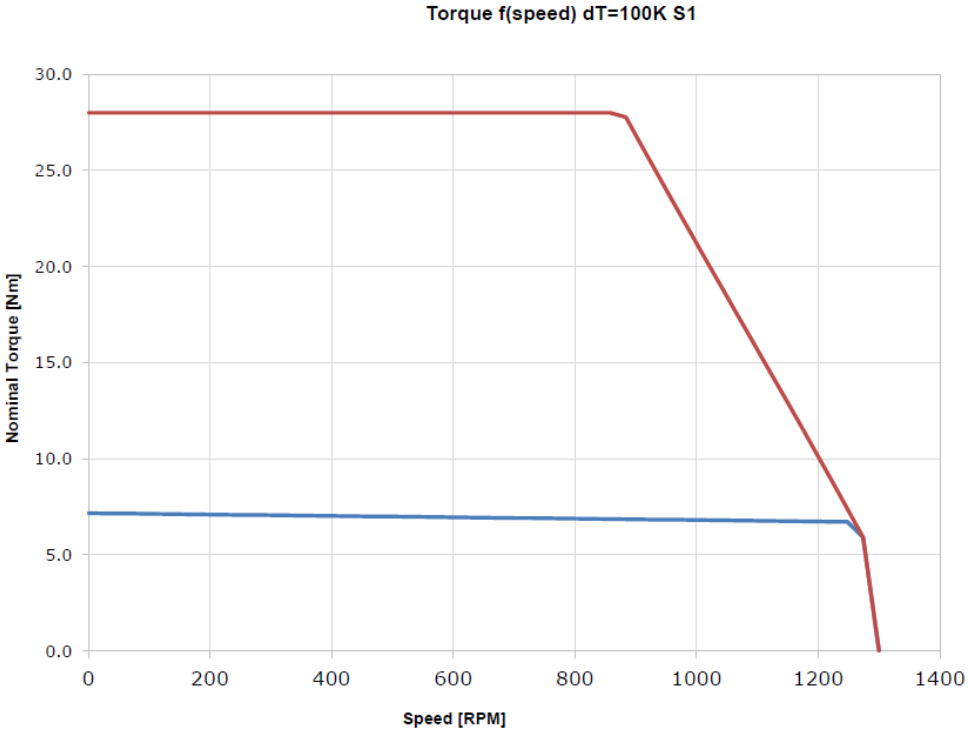
DSM542.2 230 V



DSM542.2 400 V



DSM542.4 230 V



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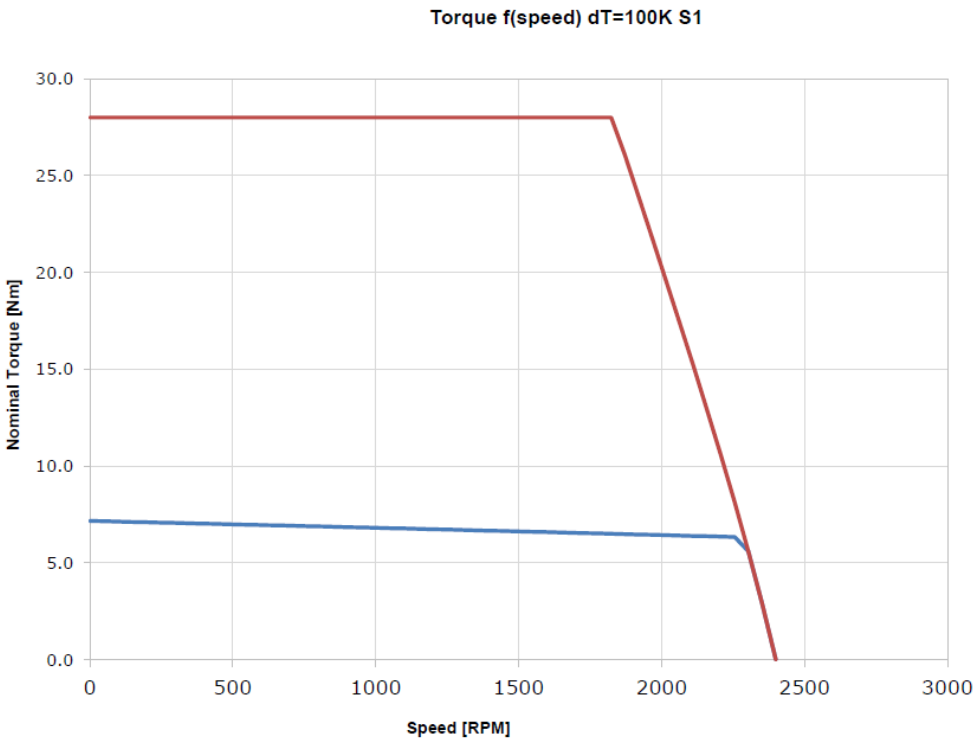
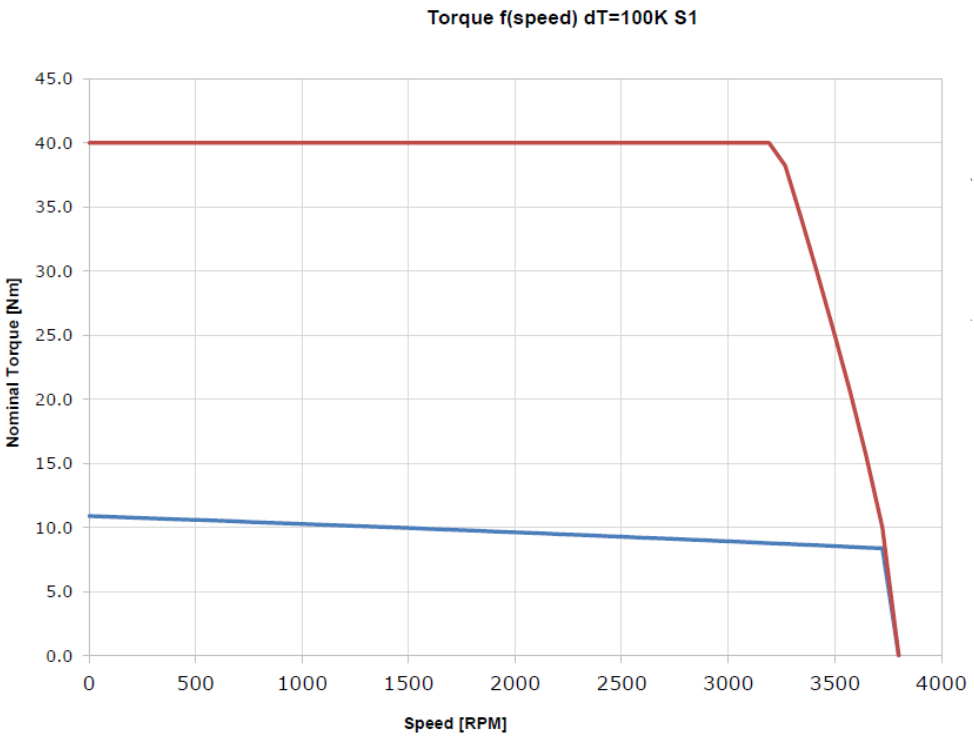
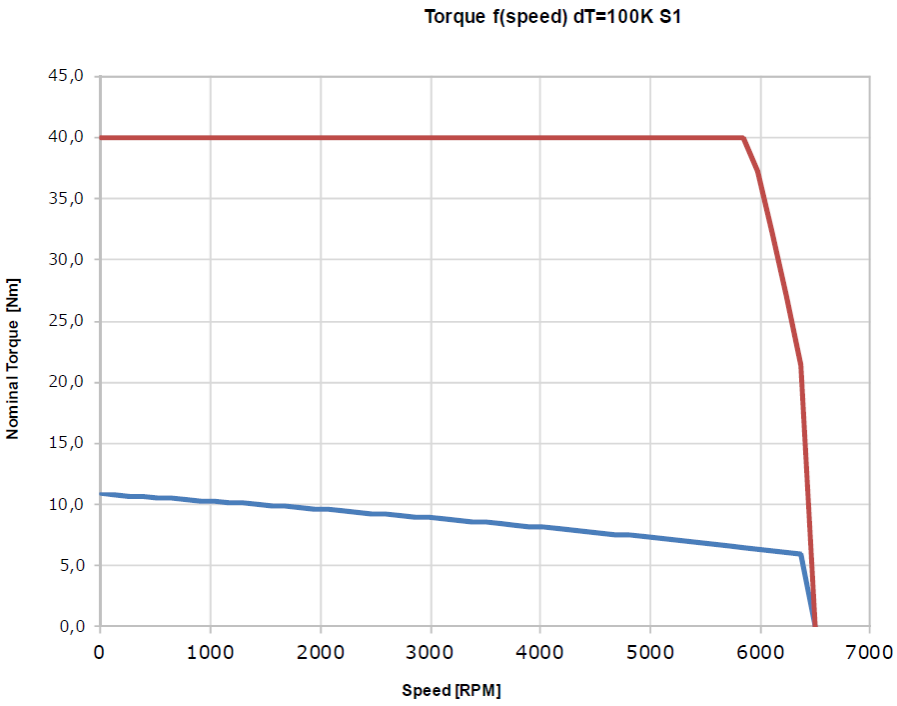


