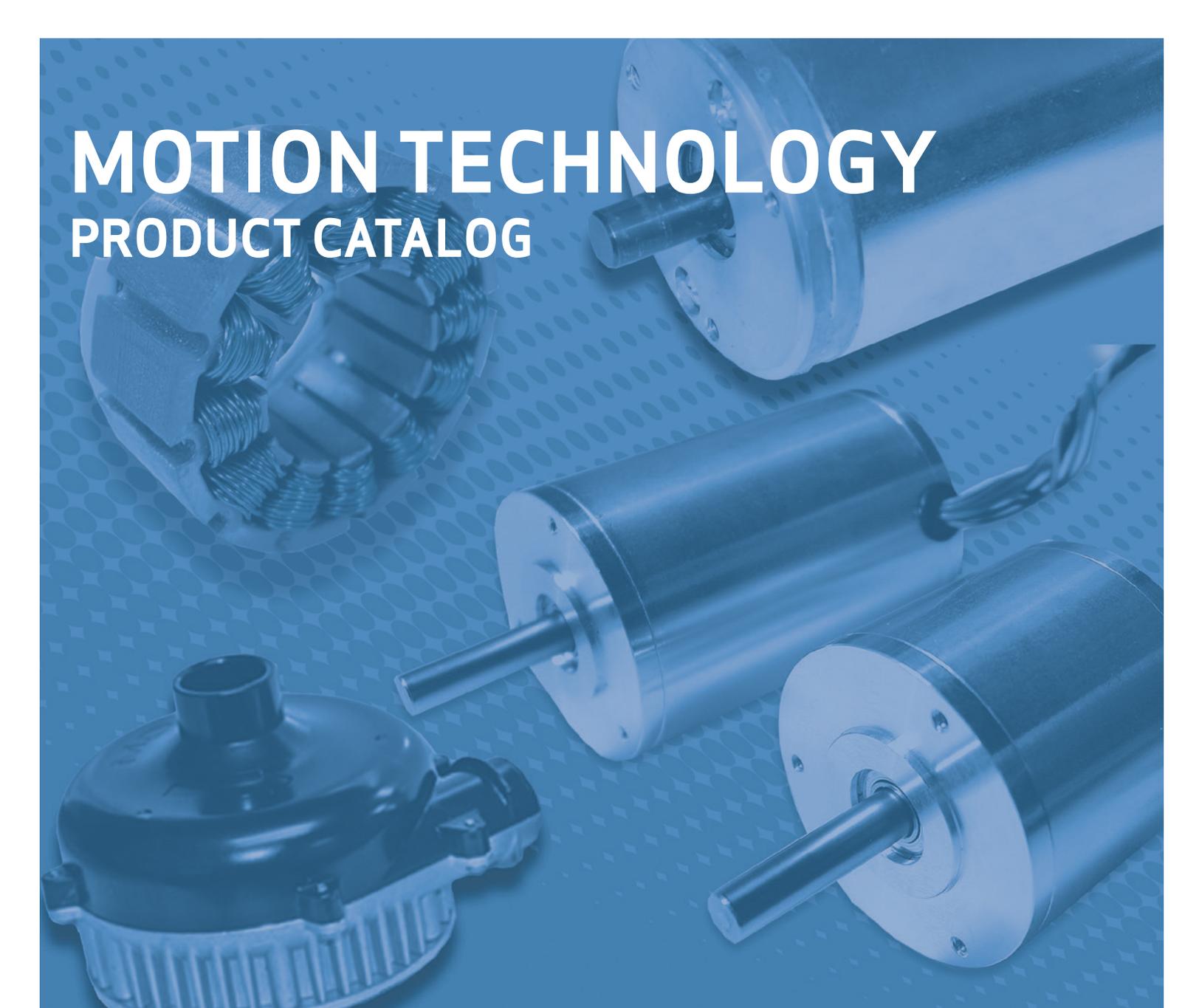


MOTION TECHNOLOGY

PRODUCT CATALOG



Rev. C, June 2023

BRUSHLESS MOTORS, AIR MOVING PRODUCTS
AND DRIVE ELECTRONICS

WHEN PERFORMANCE REALLY MATTERS

MOOG

Whenever the highest levels of motion control performance and design flexibility are required, you'll find Moog expertise at work.

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Moog is an innovative motion technology company with unique design and manufacturing capabilities for electromechanical and fiber optic products. Founded 70 years ago, the company's original vision was to become a research and development business offering new technologies for the emerging inertial navigation marketplace for aircrafts. Quickly, it evolved into a manufacturing operation where the designs were crafted into products that were in high demand.

Moog has a legacy for providing high-quality products used in critical defense and space applications. Over the years, this foundation has expanded to a broad spectrum of industrial markets, including medical, automation, marine and communications. The company is ISO9001 certified and utilizes world-class manufacturing concepts, including Six-Sigma and Lean Manufacturing, to allow the company to produce the highest quality products at competitive prices.

Moog offers standard and customer-specific solutions for industrial, medical, marine, aerospace and defense applications. More information about Moog is available at www.moog.com.

Note: This catalog contains basic marketing information and general part descriptions of Moog. With respect to the U.S. export regulations, the products described herein are controlled by the U.S. Commerce Department or the U.S. State Department. Contact Moog for additional detail on the export controls that are applicable to your part.

SILENCER® SERIES BRUSHLESS DC MOTORS OVERVIEW

BN12, 17, 23, 28, 34 and 42

Quiet, Brushless Motors

Silencer® Brushless motors provide smooth, efficient operation and increased speed ranges. Utilizing bonded neo magnets, our BN series motors provide excellent value with their low cost and high torque. Each frame of the BN motors is available in multiple lengths with a variety of electrical options to meet a wide range of commercial and industrial operating specifications.

Reliable, Low-Cost Operation

The compact BN motors are well-suited for applications demanding low audible noise and long life. An aluminum housing protects the unit in rugged applications and environments. Typical options include electronic drives, encoders and gearheads, as well as Hall effect, resolver and sensorless feedback.

Our engineering department is available for consultation to help you tailor a brushless motor for your specific application.

Typical Applications

- Medical equipment - blowers, compressors, pumps, and electric scooters and wheelchairs
- Automatic door and window openers
- Computer-controlled embroidery machines
- Scanners
- Packaging equipment and printing products
- HVAC equipment (air handling)
- Robotic tape storage and retrieval
- Semiconductor handling and insertion machines
- Actuators
- Factory automation

Features

- Inside rotor construction for quick acceleration
- 8 pole motor standard, 4 pole motors optional for high speed applications
- Compact size - lengths from 1.3 to 5.5 inches
- Diameter - 1.2 to 4.15 inches
- Continuous torques from 2.4 to 519 oz-in
- High energy neodymium magnets
- Safe, arcless operation
- High speed capability - up to 20,000 rpm
- High torque per dollar ratio

Benefits

- Operation at any single speed - not limited to AC frequency
- Motor life is not limited to brush or commutator life
- An essentially linear speed / torque curve
- Efficient operation without losses associated with brushes and commutation or armature induction
- Precise, variable speed control
- Extremely quiet operation
- Long-life operation

Encoders

High resolution, high reliability, and state-of-the-art technology in a small package:

- Bidirectional incremental code
- Up to 1024 cycles standard
- Up to 3 channels: A, B, and index
- TTL / CMOS compatible
- Hewlett Packard HEDS-5500 encoder standard, other configurations and resolutions available

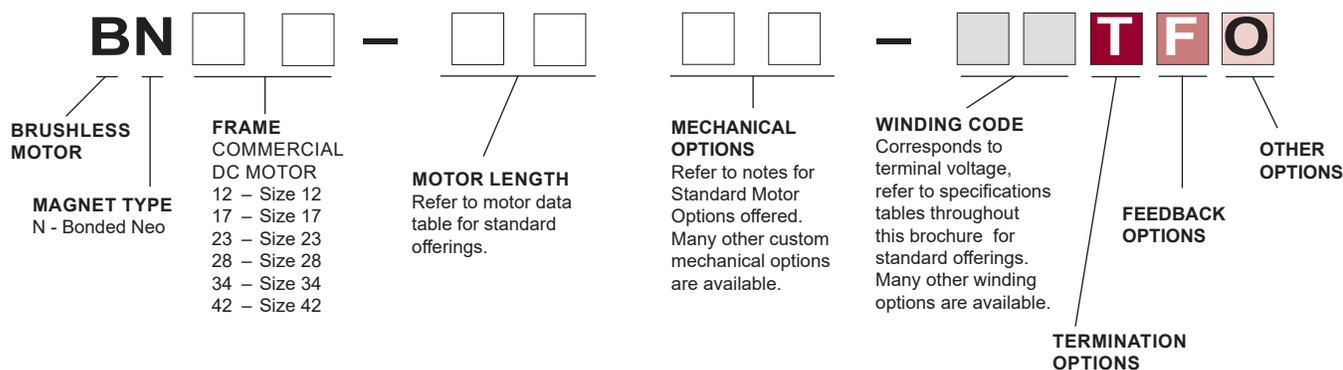
Silencer Brushless Motor Drives

Optimized for use with Silencer Brushless DC motors, these drives provide:

- Multiple operating modes - commutation, velocity, torque, 2 and 4 quadrant
- Feedback using Hall effect sensor or encoder
- Efficient PWM speed control
- CE approved for European applications
- Low cost

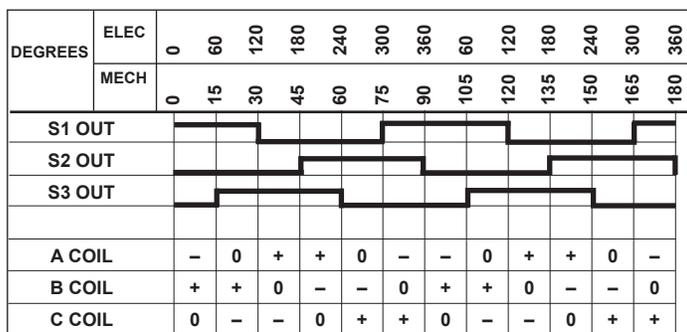
SPECIFICATIONS AND NUMBERING SYSTEM

Part Numbering System Guide

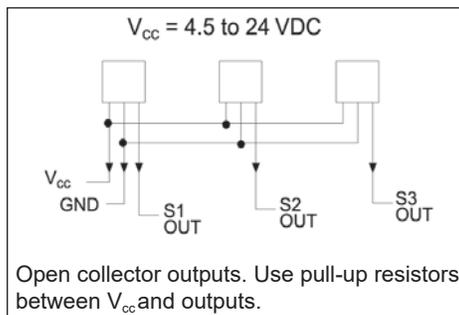


Conversion Table		
FROM	TO	MULTIPLY BY
Length		
inches	cm	2.540
feet	cm	30.48
cm	inches	.3937
cm	feet	3.281×10^{-2}
Mass		
oz	g	28.35
lb	g	453.6
g	oz	3.527×10^{-2}
lb	oz	16.0
g	lb	2.205×10^{-3}
oz	lb	6.250×10^{-2}
Torque		
oz-in	Nm	141.61^{-1}
oz-in	g-cm	72.01
lb-ft	g-cm	1.383×10^4
g-cm	oz-in	1.389×10^{-2}
lb-ft	oz-in	192.0
g-cm	lb-ft	7.233×10^{-5}
oz-in	lb-ft	5.208×10^{-3}
Rotation		
rpm	degrees/sec	6.0
rad/sec	degrees/sec	57.30
degrees/sec	rpm	.1667
rad/sec	rpm	9.549
degrees/sec	rad/sec	1.745×10^{-2}
rpm	rad/sec	.1047
Moment Of Inertia		
oz-in ²	g-cm ²	182.9
lb-ft ²	g-cm ²	4.214×10^5
g-cm ²	oz-in ²	5.467×10^{-3}
lb-ft ²	oz-in ²	2.304×10^3
g-cm ²	lb-ft ²	2.373×10^{-6}
oz-in ²	lb-ft ²	4.340×10^{-4}
oz-in-sec ²	g-cm ²	7.062×10^4

Timing Diagram for Hall Switches



Hall Effect Switches



IMPORTANT

The operational life and performance of any motor is dependent upon individual operating parameters, environment, temperature and other factors. Your specific application results may vary. Please consult the factory to discuss your requirements.

Bearing Load Rating (lbs)

Motor Size	Dynamic	Static
BN-12	295	110
BN-17	331	134
BN-23	743	304
BN-28	1022	422
BN-34	1532	683
BN-42	1340	725

BN12 SPECIFICATIONS

Continuous Stall Torque 2.4 - 8.6 oz-in (0.0170 - 0.0607 Nm) / Peak Torque 13 - 77 oz-in (0.0918 - 0.5437 Nm)

Part Number*		BN12-13AF- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN12-18AF- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN12-23AF- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN12-28AF- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Winding Code**		01	02	03	01	02	03	01	02	03	01	02	03
L = Length	inches	1.30			1.80			2.30			2.80		
	millimeters	33.02			45.72			58.42			71.12		
Terminal Voltage	volts DC	12.0	24.0	36.0	12.0	24.0	36.0	12.0	24.0	36.0	12.0	24.0	36.0
Peak Torque	oz-in	13.0	13.0	14.0	37.0	37.0	39.0	58.0	58.0	61.0	77.0	77.0	72.0
	Nm	0.0918	0.0918	0.0989	0.2613	0.2613	0.2754	0.4096	0.4096	0.4308	0.5437	0.5437	0.5084
Continuous Stall Torque	oz-in	2.4	2.4	2.4	4.9	5.0	5.0	6.9	6.9	6.9	8.3	8.6	8.6
	Nm	0.0169	0.0169	0.0169	0.0346	0.0353	0.0353	0.0487	0.0487	0.0487	0.0586	0.0607	0.0607
Rated Speed	RPM	13027.0	12736.0	13753.0	11928.0	11448.0	12320.0	10604.0	10601.0	11489.0	11036.0	10253.0	9529.0
	rad/sec	1364	1334	1440	1249	1199	1290	1110	1110	1203	1156	1074	998
Rated Torque	oz-in	1.8	1.8	1.8	3.5	3.6	3.5	5.0	5.0	4.7	5.4	5.9	6.2
	Nm	0.0127	0.0127	0.0127	0.0247	0.0254	0.0247	0.0353	0.0353	0.0332	0.0381	0.0417	0.0438
Rated Current	Amps	2.26	1.13	0.77	3.49	1.76	1.20	4.32	2.16	1.46	4.81	2.46	1.61
Rated Power	watts	17.3	17.0	18.3	30.9	30.5	31.9	39.2	39.2	39.9	44.1	44.7	43.7
Torque Sensitivity	oz-in/amp	1.02	2.06	2.95	1.24	2.56	3.64	1.42	2.84	4.01	1.41	2.99	4.75
	Nm/amp	0.0072	0.0145	0.0208	0.0088	0.0181	0.0257	0.0100	0.0201	0.0283	0.0100	0.0211	0.0335
Back EMF	volts/KRPM	0.75	1.53	2.18	0.92	1.89	2.69	1.05	2.10	2.96	1.04	2.21	3.51
	volts/rad/sec	0.0072	0.0145	0.0208	0.0088	0.0181	0.0257	0.0100	0.0201	0.0283	0.0100	0.0211	0.0335
Terminal Resistance	ohms	0.953	3.89	7.85	0.403	1.67	3.36	0.294	1.18	2.36	0.219	0.934	2.36
Terminal Inductance	mH	0.254	1.100	2.210	0.181	0.742	1.460	0.172	0.692	1.374	0.128	0.447	1.220
Motor Constant	oz-in/sq.rt.watt	1.04	1.04	1.05	1.95	1.98	1.99	2.62	2.61	2.61	3.01	3.09	3.09
	Nm/sq.rt.watt	0.00738	0.00738	0.00744	0.01379	0.01399	0.01402	0.01849	0.01846	0.01843	0.02128	0.02185	0.02183
Rotor Inertia	oz-in-sec ² x10 ⁻³	0.040	0.040	0.040	0.080	0.080	0.080	0.120	0.120	0.120	0.16	0.16	0.16
	g-cm ²	2.82	2.82	2.82	5.65	5.65	5.65	8.47	8.47	8.47	11.3	11.3	11.3
Weight	oz	3.6	3.6	3.6	5.5	5.5	5.5	7.3	7.3	7.3	9.1	9.2	9.2
	g	102.2	102.2	102.2	156.2	156.2	156.2	207.3	207.3	207.3	258.4	261.3	261.3
# of Poles		8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Timing		120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°
Mech. Time Constant	ms	5.2	5.2	5.1	3.0	2.9	2.9	2.5	2.5	2.5	2.5	2.4	2.4
Electrical Time Constant	ms	0.14	0.14	0.14	0.24	0.25	0.25	0.29	0.29	0.29	0.29	0.31	0.31
Thermal Resistivity	deg. C/watt	10.7	10.3	11.2	9.5	8.9	9.3	8.3	8.3	8.3	7.7	7.3	7.4
Speed/Torque Gradient	rpm/oz-in	1245.8	1234.2	1220.6	353.3	345.2	343.2	197.2	197.9	198.8	149.3	141.3	141.6

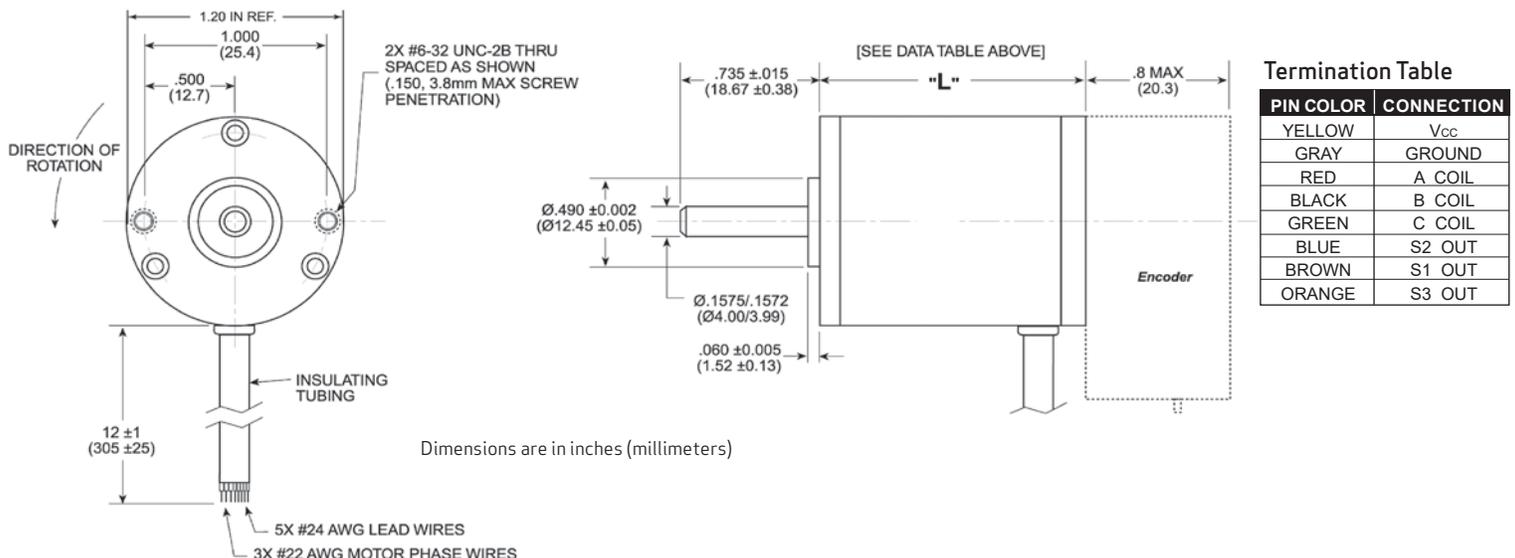
- Notes:
- Motor mounted to a 4 x 4 x 1/4 inches aluminum plate, still air.
 - Maximum winding temperature of 155°C.
 - Typical electrical specifications at 25°C.
 - Motor Terminal Voltages are representative only; motors may be operated at voltages other than those listed in the table. For assistance please contact our applications engineer.
 - For MS (military style) connector, please specify connector housing and terminal.
 - Data for informational purposes only. Should not be considered a binding performance agreement. For specific applications, please contact the factory.

*Many other custom mechanical options are available – consult factory.
 **Many other winding options are available – consult factory.

