COMPACT DYNAMIC BRUSHLESS SERVO MOTORS
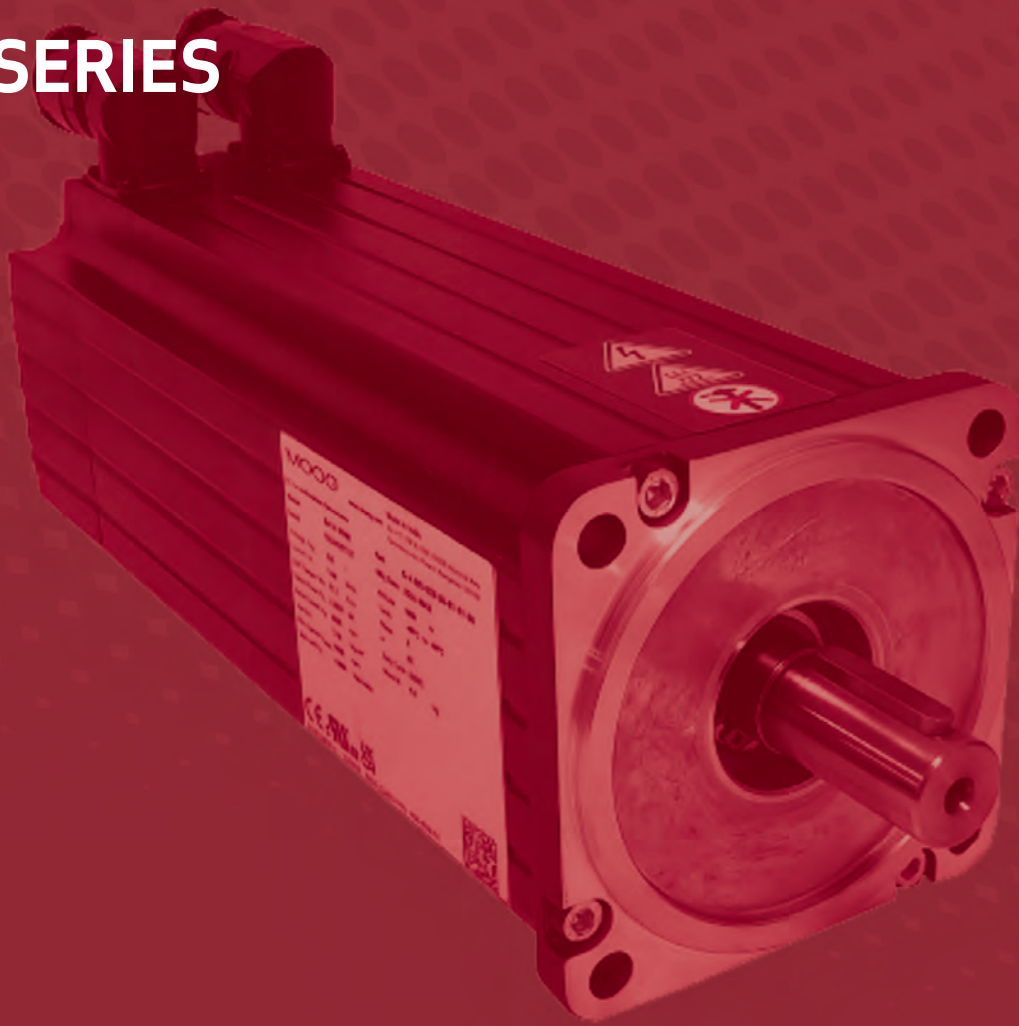
CD SERIES

LOW INERTIA, COMPACT LENGTH SERVO MOTORS
FOR HIGHLY DYNAMIC APPLICATIONS

SHAPING THE WAY THE WORLD MOVES™

MOOG

Whenever the highest levels of motion control performance and design flexibility are required, you'll find Moog expertise at work. Through collaboration, creativity, and world-class technological solutions, we help you overcome your toughest engineering obstacles. Enhance your machine's performance. And help take your thinking further than you ever thought possible.

MAKING THE IMPOSSIBLE POSSIBLE IN MOTION CONTROL

Moog Industrial is your partner of choice when performance really matters. We combine world class technologies with expert advisory support to solve our customers' most difficult challenges in motion control.

Our Experience

Moog Industrial excels in a wide range of applications, including industrial automation, machine building, robotics and medical motion control - just to name a few.

Get exceptional customer support from our well-trained experts, backed by Moog's longstanding track record of high performance and trusted experience. All related technology is owned by Moog.

We Will Make You Triumph

Moog's typical hands-on mentality and our ambition to make the impossible possible in motion control can provide you with a competitive advantage, which will most likely last for years.

Our formula:
- Superior and reliable machine design, based on technology-neutral approach
- Customize to your very specific requirements, including the utmost compactness and quietness
- Improved profitability through economically effective project design
- A trustful partnership, driven by empathy and passion
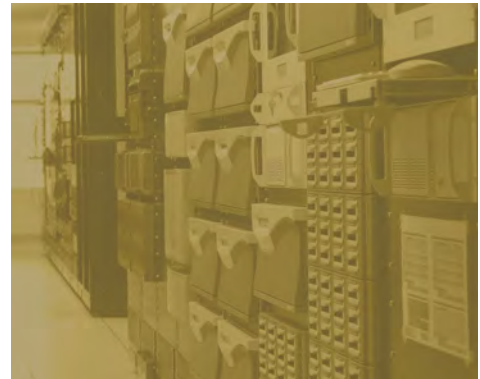
ADVANTAGES AND TECHNICAL CHARACTERISTICS

Moog's CD range

The Moog CD range of Servo Motors are synchronous permanent magnet motors that stand out for their extremely high level of overloadability and high acceleration speeds. The CD motor is available in a wider range of sizes.

High dynamics, exceptional power density, optimum reliability

The CD motors are made with the latest materials and components to guarantee improved performance and reliability compared with the motors of previous ranges. In addition, they ensure high continuous and peak performance, and excellent dynamics.

A wide selection of personalization options to meet most application needs

The motors of the CD range are designed to satisfy the application needs of most machine manufacturers. Moog can offer special windings to optimize the performance levels between the motor and the drive, reduce overall system costs.

Compact design

The CD motors can be personalized with special shafts (various lengths and diameters, hollow shafts, etc.) or special flanges.

Feedback systems

Apart from the standard resolver and encoder systems, the CD motors can also be equipped with special feedback systems.

Technical characteristics

- Motors designed to EN/IEC 60034

- Ambient temperature -20 to +40 °C (-4 to 104 °F)

- Altitude up to 1000 m a.s.l (reduced performance with higher altitudes)

- Storage temperature -20 to +70 °C (-4 to 158 °F)

- IP65 (natural) and IP54 (Fan cooled) protection in compliance with IEC60034-5. IP67 on request and with Moog specified mating connectors.

- IC0041/IC410 cooling (closed, non-ventilated machine for naturally cooled motor and IC416 for fan cooled motor, in compliance with IEC 60034-6

- Class F insulation

- Three-phase star/delta winding

- Rotor with rare earth magnets

- Sealed/shielded bearings with lifetime lubrication

- Static brake on request

- Standard feedbacks:

  2 pole resolver with transformation ratio of 0.5±10% Reference signal 4 Vrms in a frequency of 3.4 kHz.
  or
  Heidenhain absolute inductive encoder (single or multi turn) with EnDat 2.2 and functional safety.
  Resolution 19 bit signal + 12 bits for multi turn
  Supply voltage:3.6 Vdc-14 Vdc

- Optional feedback on request:

  Heidenhain absolute optical encoder (single or multi turn) with EnDat 2.2 and functional safety.
  Resolution 23 bit single turn + 12 bits for multi turn (motor sizes 2 and 3).
  Resolution 25 bit single turn + 12 bits for multi turn (motor sizes 4,5 and 6)
  Supply voltage: 3.6 Vdc -14 Vdc

  Other encoder on request.

- Thermal protection via PT1000

- Straight or rotatable or fixed angle connectors

- Smooth shaft with threaded hole for keying, in compliance with DIN 332

- Motor shaft keyway per DIN 6885, IEC 60072-1

- Construction form and assembly configuration IMB5, IMV1 and IMV3 in compliance with EN60034-7

- Runout class per DIN 42955, IEC 60072-1

- Balancing grade Q = 2.5, in compliance with ISO 1940-1 (NB: balancing with key for key option)

- Impact: 30 g for 11 ms on the two axes, in compliance with IEC60068-2-27

- Vibrations (all three axes):
  - Frequency range: 10 Hz to 150 Hz
  - Cross over frequency: 60.1 Hz
  - Displacement amplitude: 0.35 mm (0.0138 inch)
  - Acceleration: 5 g
  - Fan cooled motor comes with reduced acceleration ratings

- Color: black

ADVANTAGES AND TECHNICAL CHARACTERISTICS

General Information

1. Continuous ratings based upon:

   a. Operation in still air with ambient temperatures at 25 °C (77 °F).

   b. Winding temperature at 110 °C (230 °F) over an ambient of 25 °C (77 °F).

   c. Motor front flange attached to a steel mounting plate measuring 300 x 300 x 25 mm (11.81 x 11.81 x1.00 in).

   d. Performance mentioned in the technical data section corresponds to 4 kHz drive frequency.

2. Peak rating based on duty cycle. Please contact Moog application engineering.

3. KT – line show non-linearity between current and torque at high end.

4. Nominal speed and power values at maximum continuous output power with conditions per note 1.

5. Resistance and inductance measurement based on cold values [i.e., measured at 25 °C (77 °F)].

6. Current ratings are Arms per phase.

7. Avoid uneven current phase load at zero speed – the RMS phase current values differ across the phases which may lead to single-phase overheating. For additional information, please contact Moog.

8. Motor performance as measured with Moog servo drives at 325 and 565 VDC link. For other drives and voltage levels, please contact your local Moog application engineers.

9. Specification tolerances are +/-10 %.

10. Performance declared are for motor with resolver feedback.

11. The maximum speed, nmax is the maximum allowable operating speed. This speed is either limited by the voltage limiting back E.M.F. characteristic or mechanically by centrifugal forces and/or bearing-stressing, whichever value is lower.

12. Although very low maintenance, we advise you talk to your local Moog customer service team to determine an appropriate maintenance schedule for these servo motors based on loading and usage. Also you may refer Installation instruction for additional details.

OVERVIEW OF THE CD SERIES SERVO MOTORS

Type code*	Maximum torque Nm (lbf in)	Continuous stall torque Nm (lbf in)	Rotor inertia kg cm^2 (10^{-4} lbf in s^2)	Rated speed [1] r/min	Square flange mm (in)
G-2	0.83 to 6.64 (7.31 to 58.6)	0.24 to 2.02 (2.1 to 17.9)	0.09 to 0.44 (0.8 to 3.86)	9,000 to 5,000	55 (2.1)
G-3	1.72 to 13.33 (15.33 to 118)	0.55 to 3.94 (4.9 to 34.9)	0.16 to 0.97 (1.40 to 8.60)	11,000 to 3,400	70 (2.8)
G-4	3.38 to 41.4 (29.9 to 363)	1.25 to 11.33 (11.1 to 100)	1.05 to 7.05 (9.30 to 62.45)	8,000 to 2,600	100 (3.9)
G-5	13.25 to 94.55 (117 to 837)	5.8 to 35.17 (51.3 to 311)	4.71 to 27.23 (41.74 to 241)	5,000 to 1,800	140 (5.5)
G-6	40.25 to 240 (356 to 2,124)	14.0 to 74.26 (123.9 to 657.2)	27.78 to 156.99 (245.86 to 1,389.34)	4,000 to 2,000	190 (7.5)

1) Rated speed can be easily adjusted by changing the stator windings. Please refer to your local Moog application engineer for information.

* Refer to the section on Ordering Information - Ordering Code for servo motor type definition
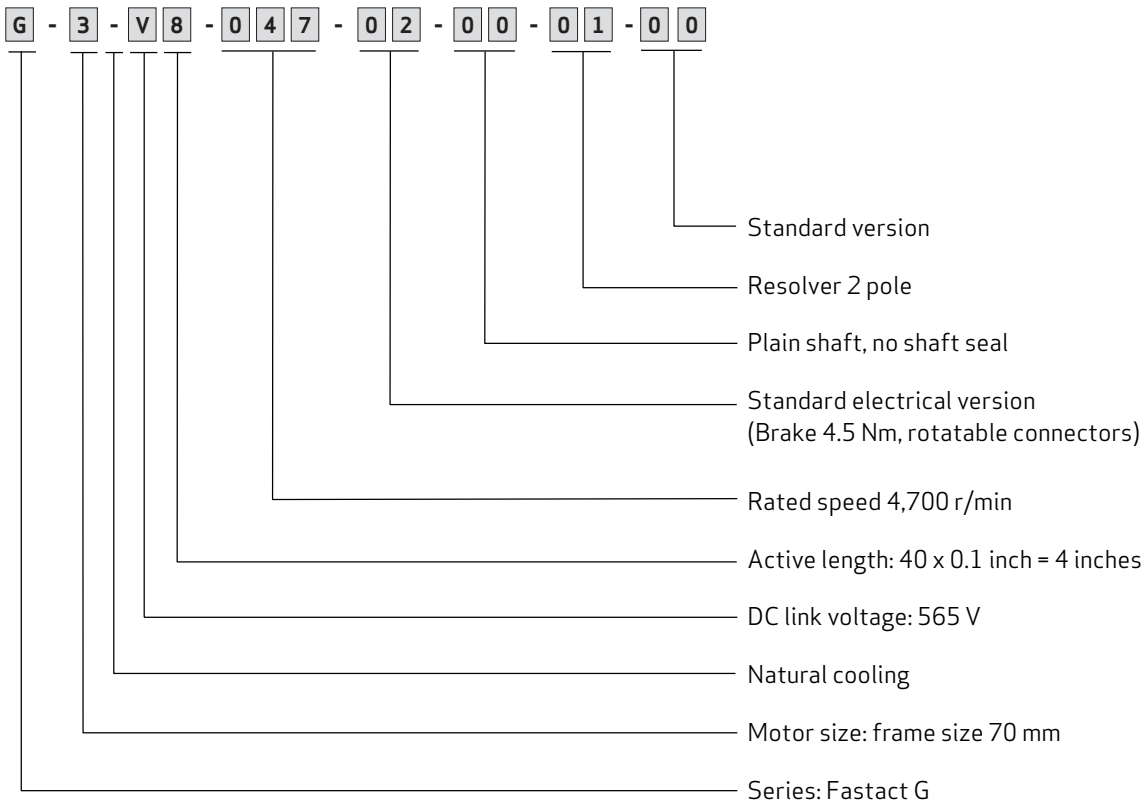
ORDERING CODE

How to order

To order a motor, choose the various Type options by filling in the boxcar on the inside back page of the catalog.

Moog sales department will provide the corresponding Model number suitable for the order.

Both model number and boxcar (Model and Type respectively) will be present on the motor nameplate.

Example

G - 3 - V 8 - 0 4 7 - 0 2 - 0 0 - 0 1 - 0 0

- Standard version
- Resolver 2 pole
- Plain shaft, no shaft seal
- Standard electrical version (Brake 4.5 Nm, rotatable connectors)
- Rated speed 4,700 r/min
- Active length: 40 x 0.1 inch = 4 inches
- DC link voltage: 565 V
- Natural cooling
- Motor size: frame size 70 mm
- Series: Fastact G

ORDERING CODE

G - □ - □□ - □□□ - □□ - □□ - □□ - □□

Motor size

2	55 mm (Flange)
3	70 mm (Flange)
4	100 mm (Flange)
5	140 mm (Flange)
6	190 mm (Flange)

Cooling options

-	Natural cooling
F	Fan cooling for size 4/5/6

DC link voltage

M	Low voltage: 325 V_{DC}
V	High voltage: 565 V_{DC}

Note: Motor with PT1000 Thermistor

Stack length[6]

Code	Motor size				
	2	3	4	5	6
0	Special				
2	L05	L05	L05	L10	L15
4	L10	L15	L10	L20	L30
6	L20	L25	L20	L30	L45
8	L40	L40	L40	L50	L60
9	-	-	L60	L70	L90

[6]Active length in 0.1 inch

Rated speed[1]

xxx	r/100 min

[1]Example: r/min = 3500/100 = 035

Electrical options[2]

	Brake [3] option	Rotatable connector	Straight connector	Fixed angle connector
00		✓		
02	✓	✓		
03			✓	
05	✓		✓	
06				✓
08	✓			✓
09	Special			

[2]Resolver motors with Fixed angle connectors
Encoder motors with Rotatable angle connectors
[3]Contact Moog for Legacy Brake options

Brake options

Motor size				
2	3	4	5	6
1Nm	4.5 Nm	14 Nm	22 Nm	72 Nm

Mechanical option

	Keyway	Shaft exit seal
00		
01	✓	
02		✓
03	✓	
04	Special	

Feedback options[4][5]

	Motor size				
	2	3	4	5	6
00	Not allowed				
01	2 Poles Resolver				
08	Special				
09	Absolute single - Turn Encoder				
10	Absolute Multi - Turn Encoder				

[4]High Resolution optical Encoder Available on request
[5]Contact Moog for Legacy Feedback options

Special version

00	Standard version

SIZE 2
Natural Cooling, Low Voltage, Type G-2-M

Characteristics and Nominal Values with Sinusoidal Drive

Characteristics		G-2-M2*	G-2-M4	G-2-M6	G-2-M8	Units
Continuous stall torque	M_0	0.24 (2.1)	0.48 (4.2)	1.00 (8.9)	2.02 (17.9)	Nm (lbf in)
Rated torque	M_N	0.18 (1.6)	0.33 (2.9)	0.69 (6.1)	1.58 (14)	Nm (lbf in)
Maximum torque	M_{max}	0.83 (7.3)	1.63 (14.4)	3.28 (29)	6.64 (58.8)	Nm (lbf in)
Rated speed	n_N	8,000	7,400	6,500	5,000	r/min
Maximum speed	n_{max}	11,200	9,800	8,800	7,000	r/min
Continuous stall current	I_0	0.67	1.19	2.15	3.46	A_{rms}
Maximum current	I_{max}	2.4	4.3	7.5	12.0	A_{rms}
Rated power	P_N	0.15 (0.2)	0.26 (0.3)	0.47 (0.6)	0.83 (1.1)	kW (hp)
Torque constant	k_T	0.36 (3.2)	0.40 (3.5)	0.46 (4.1)	0.58 (5.1)	Nm/A_{rms} (lbf in/A_{rms})
Voltage constant	k_e	22.5	25.7	28.7	36.2	$V_{rms}/k_{r/min}$
Thermal time constant	t_{th}	245	415	514	926	s
Winding resistance at 25 °C (77 °F) (phase to phase)	R_{tt}	47.968	20.881	9.623	6.257	Ohm
Winding inductance (phase to phase)	L_{tt}	26.5	15.6	9.1	6.9	mH
Rotor inertia with resolver	J	0.090 (0.8)	0.14 (1.2)	0.24 (2.1)	0.44 (3.9)	kg cm^2 (10^{-4} lbf in s^2)
Rotor inertia with encoder	J	0.070 (0.62)	0.12 (1.1)	0.22 (1.9)	0.42 (3.7)	kg cm^2 (10^{-4} lbf in s^2)
Weight (without brake)	m	1.0 (2.2)	1.2 (2.6)	1.8 (4)	2.30 (5.1)	kg (lb)

Optional holding brake	Specifications	Units
Holding torque	1.0 (8.9)	Nm (lbf in)
Extra weight	0.12 (0.3)	kg (lb)
Extra inertia with resolver	0.021 (0.19)	kg cm^2 (10^{-4} lbf in s^2)
Extra inertia with encoder	0.021 (0.19)	kg cm^2 (10^{-4} lbf in s^2)
Power requirement	10	W
Voltage requirement (+6 % -10 %)	24	V_{DC}

Notes:

1. Motor performances as measured with Moog's servo drive of proper size

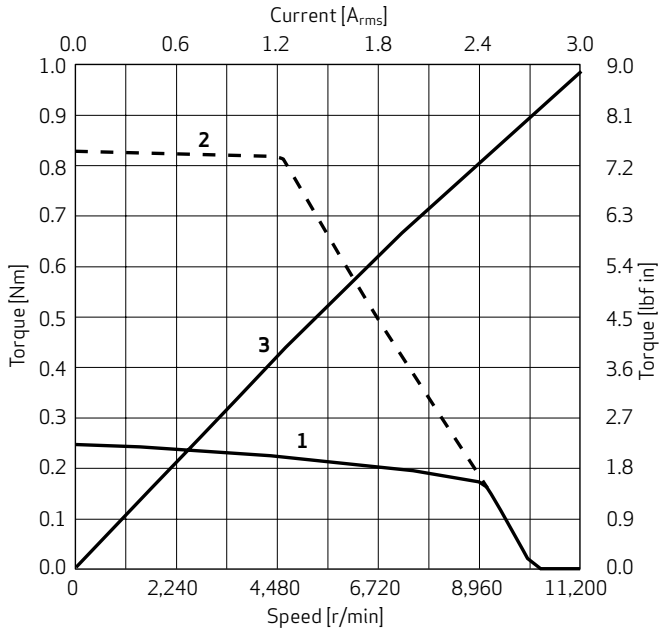2. Motor pole count: 8

3. DC link voltage 325 V

* Refer to the section on Ordering Information - Ordering Code for servo motor type definition.
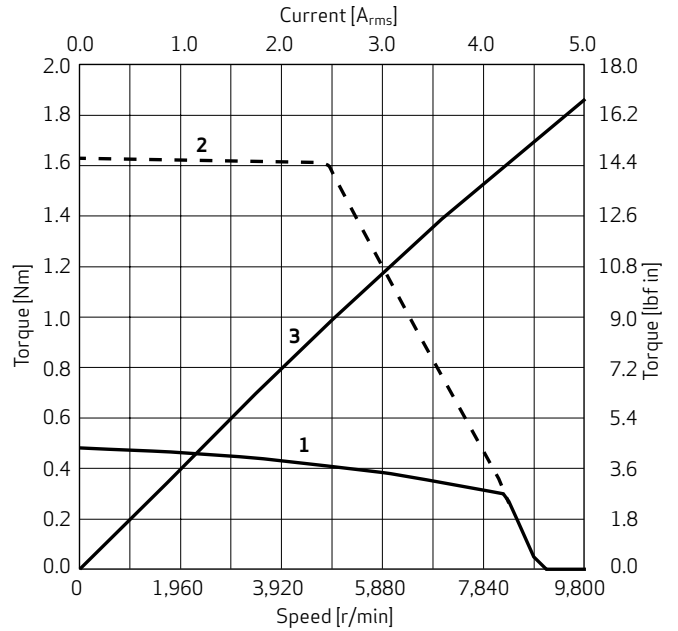
SIZE 2
Natural Cooling, Low Voltage, Type G-2-M
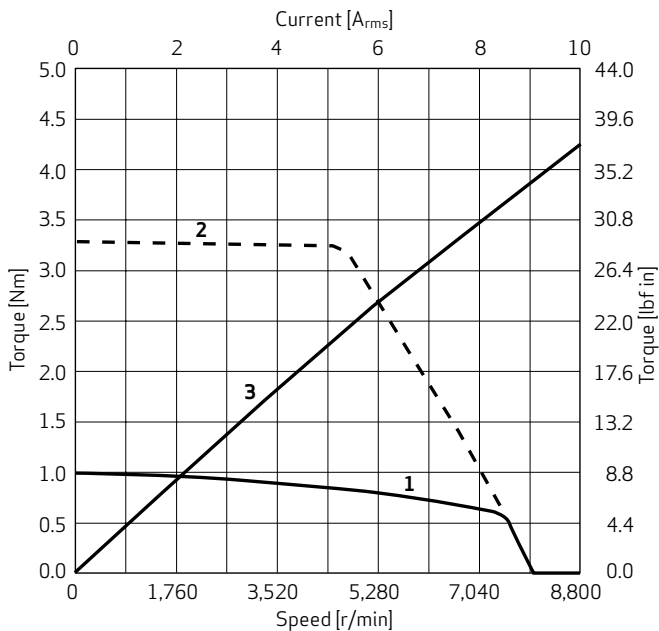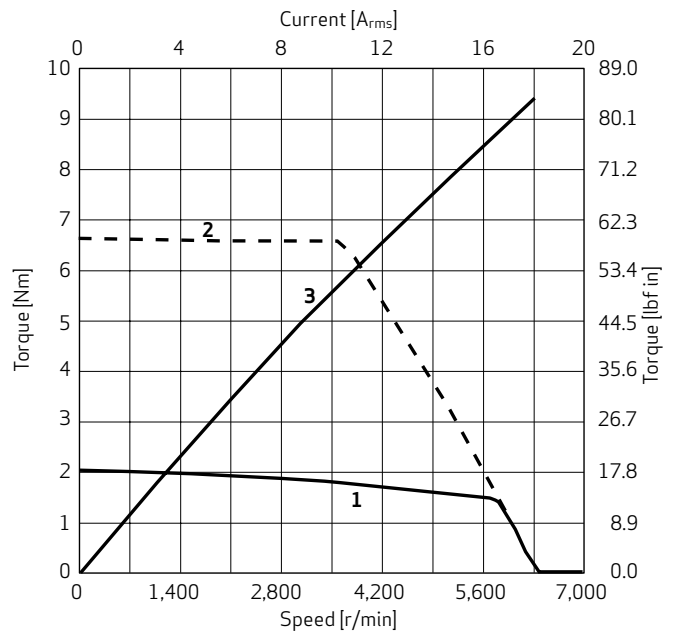
Motor Characteristics

