COMPACT DYNAMIC BRUSHLESS SERVO MOTORS
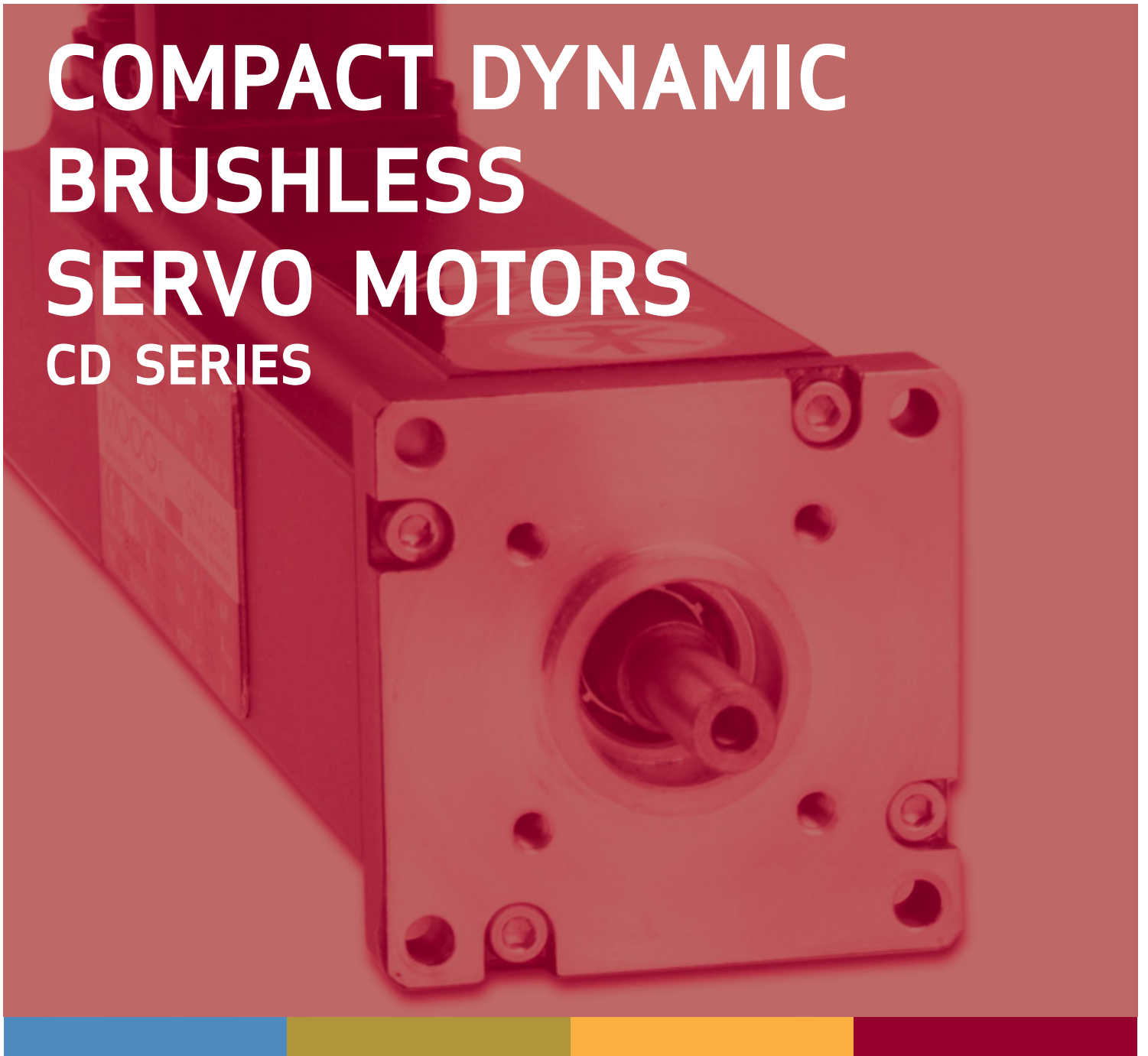
CD SERIES

LOW INERTIA, COMPACT LENGTH SERVO MOTORS
FOR HIGHLY DYNAMIC APPLICATIONS

WHAT MOVES YOUR WORLD

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.

This catalog is for users with technical knowledge. To ensure all necessary characteristics for function and safety of the system, the user has to check the suitability of the products described herein. The products described herein are subject to change without notice. In case of doubt, please contact Moog.

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PRODUCT OVERVIEW

Low Inertia, Compact Length and Reliability

For over two decades, the name Moog has been associated with brushless servo motors and servo drives offering the highest dynamics, power density and reliability. These products are designed as a system to deliver superior servo performance. Moog offers a broad range of standard as well as custom solutions to meet your unique application requirements. Moog brushless servo motors and drives are found on a variety of applications; especially where dynamics, compact size and reliability are important.

Compact Dynamic Brushless Servomotors

Moog's Compact Dynamic Brushless Servo Motors (CD Series) are electronically commutated synchronous AC motors with permanent magnet field excitation. The CD Series Servo Motors are designed for highly dynamic servo applications where positioning times of 30 msec or less are often the norm. The CD Series Servo Motors offers one of the industry's widest power ranges with standard models available at continuous torque ratings from 0.15 to 72 Nm (1.4 to 638 lb in). The modular design is supported by a variety of options with Moog's application staff capable of supplying fully customized solutions.

The CD Series Servo Motors range covers 6 frame sizes, 6 magnetic designs, with natural/fan cooling options and highly customizable construction. The wide range of these servo motors, combined with the ability to seamlessly integrate with existing infrastructure, reduces the need for redesign, limits cost and improves space utilization.

The CD Series Servo Motors are available with the following options:

- Cooling options: Natural and fan cooling
- Integral holding brakes
- Resolver or encoder based feedback
- Various connector options
- Plain or slot and key type shafts
- Teflon shaft seal (IP67 sealing)

Proprietary, Low-Cogging, Design Delivers Smooth Low Speed Operation

The CD Series Servo Motors includes several design enhancements to deliver smooth slow speed performance. The enhancements include the selection of a high pole count (8 to 12 poles) electromagnetic design, a stator with nonsymmetric slot count and other proprietary features to minimize cogging.

Extended Life and Versatility

All CD Series Servo Motors are manufactured using tight machining tolerances, precision balancing and undergo thorough production testing to guarantee a long service life. The use of high reliability feedback devices, sealed lifetime lubricated bearings and IP65 compliant construction combine to extend service life and offer years of reliable, low maintenance operation.

CD Series Servo Motors can be used in various drives. Moog servo drives can further optimize machine performance and ensure smooth integration.

Servo Drives

Servo Motors

PRODUCT OVERVIEW

Overview of CD Series Servo Motors

Type code*	Maximum torque	Continuous stall torque	Rotor inertia	Rated speed [1]	Square flange
	Nm (lbf in)	Nm (lbf in)	kg cm^2 (10^{-4} lbf in s^2)	r/min	mm (in)
G-1	0.5 to 1.51 (4.40 to 13.40	0.16 to 0.35 (1.4 to 3.1)	0.027 to 0.072 (0.24 to 0.64)	9,000 to 6,000	40 (1.5)
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.

FEATURES AND BENEFITS

| Features	Benefits
Robust thermal design with superior dynamics	
• Proprietary low-clogging design • Electromagnetic design with exceptional overload capacity	• Smooth low-speed performance • Faster operation and higher performance • Increased productivity • Improved product quality through accurate control
Construction	
• Compact and lightweight • Ruggedized with aluminum housing	• Higher power density and a higher torque-to-weight ratio • Allows greater payloads and/or increased acceleration when motor is mounted on a moving axis • Maintenance free operation and increased system availability
Range	
• Maximum torque from 0.5 to 240 Nm (4.4 to 2,124 lbf in) and power from 0.13 to 10.68 kW (0.2 to 14.3 hp) • 6 frame sizes, 6 magnetic designs and natural/fan cooling options	• Over 50,000 variants for machine builders to choose from • Enables rapid machine design process • Improved cycle times
Flexibility	
• Ability to match exact customer requirements • Customization of flange sizes, connector types and versions for use in special environments	• Seamless integration into existing infrastructure • Reduced need for system redesign

TECHNICAL FEATURES

1. Moog Motor Performance Characteristics

In collaborating with a variety of industrial machine designers, Moog engineers realized the critical role the application sizing process plays in overall machine design. With global competition forcing designers to do more with less, there is an ever-increasing need to avoid unnecessary margin and "size" exactly to your application needs. It is for these reasons that Moog engineers specify motor performance characteristics in a manner that makes them practical for designing your system. Motor characteristics are specified under the same environmental conditions in which they will be used, with notes clearly articulating the operating conditions.

The motor performance characteristic contains three elements.

Example Diagram: G-4-M6 (L20)
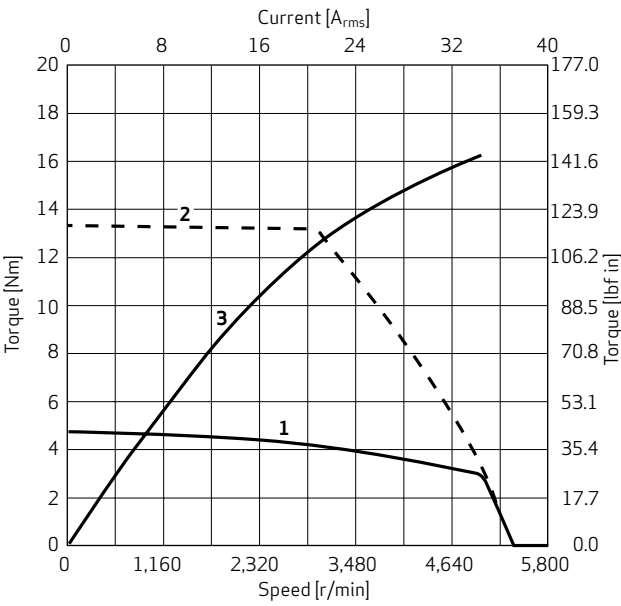
1   Continuous torque
2   Maximum torque
3   Torque constant k_T

Continuous Torque Curve

This curve illustrates the motor torque available at 100 % duty cycle under the following conditions:

- Operation in still air with ambient temperatures up to 40 °C (104 °F)
- Winding temperature measure up to 110 °C (230 °F) over ambient for resolver feedback motors
- Motor front flange attached to a steel mounting plate measuring minimum 300 x 300 x 25 mm (11.81 x 11.81 x 1.00 in)

Maximum Torque Curve

This curve reflects the motor torque available with a 5 % duty cycle (1 out of 20 seconds). It is based on years of practical industry experience and is useful for typical servo applications.

k_T Characteristic (Torque Constant)

The motor k_T characteristic depicts stator saturation at various operating points and can be used to optimize sizing in low duty cycle applications. CD Series Servo Motors can deliver a low duty cycle "impulse torque" which is typically 20 to 30 % more than rated peak torque. While motors can be operated reliably at this operating point it is recommended that a member of Moog's application team reviews the application to ensure thermal restrictions are not violated.

TECHNICAL FEATURES

2. Conformity to Standards

CD Series Servo Motors meet the requirements of the EC directives such as Low Voltage directive and EMC directives (together with Moog Servo Drives). These motors are also UL approved and conform to UL standards.

3. Ruggedized Design

The CD Series Servo Motors are designed and manufactured in accordance with strict CE standards, using ruggedized components with proven reliability in harsh thermal and shock load environments. These all combine to offer years of reliable, maintenance-free, operation and boost overall system availability. The use of high reliability feedback devices, sealed lifetime lubricated bearings, precision balanced rotors (Class G 6.3 of ISO 1940), reduced run out machining tolerances and IP65 construction work together to extend service life.

4. Flexible Design Option for Easy Integration

The CD Series Servo Motor is available with the following options:

• Integral holding brakes

• Resolver or encoder based feedback

• Plain or slot and key type shafts

• Teflon shaft seal (IP67 sealing)

• Convection (standard) or fan cooling (upon request)

5. Fully Customized Designs Support Unique Application Requirements

The CD Series Servo Motor can be customized to meet your unique needs.

The following are typical requests supported by Moog's application staff:

• Custom motor windings

• Custom shafts and flanges

• Custom frameless designs

• Custom connector configurations (including pigtails)

• Custom feedback devices

• Custom designs for unique environments including high temperature, high shock levels, oil and water immersion, areas with explosive gases and areas with elevated radiation levels.

Motor with Encoder
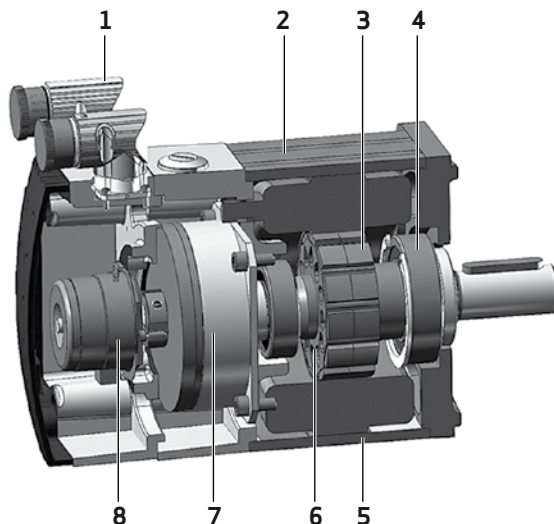
Motor with Resolver
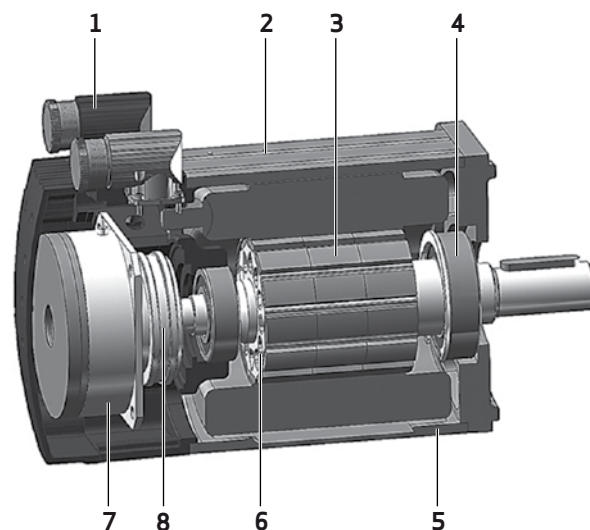
1   Metal CE/UL compliant connectors
2   Proprietary stator design
3   Rare earth magnets
4   Sealed life-time lubricated bearings
5   Lightweight extruded aluminum housing
6   Fully laminated low-inertia rotor
7   Optional holding brake
8   High reliability device feedback

SIZE 1
Natural Cooling, Low Voltage, Type G-1-M

Characteristics and Nominal Values with Sinusoidal Drive

Characteristics		G-1-M2*	G-1-M4	G-1-M6	Units
Continuous stall torque	M_0	0.16 (1.4)	0.27 (2.4)	0.35 (3.1)	Nm (lbf in)
Rated torque	M_N	0.14 (1.2)	0.24 (2.1)	0.29 (2.6)	Nm (lbf in)
Maximum torque	M_{max}	0.50 (4.4)	1.0 (8.9)	1.51 (13.4)	Nm (lbf in)
Rated speed	n_N	9,000	6,000	6,000	r/min
Maximum speed	n_{max}	20,000	11,400	8,500	r/min
Continuous stall current	I_0	0.92	0.79	0.77	A_{rms}
Maximum current	I_{max}	3.3	3.3	3.7	A_{rms}
Rated power	P_N	0.13 (0.2)	0.15 (0.2)	0.19 (0.3)	kW (hp)
Torque constant	k_T	0.17 (1.5)	0.34 (3)	0.46 (4.1)	Nm/A_{rms} $(lbf\ in/A_{rms})$
Voltage constant	k_e	11.1	22.1	29.6	$V_{rms}/k_{r/min}$
Thermal time constant	t_{th}	350	500	650	s
Winding resistance at 25 °C (77 °F) (phase to phase)	R_{tt}	20.489	30.996	37.016	Ohm
Winding inductance (phase to phase)	L_{tt}	5.2	10.4	12.3	mH
Rotor inertia with resolver	J	0.027 (0.24)	0.049 (0.43)	0.072 (0.64)	kg cm^2 (10^{-4} lbf in s^2)
Rotor inertia with encoder	J	0.029 (0.26)	0.049 (0.43)	0.069 (0.61)	kg cm^2 (10^{-4} lbf in s^2)
Weight (without brake)	m	0.55 (1.2)	0.69 (1.5)	0.84 (1.9)	kg (lb)

Optional holding brake	Option 1	Option 2	Units
Holding torque	0.4 (3.5)	N/A	Nm (lbf in)
Extra weight	0.06 (0.1)	N/A	kg (lb)
Extra inertia with resolver	0.01 (0.09)	N/A	kg cm^2 (10^{-4} lbf in s^2)
Extra inertia with encoder	0.01 (0.09)	N/A	kg cm^2 (10^{-4} lbf in s^2)
Power requirement	6	N/A	W
Voltage requirement (+6 % -10 %)	24	N/A	V_{DC}

Notes:

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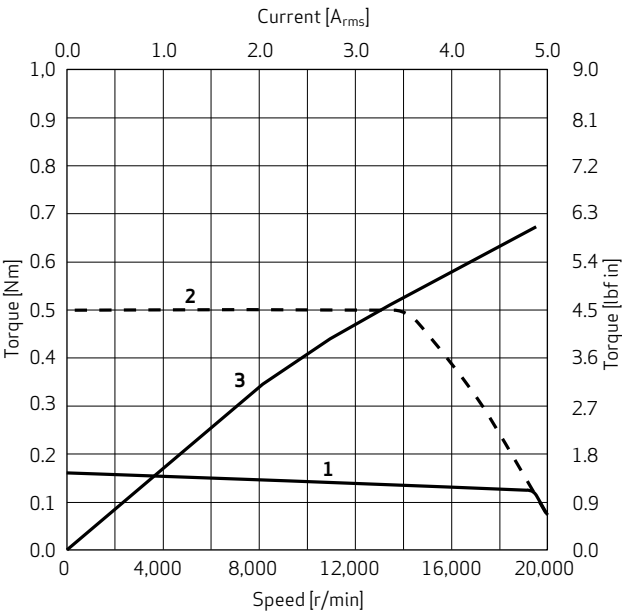3. DC link voltage 325 V