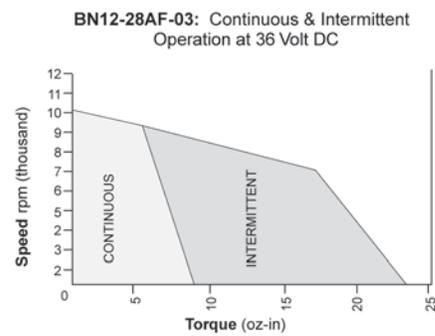
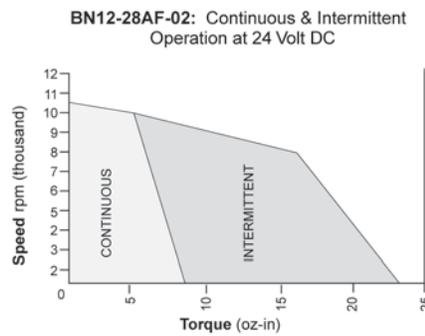
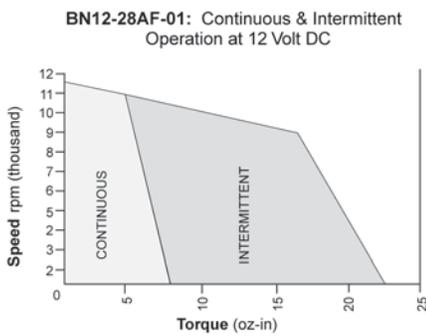
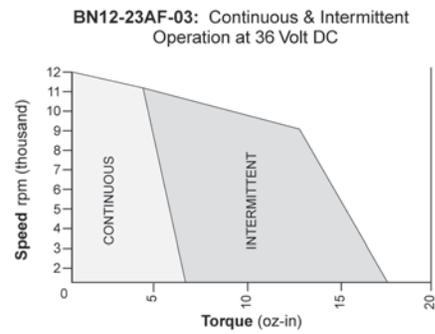
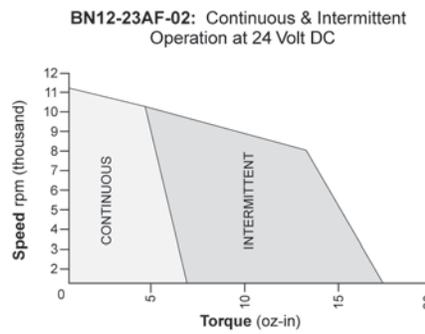
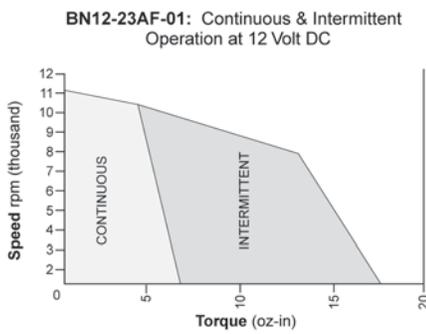
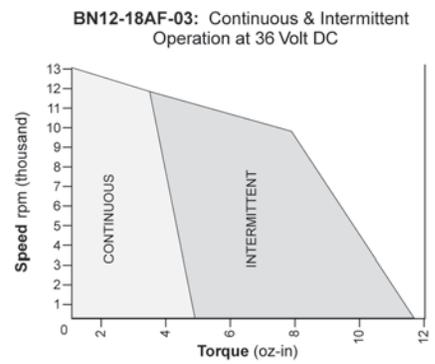
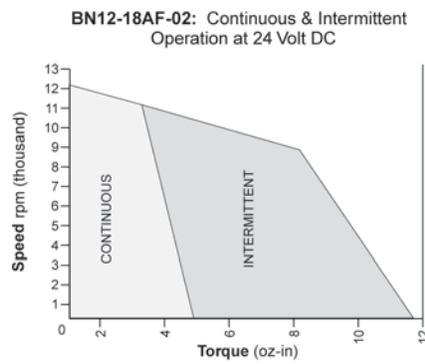
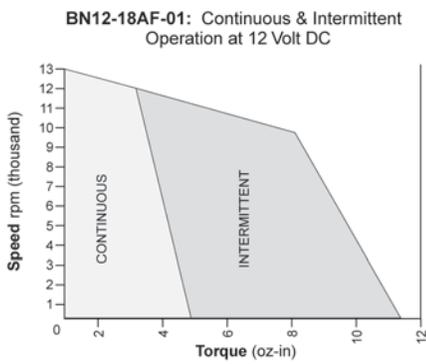
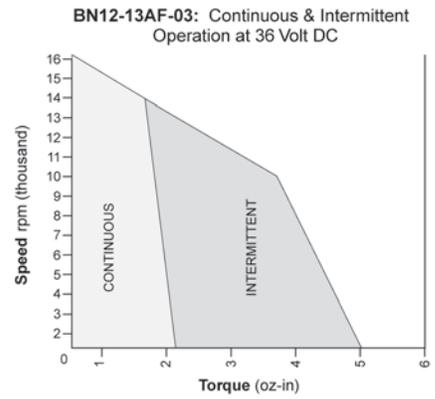
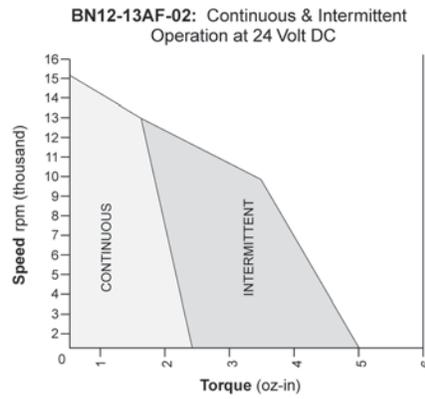
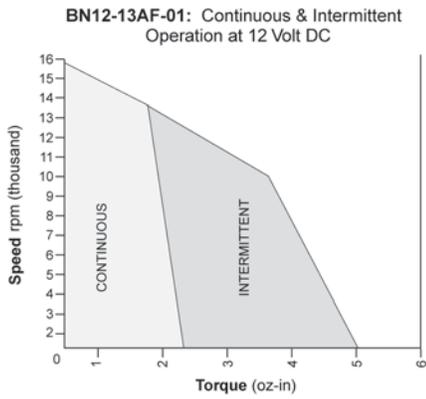
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|--|---|--|
| <input checked="" type="checkbox"/> Termination | <input checked="" type="checkbox"/> Feedback Options | <input checked="" type="checkbox"/> Other Options |
| L – Leads (std) | H – Hall Effect (std) | E – Encoder |
| C – Connector | R – Resolver | G – Gearhead |
| M – MS connector | S – Sensorless | |

BN12 TYPICAL OUTLINE



BN12 PERFORMANCE CURVES



Note: Intermittent operation is based on a 20% duty cycle of one minute on, four minutes off. Please contact the factory regarding the duty cycle of your application.

BN12 EU SPECIFICATIONS

Continuous Stall Torque 2.4 - 8.6 oz-in (0.0170 - 0.0587 Nm) / Peak Torque 13 - 77 oz-in (0.0918 - 0.544 Nm)

Part Number*		BN12-13EU- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN12-18EU- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN12-23EU- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN12-28EU- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Winding Code**		01	02	03	01	02	03	01	02	03	01	02	03
L = Length	inches	1.30			1.80			2.30			2.80		
	millimeters	33.02			45.72			58.42			71.12		
Terminal Voltage	volts DC	12	24	36	12	24	36	12	24	36	12	24	36
Peak Torque	oz-in	13	13	14	37	37	39	58	58	61	77	77	72
	Nm	0.0918	0.0918	0.0989	0.262	0.262	0.276	0.410	0.410	0.431	0.544	0.544	0.509
Continuous Stall Torque	oz-in	2.4	2.4	2.4	4.9	5.0	5.0	6.9	6.9	6.9	8.3	8.6	8.6
	Nm	0.0170	0.0170	0.0170	0.0346	0.0354	0.0354	0.0488	0.0488	0.0488	0.0587	0.0587	0.0587
Rated Speed	RPM	13027	12736	13753	11928	11448	12320	10604	10601	11489	11036	10253	9529
	rad/sec	1364	1333	1440	1249	1198	1290	1110	1110	1203	1155	1073	997
Rated Torque	oz-in	1.80	1.80	1.80	3.50	3.60	3.50	5.00	5.00	4.70	5.40	5.90	6.20
	Nm	0.0127	0.0127	0.0127	0.0248	0.0255	0.0248	0.0354	0.0354	0.0332	0.0382	0.0417	0.0438
Rated Current	Amps	2.26	1.13	0.77	3.49	1.76	1.20	4.32	2.16	1.46	4.81	2.46	1.61
Rated Power	watts	17.3	17.0	18.3	30.9	30.5	31.9	39.2	39.2	39.9	44.1	44.7	43.7
Torque Sensitivity	oz-in/amp	1.02	2.06	2.95	1.24	2.56	3.64	1.42	2.84	4.01	1.41	2.99	4.75
	Nm/amp	0.0072	0.0146	0.0209	0.0088	0.0180	0.0257	0.0101	0.0201	0.0284	0.0100	0.0212	0.0336
Back EMF	volts/KRPM	0.75	1.53	2.18	0.92	1.89	2.69	1.05	2.10	2.96	1.04	2.21	3.51
	volts/rad/sec	0.0072	0.0146	0.0209	0.0088	0.0180	0.0257	0.0101	0.0201	0.0284	0.0100	0.0212	0.0336
Terminal Resistance	ohms	0.953	3.89	7.85	0.403	1.67	3.36	0.294	1.18	2.36	0.219	0.934	2.36
Terminal Inductance	mH	0.254	1.100	2.210	0.181	0.742	1.460	0.172	0.692	1.374	0.128	0.447	1.220
Motor Constant	oz-in/sq.rt.watt	1.0	1.1	1.1	2.0	2.0	2.0	2.6	2.6	2.6	3.0	3.1	3.1
	Nm/sq.rt.watt	0.0071	0.0078	0.0078	0.0142	0.0142	0.0142	0.0184	0.0184	0.0184	0.0212	0.0219	0.0219
Rotor Inertia	oz-in-sec ²	4.0E-05	4.0E-05	4.0E-05	8.0E-05	8.0E-05	8.0E-05	1.2E-04	1.2E-04	1.2E-04	1.6E-04	1.6E-04	1.6E-04
	g-cm ²	2.83	2.83	2.83	5.65	5.65	5.65	8.48	8.48	8.48	11.3	11.3	11.3
Weight	oz	3.6	3.6	3.6	5.5	5.5	5.5	7.3	7.3	7.3	9.1	9.2	9.2
	g	102	102	102	156	156	156	207	207	207	258	261	261

Notes:

- Motor mounted to a 4 x 4 x 1/4 inches aluminum plate, still air.
- Maximum winding temperature of 155°C.
- Typical electrical specifications at 25°C.
- Motor Terminal Voltages are representative only; motors may be operated at voltages other than those listed in the table. For assistance please contact our applications engineer.
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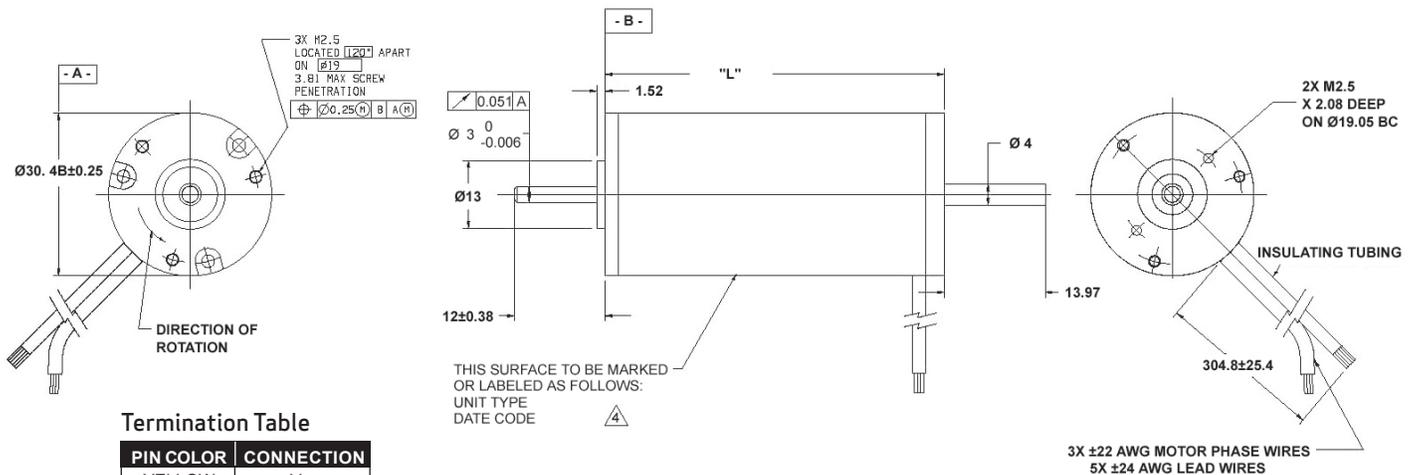
*Many other custom mechanical options are available – consult factory.

**Many other winding options are available – consult factory.

Select your options below and place their code in its corresponding block as shown on page 4.

- | | | |
|--|---|--|
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| C – Connector | R – Resolver | G – Gearhead |
| M – MS connector | S – Sensorless | |

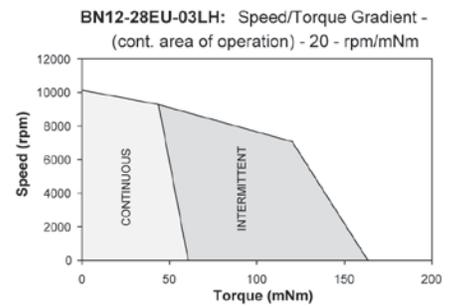
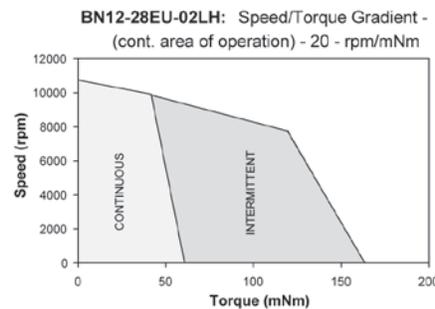
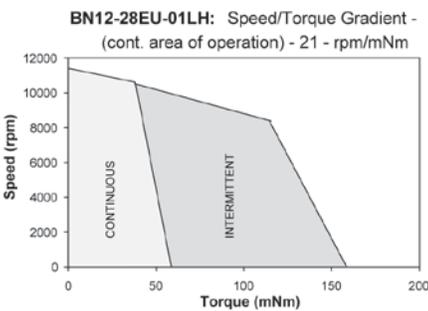
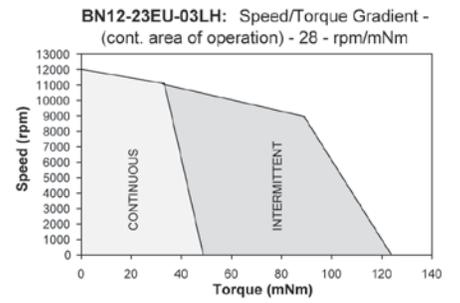
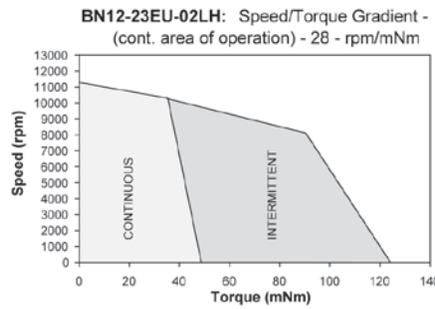
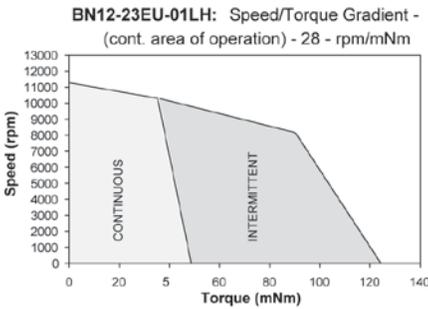
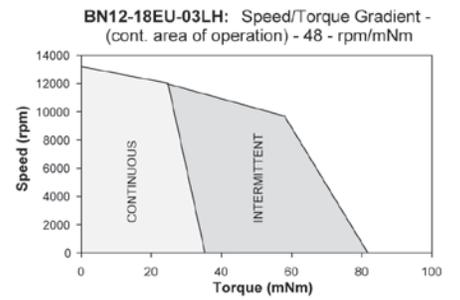
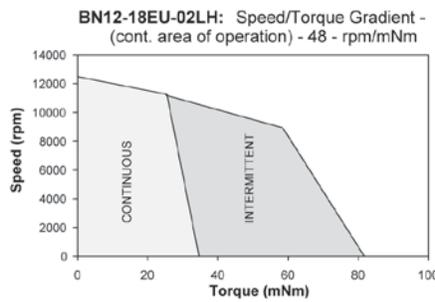
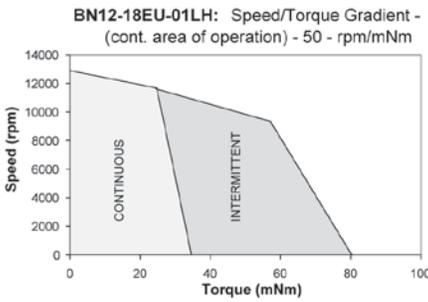
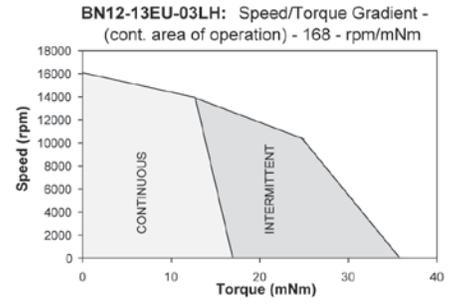
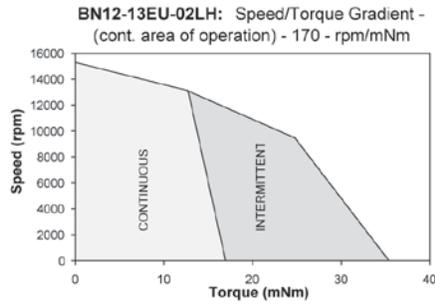
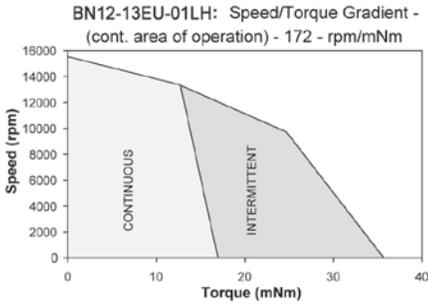
BN12 EU TYPICAL OUTLINE



Termination Table

PIN COLOR	CONNECTION
YELLOW	V _{CC}
GRAY	GROUND
RED	A COIL
BLACK	B COIL
GREEN	C COIL
BLUE	S2 OUT
BROWN	S1 OUT
ORANGE	S3 OUT

BN12 EU PERFORMANCE CURVES



Note: Intermittent operation is based on a 20% duty cycle of one minute on, four minutes off. Please contact the factory regarding the duty cycle of your application.

BN12 IP65 SPECIFICATIONS

Continuous Stall Torque 2.4 - 8.6 oz-in (0.0170 - 0.0607 Nm) / Peak Torque 13 - 77 oz-in (0.0918 - 0.5437 Nm)

Part Number*		BN12-13IP- <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN12-18IP- <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN12-23IP- <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN12-28IP- <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Winding Code**		01	02	03	01	02	03	01	02	03	01	02	03
L = Length	inches	1.82			2.32			2.82			3.32		
	millimeters	46.2			58.9			71.6			84.3		
Terminal Voltage	volts DC	12.0	24.0	36.0	12.0	24.0	36.0	12.0	24.0	36.0	12.0	24.0	36.0
Peak Torque	oz-in	13.0	13.0	14.0	37.0	37.0	39.0	58.0	58.0	61.0	77.0	77.0	72.0
	Nm	0.0918	0.0918	0.0989	0.2613	0.2613	0.2754	0.4096	0.4096	0.4308	0.5437	0.5437	0.5084
Continuous Stall Torque	oz-in	2.4	2.4	2.4	4.9	5.0	5.0	6.9	6.9	6.9	8.3	8.6	8.6
	Nm	0.0169	0.0169	0.0169	0.0346	0.0353	0.0353	0.0487	0.0487	0.0487	0.0586	0.0607	0.0607
Rated Speed	RPM	13027.0	12736.0	13753.0	11928.0	11448.0	12320.0	10604.0	10601.0	11489.0	11036.0	10253.0	9529.0
	rad/sec	1364	1334	1440	1249	1199	1290	1110	1110	1203	1156	1074	998
Rated Torque	oz-in	1.8	1.8	1.8	3.5	3.6	3.5	5.0	5.0	4.7	5.4	5.9	6.2
	Nm	0.0127	0.0127	0.0127	0.0247	0.0254	0.0247	0.0353	0.0353	0.0332	0.0381	0.0417	0.0438
Rated Current	Amps	2.26	1.13	0.77	3.49	1.76	1.20	4.32	2.16	1.46	4.81	2.46	1.61
Rated Power	watts	17.3	17.0	18.3	30.9	30.5	31.9	39.2	39.2	39.9	44.1	44.7	43.7
Torque Sensitivity	oz-in/amp	1.02	2.06	2.95	1.24	2.56	3.64	1.42	2.84	4.01	1.41	2.99	4.75
	Nm/amp	0.0072	0.0145	0.0208	0.0088	0.0181	0.0257	0.0100	0.0201	0.0283	0.0100	0.0211	0.0335
Back EMF	volts/KRPM	0.75	1.53	2.18	0.92	1.89	2.69	1.05	2.10	2.96	1.04	2.21	3.51
	volts/rad/sec	0.0072	0.0145	0.0208	0.0088	0.0181	0.0257	0.0100	0.0201	0.0283	0.0100	0.0211	0.0335
Terminal Resistance	ohms	0.953	3.89	7.85	0.403	1.67	3.36	0.294	1.18	2.36	0.219	0.934	2.36
Terminal Inductance	mH	0.254	1.100	2.210	0.181	0.742	1.460	0.172	0.692	1.374	0.128	0.447	1.220
Motor Constant	oz-in/sq.rt.watt	1.04	1.04	1.05	1.95	1.98	1.99	2.62	2.61	2.61	3.01	3.09	3.09
	Nm/sq.rt.watt	0.00738	0.00738	0.00744	0.01379	0.01399	0.01402	0.01849	0.01846	0.01843	0.02128	0.02185	0.02183
Rotor Inertia	oz-in-sec ² x10 ⁻³	0.040	0.040	0.040	0.080	0.080	0.080	0.120	0.120	0.120	0.16	0.16	0.16
	g-cm ²	2.82	2.82	2.82	5.65	5.65	5.65	8.47	8.47	8.47	11.3	11.3	11.3
Weight	oz	3.6	3.6	3.6	5.5	5.5	5.5	7.3	7.3	7.3	9.1	9.2	9.2
	g	102.2	102.2	102.2	156.2	156.2	156.2	207.3	207.3	207.3	258.4	261.3	261.3
# of Poles		8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Timing		120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°
Mech. Time Constant	ms	5.2	5.2	5.1	3.0	2.9	2.9	2.5	2.5	2.5	2.5	2.4	2.4
Electrical Time Constant	ms	0.14	0.14	0.14	0.24	0.25	0.25	0.29	0.29	0.29	0.29	0.31	0.31
Thermal Resistivity	deg. C/watt	10.7	10.3	11.2	9.5	8.9	9.3	8.3	8.3	8.3	7.7	7.3	7.4
Speed/Torque Gradient	rpm/oz-in	1245.8	1234.2	1220.6	353.3	345.2	343.2	197.2	197.9	198.8	149.3	141.3	141.6