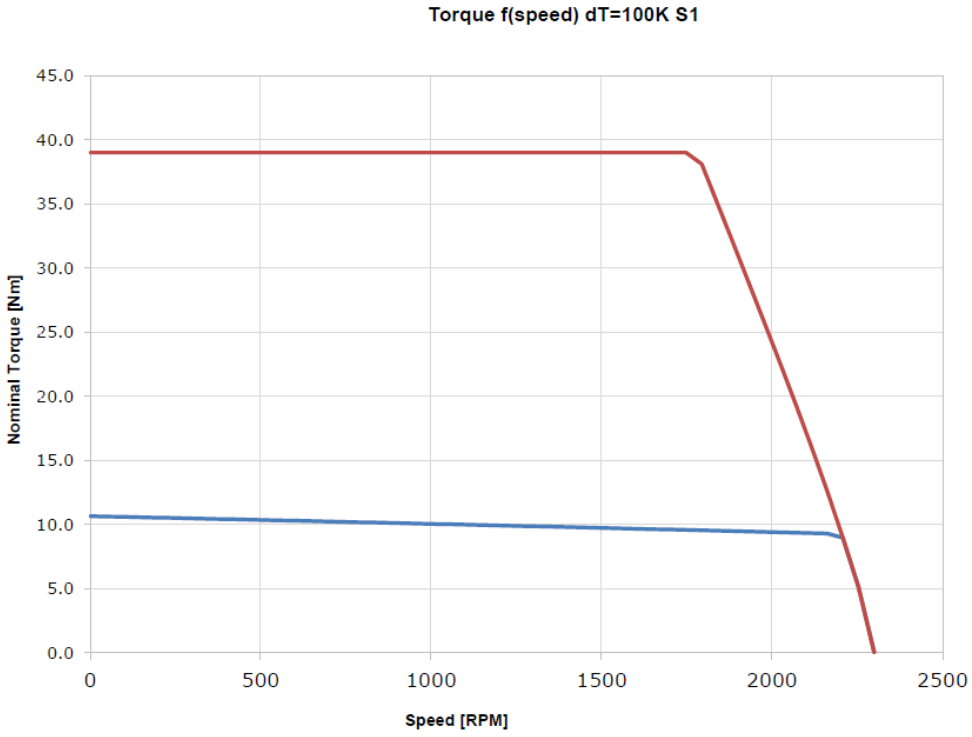
DSM543.1 230 V



DSM543.1 400 V

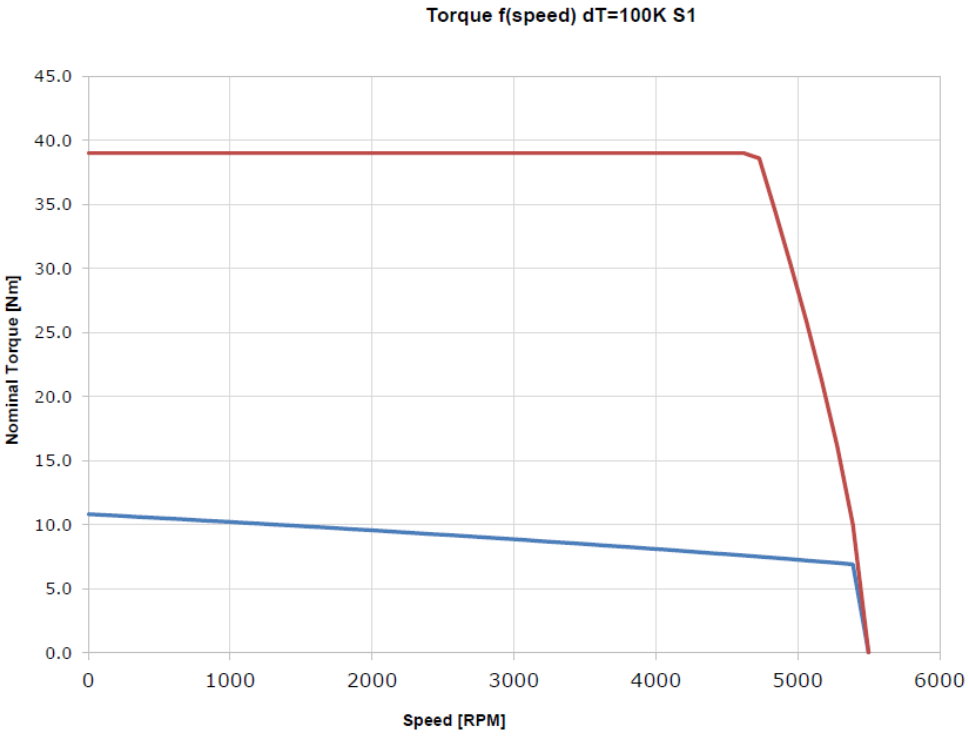


DSM543.2 230 V

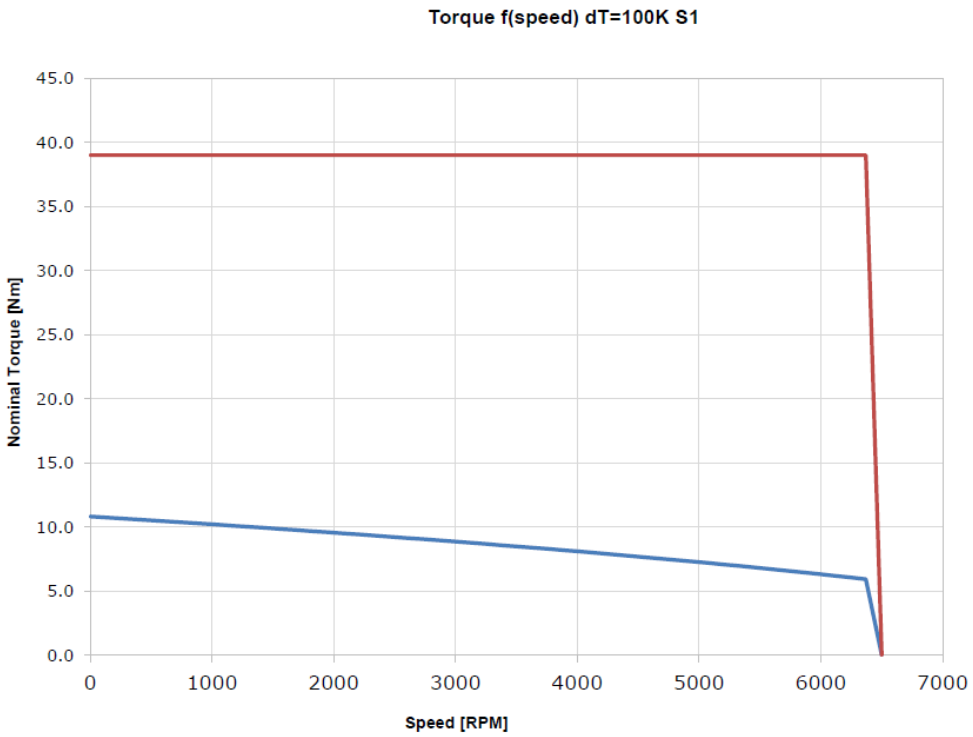


DSM543.2 400 V

DSM543.3 230 V



DSM543.3 400 V



8.8 DSM5 Size 5

8.8.1 Performance Data

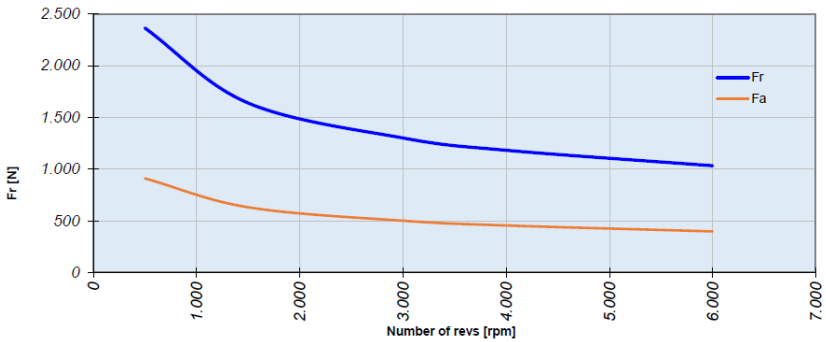
Data		Symbol [Unit]	DSM551			DSM552		
Winding code			1	2	3	1	2	3
Electrical data								
	Standstill torque	M_0 [Nm]**	10			19		
	Standstill current	I_{0rms} [A]**	9.8	6.5	12	16	12	21
	Max. nominal supply voltage	U_N [VAC]	480					
U_N = 230V	Nominal rotation speed	n_n [min-1]	3000	1900	3800			
	Nominal torque*	Mn [Nm]	8.1	8.1	7.47			
	Nominal power	P_n [kW]	2.54	1.61	2.97			
	Rated current	I_n [A]	7.94	5.26	9.22			
U_N = 400V	Nominal rotation speed	n_n [min-1]	5000	3000	6000	4,000	3000	4,000
	Nominal torque*	Mn [Nm]	7	7.8	6	10	15.2	10.2
	Nominal power	P_n [kW]	3.67	2.45	3.77	4.1	4.8	4.27
	Rated current	I_n [A]	6.86	5.06	7.41	8.3	9.87	10.97
	Peak current	I_{0max} [A]	41	27	51	64	50	82
	Peak torque	M_{0max} [Nm]	35	35	35	64	64	
	Torque constant	K_{Trms} \ [Nm/A]	1.03	1.54	0.81	1.19	1.54	0.93
	Voltage constant	K_{Erms} [mVmin]	62	93	49	72	93	56
	Winding resistance Ph-Ph	R_{20} [Ω]	0.65	1.61	0.39	0.34	0.61	0.2
	Winding inductance Ph-Ph	L [mH]	2.6	7	1.73	1.9	3.3	1.4
Mechanical Data								
	Rotor inertial torque	J [kgcm²]	22			43		
	Number of contacts		8			8		
	Thermal time constant	t_{TH} [min]	62			72		
	Weight standard	G [kg]	11			16		

* Measuring flange Aluminum 457mm * 457mm * 15mm
** Reduction:
with integrated brake reduction by 10 %.
with integrated encoder reduction by 6 %
For motors with an encoder and brake, only the higher value applies.

Data		Symbol [Unit]	DSM553				DSM554	
			1	2	3	4	1	2
Electrical data								
	Standstill torque	M_0 [Nm]**	27				35	
	Standstill current	I_{0rms} [A]**	21	15	25	9.6	25	20
	Max. nominal supply voltage	U_N [VAC]	480					
U_N = 400V	Nominal rotation speed	n_n [min-1]	3000	3000	4,000	1900	2500	2500
	Nominal torque*	Mn [Nm]	16	15.4	10	21.4	20.8	20.8
	Nominal power	P_n [kW]	5	4.8	4.19	4.26	5.4	5.4
	Rated current	I_n [A]	12.30	8.80	9.09	7.64	14.80	12.00
	Peak current	I_{0max} [A]	84	62	104	42	100	80
	Peak torque	M_{0max} [Nm]	94		94	118	118	118
	Torque constant	K_{Trms} \ [Nm/A]	1.29	1.75	1.09	2.81	1.41	1.75
	Voltage constant	K_{Erms} [mVmin]	78	106	66	170	85	106
	Winding resistance Ph-Ph	R_{20} [Ω]	0.25	0.46	0.17	1	0.18	0.32
	Winding inductance Ph-Ph	L [mH]	1.7	2.7	0.94	6.4	1.7	1.9
Mechanical Data								
	Rotor inertial torque	J [kgcm²]	65				87	
	Number of contacts		8				8	
	Thermal time constant	t_{TH} [min]	85				96	
	Weight standard	G [kg]	21				26	

* Measuring flange Aluminum 457mm * 457mm * 15mm
** Reduction:
with integrated brake reduction by 10 %.
with integrated encoder reduction by 6 %
For motors with an encoder and brake, only the higher value applies.

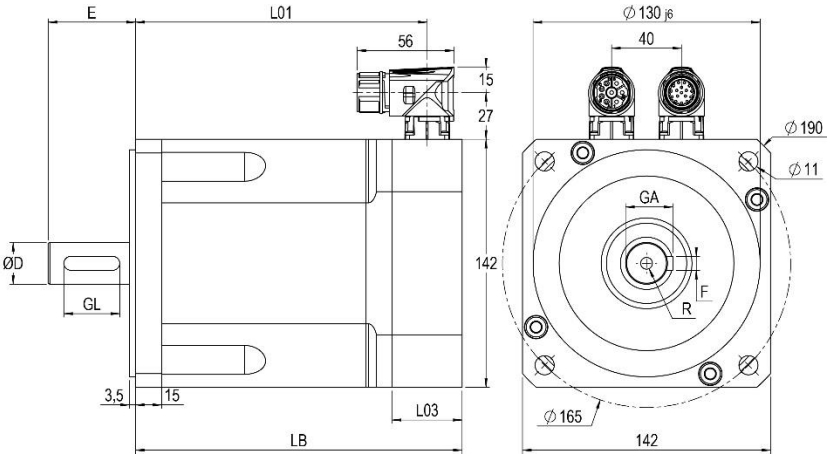
Radial and axial shaft load



8.8.2 Brake Data

Data	Symbol (Unit)	Value
Stop torque at 20 °C	M_{BR} [Nm]	40
Connection voltage	U_{BR} [VDC]	24 ± 6
Electrical power	P_{BR} [W]	24
Inertial torque	J_{BR} [kgcm²]	13.7
Release delay time	t_{BRH} [ms]	25
Application delay time	t_{BRL} [ms]	90
Brake weight	G_{BR} [kg]	3.1
Typical play	[°mech.]	0
Switching energy	E [mJ]	32

