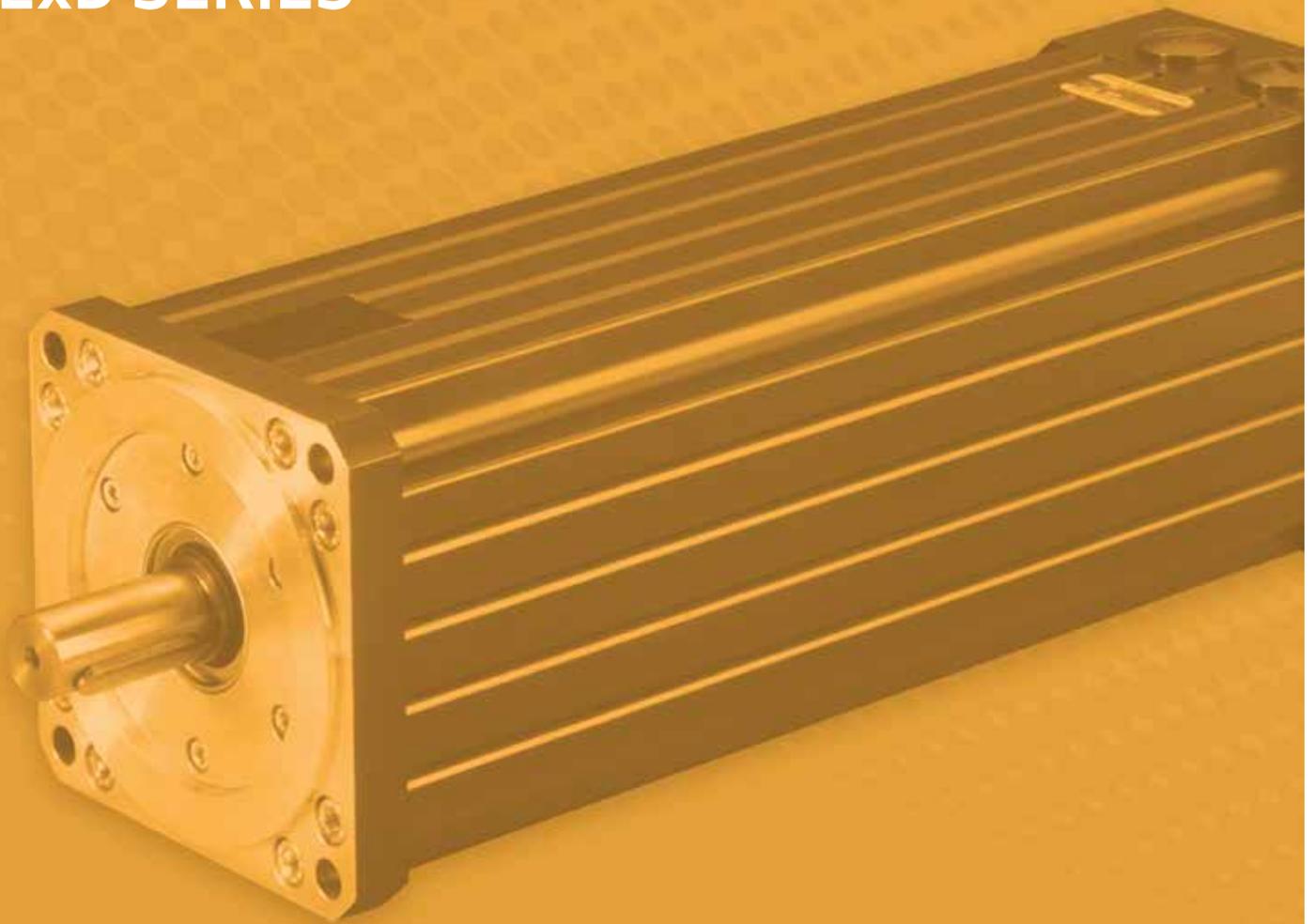


EXPLOSION PROOF DYNAMIC BRUSHLESS SERVO MOTORS

ExD SERIES



Rev. F, May 2022

FOR USE IN POTENTIALLY EXPLOSIVE ATMOSPHERES
WITH ATEX, IECEX, UL, CCC EX, KOSHA AND TRCU

WHEN PERFORMANCE REALLY MATTERS

MOOG

Whenever the highest levels of motion control performance and design flexibility are required, you'll find Moog at work. Through collaboration, creativity and world-class technological solutions, we will help you overcome even the toughest engineering challenges.

INTRODUCTION.....	2
Making The Impossible Possible In Motion Control	3
Product Overview.....	4
Certifications, Features and Benefits	5
Technical Features	6
TECHNICAL DATA	9
General Characteristics	9
Holding Brake Characteristics.....	11
Temperature Characteristics	12
Size 3.....	16
Size 5.....	20
Size 6.....	23
Wiring Diagram.....	27
Bearing Load Diagrams	28
BACKGROUND	29
Defining the Hazardous Location	29
Servo Motor Selection and Sizing.....	30
About Moog.....	34
ORDERING INFORMATION.....	35
Options.....	35
Ordering Code.....	36
OTHER MOOG PRODUCT OFFERING	38

This catalogue is written for experts. To make sure all information necessary for operation and safety has been provided, the user must check the suitability of the products described. The products described are subject to change without notice. If you have any doubts, please contact Moog.

Moog is a registered trademark of Moog Inc. All registered trademarks mentioned herein are the property of Moog Inc.

©Moog Inc. 2022. All rights reserved. All changes are reserved.

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



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. The products are designed as a system to deliver superior servo performance. Moog offers a broad range of standard models 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.

Explosion Proof Dynamic Brushless Servo Motors

Moog's Explosion Proof Dynamic Brushless Servo Motors (ExD Series) are electronically commutated synchronous AC motors with permanent magnet field excitation. The ExD Series Servo Motors are designed for highly dynamic applications where positioning times of 30 ms or less are often the norm. The ExD Series Servo Motors offers one of the industry's widest power ranges with standard models available at continuous torque ratings from 0.14 to 40 Nm (1.2 to 354 lbf in). The modular design is supported by a variety of options with Moog's application staff capable of supplying fully customized solutions.

The ExD Series servo motors range covers 3 frame sizes, 3 magnetic designs, with naturally cooling 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 improve space utilization.

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

The ExD 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 non-symmetric slot count and other proprietary features to minimize cogging.

Servo Motor ExD Series



Extended Life and Versatility

All ExD Series servo motors are manufacturing 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 IP 65/67 complaint construction combine to extend service life and offer years of reliable, low maintenance operation.

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

Standards

These motors are certified to be in compliance with following standards:

- EN/IEC 60079-0 Explosive atmospheres - Part 0: Equipment - General requirements
- EN/IEC 60079-1 Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures "d"
- EN/IEC 60079-31 Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosure "t"
- UL 674 : Electric motors and generators for use in hazardous (classified) locations
- CCC Ex
- KOSHA
- TRCU

Type of Protection

- Flameproof "d"
- Dust "tb"

Model number	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)
G3	1.6 to 13.2 (14.2 to 117)	0.52 to 3.26 (4.6 to 28.9)	0.16 to 0.97 (1.4 to 8.6)	7,800 to 3,800	70 (2.8)
G5	12.2 to 108 (108 to 542)	5.79 to 25.4 (51.2 to 225)	4.6 to 18.4 (40.7 to 163)	4,800 to 2,000	140 (5.5)
G6	40.13 to 239.31 (355 to 2,118)	12.91 to 66.68 (114 to 590)	28.6 to 157 (253 to 1,390)	4,000 to 2,000	190 (7.5)

1. Nominal speed can be easily adjusted by changing the stator windings. Please contact your local Moog application engineer for information.
2. All the above technical data is for explosion proof motor assuming T4 temperature class at +40 °C (+104 °F).

CERTIFICATIONS

Moog Explosion Proof Dynamic Brushless Servo Motors have been certified to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive environments.

The Moog Explosion Proof Dynamic Brushless Servo Motor is designed and manufactured in accordance with strict CE (VDE) 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.

For the latest certifications for Explosion Proof Dynamic Brushless Servo Motors visit www.moog.com



FEATURES AND BENEFITS

Features	Benefits
Robust thermal design with superior dynamics	
<ul style="list-style-type: none"> Proprietary low cogging design 	<ul style="list-style-type: none"> Smooth low-speed performance Faster operation and higher performance Increased productivity Improved product quality through accurate control
Construction	
<ul style="list-style-type: none"> Common design across all certification Certified for use in potential hazardous environments Compact and lightweight Ruggedized with aluminum housing Built in thermal sensor and IP65/IP67 protection class 	<ul style="list-style-type: none"> Seamless integration into application for different hazardous environment and regions Greater safety, reduced downtime and risk protection Higher power density and a higher torque-to-weight ratio Greater payloads and/or increased acceleration when motor is mounted on a moving axis Maintenance free operation and increased system availability
Range	
<ul style="list-style-type: none"> Maximum torque from 1.6 to 240 Nm (14.2 to 2.124 lbf in) and power from 0.36 to 8.36 kW (0.5 to 11.2 hp) 3 frame sizes, 3 magnetic designs, 4 ignition temperature class 	<ul style="list-style-type: none"> Many variants for machine builders to choose from Rapid machine design process Improved cycle times
Flexibility	
<ul style="list-style-type: none"> Customization of flanges sizes and shaft (length, diameter or spline fittings) 	<ul style="list-style-type: none"> Seamless integration into existing infrastructure Reduced needs for system redesign

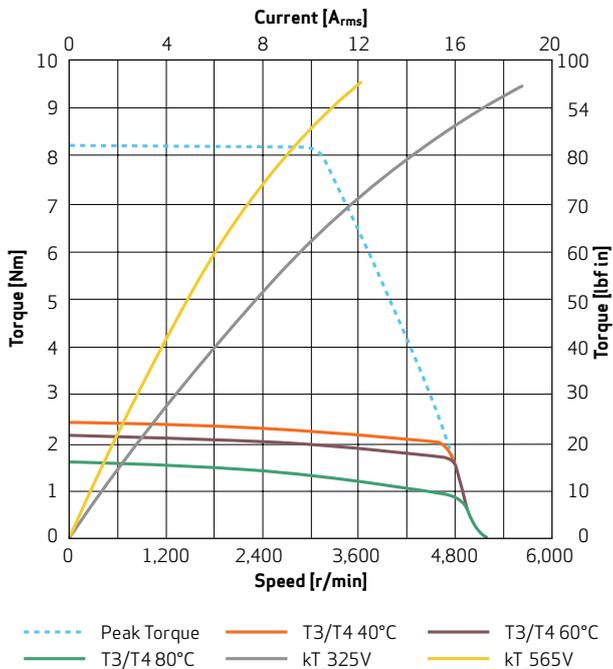
TECHNICAL FEATURES

1. Moog Motor Performance Characteristics

In collaborating with a variety of industrial machine designers, Moog engineers understand the critical role the application sizing process plays in overall machine design. With global competition forcing machine designers to do more with less, there is an ever-increasing need to your application needs. It is for these reasons that Moog specifies motor performance characteristics in a practical manner ideal 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-3LX6 T3/T4



Continuous Torque Curve

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

- Operations in still air with ambient temperatures based on T-code.
- Motor front flange attached to a steel mounting plate measuring 300 x 300 x 25 mm (11.81 x 11.81 x 1 in)

Maximum Torque Curve

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

kT Characteristics(Torque Constant)

The motor characteristics depicts stator saturation at various operating points and can be used to optimize sizing in low duty cycle Applications. ExD Series Servo Motors can deliver a low duty cycle “impulse torque” which is typically 20 to 30 % more than rated 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.

2. Conformity to Standards

ExD Series Servo Motors are ATEX, IECEx and UL certified. These motors are in accordance with EU directives such as Low Voltage directive, ATEX directive, EMC directives and other applicable standards.

Flame Proof Construction

The ExD Series Motors are designed and tested for operation in conditions where dust and vapors or gases form flammable or explosive environments. The flameproof housing has been tested and proven capable to withstand internal explosions without bursting or allowing ignition to reach outside the motor frame. These servo motors are certified for use in potentially explosive atmosphere in accordance with ATEX 2014/34/EU directive and IEC Ex for II B, II C gases and III C dust group.

3. Ruggedized Design

ExD Series Servo motors are ATEX and IECEx certified, The ExD Series Servo motors are designed and manufactured in accordance with strict standards, using ruggedized components with proven reliability in harsh thermal and shock load environments. These features 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.

TECHNICAL FEATURES

4. Flexible Design Option for Easy Integration

The ExD Series Servo motor is available with the following options:

- Integral holding brakes
- Resolver or encoder based feedback
- Plain or slot and key type shafts
- Cable gland with cable

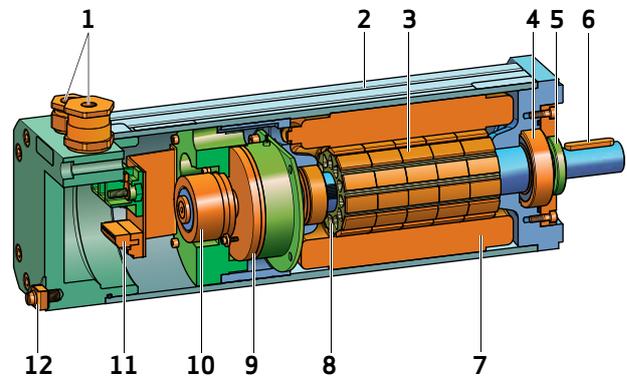
5. Fully Customized Design Supports Unique Application Requirements

The Moog ExD Series Servo Motors can be customized to meet your unique needs.