Notes:

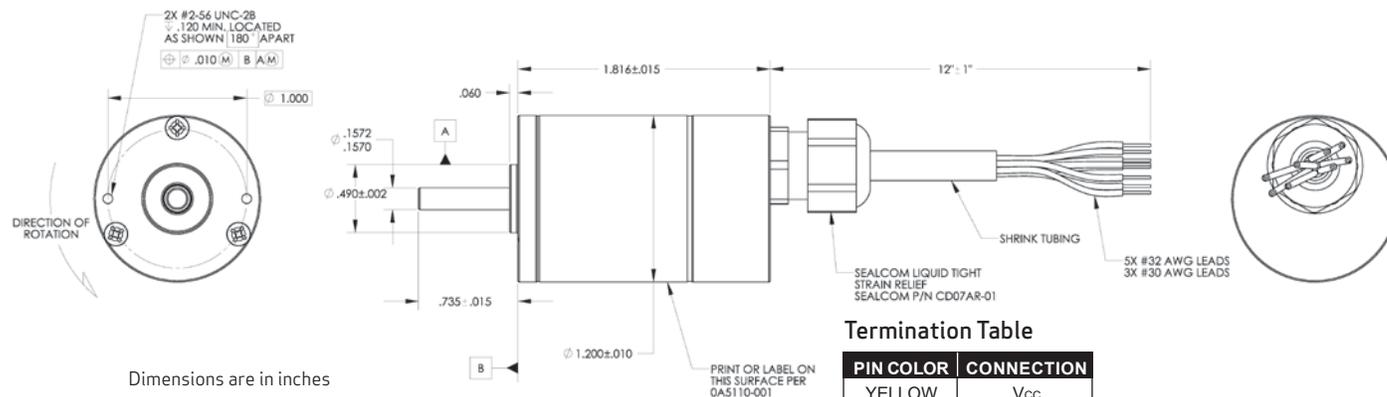
- Motor mounted to a 4 x 4 x 1/4 inches aluminum plate, still air.
- Maximum winding temperature of 155°C.
- Typical electrical specifications at 25°C.
- Motor Terminal Voltages are representative only; motors may be operated at voltages other than those listed in the table. For assistance please contact our applications engineer.
- Calculated (theoretical) speed/torque gradient.
- For MS (military style) connector, please specify connector housing and terminal.
- Data for informational purposes only. Should not be considered a binding performance agreement. For specific applications, please contact the factory.

*Many other custom mechanical options are available – consult factory.
 **Many other winding options are available – consult factory.

Select your options below and place their code in its corresponding block as shown on page 4.

- T Termination** **F Feedback Options** **O Other Options**
 L – Leads (std) H – Hall Effect (std) G – Gearhead
 C – Connector
 M – MS connector

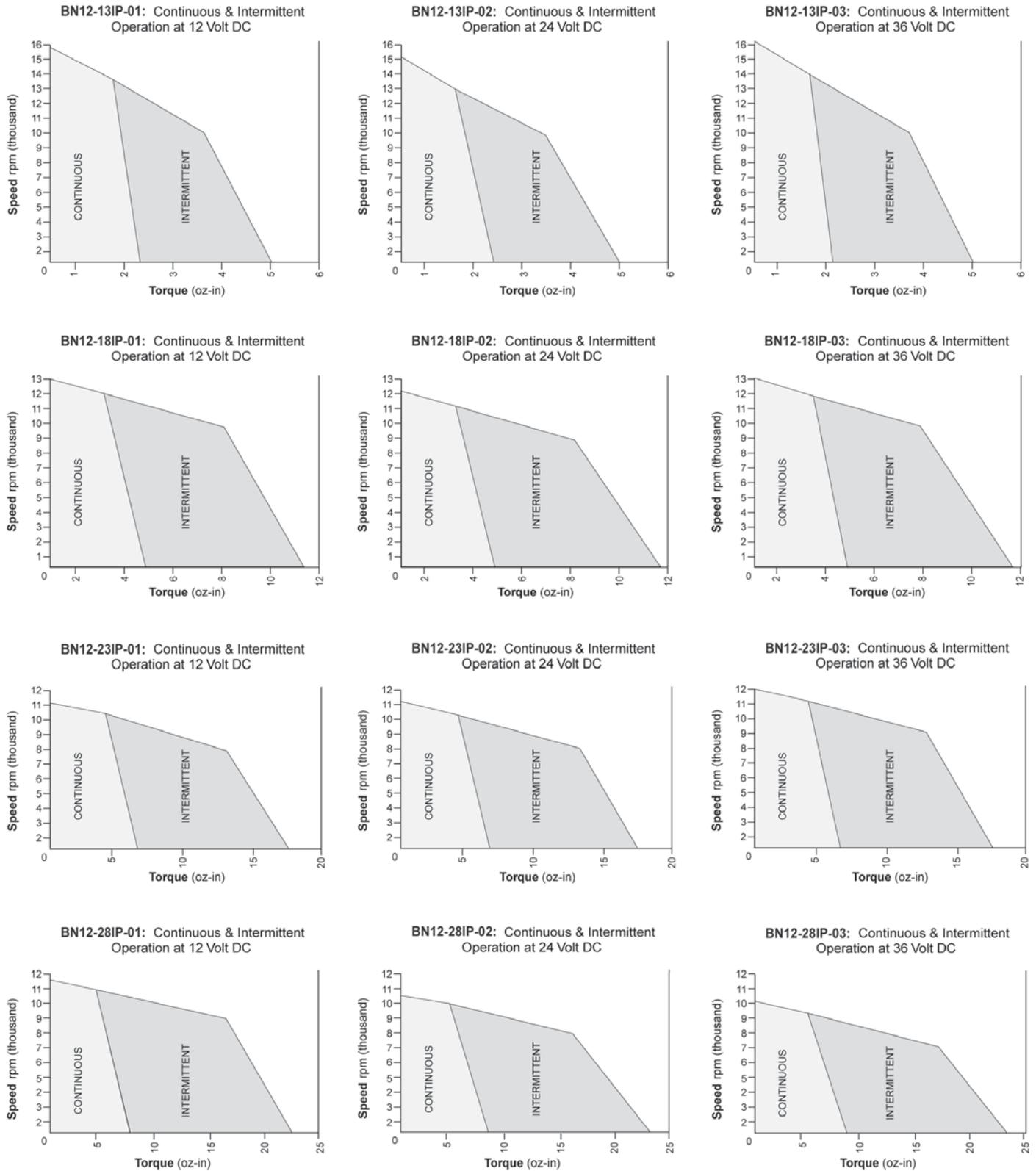
BN12 IP65 TYPICAL OUTLINE



Termination Table

PIN COLOR	CONNECTION
YELLOW	Vcc
GRAY	GROUND
RED	A COIL
BLACK	B COIL
GREEN	C COIL
BLUE	S2 OUT
BROWN	S1 OUT
ORANGE	S3 OUT

BN12 IP65 PERFORMANCE CURVES



Note: Intermittent operation is based on a 20% duty cycle of one minute on, four minutes off. Please contact the factory regarding the duty cycle of your application.

BN17 SPECIFICATIONS

Continuous Stall Torque 11.0 to 21.0 oz-in (.078 - .148 Nm) / Peak Torque 21 - 66 oz-in (.148 - .466 Nm)

Part Number*		BN17-15AA- <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN17-20AA- <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN17-25AA- <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Winding Code**		01	02	03	01	02	03	01	02	03
L = Length	inches	1.5			2			2.5		
	millimeters	38.1			50.8			63.5		
Terminal Voltage	volts DC	12	24	36	12	24	36	12	24	36
Peak Torque	oz-in	22	21	21	45	45	45	66	65	65
	Nm	0.155	0.148	0.148	0.318	0.318	0.318	0.466	0.459	0.459
Continuous Stall Torque	oz-in	11	11	12	17	18	19	19	20	21
	Nm	0.078	0.078	0.085	0.120	0.127	0.134	0.134	0.141	0.148
No-Load Speed	RPM	12,322	16,830	16,290	10,185	10,484	11,084	9,554	9,582	9,000
Rated Speed	RPM	8037	13,498	12,945	5568	7131	7937	5535	6908	6344
	rad/sec	841	1413	1355	583	747	831	580	723	664
Rated Torque	oz-in	9.22	8.2	9.25	14.85	16.01	16.5	16.15	15.1	17.81
	Nm	0.065	0.058	0.065	0.105	0.113	0.117	0.114	0.107	0.126
Rated Current	Amps	8.38	4.71	3.33	10.6	5.31	3.78	11.29	5.57	3.62
Rated Power	watts	55	82	89	61	84	97	66	77	84
Torque Sensitivity	oz-in/amp	1.29	1.83	2.9	1.54	3.05	4.34	1.68	3.32	5.33
	Nm/amp	0.009	0.013	0.020	0.011	0.022	0.031	0.012	0.023	0.038
Back EMF	volts/KRPM	0.95	1.35	2.14	1.14	2.26	3.21	1.24	2.45	3.94
	volts/rad/sec	0.009	0.013	0.020	0.011	0.022	0.031	0.012	0.023	0.038
Terminal Resistance	ohms	0.228	0.531	1.154	0.206	0.672	1.277	0.194	0.594	1.414
Terminal Inductance	mH	0.201	0.437	1.100	0.178	0.437	1.466	0.168	0.648	1.661
Motor Constant	oz-in/sq.rt.watt	2.70	2.51	2.70	3.39	3.72	3.84	3.81	4.31	4.48
	Nm/sq.rt.watt	0.019	0.018	0.019	0.024	0.026	0.027	0.027	0.030	0.032
Rotor Inertia	oz-in-sec ² x10 ⁻³	0.26	0.26	0.26	0.4	0.4	0.4	0.48	0.40	0.48
	g-cm ²	18.41	18.41	18.41	28.33	28.33	28.33	33.99	33.99	33.99
Weight	oz	7	7	7	10.4	10.4	10.3	13.7	13.6	13.7
	g	198	198	198	294	294	291	388	385	388
# of Poles		4	4	4	4	4	4	4	4	4
Timing		120°	120°	120°	120°	120°	120°	120°	120°	120°
Mech. Time Constant	ms	21.3	16	16	18.1	14.5	14.5	19.1	18.6	13.1
Electrical Time Constant	ms	0.20	0.18	0.67	0.18	0.42	0.61	0.40	0.98	0.90
Thermal Resistivity	deg. C/watt	2.95	3.95	3.93	1.86	2.86	3.14	1.77	2.18	2.64
Speed/Torque Gradient	rpm/oz-in	465	406	362	311	210	191	249	177	149

Notes:

- Motor mounted to a 4 x 4 x 1/4 inches aluminum plate, still air.
- Maximum winding temperature of 155°C.
- Typical electrical specifications at 25°C.
- Motor Terminal Voltages are representative only; motors may be operated at voltages other than those listed in the table. For assistance please contact our applications engineer.
- For MS (military style) connector, please specify connector housing and terminal.
- Data for informational purposes only. Should not be considered a binding performance agreement. For specific applications, please contact the factory.

*Many other custom mechanical options are available – consult factory.

**Many other winding options are available – consult factory.

Select your options below and place their code in its corresponding block as shown on page 4.

Termination

- L – Leads (std)
- C – Connector
- M – MS connector

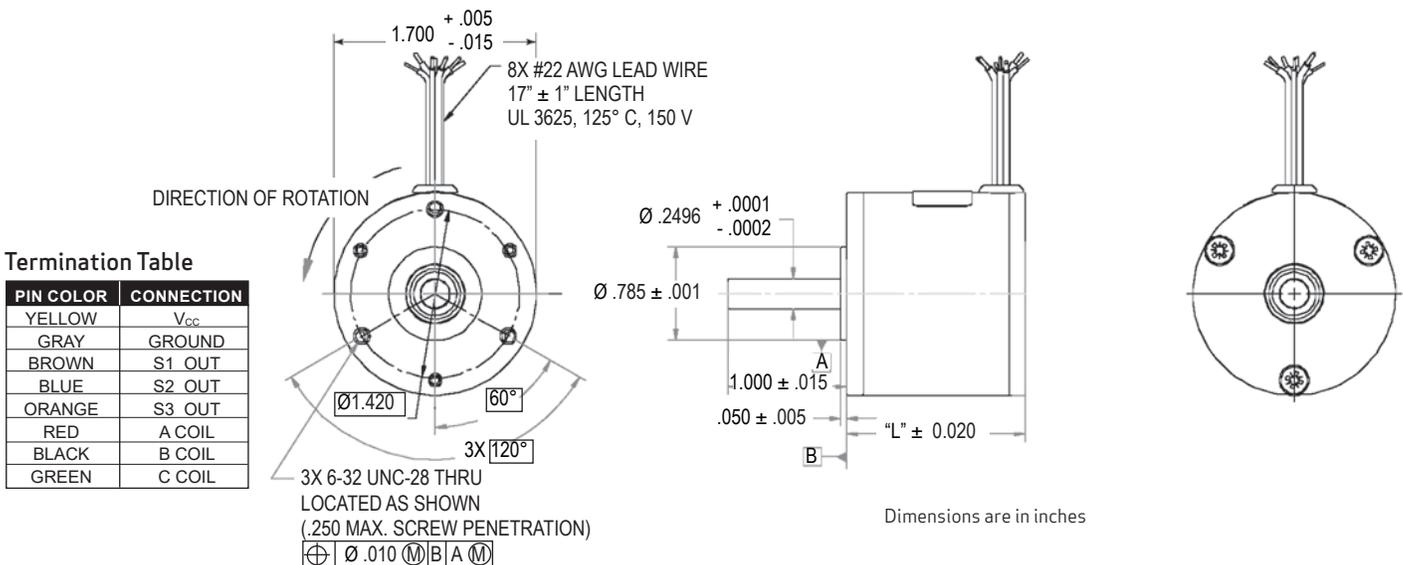
Feedback Options

- H – Hall Effect (std)
- R – Resolver
- S – Sensorless

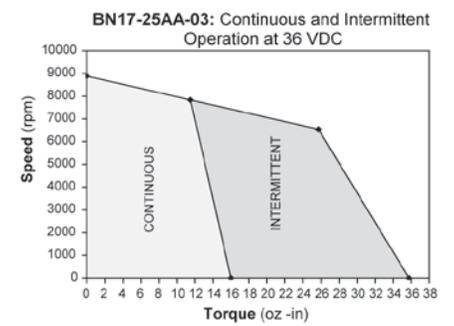
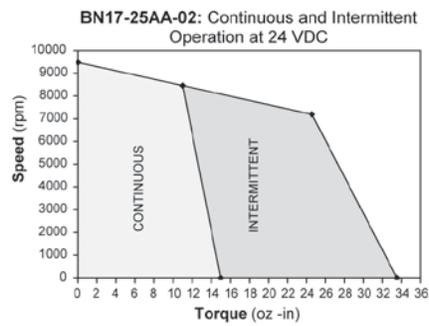
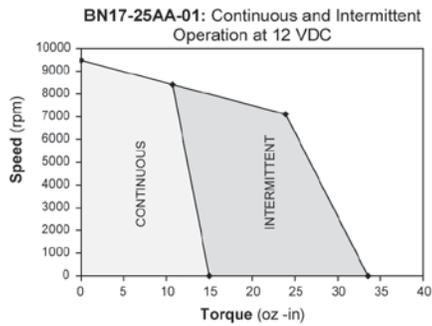
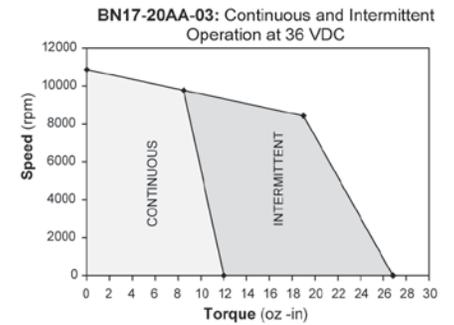
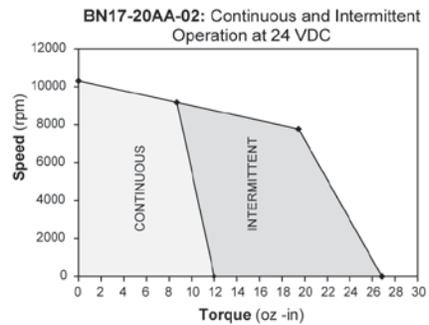
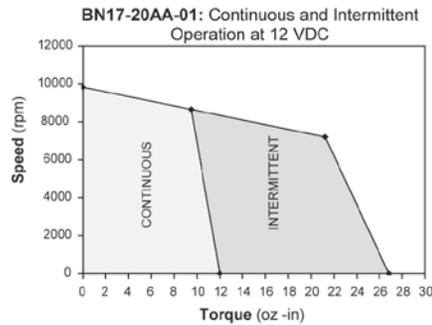
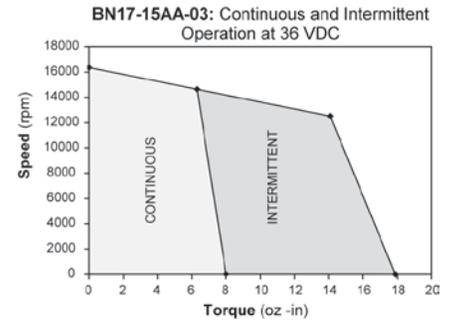
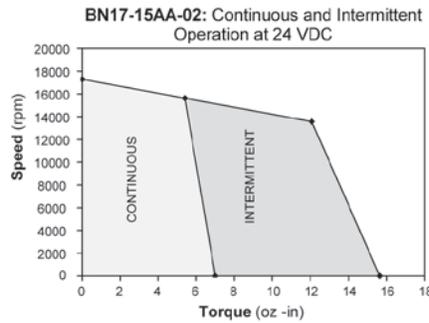
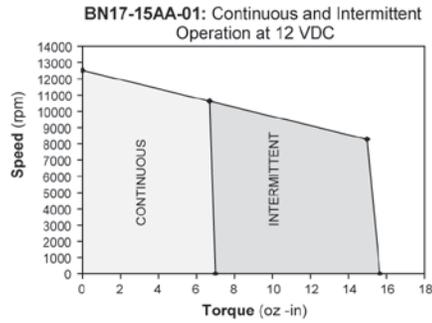
Other Options