8.8.3 Mechanical Dimensions



Dimension in mm

Encoder	Resolver			Hiperface		
Dimension of	LB	L01	L03	LB	L01	L03
DSM5.51	174	154	27	187	167	40
DSM5.52	224	204		237	217	
DSM5.53	274	254		287	267	
DSM5.54	324	304		337	317	
DSM5.51 Brake	227.5	207.5		240.5	220.5	
DSM5.52 Brake	277.5	257.5		290.5	270.5	
DSM5.53 Brake	327.5	307.5		340.5	320.5	
DSM5.54 Brakes	377.5	357.5		390.5	370.5	

Shaft dimension in mm

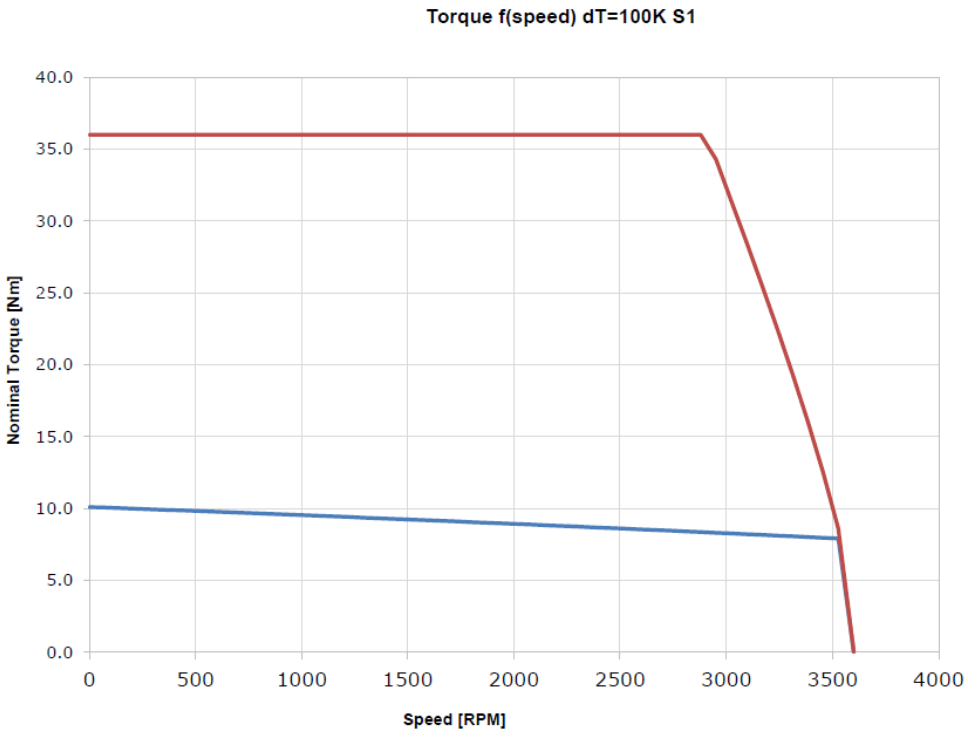
In addition to the standard shaft with parallel key, a smooth shaft is also available. See product key.