* Refer to the section on Ordering Information - Ordering Code for servo motor type definition.
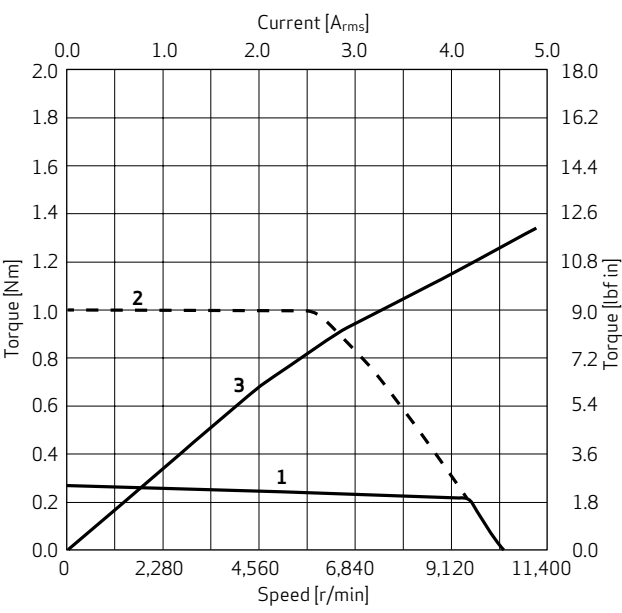
SIZE 1
Natural Cooling, Low Voltage, Type G-1-M
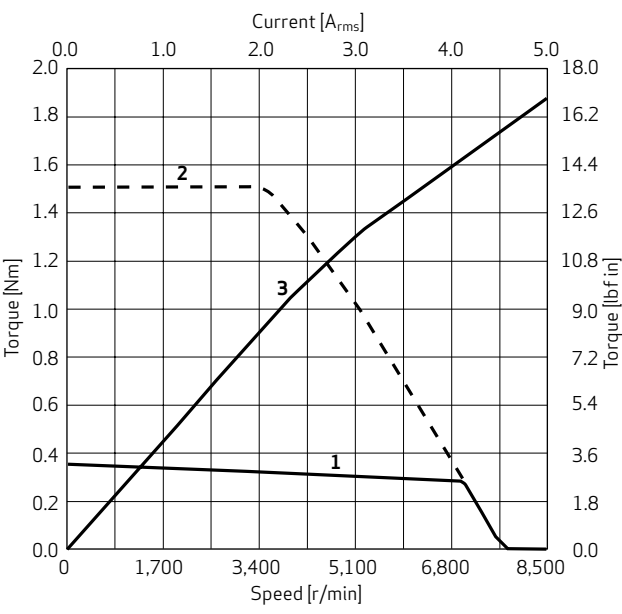
Motor Characteristics

G-1-M2

G-1-M4

G-1-M6

1   Continuous torque
2   Maximum torque
3   Torque constant k_T

SIZE 1
Natural Cooling, Low or High Voltage, Type G-1

G-1 with Resolver

Model number	Dimension "A" resolver
	mm (in)
G-1-X2	134 (5.3)
G-1-X4	154 (6.1)
G-1-X6	174 (6.9)

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 reduced class
4   Optional key 2x2x10
5   Thread M2.5x6
6   Shaft
7   Flange
8   With brake

SIZE 1
Natural Cooling, Low or High Voltage, Type G-1

G-1 with Encoder

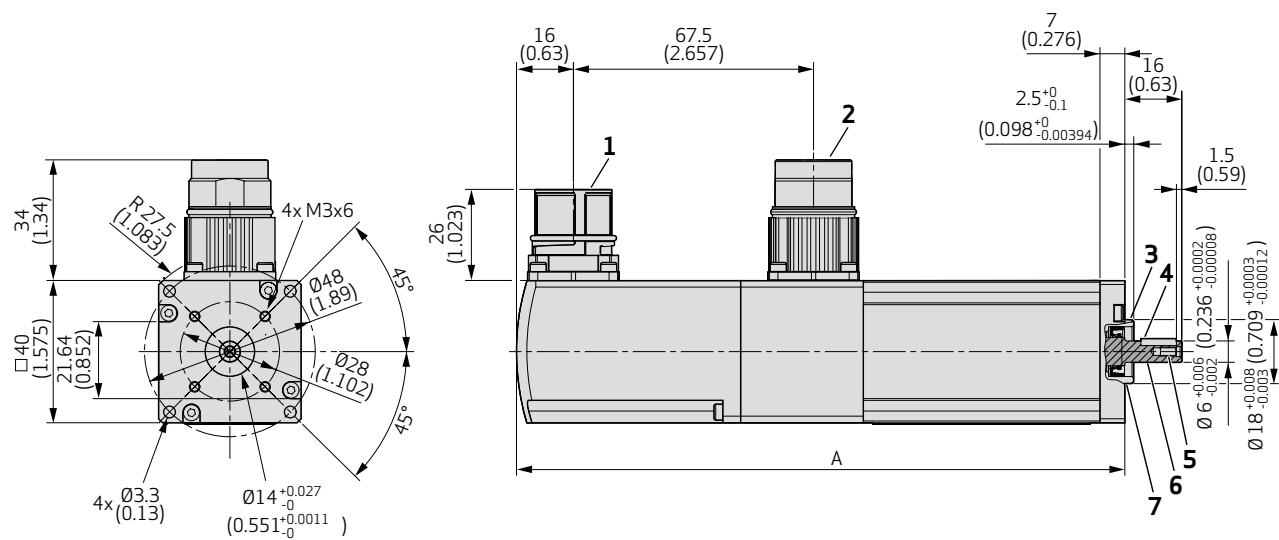| Model number	Dimension "A" encoder
	mm (in)
G-1-X2	171 (6.7)
G-1-X4	191 (7.5)
G-1-X6	211 (8.3)

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 reduced class
4   Optional key 2x2x10
5   Thread M2.5x6
6   Shaft
7   Flange

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	Option 1	Option 2	Units
Holding torque	1.0 (8.9)	N/A	Nm (lbf in)
Extra weight	0.12 (0.3)	N/A	kg (lb)
Extra inertia with resolver	0.021 (0.19)	N/A	kg cm^2 (10^{-4} lbf in s^2)
Extra inertia with encoder	0.021 (0.19)	N/A	kg cm^2 (10^{-4} lbf in s^2)
Power requirement	10	N/A	W
Voltage requirement (+6 % -10 %)	24	N/A	V_{DC}

Notes:

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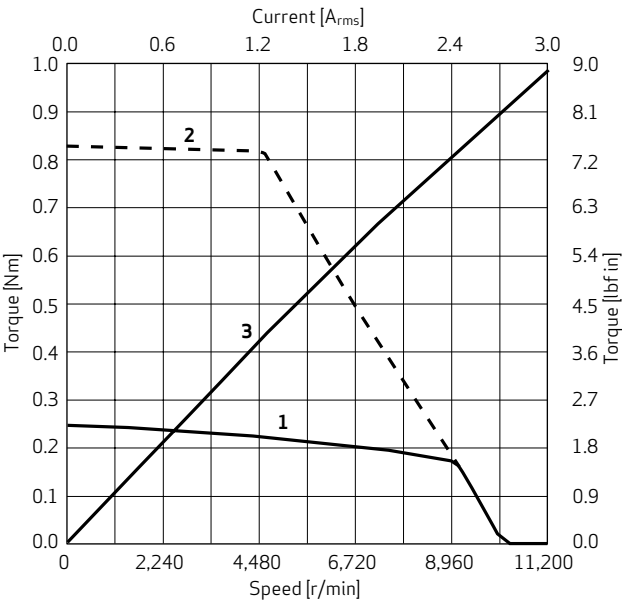3. DC link voltage 325 V

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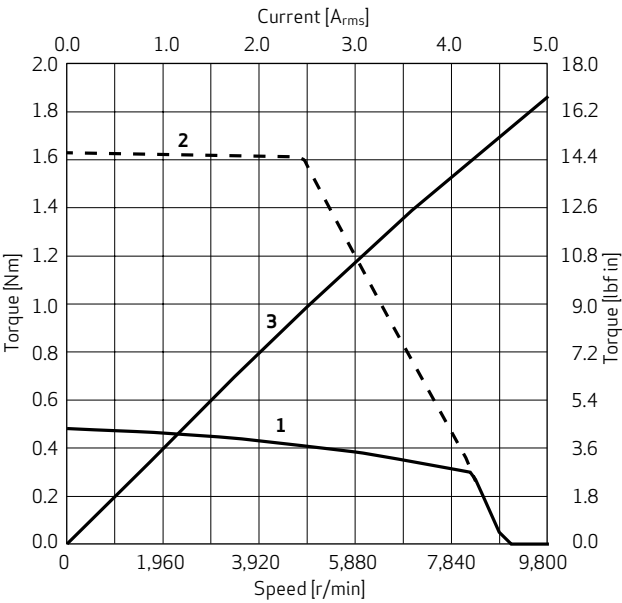
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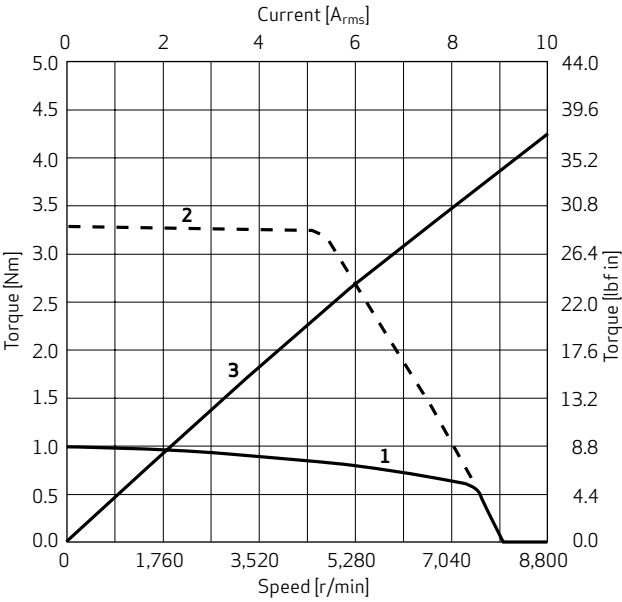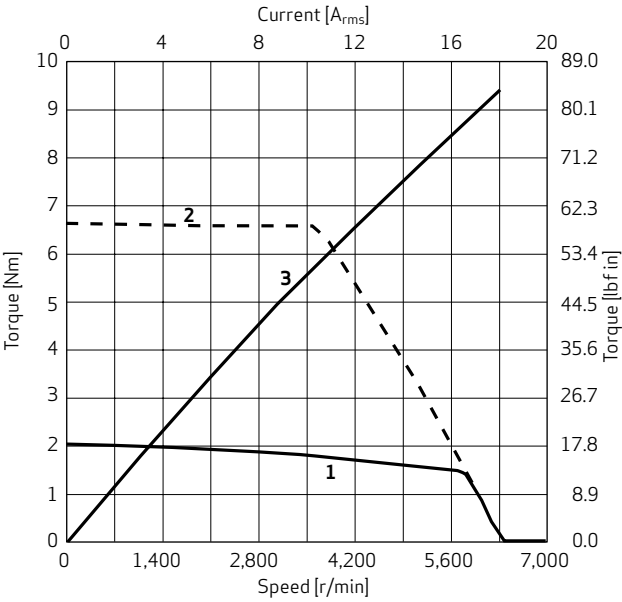# Natural Cooling, Low Voltage, Type G-2-M

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	Option 1	Option 2	Units
Holding torque	1.0 (8.9)	N/A	Nm (lbf in)
Extra weight	0.12 (0.3)	N/A	kg (lb)
Extra inertia with resolver	0.021 (0.19)	N/A	$kg\ cm^2$ $(10^{-4}\ lbf\ in\ s^2)$
Extra inertia with encoder	0.021 (0.19)	N/A	$kg\ cm^2$ $(10^{-4}\ lbf\ in\ s^2)$
Power requirement	10	N/A	W
Voltage requirement (+6 % -10 %)	24	N/A	V_{DC}

Notes:

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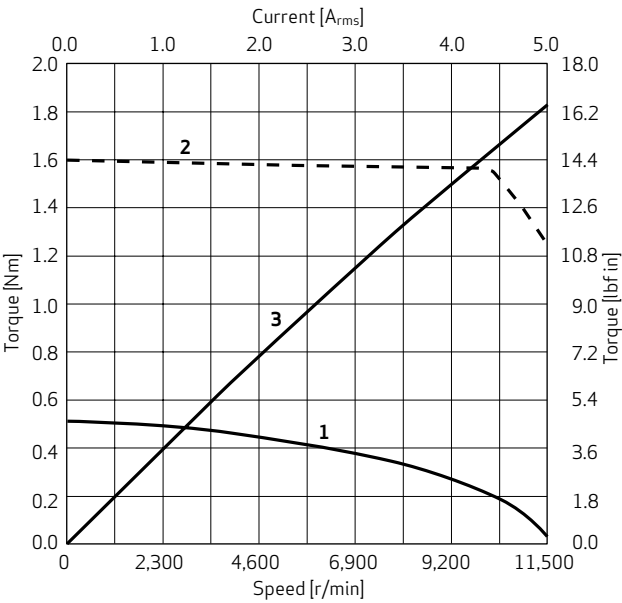2. Motor pole count: 8
3. DC link voltage 565 V

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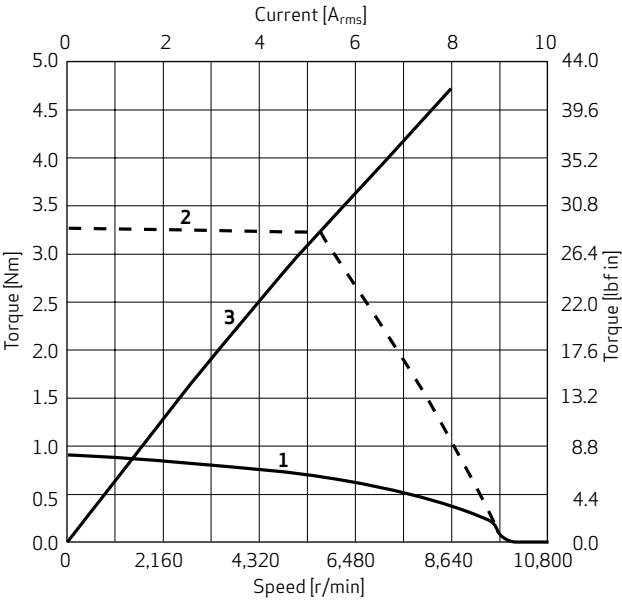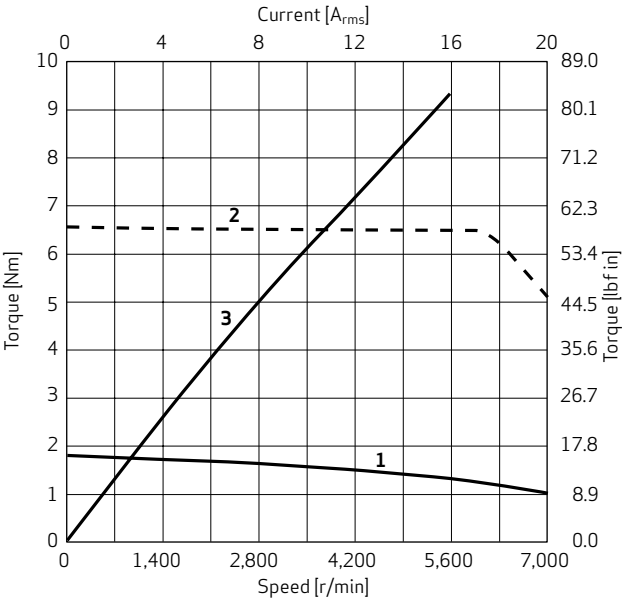# Natural Cooling, High Voltage, Type G-2-V