- E – Encoder
- G – Gearhead

BN17 TYPICAL OUTLINE

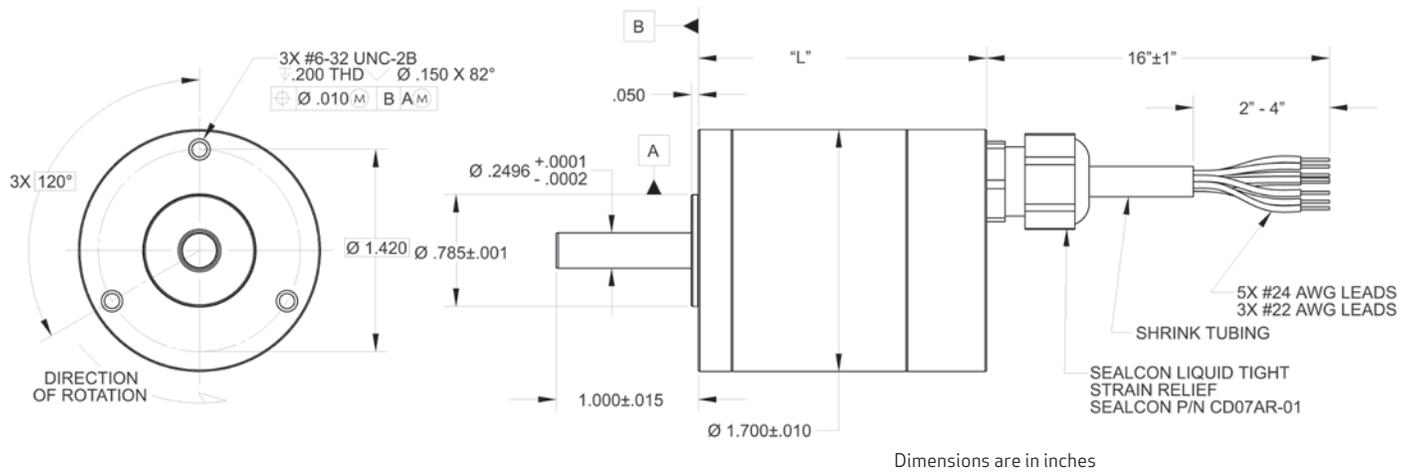


BN17 PERFORMANCE CURVES

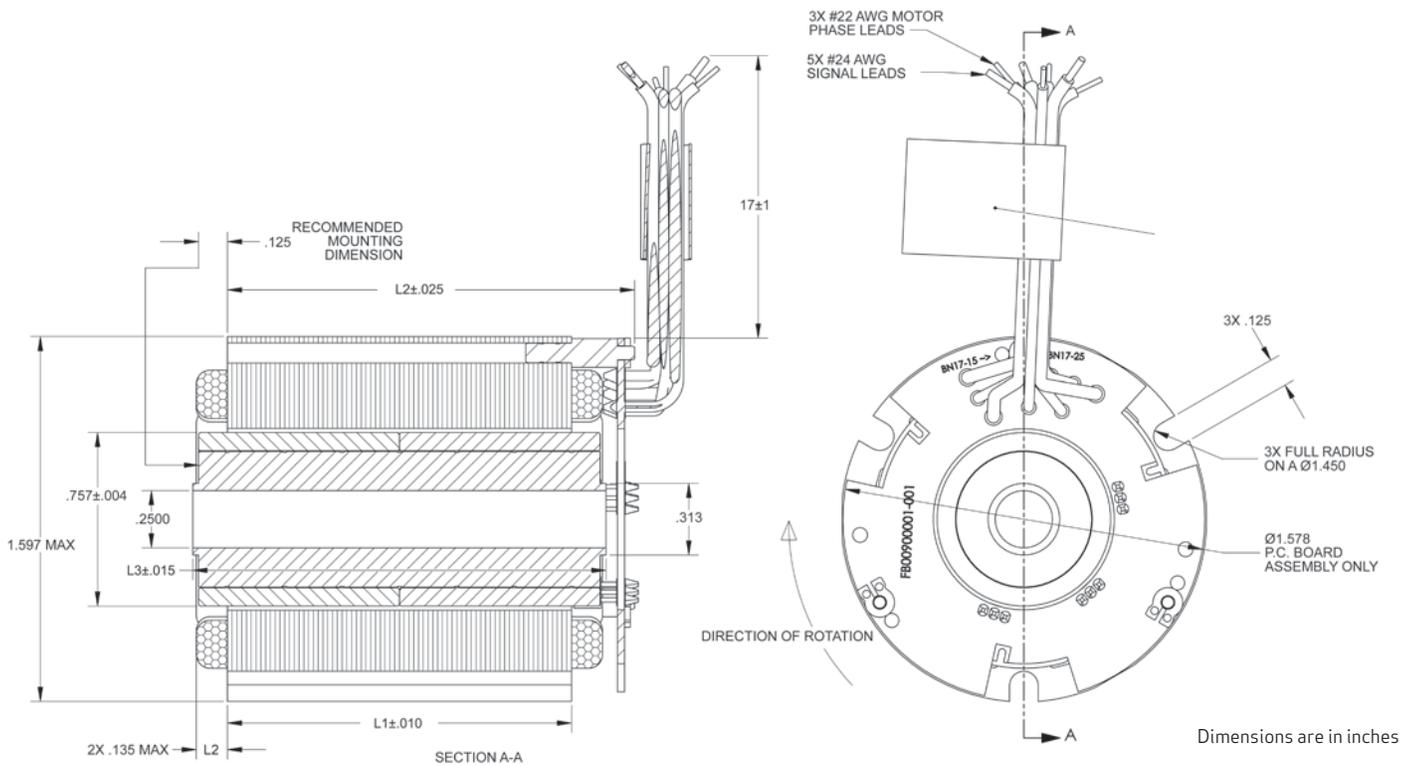


Note: Intermittent operation is based on a 20% duty cycle of one minute on, four minutes off. Please contact the factory regarding the duty cycle of your application.

BN17 IP65 TYPICAL OUTLINE - HOUSED



BN17 TYPICAL OUTLINE - FRAMELESS



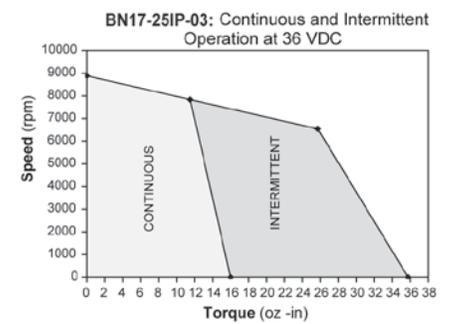
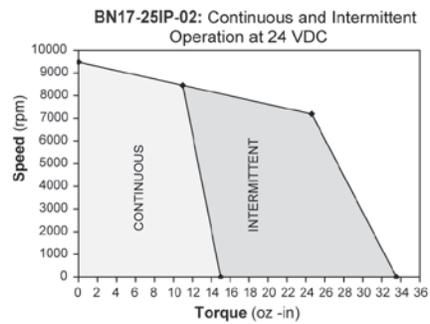
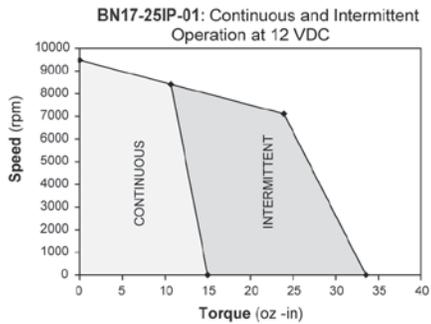
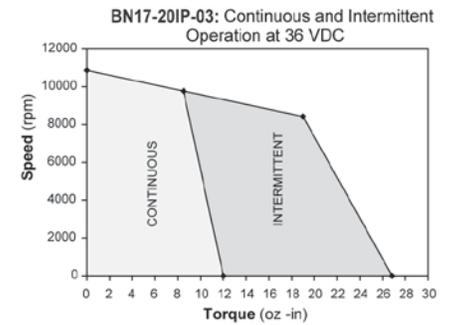
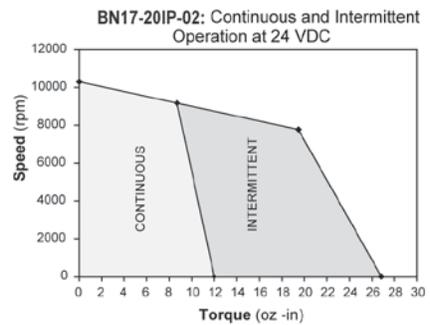
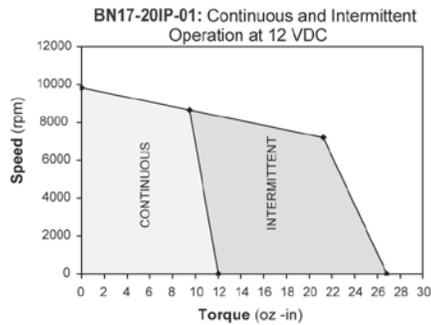
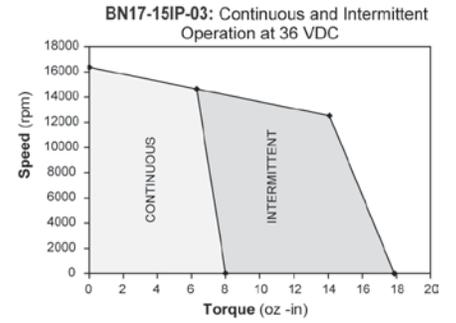
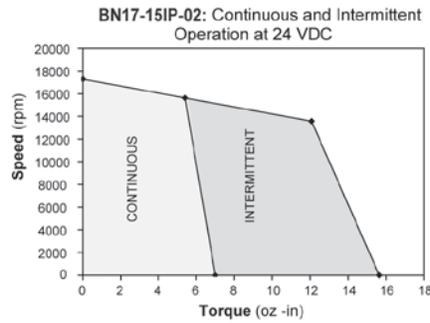
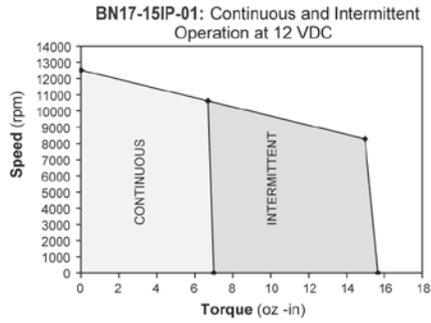
Termination Table

PIN COLOR	CONNECTION
YELLOW	V _{CC}
GRAY	GROUND
BROWN	S1_OUT
BLUE	S2_OUT
ORANGE	S3_OUT
RED	A COIL
BLACK	B COIL
GREEN	C COIL

PART NUMBER	L1	L2	L3
BN17-15ZA-XXLH	0.500	0.780	0.800
BN17-20ZA-XXLH	1.000	1.280	1.300
BN17-25ZA-XXLH	1.500	1.780	1.800

Note: For electrical performance see page 14.

BN17 IP65 PERFORMANCE CURVES



Note: Intermittent operation is based on a 20% duty cycle of one minute on, four minutes off. Please contact the factory regarding the duty cycle of your application.

BN23 SPECIFICATIONS

Continuous Stall Torque 14.6 - 54.3 oz-in (0.103 - 0.384 Nm) / Peak Torque 35 - 186 oz-in (0.2472 - 1.3134 Nm)

Part Number*		BN23-13MG- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN23-18MG- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN23-23MG- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN23-28MG- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Winding Code**		01	02	03	01	02	03	01	02	03	01	02	03
L = Length	inches	1.40			1.90			2.40			2.90		
	millimeters	35.6			48.3			60.9			73.7		
Terminal Voltage	volts DC	24	36	48	24	36	48	24	36	48	24	36	48
Peak Torque	oz-in	35	35	35	88	88	88	143	143	143	186	186	186
	Nm	0.2472	0.2472	0.2472	0.6214	0.6214	0.6214	1.0098	1.0098	1.0098	1.3134	1.3134	1.3134
Continuous Stall Torque	oz-in	14.6	17.7	14.2	30.7	31.4	35.2	42.8	44.7	42.9	50.4	54.3	53.2
	Nm	0.103	0.125	0.100	0.217	0.221	0.248	0.303	0.315	0.303	0.356	0.384	0.376
No-Load Speed		12,200	12,500	12,300	9,100	9,700	10,200	8,100	8,800	8,200	7,300	7,500	8,100
Rated Speed	RPM	8650	9060	9190	6460	7000	7130	6060	6700	6250	5340	5590	6140
	rad/sec	906	949	962	676	733	747	635	702	655	559	585	643
Rated Torque	oz-in	14.2	16.1	12.1	29.7	29.8	32.9	40.3	42.3	41.8	49.1	51.9	48.8
	Nm	0.100	0.114	0.085	0.210	0.210	0.232	0.285	0.299	0.295	0.347	0.366	0.345
Rated Current	Amps	5.80	4.30	2.38	7.75	5.43	4.88	9.47	7.44	5.00	10.45	7.66	5.85
Rated Power	watts	91	108	82	142	154	174	181	210	193	194	215	222
Torque Sensitivity	oz-in/amp	2.55	3.78	5.18	3.40	4.90	6.25	3.85	5.35	7.79	4.26	6.30	7.80
	Nm/amp	0.018	0.027	0.037	0.024	0.035	0.044	0.027	0.038	0.055	0.030	0.044	0.055
Back EMF	volts/KRPM	1.89	2.80	3.83	2.51	3.62	4.62	2.85	3.96	5.76	3.15	4.66	5.77
	volts/rad/sec	0.018	0.027	0.037	0.024	0.035	0.044	0.027	0.038	0.055	0.030	0.044	0.055
Terminal Resistance	ohms	0.465	0.939	1.890	0.246	0.507	0.800	0.178	0.347	0.715	0.181	0.366	0.576
Terminal Inductance	mH	0.350	0.758	1.53	0.275	0.580	0.930	0.220	0.420	0.900	0.230	0.490	0.770
Motor Constant	oz-in/sq.rt.watt	3.74	3.90	3.77	6.86	6.88	6.99	9.13	9.08	9.21	10.01	10.41	10.28
	Nm/sq.rt.watt	0.026	0.028	0.027	0.048	0.049	0.049	0.064	0.064	0.065	0.071	0.074	0.073
Rotor Inertia	oz-in-sec ² x10 ⁻³	0.51	0.51	0.51	0.99	0.99	0.99	1.5	1.5	1.5	1.9	1.9	1.9
	g-cm ²	36	36	36	70	70	70	106	106	106	134	134	134
Weight	oz	8.3	8.4	8.3	13.6	13.7	13.8	19.1	19.1	19.1	24.4	24.7	24.5
	g	234.0	238.0	234.0	386.0	389.0	391.0	542.0	542.0	542.0	693.0	699.0	694.0
# of Poles		8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Timing		120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°
Mech. Time Constant	ms	5.20	4.7	5.1	3.0	3.0	2.9	2.5	2.6	2.5	2.7	2.5	2.5
Electrical Time Constant	ms	0.75	0.81	0.81	1.12	1.14	1.16	1.24	1.21	1.26	1.27	1.34	1.34
Thermal Resistivity	deg. C/watt	2.28	2.34	3.44	2.49	2.67	1.81	2.36	1.89	2.35	1.93	1.80	1.86
Speed/Torque Gradient	rpm/oz-in	250.0	213.7	257.0	88.9	90.6	93.3	50.6	49.6	46.7	39.9	36.8	40.2

Notes:

- Motor mounted to a 6 x 6 x 1/4 inches aluminum plate, still air.
- Maximum winding temperature of 155°C.
- Typical electrical specifications at 25°C.
- Data shown for 8 pole motors. Please consult factory for 4 pole specifications.
- Motor Terminal Voltages are representative only; motors may be operated at voltages other than those listed in the table. For assistance please contact our applications engineer.
- For MS (military style) connector, please specify connector housing and terminal.
- Data for informational purposes only. Should not be considered a binding performance agreement. For specific applications, please contact the factory.

*Many other custom mechanical options are available – consult factory.

**Many other winding options are available – consult factory.

Select your options below and place their code in its corresponding block as shown on page 4.

Termination

- L – Leads (std)
- C – Connector
- M – MS connector

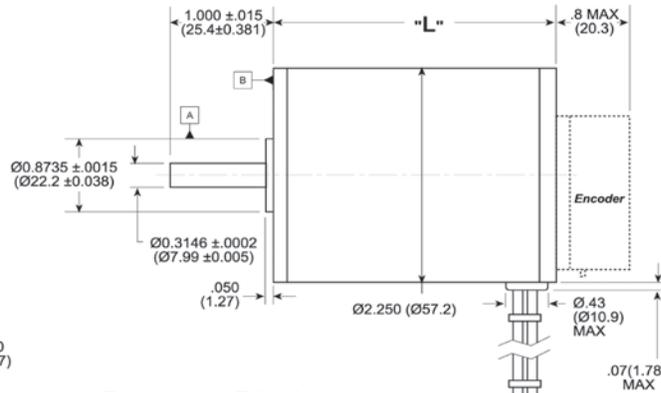
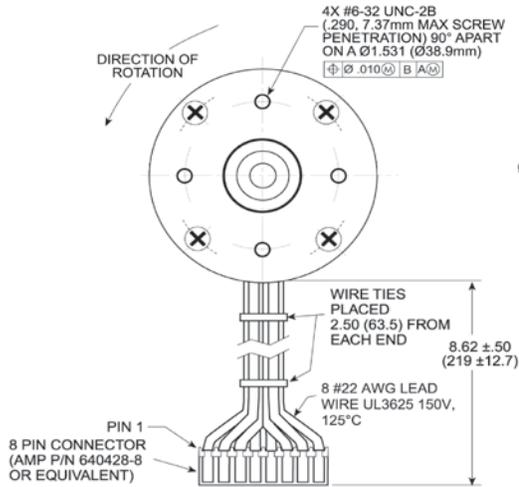
Feedback Options

- H – Hall Effect (std)
- R – Resolver
- S – Sensorless

Other Options

- E – Encoder
- G – Gearhead

BN23 TYPICAL OUTLINE - HOUSED



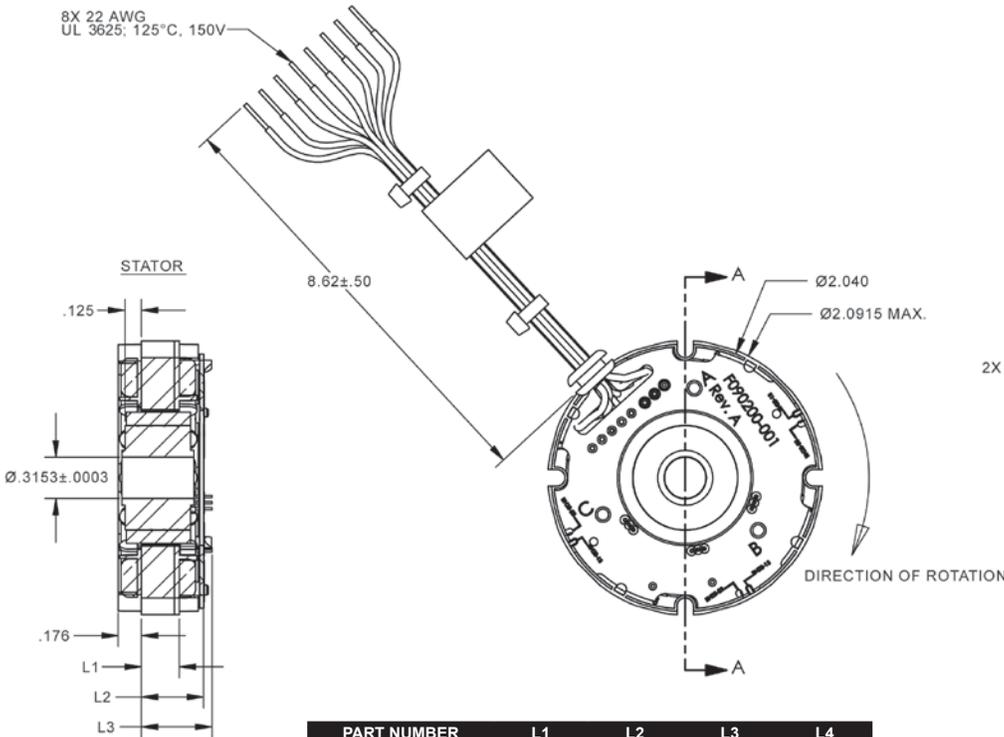
Termination Table*

PIN #	CONNECTION	WIRE COLOR
1	V _{CC}	Yellow or White / Yellow
2	GROUND	White / Gray
3	A COIL	White / Violet
4	B COIL	White / Black
5	C COIL	Green
6	S2 OUT	White / Blue
7	S1 OUT	White / Brown
8	S3 OUT	White

Dimensions are in inches (millimeters)

*We reserve the right to use solid color wires or white wires with color trace.

BN23 TYPICAL OUTLINE - FRAMELESS

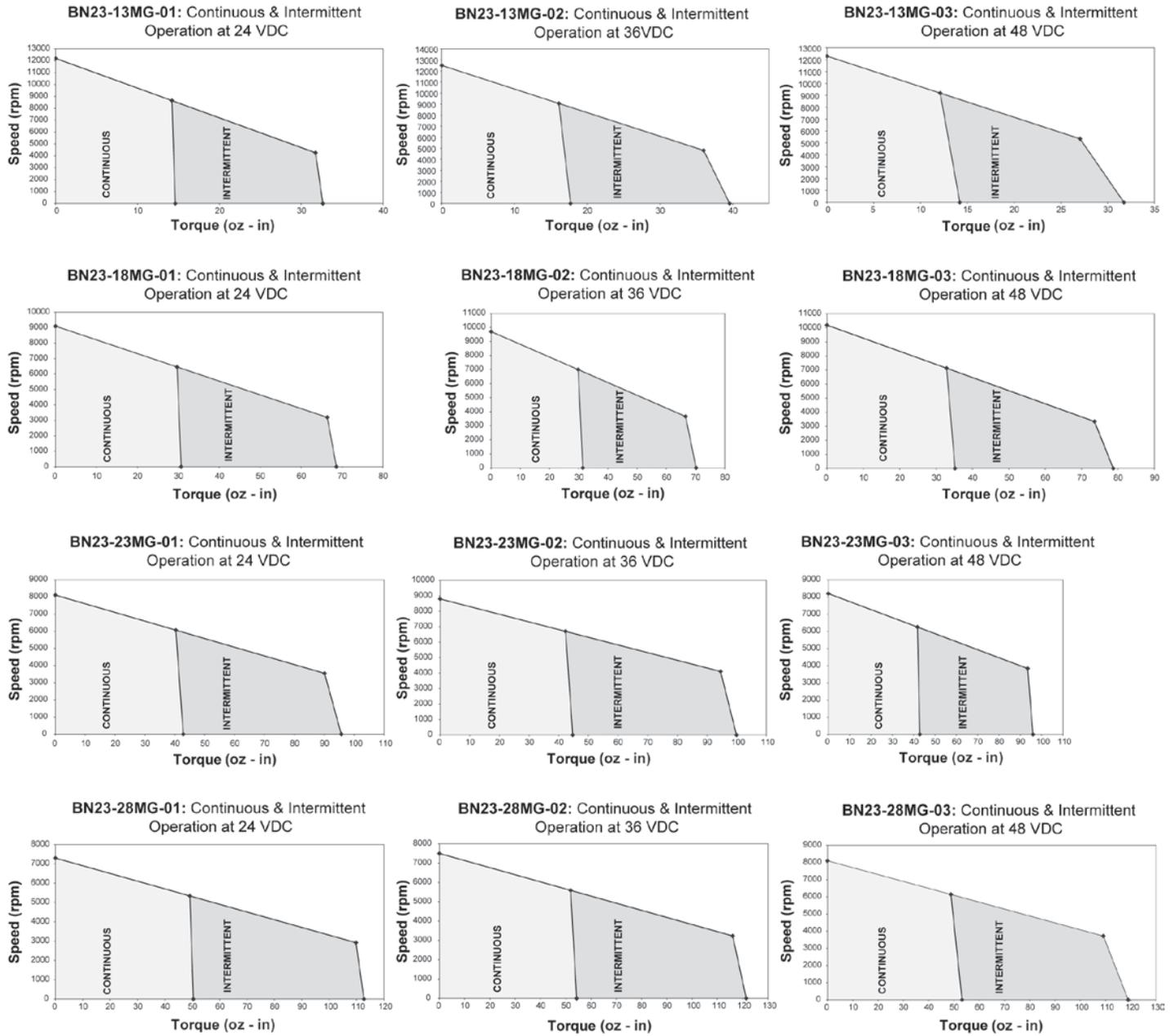


PART NUMBER	L1	L2	L3	L4
BN23-13ZMG-XXLH	0.288	0.474	0.550	0.550
BN23-18ZMG-XXLH	0.788	0.974	1.050	1.050
BN23-23ZMG-XXLH	1.288	1.470	1.550	1.550
BN23-28ZMG-XXLH	1.788	1.970	2.050	2.050

Note: For electrical performance see page 17.