G-2-M2

G-2-M4

G-2-M6

G-2-M8

1   Continuous torque
2   Maximum torque
3   Torque constant k_T

SIZE 2
Natural Cooling, High Voltage, Type G-2-V

Characteristics and Nominal Values with Sinusoidal Drive

Characteristics		G-2-V2	G-2-V4	G-2-V6	G-2-V8	Units
Continuous stall torque	M_0	0.26 (2.3)	0.51 (4.5)	0.88 (7.8)	1.79 (15.8)	Nm (lbf in)
Rated torque	M_N	0.18 (1.6)	0.35 (3.1)	0.52 (4.6)	1.23 (10.9)	Nm (lbf in)
Maximum torque	M_{max}	0.84 (7.4)	1.60 (14.2)	3.27 (28.9)	6.56 (58.1)	Nm (lbf in)
Rated speed	n_N	9,000	7,500	7,500	6,000	r/min
Maximum speed	n_{max}	15,500	11,500	10,800	7,000	r/min
Continuous stall current	I_0	0.64	1.29	1.36	2.73	A_{rms}
Maximum current	I_{max}	2.2	4.3	5.3	10.6	A_{rms}
Rated power	P_N	0.17 (0.2)	0.27 (0.4)	0.41 (0.5)	0.77 (1)	kW (hp)
Torque constant	k_T	0.40 (3.5)	0.39 (3.5)	0.65 (5.8)	0.65 (5.8)	Nm/A_{rms} (lbf in/A_{rms})
Voltage constant	k_e	24.9	25.1	40.4	40.4	$V_{rms}/k_{r/min}$
Thermal time constant	t_{th}	245	415	514	926	s
Winding resistance at 25 °C (77 °F) (phase to phase)	R_{tt}	53.047	17.833	24.263	10.010	Ohm
Winding inductance (phase to phase)	L_{tt}	32.4	15.0	17.9	8.7	mH
Rotor inertia with resolver	J	0.09 (0.8)	0.14 (1.2)	0.24 (2.1)	0.44 (3.9)	kg cm^2 (10^{-4} lbf in s^2)
Rotor inertia with encoder	J	0.07 (0.62)	0.12 (1.1)	0.22 (1.9)	0.42 (3.7)	kg cm^2 (10^{-4} lbf in s^2)
Weight (without brake)	m	1 (2.2)	1.20 (2.6)	1.80 (4)	2.30 (5.1)	kg (lb)

| Optional holding brake	Specifications	Units
Holding torque	1.0 (8.9)	Nm (lbf in)
Extra weight	0.12 (0.3)	kg (lb)
Extra inertia with resolver	0.021 (0.19)	kg cm^2 (10^{-4} lbf in s^2)
Extra inertia with encoder	0.021 (0.19)	kg cm^2 (10^{-4} lbf in s^2)
Power requirement	10	W
Voltage requirement (+6 % -10 %)	24	V_{DC}

Notes:

1. Motor performances as measured with Moog's servo drive of proper size
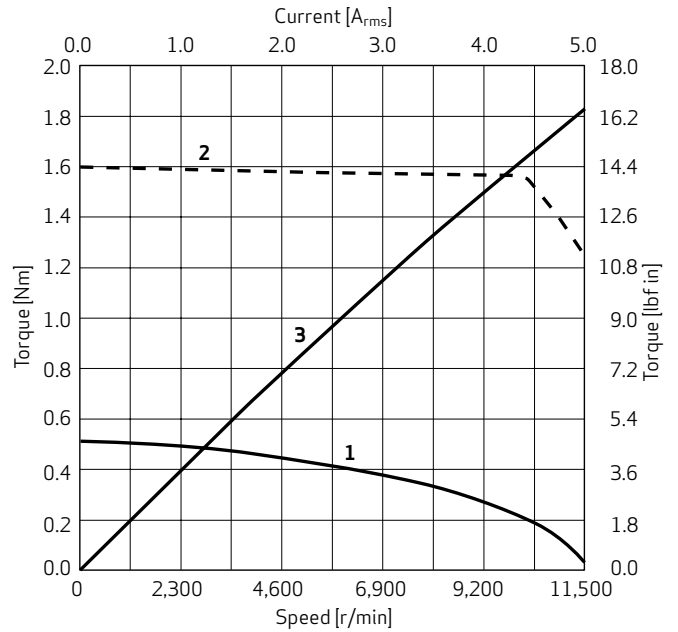2. Motor pole count: 8
3. DC link voltage 565 V

SIZE 2
Natural Cooling, High Voltage, Type G-2-V
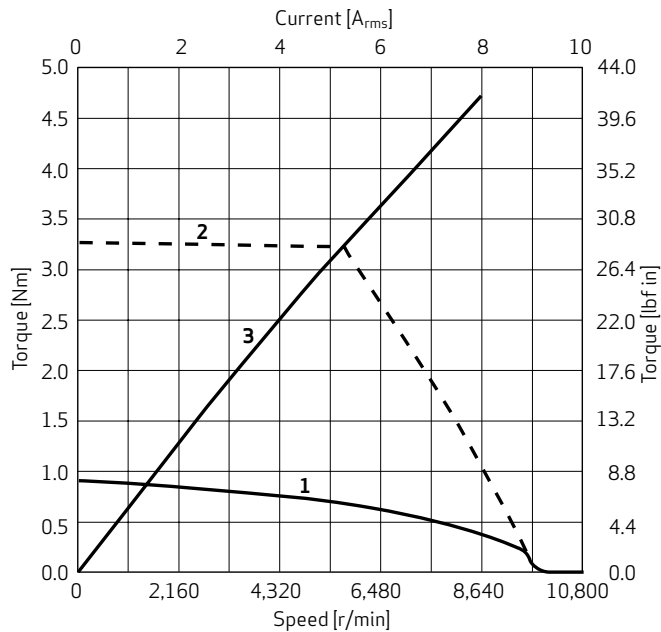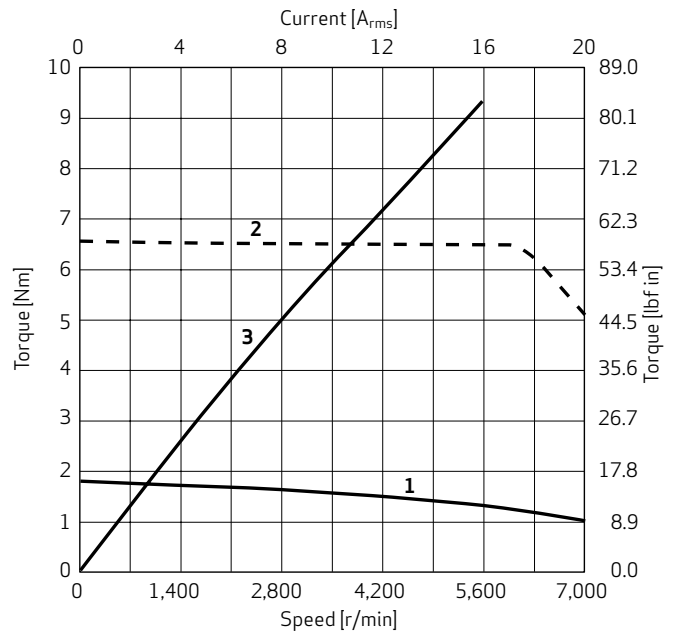
Motor Characteristics

G-2-V2
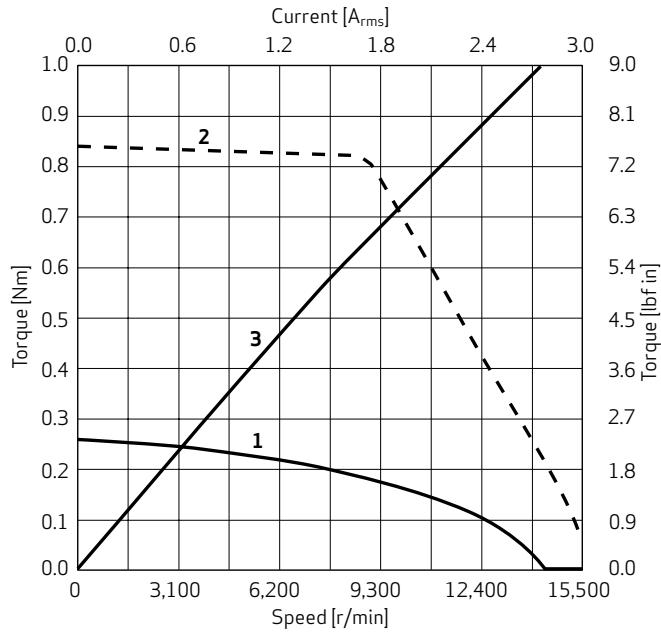
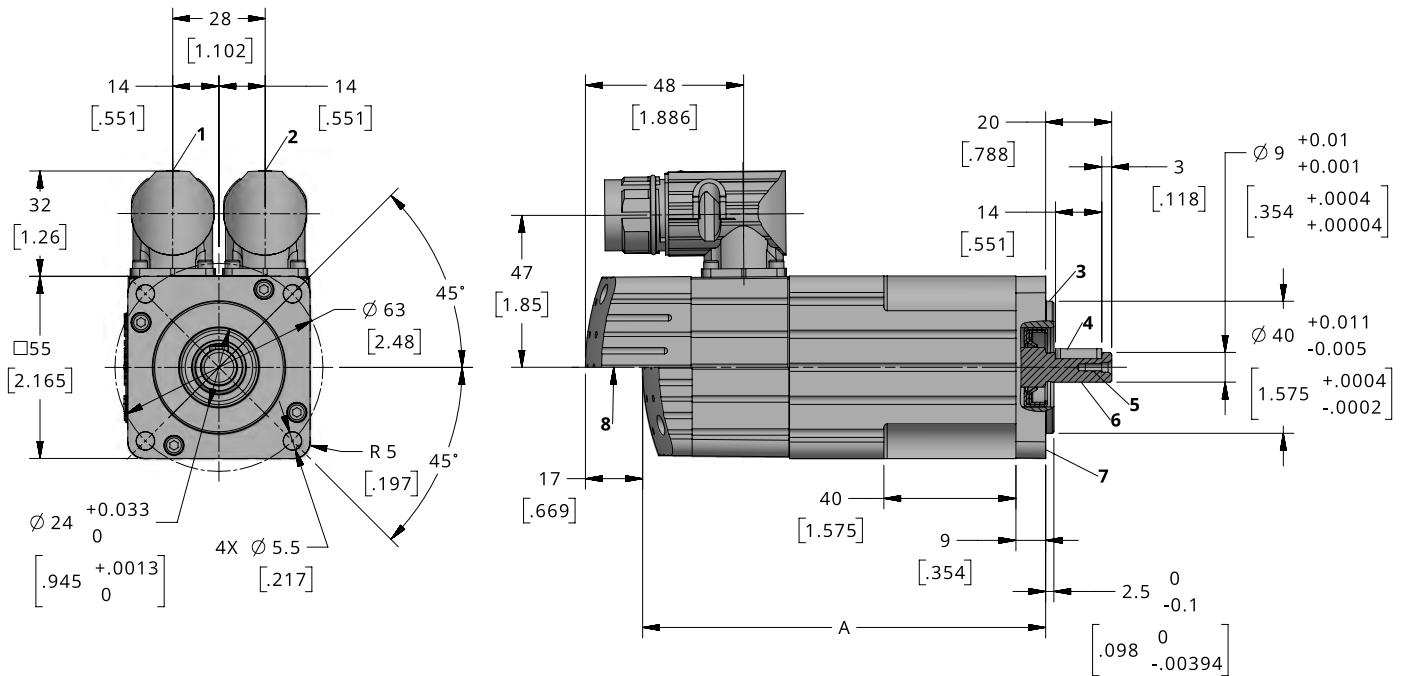
G-2-V4

G-2-V6

G-2-V8

1   Continuous torque
2   Maximum torque
3   Torque constant k_T

SIZE 2
Natural Cooling, Low or High Voltage, Type G-2

G-2 with Resolver

Model number	Dimension "A" resolver
	mm (in)
G-2-X2	109 (4.29)
G-2-X4	122 (4.80)
G-2-X6	147 (5.78)
G-2-X8	198 (7.79)

Note: Dimensions mm (in)

X is a placeholder for M or V, for example, X2 is placeholder for M2 or V2

1 Power connector size 1
2 Signal connector
3 Runout class as per IEC/DIN normal class
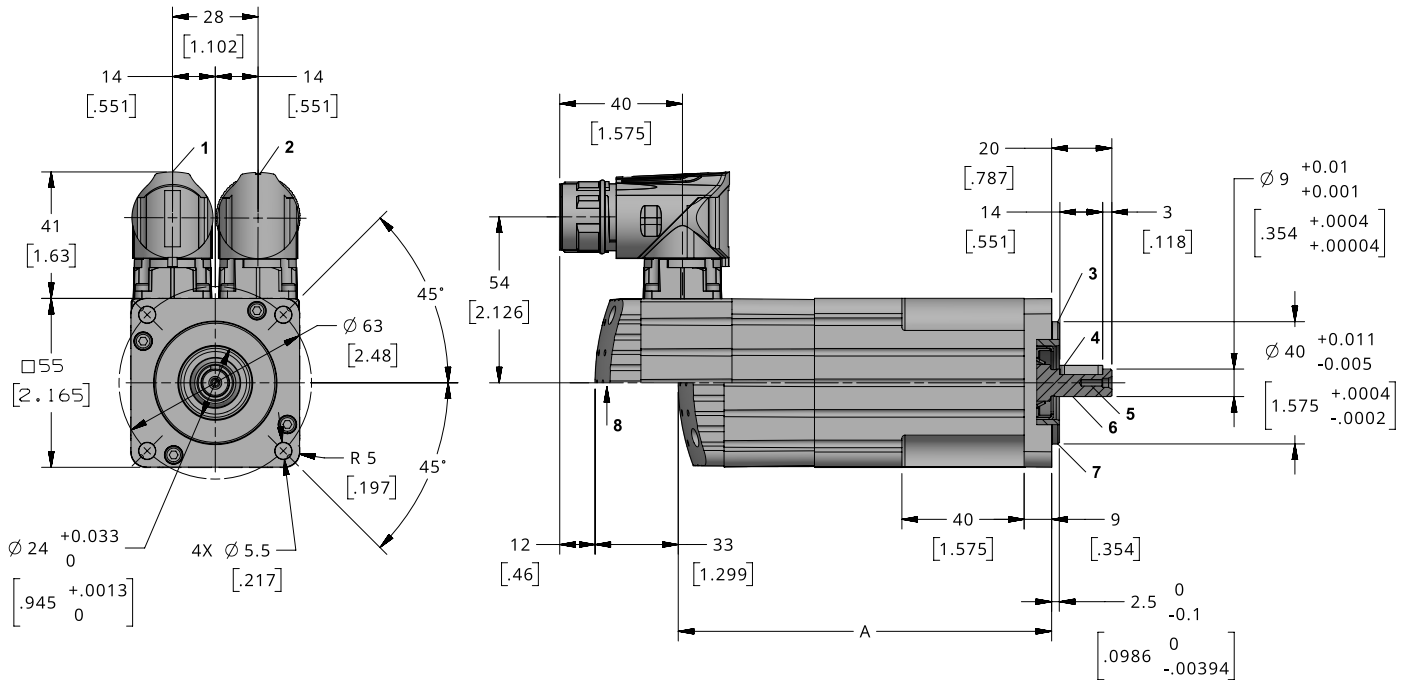4 Optional key 3x3x14
5 Thread M2.5x8
6 Shaft
7 Flange
8 With brake

SIZE 2
Natural Cooling, Low or High Voltage, Type G-2

G-2 with Encoder

Model number	Dimension "A" encoder
	mm (in)
G-2-X2	109 (4.29)
G-2-X4	122 (4.80)
G-2-X6	147 (5.78)
G-2-X8	198 (7.79)

Note: Dimensions mm (in)

X is a placeholder for M or V, for example, X2 is placeholder for M2 or V2

1   Power connector size 1
2   Signal connector
3   Runout class as per IEC/DIN normal class
4   Optional key 3x3x14
5   Thread M2.5x8
6   Shaft
7   Flange
8   With brake

SIZE 3
Natural Cooling, Low Voltage, Type G-3-M

Characteristics and Nominal Values with Sinusoidal Drive

Characteristics		G-3-M2*	G-3-M4	G-3-M6	G-3-M8	Units
Continuous stall torque	M_0	0.62 (5.5)	1.64 (14.5)	2.58 (22.8)	3.94 (34.9)	Nm (lbf in)
Rated torque	M_N	0.57 (5)	1.41 (12.5)	2.35 (20.8)	3.62 (32)	Nm (lbf in)
Maximum torque	M_{max}	1.73 (15.3)	5.00 (44.3)	8.35 (73.9)	13.33 (118)	Nm (lbf in)
Rated speed	n_N	7,200	6,000	4,100	3,400	r/min
Maximum speed	n_{max}	10,500	8,000	5,500	4,500	r/min
Continuous stall current	I_0	1.57	3.17	3.40	4.19	A_{rms}
Maximum current	I_{max}	5.0	11.0	12.5	16.1	A_{rms}
Rated power	P_N	0.43 (0.6)	0.89 (1.2)	1.01 (1.4)	1.29 (1.7)	kW (hp)
Torque constant	k_T	0.40 (3.5)	0.52 (4.6)	0.76 (6.7)	0.94 (8.3)	Nm/A_{rms} (lbf in/A_{rms})
Voltage constant	k_e	24.0	31.6	45.9	56.3	$V_{rms}/k_{r/min}$
Thermal time constant	t_{th}	333	758	967	1,345	s
Winding resistance at 25 °C (77 °F) (phase to phase)	R_{tt}	15.964	4.889	5.075	4.139	Ohm
Winding inductance (phase to phase)	L_{tt}	18.7	8.4	10.1	9.0	mH
Rotor inertia with resolver	J	0.16 (1.4)	0.39 (3.5)	0.62 (5.5)	0.97 (8.6)	kg cm^2 (10^{-4} lbf in s^2)
Rotor inertia with encoder	J	0.14 (1.2)	0.37 (3.3)	0.60 (5.3)	0.96 (8.5)	kg cm^2 (10^{-4} lbf in s^2)
Weight (without brake)	m	1.70 (3.7)	2.00 (4.4)	2.60 (5.7)	3.50 (7.7)	kg (lb)

Optional holding brake	Specifications	Units
Holding torque	4.5 (39.8)	Nm (lbf in)
Extra weight	0.33 (0.7)	kg (lb)
Extra inertia with resolver	0.18 (1.6)	kg cm^2 (10^{-4} lbf in s^2)
Extra inertia with encoder	0.18 (1.6)	kg cm^2 (10^{-4} lbf in s^2)
Power requirement	12	W
Voltage requirement (+6 % -10 %)	24	V_{DC}

Notes:

1. Motor performances as measured with Moog´s servo drive of proper size
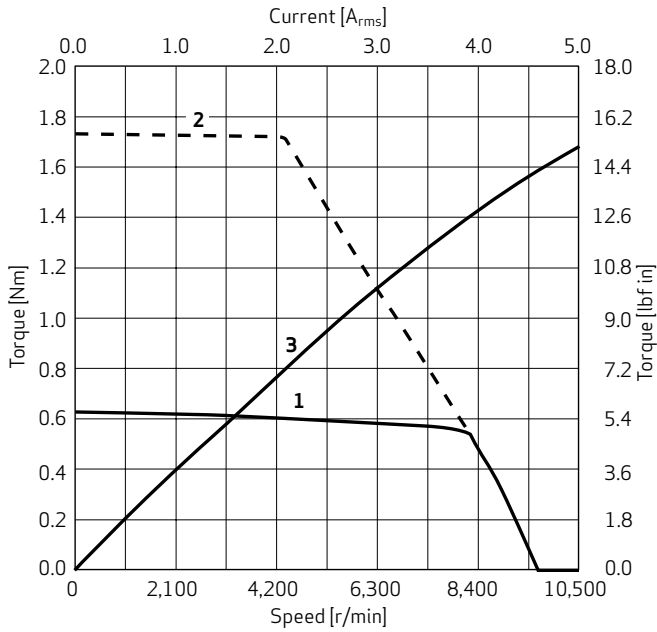2. Motor pole count: 8
3. DC link voltage 325 V