Motor Characteristics

G-2-V2
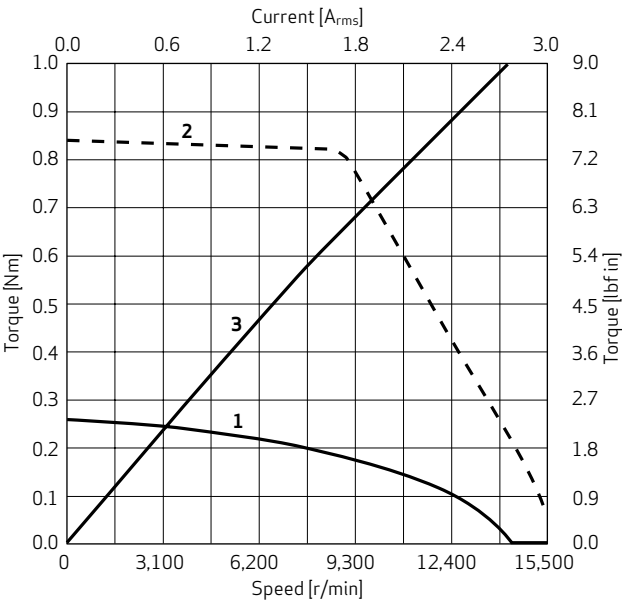
G-2-V4

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
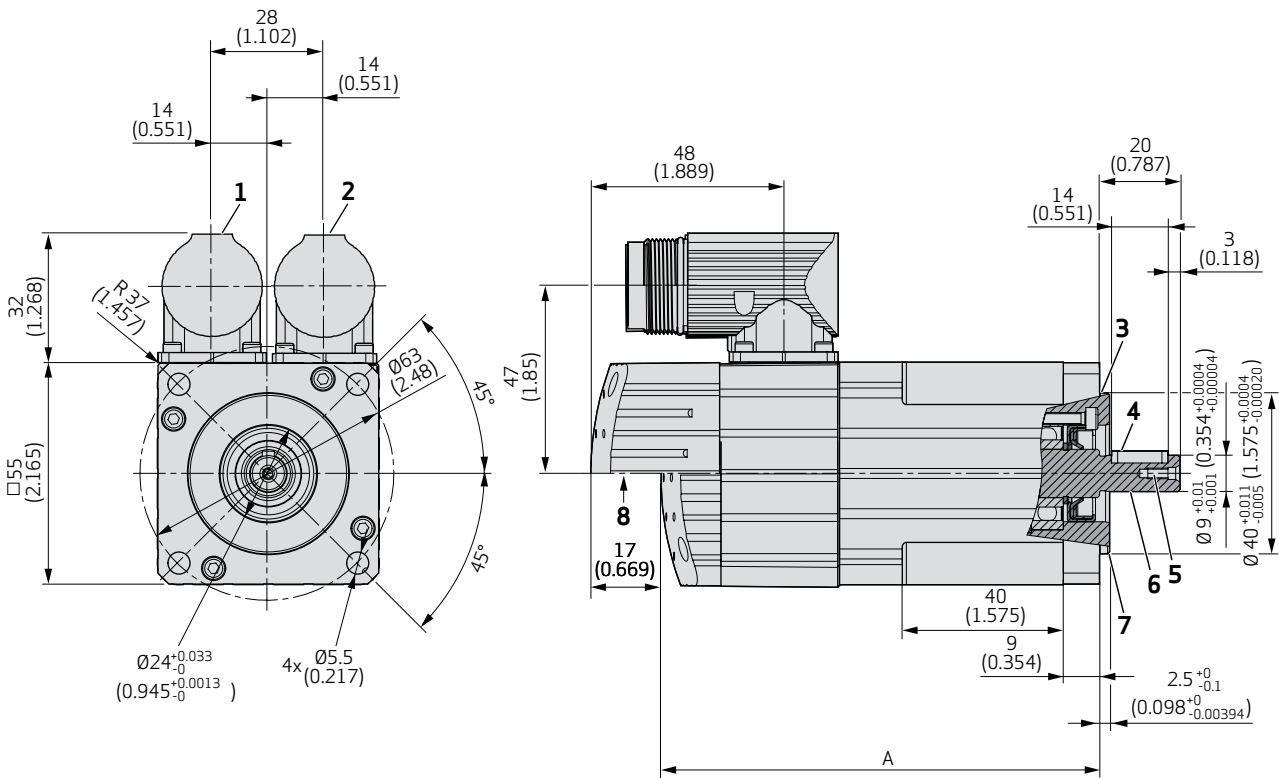
Model number	Dimension "A" resolver
	mm (in)
G-2-X2	109 (4.3)
G-2-X4	122 (4.8)
G-2-X6	147 (5.8)
G-2-X8	198 (7.8)

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 reduced 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
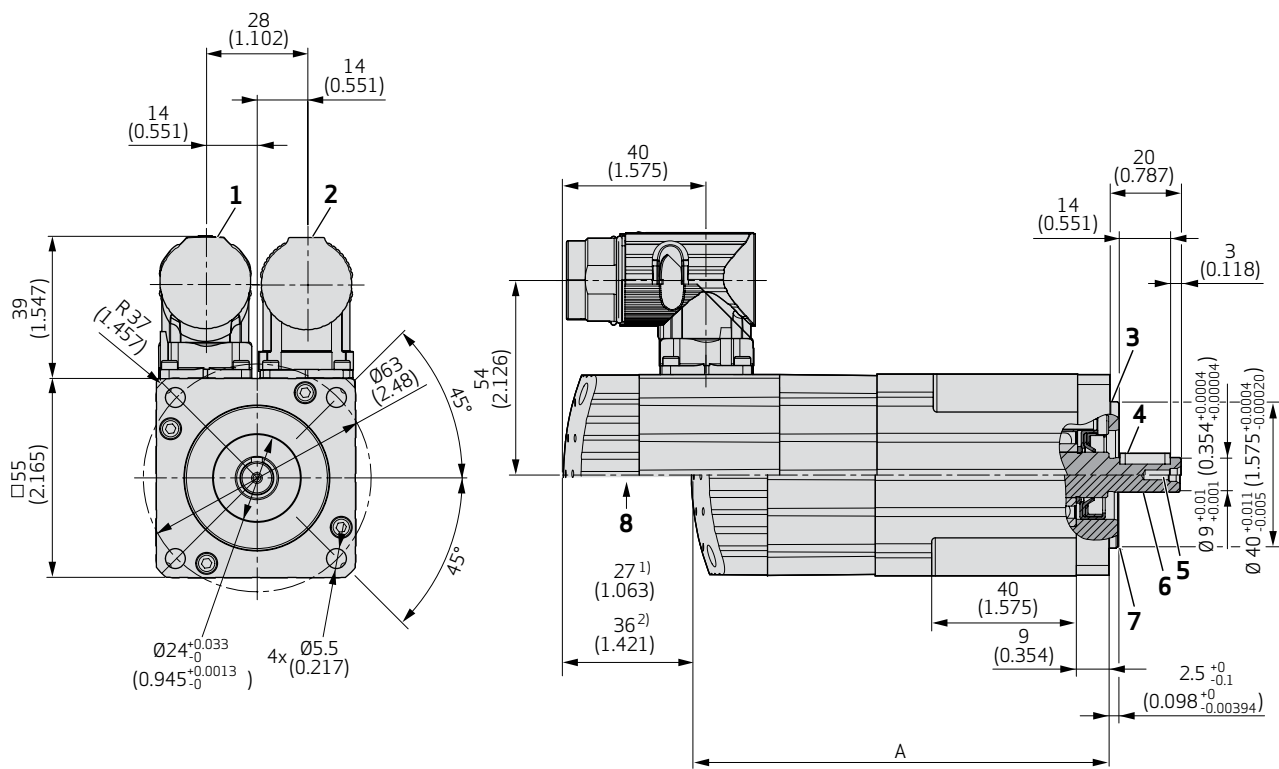
Model number	Dimension "A" encoder [1]	Dimension "A" encoder [2]
	mm (in)	mm (in)
G-2-X2	115 (4.5)	134 (5.3)
G-2-X4	128 (5)	147 (5.8)
G-2-X6	154 (6.1)	173 (6.8)
G-2-X8	205 (8.1)	224 (8.8)

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

1) Feedback options 02, 03, 04, 06 and 07

2) Feedback option 05

Note: Dimensions mm (in)
X is a placeholder for M or V, for example, X2 is placeholder for M2 or V2

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	Option 1	Option 2	Units
Holding torque	2.0 (17.7)	4.5 (39.8)	Nm (lbf in)
Extra weight	0.2 (0.4)	0.33 (0.7)	kg (lb)
Extra inertia with resolver	0.07 (0.62)	0.18 (1.6)	$kg\ cm^2$ $(10^{-4}\ lbf\ in\ s^2)$
Extra inertia with encoder	0.07 (0.62)	0.18 (1.6)	$kg\ cm^2$ $(10^{-4}\ lbf\ in\ s^2)$
Power requirement	11	12	W
Voltage requirement (+6 % -10 %)	24	24	V_{DC}

Notes:

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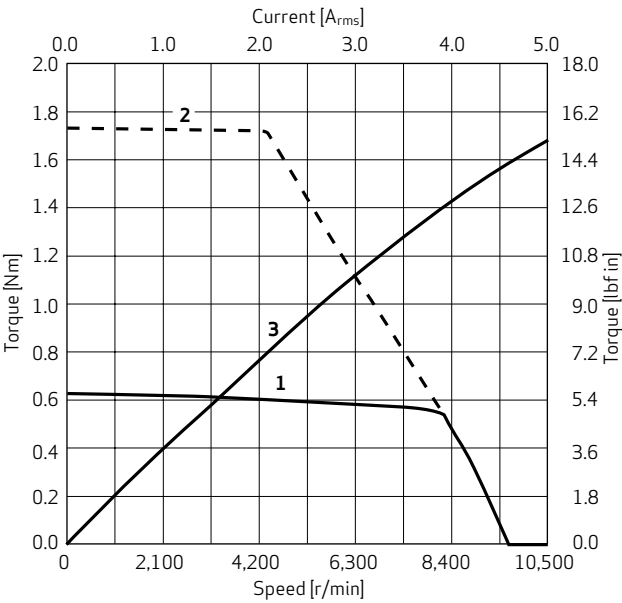3. DC link voltage 325 V

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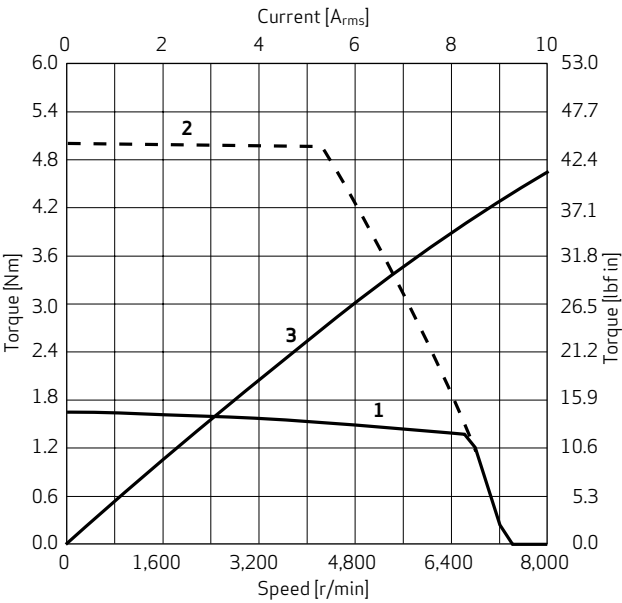
SIZE 3
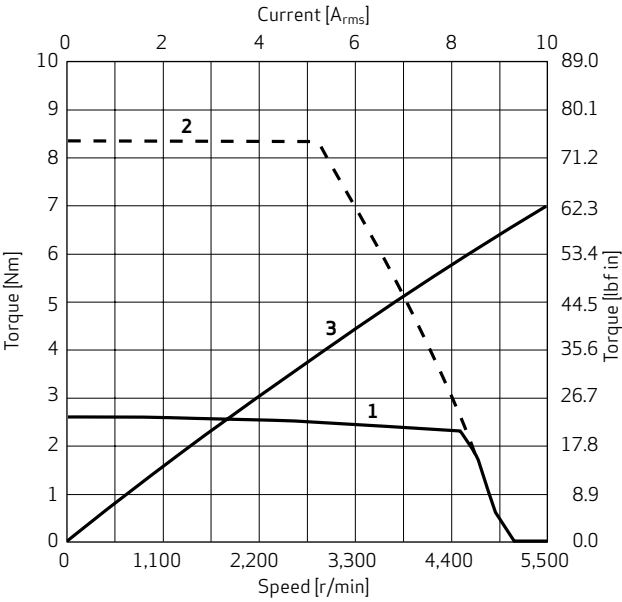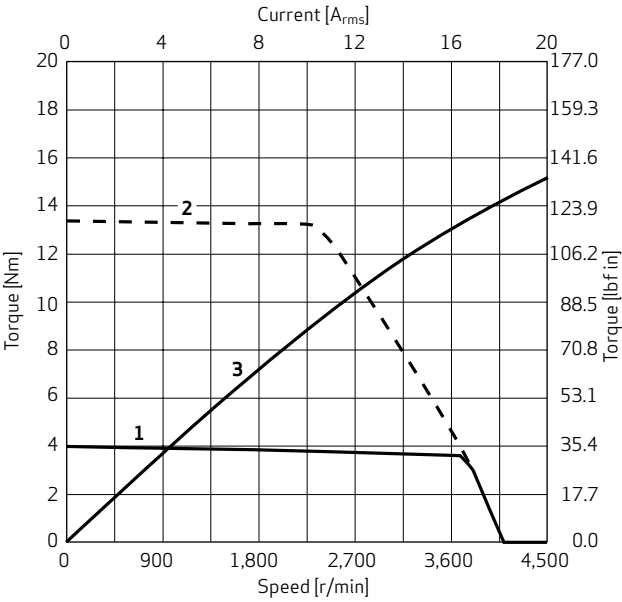# Natural Cooling, Low Voltage, Type G-3-M

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	Option 1	Option 2	Units
Holding torque	2.0 (17.7)	4.5 (39.8)	Nm (lbf in)
Extra weight	0.2 (0.4)	0.33 (0.7)	kg (lb)
Extra inertia with resolver	0.07 (0.62)	0.18 (1.6)	$kg\ cm^2$ $(10^{-4}\ lbf\ in\ s^2)$
Extra inertia with encoder	0.07 (0.62)	0.18 (1.6)	$kg\ cm^2$ $(10^{-4}\ lbf\ in\ s^2)$
Power requirement	11	12	W
Voltage requirement (+6 % -10 %)	24	24	V_{DC}

Notes:

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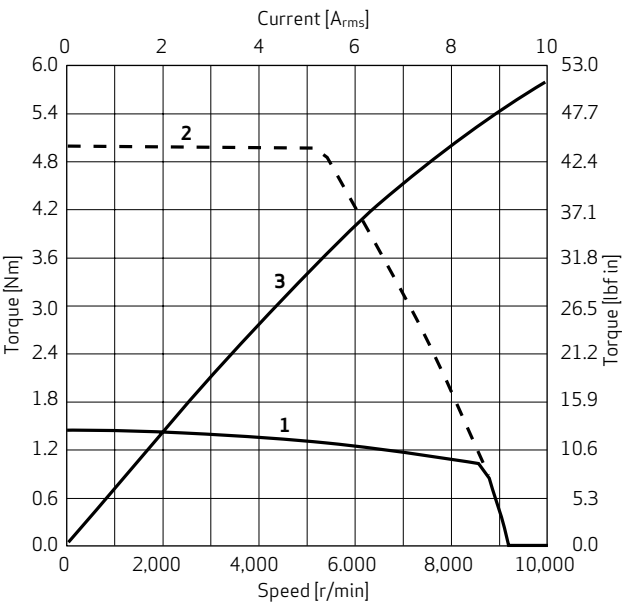2. Motor pole count: 8
3. DC link voltage 565 V