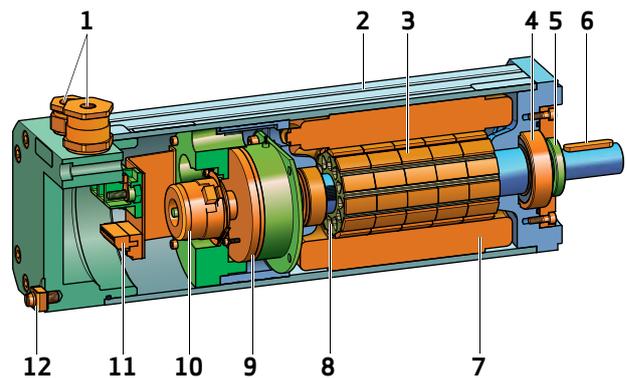
The following are some common requests supported by Moog's application staff:

- Custom motor windings
- Custom shafts and flanges
- Choice of feedback devices

Motor with Resolver



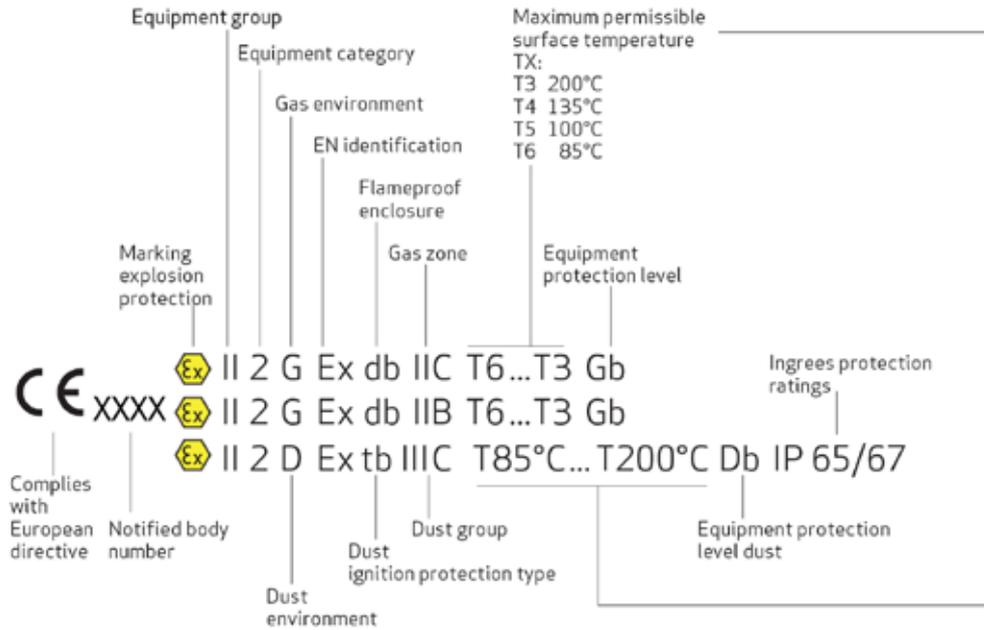
Motor with Encoder



1. Cable gland
2. Proprietary stator design
3. Rare earth magnets
4. Sealed life-time lubricated bearings
5. Radial shaft seal
6. Keyway (optional)
7. Lightweight extruded aluminum housing
8. Fully laminated low-inertia rotor
9. Optional holding brake
10. Highly reliability feedback device
11. Connection strip
12. External ground terminal

TECHNICAL FEATURES

6. Marking



DEMKO 10 ATEX 0915070X; IECEX UL 10.0015X Moog India
 DEMKO 13 ATEX 1333019X; IECEX UL 16.0100X Moog GmbH

Confirming standard Test approval number

NEC Marking (CID1)

Class I Division 1 Groups C and D (Size 5)
 File Number - E516974

NEC Marking (CID2)

Class I, Zone 1, AEx db IIC T6...T3 Gb
 Zone 22 AEx tc IIIC Dc
 File Number - E496329

Equivalent Marking for CID2

Class I Division 2 Groups A, B, C and D T6...T3
 Class II Division 2 Groups F and G

7. Certificate Download

Please visit our Explosion Proof Servo Motor product page on www.moog.com to download the document.

- ATEX Certificate
- IECEX Certificate
- NEC Certificate
- CCC Ex Certificate
- TRCU
- Kosha

GENERAL CHARACTERISTICS

Low Voltage 325 V _{DC}								
Model number ⁴⁾	Maximum torque	Maximum current	Continuous stall torque	Continuous stall current	Maximum speed ³⁾	Winding resistance at 25 °C (77 °F) (phase to phase)	Rotor inertia	Weight (without brake) ⁵⁾
	M _{max} [Nm (lbf in)]	I _{max} [A _{rms}]	M ₀ [Nm (lbf in)]	I ₀ [A _{rms}]	n _{max} [r/min]	R _{tt} [Ohm]	J [kg cm ² (10 ⁻⁴ lbf in s ²)]	m [kg (lb)]
G-3LM2	1.6 (14.2)	4.6	0.52 (4.6)	1.32	10,100	15.523	0.16 (1.4)	2.1 (4.6) / 3.3 (7.27)
G-3LM4	4.9 (43.4)	10.7	1.39 (12.3)	2.68	8,000	4.784	0.39 (3.5)	2.7 (6) / 3.9 (8.59)
G-3LM6	8.2 (72.6)	12.3	2.16 (19.1)	2.85	5,500	5.500	0.62 (5.5)	3.3 (7.3) / 4.5 (9.92)
G-3LM8	13.2 (117)	16.3	3.26 (28.9)	3.53	4,500	4.139	0.97 (8.6)	4.2 (9.3) / 5.4 (11.90)
G-5LM2	12.2 (108)	24.2	5.79 (51.2)	9.4	6,600	0.814	4.6 (40.7)	12.1 (26.7)
G-5LM4	25.8 (228)	33	10.83 (95.9)	10.76	4,100	0.709	8 (70.8)	14.3 (31.5)
G-5LM6	38.2 (338)	38.1	15.7 (139)	12.27	3,300	0.634	11.5 (102)	16.5 (36.4)
G-5LM8	61.2 (542)	43	25.3 (224)	14.52	2,400	0.554	18.4 (163)	21 (46.3)
G-6LM2	40 (354)	72	13 (115)	19.75	6,100	0.234	28.6 (253)	27.8 (61.3)
G-6LM4	80 (708)	107	26 (230)	29.35	4,600	0.14	54.5 (482)	33.3 (73.4)
G-6LM6	120 (1,062)	134	37 (327)	34.63	3,900	0.115	80.3 (711)	39.1 (86.2)
G-6LM8	160 (1,416)	154	48 (425)	39.15	3,300	0.105	106.4 (942)	45 (99.2)
G-6LM9	240 (2,124)	178	70 (620)	42.4	2,600	0.105	157 (1,389)	57.6 (127)

Notes:

- 1) Motor performance as measured with Moog's servo drive of proper size.
- 2) Motor pole count: G-3L is 8, G-5L and G-6L is 12.
- 3) Maximum speed mentioned by considering motor with resolver as feedback device.
- 4) Refer to the section on ordering information - ordering code for servo motor type definition.
- 5) Motor weight with electrical option for G-3LM2 - G-3LM8.

Size	Electrical option	
	00-05 Weight	06-11 Weight
	kg (lbs)	kg (lbs)
G-3LM2	2.1 (4.6)	3.3 (7.27)
G-3LM4	2.7 (6)	3.9 (8.59)
G-3LM6	3.3 (7.3)	4.5 (9.92)
G-3LM8	4.2 (9.3)	5.4 (11.9)

GENERAL CHARACTERISTICS

High Voltage 565 V _{DC}								
Model number ⁴⁾	Maximum torque	Maximum current	Continuous stall torque	Continuous stall current	Maximum speed ³⁾	Winding resistance at 25 °C (77 °F) (phase to phase)	Rotor inertia	Weight (without brake) ⁵⁾
	M _{max} [Nm (lbf in)]	I _{max} [A _{rms}]	M ₀ [Nm (lbf in)]	I ₀ [A _{rms}]	n _{max} [r/min]	R _{tt} [Ohm]	J [kg cm ² (10 ⁻⁴ lbf in s ²)]	m [kg (lb)]
G-3LV2	1.6 (14.2)	3.8	0.52 (4.6)	1.08	14,400	23.507	0.16 (1.4)	2.1 (4.6) / 3.3 (7.27)
G-3LV4	4.9 (43.4)	7.9	1.39 (12.3)	1.94	10,100	9.323	0.39 (3.5)	2.7 (6) / 3.9 (8.59)
G-3LV6	8.2 (72.6)	8	2.16 (19.1)	1.81	6,100	12.87	0.62 (5.5)	3.3 (7.3) / 4.5 (9.92)
G-3LV8	13.2 (117)	12	3.26 (28.9)	2.56	5,700	8.085	0.97 (8.6)	4.2 (9.3) / 5.4 (11.90)
G-5LV2	12.2 (108)	13.6	5.79 (51.2)	5.16	6,300	2.744	4.6 (40.7)	12.1 (26.7)
G-5LV4	25.8 (228)	23	10.83 (95.9)	7.4	4,900	1.549	8 (70.8)	14.3 (31.5)
G-5LV6	38.2 (338)	35.5	15.7 (139)	11.35	5,200	0.756	11.5 (102)	16.5 (36.4)
G-5LV8	61.2 (542)	44	25.3 (224)	14.52	4,200	0.586	18.4 (163)	21 (46.3)
G-6LV2	40 (354)	48	12.85 (114)	13.21	7,100	0.513	28.6 (253)	27.8 (61.3)
G-6LV4	80 (708)	77.2	24.95 (221)	20.65	5,800	0.283	54.5 (482)	33.3 (73.4)
G-6LV6	120 (1,062)	88.2	36.24 (321)	22.84	4,500	0.263	80.3 (711)	39.1 (86.2)
G-6LV8	160 (1,416)	88.2	47.3 (419)	22.35	3,300	0.105	106.4 (942)	45 (99.2)
G-6LV9	240 (2,124)	124	66.68 (590)	29.36	3,100	0.219	157 (1,389)	57.6 (127)

Notes:

- 1) Motor performance as measured with Moog’s servo drive of proper size.
- 2) Motor pole count: G-3L is 8, G-5L and G-6L is 12.
- 3) Maximum speed mentioned by considering motor with resolver as feedback device.
- 4) Refer to the section on ordering information - ordering code for servo motor type definition.
- 5) Motor weight with electrical option for G-3LV2 - G-3LV8.

Size	Electrical option	
	00-05 Weight	06-11 Weight
	kg (lbs)	kg (lbs)
G-3LV2	2.1 (4.6)	3.3 (7.27)
G-3LV4	2.7 (6)	3.9 (8.59)
G-3LV6	3.3 (7.3)	4.5 (9.92)
G-3LV8	4.2 (9.3)	5.4 (11.9)

HOLDING BRAKE CHARACTERISTICS

Model number ⁴⁾	Optional holding brake	Holding torque	Extra weight	Extra inertia	Power requirement	Voltage requirement
		[Nm (lbf in)]	[kg (lb)]	[kg cm ² (10 ⁻⁴ lbf in s ²)]	[W]	[V _{DC}]
G-3L	Low torque	2.0 (17.7)	0.2 (0.4)	0.07 (0.62)	11	24
	High torque	4.5 (39.8)	0.3 (0.7)	0.18 (1.6)	12	24
G-5L	Low torque	14 (124)	2.3 (5.1)	1.0 (8.9)	15.6	24
	High torque	22 (195)	3 (6.6)	3.6 (31.9)	17	24
G-6L	Low torque	22 (195)	3 (6.6)	3.3 (29.2)	17	24
	High torque	72 (637)	7.3 (16.1)	15.7 (139)	40	24

TEMPERATURE CHARACTERISTICS

Characteristics Based on Temperature Class T3/T4

T3/T4: 40°C (104°F) ambient temperature ¹⁾				
Model number	Continuous stall torque	Rated torque	Rated speed	Rated power
	M_0	M_N	n_N	P_N
	[Nm (lbf in)]	[Nm (lbf in)]	[r/min]	[kW (hp)]
G-3LX2	0.52 (4.6)	0.44 (3.9)	7,800	0.359 (0.5)
G-3LX4	1.39 (12.3)	1.08 (9.6)	6,300	0.713 (1)
G-3LX6	2.16 (19.1)	1.81 (16)	4,600	0.872 (1.2)
G-3LX8	3.26 (28.9)	2.8 (24.8)	3,800	1.114 (1.5)
G-5LX2	5.79 (51.2)	4.32 (38.2)	4,800	2.171 (2.9)
G-5LX4	10.83 (95.9)	8.14 (72)	3,500	2.983 (4)
G-5LX6	15.7 (139)	12.35 (109)	2,700	3.492 (4.7)
G-5LX8	25.3 (224)	20.95 (185)	2,000	4.388 (5.9)
G-6LX2	13 (115)	8 (70.8)	4,000	3.351 (4.5)
G-6LX4	26 (230)	16.5 (146)	3,000	5.184 (6.9)
G-6LX6	37 (327)	24.5 (217)	2,500	6.414 (8.6)
G-6LX8	48 (425)	28.5 (252)	2,200	6.566 (8.8)
G-6LX9	70 (620)	40 (354)	2,000	8.378 (11.2)

T3/T4: 60°C (104°F) ambient temperature ¹⁾				
Model number	Continuous stall torque	Rated torque	Rated speed	Rated power
	M_0	M_N	n_N	P_N
	[Nm (lbf in)]	[Nm (lbf in)]	[r/min]	[kW (hp)]
G-3LX2	0.46 (4.1)	0.37 (3.3)	7,800	0.302 (0.4)
G-3LX4	1.22 (10.8)	0.88 (7.8)	6,300	0.581 (0.8)
G-3LX6	1.91 (16.9)	1.51 (13.4)	4,600	0.727 (1)
G-3LX8	2.88 (25.5)	2.36 (20.9)	3,800	0.939 (1.3)
G-5LX2	5.15 (45.6)	3.47 (30.7)	4,800	1.744 (2.3)
G-5LX4	9.64 (85.3)	6.56 (58.1)	3,500	2.404 (3.2)
G-5LX6	13.98 (124)	10.21 (90.4)	2,700	2.887 (3.9)
G-5LX8	22.6 (200)	17.58 (156)	2,000	3.682 (4.9)
G-6LX2	12 (106)	6 (53.1)	4,000	2.513 (3.4)
G-6LX4	23 (204)	11.5 (102)	3,000	3.613 (4.8)
G-6LX6	33 (292)	17.6 (156)	2,500	4.608 (6.2)
G-6LX8	44 (389)	24 (212)	2,200	5.529 (7.4)
G-6LX9	64 (566)	39 (345)	1,800	7.351 (9.9)