Dimensions are in inches

BN23 PERFORMANCE CURVES



Note: Intermittent operation is based on a 20% duty cycle of one minute on, four minutes off. Please contact the factory regarding the duty cycle of your application.

BN23 EU SPECIFICATIONS

Continuous Stall Torque 14.6 - 54.3 oz-in (0.103 - 0.384 Nm) / Peak Torque 35 - 186 oz-in (0.2472 - 1.3134 Nm)

Part Number*		BN23-13EU- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN23-18EU- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN23-23EU- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN23-28EU- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Winding Code**		01	02	03	01	02	03	01	02	03	01	02	03
L = Length	inches	1.40			1.90			2.40			2.90		
	millimeters	35.6			48.3			60.9			73.7		
Terminal Voltage	volts DC	24	36	48	24	36	48	24	36	48	24	36	48
Peak Torque	oz-in	35	35	35	88	88	88	143	143	143	186	186	186
	Nm	0.2472	0.2472	0.2472	0.6214	0.6214	0.6214	1.0098	1.0098	1.0098	1.3134	1.3134	1.3134
Continuous Stall Torque	oz-in	14.6	17.7	14.2	30.7	31.4	35.2	42.8	44.7	42.9	50.4	54.3	53.2
	Nm	0.103	0.125	0.100	0.217	0.221	0.248	0.303	0.315	0.303	0.356	0.384	0.376
No-Load Speed		12,200	12,500	12,300	9,100	9,700	10,200	8,100	8,800	8,200	7,300	7,500	8,100
Rated Speed	RPM	8650	9060	9190	6460	7000	7130	6060	6700	6250	5340	5590	6140
	rad/sec	906	949	962	676	733	747	635	702	655	559	585	643
Rated Torque	oz-in	14.2	16.1	12.1	29.7	29.8	32.9	40.3	42.3	41.8	49.1	51.9	48.8
	Nm	0.100	0.114	0.085	0.210	0.210	0.232	0.285	0.299	0.295	0.347	0.366	0.345
Rated Current	Amps	5.80	4.30	2.38	7.75	5.43	4.88	9.47	7.44	5.00	10.45	7.66	5.85
Rated Power	watts	91	108	82	142	154	174	181	210	193	194	215	222
Torque Sensitivity	oz-in/amp	2.55	3.78	5.18	3.40	4.90	6.25	3.85	5.35	7.79	4.26	6.30	7.80
	Nm/amp	0.018	0.027	0.037	0.024	0.035	0.044	0.027	0.038	0.055	0.030	0.044	0.055
Back EMF	volts/KRPM	1.89	2.80	3.83	2.51	3.62	4.62	2.85	3.96	5.76	3.15	4.66	5.77
	volts/rad/sec	0.018	0.027	0.037	0.024	0.035	0.044	0.027	0.038	0.055	0.030	0.044	0.055
Terminal Resistance	ohms	0.465	0.939	1.890	0.246	0.507	0.800	0.178	0.347	0.715	0.181	0.366	0.576
Terminal Inductance	mH	0.350	0.758	1.53	0.275	0.580	0.930	0.220	0.420	0.900	0.230	0.490	0.770
Motor Constant	oz-in/sq.rt.watt	3.74	3.90	3.77	6.86	6.88	6.99	9.13	9.08	9.21	10.01	10.41	10.28
	Nm/sq.rt.watt	0.026	0.028	0.027	0.048	0.049	0.049	0.064	0.064	0.065	0.071	0.074	0.073
Rotor Inertia	oz-in-sec ² x10 ⁻³	0.51	0.51	0.51	0.99	0.99	0.99	1.5	1.5	1.5	1.9	1.9	1.9
	g-cm ²	36	36	36	70	70	70	106	106	106	134	134	134
Weight	oz	8.3	8.4	8.3	13.6	13.7	13.8	19.1	19.1	19.1	24.4	24.7	24.5
	g	234.0	238.0	234.0	386.0	389.0	391.0	542.0	542.0	542.0	693.0	699.0	694.0
# of Poles		8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Timing		120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°
Mech. Time Constant	ms	5.20	4.7	5.1	3.0	3.0	2.9	2.5	2.6	2.5	2.7	2.5	2.5
Electrical Time Constant	ms	0.75	0.81	0.81	1.12	1.14	1.16	1.24	1.21	1.26	1.27	1.34	1.34
Thermal Resistivity	deg. C/watt	2.28	2.34	3.44	2.49	2.67	1.81	2.36	1.89	2.35	1.93	1.80	1.86
Speed/Torque Gradient	rpm/oz-in	250.0	213.7	257.0	88.9	90.6	93.3	50.6	49.6	46.7	39.9	36.8	40.2

Notes:

- Motor mounted to a 6" x 6" x 1/4" aluminum plate, still air.
- Maximum winding temperature of 155°C.
- Typical electrical specifications at 25°C.
- Data shown for 8 pole motors. Please consult factory for 4 pole specifications.
- Motor Terminal Voltages are representative only; motors may be operated at voltages other than those listed in the table. For assistance please contact our applications engineer.
- For MS (military style) connector, please specify connector housing and terminal.
- Data for informational purposes only. Should not be considered a binding performance agreement. For specific applications, please contact the factory.

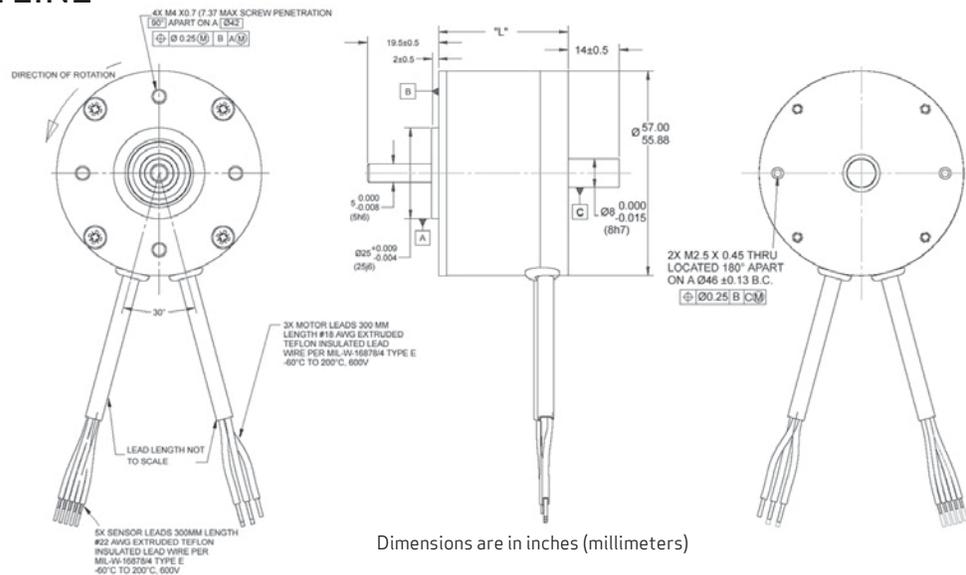
*Many other custom mechanical options are available – consult factory.

**Many other winding options are available – consult factory.

Select your options below and place their code in its corresponding block as shown on page 4.

- | | | |
|--|---|--|
| <input checked="" type="checkbox"/> Termination | <input checked="" type="checkbox"/> Feedback Options | <input checked="" type="checkbox"/> Other Options |
| L – Leads (std) | H – Hall Effect (std) | E – Encoder |
| C – Connector | R – Resolver | G – Gearhead |
| M – MS connector | S – Sensorless | |

BN23 EU TYPICAL OUTLINE

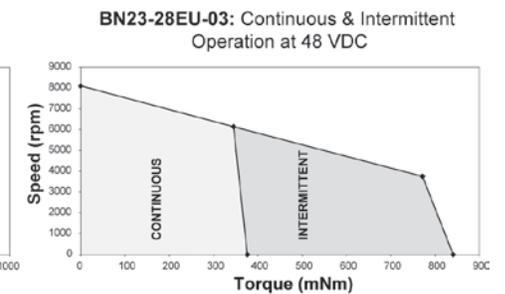
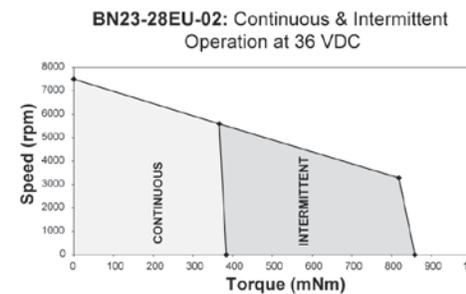
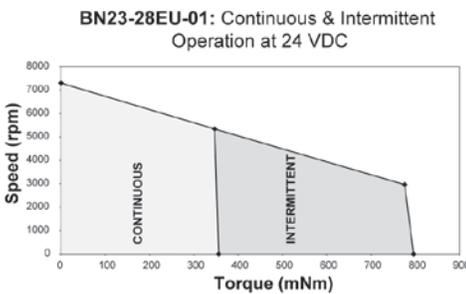
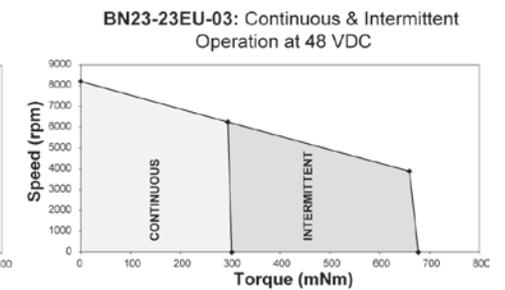
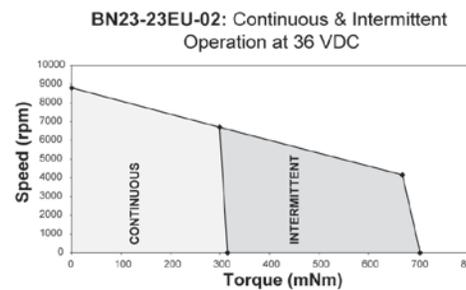
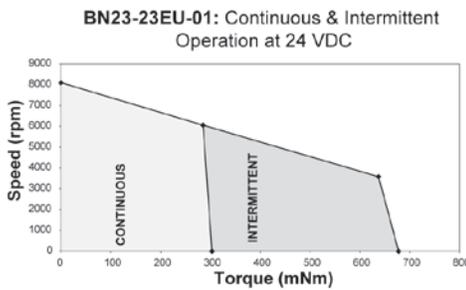
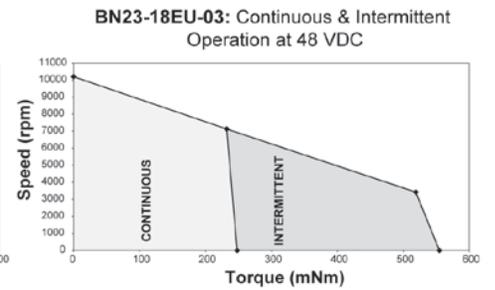
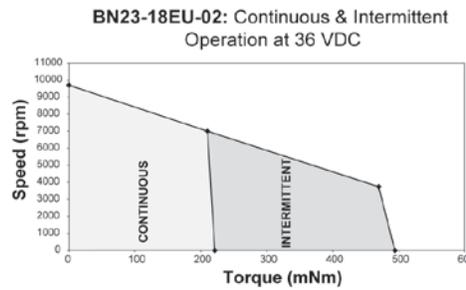
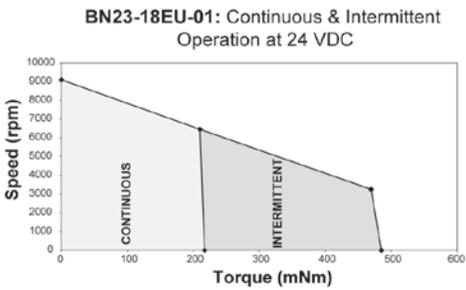
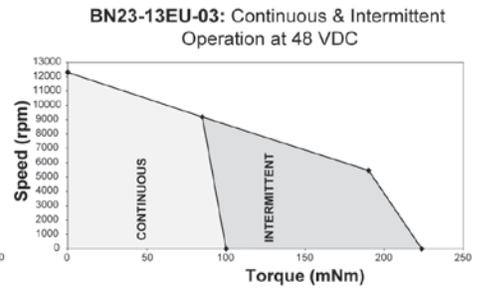
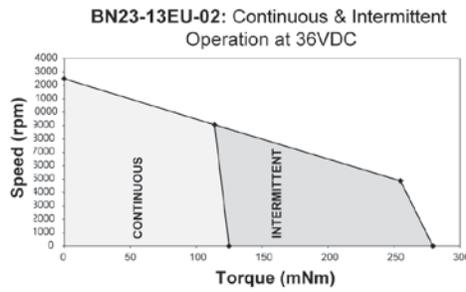
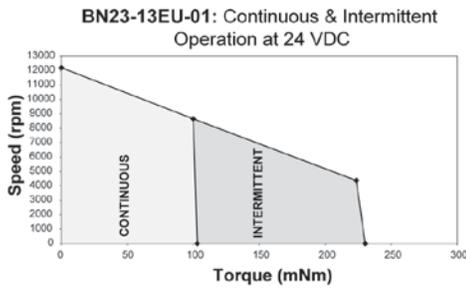


Termination Table*

COLOR	CONNECTION
VIOLET	A COIL
GREEN	C COIL
BLACK	B COIL
GRAY	HALL GND
YELLOW	HALL V _{CC}
WHITE	HALL S3
BLUE	HALL S2
BROWN	HALL S1

*We reserve the right to use solid color wires or white wires with color trace.

BN23 EU PERFORMANCE CURVES



S/T Gradient = 35.4 rpm/mNm

Note: Intermittent operation is based on a 20% duty cycle of one minute on, four minutes off. Please contact the factory regarding the duty cycle of your application.

BN23 IP65 SPECIFICATIONS

Continuous Stall Torque 12.6 - 41 oz-in (0.0890 - 0.290 Nm) / Peak Torque 35 - 186 oz-in (0.248 - 1.32 Nm)

Part Number*		BN23-13IP- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN23-18IP- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN23-23IP- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN23-28IP- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Winding Code**		01	02	03	01	02	03	01	02	03	01	02	03
L = Length	inches	2.43			2.93			3.43			3.93		
	millimeters	61.72			74.42			87.12			99.82		
Terminal Voltage	volts DC	24	36	48	24	36	48	24	36	48	24	36	48
Peak Torque	oz-in	35	35	35	88	88	88	143	143	143	186	186	186
	Nm	0.2472	0.2472	0.2472	0.6214	0.6214	0.6214	1.0098	1.0098	1.0098	1.3134	1.3134	1.3134
Continuous Stall Torque	oz-in	14.6	17.7	14.2	30.7	31.4	35.2	42.8	44.7	42.9	50.4	54.3	53.2
	Nm	0.103	0.125	0.100	0.217	0.221	0.248	0.303	0.315	0.303	0.356	0.384	0.376
No-Load Speed		12,200	12,500	12,300	9,100	9,700	10,200	8,100	8,800	8,200	7,300	7,500	8,100
Rated Speed	RPM	8650	9060	9190	6460	7000	7130	6060	6700	6250	5340	5590	6140
	rad/sec	906	949	962	676	733	747	635	702	655	559	585	643
Rated Torque	oz-in	14.2	16.1	12.1	29.7	29.8	32.9	40.3	42.3	41.8	49.1	51.9	48.8
	Nm	0.100	0.114	0.085	0.210	0.210	0.232	0.285	0.299	0.295	0.347	0.366	0.345
Rated Current	Amps	5.80	4.30	2.38	7.75	5.43	4.88	9.47	7.44	5.00	10.45	7.66	5.85
Rated Power	watts	91	108	82	142	154	174	181	210	193	194	215	222
Torque Sensitivity	oz-in/amp	2.55	3.78	5.18	3.40	4.90	6.25	3.85	5.35	7.79	4.26	6.30	7.80
	Nm/amp	0.018	0.027	0.037	0.024	0.035	0.044	0.027	0.038	0.055	0.030	0.044	0.055
Back EMF	volts/KRPM	1.89	2.80	3.83	2.51	3.62	4.62	2.85	3.96	5.76	3.15	4.66	5.77
	volts/rad/sec	0.018	0.027	0.037	0.024	0.035	0.044	0.027	0.038	0.055	0.030	0.044	0.055
Terminal Resistance	ohms	0.465	0.939	1.890	0.246	0.507	0.800	0.178	0.347	0.715	0.181	0.366	0.576
Terminal Inductance	mH	0.350	0.758	1.53	0.275	0.580	0.930	0.220	0.420	0.900	0.230	0.490	0.770
Motor Constant	oz-in/sq.rt.watt	3.74	3.90	3.77	6.86	6.88	6.99	9.13	9.08	9.21	10.01	10.41	10.28
	Nm/sq.rt.watt	0.026	0.028	0.027	0.048	0.049	0.049	0.064	0.064	0.065	0.071	0.074	0.073
Rotor Inertia	oz-in-sec ² x10 ⁻³	0.51	0.51	0.51	0.99	0.99	0.99	1.5	1.5	1.5	1.9	1.9	1.9
	g-cm ²	36	36	36	70	70	70	106	106	106	134	134	134
Weight	oz	8.3	8.4	8.3	13.6	13.7	13.8	19.1	19.1	19.1	24.4	24.7	24.5
	g	234.0	238.0	234.0	386.0	389.0	391.0	542.0	542.0	542.0	693.0	699.0	694.0
# of Poles		8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Timing		120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°
Mech. Time Constant	ms	5.20	4.7	5.1	3.0	3.0	2.9	2.5	2.6	2.5	2.7	2.5	2.5
Electrical Time Constant	ms	0.75	0.81	0.81	1.12	1.14	1.16	1.24	1.21	1.26	1.27	1.34	1.34
Thermal Resistivity	deg. C/watt	2.28	2.34	3.44	2.49	2.67	1.81	2.36	1.89	2.35	1.93	1.80	1.86
Speed/Torque Gradient	rpm/oz-in	250.0	213.7	257.0	88.9	90.6	93.3	50.6	49.6	46.7	39.9	36.8	40.2

Notes:

- Motor mounted to a 6" x 6" x 1/4" aluminum plate, still air.
- Maximum winding temperature of 155°C.
- Typical electrical specifications at 25°C.
- Motor Terminal Voltages are representative only; motors may be operated at voltages other than those listed in the table. For assistance please contact our applications engineer.
- Calculated (theoretical) speed/torque gradient.
- For MS (military style) connector, please specify connector housing and terminal.
- Data for informational purposes only. Should not be considered a binding performance agreement. For specific applications, please contact the factory.

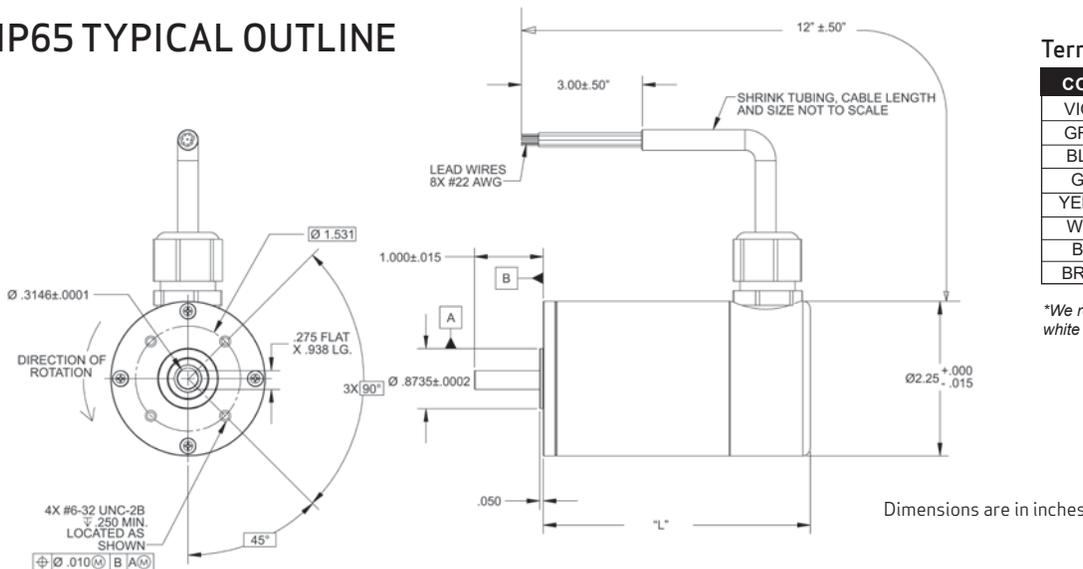
*Many other custom mechanical options are available – consult factory.