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

Motor Characteristics

G-3-V2
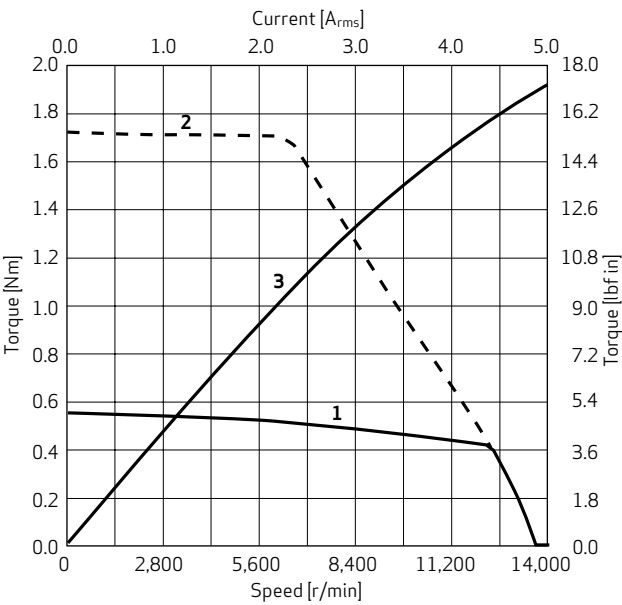
G-3-V4

G-3-V6
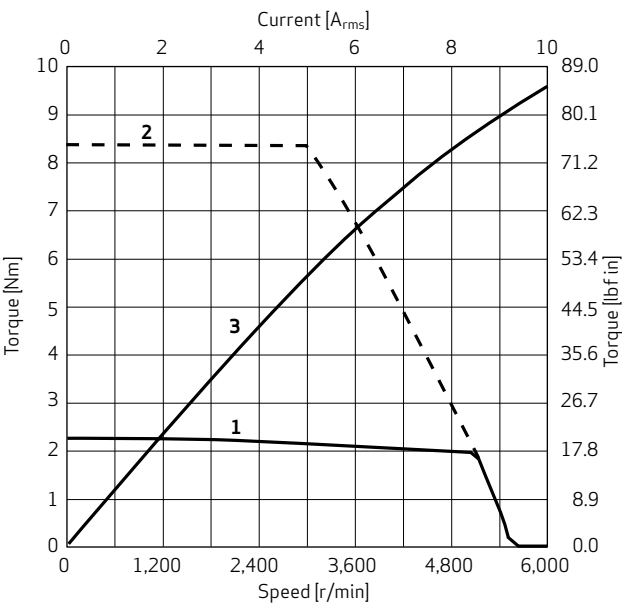
G-3-V8

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
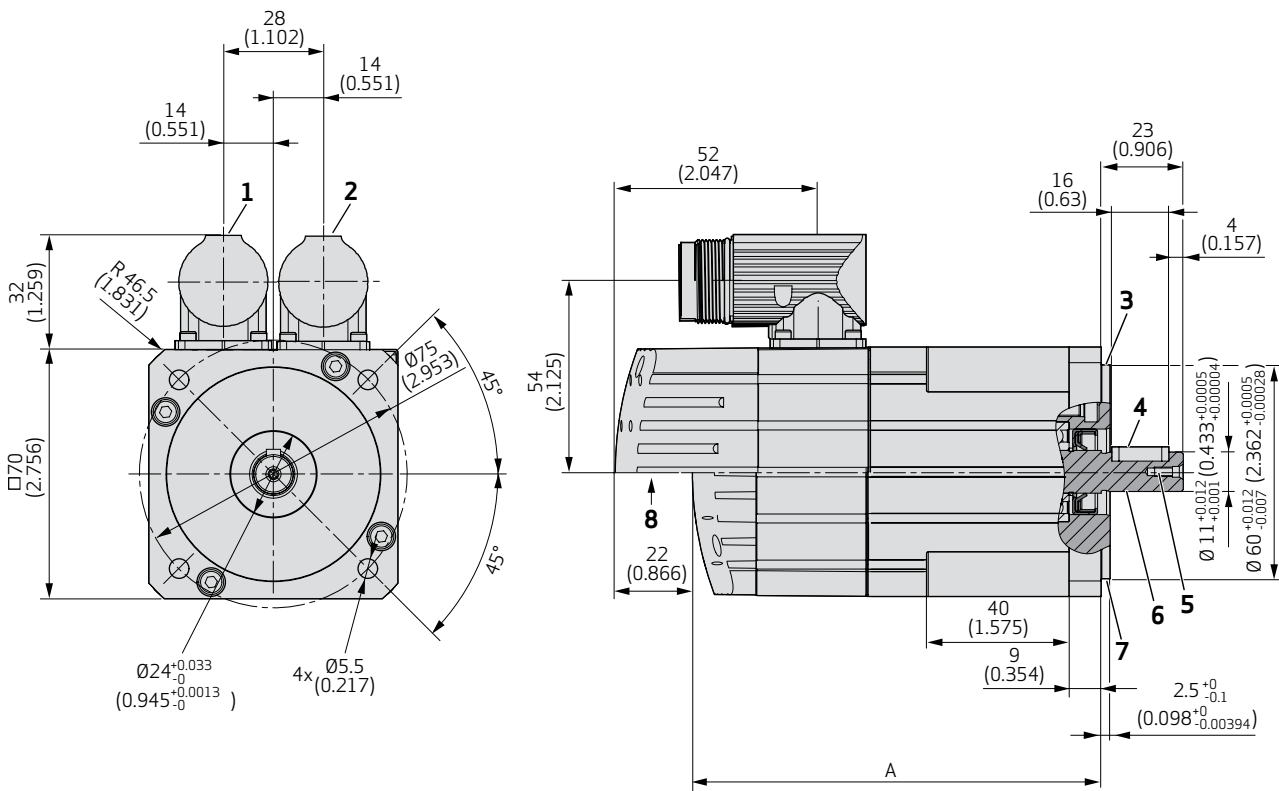
Model number	Dimension "A" resolver
	mm (in)
G-3-X2	114 (4.5)
G-3-X4	140 (5.5)
G-3-X6	165 (6.5)
G-3-X8	203 (8)

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 reduced 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
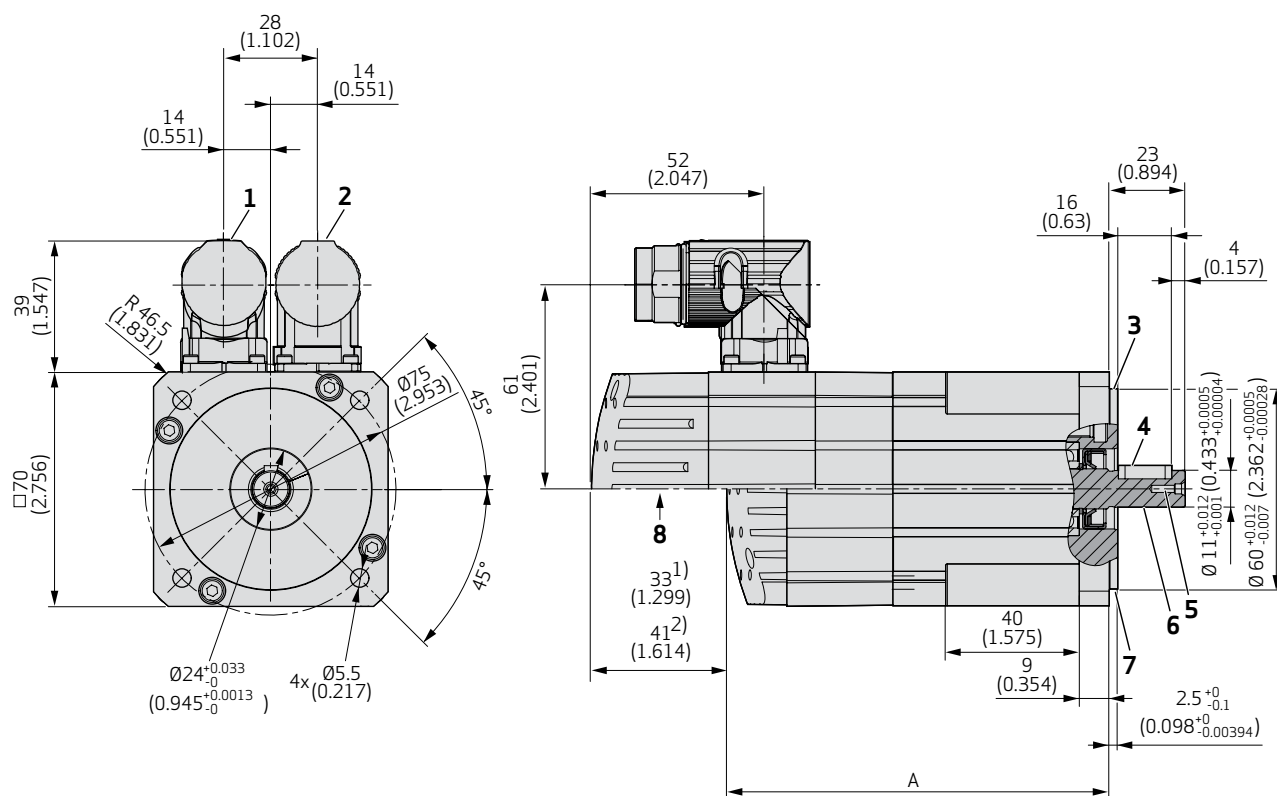
Model number	Dimension "A" encoder [1]	Dimension "A" encoder [2]
	mm (in)	mm (in)
G-3-X2	114 (4.5)	130 (5.1)
G-3-X4	140 (5.5)	156 (6.1)
G-3-X6	165 (6.5)	181 (7.1)
G-3-X8	203 (8)	219 (8.6)

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

1)   Feedback options 02, 03, 04, 06 and 07

2)   Feedback option 05

Note: Dimensions mm (in)

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

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	Option 1	Option 2	Units
Holding torque	9.0 (79.7)	14 (124)	Nm (lbf in)
Extra weight	0.53 (1.2)	0.8 (1.8)	kg (lb)
Extra inertia with resolver	0.54 (4.8)	1.0 (8.9)	kg cm^2 (10^{-4} lbf in s^2)
Extra inertia with encoder	0.61 (5.4)	1.1 (9.7)	kg cm^2 (10^{-4} lbf in s^2)
Power requirement	18	15.6	W
Voltage requirement (+6 % -10 %)	24	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
4. With encoder for holding torque, option 2: 14.5 Nm (128.5 lb)

* 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	Option 1	Option 2	Units
Holding torque	9.0 (79.7)	14 (124)	Nm (lbf in)
Extra weight	0.53 (1.2)	0.8 (1.8)	kg (lb)
Extra inertia with resolver	0.54 (4.8)	1.0 (8.9)	kg cm^2 (10^{-4} lbf in s^2)
Extra inertia with encoder	0.61 (5.4)	1.1 (9.7)	kg cm^2 (10^{-4} lbf in s^2)
Power requirement	18	15.6	W
Voltage requirement (+6 % -10 %)	24	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
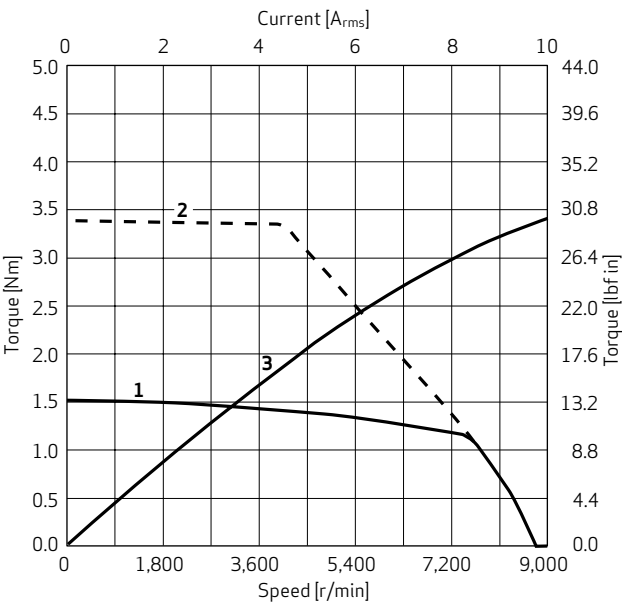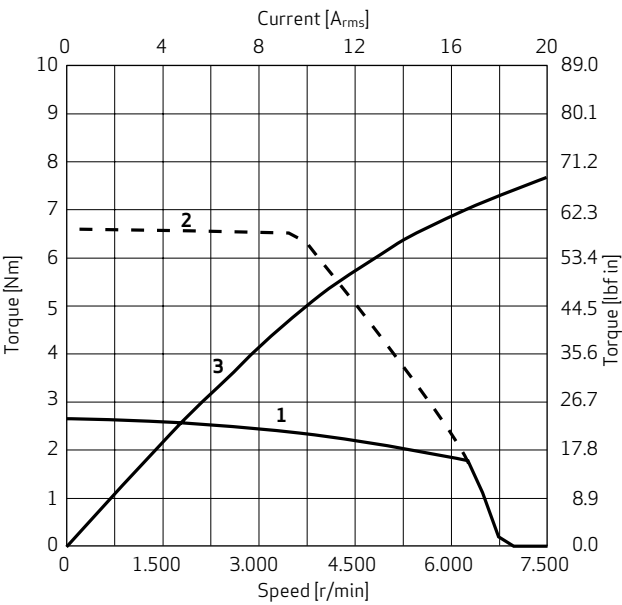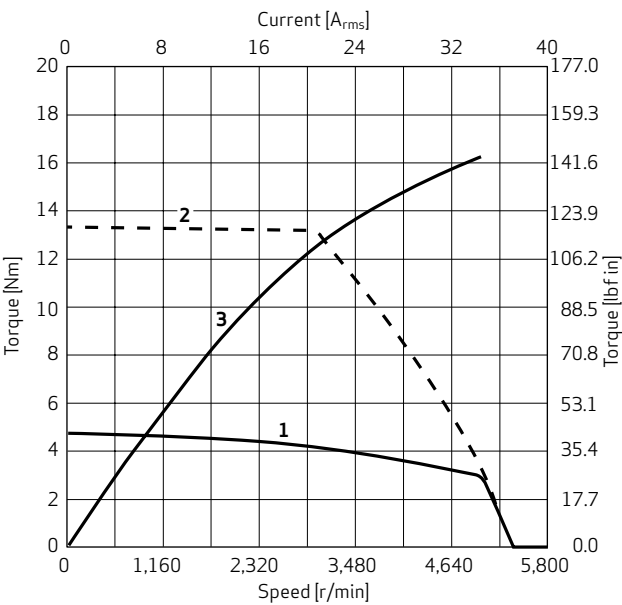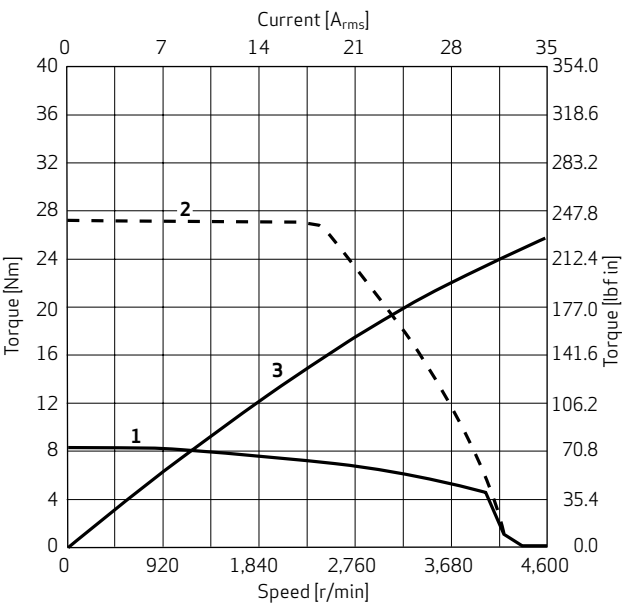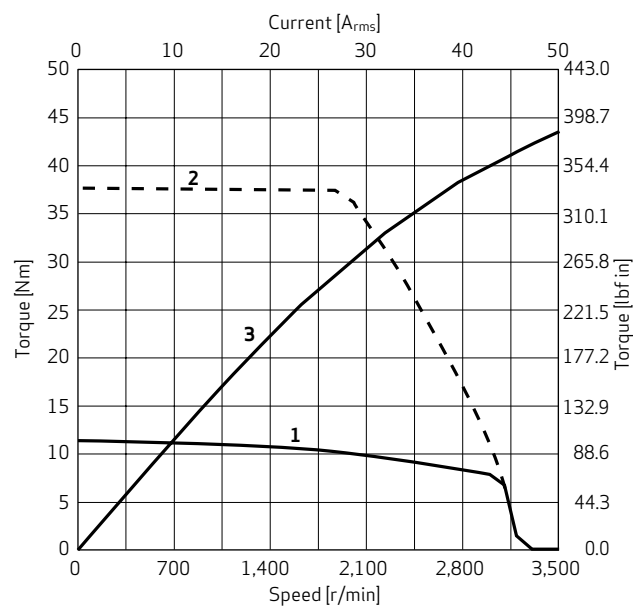4. With encoder for holding torque, option 2: 14.5 Nm (128.5 lb)

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

Motor Characteristics

G-4-V2
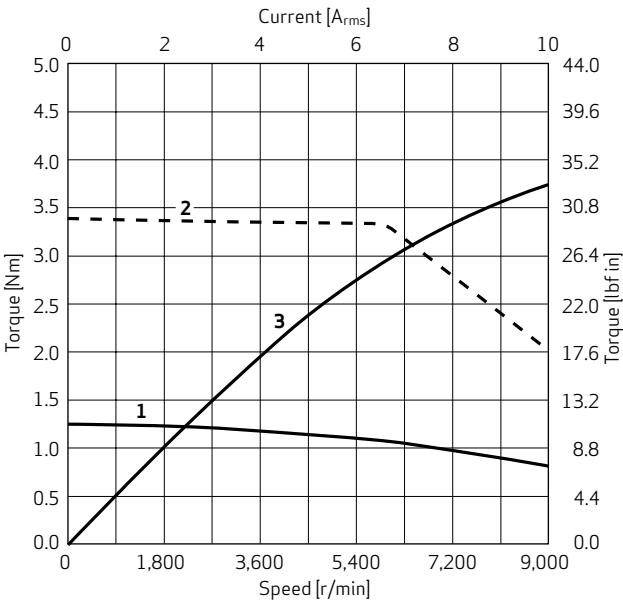
G-4-V4
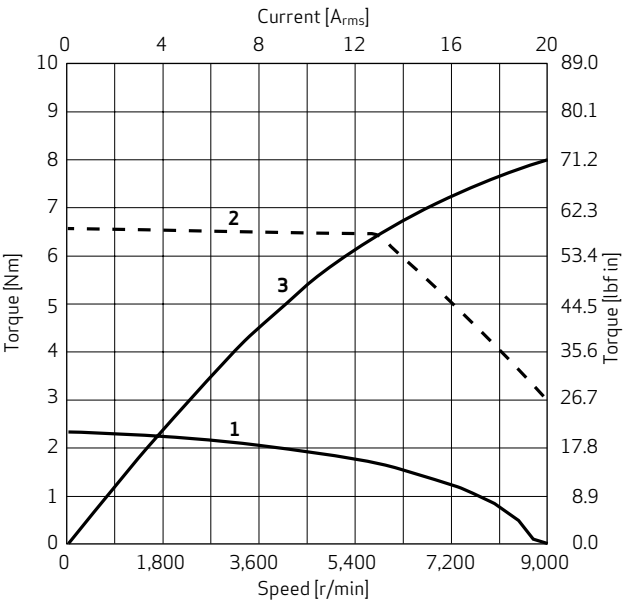
G-4-V6
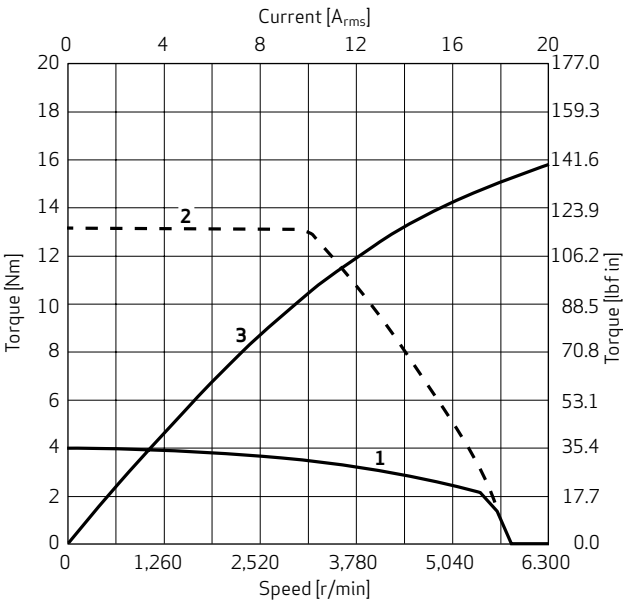
G-4-V8