Shaft	
D	24j6
E	50
GL	32
GA	27
F	8
R	M8x15

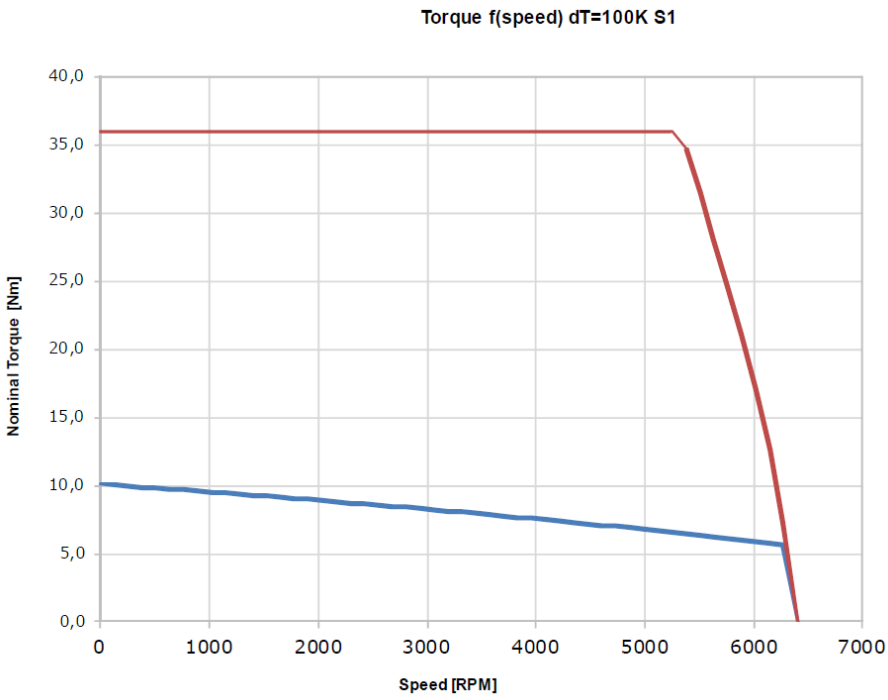
8.8.4 Motor Characteristics

Blue line: Rated torque
Red line: Peak torque

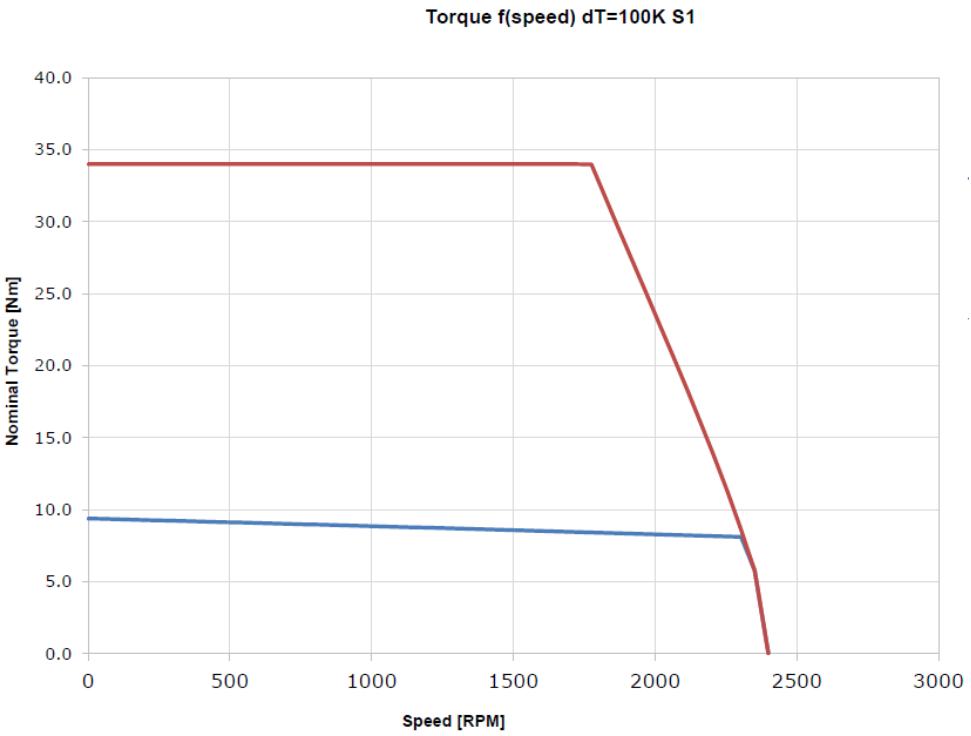
DSM551.1 230 V



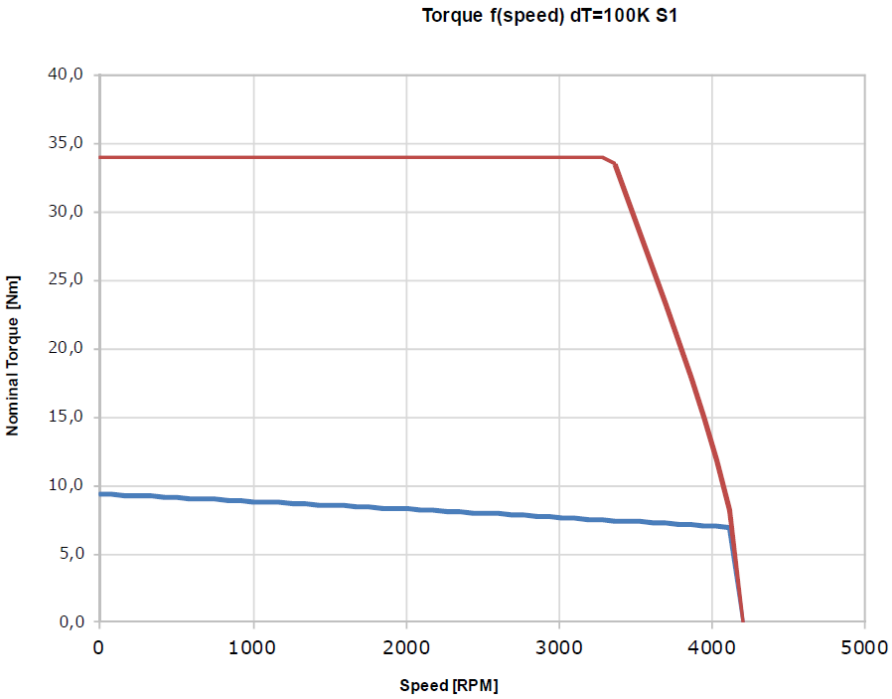
DSM551.1 400 V



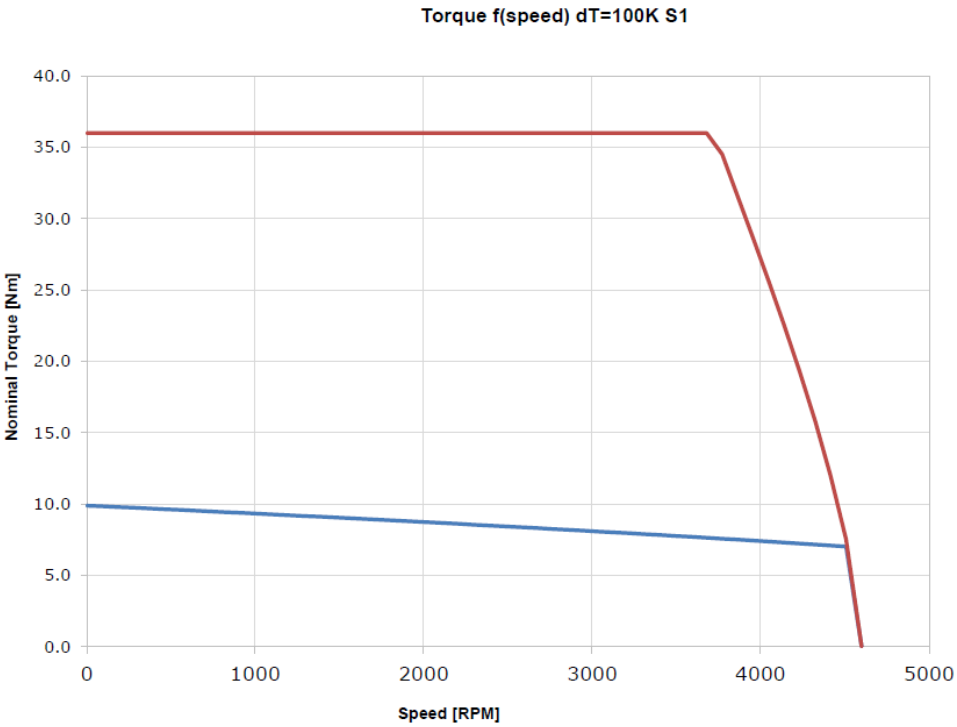
DSM551.2 230 V



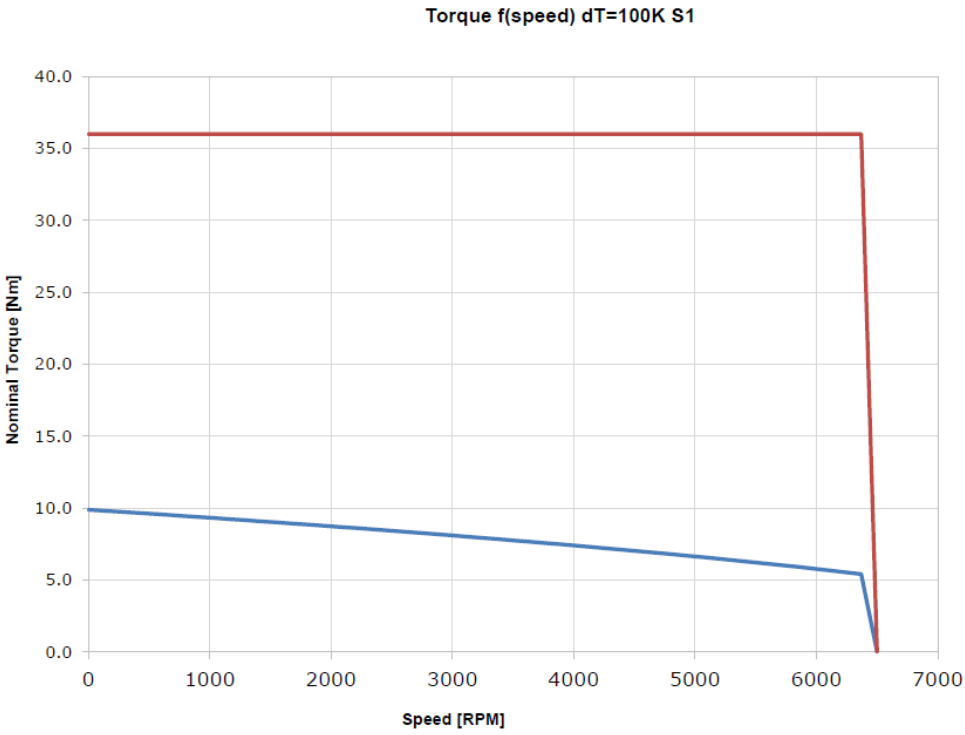
DSM551.2 400 V



DSM551.3 230 V



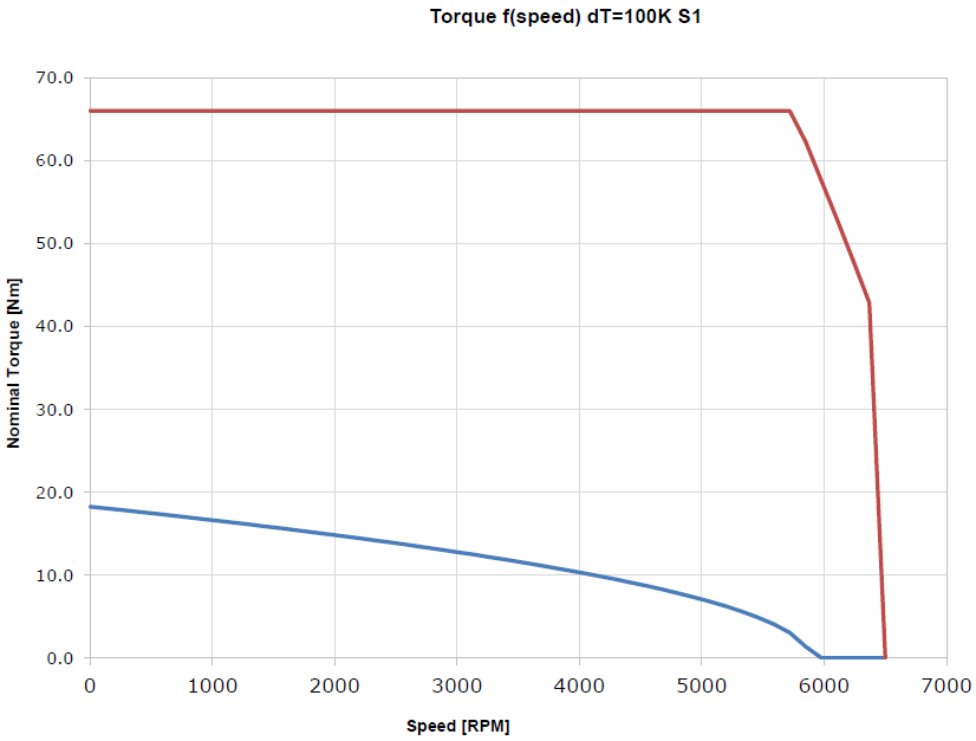
DSM551.3 400 V



DSM552.1 400 V

DSM552.2 400 V

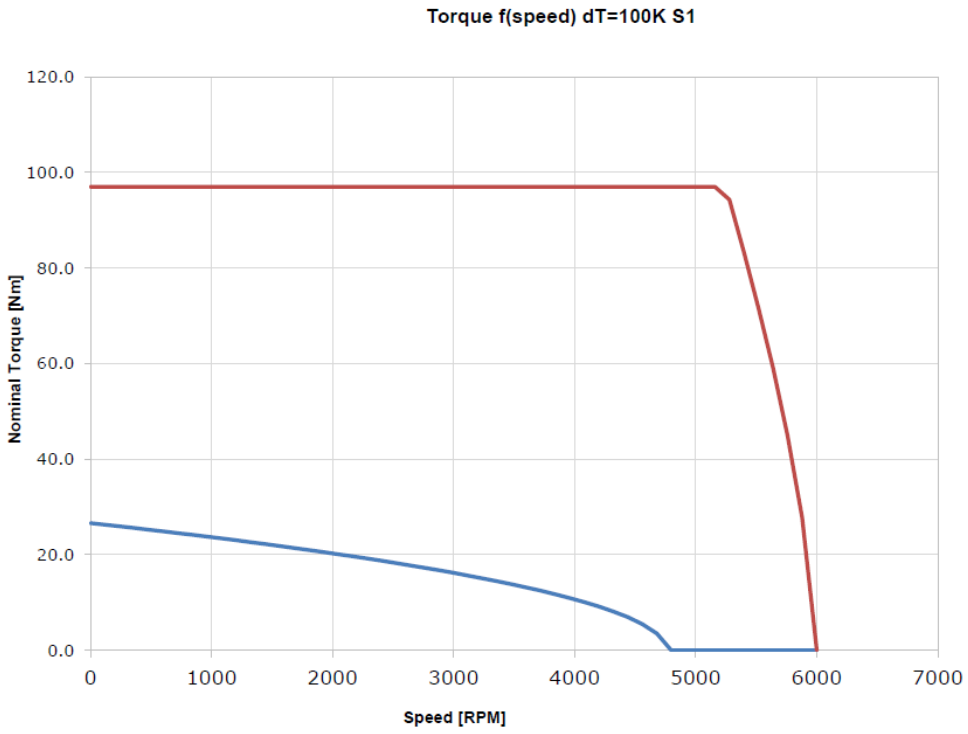
DSM552.3 400 V



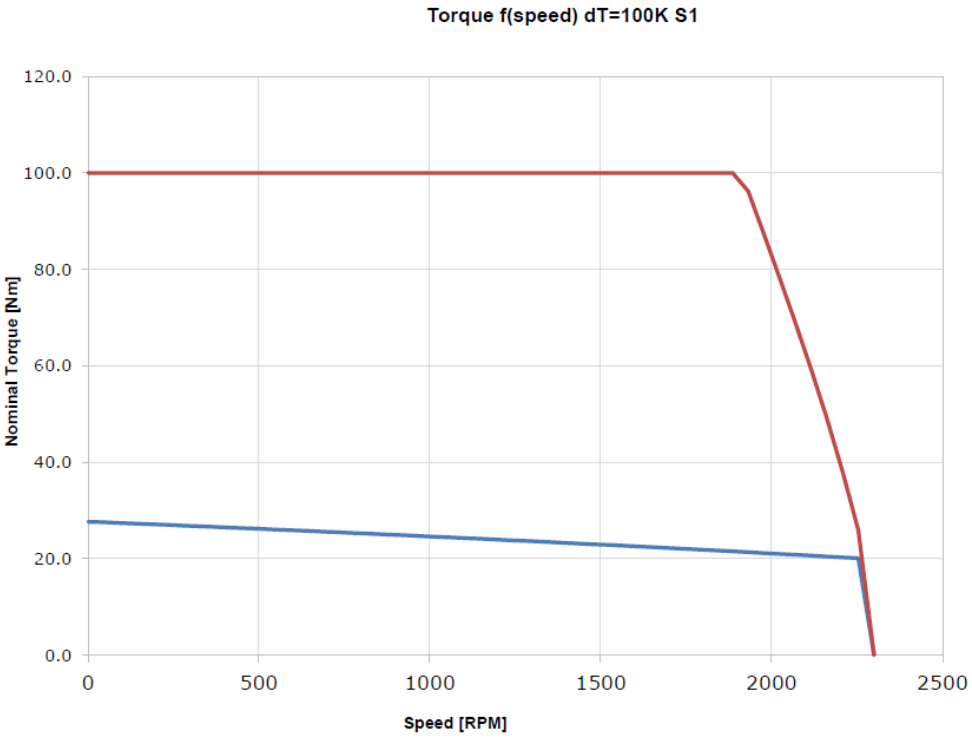
DSM553.1 400 V

DSM553.2 400 V

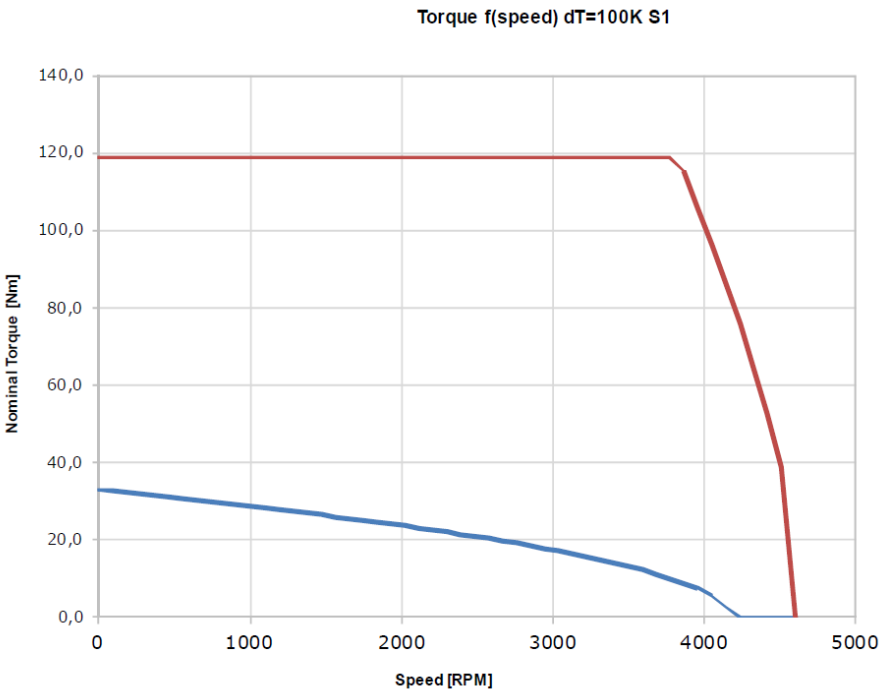
DSM553.3 400 V



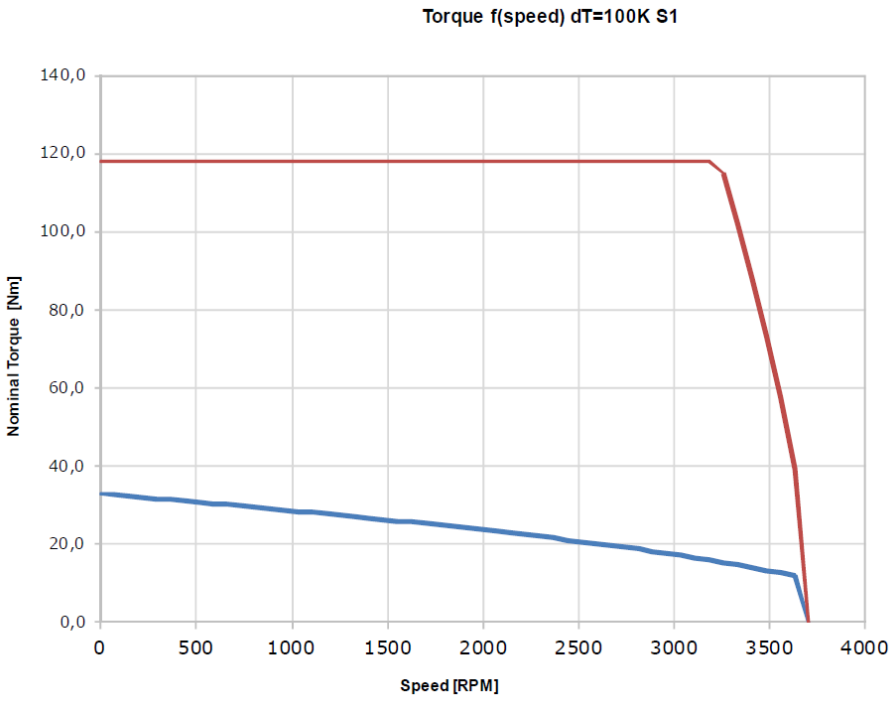
DSM553.4 400 V



DSM554.1 400 V



DSM554.2 400 V



8.9 DSM5 Size 6

8.9.1 Performance Data

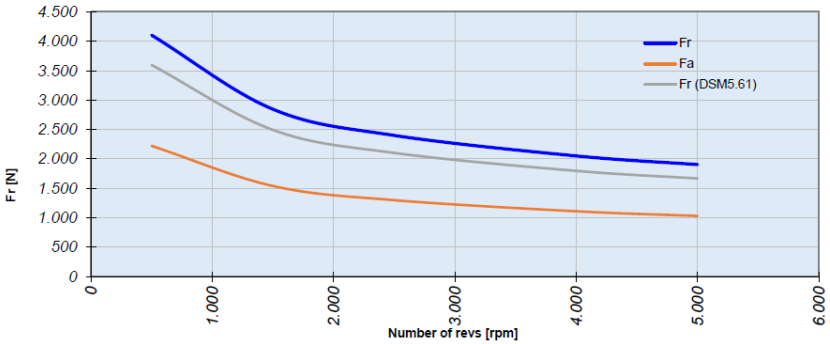
Data		Symbol [Unit]	DSM561		DSM562		DSM563	
Winding code			1	2	1	2	2	3
Electrical data								
	Standstill torque	M_0 [Nm]**	15		28		50	
	Standstill current	I_{0rms} [A]**	11	9.1	24	13	18	5
	Max. nominal supply voltage	U_N [VAC]	480					
U_N = 400V	Nominal rotation speed	n_n [min-1]	3000	2000	3000	2000	2000	500
	Nominal torque*	Mn [Nm]	10.6	12.1	17.7	21.7	27.4	43.2
	Nominal power	P_n [kW]	3.33	2.53	5.56	4.55	5.74	2.26
	Rated current	I_n [A]	8.10	7.33	15.10	9.8	9.79	4.35
	Peak current	I_{0max} [A]	37	27	72	38	55	16
	Peak torque	M_{0max} [Nm]	40	40	72		130	130
	Torque constant	K_{Trms} \ [Nm/A]	1.31	1.65	1.17	2.22	2.8	9.92
	Voltage constant	K_{Erms} [mVmin]	79	100	71	134	169	600
	Winding resistance Ph-Ph	R_{20} [Ω]	0.6	0.95	0.18	0.74	0.36	4.9
	Winding inductance Ph-Ph	L [mH]	3.4	6.5	1.2	5.3	3.2	38
Mechanical Data								
	Rotor inertial torque	J [kgcm²]	54		91		177	
	Number of contacts		8		8		8	
	Thermal time constant	t_{TH} [min]	75		90		106	
	Weight standard	G [kg]	17		23		36	

* Measuring flange Aluminum 457mm * 457mm * 15mm
** Reduction:
with integrated brake reduction by 10 %.
with integrated encoder reduction by 6 %