**Many other winding options are available – consult factory.

Select your options below and place their code in its corresponding block as shown on page 4.

- Termination**
 - Leads (std)
 C – Connector
 M – MS connector
- Feedback Options**
 H – Hall Effect (std)
- Other Options**
 G – Gearhead

BN23 IP65 TYPICAL OUTLINE

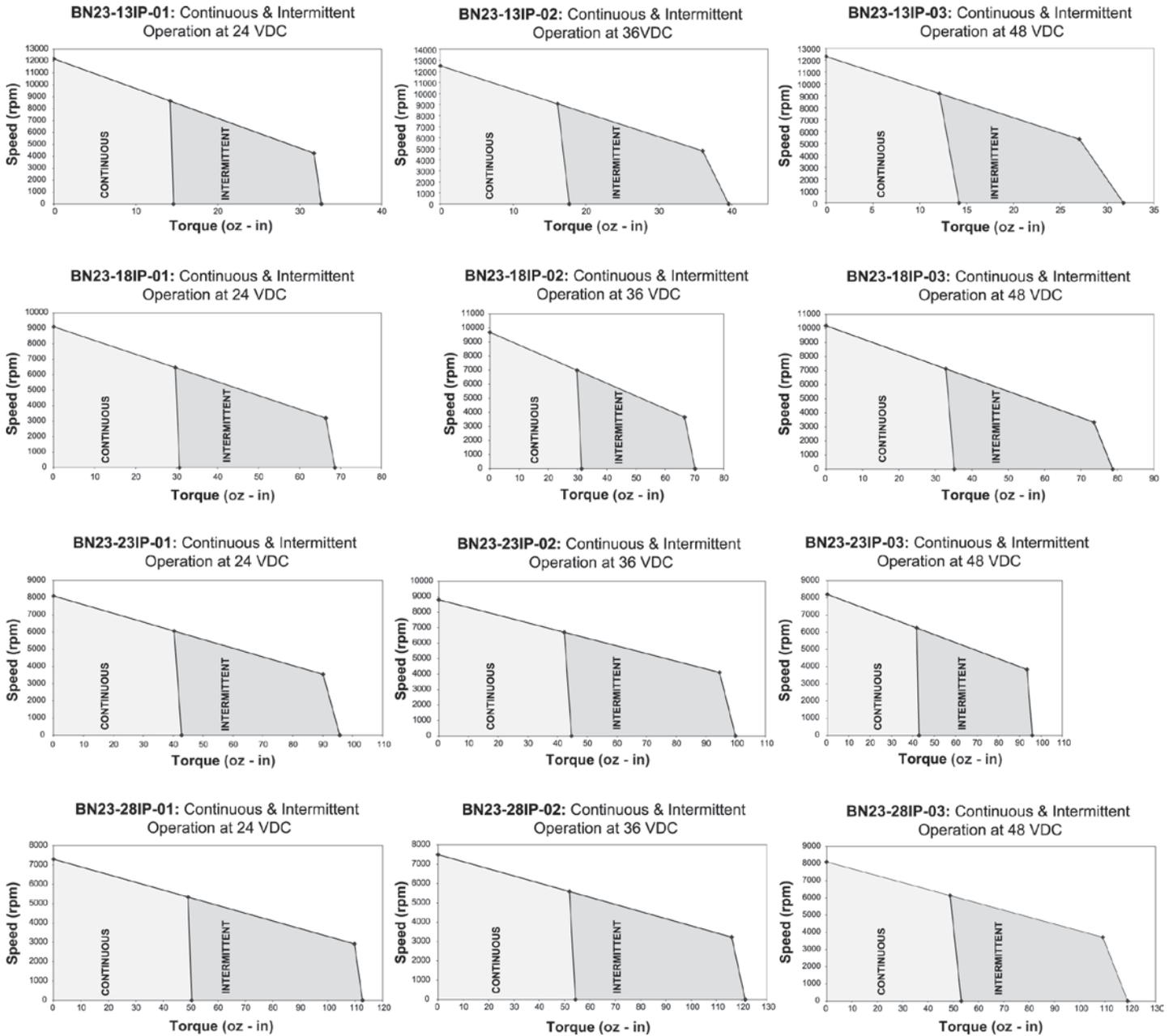


Termination Table*

COLOR	CONNECTION
VIOLET	A COIL
GREEN	C COIL
BLACK	B COIL
GRAY	HALL GND
YELLOW	HALL V _{CC}
WHITE	HALL S3
BLUE	HALL S2
BROWN	HALL S1

*We reserve the right to use solid color wires or white wires with color trace.

BN23 IP65 PERFORMANCE CURVES



Note: Intermittent operation is based on a 20% duty cycle of one minute on, four minutes off.
Please contact the factory regarding the duty cycle of your application.

BN28 SPECIFICATIONS

Continuous Stall Torque 43 - 108 oz-in (0.30 - 0.76 Nm) / Peak Torque 188 - 737 oz-in (1.33 - 5.2 Nm)

Part Number*		BN28-21AF- <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN28-29AF- <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN28-36AF- <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN28-44AF- <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Winding Code**		01	02	03	01	02	03	01	02	03	01	02	03
L = Length	inches	2.10			2.90			3.60			4.40		
	millimeters	53.3			73.7			91.4			111.8		
Terminal Voltage	volts DC	24.0	48.0	72.0	24.0	48.0	72.0	24.0	48.0	72.0	24.0	48.0	72.0
Peak Torque	oz-in	188.0	188.0	188.0	407.0	407.0	407.0	596.0	596.0	596.0	737.0	737.0	737.0
	Nm	1.3276	1.3276	1.3276	2.8740	2.8740	2.8740	4.2087	4.2087	4.2087	5.2043	5.2043	5.2043
Continuous Stall Torque	oz-in	43.0	44.0	46.0	71.0	74.0	72.0	93.0	95.0	93.0	106.0	108.0	105.0
	Nm	0.3036	0.3107	0.3248	0.5014	0.5226	0.5084	0.6567	0.6708	0.6567	0.7485	0.7626	0.7415
Rated Speed	RPM	9170	9230	9240	8870	8900	7890	5890	5910	5230	4660	4680	4120
	rad/sec	960	967	968	929	932	826	617	619	548	488	490	431
Rated Torque	oz-in	31	31	33	40	40	46	68	70	72	84	84	86
	Nm	0.2189	0.2189	0.2330	0.2825	0.2825	0.3248	0.4802	0.4943	0.5084	0.5932	0.5932	0.6073
Rated Current	Amps	10.26	5.13	3.63	12.67	6.33	4.29	14.31	7.35	4.51	14.25	7.13	4.35
Rated Power	watts	210.3	211.6	225.5	262.4	263.3	268.4	296.2	306.0	278.5	289.5	290.8	262.1
Torque Sensitivity	oz-in/amp	3.24	6.49	9.73	3.48	6.95	11.59	5.07	10.13	16.89	6.25	12.50	20.84
	Nm/amp	0.0229	0.0458	0.0687	0.0246	0.0491	0.0818	0.0358	0.0715	0.1193	0.0441	0.0883	0.1472
Back EMF	volts/KRPM	2.40	4.80	7.20	2.57	5.14	8.57	3.75	7.49	12.49	6.79	9.24	15.41
	volts/rad/sec	0.0229	0.0458	0.0687	0.0246	0.0491	0.0818	0.0358	0.0715	0.1193	0.048	0.0883	0.1472
Terminal Resistance	ohms	0.14	0.51	1.08	0.087	0.25	0.72	0.10	0.36	1.05	0.147	0.47	1.38
Terminal Inductance	mH	0.18	0.72	1.62	0.11	0.43	1.19	0.17	0.69	1.92	0.24	0.97	2.69
Motor Constant	oz-in/sq.rt.watt	8.72	9.06	9.38	13.44	13.93	13.69	16.45	16.86	16.49	17.82	18.18	17.73
	Nm/sq.rt.watt	0.062	0.064	0.066	0.095	0.098	0.097	0.116	0.119	0.11645	0.12584	0.12835	0.12518
Rotor Inertia	oz-in-sec ² x10 ⁻³	2.30	2.30	2.30	4.40	4.40	4.40	6.60	6.60	6.60	8.80	8.80	8.80
	g-cm ²	162.3	162.3	162.3	310.5	310.5	310.5	465.8	465.8	465.8	621.0	621.0	621.0
Weight	oz	23.0	23.0	23.0	35.0	35.0	35.0	48.0	48.0	48.0	61.0	61.0	61.0
	g	653.2	653.2	653.2	994.0	994.0	994.0	1363.2	1363.2	1363.2	1732.4	1732.4	1732.4
# of Poles		8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Timing		120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°
Mech. Time Constant	ms	4.3	4.0	3.7	3.4	3.2	3.3	3.5	3.3	3.4	3.9	3.8	4.0
Electrical Time Constant	ms	1.30	1.40	1.51	1.64	1.73	1.66	1.79	1.91	1.83	1.95	2.05	1.95
Thermal Resistivity	deg. C/watt	2.9	3.0	2.9	2.5	2.6	2.6	2.2	2.2	2.3	2.0	2.0	2.1
Speed/Torque Gradient	rpm/oz-in	47	47	47	25	25	25	20	20	20	13	13	13

Notes:

- Motor mounted to a 10 x 10 x 1/4 inches aluminum plate, still air.
- Maximum winding temperature of 155°C.
- Typical electrical specifications at 25°C.
- Motor Terminal Voltages are representative only; motors may be operated at voltages other than those listed in the table. For assistance please contact our applications engineer.
- For MS (military style) connector, please specify connector housing and terminal.
- Data for informational purposes only. Should not be considered a binding performance agreement. For specific applications, please contact the factory.

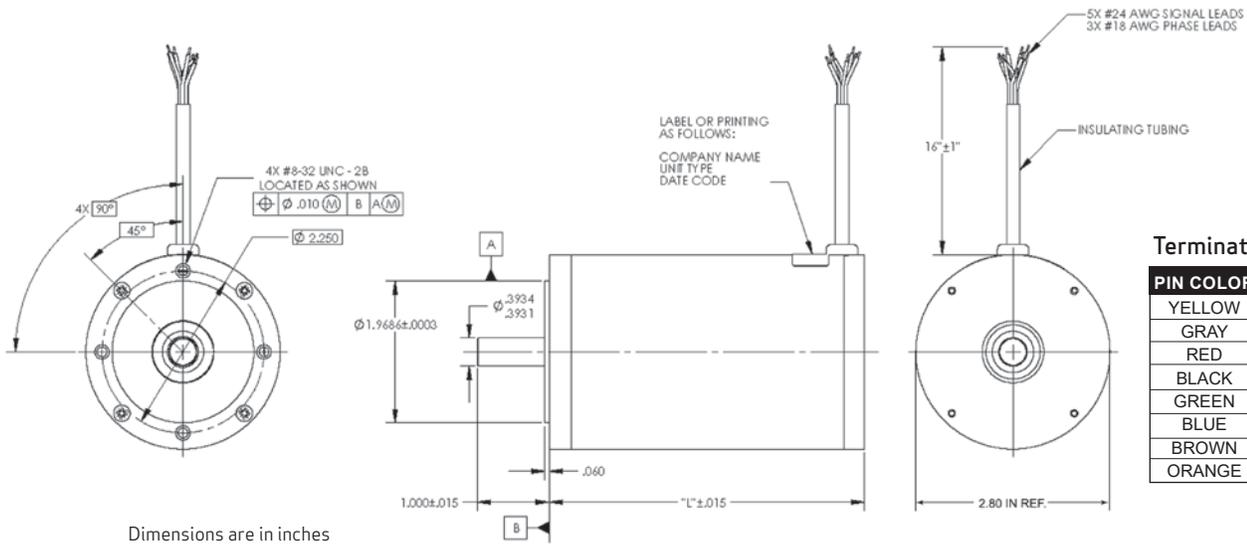
*Many other custom mechanical options are available – consult factory.

**Many other winding options are available – consult factory.

Select your options below and place their code in its corresponding block as shown on page 4.

- | | | |
|--|---|--|
| <input checked="" type="checkbox"/> Termination | <input checked="" type="checkbox"/> Feedback Options | <input checked="" type="checkbox"/> Other Options |
| L – Leads (std) | H – Hall Effect (std) | E – Encoder |
| C – Connector | R – Resolver | G – Gearhead |
| M – MS connector | S – Sensorless | |

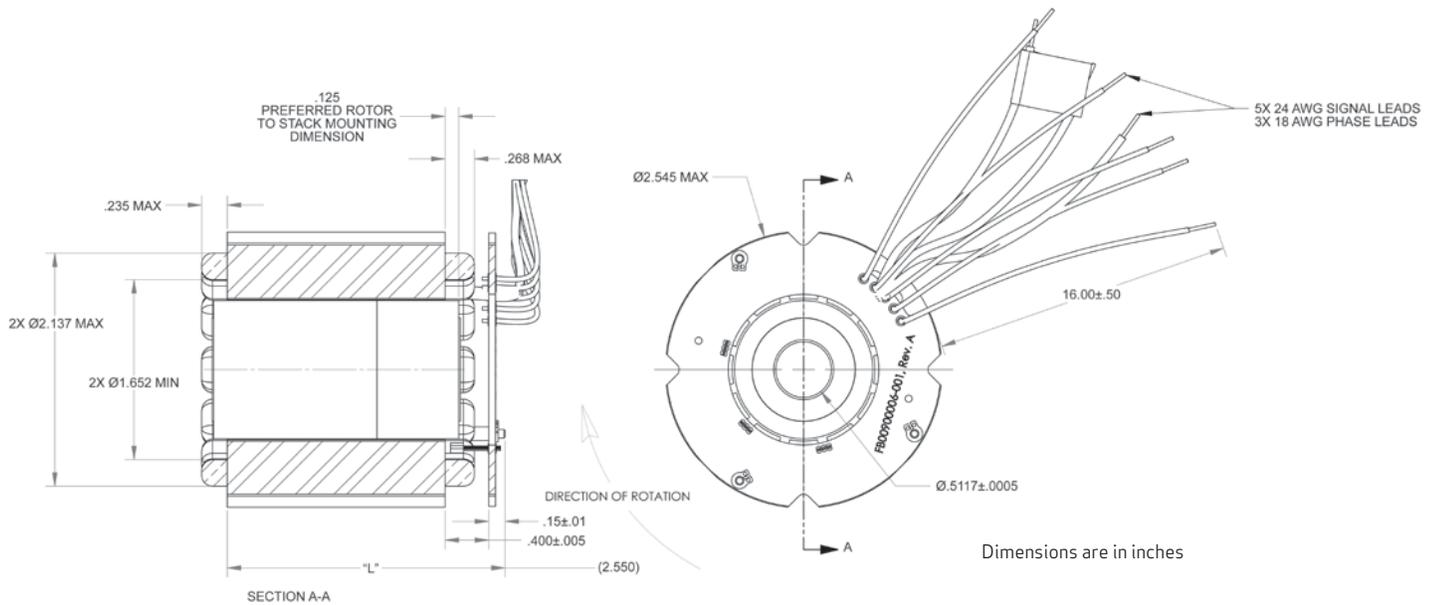
BN28 TYPICAL OUTLINE - HOUSED



Termination Table

PIN COLOR	CONNECTION
YELLOW	Vcc
GRAY	GROUND
RED	A COIL
BLACK	B COIL
GREEN	C COIL
BLUE	S2 OUT
BROWN	S1 OUT
ORANGE	S3 OUT

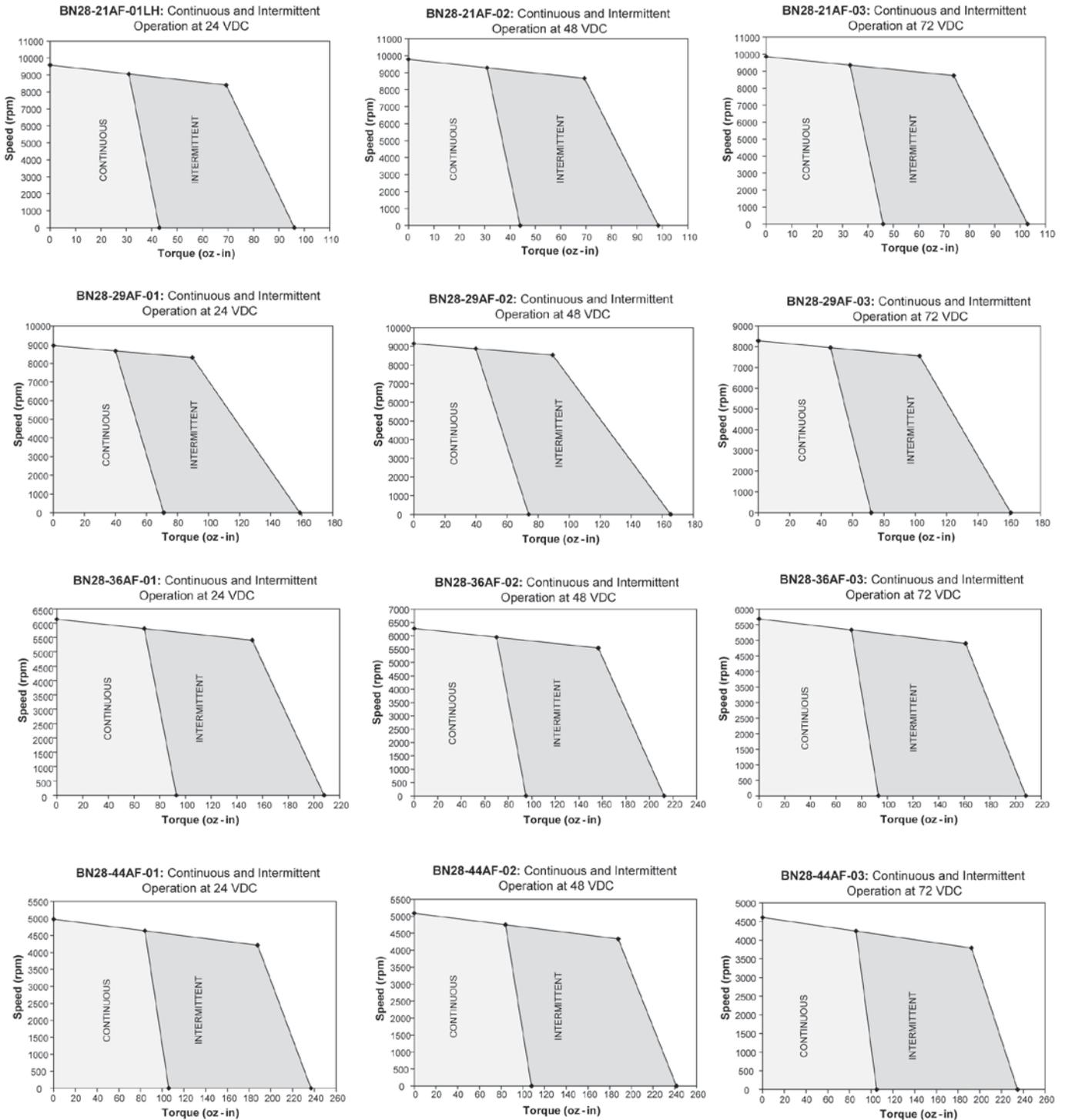
BN28 TYPICAL OUTLINE - FRAMELESS



PART NUMBER	"L"
BN28-21ZP-XXLH	1.050
BN28-29ZP-XXLH	1.80
BN28-36ZP-XXLH	2.550
BN28-44ZP-XXLH	3.300

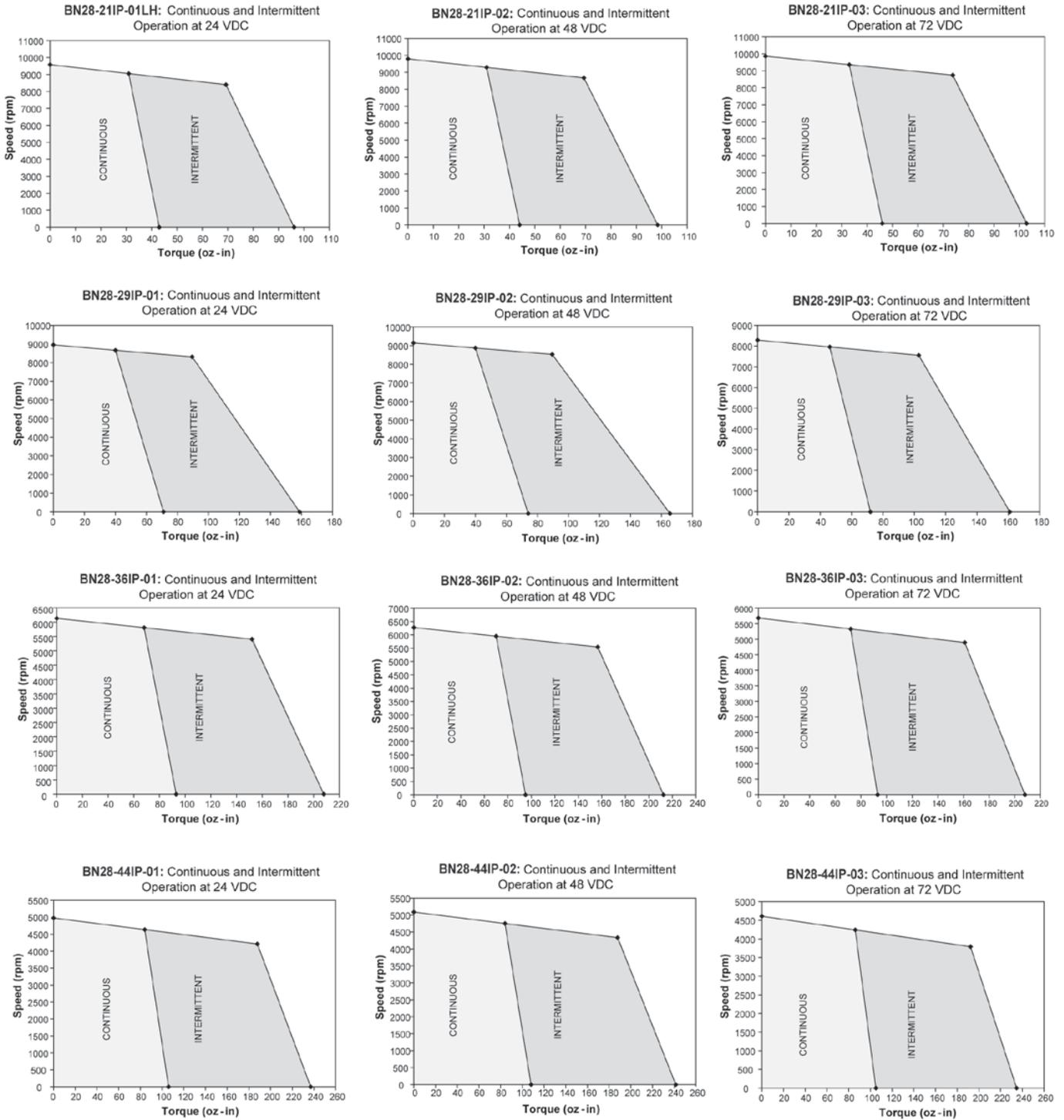
Note: For electrical performance see page 24.