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
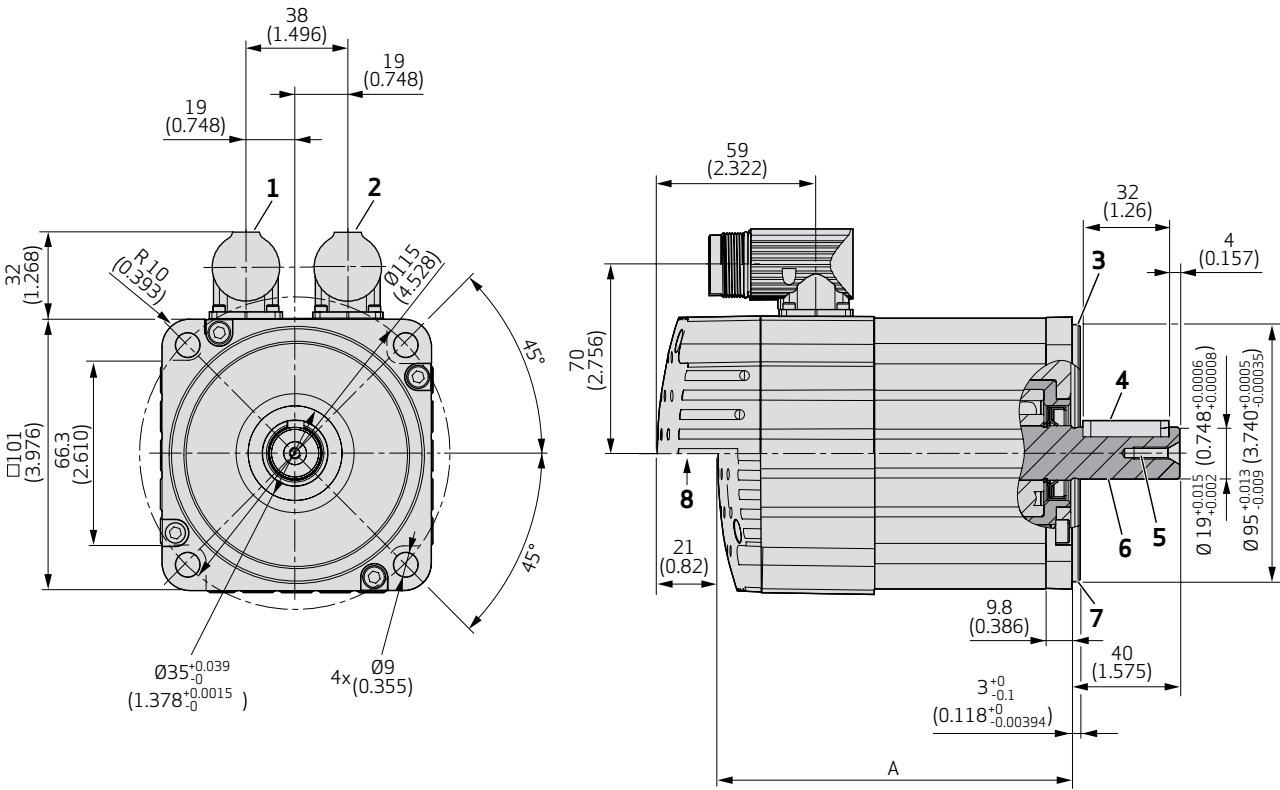
Model number	Dimension "A" resolver
	mm (in)
G-4-X2	133 (5.2)
G-4-X4	146 (5.7)
G-4-X6	171 (6.7)
G-4-X8	222 (8.7)
G-4-X9	273 (10.7)

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 reduced 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
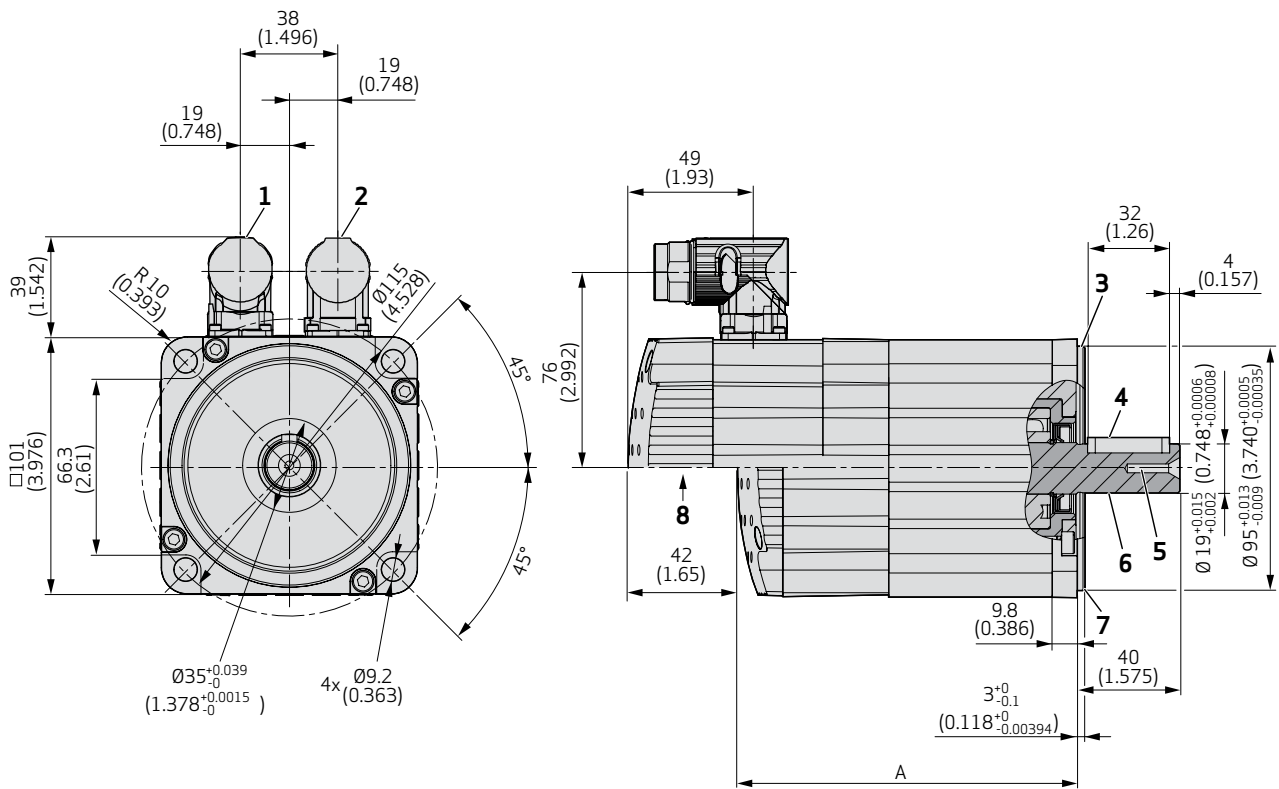
Model number	Dimension "A" encoder
	mm (in)
G-4-X2	133 (5.2)
G-4-X4	146 (5.7)
G-4-X6	171 (6.7)
G-4-X8	222 (8.7)
G-4-X9	273 (10.7)

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 reduced 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	Option 1	Option 2	Units
Holding torque	14 (124)	22 (195)	Nm (lbf in)
Extra weight	0.8 (1.8)	1.2 (2.6)	kg (lb)
Extra inertia with resolver	1.0 (8.9)	3.6 (31.9)	kg cm^2 $(10^{-4}$ lbf in s$^2)$
Extra inertia with encoder	1.1 (9.7)	3.8 (33.6)	kg cm^2 $(10^{-4}$ lbf in s$^2)$
Power requirement	15.6	17	W
Voltage requirement (+6 % -10 %)	24	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
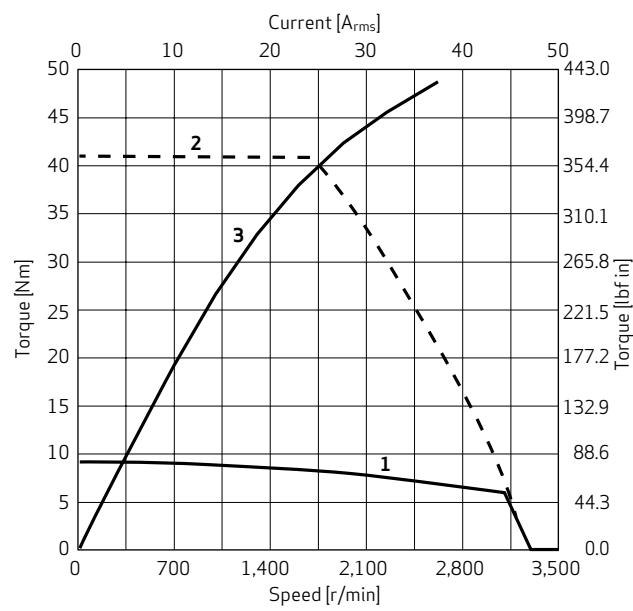# Natural Cooling, Low Voltage, Type G-5-M

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	Option 1	Option 2	Units
Holding torque	14 (124)	22 (195)	Nm (lbf in)
Extra weight	0.8 (1.8)	1.2 (2.6)	kg (lb)
Extra inertia with resolver	1.0 (8.9)	3.6 (31.9)	kg cm^2 (10^{-4} lbf in s^2)
Extra inertia with encoder	1.1 (9.7)	3.8 (33.6)	kg cm^2 (10^{-4} lbf in s^2)
Power requirement	15.6	17	W
Voltage requirement (+6 % -10 %)	24	24	V_{DC}

Notes:

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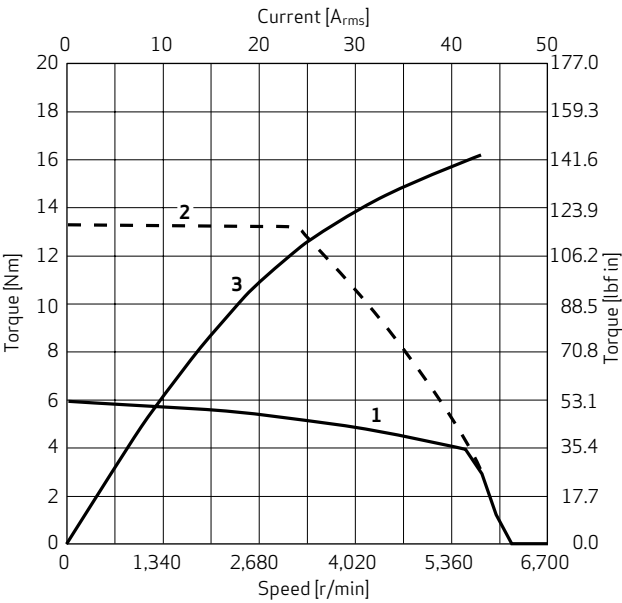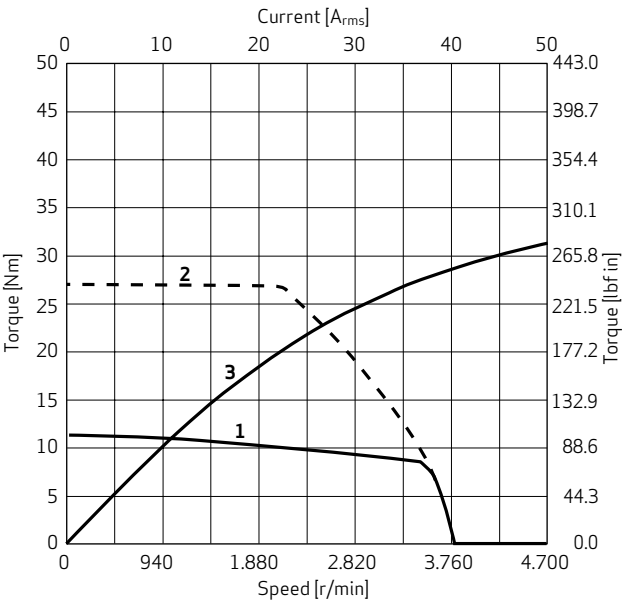2. Motor pole count: 12
3. DC link voltage 565 V

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

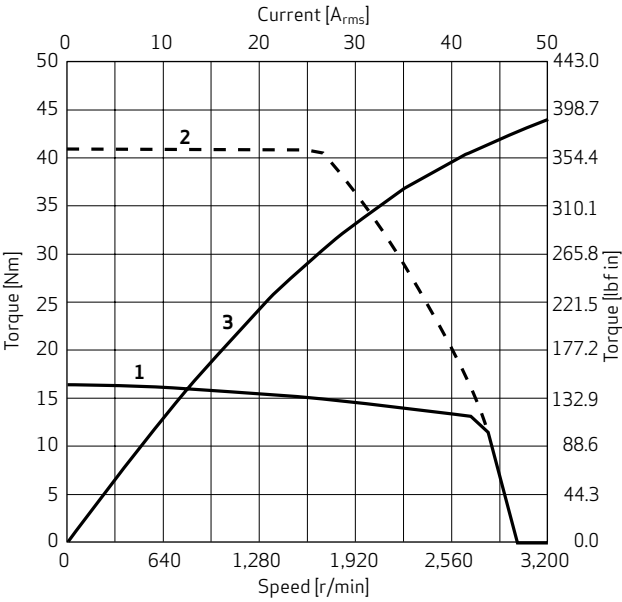## Motor Characteristics

G-5-V2
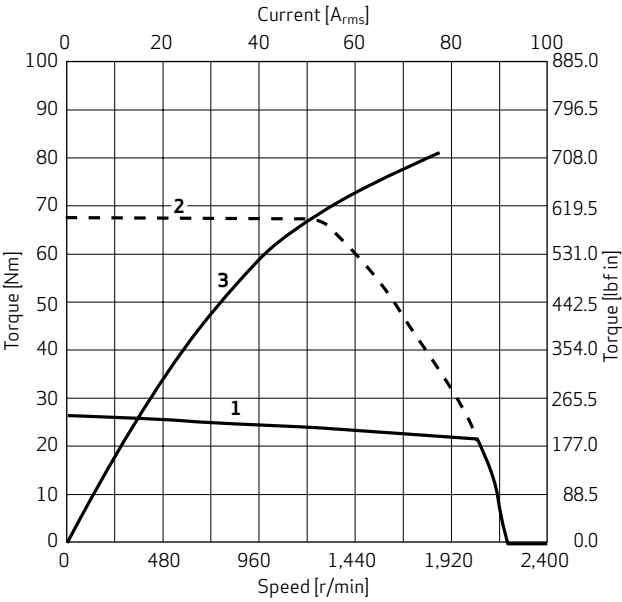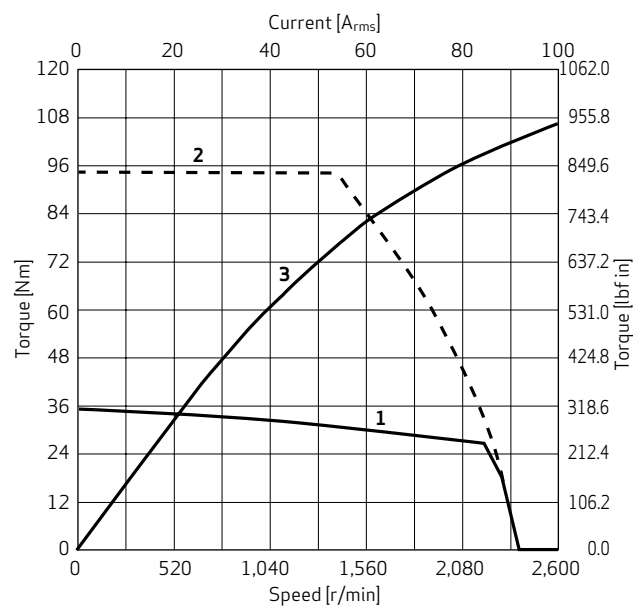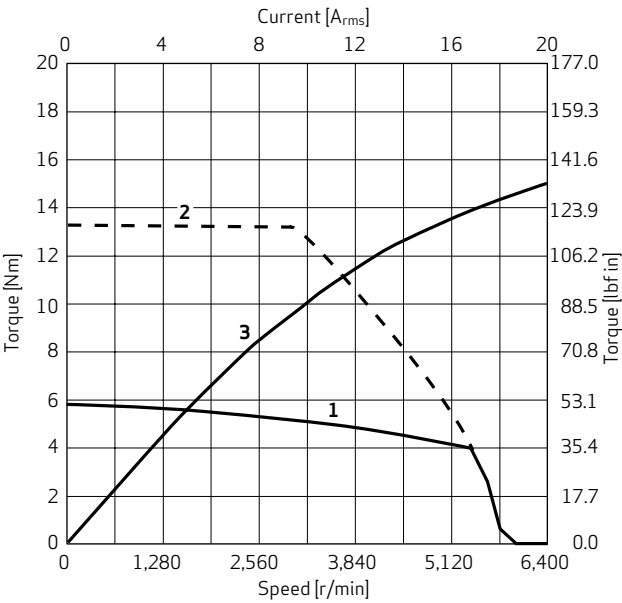