Notes:

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

TEMPERATURE CHARACTERISTICS

T3/T4: 80°C (176°F) ambient temperature ¹⁾				
Model number	Continuous stall torque	Rated torque	Rated speed	Rated power
	M_0	M_N	n_N	P_N
	[Nm (lbf in)]	[Nm (lbf in)]	[r/min]	[kW (hp)]
G-3LX2	0.34 (3)	0.21 (1.9)	7,800	0.172 (0.2)
G-3LX4	0.91 (8.1)	0.34 (3)	6,300	0.224 (0.3)
G-3LX6	1.41 (12.5)	0.83 (7.3)	4,600	0.400 (0.5)
G-3LX8	2.14 (18.9)	1.38 (12.2)	3,800	0.549 (0.7)
G-5LX2	4.3 (38.1)	2.06 (18.2)	4,800	1.035 (1.4)
G-5LX4	8.05 (71.2)	3.88 (34.3)	3,500	1.422 (1.9)
G-5LX6	11.67 (103)	6.73 (59.6)	2,700	1.903 (2.6)
G-5LX8	18.87 (167)	12.43 (110)	2,000	2.603 (3.5)
G-6LX2	10 (88.5)	6.5 (57.5)	2,800	1.906 (2.6)
G-6LX4	19 (168)	12 (106)	2,100	2.639 (3.5)
G-6LX6	28 (248)	17 (150)	1,800	3.204 (4.3)
G-6LX8	36 (319)	23 (204)	1,600	3.854 (5.2)
G-6LX9	53 (469)	32 (283)	1,500	5.027 (6.7)

T3/T4: 100°C (212°F) ambient temperature ¹⁾				
Model number	Continuous stall torque	Rated torque	Rated speed	Rated power
	M_0	M_N	n_N	P_N
	[Nm (lbf in)]	[Nm (lbf in)]	[r/min]	[kW (hp)]
G-5LX2	3.96 (35)	2.4 (21.2)	4,000	1.005 (1.3)
G-5LX4	7.55 (66.8)	4.94 (43.7)	2,700	1.397 (1.9)
G-5LX6	11.06 (97.9)	7.08 (62.7)	2,300	1.705 (2.3)
G-5LX8	17.71 (157)	11.87 (105)	1,800	2.237 (3)
G-6LX2	8 (70.8)	4 (35.4)	2,000	0.838 (1.1)
G-6LX4	14 (124)	8.6 (76.1)	1,400	1.261 (1.7)
G-6LX6	21 (186)	13 (115)	1,100	1.497 (2)
G-6LX8	27 (239)	17 (150)	1,000	1.780 (2.4)
G-6LX9	40 (354)	24 (212)	1,250	3.142 (4.2)

Notes:

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

TEMPERATURE CHARACTERISTICS

T3/T4: 120°C (248°F) ambient temperature¹⁾²⁾				
Model number	Continuous stall torque	Rated torque	Rated speed	Rated power
	M_0	M_N	n_N	P_N
	[Nm (lbf in)]	[Nm (lbf in)]	[r/min]	[kW (hp)]
G-5LX2	3.12 (27.6)	2.04 (18.1)	2,700	0.577 (0.8)
G-5LX4	5.88 (52)	3.72 (32.9)	2,000	0.779 (1)
G-5LX6	8.66 (76.6)	5.29 (46.8)	1,700	0.942 (1.3)
G-5LX8	13.94 (123.4)	8.32 (73.6)	1,400	1.220 (1.6)

Notes:

- 1) X is a placeholder for M or V, for example, X2 is placeholder for M2 or V2.
- 2) For characteristic details of other ambient temperatures contact Moog application engineer.

TEMPERATURE CHARACTERISTICS

Characteristics Based on Temperature Class T5

T5: +40°C (104°F) ambient temperature				
Model number	Continuous stall torque	Rated torque	Rated speed	Rated power
	M_0	M_N	n_N	P_N
	[Nm (lbf in)]	[Nm (lbf in)]	[r/min]	[kW (hp)]
G-3LX2	0.43 (3.8)	0.33 (2.9)	7,800	0.270 (0.4)
G-3LX4	1.17 (10.4)	0.75 (6.6)	6,300	0.495 (0.7)
G-3LX6	1.81 (16)	1.34 (11.9)	4,600	0.645 (0.9)
G-3LX8	2.74 (24.3)	2.12 (18.8)	3,800	0.844 (1.1)
G-5LX2	5.09 (45.1)	3.14 (27.8)	4,800	1.578 (2.1)
G-5LX4	9.53 (84.3)	5.92 (52.4)	3,500	2.170 (2.9)
G-5LX6	13.82 (122)	9.46 (83.7)	2,700	2.675 (3.6)
G-5LX8	22.35 (198)	16.5 (146)	2,000	3.456 (4.6)
G-6LX2	10 (88.5)	7 (62)	2,700	1.979 (2.7)
G-6LX4	20 (177)	12 (106)	2,000	2.513 (3.4)
G-6LX6	29 (257)	17.5 (155)	1,700	3.115 (4.2)
G-6LX8	38 (336)	23.5 (208)	1,500	3.691 (4.9)
G-6LX9	55 (487)	35 (310)	1,300	4.765 (6.4)

Characteristics Based on Temperature Class T6

T6: +40°C (104°F) ambient temperature				
Model number	Continuous stall torque	Rated torque	Rated speed	Rated power
	M_0	M_N	n_N	P_N
	[Nm (lbf in)]	[Nm (lbf in)]	[r/min]	[kW (hp)]
G-3LX2	0.32 (2.8)	0.14 (1.2)	7,800	0.114 (0.2)
G-3LX4	0.85 (7.5)	0.59 (5.2)	4,000	0.247 (0.3)
G-3LX6	1.32 (11.7)	0.44 (3.9)	4,600	0.212 (0.3)
G-3LX8	1.99 (17.6)	0.91 (8.1)	3,800	0.362 (0.5)
G-5LX2	4.03 (35.7)	1.46 (12.9)	4,200	0.642 (0.9)
G-5LX4	7.54 (66.7)	2.51 (22.2)	3,100	0.815 (1.1)
G-5LX6	10.93 (96.7)	4.42 (39.1)	2,500	1.157 (1.6)
G-5LX8	17.68 (156)	7.83 (69.3)	2,000	1.640 (2.2)
G-6LX2	9 (79.7)	6 (53.1)	2,100	1.319 (1.8)
G-6LX4	17 (150)	10.8 (95.6)	1,500	1.696 (2.3)
G-6LX6	25 (221)	13.8 (122)	1,400	2.023 (2.7)
G-6LX8	38 (336)	19 (168)	1,200	2.388 (3.2)
G-6LX9	47 (416)	27 (239)	1,100	3.110 (4.2)

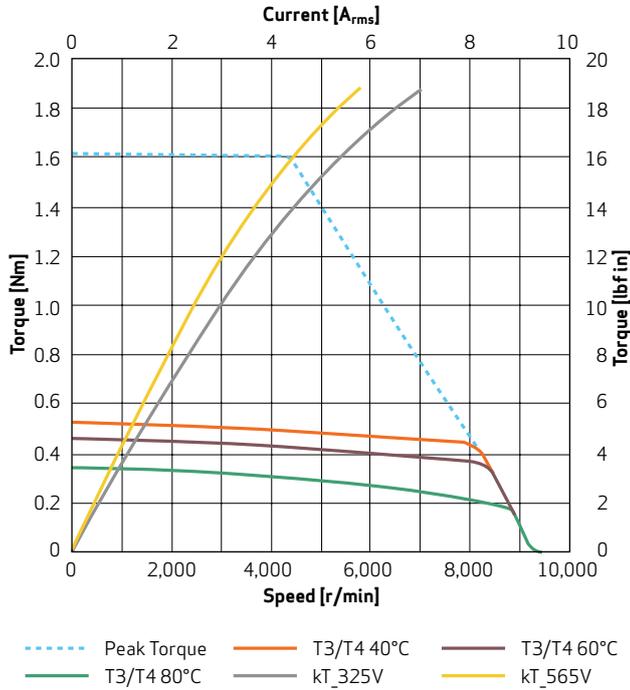
Notes:

- 1) X is a placeholder for M or V, for example, X2 is placeholder for M2 or V2.
- 2) For characteristic details of other ambient temperatures contact Moog application engineer.

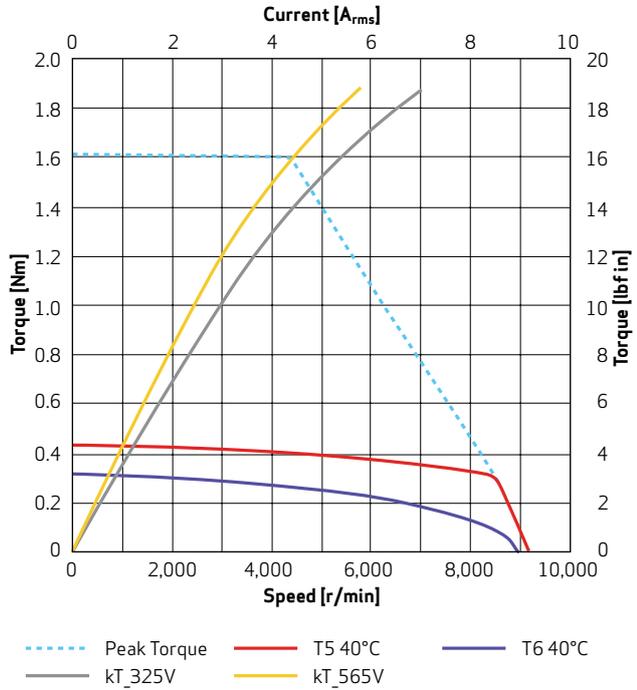
SIZE 3

Motor Characteristics

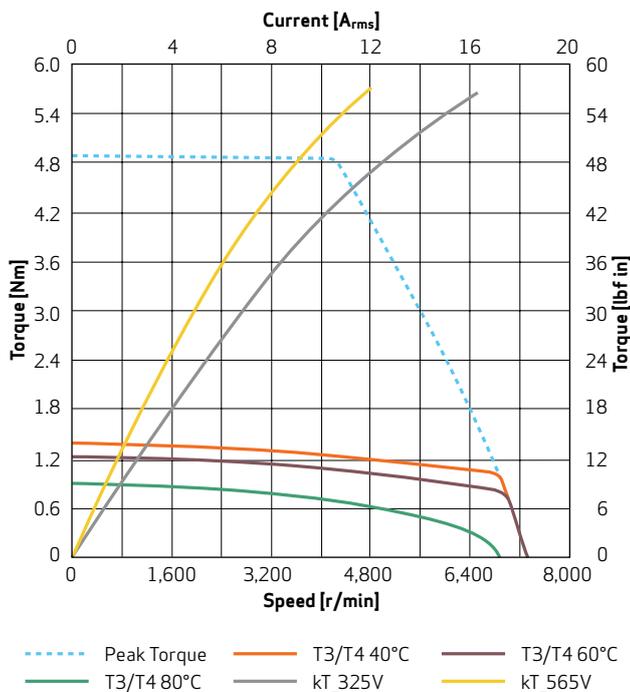
G-3LX2 T3/T4



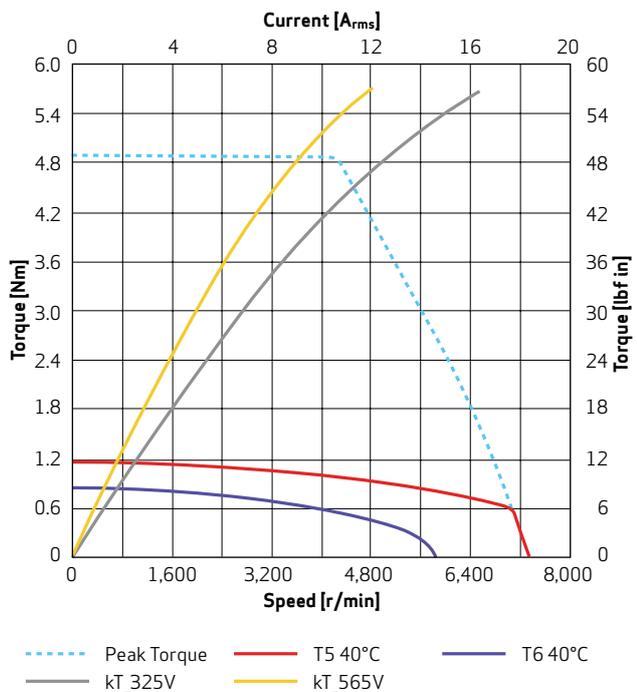
G-3LX2 T5/T6



G-3LX4 T3/T4



G-3LX4 T5/T6

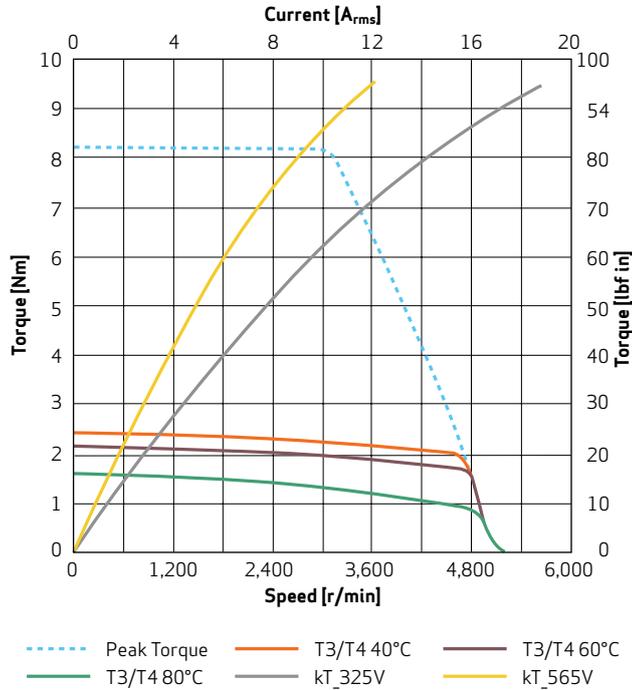


Notes:

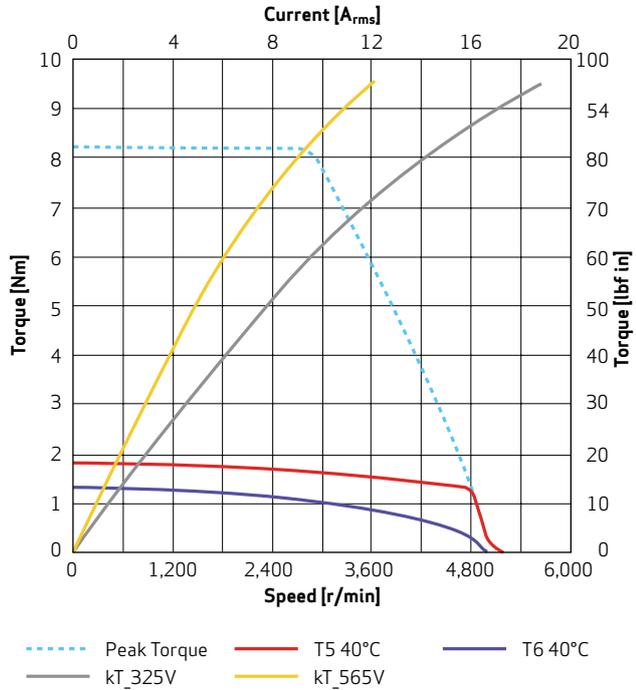
1) Motor performance as measured with Moog's servo drive of proper size.

SIZE 3 Motor Characteristics

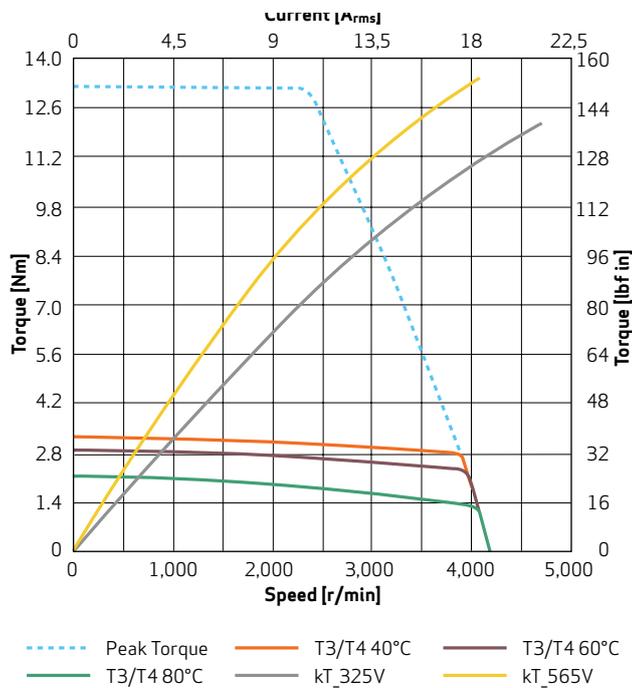
G-3LX6 T3/T4



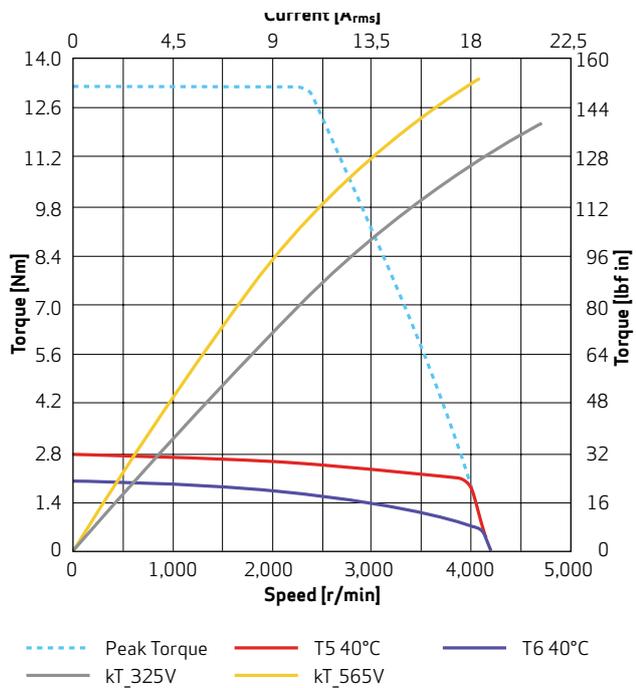
G-3LX6 T5/T6



G-3LX8 T3/T4



G-3LX8 T5/T6



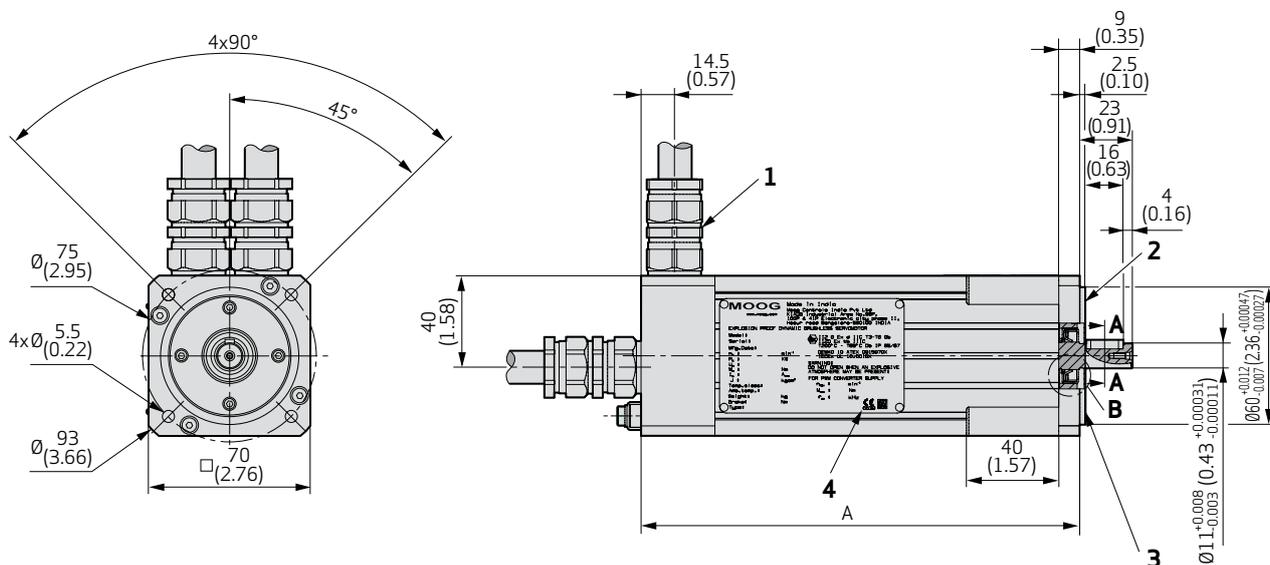
Notes:

1) X is a placeholder for M or V, for example, X2 is placeholder for M6 or V6.

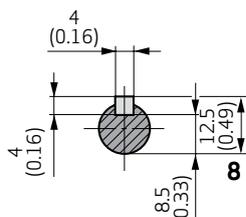
SIZE 3

Dimensions

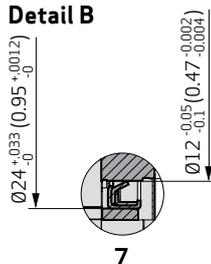
(For electrical options 00-05 refer ordering code)



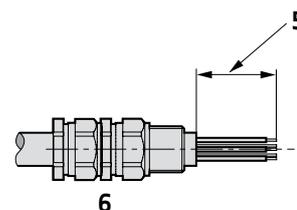
Section A-A



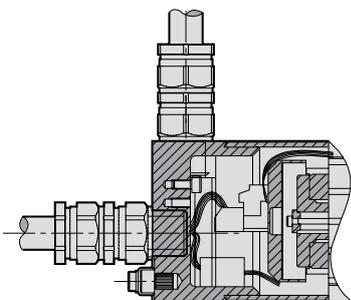
Detail B



Cable Gland



Sectional view for connection cable



1. Alternative cable outlet
2. Run out class as per IEC/DIN Normal class
3. Flange
4. Name plate
5. Stripping length to be determined
6. Cable gland entry M20x1.5
7. Shaft seal
8. Optional shaft key

Model number	Dimension "A" resolver with brake	Dimension "A" encoder without brake	Dimension "A" resolver without brake
	mm (in)	mm (in)	mm (in)
G-3LX2	190 (7.5)	190 (7.5)	164 (6.5)
G-3LX4	216 (8.5)	216 (8.5)	190 (7.5)
G-3LX6	241 (9.5)	241 (9.5)	215 (8.5)
G-3LX8	279 (11)	279 (11)	253 (10)

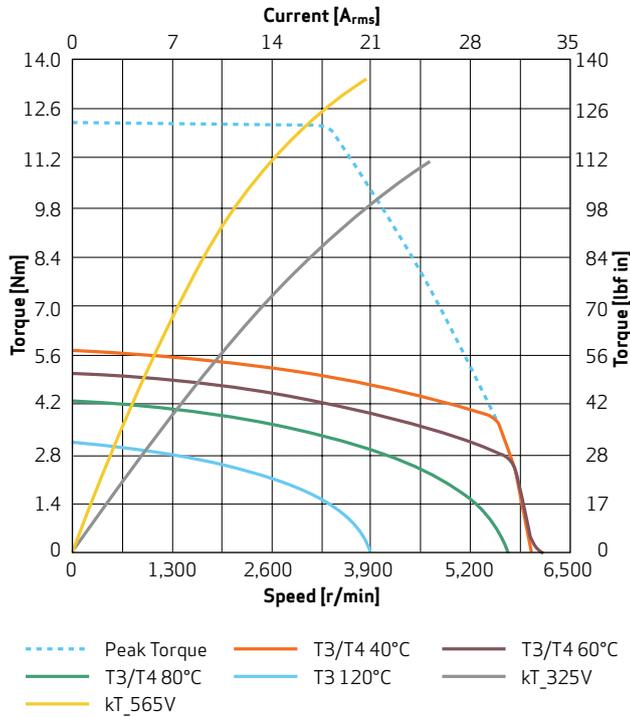
Notes:

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

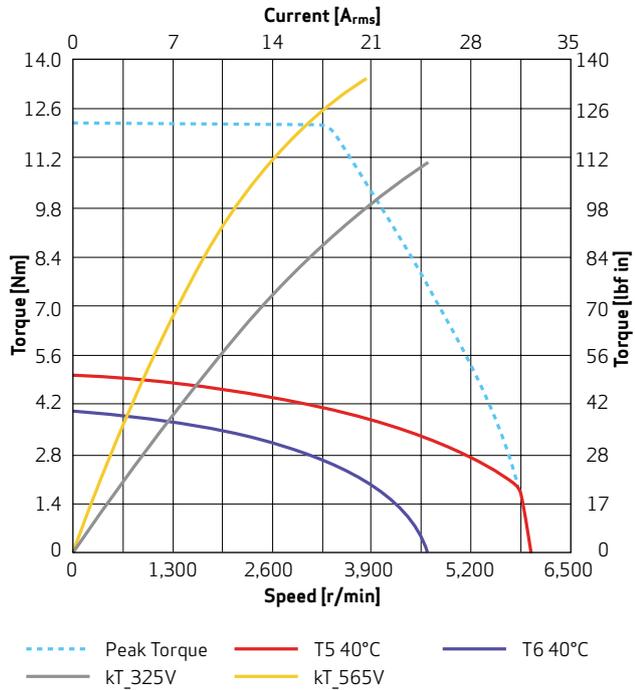
SIZE 5

Motor Characteristics

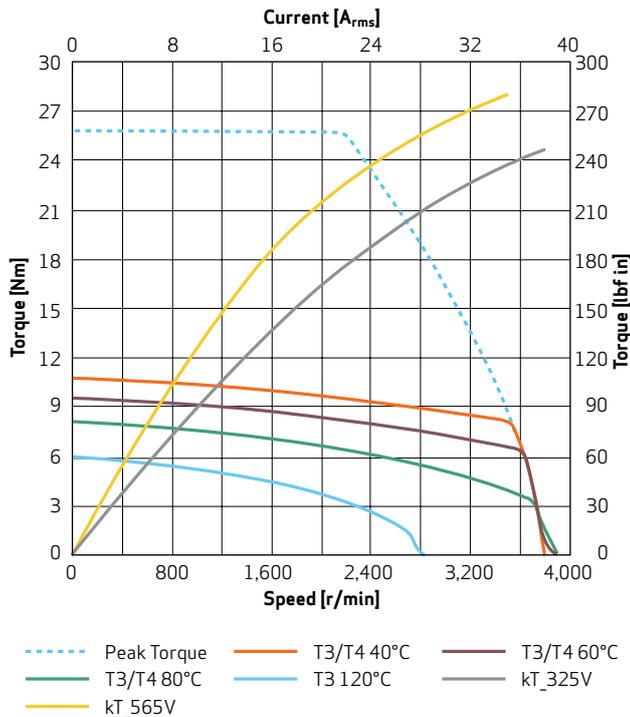
G-5LX2 T3/T4



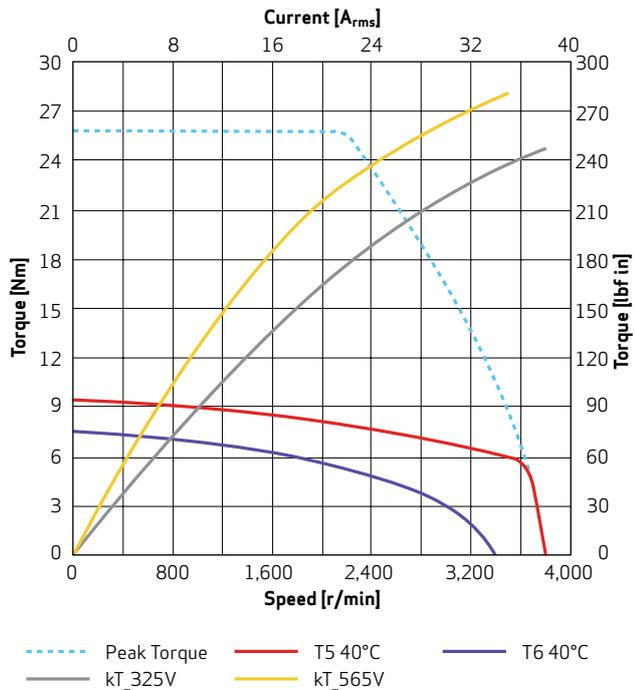
G-5LX2 T5/T6



G-5LX4 T3/T4



G-5LX4 T5/T6



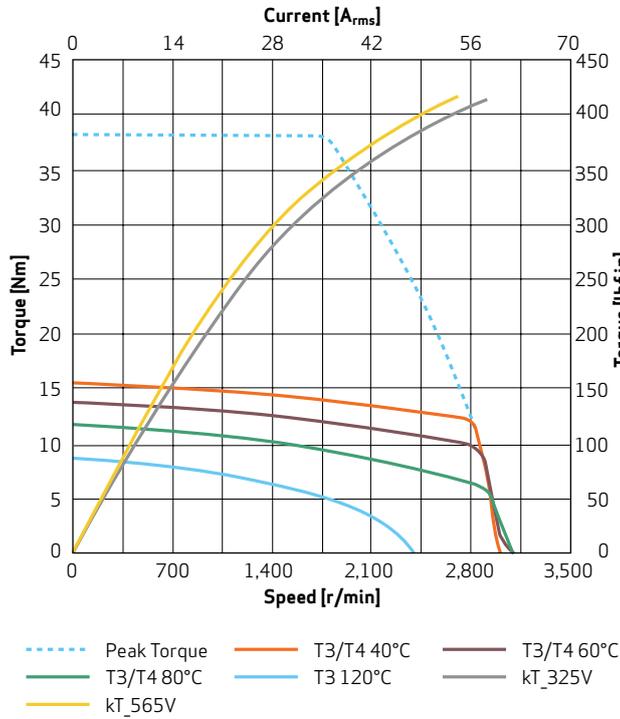
Notes:

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

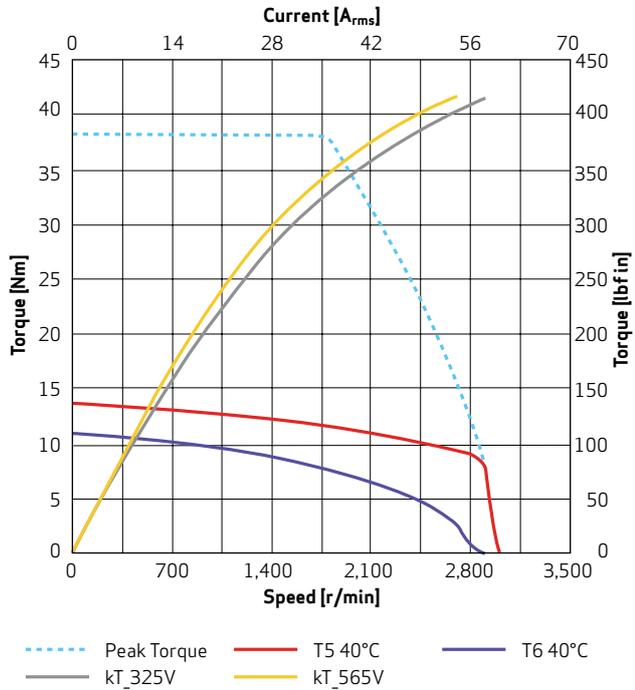
SIZE 5

Motor Characteristics

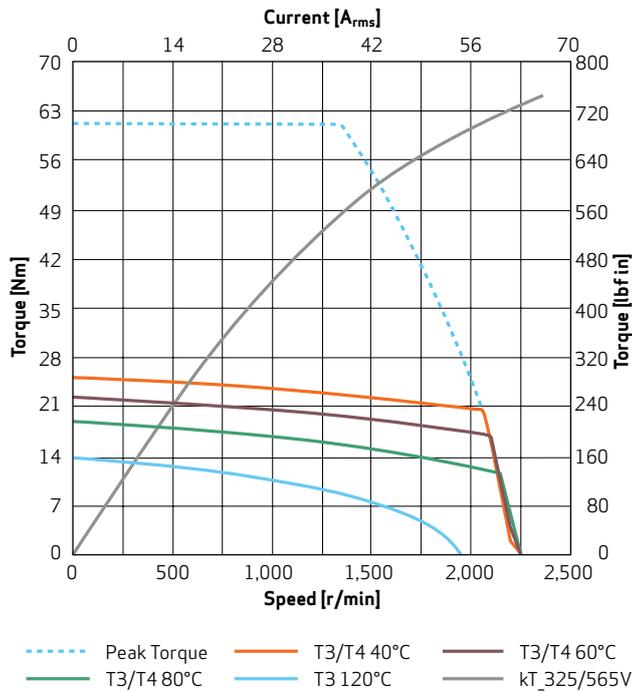
G-5LX6 T3/T4



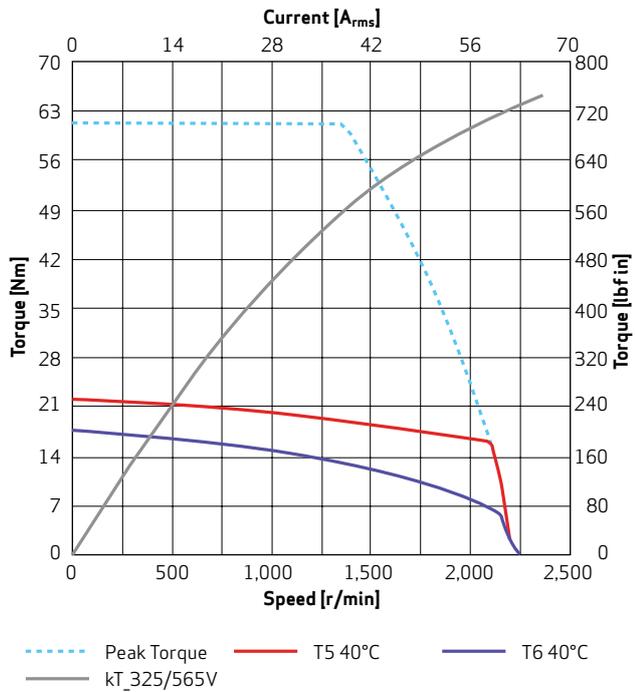
G-5LX6 T5/T6



G-5LX8 T3/T4



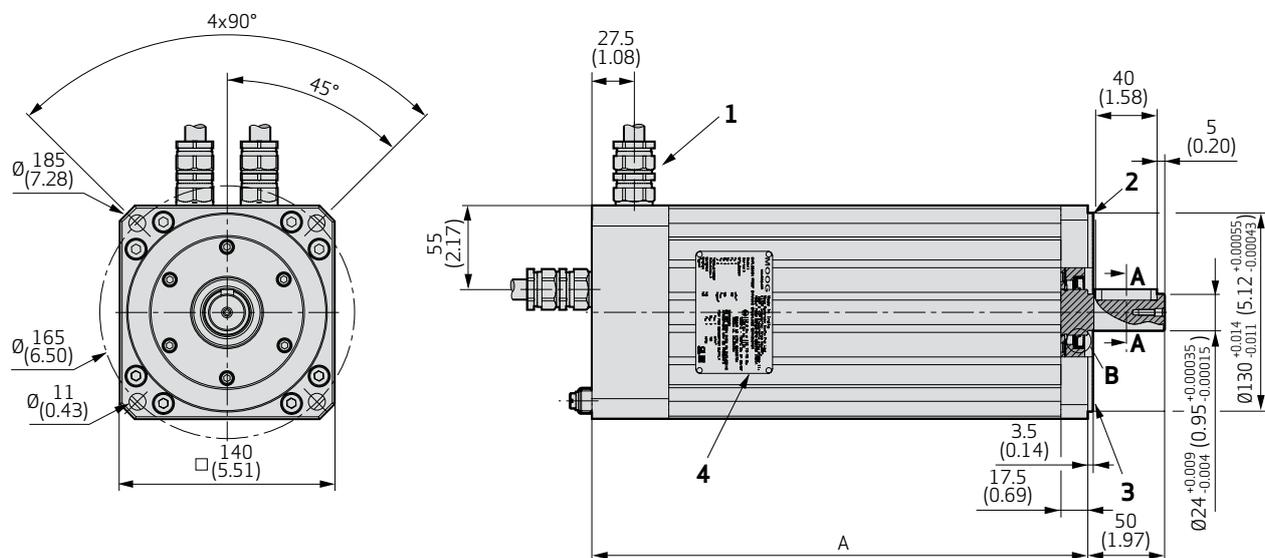
G-5LX8 T5/T6



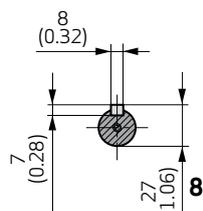
Notes:

1) X is a placeholder for M or V, for example, X2 is placeholder for M6 or V6.

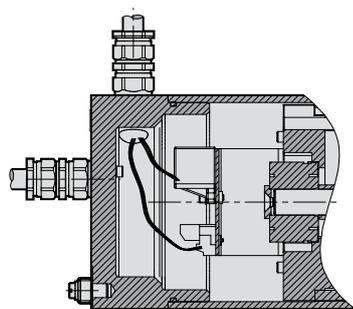
SIZE 5 Dimensions



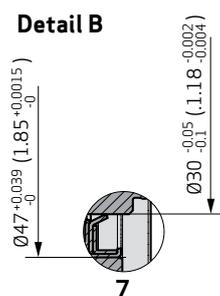
SECTION A-A



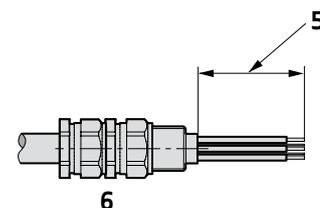
Sectional view for connection cable



Detail B



Cable Gland



1. Alternative cable outlet
2. Run out class as per IEC/DIN Normal class
3. Flange
4. Name plate
5. Stripping length to be determined
6. Cable gland entry
 - a) M20x1.5 for ATEX and IECEx (optional M25x1.5)
 - b) 1/2-14 NPT and 3/4-14 NPT thread for ATEX, IECEx and CLASS I DIVISION 1
7. Shaft seal
8. Optional shaft key

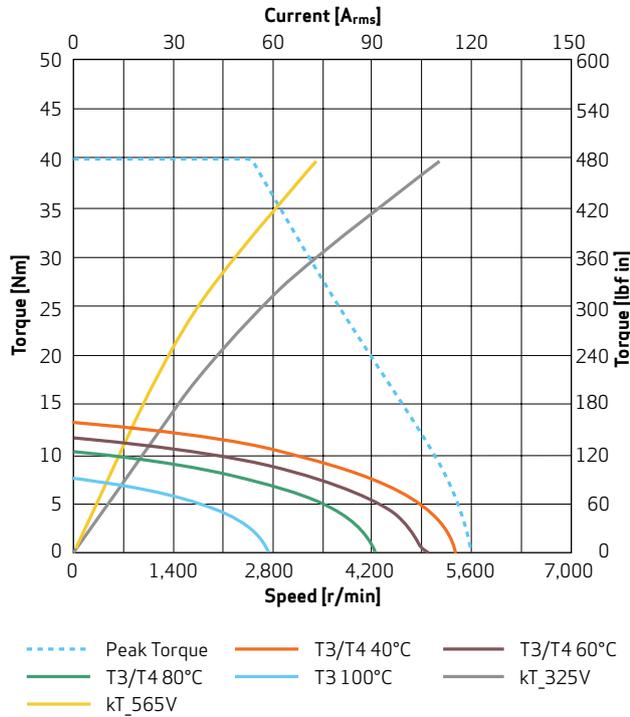
Model number	Dimension "A" resolver without brake encoder without brake	Dimension "A" resolver with brake encoder with brake
	mm (in)	mm (in)
G-5LX2	265 (10.4)	323 (12.7)
G-5LX4	290 (11.4)	348 (13.7)
G-5LX6	315 (12.4)	373 (14.7)
G-5LX8	366 (14.4)	424 (16.7)

Notes:

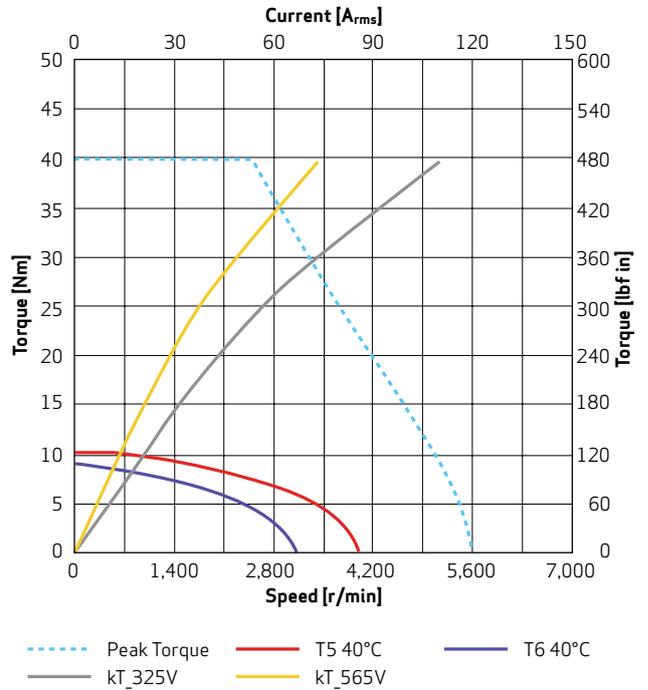
1) X is a placeholder for M or V, for example, X2 is placeholder for M2 or V2.