BN28 PERFORMANCE CURVES



Note: Intermittent operation is based on a 20% duty cycle of one minute on, four minutes off. Please contact the factory regarding the duty cycle of your application.

BN28 IP65 PERFORMANCE CURVES



Note: Intermittent operation is based on a 20% duty cycle of one minute on, four minutes off. Please contact the factory regarding the duty cycle of your application.

BN34 SPECIFICATIONS

Continuous Stall Torque 83 - 309 oz-in (0.587 - 2.19 Nm) / Peak Torque 326 - 1445 oz-in (2.31 - 10.21 Nm)

Part Number*		BN34-25AF- <input type="checkbox"/>			BN34-35AF- <input type="checkbox"/>			BN34-45AF- <input type="checkbox"/>			BN34-55AF- <input type="checkbox"/>		
Winding Code**		01	02	03	01	02	03	01	02	03	01	02	03
L = Length	inches	2.5			3.5			4.5			5.5		
	millimeters	63.5			88.9			114.3			139.7		
Terminal Voltage	volts DC	24	50	100	24	50	100	24	50	100	24	50	100
Peak Torque	oz-in	310	310	310	657	643	657	1006	1006	1006	1375	1375	1375
	Nm	2.19	2.19	2.19	4.64	4.5405	4.64	7.11	7.11	7.11	9.71	9.71	9.71
Continuous Stall Torque	oz-in	88	93	90	140	162	172	210	220	236	249	288	299
	Nm	0.62	0.66	0.64	0.99	1.144	1.21	1.49	1.55	1.67	1.76	2.03	2.11
Rated Speed	RPM	8130	7500	7280	6010	6400	6380	3800	5170	5270	2750	4350	4360
	rad/sec	851	785	762	629	670	667	397	541	552	288	455	456
Rated Torque	oz-in	60	64	62	93	106	110	172	148	170	214	208	214
	Nm	0.4237	0.45	0.44	0.6567	0.749	0.78	1.24	1.05	1.2005	1.51	1.49	1.51
Rated Current	Amps	16.98	8	3.77	18.74	11	5.8	23.1	12.6	7	21.16	14.85	7.63
Rated Power	watts	361	355	334	417	502	519	483	567	612	435	669	690
Torque Sensitivity	oz-in/amp	3.78	8.5	17.48	5.06	9.92	20.26	7.76	12.42	26.39	10.5	14.7	29.39
	Nm/amp	0.027	0.06	0.123	0.036	0.0701	0.142	0.055	0.088	0.186	0.074	0.104	0.208
Back EMF	volts/KRPM	2.79	6.29	12.92	3.74	7.34	14.98	5.74	9.18	19.51	7.76	10.87	21.73
	volts/rad/sec	0.027	0.06	0.123	0.036	0.07	0.143	0.055	0.088	0.186	0.074	0.104	0.208
Terminal Resistance	ohms	0.079	0.253	1.12	0.05	0.147	0.548	0.068	0.141	0.557	0.088	0.131	0.487
Terminal Inductance	mH	0.12	0.62	2.62	0.1	0.43	1.72	0.17	0.43	1.94	0.23	0.44	1.78
Motor Constant	oz-in/sq.rt.watt	13.44	16.11	16.51	22.63	25.87	27.37	29.75	33.06	35.36	35.4	40.61	42.11
	Nm/sq.rt.watt	0.11	0.11	0.12	0.16	0.183	0.19	0.22	0.23	0.25	0.25	0.29	0.3
Rotor Inertia	oz-in-sec ² x10 ⁻³	7.2	7.2	7.2	14.1	12	14	21	21	21	28	28	28
	g-cm ²	510	510	510	1000	846.8	1000	1500	1500	1500	2000	2000	2000
Weight	oz	36	37	36	62	62	62	87	89	89	114	116	116
	g	1020	1030	1030	1750	1760.8	1770	2480	2520	2530	3230	3300	3.3
# of Poles		8	8	8	8	8	8	8	8	8	8	8	8
Timing		120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°
Mech. Time Constant	ms	3.87	3.58	3.75	3.96	2.5	2.7	3.38	2.75	2.41	3.2	2.43	2.26
Electrical Time Constant	ms	2.27	2.45	2.34	2.14	2.9	3.15	2.48	3.04	3.48	2.58	3.4	3.66
Thermal Resistivity	deg. C/watt	2.25	2.39	2.41	1.87	1.84	1.84	1.51	1.63	1.62	1.45	1.43	1.43
Speed/Torque Gradient	rpm/oz-in	5.3	4.3	4.3	2.8	2.8	1.8	1.1	1	1	0.8	0.7	0.6

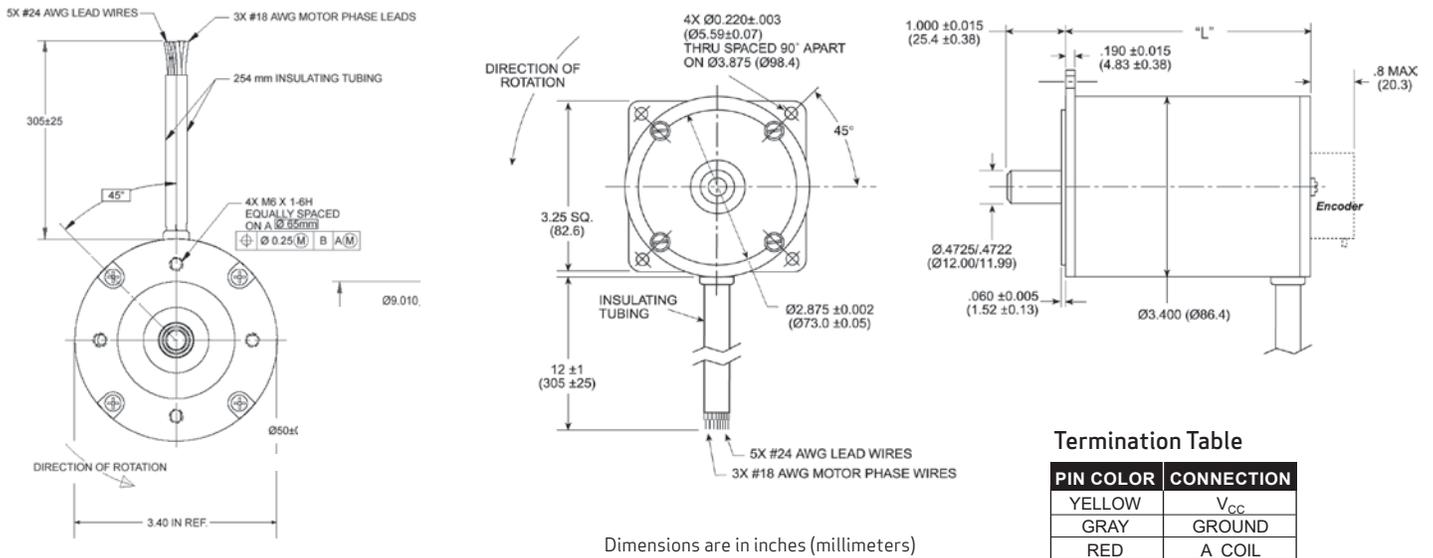
- Notes:
1. Motor mounted to a 10 x 10 x 1/4 inches aluminum plate, still air.
 2. Maximum winding temperature of 155°C.
 3. Typical electrical specifications at 25°C.
 4. Motor Terminal Voltages are representative only; motors may be operated at voltages other than those listed in the table. For assistance please contact our applications engineer.
 5. For MS (military style) connector, please specify connector housing and terminal.
 6. Data for informational purposes only. Should not be considered a binding performance agreement. For specific applications, please contact the factory.

*Many other custom mechanical options are available – consult factory.
 **Many other winding options are available – consult factory.

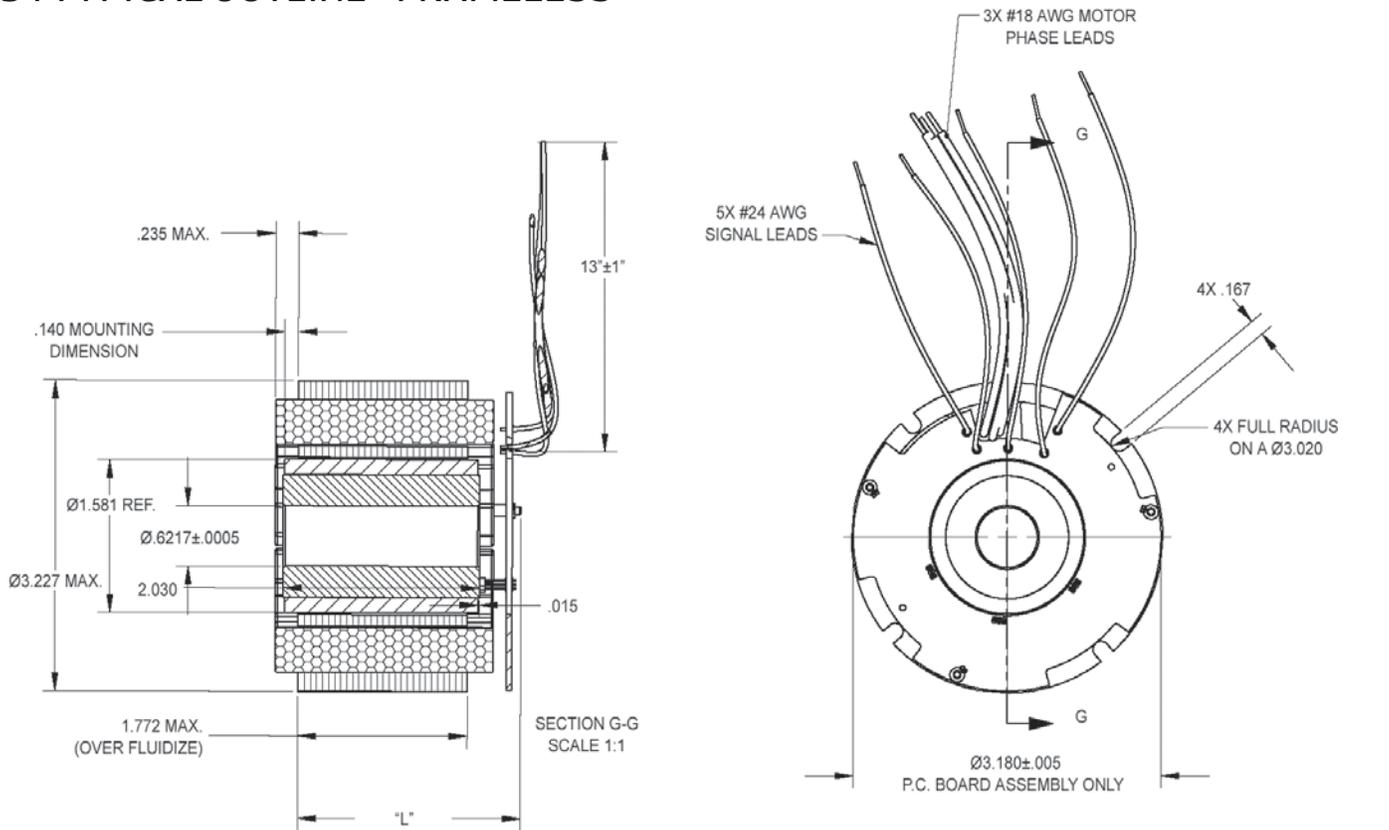
Select your options below and place their code in its corresponding block as shown on page 4.

- | | | |
|--|---|--|
| <input checked="" type="checkbox"/> Termination | <input checked="" type="checkbox"/> Feedback Options | <input checked="" type="checkbox"/> Other Options |
| L – Leads (std) | H – Hall Effect (std) | E – Encoder |
| C – Connector | R – Resolver | G – Gearhead |
| M – MS connector | S – Sensorless | |

BN34 TYPICAL OUTLINE - HOUSED



BN34 TYPICAL OUTLINE - FRAMELESS

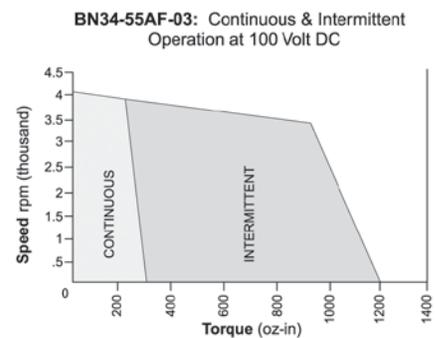
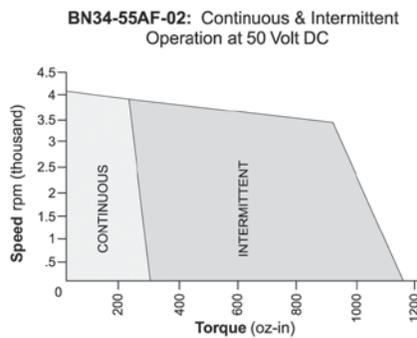
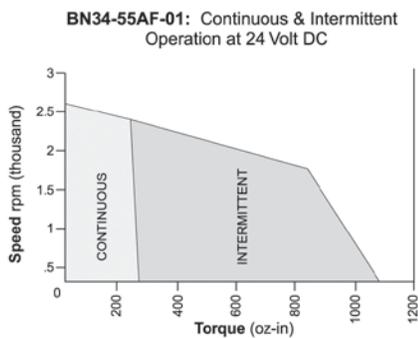
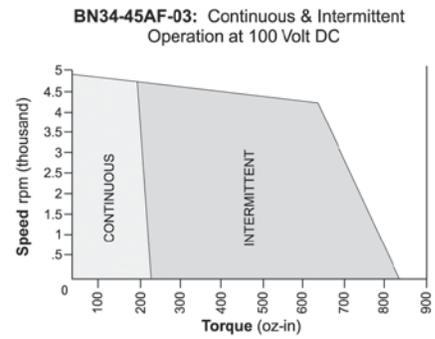
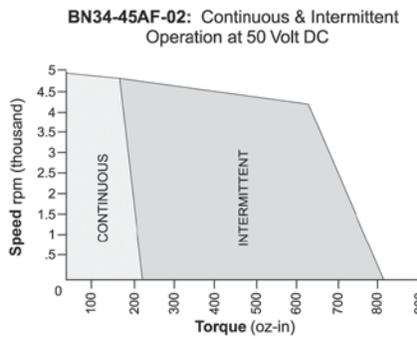
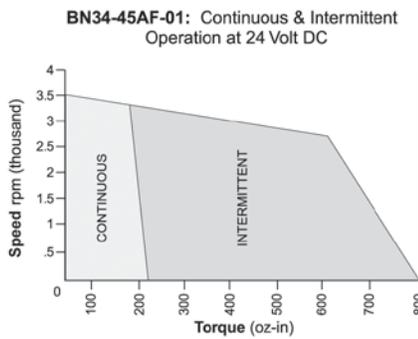
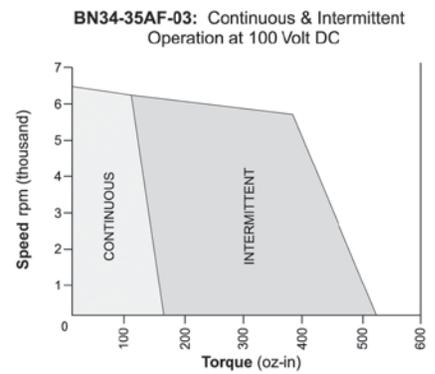
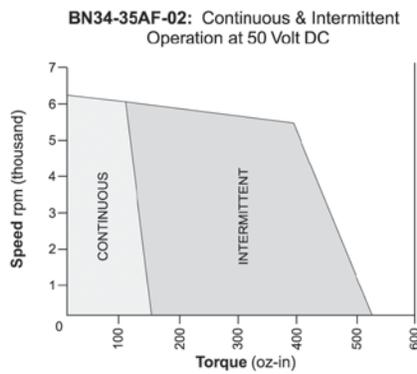
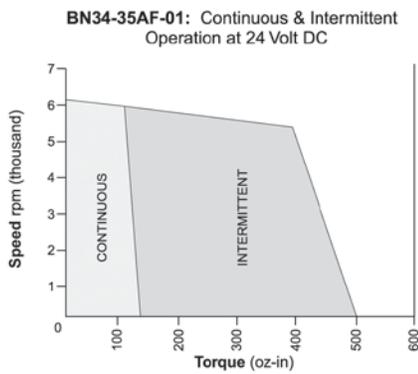
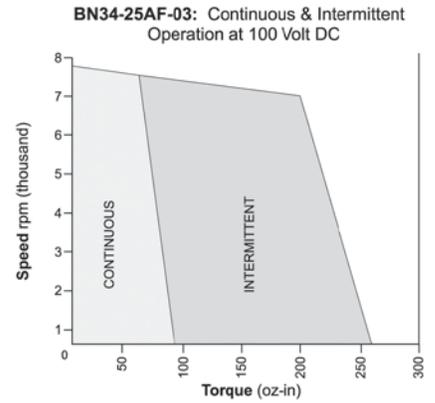
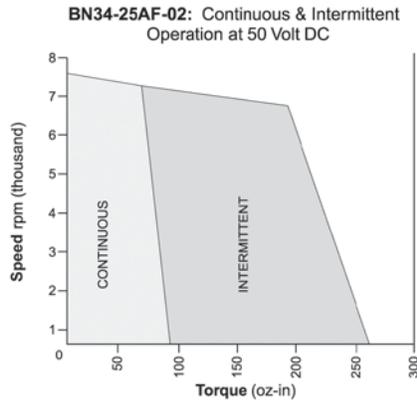
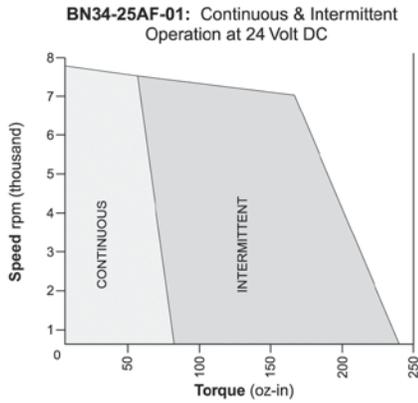


PART NUMBER	"L"
BN34-25ZP-[] [-LH	1.337
BN34-35ZP-[] [-LH	2.337
BN34-45ZP-[] [-LH	3.337
BN34-55ZP-[] [-LH	4.337

Note: See page 29 for performance data.

Dimensions are in inches

BN34 PERFORMANCE CURVES



Note: Intermittent operation is based on a 20% duty cycle of one minute on, four minutes off. Please contact the factory regarding the duty cycle of your application.