G-5-V4
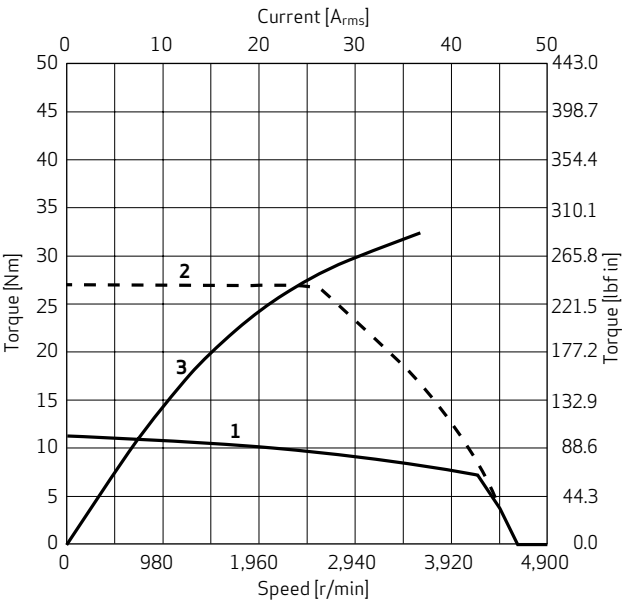
G-5-V6
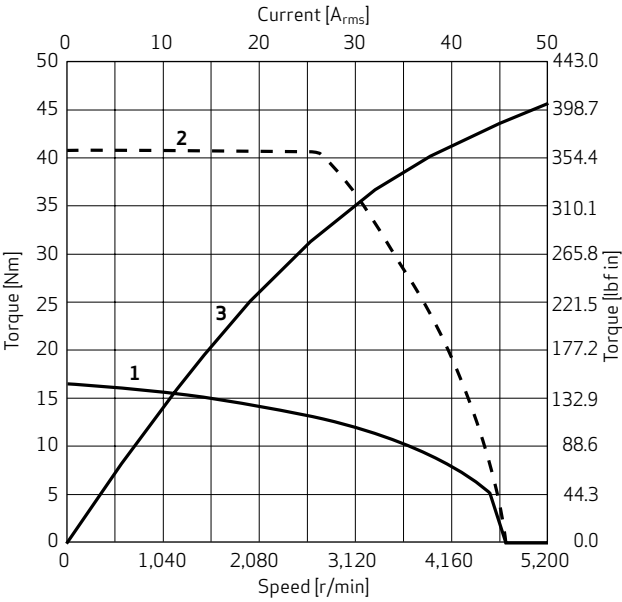
G-5-V8

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
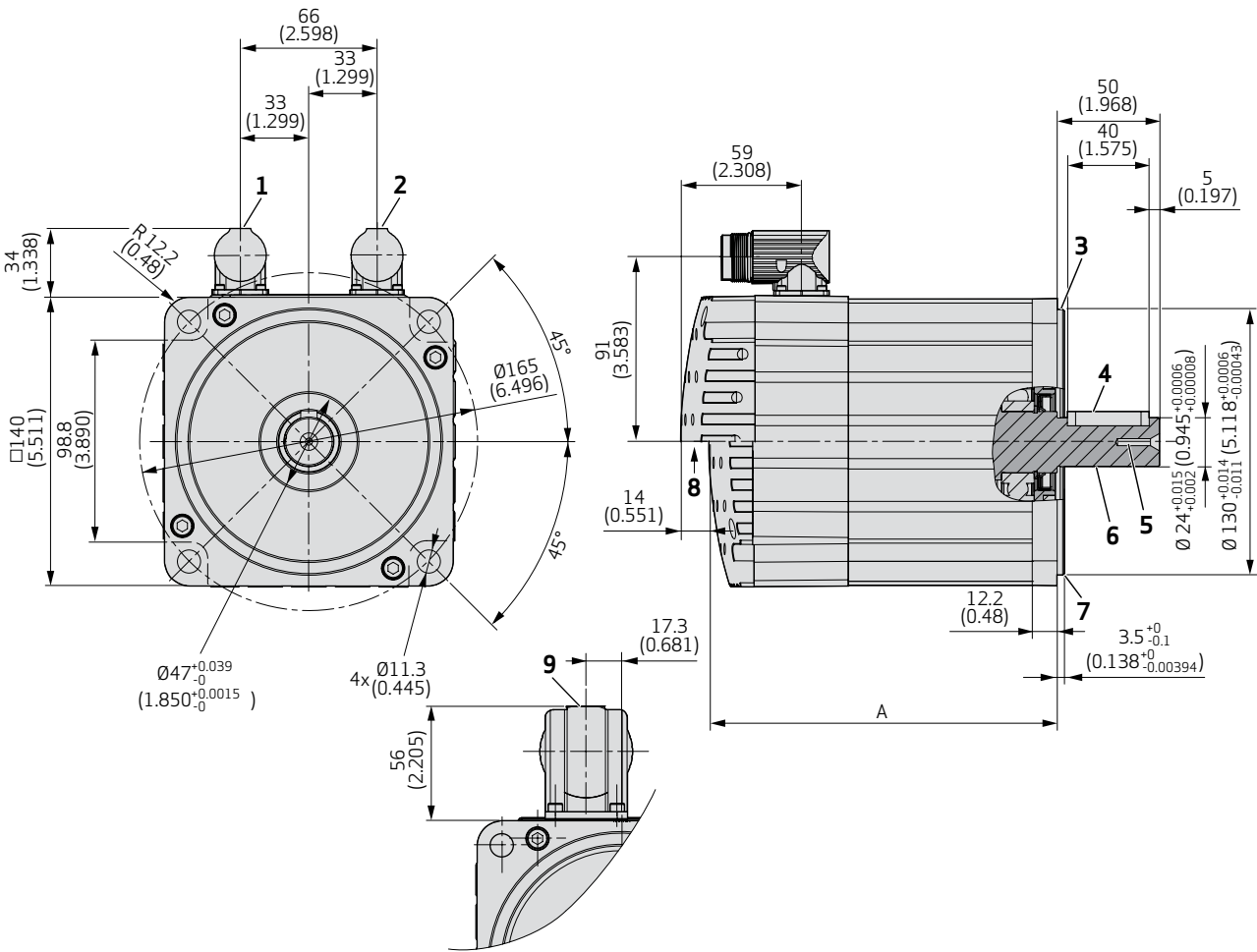
Model number	Dimension "A" resolver
	mm (in)
G-5-X2	170 (6.7)
G-5-X4	195 (7.7)
G-5-X6	220 (8.7)
G-5-X8	271 (10.7)
G-5-X9	322 (12.7)

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 reduced 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
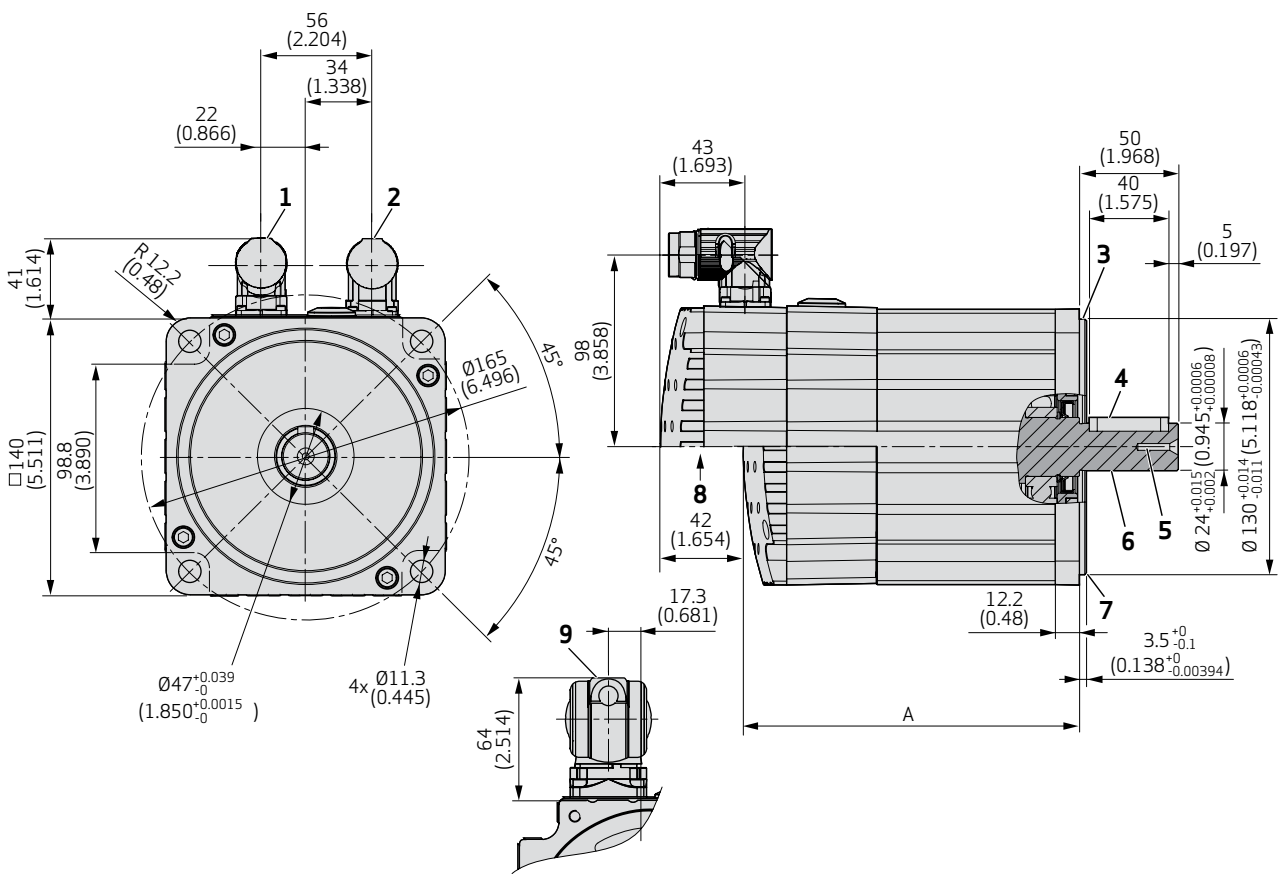
Model number	Dimension "A" encoder
	mm (in)
G-5-X2	169 (6.7)
G-5-X4	194 (7.6)
G-5-X6	220 (8.7)
G-5-X8	271 (10.7)
G-5-X9	321 (12.6)

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 reduced 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	Option 1	Option 2	Units
Holding torque	22 (195)	72 (637)	Nm (lbf in)
Extra weight	1.2 (2.6)	2.9 (6.4)	kg (lb)
Extra inertia with resolver	3.6 (31.9)	16 (142)	kg cm^2 (10^{-4} lbf in s^2)
Extra inertia with encoder	3.8 (33.6)	16 (142)	kg cm^2 (10^{-4} lbf in s^2)
Power requirement	17	40	W
Voltage requirement (+6 % -10 %)	24	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
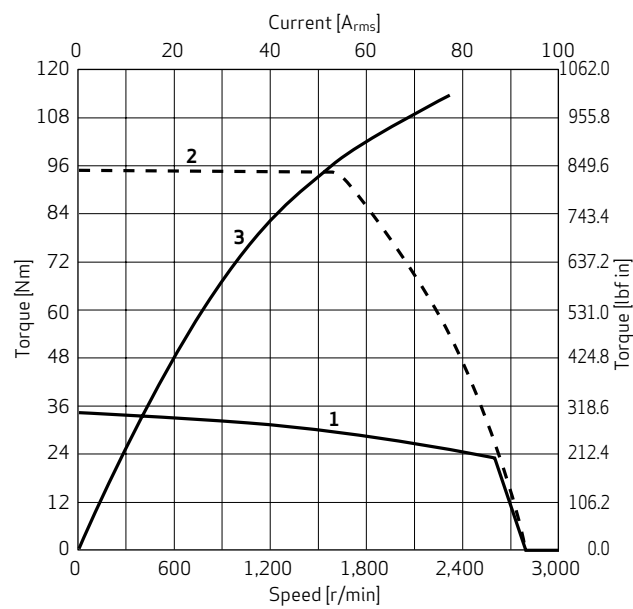# Natural Cooling, Low Voltage, Type G-6-M

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	Option 1	Option 2	Units
Holding torque	22 (195)	72 (637)	Nm (lbf in)
Extra weight	1.2 (2.6)	2.9 (6.4)	kg (lb)
Extra inertia with resolver	3.6 (31.9)	16 (142)	$kg\ cm^2$ ($10^{-4}\ lbf\ in\ s^2$)
Extra inertia with encoder	3.8 (33.6)	16 (142)	$kg\ cm^2$ ($10^{-4}\ lbf\ in\ s^2$)
Power requirement	17	40	W
Voltage requirement (+6 % -10 %)	24	24	V_{DC}

Notes:

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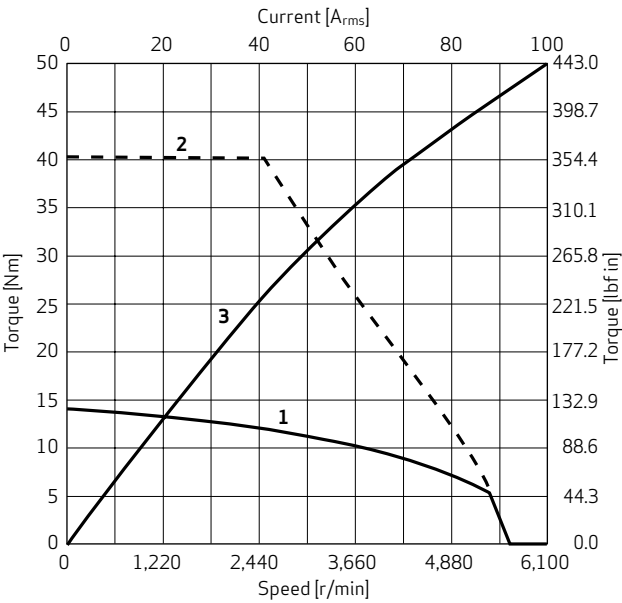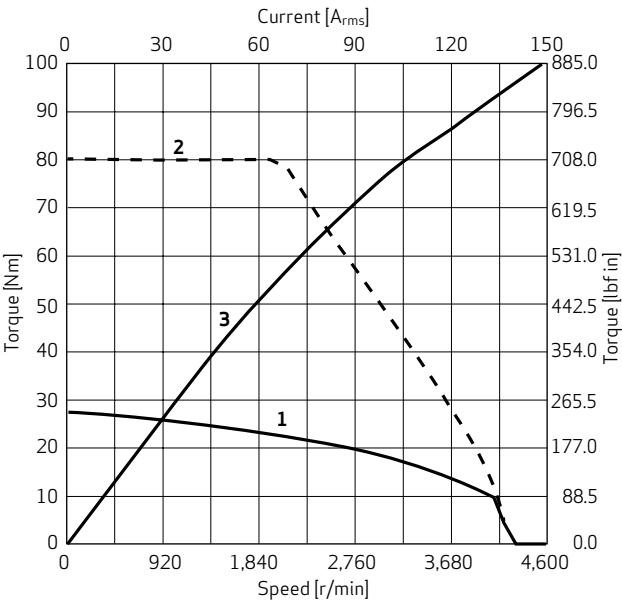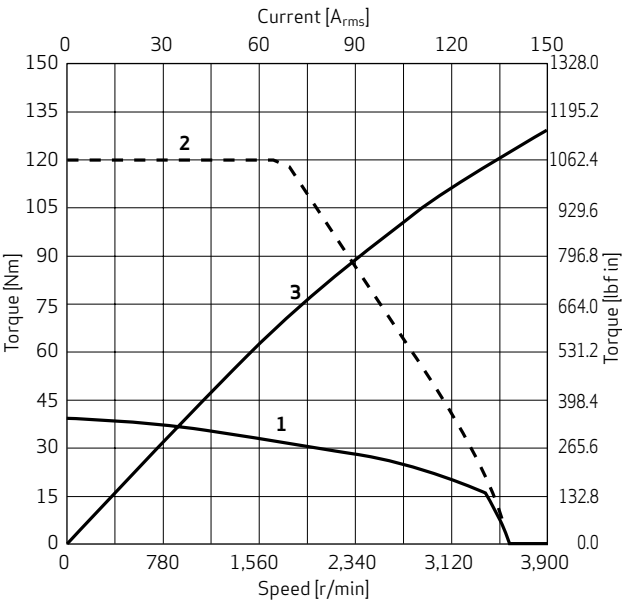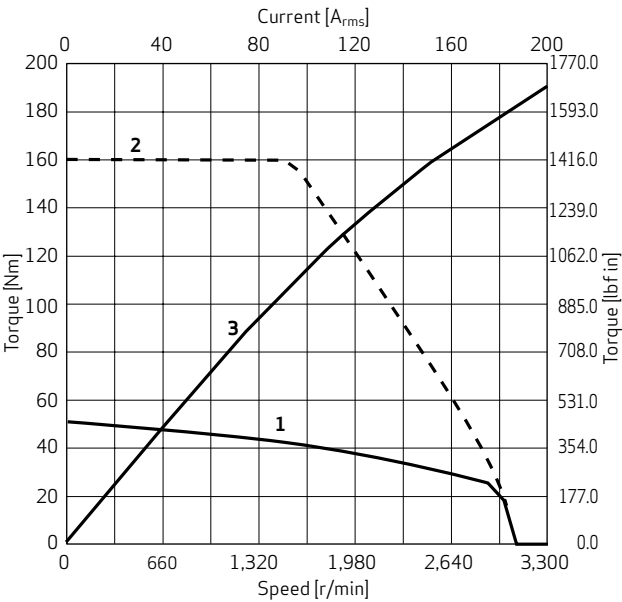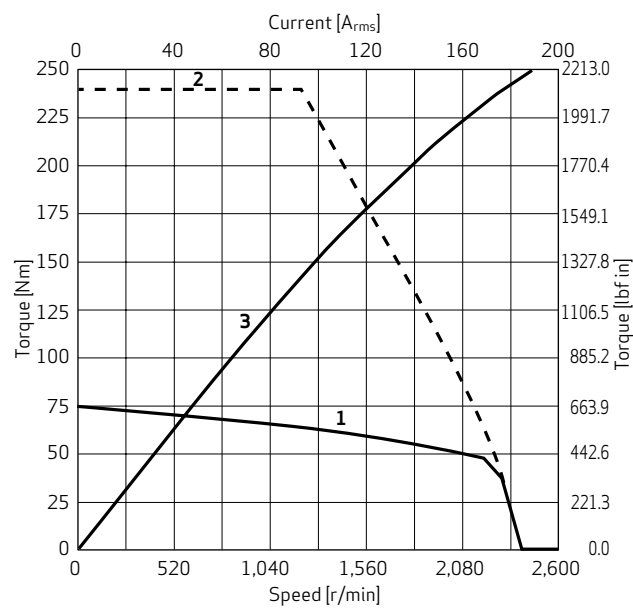2. Motor pole count: 12
3. DC link voltage 565 V