* Refer to the section on Ordering Information - Ordering Code for servo motor type definition.
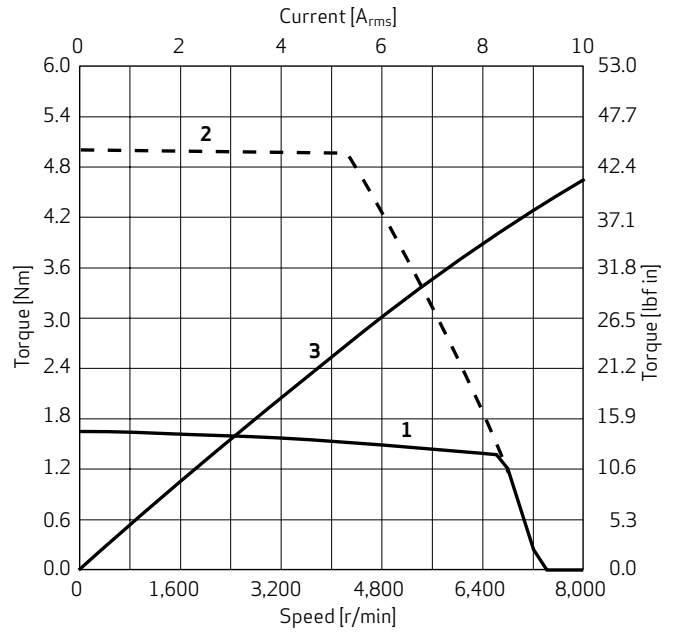
SIZE 3
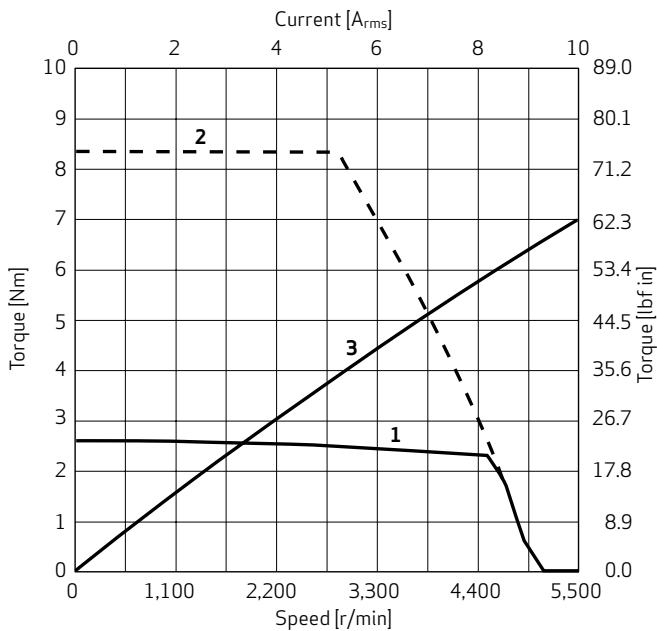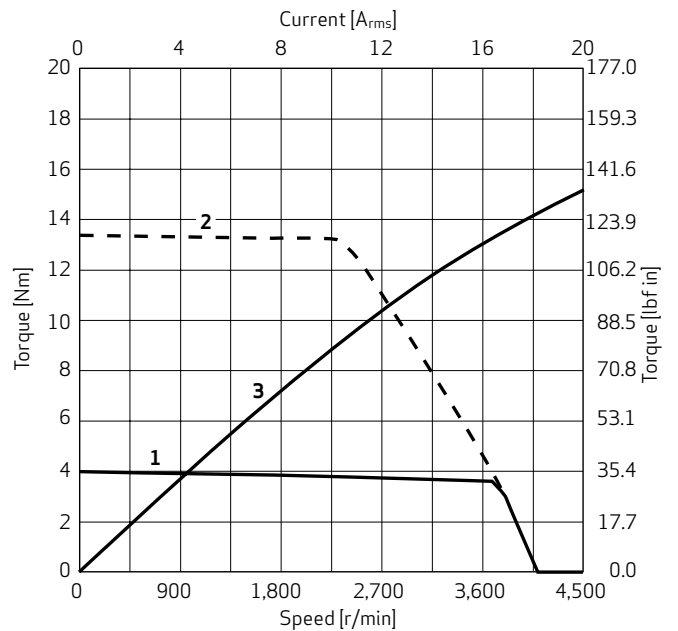# Natural Cooling, Low Voltage, Type G-3-M

Motor Characteristics

G-3-M2

G-3-M4

G-3-M6

G-3-M8

1   Continuous torque
2   Maximum torque
3   Torque constant k_T

SIZE 3
Natural Cooling, High Voltage, Type G-3-V

Characteristics and Nominal Values with Sinusoidal Drive

Characteristics		G-3-V2	G-3-V4	G-3-V6	G-3-V8	Units
Continuous stall torque	M_0	0.55 (4.9)	1.44 (12.7)	2.26 (20)	3.46 (30.6)	Nm (lbf in)
Rated torque	M_N	0.44 (3.9)	1.08 (9.6)	2.01 (17.8)	3.00 (26.6)	Nm (lbf in)
Maximum torque	M_{max}	1.72 (15.2)	5.0 (44.3)	8.38 (74.2)	13.32 (118)	Nm (lbf in)
Rated speed	n_N	11,000	8,000	4,500	4,400	r/min
Maximum speed	n_{max}	14,000	10,000	6,000	5,600	r/min
Continuous stall current	I_0	1.14	2.02	1.89	2.67	A_{rms}
Maximum current	I_{max}	4.1	8	8.0	11.7	A_{rms}
Rated power	P_N	0.51 (0.7)	0.91 (1.2)	0.95 (1.3)	1.38 (1.8)	kW (hp)
Torque constant	k_T	0.49 (4.3)	0.71 (6.3)	1.20 (10.6)	1.30 (11.5)	Nm/A_{rms} (lbf in/A_{rms})
Voltage constant	k_e	29.2	43.4	72.2	77.4	$V_{rms}/k_{r/min}$
Thermal time constant	t_{th}	333	758	967	1,345	s
Winding resistance at 25 °C (77 °F) (phase to phase)	R_{tt}	30.596	12.059	16.462	10.233	Ohm
Winding inductance (phase to phase)	L_{tt}	27.8	15.9	24.7	16.9	mH
Rotor inertia with resolver	J	0.16 (1.4)	0.39 (3.5)	0.62 (5.5)	0.97 (8.6)	kg cm^2 (10^{-4} lbf in s^2)
Rotor inertia with encoder	J	0.14 (1.2)	0.37 (3.3)	0.60 (5.3)	0.96 (8.5)	kg cm^2 (10^{-4} lbf in s^2)
Weight (without brake)	m	1.70 (3.7)	2.0 (4.4)	2.60 (5.7)	3.50 (7.7)	kg (lb)

| Optional holding brake	Specifications	Units
Holding torque	4.5 (39.8)	Nm (lbf in)
Extra weight	0.33 (0.7)	kg (lb)
Extra inertia with resolver	0.18 (1.6)	kg cm^2 (10^{-4} lbf in s^2)
Extra inertia with encoder	0.18 (1.6)	kg cm^2 (10^{-4} lbf in s^2)
Power requirement	12	W
Voltage requirement (+6 % -10 %)	24	V_{DC}

Notes:

1. Motor performances as measured with Moog´s servo drive of proper size
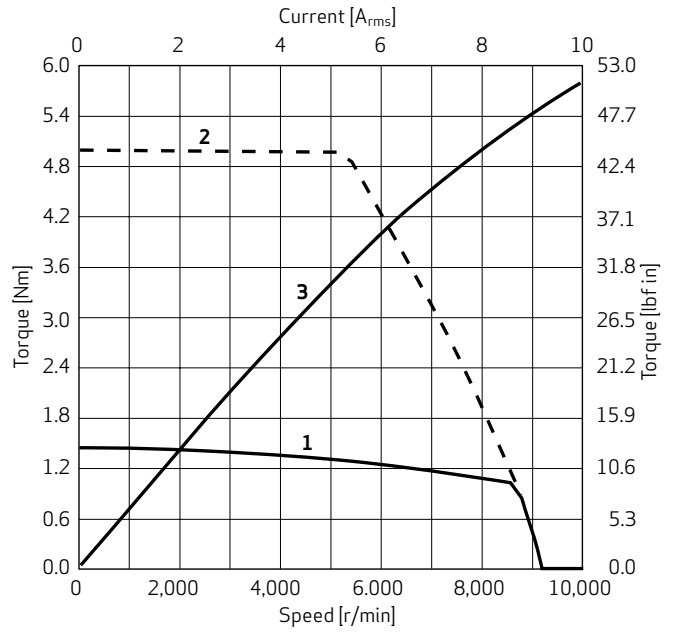2. Motor pole count: 8
3. DC link voltage 565 V

SIZE 3
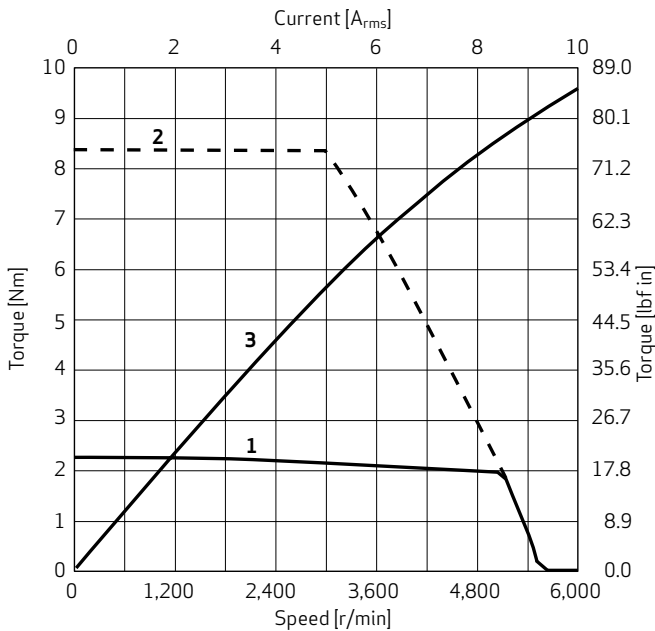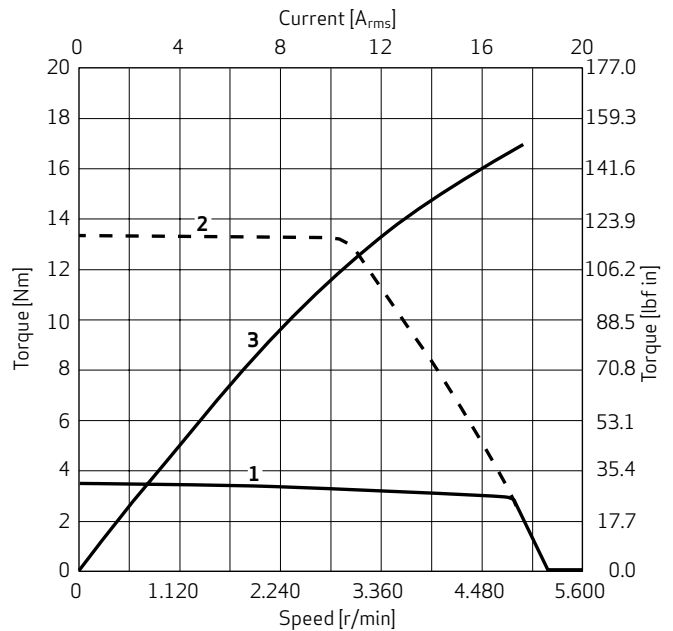# Natural Cooling, High Voltage, Type G-3-V

Motor Characteristics

G-3-V2
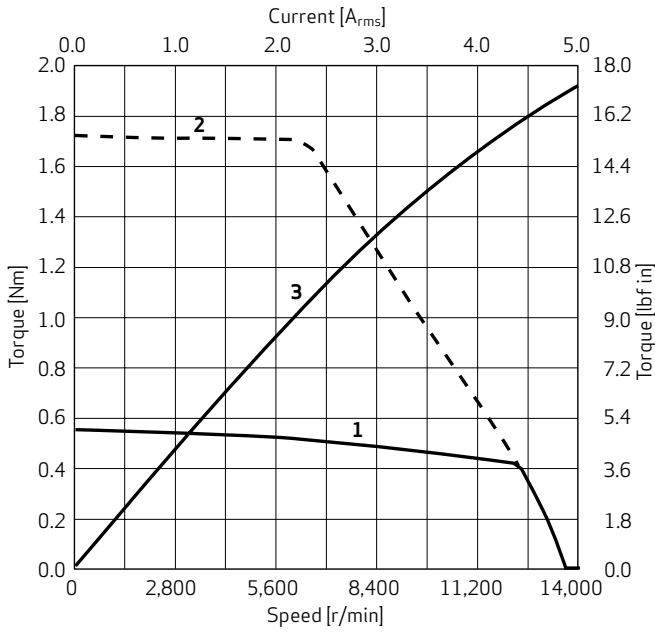
G-3-V4

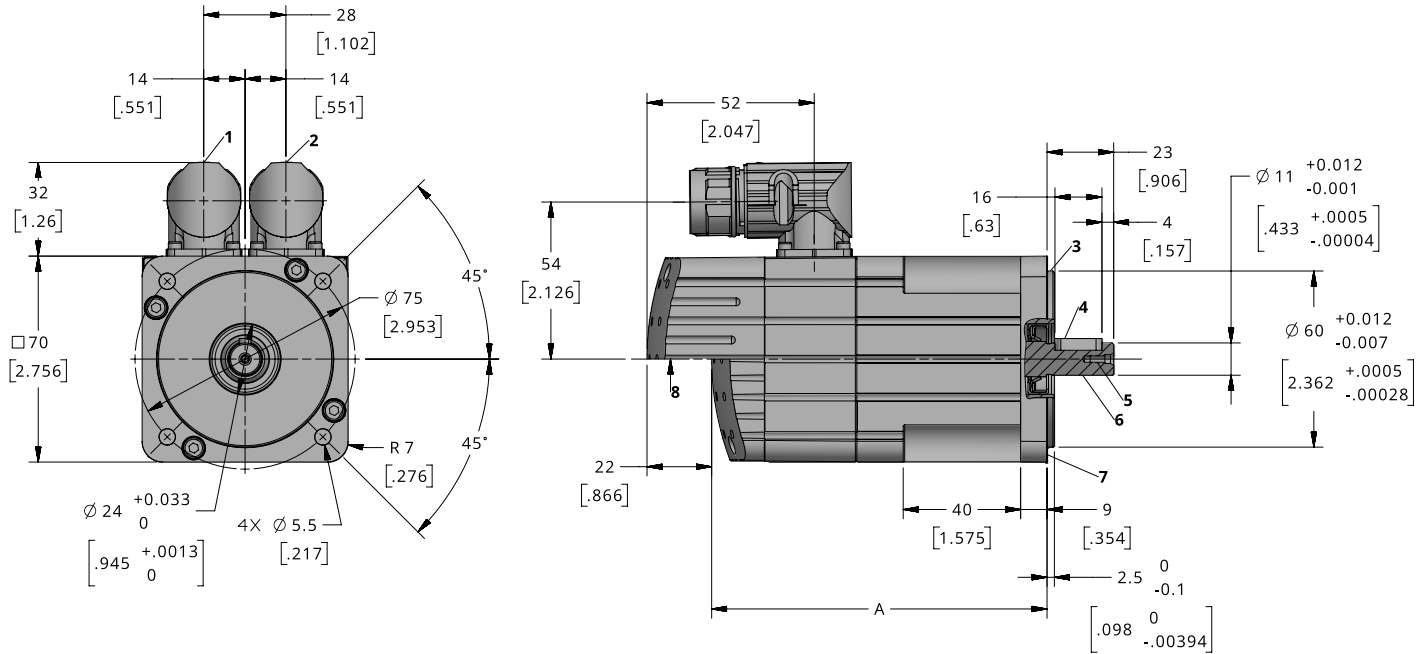### G-3-V6

G-3-V8

1   Continuous torque
2   Maximum torque
3   Torque constant k_T

SIZE 3
Natural Cooling, Low or High Voltage, Type G-3

G-3 with Resolver

Model number	Dimension "A" resolver
	mm (in)
G-3-X2	114 (4.48)
G-3-X4	140 (5.51)
G-3-X6	165 (6.49)
G-3-X8	203 (7.99)

Note: Dimensions mm (in)

X is a placeholder for M or V, for example, X2 is placeholder for M2 or V2

1   Power connector size 1
2   Signal connector
3   Runout class as per IEC/DIN normal class
4   Optional key 4x4x16
5   Thread M2.5x8
6   Shaft
7   Flange
8   With brake

SIZE 3
Natural Cooling, Low or High Voltage, Type G-3

G-3 with Encoder

Model number	Dimension "A" encoder
	mm (in)
G-3-X2	114 (4.48)
G-3-X4	140 (5.51)
G-3-X6	165 (6.49)
G-3-X8	203 (7.99)

Note: Dimensions mm (in)

X is a placeholder for M or V, for example, X2 is placeholder for M2 or V2

1   Power connector size 1
2   Signal connector
3   Run out class as per IEC/DIN normal class
4   Optional key 4x4x16
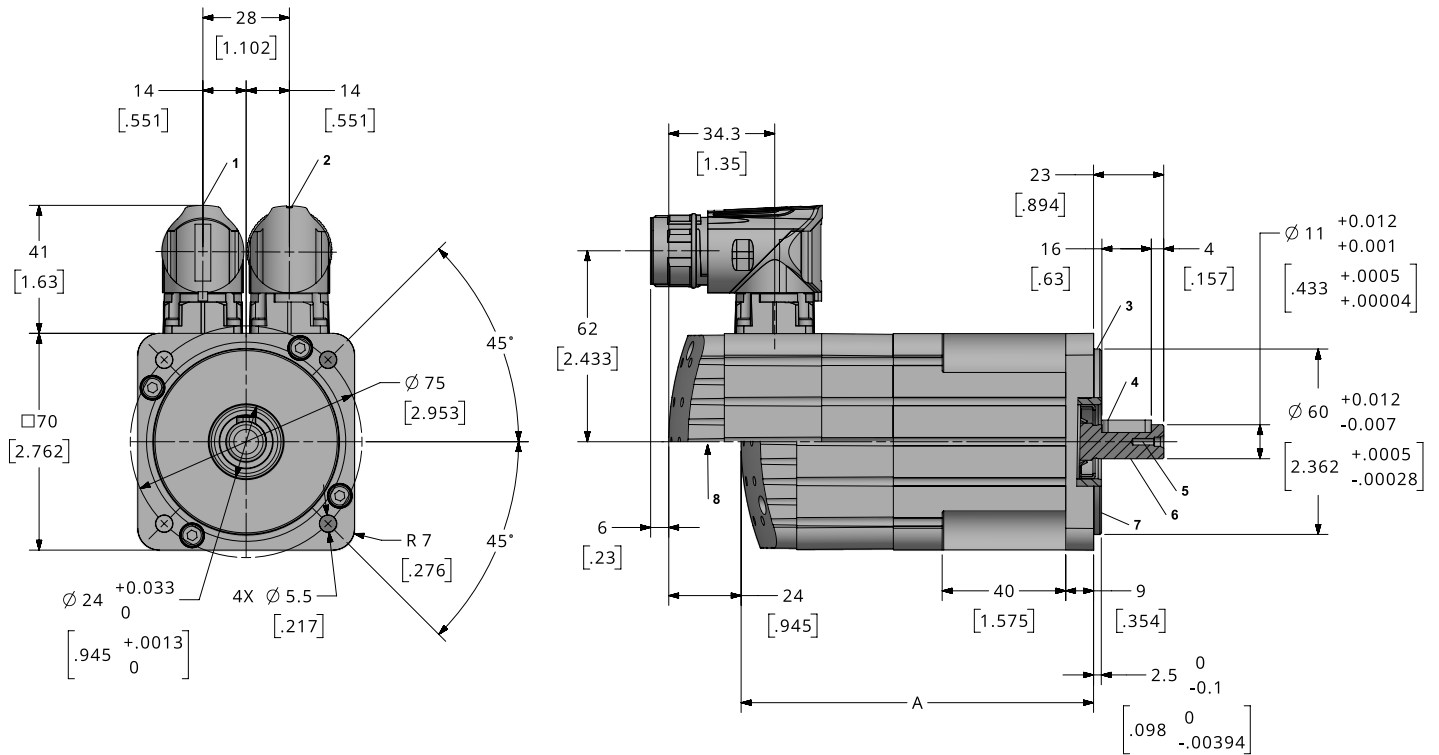5   Thread M2.5x8
6   Shaft
7   Flange
8   With brake

SIZE 4
Natural Cooling, Low Voltage, Type G-4-M

Characteristics and Nominal Values with Sinusoidal Drive

Characteristics		G-4-M2*	G-4-M4	G-4-M6	G-4-M8	G-4-M9	Units
Continuous stall torque	M_0	1.52 (13.5)	2.66 (23.5)	4.74 (42)	8.31 (73.5)	11.33 (100)	Nm (lbf in)
Rated torque	M_N	1.21 (10.7)	2.00 (17.7)	3.53 (31.2)	5.67 (50.2)	8.75 (77.4)	Nm (lbf in)
Maximum torque	M_{max}	3.38 (29.9)	6.60 (58.4)	13.30 (118)	27.22 (241)	37.60 (333)	Nm (lbf in)
Rated speed	n_N	7,000	5,500	4,200	3,500	2,600	r/min
Maximum speed	n_{max}	9,000	7,500	5,800	4,600	3,500	r/min
Continuous stall current	I_0	3.53	4.94	6.68	9.17	9.46	A_{rms}
Maximum current	I_{max}	9.5	15.0	23.0	37.0	37.0	A_{rms}
Rated power	P_N	0.88 (1.2)	1.15 (1.5)	1.55 (2.1)	2.08 (2.8)	2.38 (3.2)	kW (hp)
Torque constant	k_T	0.43 (3.8)	0.54 (4.8)	0.71 (6.3)	0.91 (8.1)	1.20 (10.6)	Nm/A_{rms} $(lbf\ in/A_{rms})$
Voltage constant	k_e	26.2	33.8	43.2	54.4	71.4	$V_{rms}/k_{r/min}$
Thermal time constant	t_{th}	703	1,001	1,475	1,812	2,000	s
Winding resistance at 25 °C (77 °F) (phase to phase)	R_{tt}	4.802	2.561	1.503	0.907	0.957	Ohm
Winding inductance (phase to phase)	L_{tt}	8.1	5.9	4.4	3.2	3.8	mH
Rotor inertia with resolver	J	1.05 (9.3)	1.56 (13.8)	2.65 (23.5)	4.86 (43)	7.05 (62.4)	$kg\ cm^2$ $(10^{-4}\ lbf\ in\ s^2)$
Rotor inertia with encoder	J	0.85 (7.5)	1.40 (12.4)	2.45 (21.7)	4.66 (41.2)	6.87 (60.8)	$kg\ cm^2$ $(10^{-4}\ lbf\ in\ s^2)$
Weight (without brake)	m	3.00 (6.6)	4.00 (8.8)	4.60 (10.1)	7.60 (16.8)	9.40 (20.7)	kg (lb)

Optional holding brake	Specifications	Units
Holding torque	14 (124)	Nm (lbf in)
Extra weight	0.8 (1.8)	kg (lb)
Extra inertia with resolver	1.0 (8.9)	$kg\ cm^2 (10^{-4}\ lbf\ in\ s^2)$
Extra inertia with encoder	1.1 (9.7)	$kg\ cm^2 (10^{-4}\ lbf\ in\ s^2)$
Power requirement	15.6	W
Voltage requirement (+6 % -10 %)	24	V_{DC}

Notes:

1. Motor performances as measured with Moog´s servo drive of proper size

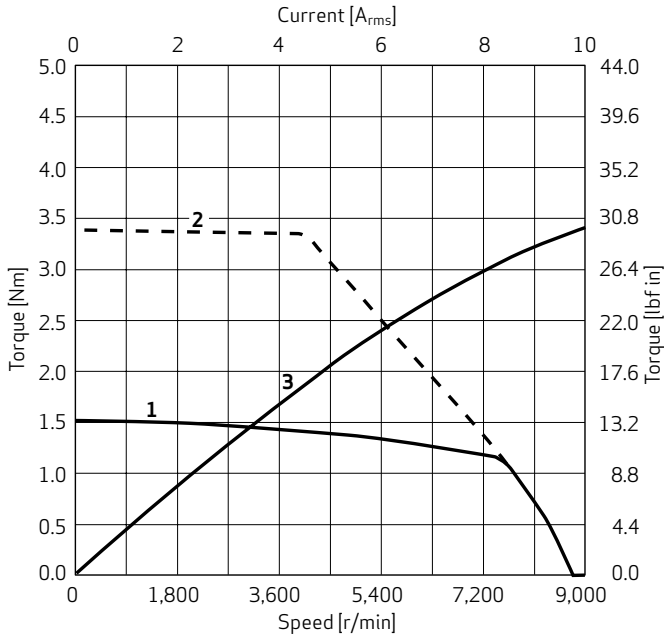2. Motor pole count: 12

3. DC link voltage 325 V

* Refer to the section on Ordering Information - Ordering Code for servo motor type definition.
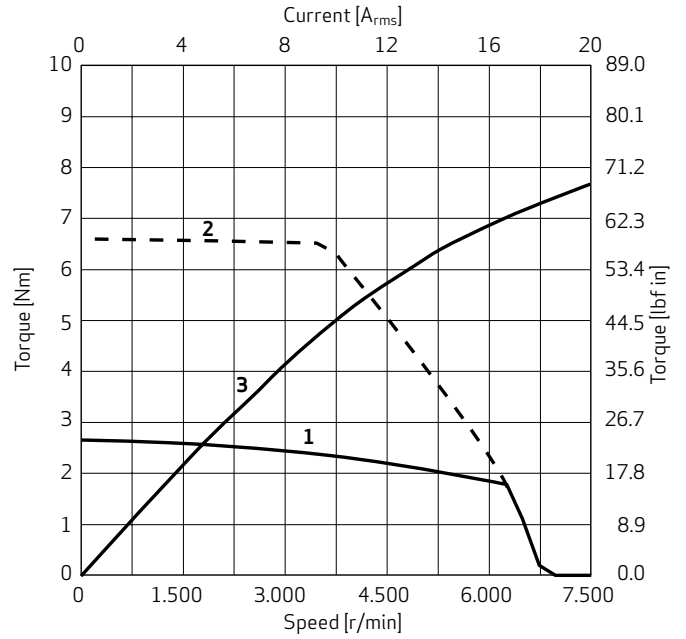
SIZE 4
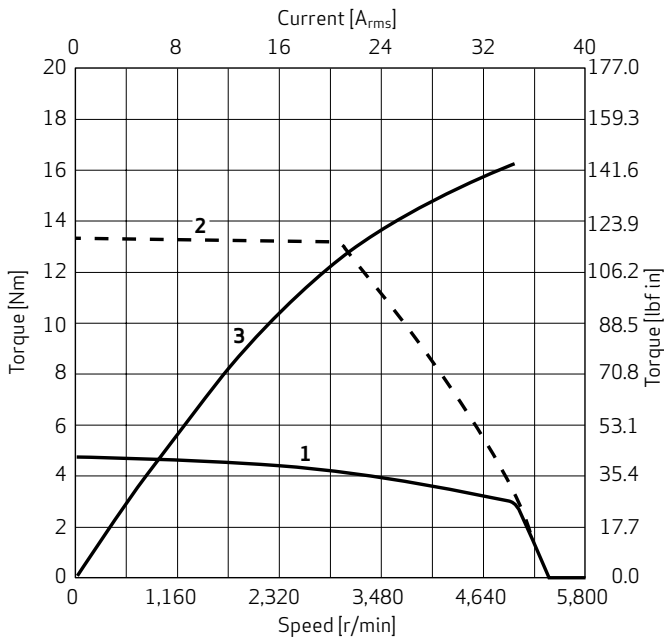# Natural Cooling, Low Voltage, Type G-4-M

Motor Characteristics

G-4-M2
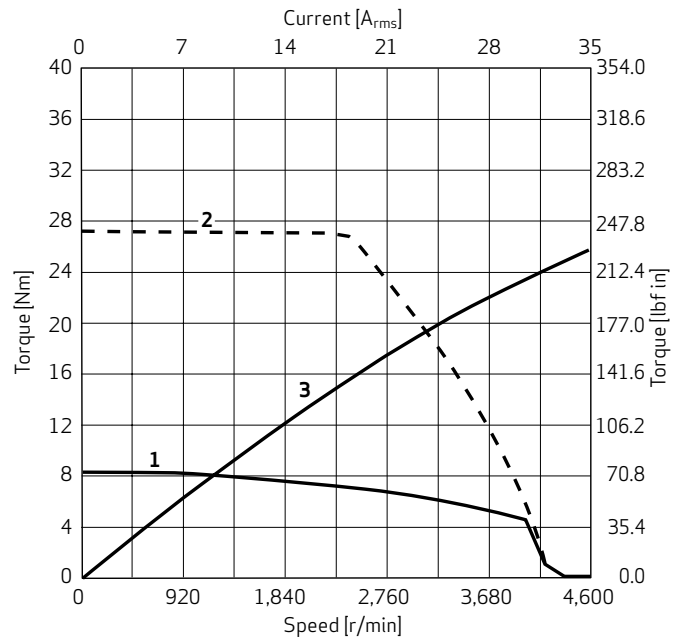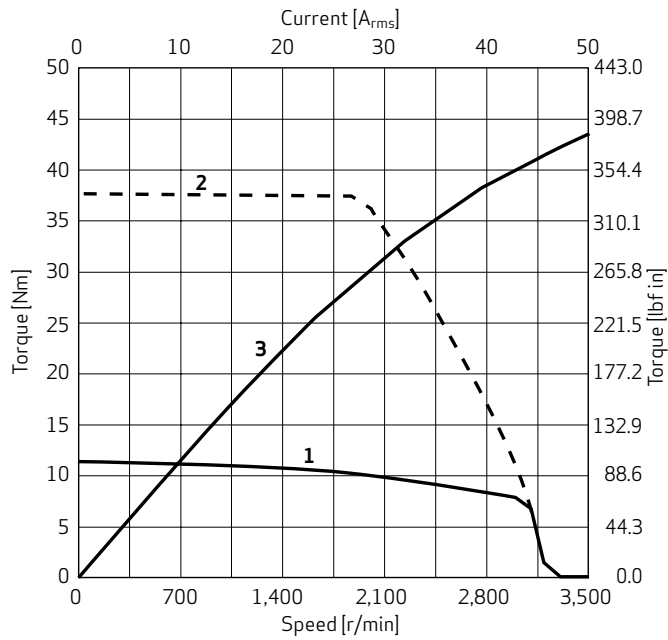

G-4-M4

G-4-M6

G-4-M8

1   Continuous torque
2   Maximum torque
3   Torque constant k_T

SIZE 4
Natural Cooling, Low Voltage, Type G-4-M

Motor Characteristics

G-4-M9

1   Continuous torque
2   Maximum torque
3   Torque constant k_T

SIZE 4
Natural Cooling, High Voltage, Type G-4-V

Characteristics and Nominal Values with Sinusoidal Drive

Characteristics		G-4-V2	G-4-V4	G-4-V6	G-4-V8	G-4-V9	Units
Continuous stall torque	M_0	1.25 (11.1)	2.31 (20.4)	4.01 (35.5)	6.85 (60.6)	9.13 (80.8)	Nm (lbf in)
Rated torque	M_N	0.90 (8)	1.73 (15.3)	2.96 (26.2)	4.60 (40.7)	6.60 (58.4)	Nm (lbf in)
Maximum torque	M_{max}	3.39 (30)	6.56 (58.1)	13.18 (117)	27.24 (241)	41.04 (363)	Nm (lbf in)
Rated speed	n_N	8,000	5,500	4,200	3500	2,800	r/min
Maximum speed	n_{max}	9,000	9,000	6,300	5,000	3500	r/min
Continuous stall current	I_0	2.42	3.88	3.46	4.60	4.41	A_{rms}
Maximum current	I_{max}	8.0	13.5	14.0	22.8	24.8	A_{rms}
Rated power	P_N	0.76 (1)	1.00 (1.3)	1.30 (1.7)	1.69 (2.3)	1.94 (2.6)	kW (hp)
Torque constant	k_T	0.52 (4.6)	0.60 (5.3)	1.16 (10.3)	1.49 (13.2)	2.07 (18.3)	Nm/A_{rms} (lbf in/A_{rms})
Voltage constant	k_e	31.3	37.2	69.7	88.4	122.4	$V_{rms}/k_{r/min}$
Thermal time constant	t_{th}	703	1,001	1,475	1,812	2,000	s
Winding resistance at 25 °C (77 °F) (phase to phase)	R_{tt}	10.224	4.146	5.581	3.602	4.399	Ohm
Winding inductance (phase to phase)	L_{tt}	11.4	7.1	11.6	8.3	10.4	mH
Rotor inertia with resolver	J	1.05 (9.3)	1.57 (13.9)	2.65 (23.5)	4.87 (43.1)	7.05 (62.4)	kg cm^2 (10^{-4} lbf in s^2)
Rotor inertia with encoder	J	0.85 (7.5)	1.40 (12.4)	2.45 (21.7)	4.66 (41.2)	6.87 (60.8)	kg cm^2 (10^{-4} lbf in s^2)
Weight (without brake)	m	3.00 (6.6)	4.00 (8.8)	4.60 (10.1)	7.60 (16.8)	9.40 (20.7)	kg (lb)

| Optional holding brake	Specifications	Units
Holding torque	14 (124)	Nm (lbf in)
Extra weight	0.8 (1.8)	kg (lb)
Extra inertia with resolver	1.0 (8.9)	kg cm^2 (10^{-4} lbf in s^2)
Extra inertia with encoder	1.1 (9.7)	kg cm^2 (10^{-4} lbf in s^2)
Power requirement	15.6	W
Voltage requirement (+6 % -10 %)	24	V_{DC}

Notes:

1. Motor performances as measured with Moog´s servo drive of proper size
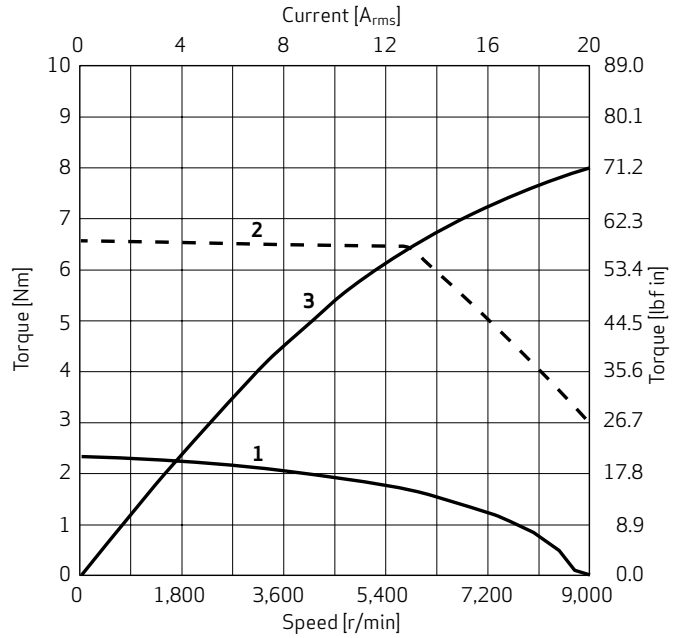2. Motor pole count: 12
3. DC link voltage 565 V

SIZE 4
Natural Cooling, High Voltage, Type G-4-V

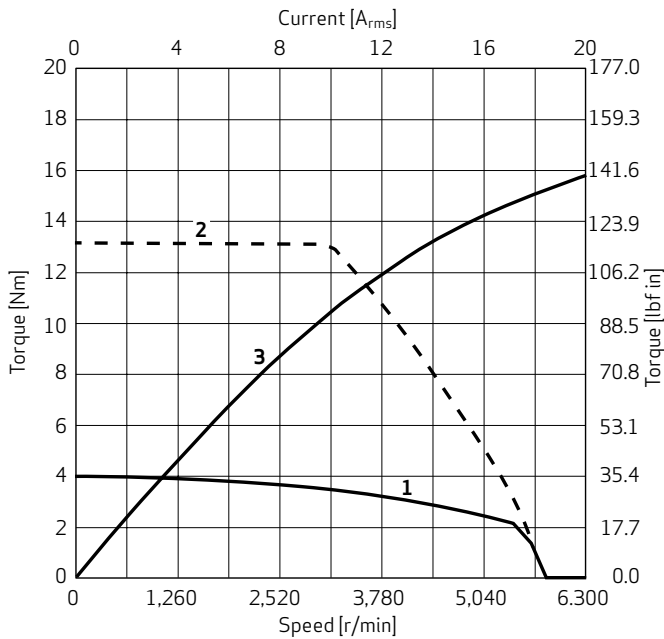**Motor Characteristics**

G-4-V2
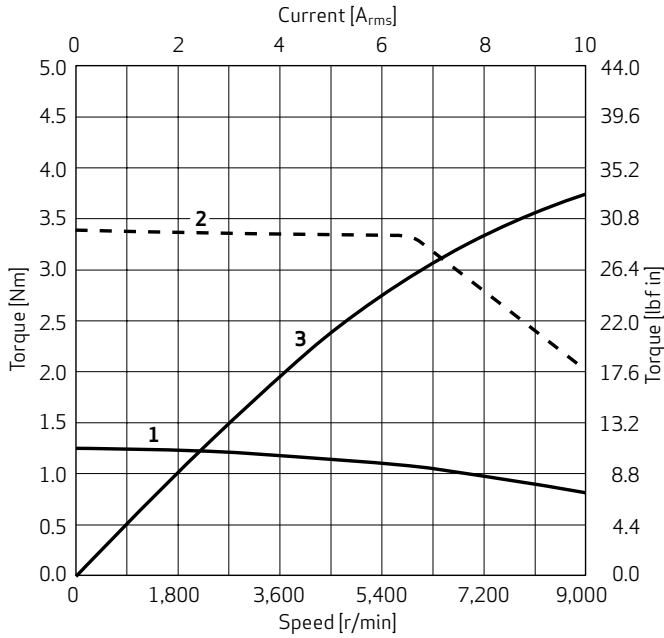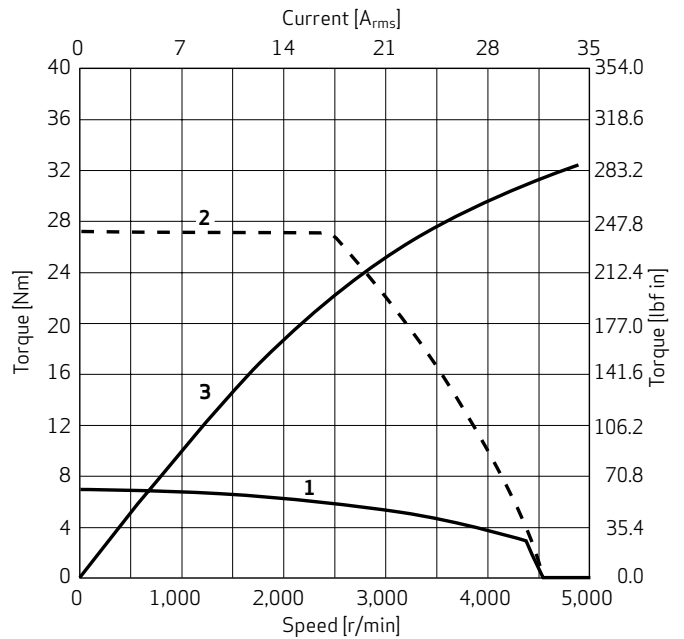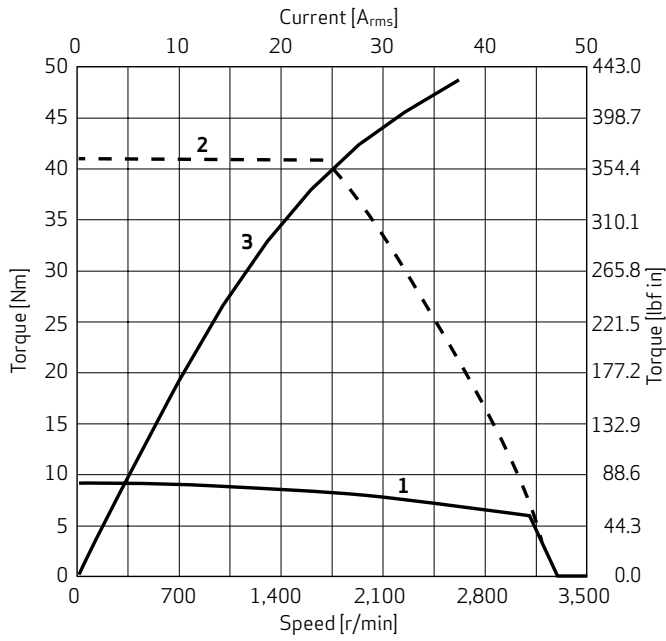

G-4-V4

G-4-V6

G-4-V8

1   Continuous torque
2   Maximum torque
3   Torque constant k_T

SIZE 4
Natural Cooling, High Voltage, Type G-4-V

Motor Characteristics

G-4-V9

1   Continuous torque
2   Maximum torque
3   Torque constant k_T

SIZE 4
Natural Cooling, Low or High Voltage, Type G-4

G-4 with Resolver

Model number	Dimension "A" resolver
	mm (in)
G-4-X2	133 (5.23)
G-4-X4	146 (5.74)
G-4-X6	171 (6.73)
G-4-X8	222 (8.74)
G-4-X9	273 (10.74)

Note: Dimensions mm (in)

X is a placeholder for M or V, for example, X2 is placeholder for M2 or V2

1   Power connector size 1
2   Signal connector
3   Runout class as per IEC/DIN normal class
4   Optional key 6x6x32
5   Thread M4x17
6   Shaft
7   Flange
8   With brake

SIZE 4
Natural Cooling, Low or High Voltage, Type G-4

G-4 with Encoder

Model number	Dimension "A" encoder
	mm (in)
G-4-X2	133 (5.23)
G-4-X4	146 (5.74)
G-4-X6	171 (6.73)
G-4-X8	222 (8.74)
G-4-X9	273 (10.74)

Note: Dimensions mm (in)

X is a placeholder for M or V, for example, X2 is placeholder for M2 or V2

1   Power connector size 1
2   Signal connector
3   Runout class as per IEC/DIN normal class
4   Optional key 6x6x32
5   Thread M4x17
6   Shaft
7   Flange
8   With brake
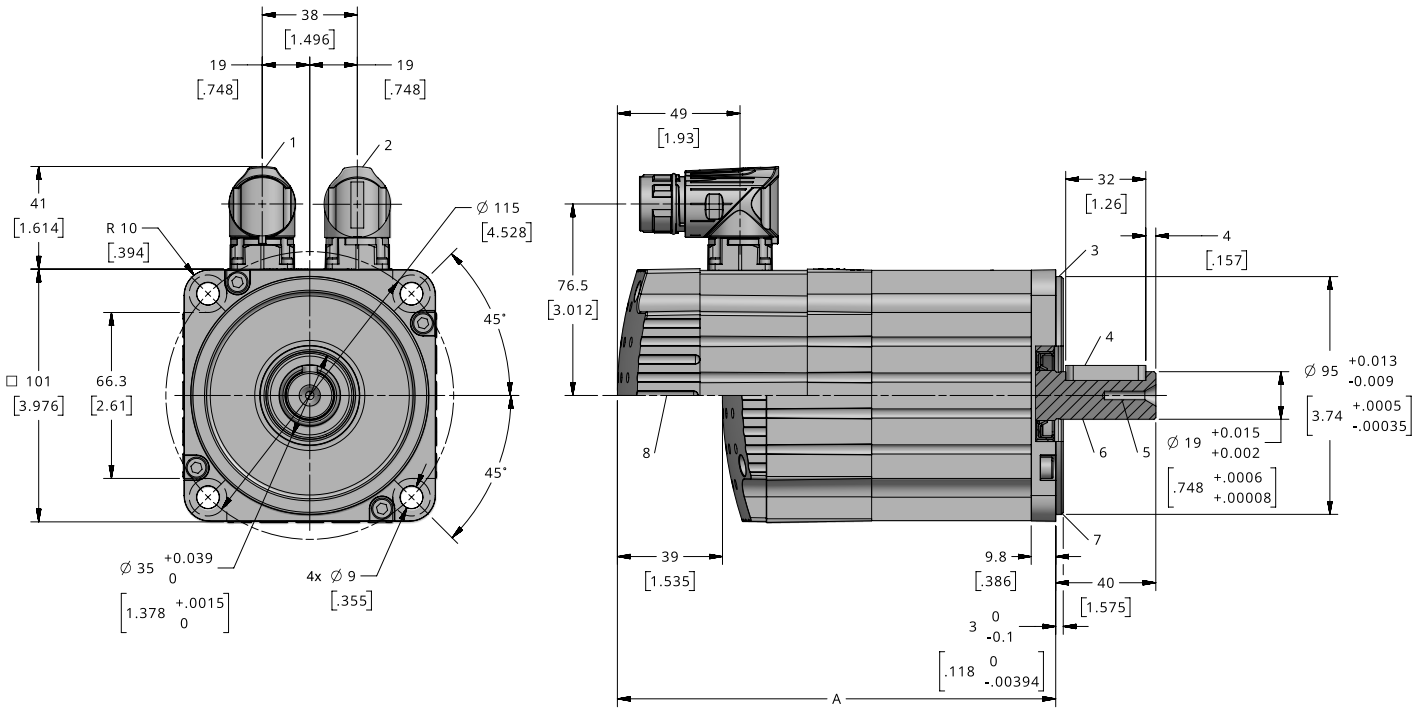
SIZE 5
Natural Cooling, Low Voltage, Type G-5-M

Characteristics and Nominal Values with Sinusoidal Drive

Characteristics		G-5-M2*	G-5-M4	G-5-M6	G-5-M8	G-5-M9	Units
Continuous stall torque	M_0	5.88 (52)	11.19 (99)	16.38 (145)	26.22 (232)	35.17 (311)	Nm (lbf in)
Rated torque	M_N	4.39 (38.9)	8.84 (78.2)	13.36 (118)	22.35 (198)	27.82 (246)	Nm (lbf in)
Maximum torque	M_{max}	13.25 (117)	26.96 (239)	40.86 (362)	67.53 (598)	94.46 (836)	Nm (lbf in)
Rated speed	n_N	4,800	3,200	2,500	1,800	2,000	r/min
Maximum speed	n_{max}	6,700	4,700	3,200	2,400	2,600	r/min
Continuous stall current	I_0	9.68	11.13	12.68	15.01	21.53	A_{rms}
Maximum current	I_{max}	28.8	35.5	42.0	51.5	77.1	A_{rms}
Rated power	P_N	2.21 (3)	2.96 (4)	3.50 (4.7)	4.21 (5.6)	5.83 (7.8)	kW (hp)
Torque constant	k_T	0.61 (5.4)	1.01 (8.9)	1.29 (11.4)	1.75 (15.5)	1.63 (14.4)	Nm/A_{rms} $(lbf\ in/A_{rms})$
Voltage constant	k_e	37.8	60.7	77.5	104.4	97.1	$V_{rms}/k_{r/min}$
Thermal time constant	t_{th}	1,587	2,196	2,539	3,292	3,700	s
Winding resistance at 25 °C (77 °F) (phase to phase)	R_{tt}	0.846	0.731	0.634	0.554	0.318	Ohm
Winding inductance (phase to phase)	L_{tt}	3.7	4.2	4.3	4.7	2.8	mH
Rotor inertia with resolver	J	4.71 (41.7)	8.43 (74.6)	12.20 (108)	19.74 (175)	27.23 (241)	kg cm^2 (10^{-4} lbf in s^2)
Rotor inertia with encoder	J	4.51 (39.9)	8.23 (72.8)	12.01 (106)	19.55 (173)	27.05 (239)	kg cm^2 (10^{-4} lbf in s^2)
Weight (without brake)	m	7.70 (17)	9.90 (21.8)	12.10 (26.7)	16.00 (35.3)	21.00 (46.3)	kg (lb)

Optional holding brake	Specifications	Units
Holding torque	22 (195)	Nm (lbf in)
Extra weight	1.2 (2.6)	kg (lb)
Extra inertia with resolver	3.6 (31.9)	kg cm^2 (10^{-4} lbf in s^2)
Extra inertia with encoder	3.8 (33.6)	kg cm^2 (10^{-4} lbf in s^2)
Power requirement	17	W
Voltage requirement (+6 % -10 %)	24	V_{DC}

Notes:

1. Motor performances as measured with Moog´s servo drive of proper size
2. Motor pole count: 12
3. DC link voltage 325 V

* Refer to the section on Ordering Information - Ordering Code for servo motor type definition.