SIZE 6 Motor Characteristics

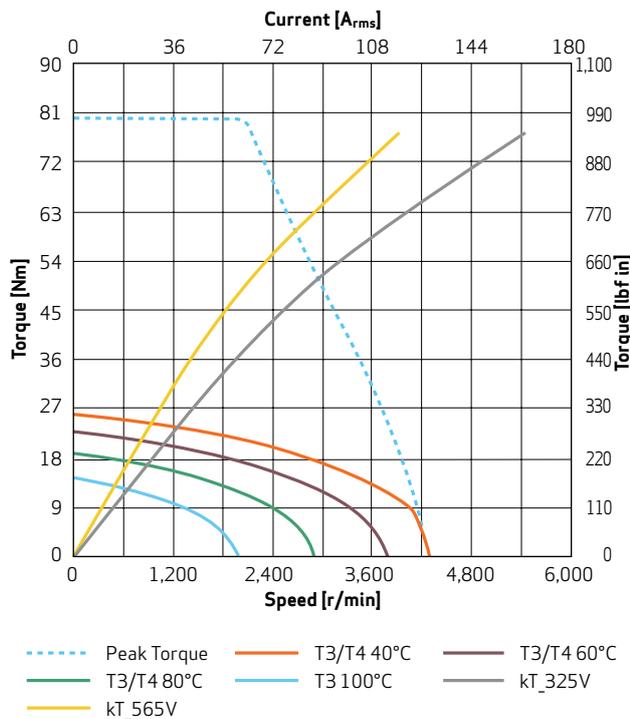
G-6LX2 T3/T4



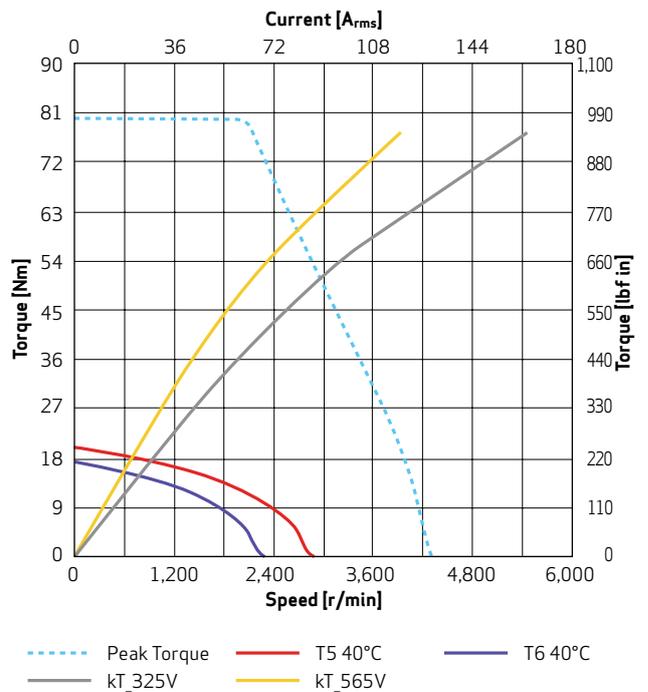
G-6LX2 T5/T6



G-6LX4 T3/T4



G-6LX4 T5/T6

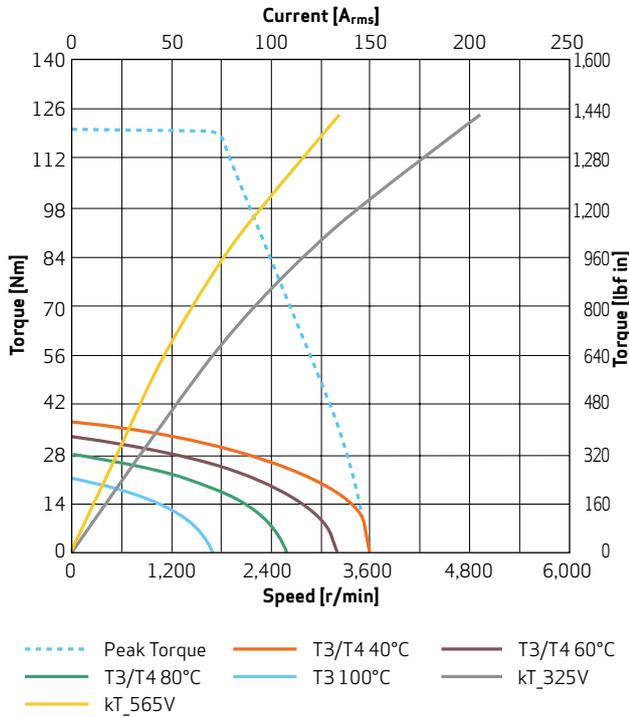


Notes:

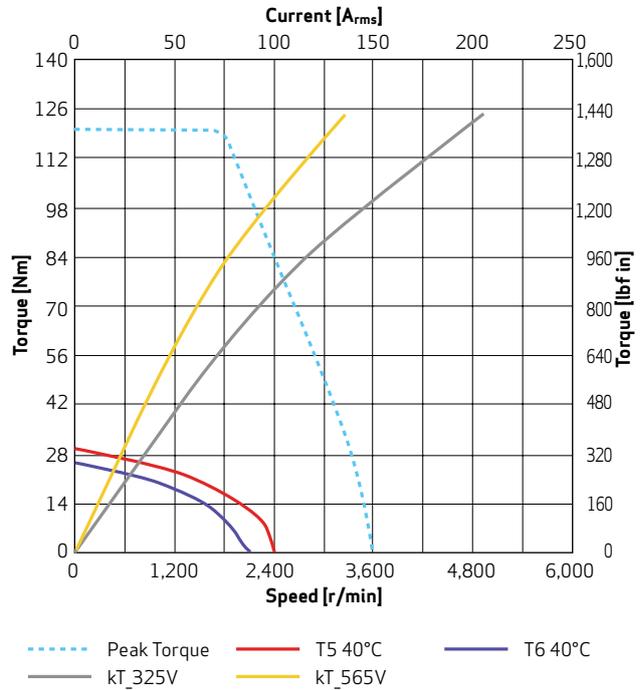
1) X is a placeholder for M or V, for example, X2 is placeholder for M2 or V2.

SIZE 6 Motor Characteristics

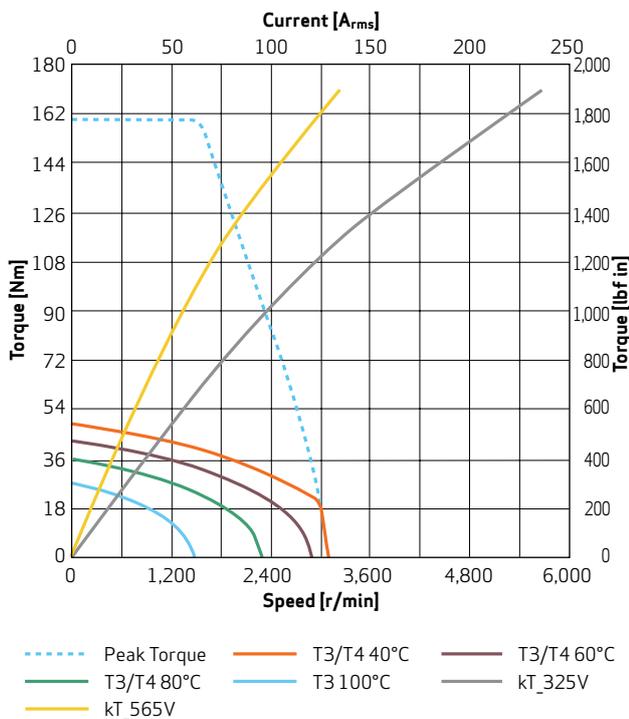
G-6LX6 T3/T4



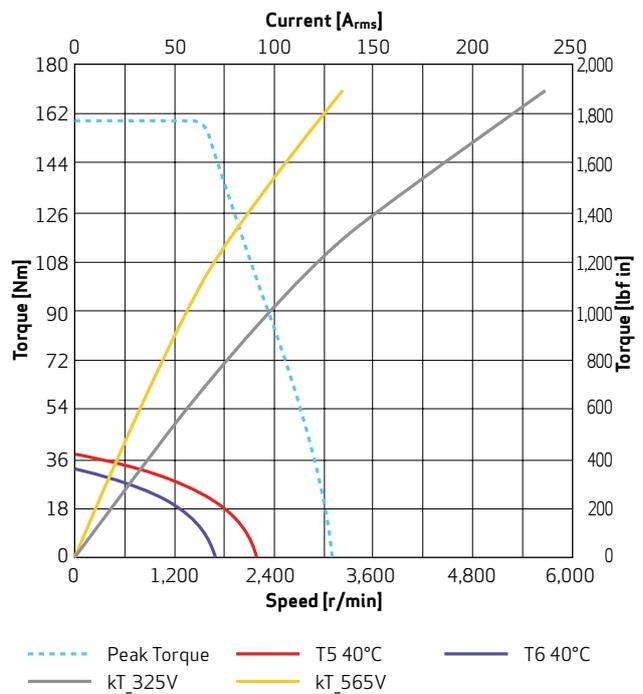
G-6LX6 T5/T6



G-6LX8 T3/T4



G-6LX8 T5/T6

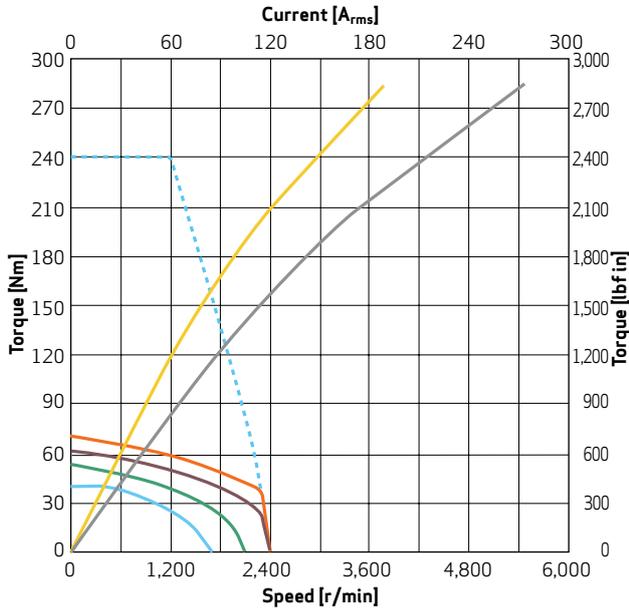


Notes:

1) X is a placeholder for M or V, for example, X2 is placeholder for M6 or V6.

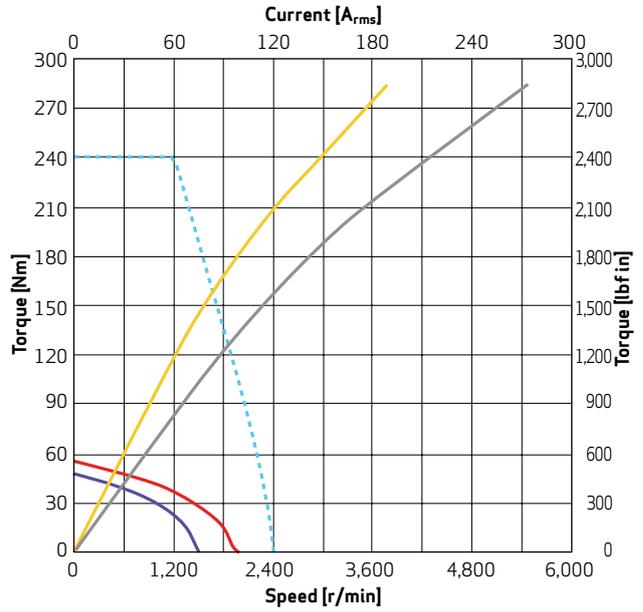
SIZE 6 Motor Characteristics

G-6LX9 T3/T4



- Peak Torque
- T3/T4 40°C
- T3/T4 60°C
- T3/T4 80°C
- T3 100°C
- kt_325V
- kt_565V

G-6LX9 T5/T6

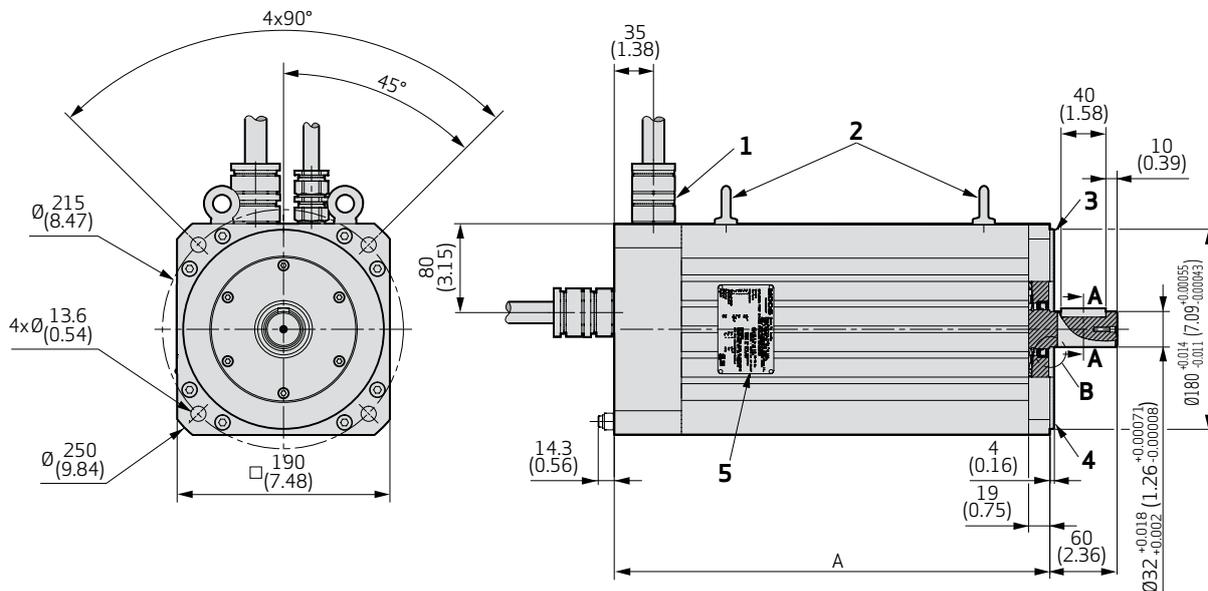


- Peak Torque
- T5 40°C
- T6 40°C
- kt_325V
- kt_565V

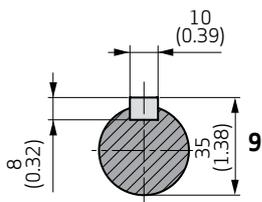
Notes:

1) X is a placeholder for M or V, for example, X2 is placeholder for M9 or V9.