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

Motor Characteristics

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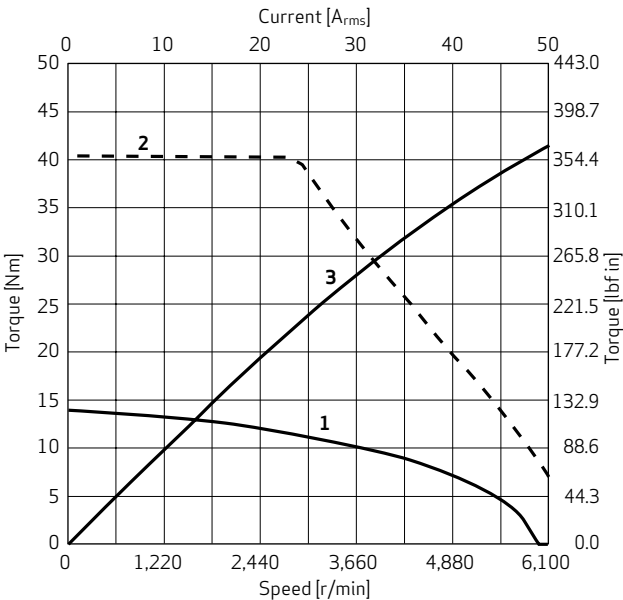
G-6-V4
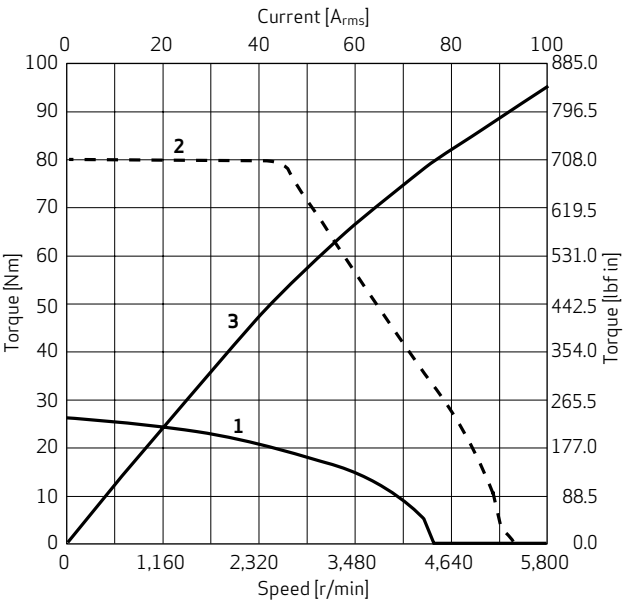
G-6-V6
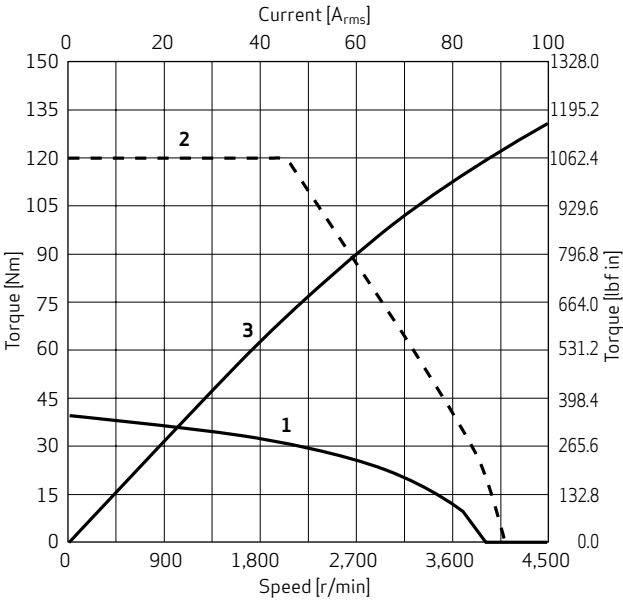
G-6-V8

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
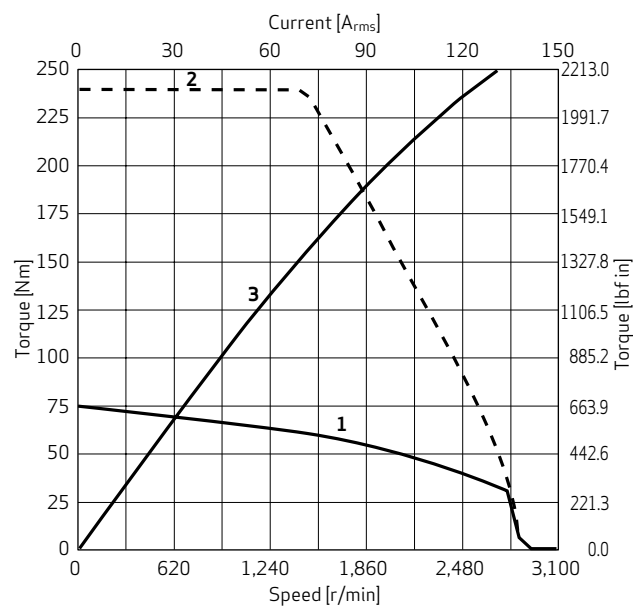
1   Continuous torque
2   Maximum torque
3   Torque constant k_T

SIZE 6

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

G-6 with Resolver
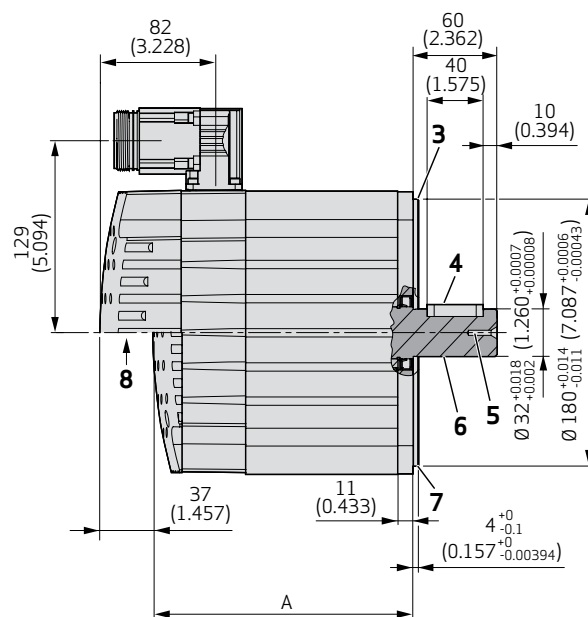
Model number	Dimension "A" resolver
	mm (in)
G-6-X2	187 (7.4)
G-6-X4	225 (8.9)
G-6-X6	263 (10.4)
G-6-X8	301 (11.9)
G-6-X9	377 (14.8)

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. Run out class as per IEC/DIN reduced class
4. Optional key 10x8x40
5. Thread M4x17
6. Shaft
7. Flange
8. With brake

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	186 (7.3)
G-6-X4	224 (8.8)
G-6-X6	262 (10.3)
G-6-X8	301 (11.9)
G-6-X9	377 (14.8)

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 Run out class as per IEC/DIN reduced class
4 Optional key 10x8x40
5 Thread M4x17
6 Shaft
7 Flange
8 With brake

WIRING DIAGRAMS
Power Connector

Power Connector

Power Connector Size 1
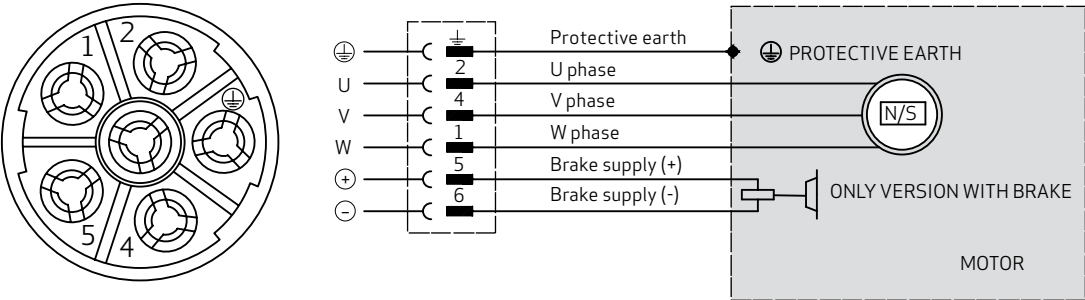
Pin	Signal
⏚	Protective earth
2	U phase
4	V phase
1	W phase
5	Brake supply (+)
6	Brake supply (-)
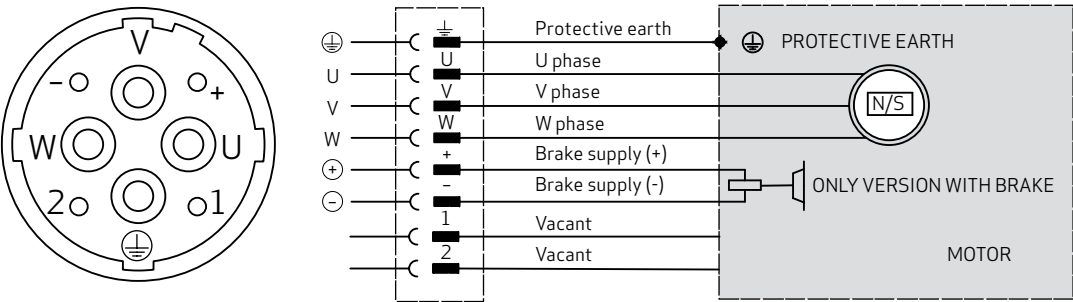
PROTECTIVE EARTH

N/S

ONLY VERSION WITH BRAKE

MOTOR

Power Connector Size 1.5

Pin	Signal
⏚	Protective earth
U	U phase
V	V phase
W	W phase
+	Brake supply (+)
–	Brake supply (-)
1	Vacant
2	Vacant

PROTECTIVE EARTH

N/S

ONLY VERSION WITH BRAKE

MOTOR

For more information on connectors, please request the CD Series Installation Instructions Manual.

Signal Resolver Connector

Signal Resolver Connector

Signal Resolver Connector

Terminal	Pin	Signal
TEMPERATURE SENSOR	5	
	6	
S1	1	Cos(+)
S3	2	Cos(-)
S2	3	Sin(+)
S4	4	Sin(-)
R1	7	Vref(+)
R2	8	Vref(-)

TEMPERATURE SENSOR

RESOLVER

MOTOR
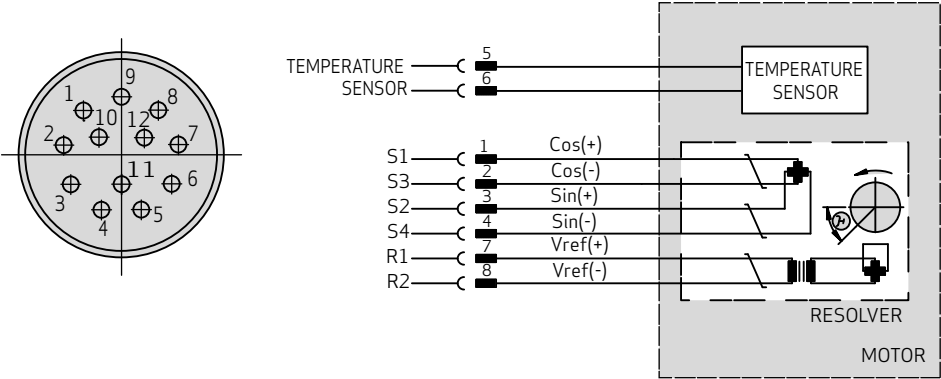
WIRING DIAGRAMS
Signal Encoder Connectors[1]

Signal Encoder Connectors[1]

Stegmann Incremental

Pin	Signal
Temperature sensor	5
	6
R	1 — Commutation track R (+)
S	2 — Commutation track S (+)
T	3 — Commutation track T (+)
$\overline{R}$	4 — Commutation track R (-)
Us	7 — Encoder supply T (Vcc+)
$\overline{S}$	8 — Commutation track S (-)
$\overline{T}$	9 — Commutation track T (-)
GND	10 — Encoder supply (GND)
Shield	11 — Inner shield
B+	12 — Incremental signal B (+)
B-	13 — Incremental signal B (-)
Z+	14 — Zero signal (+)
A+	15 — Incremental signal A (+)
A-	16 — Incremental signal A (-)
Z-	17 — Zero signal (-)

TEMPERATURE SENSOR / ENCODER / MOTOR

Stegmann Absolute

Pin	Signal
Temperature sensor	5
	6
	1 — Vacant
	2 — Vacant
	3 — Vacant
	4 — Vacant
Us	7 — Encoder supply (Vcc+)
	8 — Vacant
	9 — Vacant
GND	10 — Encoder supply (GND)
Shield	11 — Inner shield
COS+	12 — Incremental cosine (+)
REFCOS	13 — Incremental cosine (-)
Data+	14 — Data asynchronous serial line Hiperface (+)
SIN+	15 — Incremental sine (+)
REFSIN	16 — Incremental sine (-)
Data-	17 — Data asynchronous serial line Hiperface (-)

TEMPERATURE SENSOR / ENCODER / MOTOR

Heidenhain Incremental

Pin	Signal
Temperature sensor	5
	6
Up sensor	1 — Supply feedback (+)
R-	2 — Zero track (-)
R+	3 — Zero track (+)
OV sensor	4 — Supply feedback (GND)
Up	7 — Encoder supply (Vcc+)
D-	8 — Absolute cosine (-)
D+	9 — Absolute cosine (+)
OV (Un)	10 — Encoder supply (GND)
Shield	11 — Inner shield
B+	12 — Incremental cosine (+)
B-	13 — Incremental cosine (-)
C+	14 — Absolute sine (+)
A+	15 — Incremental sine (+)
A-	16 — Incremental sine (-)
C-	17 — Absolute sine (-)

TEMPERATURE SENSOR / ENCODER / MOTOR

Heidenhain Absolute

Pin	Signal
Temperature sensor	5
	6
Up sensor	1 — Supply feedback (+)
	2 — Vacant
	3 — Vacant
OV sensor	4 — Supply feedback (GND)
Up	7 — Encoder supply (Vcc+)
CLOCK	8 — Clock synchronous serial line (+)
$\overline{CLOCK}$	9 — Clock synchronous serial line (-)
OV (UN)	10 — Encoder supply (GND)
Shield	11 — Inner shield
B+	12 — Incremental cosine (+)
B-	13 — Incremental cosine (-)
DATA	14 — Data synchronous serial line ENDat (+)
A+	15 — Incremental sine (+)
A-	16 — Incremental sine (-)
$\overline{DATA}$	17 — Data synchronous serial line ENDat (-)

TEMPERATURE SENSOR / ENCODER / MOTOR

1) See ordering information; Feedback option

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-1	30 (7)	60 (13)
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-1
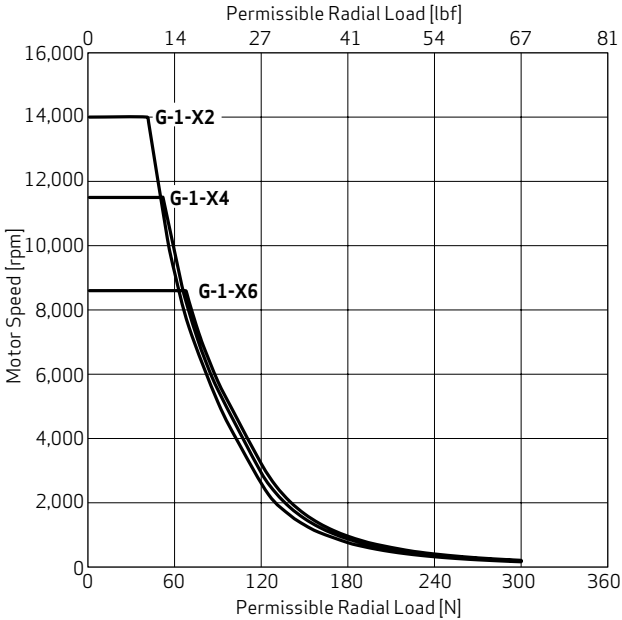
G-2
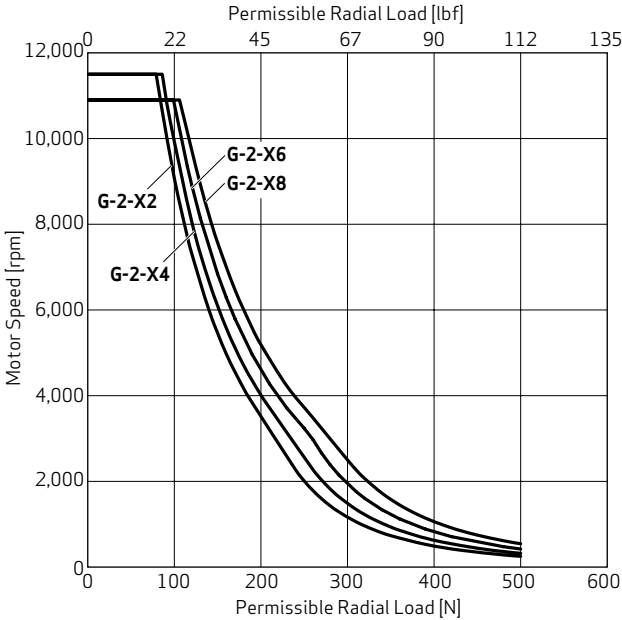
G-3

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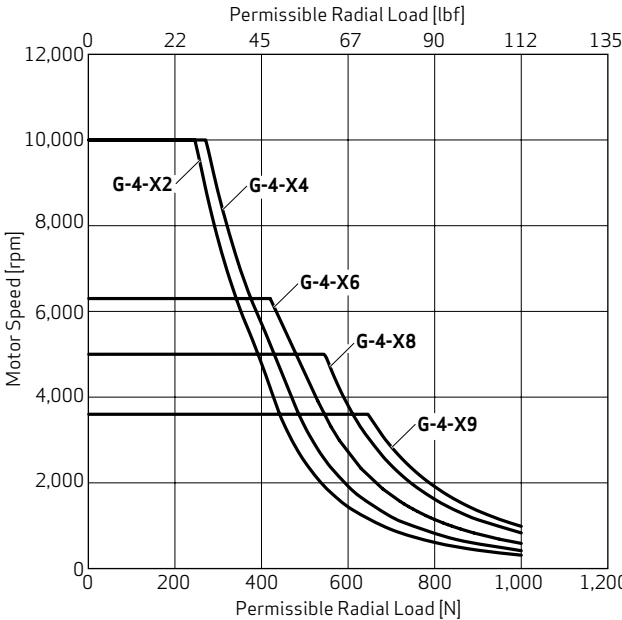
Note: X is a placeholder for M or V, for example, X2 is placeholder for M2 or V2.