SIZE 5
Natural Cooling, Low Voltage, Type G-5-M

Motor Characteristics

G-5-M2

G-5-M4

G-5-M6

G-5-M8

1   Continuous torque
2   Maximum torque
3   Torque constant k_T

SIZE 5
Natural Cooling, Low Voltage, Type G-5-M

Motor Characteristics

G-5-M9

1   Continuous torque
2   Maximum torque
3   Torque constant k_T

SIZE 5
Natural Cooling, High Voltage, Type G-5-V

Characteristics and Nominal Values with Sinusoidal Drive

Characteristics		G-5-V2	G-5-V4	G-5-V6	G-5-V8	G-5-V9	Units
Continuous stall torque	M_0	5.80 (51.3)	11.08 (98.1)	16.36 (145)	25.52 (226)	34.13 (302)	Nm (lbf in)
Rated torque	M_N	4.21 (37.3)	7.86 (69.6)	11.06 (97.9)	18.47 (163)	24.30 (215)	Nm (lbf in)
Maximum torque	M_{max}	13.29 (118)	27.02 (239)	40.86 (362)	67.53 (598)	94.55 (837)	Nm (lbf in)
Rated speed	n_N	5,000	3,800	3,400	2,600	2,400	r/min
Maximum speed	n_{max}	6,400	4,900	5,200	4,200	3,000	r/min
Continuous stall current	I_0	5.27	7.53	11.61	14.59	13.91	A_{rms}
Maximum current	I_{max}	16.0	24.4	38.5	51.5	51.5	A_{rms}
Rated power	P_N	2.21 (3)	3.13 (4.2)	3.94 (5.3)	5.03 (6.7)	6.11 (8.2)	kW (hp)
Torque constant	k_T	1.10 (9.7)	1.47 (13)	1.41 (12.5)	1.75 (15.5)	2.45 (21.7)	Nm/A_{rms} $(lbf\ in/A_{rms})$
Voltage constant	k_e	68.5	88.7	84.6	104.4	145.6	$V_{rms}/k_{r/min}$
Thermal time constant	t_{th}	1,587	2,196	2,539	3,292	3,700	s
Winding resistance at 25 °C (77 °F) (phase to phase)	R_{tt}	2.852	1.595	0.756	0.586	0.762	Ohm
Winding inductance (phase to phase)	L_{tt}	12.0	9.0	5.2	4.6	6.4	mH
Rotor inertia with resolver	J	4.71 (41.7)	8.43 (74.6)	12.20 (108)	19.74 (175)	27.23 (241)	$kg\ cm^2$ $(10^{-4}\ lbf\ in\ s^2)$
Rotor inertia with encoder	J	4.51 (39.9)	8.23 (72.8)	12.01 (106)	19.55 (173)	27.05 (239)	$kg\ cm^2$ $(10^{-4}\ lbf\ in\ s^2)$
Weight (without brake)	m	7.70 (17)	9.90 (21.8)	12.10 (26.7)	16.00 (35.3)	21.00 (46.3)	kg (lb)

Optional holding brake	Specifications	Units
Holding torque	22 (195)	Nm (lbf in)
Extra weight	1.2 (2.6)	kg (lb)
Extra inertia with resolver	3.6 (31.9)	$kg\ cm^2 (10^{-4}\ lbf\ in\ s^2)$
Extra inertia with encoder	3.8 (33.6)	$kg\ cm^2 (10^{-4}\ lbf\ in\ s^2)$
Power requirement	17	W
Voltage requirement (+6 % -10 %)	24	V_{DC}

Notes:

1. Motor performances as measured with Moog´s servo drive of proper size
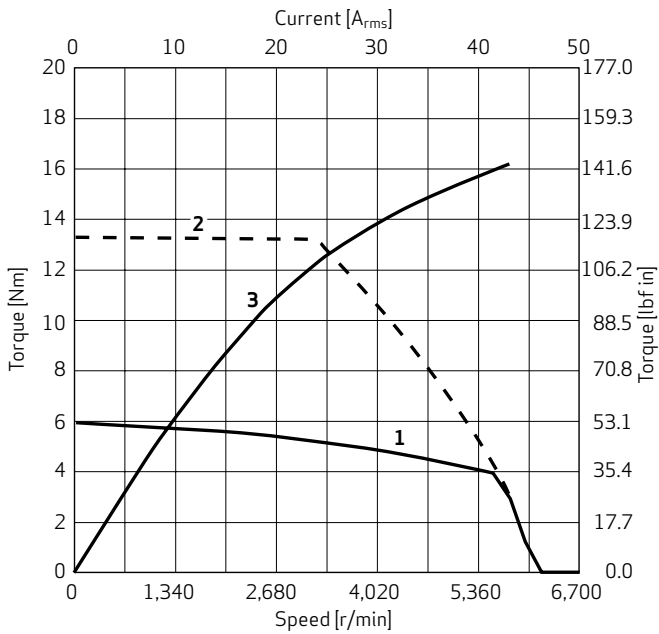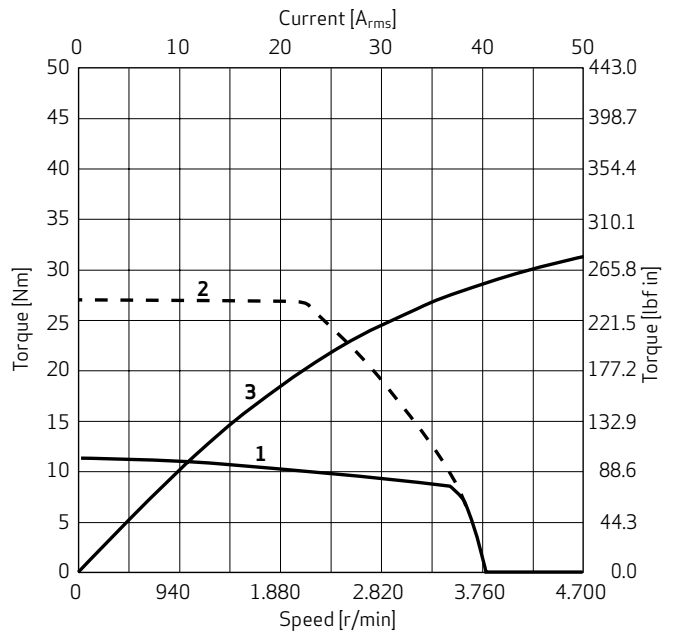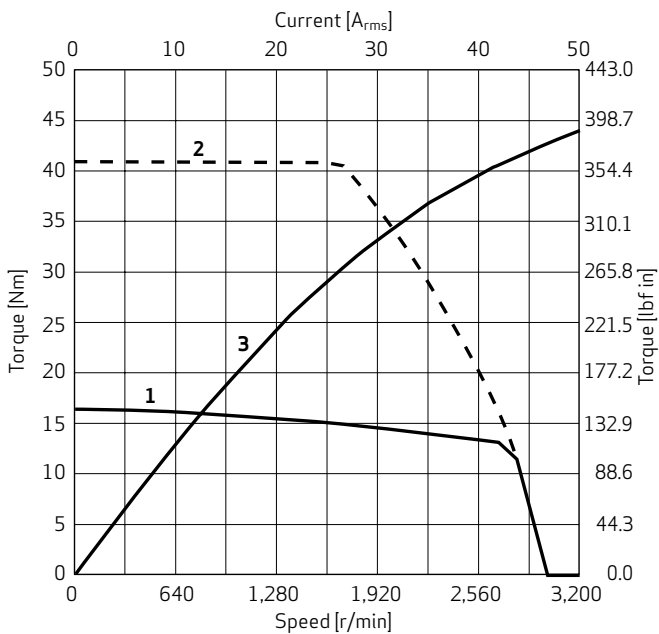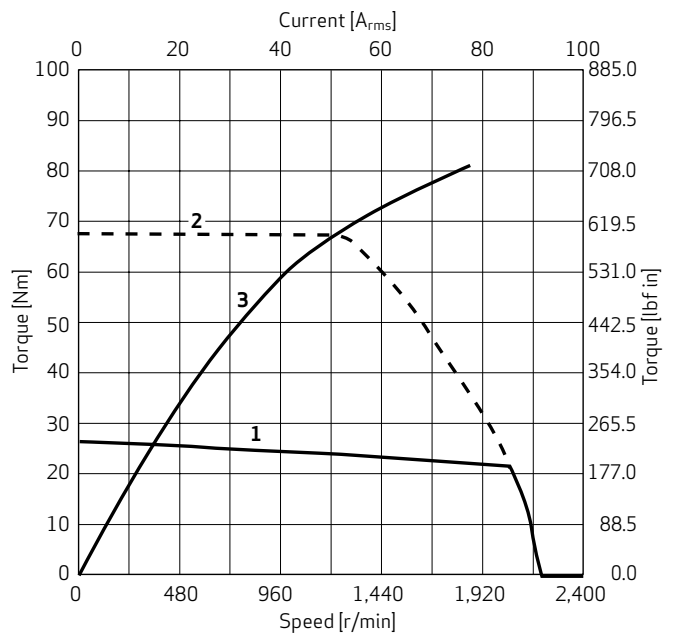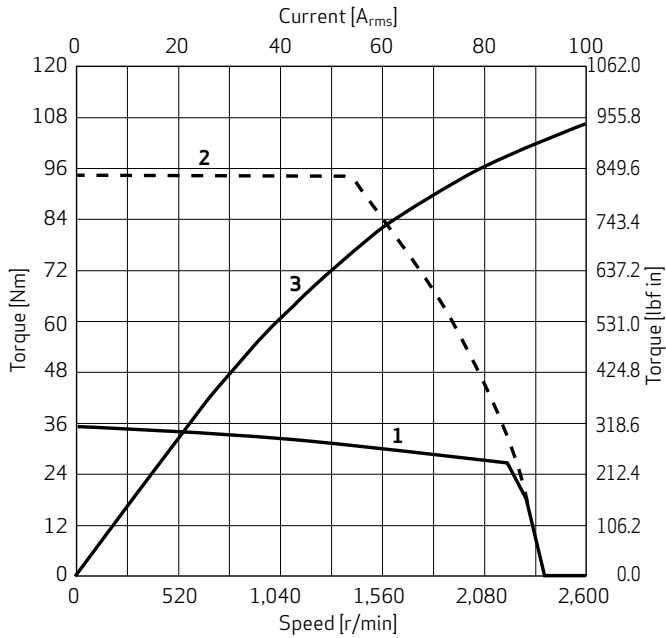2. Motor pole count: 12
3. DC link voltage 565 V

SIZE 5
Natural Cooling, High Voltage, Type G-5-V

Motor Characteristics

G-5-V2
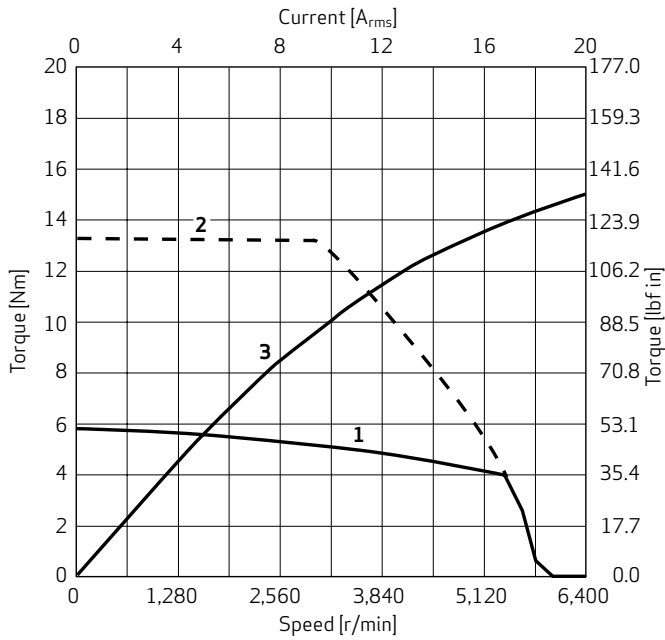
G-5-V4
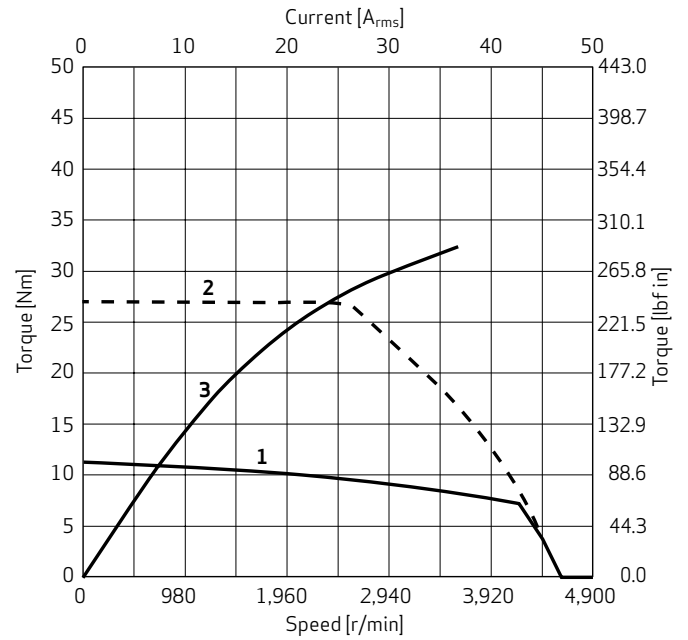
G-5-V6
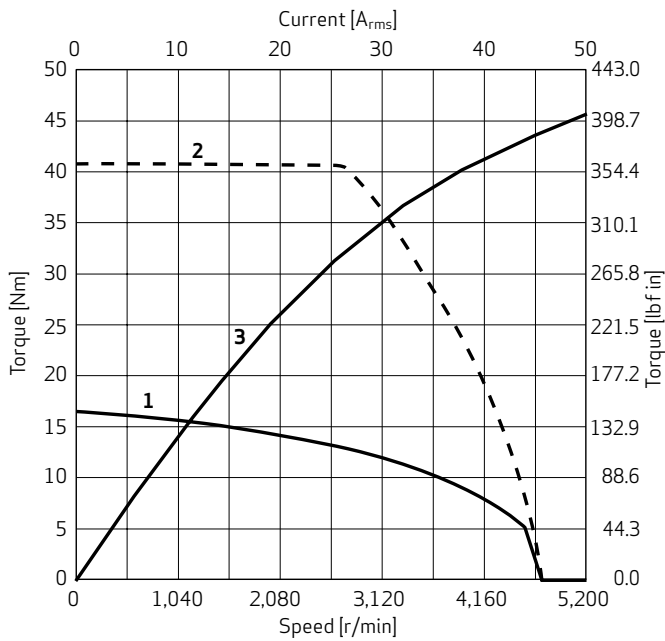
G-5-V8

1   Continuous torque
2   Maximum torque
3   Torque constant k_T

SIZE 5
Natural Cooling, High Voltage, Type G-5-V

Motor Characteristics

G-5-V9
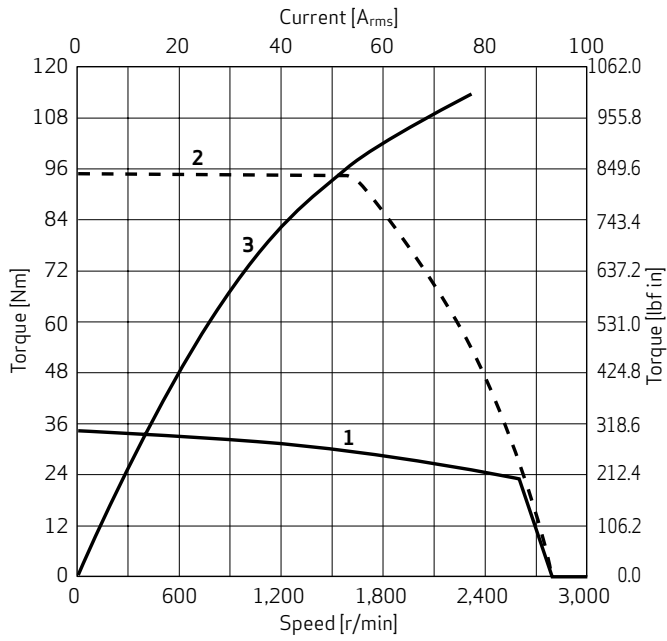
1   Continuous torque
2   Maximum torque
3   Torque constant k_T

SIZE 5
Natural Cooling, Low or High Voltage, Type G-5

G-5 with Resolver
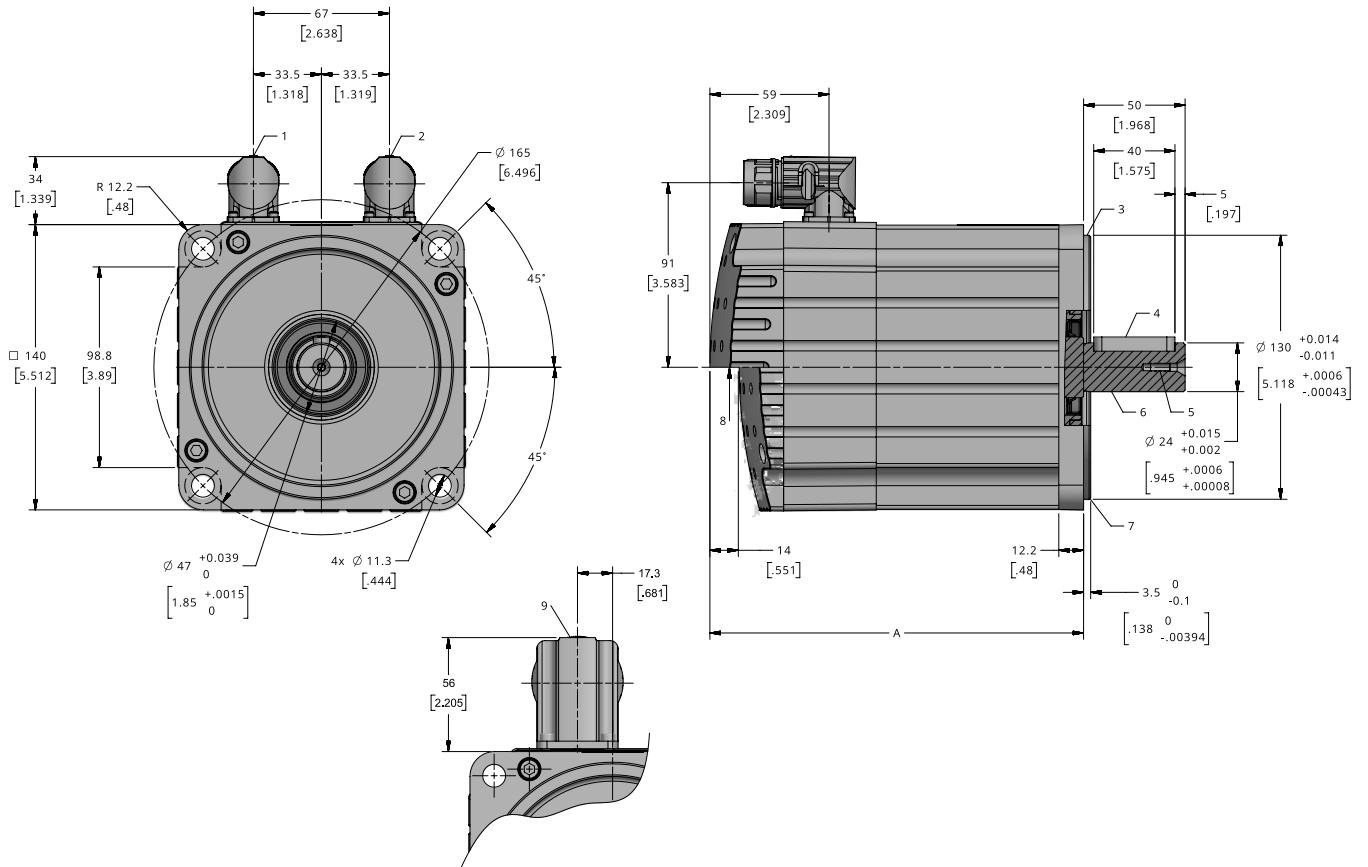
Model number	Dimension "A" resolver
	mm (in)
G-5-X2	170 (6.69)
G-5-X4	195 (7.67)
G-5-X6	220 (8.66)
G-5-X8	271 (10.66)
G-5-X9	322 (12.67)

Note: Dimensions mm (in)

X is a placeholder for M or V, for example, X2 is placeholder for M2 or V2

1 Power connector size 1
2 Signal connector
3 Runout class as per IEC/DIN normal class
4 Optional key 8x7x40
5 Thread M4x17
6 Shaft
7 Flange
8 With brake
9 Power connector size 1.5 only for G-5-X9

SIZE 5
Natural Cooling, Low or High Voltage, Type G-5

G-5 with Encoder
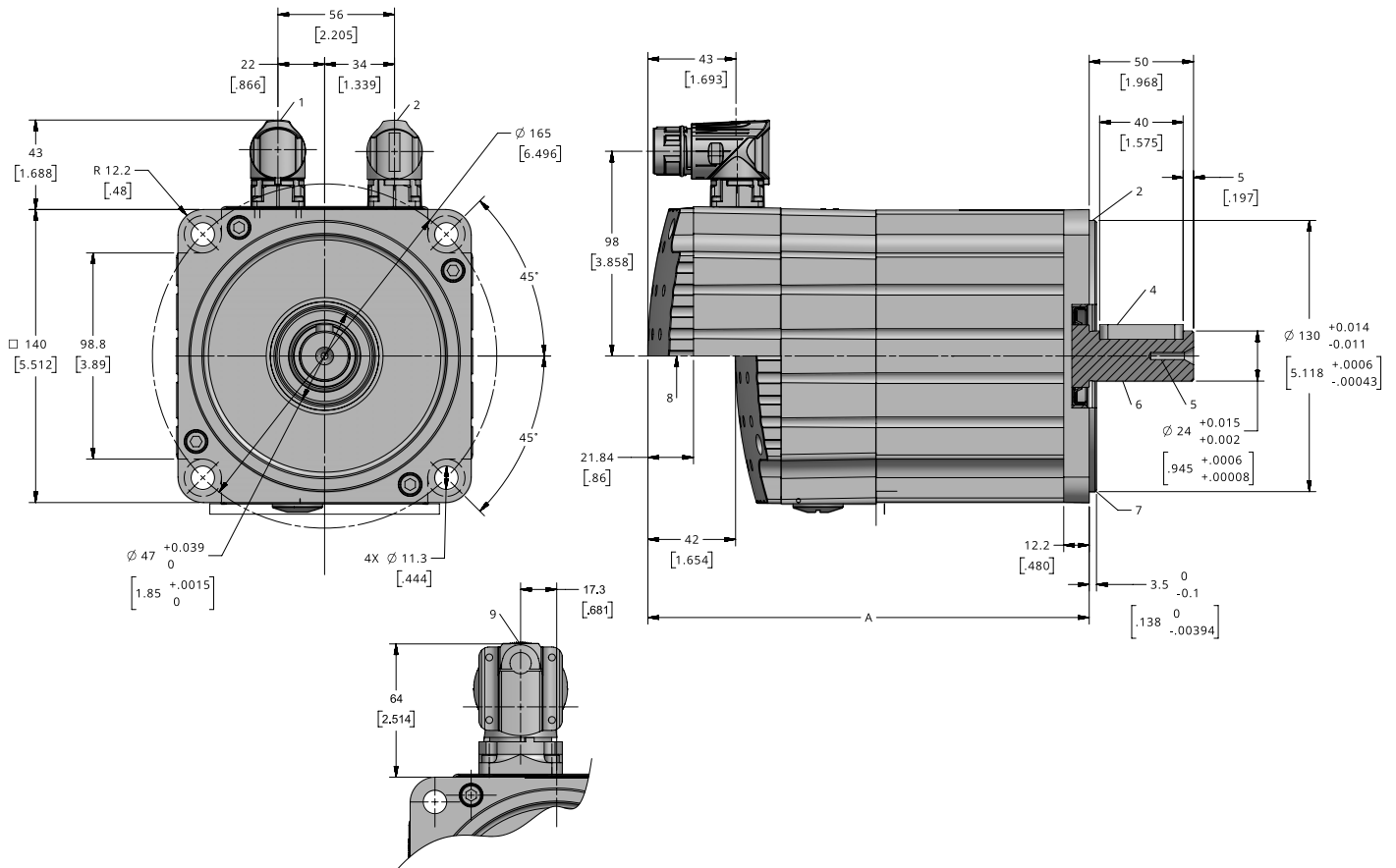
Model number	Dimension "A" encoder
	mm (in)
G-5-X2	170 (6.69)
G-5-X4	195 (7.67)
G-5-X6	220 (8.66)
G-5-X8	271 (10.66)
G-5-X9	322 (12.67)