For motors with an encoder and brake, only the higher value applies.

Data		Symbol [Unit]	DSM564					
			3					
Electrical data								
	Standstill torque	M_0 [Nm]**	70					
	Standstill current	I_{0rms} [A]**	5					
	Max. nominal supply voltage	U_N [VAC]	480					
U_N = 400V	Nominal rotation speed	n_n [min-1]	350					
	Nominal torque*	Mn [Nm]	58					
	Nominal power	P_n [kW]	2.1					
	Rated current	I_n [A]	4.36					
	Peak current	I_{0max} [A]	16					
	Peak torque	M_{0max} [Nm]	180					
	Torque constant	K_{Trms} \ [Nm/A]	13.2					
	Voltage constant	K_{Erms} [mVmin]	800					
	Winding resistance Ph-Ph	R_{20} [Ω]	5.3					
	Winding inductance Ph-Ph	L [mH]	47					
Mechanical Data								
	Rotor inertial torque	J [kgcm²]	264					
	Number of contacts		8					
	Thermal time constant	t_{TH} [min]	115					
	Weight standard	G [kg]	50					

* Measuring flange Aluminum 457mm * 457mm * 15mm
** Reduction:
with integrated brake reduction by 10 %.
with integrated encoder reduction by 6 %
For motors with an encoder and brake, only the higher value applies.

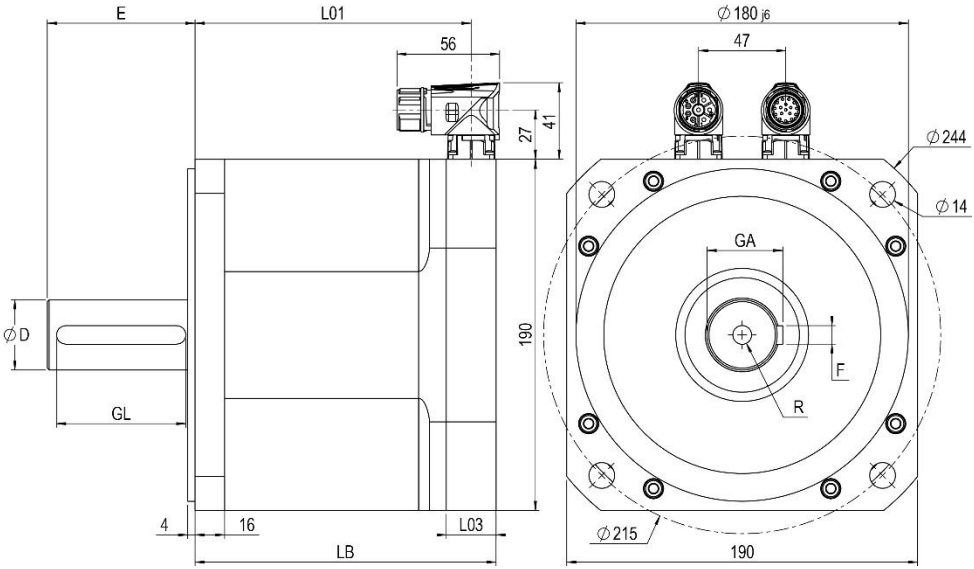
Radial and axial shaft load



8.9.2 Brake Data

Data	Symbol (Unit)	Value
Stop torque at 20 °C	M_{BR} [Nm]	70
Connection voltage	U_{BR} [VDC]	24 ± 6
Electrical power	P_{BR} [W]	35
Inertial torque	J_{BR} [kgcm²]	43.6
Release delay time	t_{BRH} [ms]	53
Application delay time	t_{BRL} [ms]	140
Brake weight	G_{BR} [kg]	6.9
Typical play	[°mech.]	0
Switching energy	E [mJ]	34

8.9.3 Mechanical Dimensions



Dimension in mm

Encoder	Resolver			Hiperface		
Dimension of	LB	L01	L03	LB	L01	L03
DSM5.61	163	139.5	27	183	159.5	47
DSM5.62	198	174.5		218	194.5	
DSM5.63	288	264.5	47	288	264.5	
DSM5.64	334.5	334.5		334.5	334.5	
DSM5.61 Brake	233.5	210	27	253.5	230	
DSM5.62 Brake	268.5	245		288.5	265	
DSM5.63 Brake	358.5	335	47	358.5	335	
DSM5.64 Brake	428.5	405		428.5	405	

Shaft dimension in mm

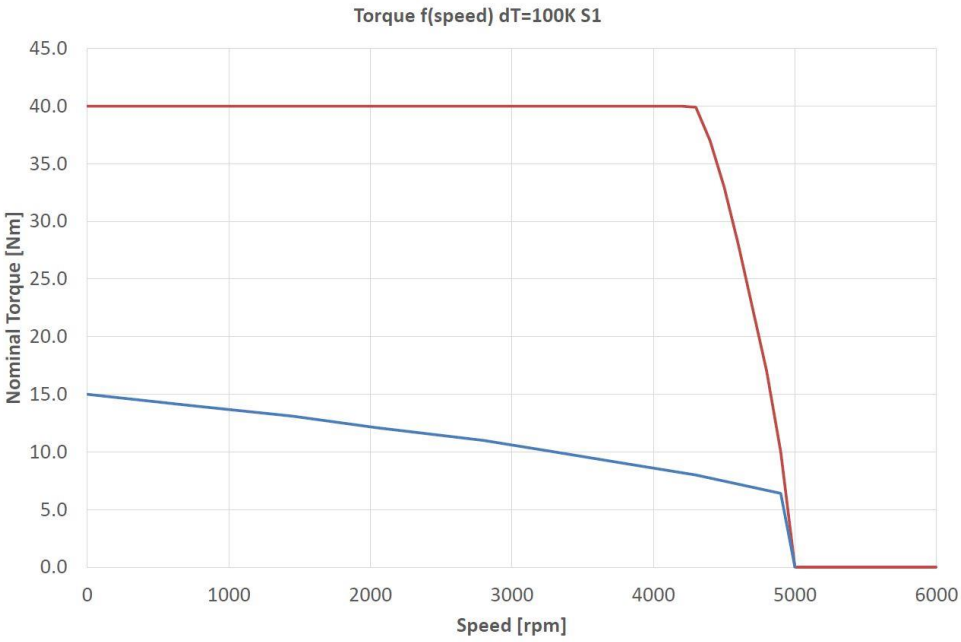
In addition to the standard shaft with parallel key, a smooth shaft is also available. See product key.