BEARING LOAD DIAGRAMS

G-5

Permissible Radial Load [lbf]

G-5-X2
G-5-X4
G-5-X6
G-5-X8
G-5-X9

Motor Speed [rpm]

Permissible Radial Load [N]

G-6

Permissible Radial Load [lbf]

G-6-X2
G-6-X4
G-6-X6
G-6-X8
G-6-X9

Motor Speed [rpm]

Permissible Radial Load [N]
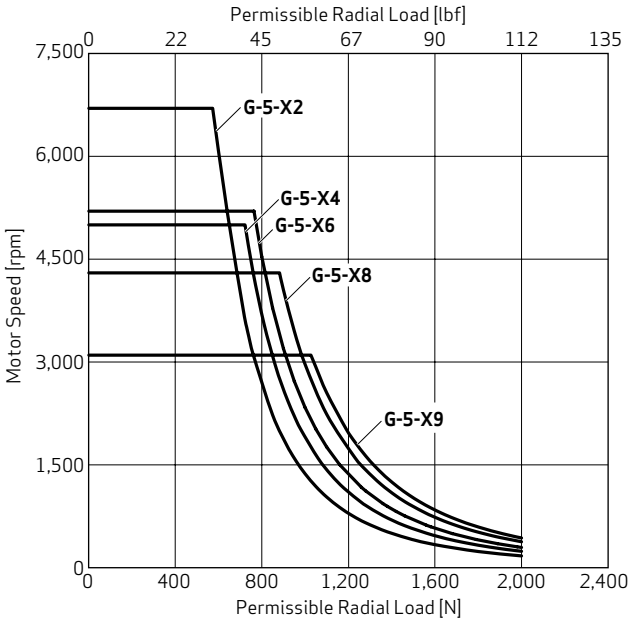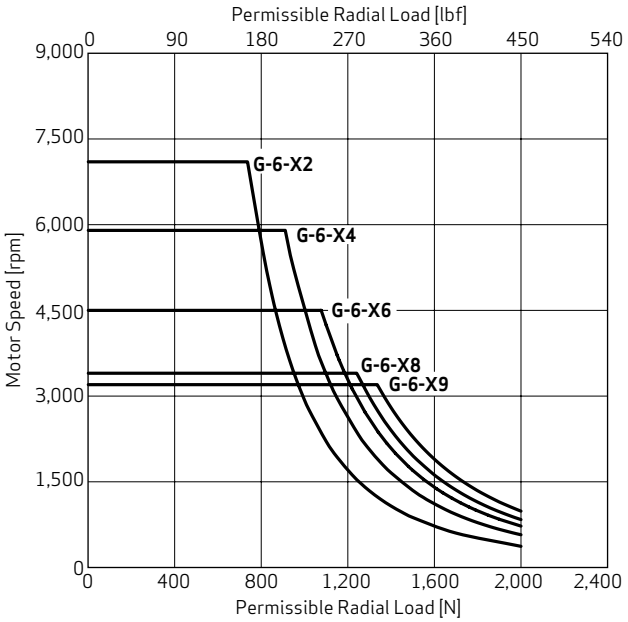
Note: X is a placeholder for M or V, for example, X2 is placeholder for M2 or V2.

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
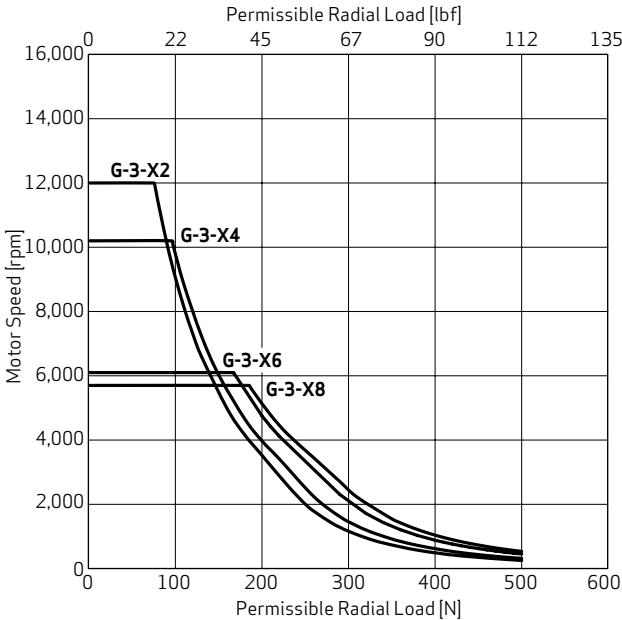 3. Maximum torque
  4. Speed

- 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 motors: 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 achieved.

SERVO MOTOR SELECTION AND SIZING

Mechanical Transmission 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/ N^2

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 :

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

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.

SERVO MOTOR SELECTION AND SIZING
General information

1. Motors designed to EN 60034

2. Runout class per DIN 42955, IEC 72-1

3. Rotors balanced to Class G 6.3 per ISO 1940

4. Sealing to IP65 (excluding shaft seal) with Moog specified mating connectors

5. Operating ambient temperature -25 to +40 °C (-13 to +104 °F)

6. Class F winding insulation

7. Motor flange dimensions per IEC 60034, ISO 286

8. Motor shaft dimensions per DIN 748

9. Motor shaft keyway per DIN 6885, IEC 72-1

10. Feedback sensors

    a. Resolver

    - Type: Transmitter

    - Pole count: 2

    - Input voltage: 4 V_{rms}

    - Carrier frequency: 3.4 to 8 kHz

    - Input current: 35 mA maximum

    - Transformation ratio: 0.5

    b. Encoder

    - Incremental

    - Absolute Single-turn

    - Absolute Multi-turn

11. CD Series Servo Motor are available in two versions:

    G-X-M: designed for the use of DC link voltage 325 V

    G-X-V: designed for the use of DC link voltage 565 V

12. Winding temperature sensors (standard version):

    G-X-M: NTC

    G-X-V: PTC with threshold at 155 °C

13. Sealed life-time lubricated bearing

Notes

1. Continuous ratings based upon:

    a. Operation in still air with ambient temperatures up to 40 °C (104 °F)

    b. Winding temperature upto 110 °C (230 °F) over ambient.

    c. Motor front flange attached to a steel mounting plate measuring 300 x 300 x 25 mm (11.81 x 11.81 x 1.00 in).

2. Peak ratings based on:

    a. Duty cycle: 5 % (1 out of 20 seconds).

    b. Iron saturation of 15 % or less.

3. Kt-line shows 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. Motor performance as measured with Moog drives at DC link voltage 325 V for the G-X-M motor and DC link voltage 565 V for G-X-V motor. For other drives and voltage levels, please talk to Moog local application engineers.

8. Specification tolerances are ±10 %.

9. For motors with Encoder feedback, please use a lower Nominal Torque, Continuous Duty, Nominal Speed rating, due to operating temperature limitations of encoder devices.

10. The maximum speed, n_{max}, 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.

11. Resolver feedback motor installation diagrams shown in this catalog assume the use of fixed angled connectors. Encoder feedback motor installation diagrams shown in this catalog assume the use of rotatable angled connectors.

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.

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.
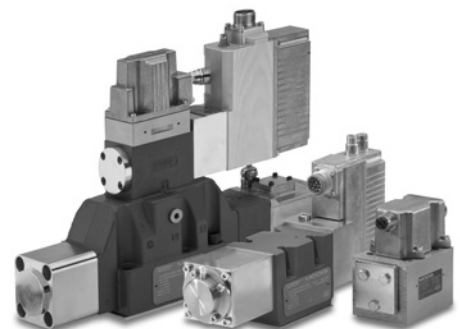
Moog products include:

- 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
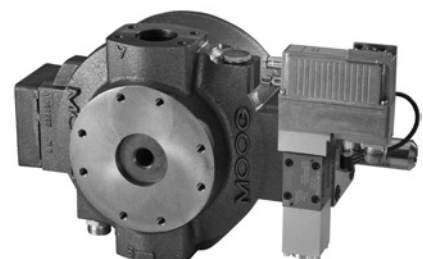- Slip Rings
- Motion Bases

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 worlds 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

Flight Simulation

Formula One Simulation Table

- Flexible programs, tailored to your needs such as upgrades, preventative maintenance and annual/multi-year contracts
- 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
Flexible Design Options

Moog's CD Series Servo Motors are available with a variety of standard and customized options to address the unique requirements of your application. Moog's motor design and application teams are continually introducing new options to address the changing needs of the market. As a result, if you need something that is not listed, contact your local Moog office to see if it is available.

Standard Options

The standard options for the CD Series Servo Motors are detailed in the type boxcar.

1. Cooling

Natural Convection Cooling

Moog's CD Series Servo Motors are designed to supply high dynamics to normal duty cycle applications. They offer very high angular acceleration in a given package size.

Fan Cooling

To supply high dynamics in high duty cycle applications, Moog offers optional fan cooling on select CD motor models. Fan cooling delivers up to 30 % greater continuous torque output without increasing motor inertia. Fans are powered by an unregulated 24 V_{DC} supply (see Motor Accessories) with dedicated power connector. Current requirements are 1 A_{DC} per motor.

2. Integral Holding Brake

Holding brakes are available for all CD Series Servo Motors. The brake is a permanent magnet style that is designed to hold the axis in position even with power removed. This is especially useful in applications where the motor is on an axis controlling a weight-induced load (e.g. vertical axis on a gantry robot). Please note that the brake is a holding brake and is not designed to stop dynamic loads. The Servo Drive is required to decelerate the axis and hold position before the brake is engaged.

The integral holding brake requires a regulated 24 V_{DC} supply (see Accessories) for proper operation. Brake power connections are through the standard motor power connector. Refer to motor technical data for brake current requirements.

3. Connectors

Moog standard CD Series Servo Motors are equipped with quick connect right angle connectors.

4. Thermal Sensor

In order to help protect the motor from overheating, a single thermal sensor in the stator is supplied as standard.

This thermal sensor can be a PTC , NTC or KTY sensor.

5. Shaft Options

CD Series Servo Motors are available with plain or slot and key metric shafts. For custom motor shafts such as spline or english dimension shafts see Custom Options.

6. Shaft Seal

In applications where the shaft/flange mating surface is immersed in fluids, a shaft seal is required to maintain motor integrity. Moog offers PTFE (Teflon) type shaft seals which have excellent operating characteristics (resistant to shrinkage and thermal stress).

7. Feedback Devices

As detailed on type code in ordering information, the CD Series Servo Motors boast a variety of resolvers, incremental encoders and single turn and multiturn optical encoders as standard.

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
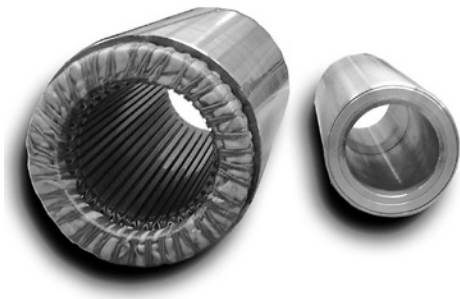
Moog´s CD frameless motor offering is based on the following standard stator dimensions:

Type	Stator diameter (nominal) [mm (in)]
G-1	35.0 (1.4)
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 spraydown 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.

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 6 – 0 0

- Standard version
- Encoder Heidenhain ECN1313 absolute single turn
- Plain shaft, no shaft seal
- Standard electrical version (Option 2, 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
- Motorsize: Frame size 70 mm
- Series: Fastact G
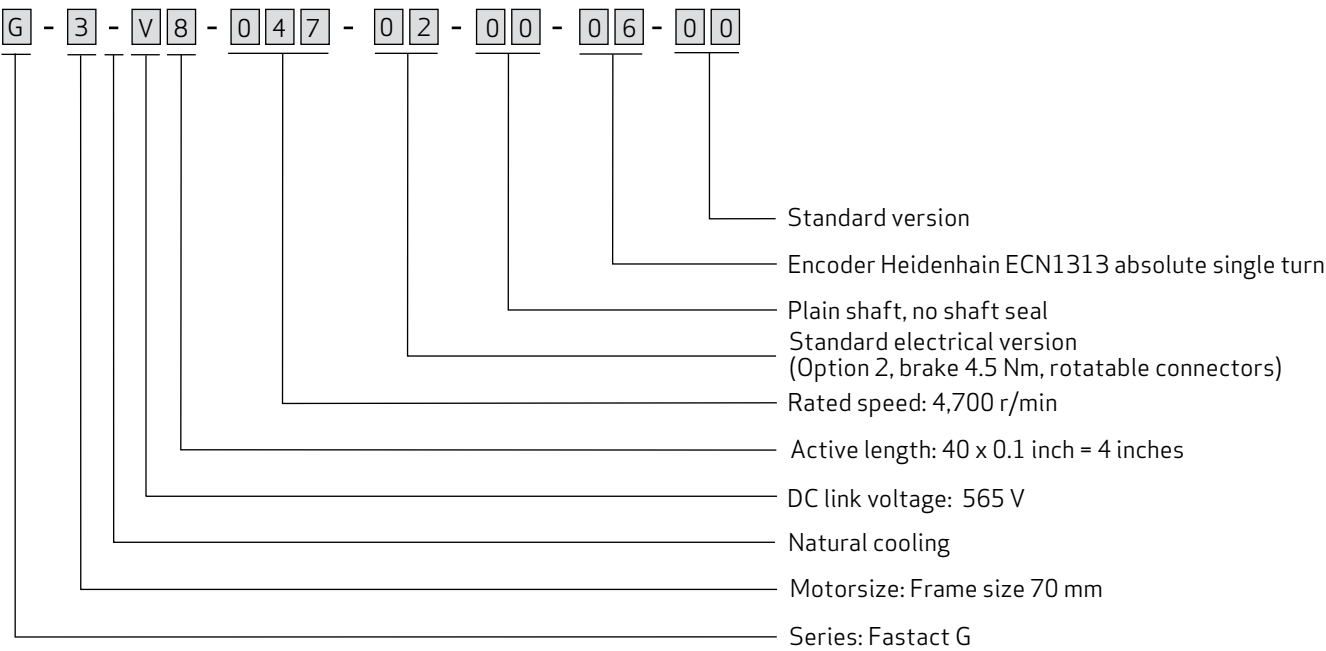
ORDERING CODE

G - ☐ - ☐☐ - ☐☐☐ - ☐☐ - ☐☐ - ☐☐ - ☐☐

Motor size

1	40 mm (Flange)
1	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} With NTC thermal sensor
V	High Voltage: 565 V_{DC} With PTC thermal sensor

Stack length [1]

Code	Motorsize					
	1	2	3	4	5	6
0	Special					
2	L20	L05	L05	L05	L10	L15
4	L40	L10	L15	L10	L20	L30
6	L60	L20	L25	L20	L30	L45
8	–	L40	L40	L40	L50	L60
9	–	–	–	L60	L70	L90

[1] Active length in 0.1 inch (for G-1 in mm)

Rated speed [2]

xxx	r/100 min

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

Electrical options [3]

	Brake options		Rotable connector	Straight connector	Fixed angled connector
	1	2			
00			▓		
01	▓		▓		
02			▓		
03				▓	
04	▓			▓	
05		▓		▓	
06					▓
07	▓				▓
08		▓			▓
09	Special				

[3] Resolver motors come with fixed angled connectors
Encoder motors come with rotable angled connectors

Brake options

		Motor size					
		1	2	3	4	5	6
1	Low torque	0.4 Nm	1 Nm	2 Nm	9 Nm	14 Nm	22 Nm
2	High torque	–	–	4.5 Nm	14 Nm [4]	22 Nm	72 Nm

[4] With encoder holding torque 14.5 Nm (128.5 lb)

Mechanical option

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

Special version

00	Standard version

Feedback options

	Motor size						Resolver/ Encoder type	
	1	2	3	4	5	6		
00	Not allowed							
01	2 poles resolver							
02	–	–		–			Incremental	Steg-mann
03	–	SKS36		SRS50			Absolute single turn	
04	–	SKM36		SRM50			Absolute multi turn	
05	–	ERN1185		ERN1387			Incremental	Heiden-hain
06	ECN1113			ECN1313			Absolute single turn	
07	EQN1125			EQN1325			Absolute multi turn	
08	Special							

TAKE A CLOSER LOOK.

Moog designs a range of motion control products that complement the performance of those featured in this document.
Visit our website for more information and contact the Moog facility nearest you.

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