Note: Dimensions mm (in)

X is a placeholder for M or V, for example, X2 is placeholder for M2 or V2

1   Power connector size 1
2   Signal connector
3   Runout class as per IEC/DIN normal class
4   Optional key 8x7x40
5   Thread M4x17
6   Shaft
7   Flange
8   With brake
9   Power connector size 1.5 only for G-5-X9

SIZE 6
Natural Cooling, Low Voltage, Type G-6-M

Characteristics and Nominal Values with Sinusoidal Drive

Characteristics		G-6-M2*	G-6-M4	G-6-M6	G-6-M8	G-6-M9	Units
Continuous stall torque	M_0	13.99 (124)	26.86 (238)	38.83 (344)	50.70 (449)	74.26 (657)	Nm (lbf in)
Rated torque	M_N	9.48 (83.9)	17.91 (159)	26.53 (235)	35.48 (314)	51.34 (454)	Nm (lbf in)
Maximum torque	M_{max}	40.25 (356)	80.03 (708)	120.01 (1,062)	160.03 (1,416)	240.06 (2,125)	Nm (lbf in)
Rated speed	n_N	4,000	3,000	2,500	2,200	2,000	r/min
Maximum speed	n_{max}	6,100	4,600	3,900	3,300	2,600	r/min
Continuous stall current	I_0	21.39	30.76	37.02	41.86	47.16	A_{rms}
Maximum current	I_{max}	72.0	107.0	133.7	154.4	178.3	A_{rms}
Rated power	P_N	3.97 (5.3)	5.63 (7.5)	6.95 (9.3)	8.18 (11)	10.75 (14.4)	kW (hp)
Torque constant	k_T	0.65 (5.8)	0.87 (7.7)	1.05 (9.3)	1.21 (10.7)	1.57 (13.9)	Nm/A_{rms} $(lbf\ in/A_{rms})$
Voltage constant	k_e	41.3	54.4	65.0	75.1	96.9	$V_{rms}/k_{r/min}$
Thermal time constant	t_{th}	2,698	3,186	3,775	3,850	4,100	s
Winding resistance at 25 °C (77 °F) (phase to phase)	R_{tt}	0.234	0.140	0.115	0.105	0.105	Ohm
Winding inductance (phase to phase)	L_{tt}	2.0	1.6	1.5	1.4	1.6	mH
Rotor inertia with resolver	J	27.78 (246)	53.57 (474)	79.36 (702)	105.40 (933)	156.98 (1,389)	kg cm^2 (10^{-4} lbf in s^2)
Rotor inertia with encoder	J	27.56 (244)	53.34 (472)	79.13 (700)	105.18 (931)	156.76 (1,387)	kg cm^2 (10^{-4} lbf in s^2)
Weight (without brake)	m	15.10 (33.3)	21.10 (46.5)	27.20 (60)	33.10 (73)	44.80 (98.8)	kg (lb)

Optional holding brake	Specifications	Units
Holding torque	72 (637)	Nm (lbf in)
Extra weight	2.9 (6.4)	kg (lb)
Extra inertia with resolver	16 (142)	kg cm^2 (10^{-4} lbf in s^2)
Extra inertia with encoder	16 (142)	kg cm^2 (10^{-4} lbf in s^2)
Power requirement	40	W
Voltage requirement (+6 % -10 %)	24	V_{DC}

Notes:

1. Motor performances as measured with Moog´s servo drive of proper size
2. Motor pole count: 12
3. DC link voltage 325 V

* Refer to the section on Ordering Information - Ordering Code for servo motor type definition.

SIZE 6
Natural Cooling, Low Voltage, Type G-6-M

Motor Characteristics

G-6-M2

G-6-M4

G-6-M6

G-6-M8

1   Continuous torque
2   Maximum torque
3   Torque constant k_T

SIZE 6
# Natural Cooling, Low Voltage, Type G-6-M

Motor Characteristics

G-6-M9

1   Continuous torque
2   Maximum torque
3   Torque constant k_T

SIZE 6
Natural Cooling, High Voltage, Type G-6-V

Characteristics and Nominal Values with Sinusoidal Drive

Characteristics		G-6-V2	G-6-V4	G-6-V6	G-6-V8	G-6-V9	Units
Continuous stall torque	M_0	13.93 (123)	26.20 (232)	38.80 (343)	50.65 (448)	74.22 (657)	Nm (lbf in)
Rated torque	M_N	9.84 (87.1)	17.47 (155)	22.64 (200)	32.97 (292)	42.48 (376)	Nm (lbf in)
Maximum torque	M_{max}	40.27 (356)	80.01 (708)	120 (1,062)	160 (1,416)	240.03 (2,124)	Nm (lbf in)
Rated speed	n_N	3,800	3,000	2,900	2,400	2,400	r/min
Maximum speed	n_{max}	6,100	5,800	4,500	3,300	3,100	r/min
Continuous stall current	I_0	14.18	21.64	24.42	23.89	32.66	A_{rms}
Maximum current	I_{max}	48.0	77.2	88.2	88.2	123.5	A_{rms}
Rated power	P_N	3.92 (5.3)	5.49 (7.4)	6.88 (9.2)	8.29 (11.1)	10.68 (14.3)	kW (hp)
Torque constant	k_T	0.98 (8.7)	1.21 (10.7)	1.59 (14.1)	2.12 (18.8)	2.27 (20.1)	Nm/A_{rms} ($lbf\ in/A_{rms}$)
Voltage constant	k_e	62.1	75.4	98.5	131.5	139.8	$V_{rms}/k_{r/min}$
Thermal time constant	t_{th}	2,698	3,186	3,775	3,850	4,100	s
Winding resistance at 25 °C (77 °F) (phase to phase)	R_{tt}	0.533	0.283	0.265	0.321	0.219	Ohm
Winding inductance (phase to phase)	L_{tt}	4.5	3.1	3.4	4.4	3.3	mH
Rotor inertia with resolver	J	27.78 (246)	53.57 (474)	79.36 (702)	105.40 (933)	156.98 (1,389)	$kg\ cm^2$ ($10^{-4}\ lbf\ in\ s^2$)
Rotor inertia with encoder	J	27.56 (244)	53.34 (472)	79.13 (700)	105.18 (931)	156.76 (1,387)	$kg\ cm^2$ ($10^{-4}\ lbf\ in\ s^2$)
Weight (without brake)	m	15.10 (33.3)	21.10 (46.5)	27.20 (60)	33.10 (73)	44.80 (98.8)	kg (lb)

Optional holding brake	Specifications	Units
Holding torque	72 (637)	Nm (lbf in)
Extra weight	2.9 (6.4)	kg (lb)
Extra inertia with resolver	16 (142)	$kg\ cm^2$ ($10^{-4}\ lbf\ in\ s^2$)
Extra inertia with encoder	16 (142)	$kg\ cm^2$ ($10^{-4}\ lbf\ in\ s^2$)
Power requirement	40	W
Voltage requirement (+6 % -10 %)	24	V_{DC}

Notes:

1. Motor performances as measured with Moog´s servo drive of proper size
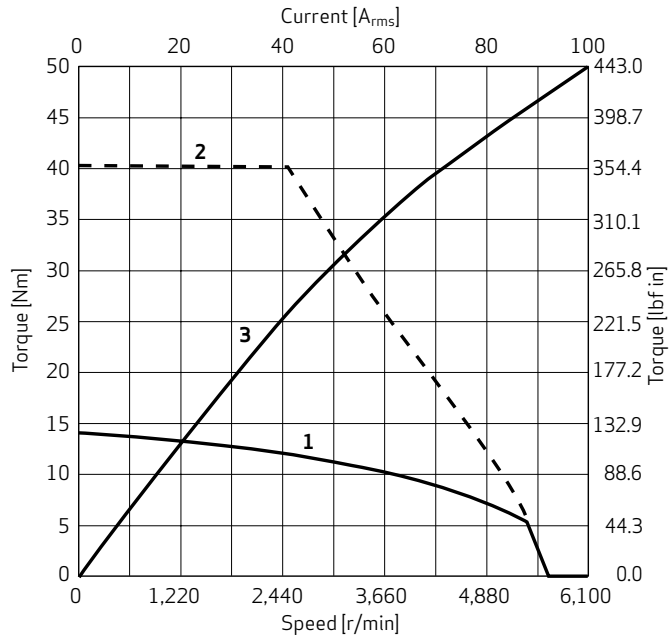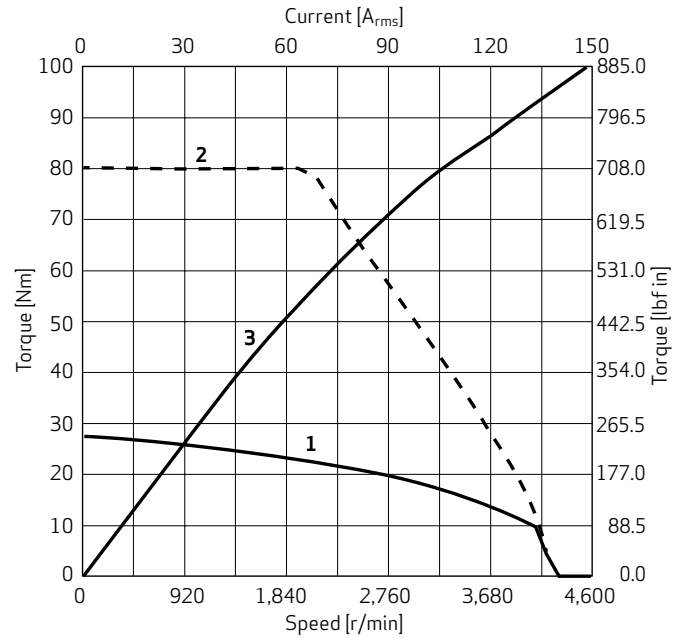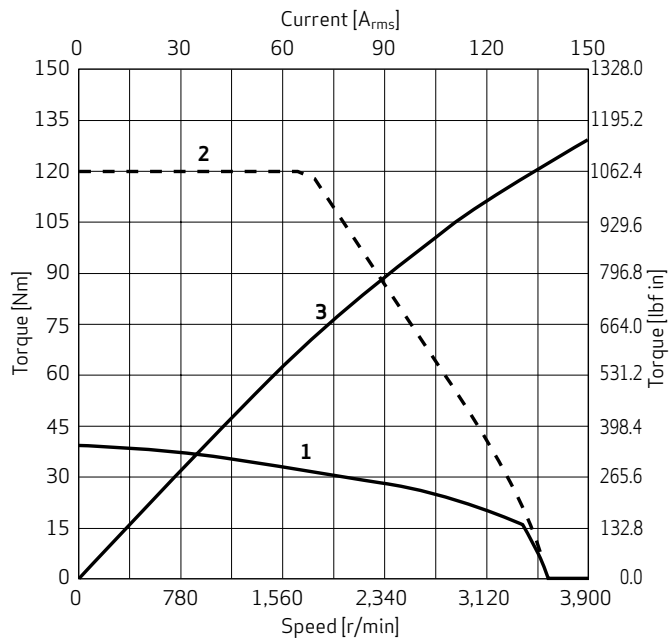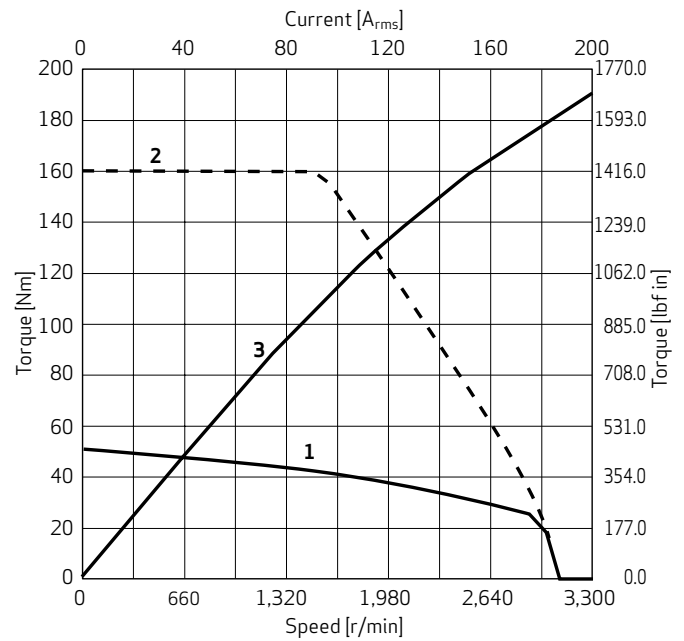2. Motor pole count: 12
3. DC link voltage 565 V

SIZE 6
Natural Cooling, High Voltage, Type G-6-V

Motor Characteristics

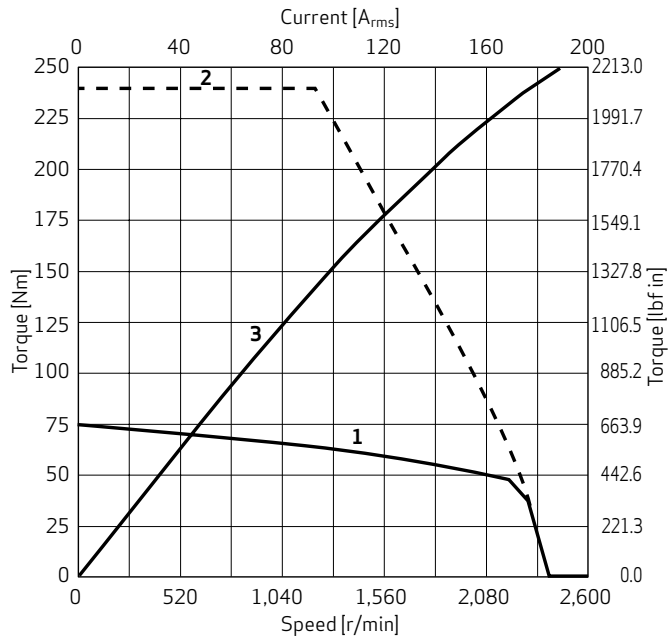### G-6-V2
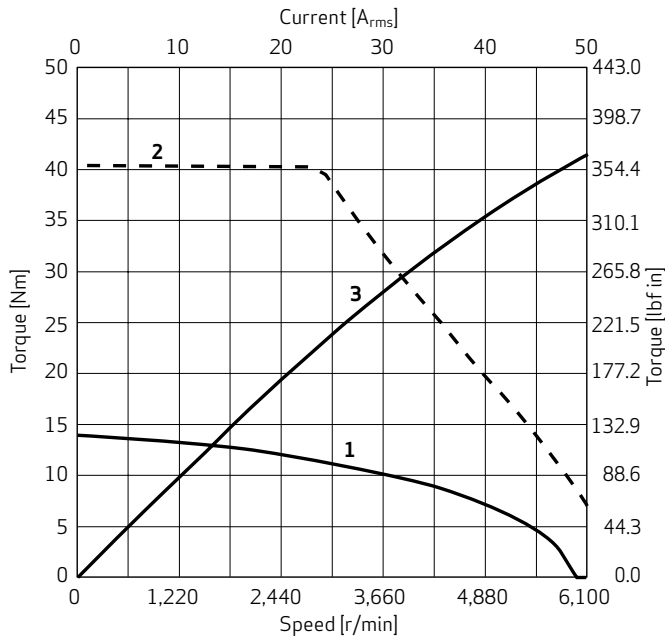
G-6-V4
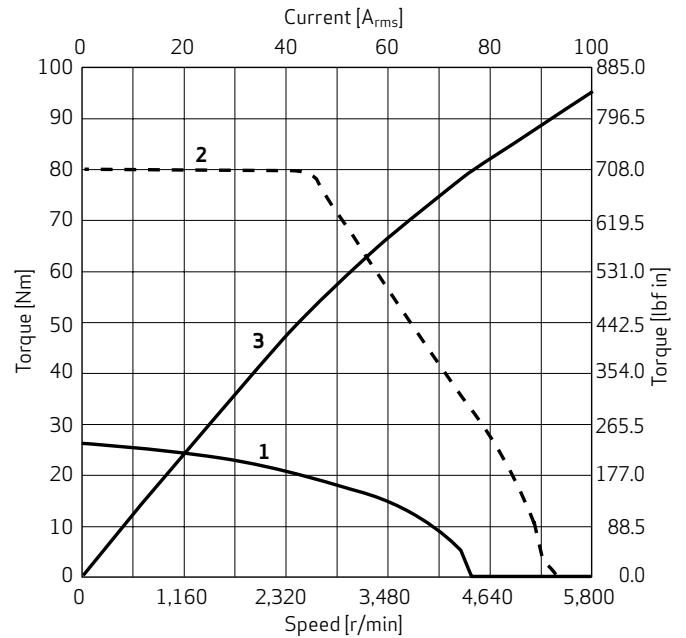
G-6-V6
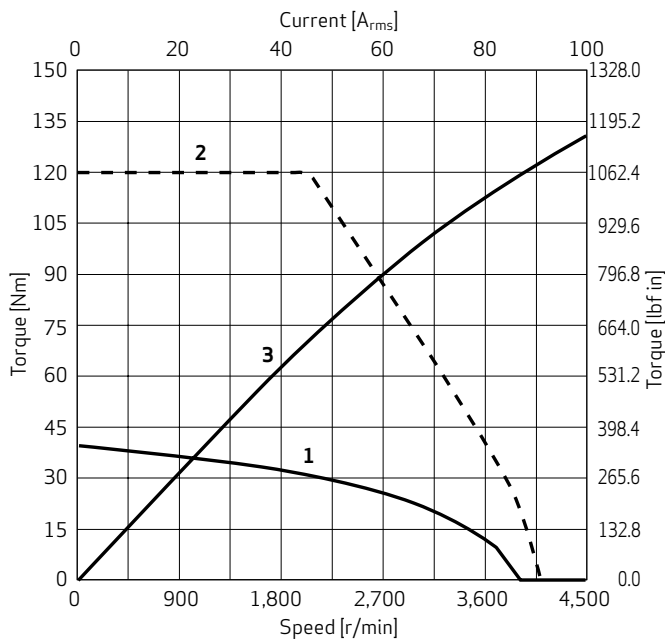
G-6-V8

1   Continuous torque
2   Maximum torque
3   Torque constant k_T

SIZE 6
Natural Cooling, High Voltage, Type G-6-V

Motor Characteristics

G-6-V9
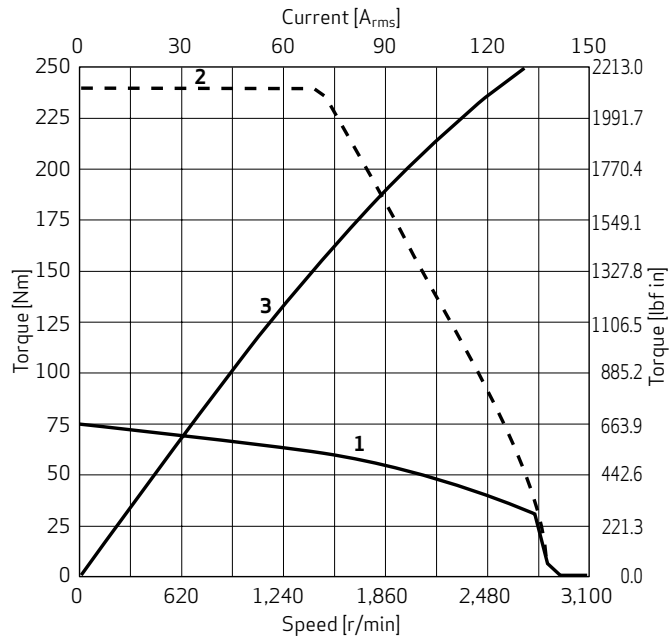
1   Continuous torque
2   Maximum torque
3   Torque constant k_T

SIZE 6
Natural Cooling, Low or High Voltage, Type G-6

G-6 with Resolver
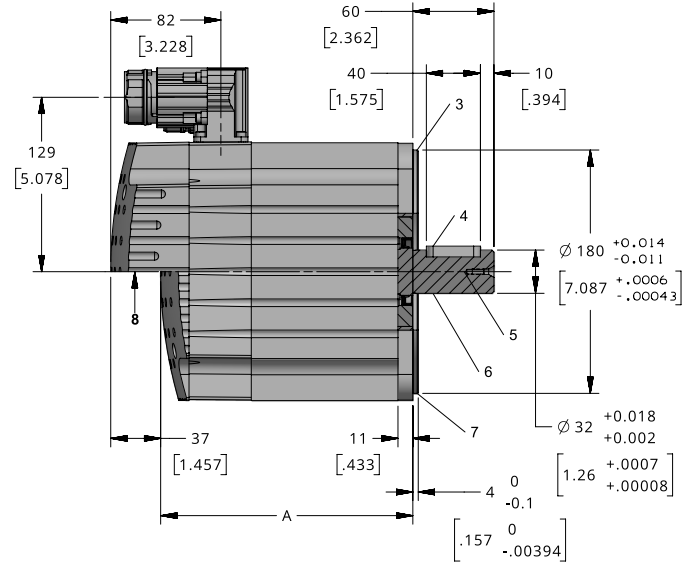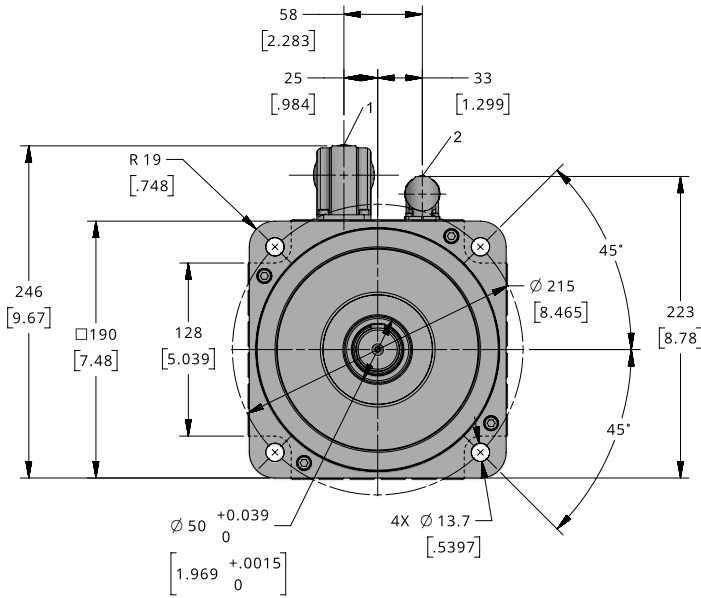
Model number	Dimension "A" resolver
	mm (in)
G-6-X2	187 (7.36)
G-6-X4	225 (8.85)
G-6-X6	263 (10.35)
G-6-X8	301 (11.85)
G-6-X9	377 (14.84)

1 Power connector size 1.5
2 Signal connector
3 Runout class as per IEC/DIN normal class
4 Optional key 10x8x40
5 Thread M4x17
6 Shaft
7 Flange
8 With brake

Note: Dimensions mm (in)

X is a placeholder for M or V, for example, X2 is placeholder for M2 or V2

SIZE 6
Natural Cooling, Low or High Voltage, Type G-6

G-6 with Encoder
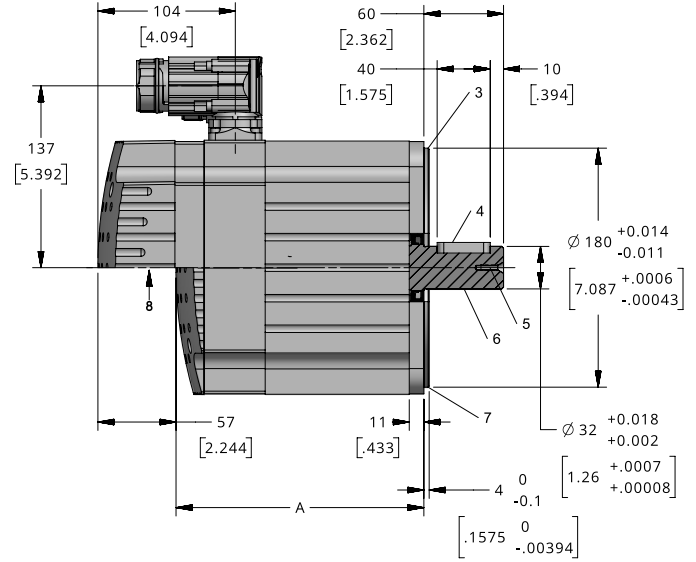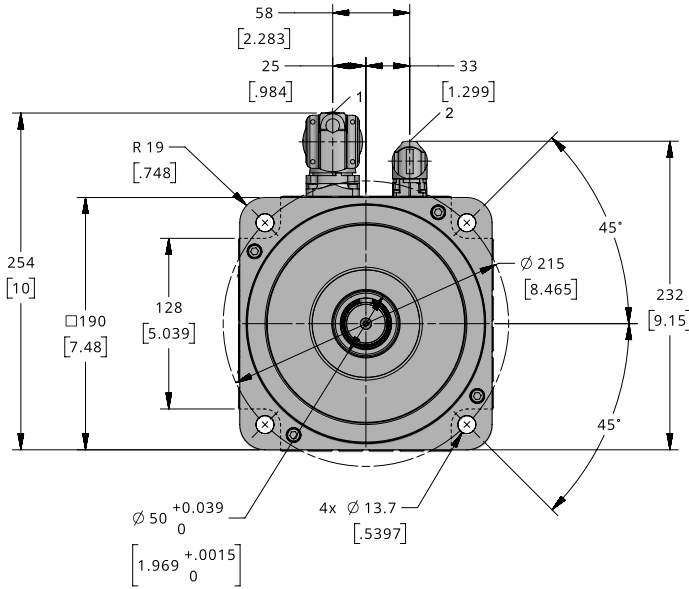
Model number	Dimension "A" encoder
	mm (in)
G-6-X2	187 (7.36)
G-6-X4	225 (8.85)
G-6-X6	263 (10.35)
G-6-X8	301 (11.85)
G-6-X9	377 (14.84)

Note: Dimensions mm (in)

X is a placeholder for M or V, for example, X2 is placeholder for M2 or V2

1   Power connector size 1.5
2   Signal connector
3   Runout class as per IEC/DIN normal class
4   Optional key 10x8x40
5   Thread M4x17
6   Shaft
7   Flange
8   With brake

CD motors are also offered with optional permanent magnet holding brakes. These brakes operate at 24 VDC and used for static braking purpose only. These brakes are not intended to be used as dynamic brake. Below table gives the Brake specifications for each size of the CD motors.