Shaft	
D	38k6
E	80
GL	70
GA	41
F	10
R	M12x28

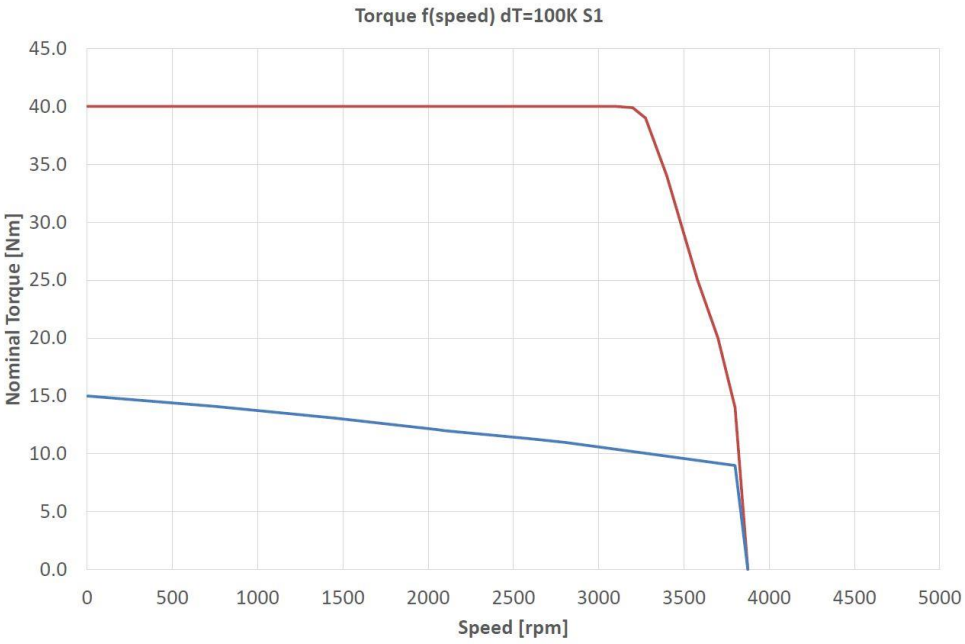
8.9.4 Motor Characteristics

Blue line: Rated torque
Red line: Peak torque

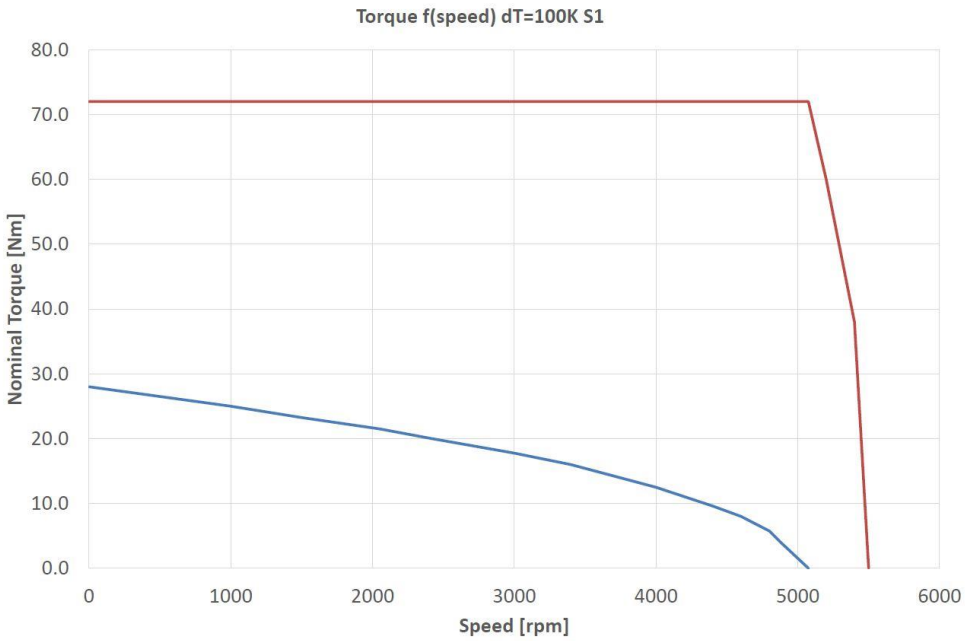
DSM561.1 400 V



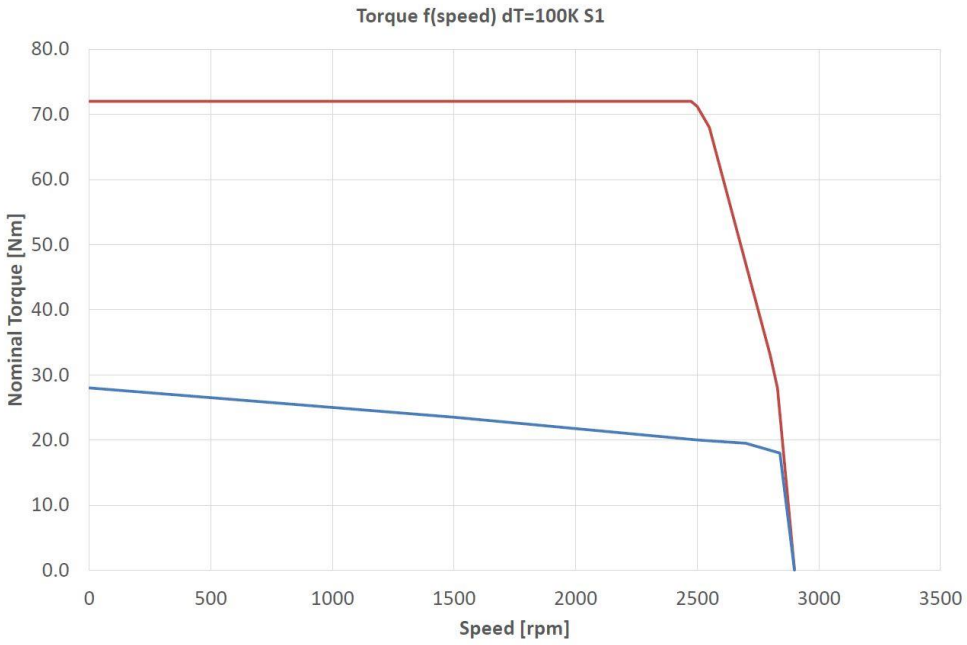
DSM561.2 400 V



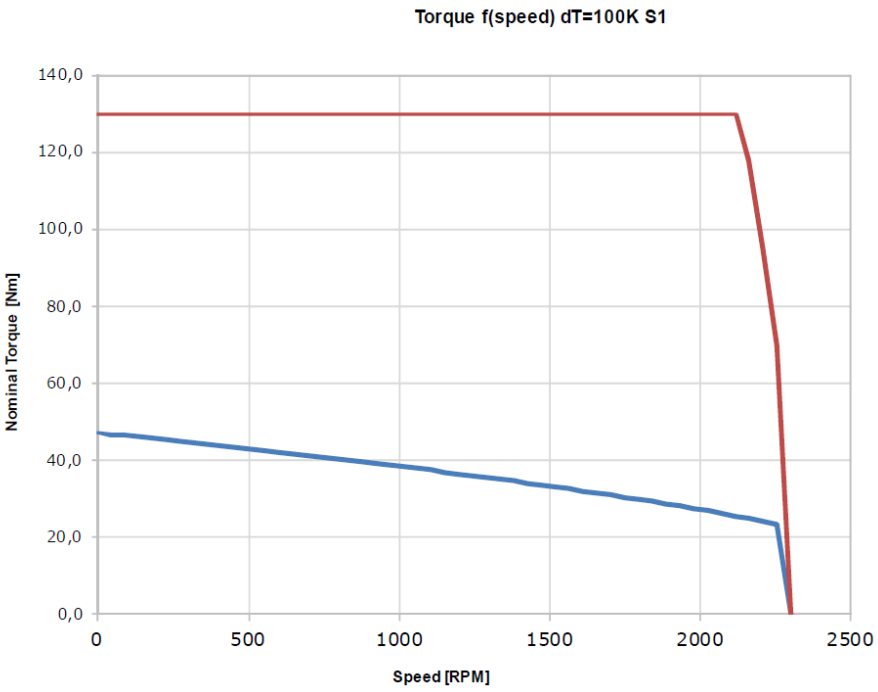
DSM562.1 400 V



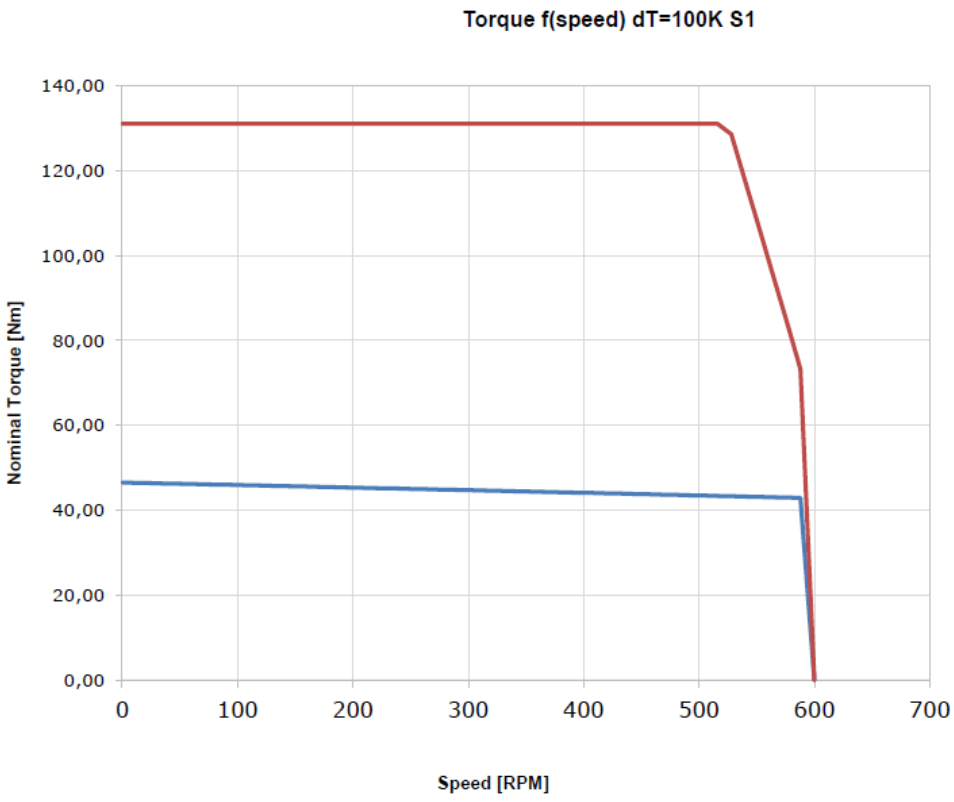
DSM562.2 400 V



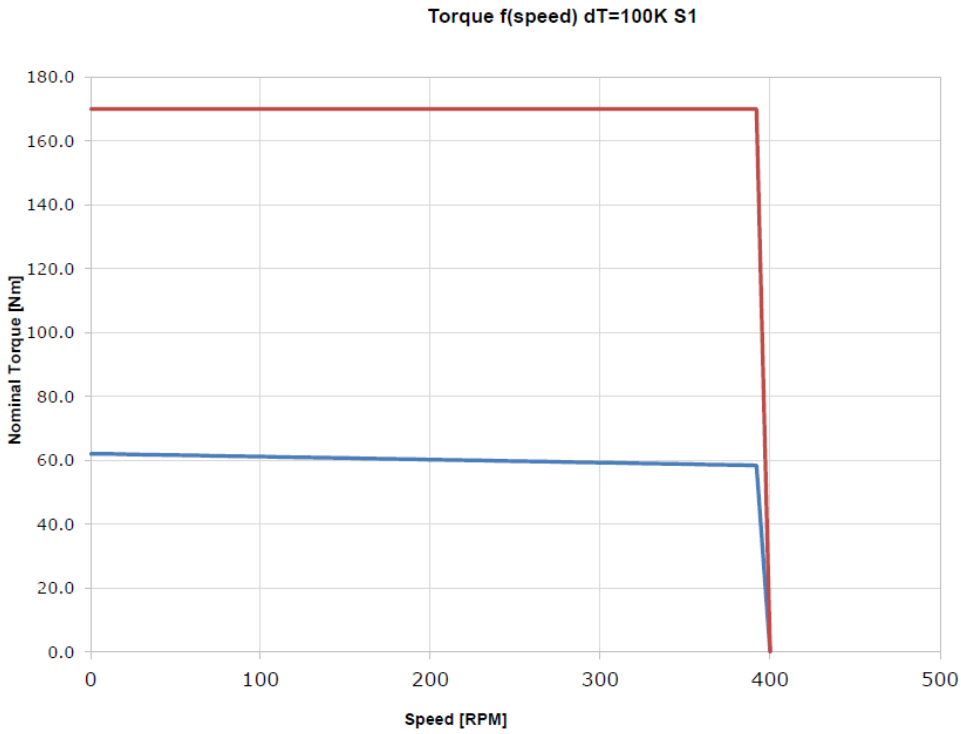
DSM563.2 400 V



DSM563.3 400 V



DSM564.3 400 V



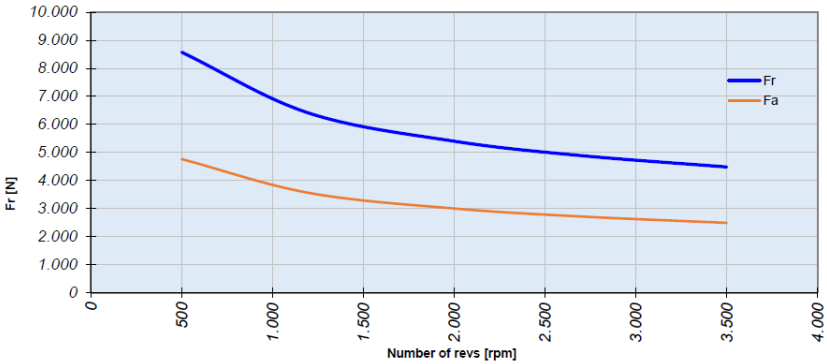
8.10 DSM5 Size 7

8.10.1 Performance Data

Data		Symbol [Unit]	DSM571					
Winding code			2					
Electrical data								
	Standstill torque	M_0 [Nm]**	76					
	Standstill current	I_{0rms} [A]**	25					
	Max. nominal supply voltage	U_N [VAC]	480					
U_N = 400V	Nominal rotation speed	n_n [min-1]	1800					
	Nominal torque*	Mn [Nm]	44.3					
	Nominal power	P_n [kW]	8.35					
	Rated current	I_n [A]	14.7					
	Peak current	I_{0max} [A]	73					
	Peak torque	M_{0max} [Nm]	200					
	Torque constant	K_{Trms} \ [Nm/A]	3.03					
	Voltage constant	K_{Erms} [mVmin]	183					
	Winding resistance Ph-Ph	R_{20} [Ω]	0.28					
	Winding inductance Ph-Ph	L [mH]	3,1					
Mechanical Data								
	Rotor inertial torque	J [kgcm²]	484					
	Number of contacts		8					
	Thermal time constant	t_{TH} [min]	100					
	Weight standard	G [kg]	50					

* Measuring flange Aluminum 457mm * 457mm * 15mm
** Reduction:
with integrated brake reduction by 10 %.
with integrated encoder reduction by 6 %
For motors with an encoder and brake, only the higher value applies.

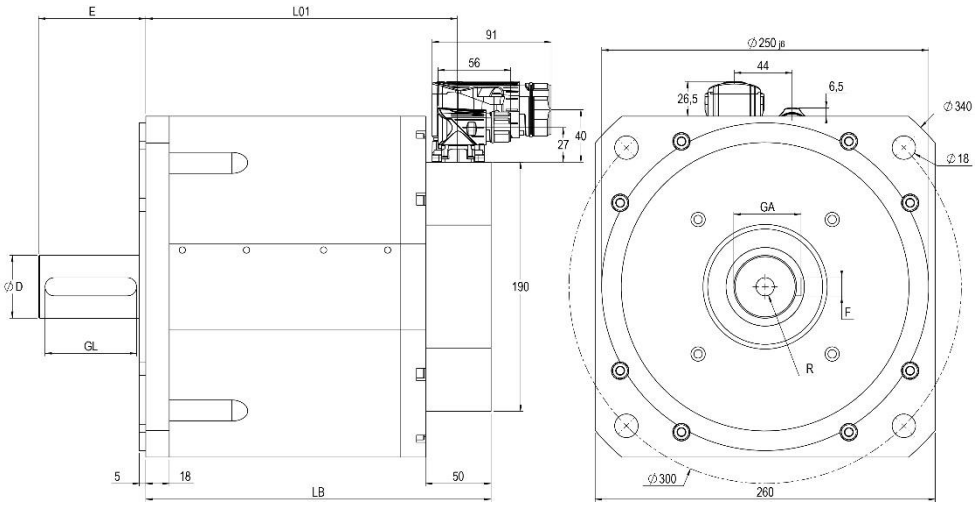
Radial and axial shaft load



8.10.2 Brake Data

Data	Symbol (Unit)	Value
Stop torque at 20 °C	M_{BR} [Nm]	120
Connection voltage	U_{BR} [VDC]	24 ± 6
Electrical power	P_{BR} [W]	37
Inertial torque	J_{BR} [kgcm²]	82.0
Release delay time	t_{BRH} [ms]	80
Application delay time	t_{BRL} [ms]	150
Brake weight	G_{BR} [kg]	13
Typical play	[°mech.]	0
Switching energy	E [mJ]	70

8.10.3 Mechanical Dimensions



Dimension in mm