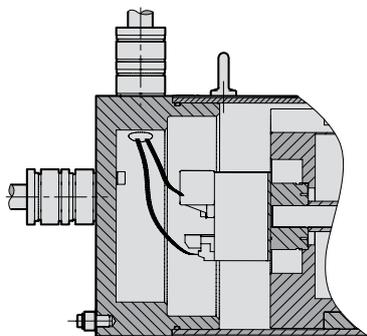
SIZE 6 Dimensions



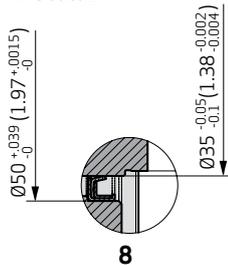
Section A-A



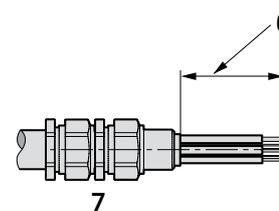
Sectional view for connection cable



Detail B



Cable Gland



1. Alternative cable outlet
2. Lifting eye bolts
3. Run out class as per IEC/DIN Normal class
4. Flange
5. Name plate
5. Stripping length to be determined
6. Cable gland entry M32x1.5 (power) and M20x1.5 (signal)
7. Shaft seal
8. Optional shaft key

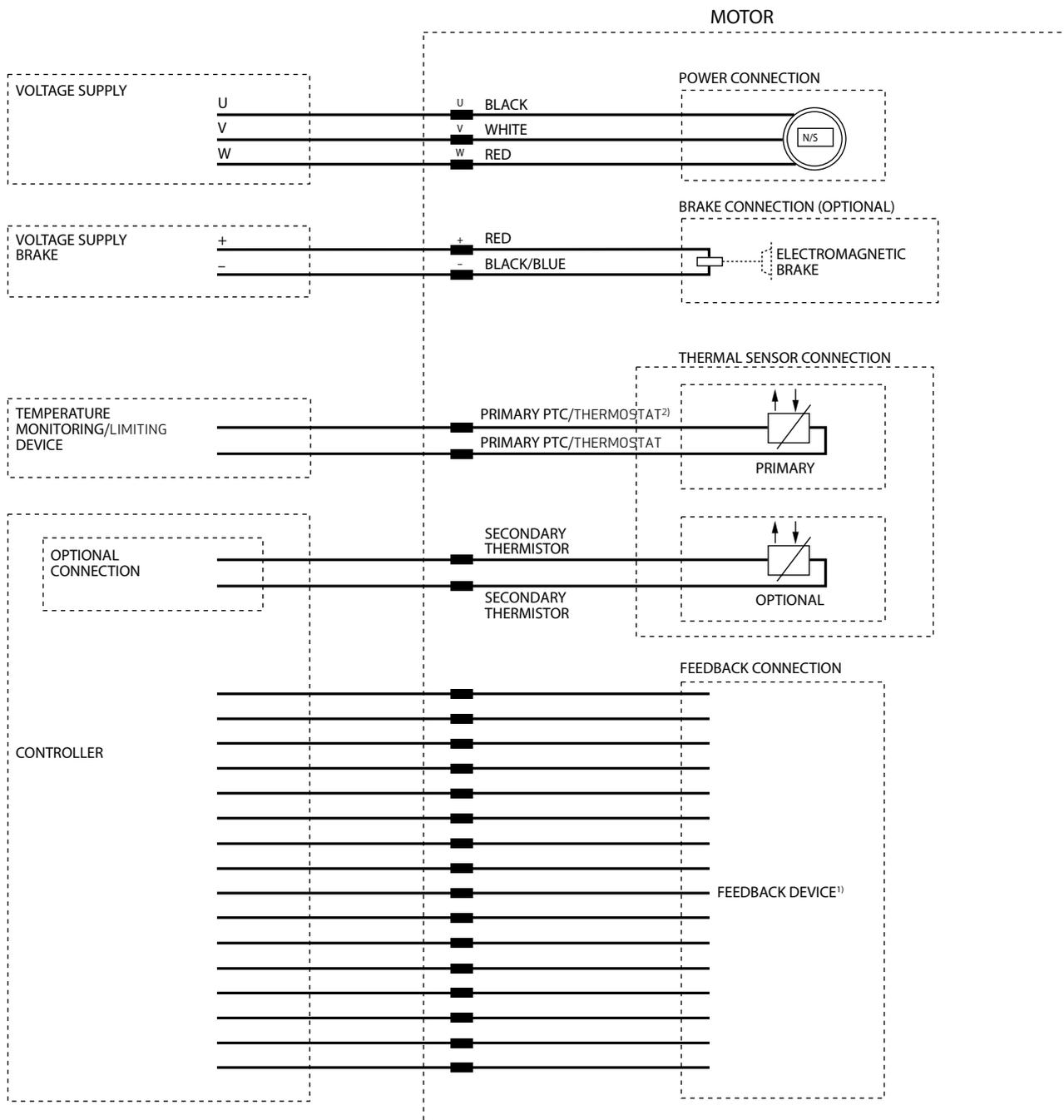
Model number	Dimension "A"	Dimension "A"
	resolver without brake encoder without brake	resolver with brake encoder with brake
	mm (in)	mm (in)
G-6LX2	331 (13)	389 (15.3)
G-6LX4	369 (14.5)	427 (16.8)
G-6LX6	407 (16)	465 (18.3)
G-6LX8	446 (17.6)	504 (19.8)
G-6LX6	522 (20.6)	580 (22.8)

Notes:

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

WIRING DIAGRAM

ATEX, IECEX, CIDI, CCC EX, KOSHA AND TRCU



Notes:

- 1) For feedback device connection details contact Moog representative.
- 2) For ATEX, IECEX, CCC Ex, Kosha and TRCU PTC will be primary sensor. For C1D1 thermostat will be primary temperature limiting device.

BEARING LOAD DIAGRAMS

Maximum Permissible Shaft Load

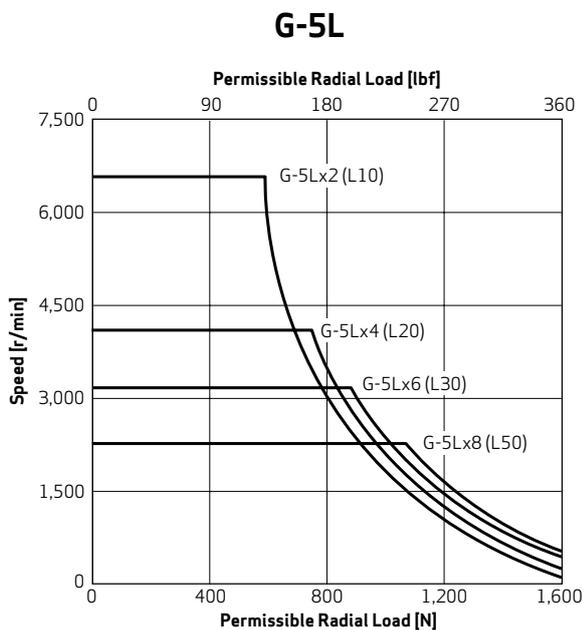
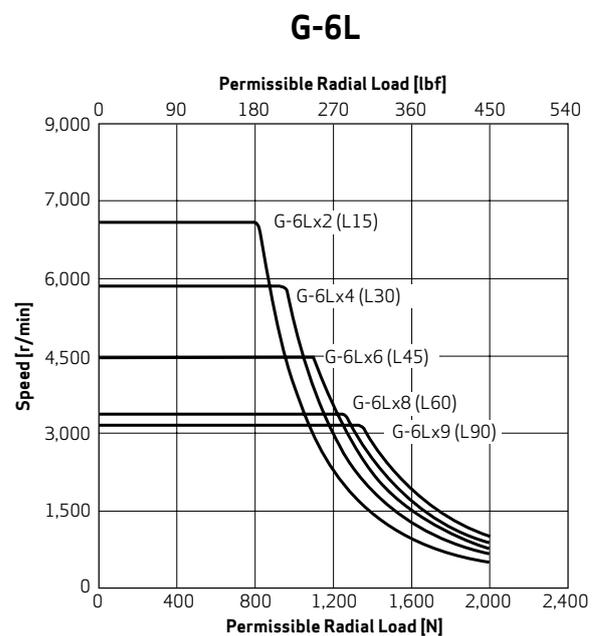
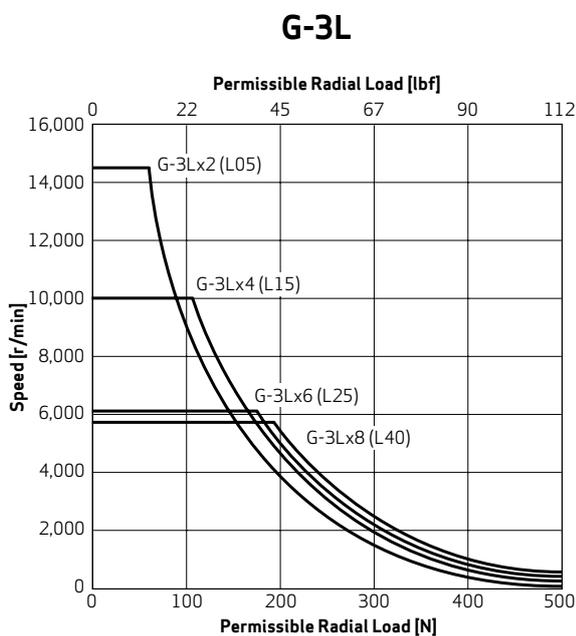
The maximum permissible radial load depends on desired service life.

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-3L	75 (17)	150 (34)
G-5L	200 (45)	400 (90)
G-6L	250 (56)	500 (112)



DEFINING THE HAZARDOUS LOCATION

It's important to define the hazardous location before the selection of the motor. IEC 60079-11 defines the methodology for classifying hazardous location. The classification could be in terms of the following points:

- Zone of operation
- Type of gas present
- Type of dust present
- Temperature rating of the motor
- Type of connection required (cable gland with cable length required)
- Type of ingress protection required.
- Based on the hazardous location classification, certification of motor is defined. The Moog ExD Servo Motor Series have been certified by UL for ATEX and IECEx certification wherein the certification code defines the application to be IIB and II C for gases and III C for dust protection, with permissible maximum surface temperature range from +85 to +200 °C (+185 to +392 °F) based on ignition temperature class.

In addition safety options provided to comply with hazardous environment certifications, explosion proof motors are equipped with a primary set of thermistor which is a PTC/thermostat thermal sensor. This PTC/thermostat thermal sensor must be connected to a temperature monitoring device which in turn should trip the motor when a motor cross the maximum allowable temperature. For selection of temperature monitoring device contact our local application engineer.

Once the hazardous location and the certification requirement of the motor have been defined, the sizing of the motor can be done.

Validation may be necessary to ensure the correct thermal and electric sizing of the motor. Contact our local application engineer for additional information and support.

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 engineer.

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 motor dynamic the system must be, the more important it is to configure these two characteristics with the 1:1 ratio. Higher inertia ratio may not tolerate any significant load change and even become unstable.
 - The continuous stall torque is the torque rating at the 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 drive used.
 - Maximum torque is declared for maximum capacity for a duration of 1 s. 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 some parameters (e.g. mechanical electrical, 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 decreasing in the downwards direction). The regeneration capacity must not be overloaded.
- A brushless servo motor has a very short response time and closely track changes in the control signals.
- 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 system parameters

- Transmission ratio
- Mechanical transmission
- Position transducer
- Electric drive types
- 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 (optional position/following accuracy in the minimum time) is achieved.

Mechanical Transmission Considerations

The following are the most common mechanical transmissions:

- Timing belt
- Cycloid and epicycloid reducer
- Rack and pinion
- Ball and 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 area can be identified:

- Low dynamic application: 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 the 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).

SERVO MOTOR SELECTION AND SIZING

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 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 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 ExD Series Servo Motors.