Optional Holding brake	G4X2	G4X3	G4X4	G4X5	G4X6	Units
Holding torque	1.0 (8.9)	4.5 (39.8)	14 (124)	22 (195)	72 (637)	Nm (lbf-in)
Weight*	0.12 (0.3)	0.33 (0.7)	0.8 (1.8)	1.2 (2.6)	2.9 (6.4)	Kg (lb)
Inertia*	0.021 (0.19)	0.18 (1.6)	1.0 (8.9)	3.6 (33.6)	16 (142)	KgCm^2 (10^{-4} lbfinS2)
Power requirement	10	12	15.6	17	40	W
Voltage requirement	24 ±10%					V$_{DC}$

*For motors with brake option additional weight and inertia of brake to be added

MECHANICAL OPTIONS AND ECCENTRICITY DATA

Shaft with key, in compliance with IEC 72-1 (2022)
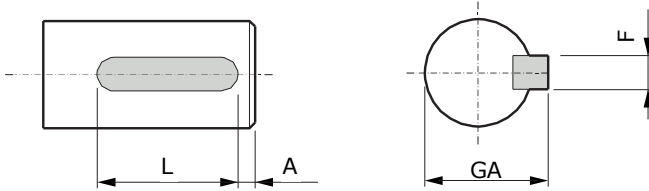
Eccentricity in compliance with IEC 72-1 (2022)
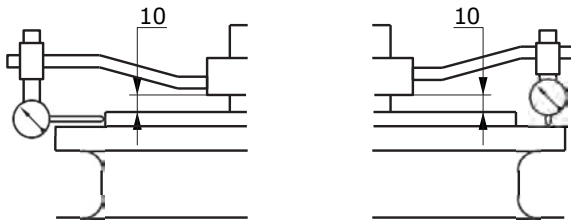
Type	G4X2	G4X3	G4X4	G4X5	G4X6
Max. concentricity and perpendicularity	0.08	0.08	0.08	0.1	0.1
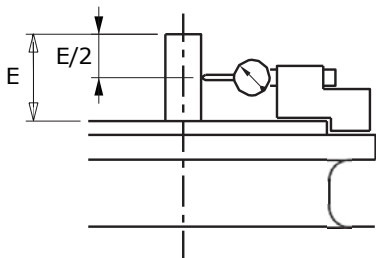
Type	G4X2	G4X3	G4X4	G4X5	G4X6
Max. runout	0.03	0.035	0.04	0.04	0.05

BEARING LOAD DIAGRAMS

Maximum Permissible Shaft Load

The maximum permissible radial load depends on the desired service life.

The bearing load curves display servo motor configurations (motor speed: radial loads) that support an operational life of 20,000 hours (L10h).

For maximum axial loads values for individual servo motor models, see the table below. Consult Moog for extended service life requirements or alternate load conditions.

Note:

Load capacity referenced to middle of output shaft.

Type	Axial load during operation [N (lbf)]	Axial load during installation [N (lbf)]
G-2	75 (17)	150 (34)
G-3	75 (17)	150 (34)
G-4	150 (34)	300 (67)
G-5	200 (45)	400 (90)
G-6	250 (56)	500 (112)

BEARING LOAD DIAGRAMS

G-2
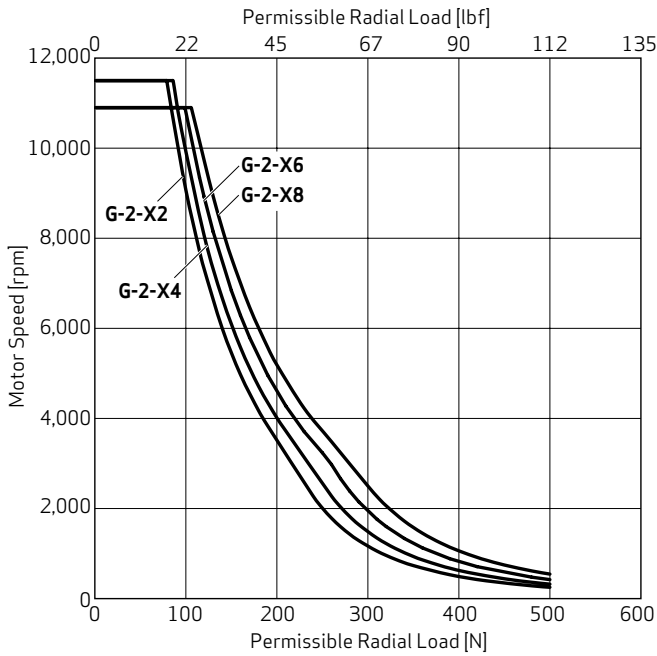
G-3
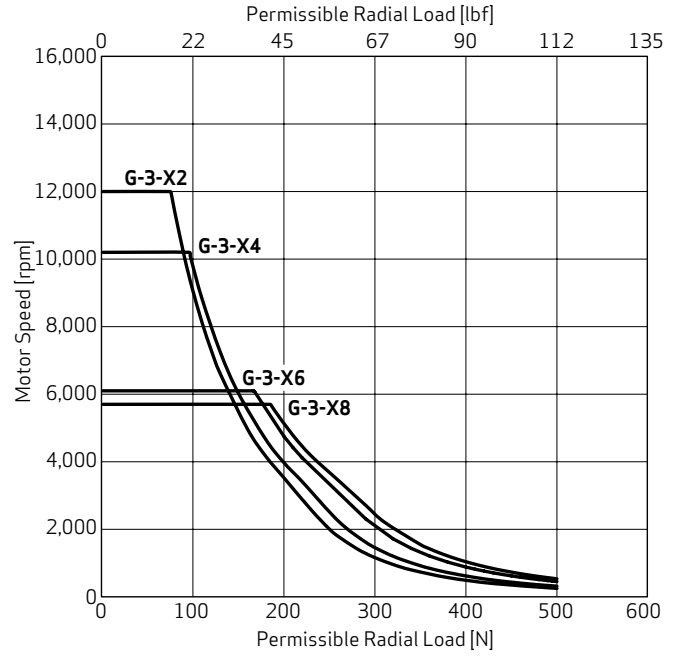
G-4
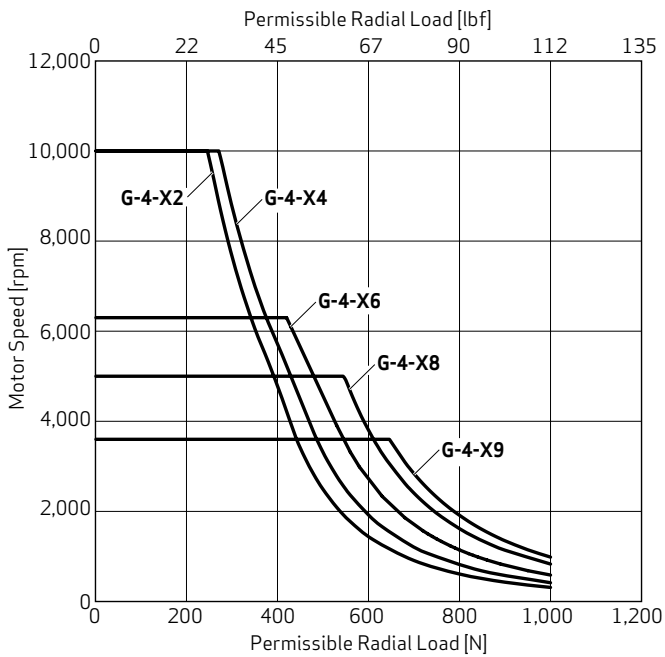
G-5
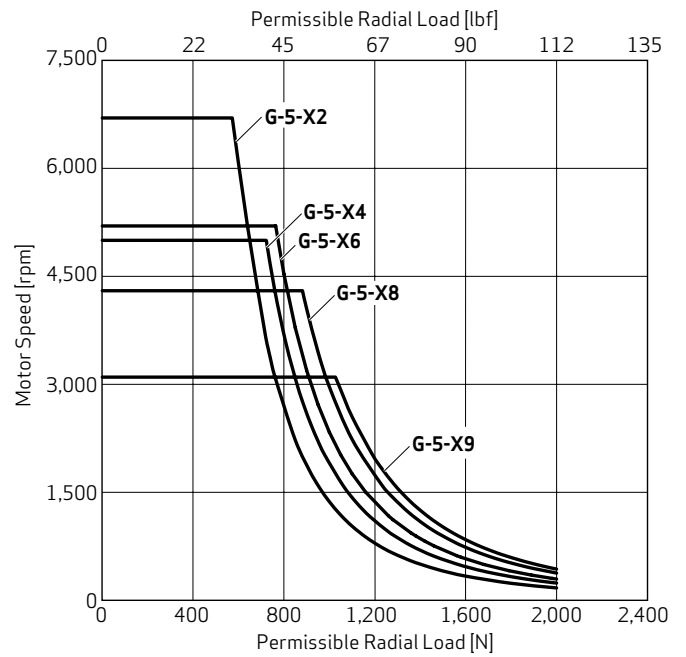
Note: X is a placeholder for M or V, for example, X2 is placeholder for M2 or V2.

BEARING LOAD DIAGRAMS

G-6
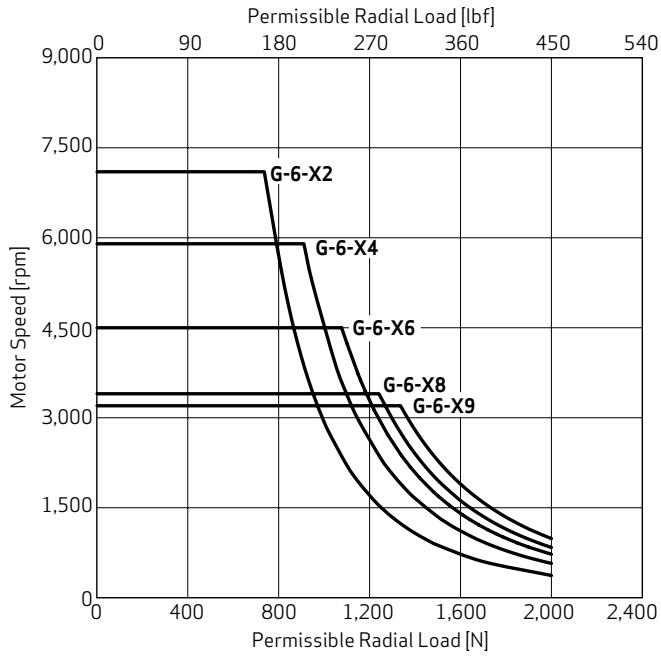
Note: X is a placeholder for M or V, for example, X2 is placeholder for M2 or V2

WIRING SCHEMATICS

For wiring schematics refer to the installation drawing provided along with the motor.

Below tables give information on cable schemes and mating connectors for power and signal connectors.

This information is only for standard motor configuration.

Cable sizes may vary in different countries due to differing national regulations with respect to current ratings and derating factors to be considered for different temperature. As a result, applicable DIN VDE/UL standard to be referred by end customer.

Note: For a special configuration please contact Moog personnel.

Power Cable and Connector Size for CD Motors		
Motor	Cable Size	Connector Size
G4X2-L05	4 x 0.25 mm2	Size 1
G4X2-L10	4 x 0.25 mm2	Size 1
G4X2-L20	4 x 0.25 mm2	Size 1
G4X2-L40	4 x 0.25 mm2	Size 1
G4X3-L05	4 x 0.75 mm2	Size 1
G4X3-L15	4 x 0.75 mm2	Size 1
G4X3-L25	4 x 0.75 mm2	Size 1
G4X3-L40	4 x 0.75 mm2	Size 1
G4X4-L05	4 x 2.5 mm2	Size 1
G4X4-L10	4 x 2.5 mm2	Size 1
G4X4-L20	4 x 2.5 mm2	Size 1
G4X4-L40	4 x 2.5 mm2	Size 1
G4X4-L60	4 x 2.5 mm2	Size 1
G4X5-L10	4 x 2.5 mm2	Size 1
G4X5-L20	4 x 2.5 mm2	Size 1
G4X5-L30	4 x 4 mm2	Size 1
G4X5-L50	4 x 4 mm2	Size 1.5
G4X5-L70	4 x 6 mm2	Size 1.5
G4X6-L15	4 x 6 mm2	Size 1.5
G4X6-L30	4 x 6 mm2	Size 1.5
G4X6-L45	4 x 6 mm2	Size 1.5
G4X6-L60	4 x 10 mm2	Size 1.5
G4X6-L90	4 x 10 mm2	Size 1.5

Note: Cable temperature up to 150ºC. Based on 40°C ambient with 110°C conductor rise due to current

WIRING SCHEMATICS

Other Components	
	Cable Size
Brake	2 x 1.0 mm² power

Recommended Mating Power Connector Part			
Connector	Cable Size	Moog Part Number	
		Speedtec	Connector Size
Mating connector loose	0.35 - 2.5 mm²	CD22372-001	Size 1
Mating connector loose	2.5- 4.0 mm²	CD22372-002	Size 1
Mating connector loose	1.5 – 10.0 mm²	CD22366-001	Size 1.5

Resolver Signal Connector	
Connector	Dimension
Cable scheme	8 x 0.25 mm², stranded wires, twisted paired, outer shield
Mating connector loose (recommended)	**Moog part numbe**r: CD22403-001

Encoder Signal Connector	
Connector	Dimension
Cable scheme	17 x 0.25 mm², stranded wires, twisted paired, outer shield
Mating connector loose (recommended)	**Moog part number:** CD22387-001

Note: For compliance with Directive 89 / 336 / EC (EMC), and for correct system operation, the signal and power cables must be shielded (minimum cover 85%). The shield must be connected to the frame at both ends, using a radio frequency connection (i.e. 360°). In the case of a connector, the connection must be made with a cable relief; in the case of a terminal block, use a metal cable gland.

Fan Connector Mini Fit 2 Pin Type	
Connector	Dimension
Cable scheme	2 x 0.25 mm², stranded wires, twisted paired, outer shield
Mating connector loose (recommended)	**Moog part number:** Receptacle housing connector: CC16750-001 (2-pin type) Female crimp terminal: CC15364-001

Fan Connector Speedtec 6 Pin Type	
Connector	Dimension
Cable scheme	2 x 0.25 mm², stranded wires, twisted paired, outer shield
Mating connector loose (recommended)	**Moog part number:** CD22372-001 (SpeedTec ready type)

WIRING DIAGRAMS - POWER

Power Connector Size 1

Protective earth	PROTECTIVE EARTH
2	U phase
4	V phase
1	W phase
5	Brake supply (+)
6	Brake supply (-) ONLY VERSION WITH BRAKE

MOTOR

Power Connector Size 1.5

Protective earth	PROTECTIVE EARTH
U	U phase
V	V phase
W	W phase
+	Brake supply (+)
-	Brake supply (-) ONLY VERSION WITH BRAKE
1	Vacant
2	Vacant
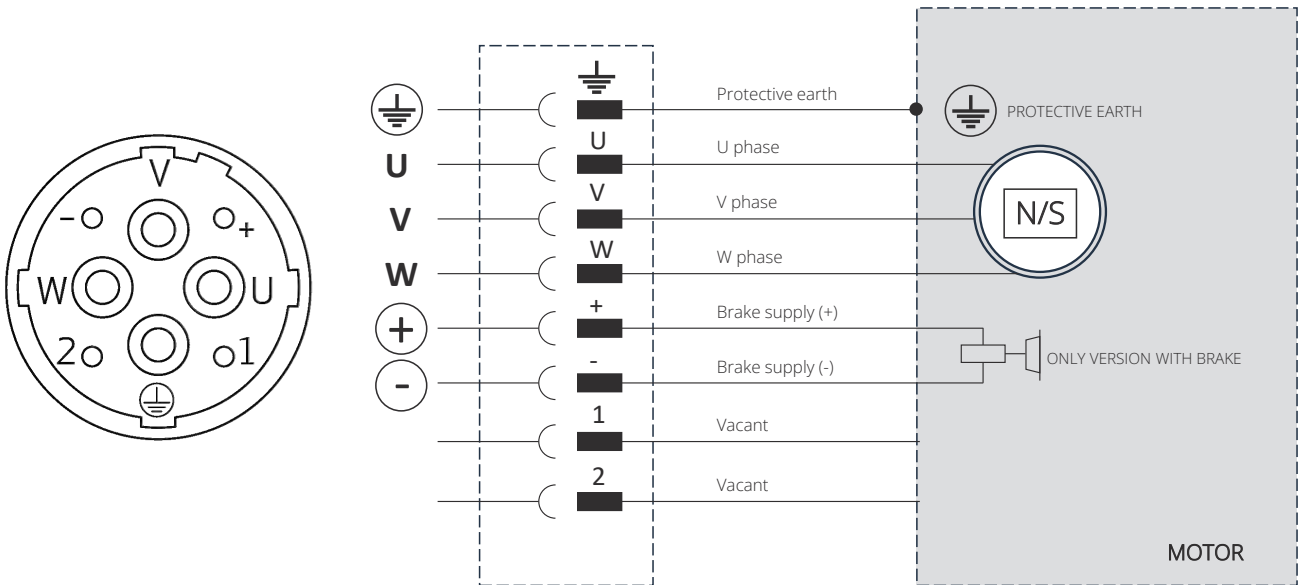
MOTOR

WIRING DIAGRAMS FEEDBACK DEVICE

Resolver – Signal Connector
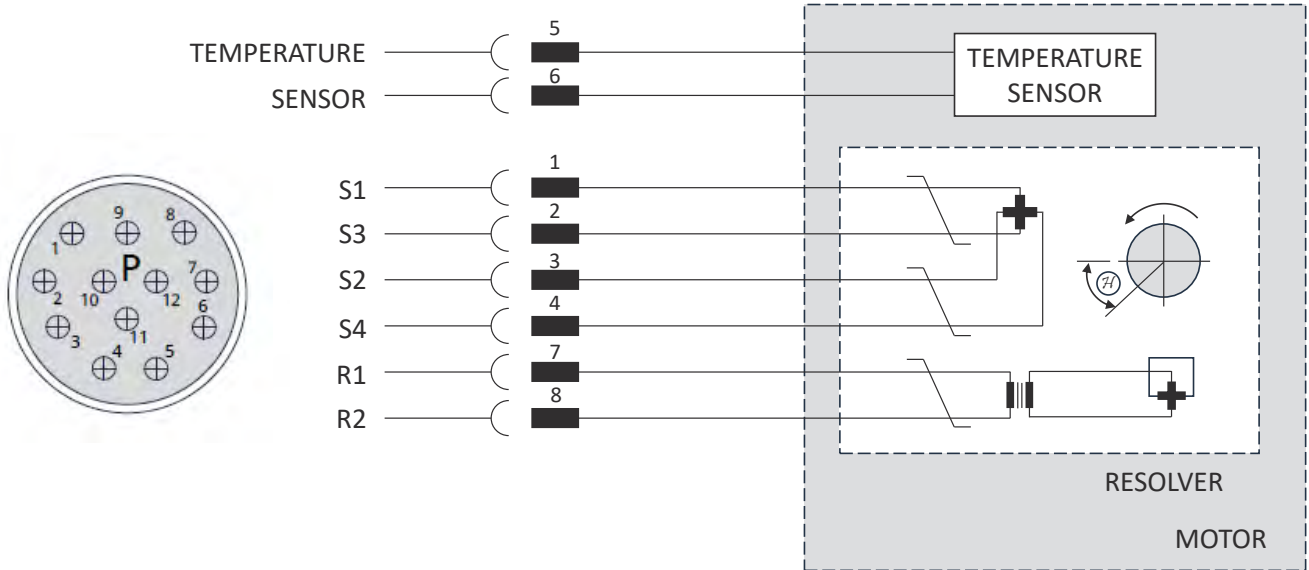
Heidenhain Absolute