Encoder	Resolver			Hiperface		
Dimension of	LB	L01	L03	LB	L01	L03
DSM5.71	261	214	47	261	214	47
DSM5.71 Brake	314	267		314	267	

Shaft dimension in mm

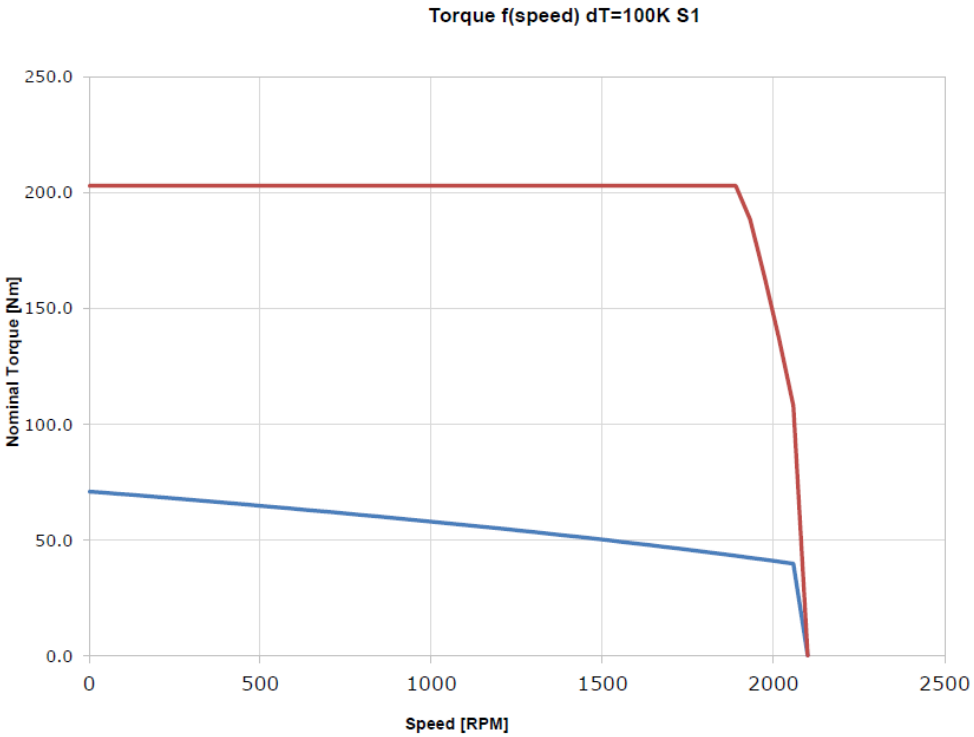
In addition to the standard shaft with parallel key, a smooth shaft is also available. See product key.

Shaft	
D	48k6
E	82
GL	70
GA	51.5
F	14
R	M16x25

8.10.4 Motor Characteristics

Blue line: Rated torque
Red line: Peak torque

DSM571.2 400 V



9 Servo Motors and Encoder Cables

Highly flexible servomotor and encoder cables for power lines. The oil resistant, abrasion and tear-proof polyurethane jacket allows for use especially in industrial environments.

Advantages:
UL and CSA-certified, halogen-free and flexible at low temperatures The cables are available in fixed lengths.

Temperature range:
Moveable: -10°C to +60 °C, fixed: -50 °C to +80 °C

Minimum bending radius:
Fixed installation 7.5 x D / flexible application: 1.5 mm² - 4.0 mm²: 10 x D starting at 4.0 mm²: 12 x D

9.1 Encoder Cable Type Code

F-R0-200-050-0-00

Encoder cable

Feedback unit used with motor:

R0	Resolver
EE	EnDat feedback for types: DA, DB, LA, LB see motor type code
EH	Hiperface feedback for types: GA, GB, GD see motor type code
IG	Incremental encoder

For the DSL one cable solution (W, Y) no encoder cable is needed.
The encoder cable is integrated in the motor cable.

Drive:

200	MDP/MDD 2000
300	SDD 310
	SDD 315
	SDD 215
	SDD 120
	MDD 1x1
	MDD 1x1-1
061	DC 061
062	DC 062

Version:

00	Standard
xx	Special

Connection type: (motor side)

0	Standard (M23 round plug)
1	ytec plug
2	Tyco plug
3	Molex plug
x	Special

Cable length:

010	1 m
015	1.5 m
020	2 m
030	3 m
040	4 m
050	5 m
100	10 m
150	15 m
200	20 m
300	30 m

Example of article number composition:
Encoder cable for motor with resolver as feedback, standard configuration, cable length 5 m

9.2 Encoder Cables

Sensor cables, shielded, preassembled on both ends, drag chain suitable and highly flexible (5 Mil. bend cycles) cables with round plugs on the motor side and device connectors.