The frequency of torsional resonance of a load with inertia J_1 connected to an axis with torsional stiffness S_m is:

$$f = (1/(2\pi)) \times \sqrt{\frac{S_m}{J_1}}$$

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

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

Consideration 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, and 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 adaption 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.

Consideration 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 Drives 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.

Consideration 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, and 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 capacity is necessary to synchronize several axes.

Moog offers three drive location options for potentially hazardous environments, namely;

- (1) In cabinet outside area,
- (2) In cabinet in area,
- (3) On machine.

Please contact Moog to discuss the best option for your application.

SERVO MOTOR SELECTION AND SIZING

Motor selection

After the choice of the transmission ratio, based on load, speed and other 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. Contact Moog local application engineer for additional information and support. 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 IEC/EN 60034
2. Certified to ATEX, IECEX, CCC Ex, kosha, TRCU and NEC Class I
3. Rotors balanced to Class G6.3 per ISO 1940
4. Sealing to IP65
5. Operating ambient temperature refer to box car
6. Class F winding insulation
7. Motor flange dimensions per IEC 34, DIN 42948, 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 Vrms
 - 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. ExD series servo motor are available in two versions:
 - G-xLM: Designed for the use of 325 VDC link
 - G-xLV: Designed for the use of 565 VDC link
12. Winding temperature sensors (standard version): PTC as per temperature class and NTC
13. Sealed life-time lubricated bearing
14. Cable gland optional

Notes

1. Continuous rating based upon:
 - a. Operation in still air with ambient temperatures as indicated in the specification table.
 - b. 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 of 5 % (1 out of 20 seconds)
 - b. Iron saturation of 15 % or less
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. Motor performance as measured with Moog drives at 325 VDC link for the G-xLM motor and 565 VDC link for G-xLV 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 drives
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. Although very low maintenance, we advise you to talk your local Moog customer service team to determine an appropriate maintenance schedule

ABOUT MOOG Solutions

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.

Hydraulic Solutions

Since Bill Moog invented the first commercially viable servo valve in 1951, Moog has set the standard for worldclass 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.

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 help you:

- Maximize uptime
- Get more from your machine investment

It reflects our commitment to keeping your motion control components and systems running at peak performance. We help you transform maintenance by moving from reactive to planned. Around the globe in 24 countries, local teams of trained Moog technicians are on standby with the services you need from express repairs to exchange programs, and on-site technical support.

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



Flight Simulation



Formula One Simulation Table

Look to Moog for global support including:

- Factory Repair Services – Restore your products to “like new” performance with high quality repairs using authentic OEM components
- Replacement Parts/Spares – Obtain authentic OEM products whenever and wherever they are needed around the globe
- Professional Field Services – Access on-site technical support from knowledgeable professionals for installation, commissioning and troubleshooting
- Flexible Service Agreements – Lower your total cost of ownership and reduce your risk of downtime with a tailored package of services to meet your needs
- Offer consistent quality anywhere in the world

For more information on Moog Global Support visit www.moogglobalsupport.com.



OPTIONS

Flexible Design Options

Moog's ExD Series Servo Motors are available with a variety of standard and custom 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 place. As a result, if you need something that's not presently listed, contact your local sales office.

Standard Options

The Standard options for the ExD Series Servo Motors are detailed in the type box car.

- Feedback Devices

Feedback device listed in the ordering code are considered as standard. Requirement of any other types of special feedback devices, please consult your local Moog sales office.

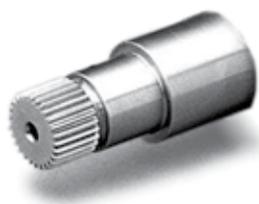
- Integral Holding Brake

Holding brakes are available for all standard ExD 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).

The integral holding brake requires a regulated 24 VDC supply (see Accessories) for proper operation. Refer to motor technical data for brake current requirements. 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.

- Shaft Options

Standard ExD 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.



Customizable Options

Motor Windings

Moog's standard ExD Series Servo Motors are designed to address the needs of most dynamic motion control applications. However, Moog recognizes that OEMs have unique needs which cannot 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 nonstandard bus voltages or deliver customized performance characteristics for applications with unique speed or current requirements. However our custom winding will be adhered to only when it meet the Ex standard requirement.

Shafts and Flanges

To support legacy products or meet unique application needs, Moog's modular ExD Series Servo Motor design is capable of supporting custom shafts (length, diameter or spline fittings) and custom flanges.

Cable Gland with Cable

Moog provides customized cable with suitable cable gland to provide the desired connection to the servo drive, temperature monitoring device and power supply.

Special Paint

Moog provides special paint to operate the motors in corrosive and harsh environments. IECEx marking suitable for this option shall be provided.

Accessories

To speed-up 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 pre-assembled motor cables, crimp tools, power supplies, please consult your local Moog sales office.

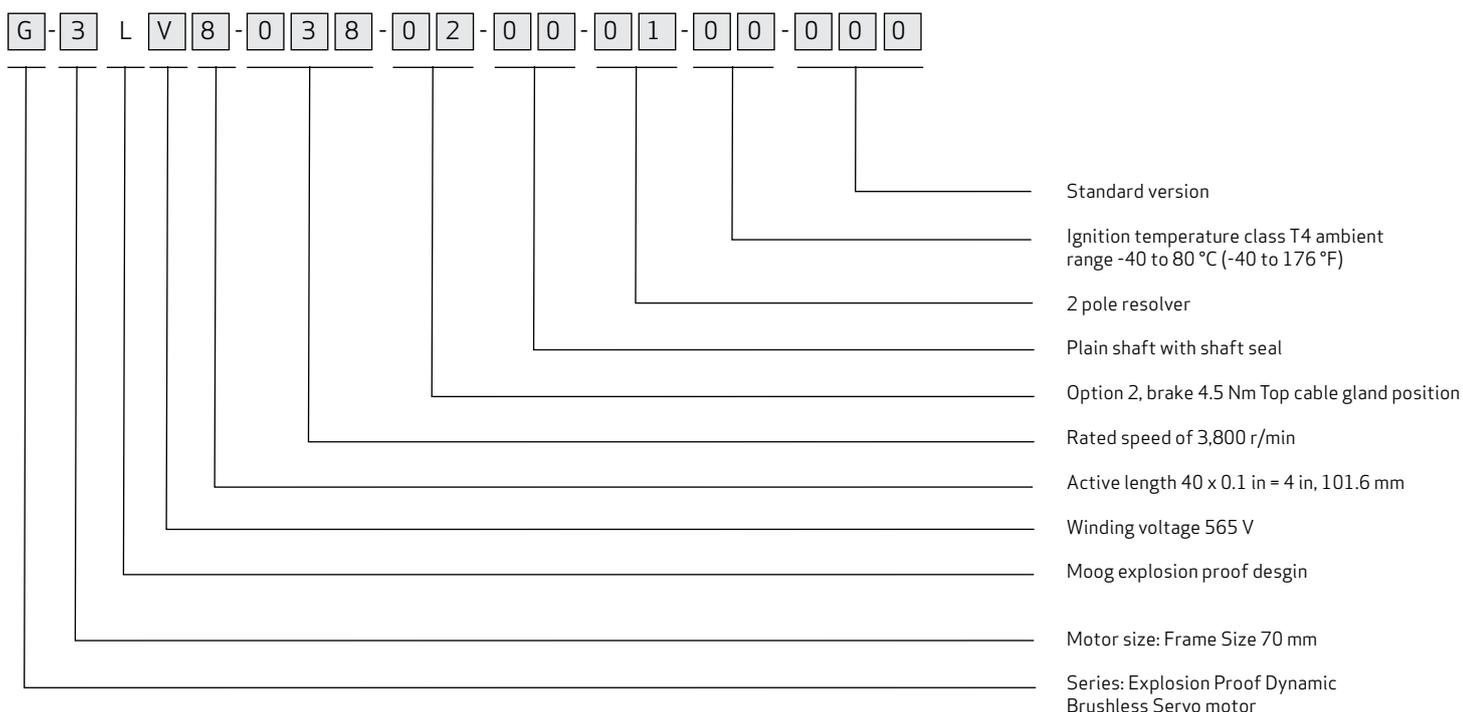
ORDERING CODE

How to order

To order a motor, choose the various type options by filling in the ordering code on the inside back page of the catalog.

Moog Sales department will provide the corresponding model numbers suitable for the order.

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



1. Thermal sensor option for ATEX/IECEX: PTC is primary thermal sensor. Second set of thermal sensors is NTC as standard.

Thermal sensor option for NEC C1D1: Primary temperature limiting device is Thermostat. Secondary any other thermal sensor like PTC or NTC.
2. Any non standard stack length between L05 to L40 for size 3, between L10 to L50 for size 5 and between L15 to L90 for size 6.
3. Standard motor delivered without cable gland or cable. Following are the standard cable gland entry size are offered.
Size 3 and 5, M20 x1.5 (both power and signal)
Size 6 M32x1.5 (power) and M20x1.5 (signal)
4. Size 3 encoder motors are always without brake and signal leads will be flying leads for electrical option 00-05
5. T3 ignition temperature class for size 3 and 5 between -40 °C - +80 °C for gas and dust.

6. T3 ignition temperature class for size 5 between +80 °C (+176 °F) to +120 °C (+248 °F) only gas code is applicable.
7. T3 Ignition temperature class for size 6 between -40 °C - +100 °C for gas and dust.

ORDERING

G - [] L [] [] - [] [] [] - [] [] [] - [] [] [] - [] [] [] - [] [] []

Motor Size	
3	70 mm (flange)
5	140 mm (flange)
6	190 mm (flange)

Nominal speed ²⁾	
xxx	r/100 min

Special version	
000	Standard version

L	Moog Ex design UL
---	-------------------

Winding voltage	
M	Low voltage
V	High voltage

Stack length ¹⁾			
Code	Motor size		
	3	5	6
0	Special ²⁾		
2	L05	L10	L15
4	L15	L20	L30
6	L25	L30	L45
8	L40	L50	L60
9			L90

1) Active length in 0.1 inch

	Electrical option					
	Brake options		Cable gland position		Increased clearance for connection ³⁾	
	1	2	Top	Back	No additional clearance	Additional clearance
00						
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
99	Special version - not affecting the electrical performance or protection methods of the device as described in the documents					

3) Additional clearance for internal clearance for connection is applicable only for G493 models

Mechanical option		
	Keyway	Shaft exit seal
00		
01		
99	Special	

Feedback option						
	Motor size			Resolver/encoder type		
	3	5	6			
00	Not allowed			Incremental		
01	2 poles resolver					
02				Stegmann		
03	SKS36	SRS50	SRS50			Absolute single turn
04	SKM36	SRM50	SRM50			Absolute multi turn
05	ERN1185	ERN1387	ERN1387	Heidenhain		
06	-	ECN1313	ECN1313			Absolute single turn
07	-	EQN1325	EQN1325			Absolute multi turn
99	Special					

Brake options				
Code		Motor size		
		3	5	6
Low-T	1	2 Nm	14 Nm	22 Nm
		18 lbf in	124 lbf in	195 lbf in
High-T	2	4.5 Nm	22 Nm	72 Nm
		40 lbf in	195 lbf in	637 lbf in

Ignition temp class/ambient ⁴⁾																		
°C	-20 to 40	-20 to 50	-20 to 60	-20 to 70	-20 to 80	-20 to 90	-20 to 100	-20 to 110	-20 to 120	-40 to 40	-40 to 50	-40 to 60	-40 to 70	-40 to 80	-40 to 90	-40 to 100	-40 to 110	-40 to 120
°F	-4 to +104	-4 to +122	-4 to +140	-4 to +158	-4 to +176	-4 to +194	-4 to +212	-4 to +230	-4 to +248	-40 to +104	-40 to +122	-40 to +140	-40 to +158	-40 to +176	-40 to +194	-40 to +212	-40 to +230	-40 to +248
00														T4				
01		T4																
02			T4															
03	T4																	
04				T4														
05					T4													
06										T4								
07											T4							
08												T4						
09													T4					
10	T5																	
11										T5								
12	T6																	
13										T6								
14	T3																	
15		T3																
16			T3															
17				T3														
18					T3													
19						T3												
20							T3											
21								T3										
22									T3									
23										T3								
24											T3							
25												T3						
26													T3					
27														T3				
28															T3			
29																T3		
30									T3									T3
31										T3								
99	Special																	

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.

CD (Compact Dynamic) Brushless Servo Motors

Combining compactness with performance, the CD servo motor series offers one of the industry's widest power ranges with continuous nominal torques from 0.15 to 77 Nm (1.3 to 681 lb-in). The modular design is supported by a variety of options with Moog's application engineers capable of supplying fully customized solutions.



HD (High Dynamic) Brushless Servo Motors

The HD servo motor series stands out for its extremely high level of dynamic and high acceleration speeds. With nominal torques from 0.4 Nm to 831 Nm (3.5 to 7355 lb-in) and a fully customizable modular structure,



these motors are perfect for high dynamic applications where reliable performance is fundamental.

CP (Compact Power) Brushless Servo Motors

The CP servo motor series is a range of compact motors with high power density. These motors are designed for dynamic servo applications where small dimensions (especially shorter length) and high torque are needed.



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.



DI2020 - Decentralized Servo Drive

Servo control integrated with a high efficiency brushless motor. It allows great machine design freedom and a significant reduction in wiring and cabinet space.



MORE SOLUTIONS. 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



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

Moog is a registered trademark of Moog Inc. and its subsidiaries.
All trademarks as indicated herein are the property of Moog Inc. and its subsidiaries. Product and company names listed are trademarks or trade names of their respective companies.

©2022 Moog Inc. All rights reserved. All changes are reserved.

Moog Explosion Proof Dynamic Brushless Servo Motors Catalog
MCM/Rev. F, May 2022, Id. CDL32776-en

WHEN PERFORMANCE REALLY MATTERS

MOOG