Absolute single turn/multi turn
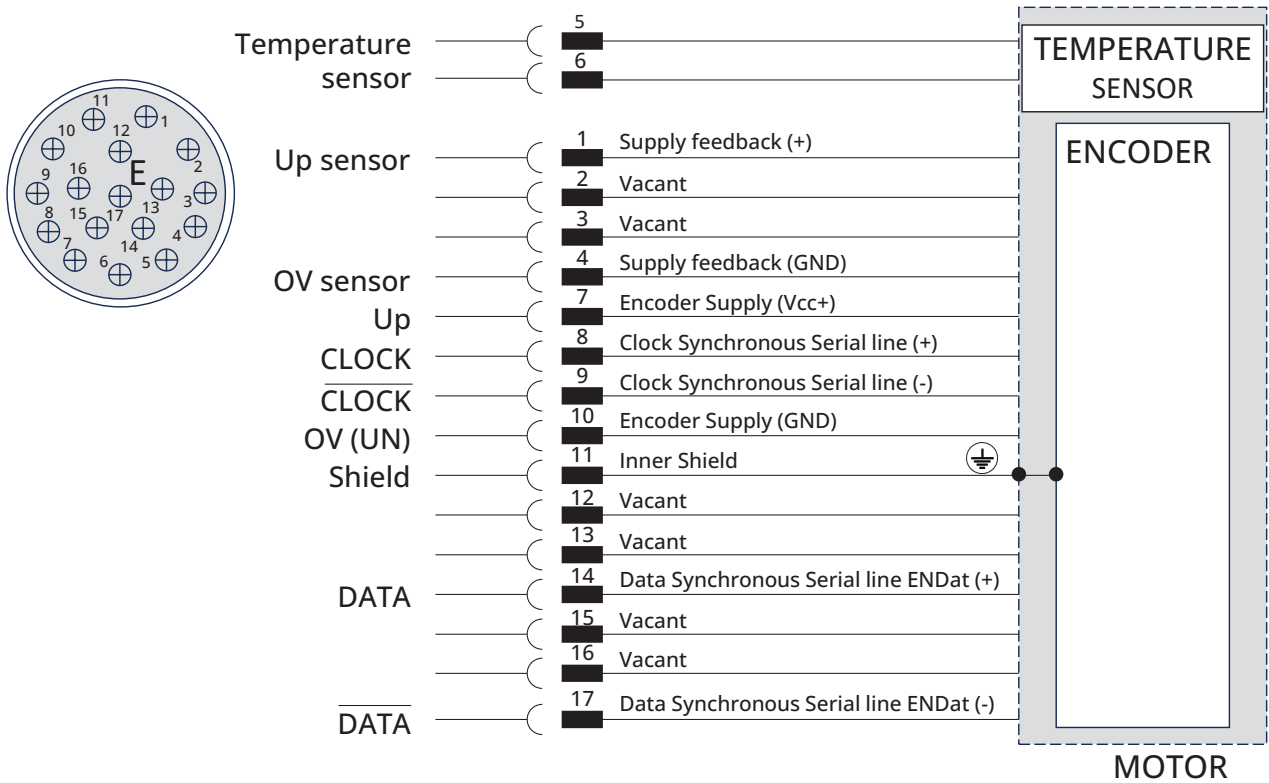
WIRING DIAGRAMS FAN CONNECTOR

Fan – Minifit Connector
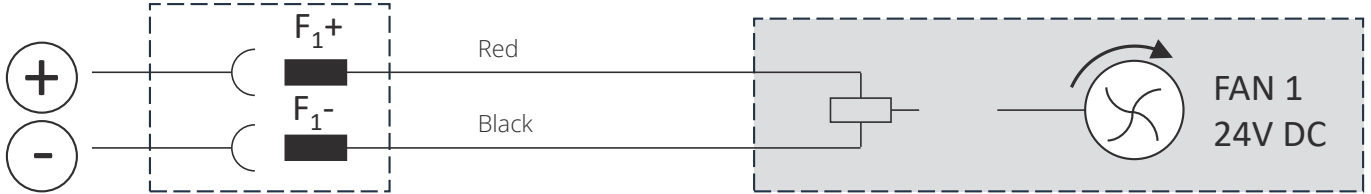
Fan – Power Connector Size 1
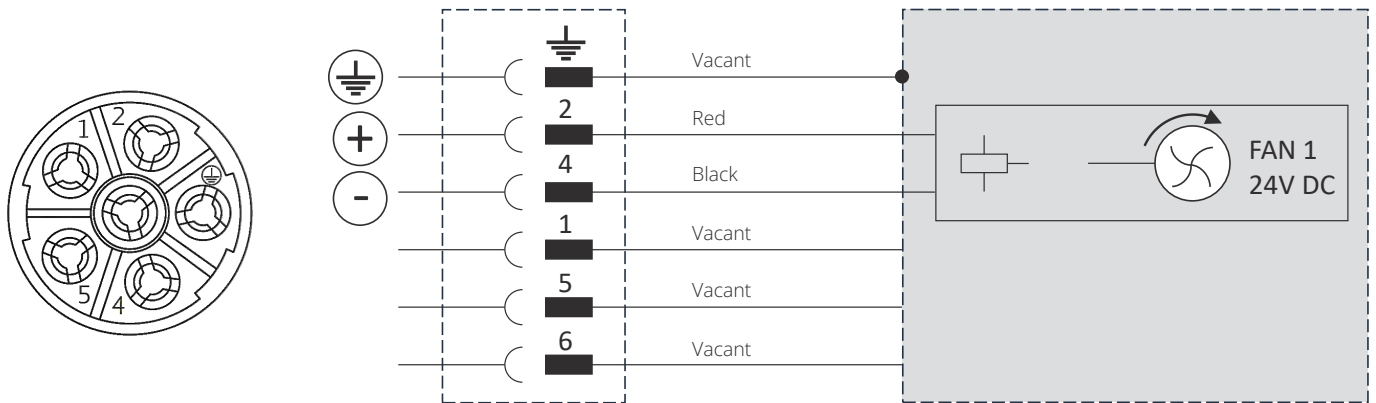
CONNECTORS

Moog motors have Threaded, Speedtec and Speedtec-ready connectors mounted on it. The Threaded and Speedtec-ready connectors will have O-ring installed in them.

The mating connectors are of two types Threaded and Speedtec plug type.

The threaded speedtec connector have the following thread sizes:

- Size 1 connector – M23x1P
- Size 1.5 connector – M40x1.5P

If a Speedtec-ready connector is used with a Threaded plug mating connector, the O-ring need not be removed from the motor connector, i.e., the connector can be used as is.

Speedtec-ready Connector
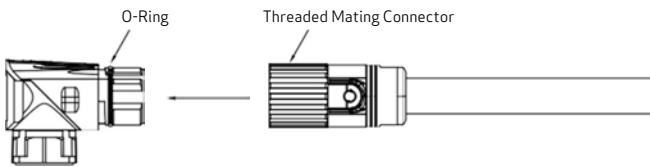
Figure 1: Speedtec-ready motor connector with O-ring (Example with angled connector)

If a Speedtec-ready connector is used with a Speedtec plug mating connector, then O-ring should be removed from the motor connector.

Speedtec-ready Connector
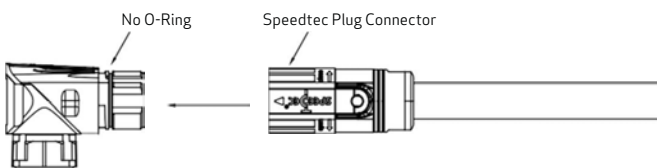
Figure 2: Speedtec-ready motor connector with O-ring uninstalled (Example with angled connector)

Fan Connector with Mating Connector

- Minifit connector
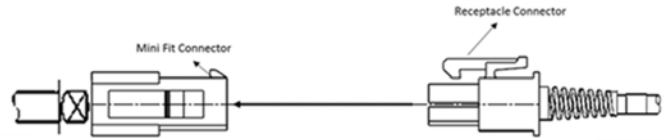
Figure 3: Fan connector with mating connector

Note: For more details on connectors please contact Moog personnel (for the pin arrangement please refer to installation drawings).

OUR WIDE RANGE OF SERVO MOTOR PRODUCTS

We are committed to offering a range of servo motor products with matched servo drives that are easy to integrate into industrial; applications.

Moog servo motors are electronically commutated synchronous AC motors with magnet field excitation. Our portfolio includes three motor families, with different characteristics to answer to
any applicative need.

ExD Explosion-Proof Brushless Servo Motors

Designed and tested for operation in conditions where vapors or gases form flammable or explosive environments. Flameproof housing withstands internal explosions without bursting.

HD (High Dynamic) Brushless Servo Motors

Combining compactness with performance, the HD servo motor series offers one of the industry's widest power ranges with continuous nominal torques from 2.91 to 996 Nm (25.76 to 8815.34 lb-in). The modular design is supported by a variety. of options with Moog's application engineers capable of supplying fully customized solutions.

OTHER MOOG PRODUCT OFFERING

SERVO DRIVES AND ELECTRONICS

Moog servo drives and electronic products can deliver the highest level of control accuracy, dynamic performance and reliability in both centralized and decentralized configurations. Machine designers are allowed complete freedom to achieve their goals, with space savings and optimized layouts perfectly fitting both traditional cabinets and distributed control architectures.

CENTRALIZED SOLUTIONS

Moog drive portfolio for cabinet installation include both single-axis and multi-axis configurations.

Single-Axis Drives
DS2020 Series - Ultra Compact Single-Axis Servo Drive

Standalone servo drive with integrated power supply, specifically designed with extremely compact dimensions for space saving.

Multi-Axis Drives
DM2020 Series - Digital Multi-Axis Servo Drive

Modular design drive platform, single and double axis modules, with shared power supply. About 50% more compact than a comparable standalone configuration.

DECENTRALIZED SOLUTIONS

Out-of-cabinet products for flexible machine architecture.

DR2020 - Machine-Mounted Servo Drive

On-board servo control, for installation on machine surfaces and easy daisy-chain and out of the cabinet connections.

SERVO MOTOR SELECTION AND SIZING

This application information provides some tools and guidelines to assist with the correct motor sizing for a new application. When a fully optimized system is required, please contact your local Moog application engineers.

Fundamental Application Data

- A motor is selected to meet four characteristics:

1. Inertia ratio
2. RMS torque
3. Maximum torque
4. Speed

- Inertia ratio is generally the most important characteristic when selecting a servo system. It is the ratio of reflected total load inertia to the motor shaft inertia. As a general guideline, the more dynamic the system must be, the more important it is to configure these two characteristics with a 1:1 ratio. Higher inertia ratios may not tolerate any significant load change and even become unstable.

- The continuous stall torque is the torque rating at zero speed. This torque is generally higher than the continuous torque at operating speed. The achievable torque depends on the combination of the motor and the drive used.

- Maximum torque is declared for maximum capacity for a duration of 1s. Lower maximum torques can be tolerated for longer durations. For critical applications it is recommended to contact Moog application engineering support.

Special Considerations

- Brushless servo motor-based systems are not like a standard asynchronous motor: They are complete control systems. Because there is more freedom of design, there are also more parameters (e.g. mechanical, electric, electronics) to be identified in comparison to a conventional motor-based system.

- Attention must be paid to applications that place a heavy load on the motor (typically vertical load applications when decelerating in the downwards direction). The regeneration capacity must not be overloaded.

- A brushless servo motor has a very short response time and closely tracks changes in the control signals.

- Correctly sized servo motors can run with high case temperature. It is important to ensure that motor heat is properly dissipated. Dissipation may be through a volume of "still" air, heatsinks, fan cooling or liquid cooling.

- The speed accuracy depends much more on the quality of the sensor signal (and on the control algorithm of the drive) than on the motor and the load.

- The time lag between a load disturbance and speed adjustment depends on the resolution of the position transducer and on the parameters of the drive.

Selection and Optimization of Systems Parameters

- Transmission ratio
- Mechanical transmission
- Position transducer.
- Electronic drive type
- Control approach.

Transmission Ratio Considerations

Motors are sized on output torque, so that a high transmission ratio is useful to minimize the motor mass and cost, but it might not be the best choice in terms of overall cost and of dynamic performance.

When a motor is applied directly to the load, maximum stiffness and bandwidth (optimal position/following accuracy in the minimum time) is achieve

SERVO MOTOR SELECTION AND SIZING

MechanicalTransmission Considerations

The following are the most common mechanical transmissions:

- Timing belt
- Cycloid and epicycloid reducer
- Rack and pinion.
- Ball screw

Where N = transmission ratio, the load parameters are transferred to the motor axis according to the following relationship:

- Motor speed = load speed x N
- Motor torque = load torque/N
- Load inertia reflected to the motor axis
  = load inertia/ N2

In order to identify the optimal mechanical transmission for an application, two main application areas can be identified:

- Low dynamic applications: The main objective of the motion is the supply of power. Dynamic performances are not important and involved power is quite large. The motor cost is a significant percentage of the overall system cost.

- High dynamic applications: The objective of the motion is positioning. Most of the energy is used to accelerate, brake and to position the load in minimum time with maximum accuracy.

For low dynamic applications, simple speed reducers are acceptable.

For high dynamic applications, the required torques are mainly inertial. Moog's general recommendation is to orientate the choice towards inertial matching (e.g. transmission ratio which makes the load inertia translated to the motor axis equal to the motor inertia).

When the load inertia transferred to the motor is more than a few times the motor inertia, a high control.
bandwidth is necessary to electronically compensate for the inertia mismatch and mechanical linkages must be stiff and with no backlash.

Based onto these considerations, it is important to consider whether to generate the torque with a long and narrow motor or with a short and compact motor:

- Long motors are optimized for of minimum inertia so that they meet the requirement of high acceleration with low inertia loads.

- Short and compact motors are optimized for torsional stiffness so that they meet the requirements of high inertia loads.

In applications with large inertia and short positioning time a check must be made on the torsional resonance frequency to ensure it remains above 1,000 Hz assuming that a closed-loop bandwidth of 300 Hz is achieved by the high dynamic performances of CD Series Servo Motors. The frequency of torsional resonance of a load with inertia J1 connected to an axis with torsional stiffness S_m is:

$$f = (\frac{1}{2\pi}) \times \sqrt{\frac{S_m}{J1}}$$

The torsional stiffness of a steel shaft with diameter D and with length L is:

$$S_m = \frac{\pi \times D^4 \times 2.466 \times 10^{-3}}{L}$$

Considerations on Selecting Position Transducers

A high-performance brushless motor is required to have low inertia, high torque and high torsional stiffness. The next considerations are the mechanics of the feed system and the position transducer.

Most common position transducers are resolvers and encoders.

Performances can dramatically be improved with encoders as they have:

- 1,000 times better resolution than a resolver
- 20 times better accuracy
- 1,000 times better signal/noise ratio

By using sinusoidal encoders, the rotational uniformity and the velocity dynamics are much higher. In other words, the sinusoidal encoder dramatically improves performance in terms of response time, servo error, overshoot and axis residual vibrations.

With a sinusoidal encoder the static positioning accuracy is about 20 arcs and, more importantly, the accuracy is not affected by the cabling quality. The dynamic error is limited by the signal/noise ratio.

A limitation to the adoption of encoders is the maximum allowed temperature which is on the order of 110 °C (230 °F) while a resolver is able to tolerate the 155 °C (331 °F) of Class F.

Encoders are typically more expensive than resolvers.

SERVO MOTOR SELECTION AND SIZING

Considerations on Selecting Servo Drive Type

In order to get the highest rotation uniformity at any speed, torque ripple must be minimized. To achieve this, careful choice of both sinusoidal motor and control system must be made. The motor is matched to a sinusoidal PWM inverter, of which amplitude, frequency and phase are separately controlled.

The PWM frequency used should be at least 10 KHz. Currently, all Moog Servo Dives are fully digital with position, velocity and torque digital loops.

Sampling time should be as short as possible to achieve wide system bandwidth.

Reference signals (position or speed) are provided in analog or digital form.

Analog reference is ±10 V while digital reference can be provided using various protocols.

Considerations on Configuring a Control Strategy

Control systems can be configured according to three control strategies:

- Torque control: The speed depends on the load.
- Velocity control: The torque depends on the load.
- Position control: The torque depends on the load.

The torque control strategy is used when it is needed to control a force or pull (e.g. winders, unwinders, paper

processing, textile). Torque control is intrinsic to brushless motors as they are controlled by electrical current. Hence, torque control does not need accurate transducers.

Velocity control is the most traditional strategy. It uses an integration term so that the speed error is limited to the system offsets.

Position control is carried out only by digital drives, so that the steady state position and speed following error is limited to a few points of the sensor (for an encoder with 4,096 pulse/revolutions this implies 1/16,000 of a revolution). Position loop capability is necessary to synchronize several axes.

Motor Selection

After the choice of the transmission ratio, based on load, speed and other load data, a first preliminary selection of a motor model can be performed.

The following sequence is suggested:

1. Trace the speed/time diagram of the load cycle.
2. Transfer the inertia and the loads of the system to the motor shaft.
3. Calculate the cycle of the accelerations and the inertial torques.
4. Add the load on the motor axis to the inertial torque.
5. Calculate the root mean square value of the torque.
6. Calculate the root mean square of the speed.
7. Calculate the maximum torque in the cycle.
8. Calculate the maximum duration time of the maximum torque in the cycle.
9. Calculate the required torque at the maximum speed.
10. Calculate the maximum torque.

With this data, a preliminary choice of the motor (and the drive) can be performed.

Validation is necessary at this point to ensure the correct thermal and electric sizing of the motor. A motor is considered properly sized when it achieves a maximum temperature of 50 °C (122 °F) above room temperature.

The following sequence is suggested to verify the selection:

- Check the maximum torque.
- Check the rise in temperature.
- Check that the maximum speed that can be reached.

Points 1 and 2 can be solved by the selection of a larger motor, while point 3 can be solved by the selection of a motor with a higher speed winding. Also, a higher drive current will be necessary.

ABOUT MOOG

Moog Inc. is a worldwide designer, manufacturer and integrator of precision control components and systems. Moog's Industrial Group designs and manufactures high performance motion control solutions combining electric, hydraulic, and hybrid technologies with expert consultative support in a range of applications including energy production and generation machinery, industrial production machinery and simulation and test equipment. We help performance-driven companies design and develop their next-generation machines. Moog Industrial Group, with fiscal year 2013 sales of USD 592 million and over 40 locations worldwide, is part of Moog Inc. (NYSE:MOG.A and MOG.B) which has sales of USD 2.61 billion.

This vast scope ensures that our engineers remain close to the needs of machine builders and provide flexible design solutions and technical expertise tailored to our customers' toughest challenges.

Moog experts work in close collaboration with machine builders and application engineers to design motion control systems for greater productivity, higher reliability, superior connectivity, less costly maintenance and more effective operations. Our regional presence, industry knowledge and design flexibility ensures Moog motion control solutions are tailored to their environment — from meeting operating regulations and performance standards, to taking machine performance to a higher level.

Products

At the heart of every Moog solution is an array of products engineered for precision, high performance and reliability. For more than six decades, Moog products have been specified for critical machine applications.

Some are developed specifically for unique operating environments. Others are standard equipment on machines across many industries. All are continuously improved to take advantage of the latest technology breakthroughs and advancements.

Moog products include:

- Servo Valves and Proportional Valves
- Servo Motors and Servo Drives
- Servo Controllers and Software
- Radial Piston Pumps
- Actuators
- Integrated Hydraulic Manifold Systems and Cartridge Valves
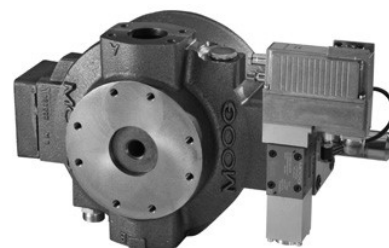- Slip Rings
- Motion Bases

Servo Drives

Servo Motors

Servo Valves

Radial Piston Pumps

ABOUT MOOG

Solutions

Hydraulic Solutions

Since Bill Moog invented the first commercially viable servo valve in 1951, Moog has set the standard for world- class hydraulic technology. Today, Moog products are used in a variety of applications - providing high power, enhanced productivity, and ever better performance for some of the world's most demanding applications.

Electric Solutions

Clean operation, low noise generation, less maintenance and reduced power consumption make Moog electric solutions ideal for applications worldwide. Moog is the ideal partner for applications where transitioning technologies requires special expertise.

Hybrid Solutions

By incorporating the advantages of existing hydraulic and electric technologies - including modular flexibility, increased efficiency, and cleanliness - into innovative hybrid solutions, Moog offers new performance potential in specialized applications.

Moog Global Support

Moog Global Support is our promise to offer world-class Repair and Maintenance Services delivered expertly by our trained technicians. With the reliability only available from a leading manufacturer with facilities around the world, Moog offers you service and expertise you can count on to keep your equipment operating as it should.

This promise offers many benefits to our customers including:

- Reduce your downtime by keeping critical machines running in peak performance.
- Protect your investment by ensuring reliability, versatility and long-life of products.
- Better plan your maintenance activities and make systematic upgrades.
- Leverage our flexible programs to meet the unique service requirements of your facility.

Look to Moog for global support including:

- Repair services using OEM parts are performed by trained technicians to the latest specifications.
- Stock management of spare parts and products to prevent unplanned downtime.
- Flexible programs, tailored to your needs such as upgrades, preventative maintenance and annual/ multi- year contracts.

Flight Simulation

Formula One Simulation Table

- On-site services bring the expertise to you, providing quicker commissioning, set-up and diagnostics.
- Access to reliable services that are guaranteed to offer consistent quality anywhere in the world.

For more information on Moog Global Support visit www.moog.com/industrial/service.

OPTIONS
Customizable Options

Motor Windings

Moog's CD Series Servo Motors are designed to address the needs of most dynamic motion control applications. However, Moog recognizes that OEMs have unique needs which can not always be addressed by catalog products. This is why Moog offers custom motor windings. Custom motor windings may be used to optimize motor performance in applications with non-standard bus voltages or deliver customized performance characteristics for applications with unique speed or current requirements.

Frameless Options

In addition to offering our compact CD Series Servo Motors in a frameless package, Moog's motor design and application teams are able to develop specialty motors meeting your unique specifications. Moog's high power density design allows our motor to be packaged in envelopes where other motors simply won't fit. In addition, Moog's design expertise includes motors adapted for operation in extreme environments:

• Elevated temperatures
• Explosive/flammable gases
• Underwater applications
• High shock loads
• Radiation zones
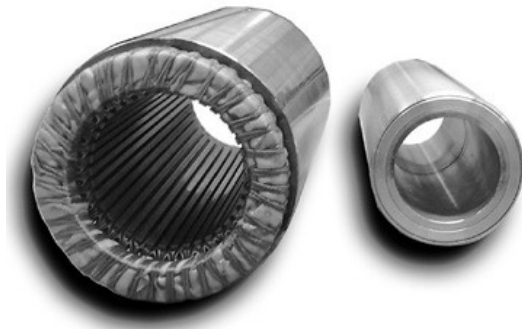
Moog´s CD frameless motor offering is based on the following standard stator dimensions:

Type	Stator diameter (nominal) [mm (in)]
G-2	48.0 (1.9)
G-3	63.5 (2.5)
G-4	91.9 (3.6)
G-5	129.5 (5.1)
G-6	178 (7)

Custom Shafts and Flanges

To support legacy products or meet unique application needs, Moog's modular CD motor design is capable of supporting custom shafts (e.g. length, diameter or spline fittings) and custom flanges.

Custom Connectors

Moog's CD Series Servo Motors standard connector options are detailed in the Ordering Information.

For non standard options, please contact your local Moog office.

Custom Feedback Options

In addition to standard resolver and encoder options as detailed in the Ordering Information, Moog can support requests, where practical, for special feedback devices such as other resolver or encoders types, tachometers and hall effect sensors.

Custom Coatings

Moog's CD Series Servo Motors can be customized for spray down environments. Moog is capable of coating the motors with FDA required coatings for applications in the food processing industry.

Accessories

To speed your design cycle, Moog offers a variety of accessories which have been specified and tested for compatibility with our motors and drives. These accessories will also minimize assembly activities, allowing you to reduce production time.

To obtain preassembled motor cables, crimp tools, power supplies, please contact Moog staff.

MORE PRODUCTS. MORE SUPPORT.

Moog covers an extensive range of motion control solutions and also provides service and support. Moog has offices around the world. For more information or the office nearest you, visit **www.moog.com/contact-us/moog-facilities**

Australia	India	South Africa
Brazil	Ireland	Spain
Canada	Italy	Sweden
China	Japan	Turkey
France	Korea	United Kingdom
Germany	The Netherlands	United States of America
Hong Kong	Singapore	

For product information, visit **www.moog.com** or email us **em-motioncontrol@moog.com**

SHAPING THE WAY THE WORLD MOVES™

MOOG