Description	Encoder Type	Length	Outer Diameter
for MDP/MDD 2000			
F-R0-200-010-0-00	Resolver	1 meter	ca. 6.4 mm
F-R0-200-020-0-00	Resolver	2 meters	ca. 6.4 mm
F-R0-200-030-0-00	Resolver	3 meters	ca. 6.4 mm
F-R0-200-040-0-00	Resolver	4 meters	ca. 6.4 mm
F-R0-200-050-0-00	Resolver	5 meters	ca. 6.4 mm
F-R0-200-100-0-00	Resolver	10 meters	ca. 6.4 mm
F-R0-200-150-0-00	Resolver	15 meters	ca. 6.4 mm
F-R0-200-200-0-00	Resolver	20 meters	ca. 6.4 mm
F-EH-200-010-0-00	Hiperface	1 meter	ca. 7.8 mm
F-EH-200-020-0-00	Hiperface	2 meters	ca. 7.8 mm
F-EH-200-030-0-00	Hiperface	3 meters	ca. 7.8 mm
F-EH-200-040-0-00	Hiperface	4 meters	ca. 7.8 mm
F-EH-200-050-0-00	Hiperface	5 meters	ca. 7.8 mm
F-EH-200-100-0-00	Hiperface	10 meters	ca. 7.8 mm
F-EH-200-150-0-00	Hiperface	15 meters	ca. 7.8 mm
F-EH-200-200-0-00	Hiperface	20 meters	ca. 7.8 mm

Description	Encoder Type	Length	Outer Diameter
for SDD 310 / 315 / 335 / 215 / 120 for MDD 111-1/121-1			
F-R0-300-010-0-00	Resolver	1 meter	ca. 6.4 mm
F-R0-300-020-0-00	Resolver	2 meters	ca. 6.4 mm
F-R0-300-030-0-00	Resolver	3 meters	ca. 6.4 mm
F-R0-300-040-0-00	Resolver	4 meters	ca. 6.4 mm
F-R0-300-050-0-00	Resolver	5 meters	ca. 6.4 mm
F-R0-300-100-0-00	Resolver	10 meters	ca. 6.4 mm
F-R0-300-150-0-00	Resolver	15 meters	ca. 6.4 mm
F-R0-300-200-0-00	Resolver	20 meters	ca. 6.4 mm
F-EH-300-010-0-00	Hiperface	1 meter	ca. 7.8 mm
F-EH-300-020-0-00	Hiperface	2 meters	ca. 7.8 mm
F-EH-300-030-0-00	Hiperface	3 meters	ca. 7.8 mm
F-EH-300-040-0-00	Hiperface	4 meters	ca. 7.8 mm
F-EH-300-050-0-00	Hiperface	5 meters	ca. 7.8 mm
F-EH-300-100-0-00	Hiperface	10 meters	ca. 7.8 mm
F-EH-300-150-0-00	Hiperface	15 meters	ca. 7.8 mm
F-EH-300-200-0-00	Hiperface	20 meters	ca. 7.8 mm

Description	Encoder Type	Length	Outer Diameter
For DC 061-1/101			
F-R0-061-015-0-00	Resolver	1.5 meters	ca. 6.4 mm
F-R0-061-030-0-00	Resolver	3 meters	ca. 6.4 mm
F-R0-061-050-0-00	Resolver	5 meters	ca. 6.4 mm
F-R0-061-100-0-00	Resolver	10 meters	ca. 6.4 mm
F-EH-300-010-0-00	Hiperface	1 meter	ca. 7.8 mm
F-EH-300-020-0-00	Hiperface	2 meters	ca. 7.8 mm
F-EH-300-030-0-00	Hiperface	3 meters	ca. 7.8 mm
F-EH-300-040-0-00	Hiperface	4 meters	ca. 7.8 mm
F-EH-300-050-0-00	Hiperface	5 meters	ca. 7.8 mm
F-EH-300-100-0-00	Hiperface	10 meters	ca. 7.8 mm
F-EH-300-150-0-00	Hiperface	15 meters	ca. 7.8 mm
F-EH-300-200-0-00	Hiperface	20 meters	ca. 7.8 mm

9.3 Motor Cable Type Code

M 200 B-15-0-050-0-00

Motor cable

Drive:

200	MDP/MDD 2000
310	SDD 310
	SDD 315
	SDD 215
	SDD 120
100	MDD 111
	MDD121
101	MDD 111-1
	MDD 121-1
061	DC 061-1
062	DC 062

Assembly:

B	both sides
*E	one-sided

*with y-tec only one side is possible

Cable cross section:

*10	1.0 mm²
15	1.5 mm²
25	2.5 mm²
40	4.0 mm²

*with DC and MDD 10X, only 10 possible

Version:

00	Standard
01	drive type 310 only without shield plate
*02	Hiperface DSL (only Drive type 200)
03	Motor thermostat (only Drive type 200)
x	Special

*for encoder types W and Y

Conncetion type: (motor side)

0	Standard (M23 round plug)
1	ytec plug
2	Tyco plug
3	Molex plug
4	M40 Round connectors
x	Special

Cable length:

*010	1 m
**015	1.5 m
*020	2 m
* **030	3 m
*040	4 m
050	5 m
100	10 m
150	15 m
200	20 m
250	25 m
300	30 m

*possible for MDD only
**possible for DC only

Brake:*

0	no brake
1	brake (+2x0.5 mm²)

*only MDD with brake

Example of article number composition:
Motor cable for MDD type 2000, assembled on both sides, wire cross section 1.5 mm², withou brake, cable length 5 m, Standard configuration

9.4 Motor cable

For motors with or without holding brakes, shielded, preassembled on both sides, drag chain suitable and highly flexible (5 bend cycles) cables with round plugs on the motor side and module connectors.

Description	Length	Cable diameter	Outer Diameter
for MDP/MDD 2000			
M200B-15-1-010-0-00	1 meter	1.5 mm^2	12
M200B-15-1-020-0-00	2 meters	1.5 mm^2	12
M200B-15-1-030-0-00	3 meters	1.5 mm^2	12
M200B-15-1-040-0-00	4 meters	1.5 mm^2	12
M200B-15-1-050-0-00	5 meters	1.5 mm^2	12
M200B-15-1-100-0-00	10 meters	1.5 mm^2	12
M200B-15-1-150-0-00	15 meters	1.5 mm^2	12
M200B-15-1-200-0-00	20 meters	1.5 mm^2	12
M200B-25-1-010-0-00	1 meter	2.5 mm^2	13.2
M200B-25-1-020-0-00	2 meters	2.5 mm^2	13.2
M200B-25-1-030-0-00	3 meters	2.5 mm^2	13.2
M200B-25-1-040-0-00	4 meters	2.5 mm^2	13.2
M200B-25-1-050-0-00	5 meters	2.5 mm^2	13.2
M200B-25-1-100-0-00	10 meters	2.5 mm^2	13.2
M200B-25-1-150-0-00	15 meters	2.5 mm^2	13.2
M200B-25-1-200-0-00	20 meters	2.5 mm^2	13.2

M200B-40-1-010-4-00	1 meter	4.0 mm^2	14.8
M200B-40-1-020-4-00	2 meters	4.0 mm^2	14.8
M200B-40-1-030-4-00	3 meters	4.0 mm^2	14.8
M200B-40-1-040-4-00	4 meters	4.0 mm^2	14.8
M200B-40-1-050-4-00	5 meters	4.0 mm^2	14.8
M200B-40-1-100-4-00	10 meters	4.0 mm^2	14.8
M200B-40-1-150-4-00	15 meters	4.0 mm^2	14.8
M200B-40-1-200-4-00	20 meters	4.0 mm^2	14.8

Description	Length	Cable diameter	Outer Diameter
for MDP/MDD 2000 Hiperface DSL single-cable solution			
M200B-15-1-010-0-02	1 meter	1.5 mm^2	13.2
M200B-15-1-020-0-02	2 meters	1.5 mm^2	13.2
M200B-15-1-030-0-02	3 meters	1.5 mm^2	13.2
M200B-15-1-040-0-02	4 meters	1.5 mm^2	13.2
M200B-15-1-050-0-02	5 meters	1.5 mm^2	13.2
M200B-15-1-100-0-02	10 meters	1.5 mm^2	13.2
M200B-15-1-150-0-02	15 meters	1.5 mm^2	13.2
M200B-15-1-200-0-02	20 meters	1.5 mm^2	13.2
M200B-25-1-010-0-02	1 meter	2.5 mm^2	14
M200B-25-1-020-0-02	2 meters	2.5 mm^2	14
M200B-25-1-030-0-02	3 meters	2.5 mm^2	14
M200B-25-1-040-0-02	4 meters	2.5 mm^2	14
M200B-25-1-050-0-02	5 meters	2.5 mm^2	14
M200B-25-1-100-0-02	10 meters	2.5 mm^2	14
M200B-25-1-150-0-02	15 meters	2.5 mm^2	14
M200B-25-1-200-0-02	20 meters	2.5 mm^2	14
M200B-40-1-010-4-02	1 meter	4.0 mm^2	15.8
M200B-40-1-020-4-02	2 meters	4.0 mm^2	15.8
M200B-40-1-030-4-02	3 meters	4.0 mm^2	15.8
M200B-40-1-040-4-02	4 meters	4.0 mm^2	15.8
M200B-40-1-050-4-02	5 meters	4.0 mm^2	15.8
M200B-40-1-100-4-02	10 meters	4.0 mm^2	15.8
M200B-40-1-150-4-02	15 meters	4.0 mm^2	15.8
M200B-40-1-200-4-02	20 meters	4.0 mm^2	15.8

Documentation Changes

Change date	Affected pages	Chapter	Note
15.04.2020		8 Technical Data	Motor characteristics expanded
02.06.2020		8 Technical Data	Values expanded
15.06.2020		8 Technical Data	24V motors added
13.07.2020		8 Technical Data	Technical data updated
23.07.2020	22	6.4.1 Connection Diagram for Motors with a resolver M23 connector	Graphic modified
07.12.2020	9 153 156	3.1 Type Code 9.1 Encoder Cable Type Code 9.3 Motor Cable Type Code	Graphic exchanged Graphic exchanged Graphic exchanged
05.03.2021		3.1 Type Code 9.1 Encoder Cable Type Code 9.3 Motor Cable Type Code 8 Technical Data 9.2 Encoder Cables 9.4 Motor cable	Graphic exchanged Graphic exchanged Graphic exchanged Technical data updated Dimensions expanded Values updated and expanded Values updated and expanded
31.03.2021		9.4 Motor cable	1 mm² cable removed
09.07.2021	Document		General revision (type key etc.)
18.08.2021	23 24	6.4.1 Connection Diagram for Motors with a Resolver M23 Connector 6.4.2 Connection Diagram for Motors with a Resolver Ytec Connector	Graphic changed

02.03.2022	9 34 137 141-144	3.1 Type Key 8.3.1 Performance Data 8.9.1 Performance Data 8.9.4 Motor Characteristics	Graphics adapted Values corrected Values corrected Graphics adapted
06.05.2022		3.1 Type Key	Graphics adapted
24.01.2023		Brake Data	All brake data adjusted
10.11.2023	17	4.4.1 Parameter Data for Hiperface DSL Encoders	Chapter added
20.11.2023	36 54	8.3.2 Brake Data 8.4.2 Brake Data	Values changed
21.01.2025	9	3.1 Type Key	Graphics changed