BN34 EU SPECIFICATIONS

Continuous Stall Torque 83 - 309 oz-in (0.587 - 2.19 Nm) / Peak Torque 326 - 1445 oz-in (2.31 - 10.21 Nm)

Part Number*		BN34-25EU- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN34-35EU- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN34-45EU- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN34-55EU- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Winding Code**		01	02	03	01	02	03	01	02	03	01	02	03
L = Length	inches	2.5			3.5			4.5			5.5		
	millimeters	63.5			88.9			114.3			139.7		
Terminal Voltage	volts DC	24	50	100	24	50	100	24	50	100	24	50	100
Peak Torque	oz-in	310	310	310	657	643	657	1006	1006	1006	1375	1375	1375
	Nm	2.19	2.19	2.19	4.64	4.5405	4.64	7.11	7.11	7.11	9.71	9.71	9.71
Continuous Stall Torque	oz-in	88	93	90	140	162	172	210	220	236	249	288	299
	Nm	0.62	0.66	0.64	0.99	1.144	1.21	1.49	1.55	1.67	1.76	2.03	2.11
Rated Speed	RPM	8130	7500	7280	6010	6400	6380	3800	5170	5270	2750	4350	4360
	rad/sec	851	785	762	629	670	667	397	541	552	288	455	456
Rated Torque	oz-in	60	64	62	93	106	110	172	148	170	214	208	214
	Nm	0.4237	0.45	0.44	0.6567	0.749	0.78	1.24	1.05	1.2005	1.51	1.49	1.51
Rated Current	Amps	16.98	8	3.77	18.74	11	5.8	23.1	12.6	7	21.16	14.85	7.63
Rated Power	watts	361	355	334	417	502	519	483	567	612	435	669	690
Torque Sensitivity	oz-in/amp	3.78	8.5	17.48	5.06	9.92	20.26	7.76	12.42	26.39	10.5	14.7	29.39
	Nm/amp	0.027	0.06	0.123	0.036	0.0701	0.142	0.055	0.088	0.186	0.074	0.104	0.208
Back EMF	volts/KRPM	2.79	6.29	12.92	3.74	7.34	14.98	5.74	9.18	19.51	7.76	10.87	21.73
	volts/rad/sec	0.027	0.06	0.123	0.036	0.07	0.143	0.055	0.088	0.186	0.074	0.104	0.208
Terminal Resistance	ohms	0.079	0.253	1.12	0.05	0.147	0.548	0.068	0.141	0.557	0.088	0.131	0.487
Terminal Inductance	mH	0.12	0.62	2.62	0.1	0.43	1.72	0.17	0.43	1.94	0.23	0.44	1.78
Motor Constant	oz-in/sq.rt.watt	13.44	16.11	16.51	22.63	25.87	27.37	29.75	33.06	35.36	35.4	40.61	42.11
	Nm/sq.rt.watt	0.11	0.11	0.12	0.16	0.183	0.19	0.22	0.23	0.25	0.25	0.29	0.3
Rotor Inertia	oz-in-sec ²	7.2	7.2	7.2	14.1	12	14	21	21	21	28	28	28
	g-cm ²	510	510	510	1000	846.8	1000	1500	1500	1500	2000	2000	2000
Weight	oz	36	37	36	62	62	62	87	89	89	114	116	116
	g	1020	1030	1030	1750	1760.8	1770	2480	2520	2530	3230	3300	3.3

Notes:

- Motor mounted to a 10 x 10 x 1/4 inches aluminum plate, still air.
- Maximum winding temperature of 155°C.
- Typical electrical specifications at 25°C.
- Motor Terminal Voltages are representative only; motors may be operated at voltages other than those listed in the table. For assistance please contact our applications engineer.
- For MS (military style) connector, please specify connector housing and terminal.
- Data for informational purposes only. Should not be considered a binding performance agreement. For specific applications, please contact the factory.

*Many other custom mechanical options are available – consult factory.

**Many other winding options are available – consult factory.

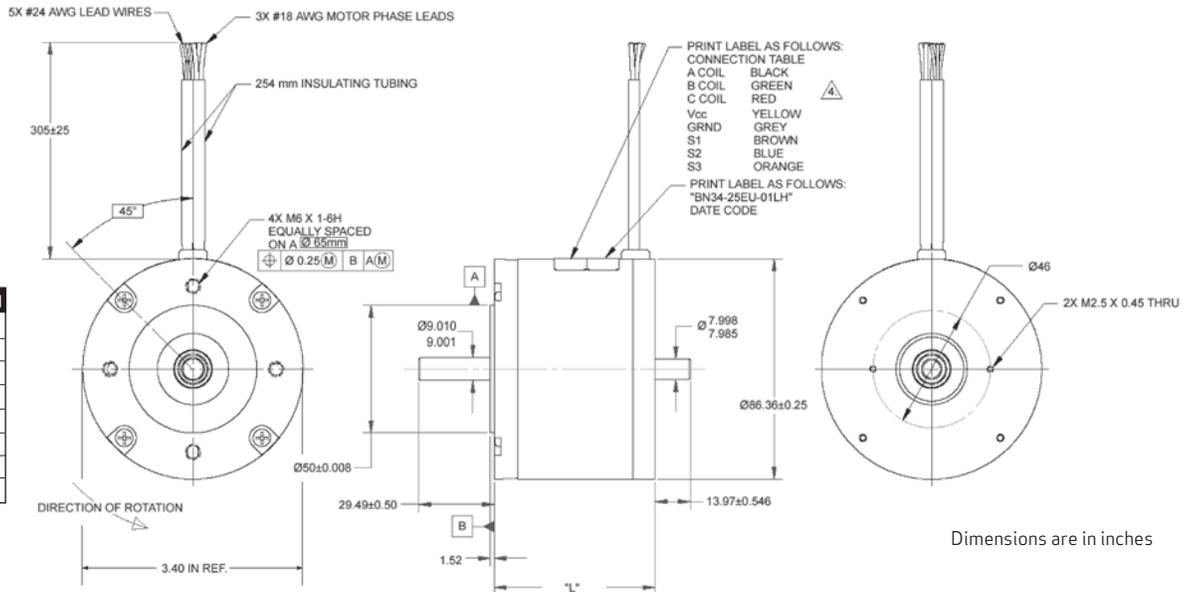
Select your options below and place their code in its corresponding block as shown on page 4.

- | | | |
|--|---|--|
| <input checked="" type="checkbox"/> Termination | <input checked="" type="checkbox"/> Feedback Options | <input checked="" type="checkbox"/> Other Options |
| L – Leads (std) | H – Hall Effect (std) | E – Encoder |
| C – Connector | R – Resolver | G – Gearhead |
| M – MS connector | S – Sensorless | |

BN34 EU TYPICAL OUTLINE

Termination Table

PIN COLOR	CONNECTION
YELLOW	V _{CC}
GRAY	GROUND
RED	A COIL
BLACK	B COIL
GREEN	C COIL
BLUE	S2 OUT
BROWN	S1 OUT
ORANGE	S3 OUT



BN34 IP65 SPECIFICATIONS

Continuous Stall Torque 83 - 309 oz-in (0.587 - 2.19 Nm) / Peak Torque 326 - 1445 oz-in (2.31 - 10.21 Nm)

Part Number*		BN34-25IP - <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN34-35IP - <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN34-45IP - <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN34-55IP - <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Winding Code**		01	02	03	01	02	03	01	02	03	01	02	03
L = Length	inches	2.5			3.5			4.5			5.5		
	millimeters	63.5			88.9			114.3			139.7		
Terminal Voltage	volts DC	24	50	100	24	50	100	24	50	100	24	50	100
Peak Torque	oz-in	310	310	310	657	643	657	1006	1006	1006	1375	1375	1375
	Nm	2.19	2.19	2.19	4.64	4.5405	4.64	7.11	7.11	7.11	9.71	9.71	9.71
Continuous Stall Torque	oz-in	88	93	90	140	162	172	210	220	236	249	288	299
	Nm	0.62	0.66	0.64	0.99	1.144	1.21	1.49	1.55	1.67	1.76	2.03	2.11
Rated Speed	RPM	8130	7500	7280	6010	6400	6380	3800	5170	5270	2750	4350	4360
	rad/sec	851	785	762	629	670	667	397	541	552	288	455	456
Rated Torque	oz-in	60	64	62	93	106	110	172	148	170	214	208	214
	Nm	0.4237	0.45	0.44	0.6567	0.749	0.78	1.24	1.05	1.2005	1.51	1.49	1.51
Rated Current	Amps	16.98	8	3.77	18.74	11	5.8	23.1	12.6	7	21.16	14.85	7.63
Rated Power	watts	361	355	334	417	502	519	483	567	612	435	669	690
Torque Sensitivity	oz-in/amp	3.78	8.5	17.48	5.06	9.92	20.26	7.76	12.42	26.39	10.5	14.7	29.39
	Nm/amp	0.027	0.06	0.123	0.036	0.0701	0.142	0.055	0.088	0.186	0.074	0.104	0.208
Back EMF	volts/KRPM	2.79	6.29	12.92	3.74	7.34	14.98	5.74	9.18	19.51	7.76	10.87	21.73
	volts/rad/sec	0.027	0.06	0.123	0.036	0.07	0.143	0.055	0.088	0.186	0.074	0.104	0.208
Terminal Resistance	ohms	0.079	0.253	1.12	0.05	0.147	0.548	0.068	0.141	0.557	0.088	0.131	0.487
Terminal Inductance	mH	0.12	0.62	2.62	0.1	0.43	1.72	0.17	0.43	1.94	0.23	0.44	1.78
Motor Constant	oz-in/sq.rt.watt	13.44	16.11	16.51	22.63	25.87	27.37	29.75	33.06	35.36	35.4	40.61	42.11
	Nm/sq.rt.watt	0.11	0.11	0.12	0.16	0.183	0.19	0.22	0.23	0.25	0.25	0.29	0.3
Rotor Inertia	oz-in-sec ² x10 ⁻³	7.2	7.2	7.2	14.1	12	14	21	21	21	28	28	28
	g-cm ²	510	510	510	1000	846.8	1000	1500	1500	1500	2000	2000	2000
Weight	oz	36	37	36	62	62	62	87	89	89	114	116	116
	g	1020	1030	1030	1750	1760.8	1770	2480	2520	2530	3230	3300	3.3
# of Poles		8	8	8	8	8	8	8	8	8	8	8	8
Timing		120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°
Mech. Time Constant	ms	3.87	3.58	3.75	3.96	2.5	2.7	3.38	2.75	2.41	3.2	2.43	2.26
Electrical Time Constant	ms	2.27	2.45	2.34	2.14	2.9	3.15	2.48	3.04	3.48	2.58	3.4	3.66
Thermal Resistivity	deg. C/watt	2.25	2.39	2.41	1.87	1.84	1.84	1.51	1.63	1.62	1.45	1.43	1.43
Speed/Torque Gradient	rpm/oz-in	5.3	4.3	4.3	2.8	2.8	1.8	1.1	1	1	0.8	0.7	0.6

Notes:

- Motor mounted to a 10 x 10 x 1/4 inches aluminum plate, still air.
- Maximum winding temperature of 155°C.
- Typical electrical specifications at 25°C.
- Motor Terminal Voltages are representative only; motors may be operated at voltages other than those listed in the table. For assistance please contact our applications engineer.
- Calculated (theoretical) speed/torque gradient.
- For MS (military style) connector, please specify connector housing and terminal.
- Data for informational purposes only. Should not be considered a binding performance agreement. For specific applications, please contact the factory.

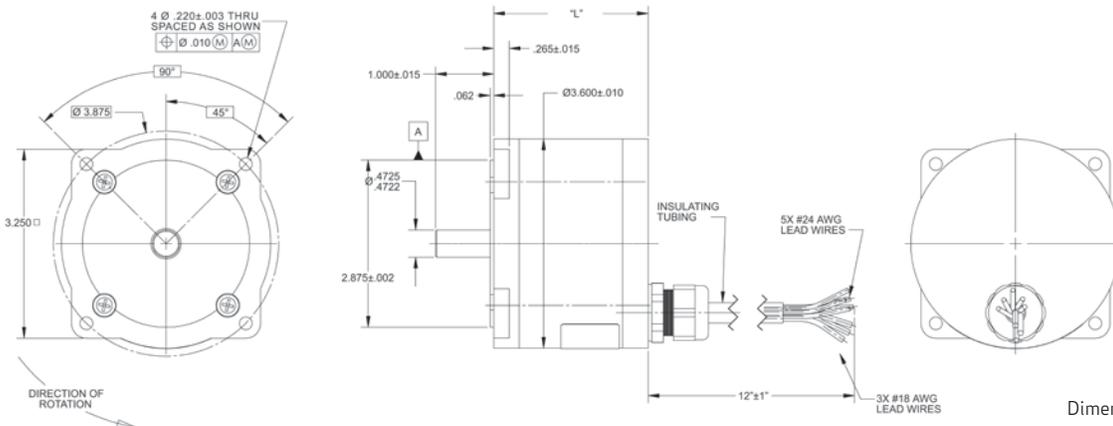
*Many other custom mechanical options are available – consult factory.

**Many other winding options are available – consult factory.

Select your options below and place their code in its corresponding block as shown on page 4.

- | | | |
|--|---|--|
| <input checked="" type="checkbox"/> Termination | <input checked="" type="checkbox"/> Feedback Options | <input checked="" type="checkbox"/> Other Options |
| L – Leads (std) | H – Hall Effect (std) | E – Encoder |
| C – Connector | R – Resolver | G – Gearhead |
| M – MS connector | S – Sensorless | |

BN34 IP65 TYPICAL OUTLINE

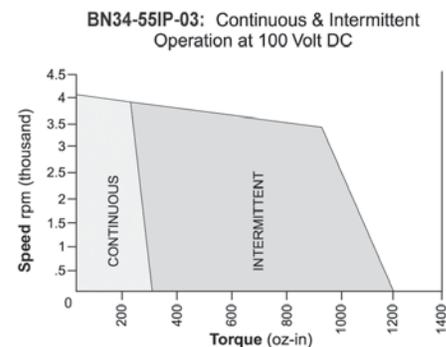
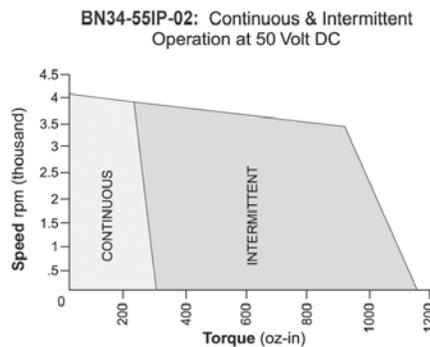
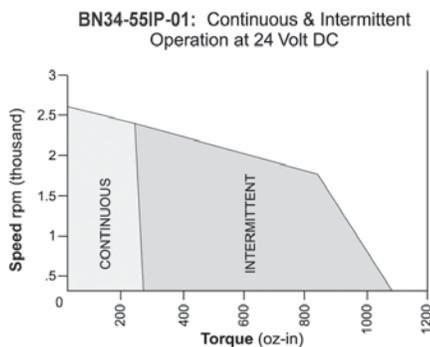
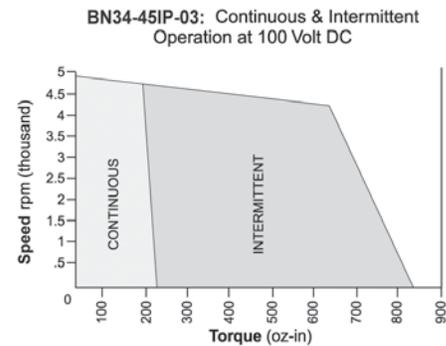
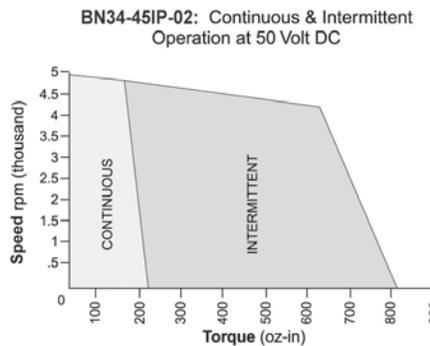
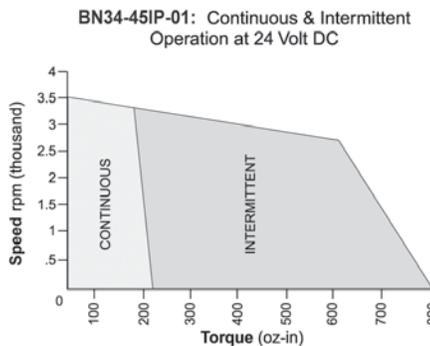
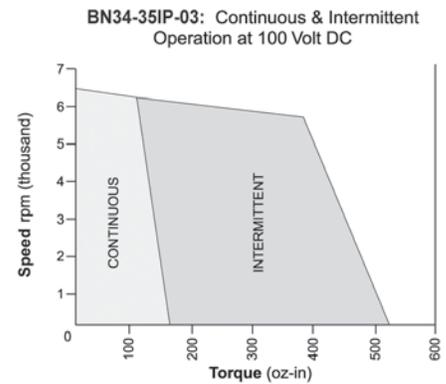
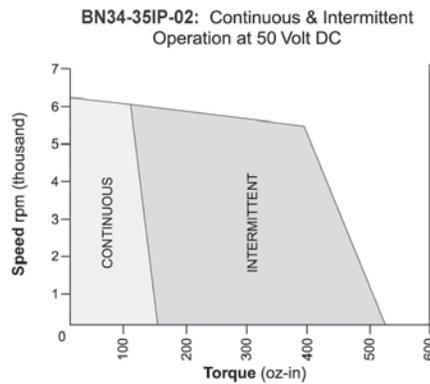
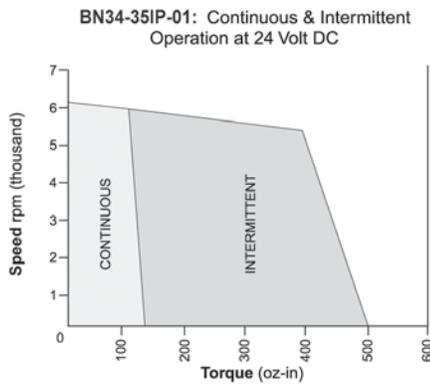
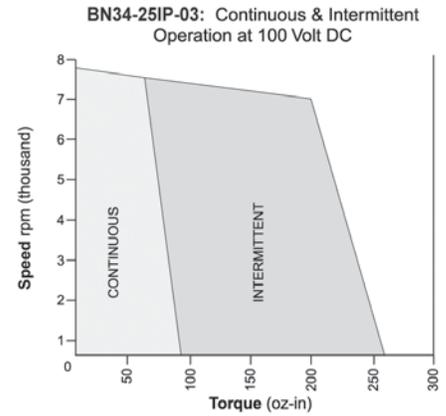
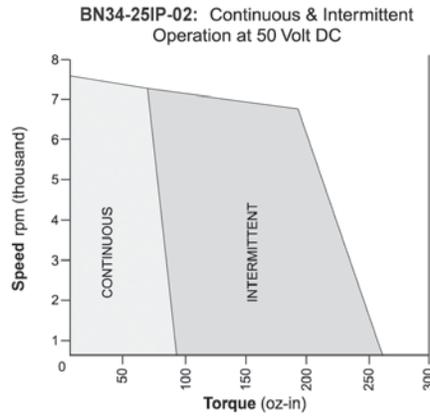
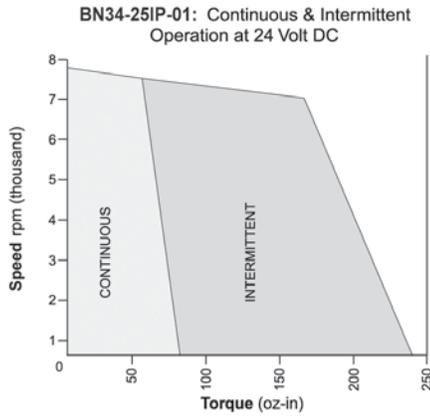


Termination Table

PIN COLOR	CONNECTION
YELLOW	V _{CC}
GRAY	GROUND
RED	A COIL
BLACK	B COIL
GREEN	C COIL
BLUE	S2 OUT
BROWN	S1 OUT
ORANGE	S3 OUT

Dimensions are in inches

BN34 IP65 PERFORMANCE CURVES



Note: Intermittent operation is based on a 20% duty cycle of one minute on, four minutes off. Please contact the factory regarding the duty cycle of your application.

BN42 SPECIFICATIONS

Continuous Stall Torque 144 - 519 oz-in (1.02 - 3.67 Nm) / Peak Torque 609 - 2560 oz-in (4.30 - 18.1 Nm)

Part Number*		BN42-23AF- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN42-33AF- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN42-43AF- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN42-53AF- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Winding Code**		01	02	03	01	02	03	01	02	03	01	02	03
L = Length	inches	2.30			3.30			4.30			5.30		
	millimeters	58.4			83.8			109.2			134.6		
Terminal Voltage	volts DC	24.0	50.0	100.0	24.0	50.0	100.0	24.0	50.0	100.0	24.0	50.0	100.0
Peak Torque	oz-in	609.0	609.0	609.0	1248.0	1248.0	1248.0	1906.0	1906.0	1906.0	2560.0	2560.0	2560.0
	Nm	4.3005	4.3005	4.3005	8.8128	8.8128	8.8128	13.4592	13.4592	13.4592	18.0774	18.0774	18.0774
Continuous Stall Torque	oz-in	144.0	156.0	155.0	266.0	281.0	287.0	387.0	398.0	407.0	496.0	510.0	519.0
	Nm	1.0169	1.1016	1.0945	1.8784	1.9843	2.0267	2.7328	2.8105	2.8740	3.5025	3.6014	3.6649
Rated Speed	RPM	6050.0	5950.0	6140.0	3710.0	4710.0	4710.0	2380.0	3840.0	3840.0	1740.0	2820.0	2820.0
	rad/sec	634	623	643	389	493	493	249	402	402	182	295	295
Rated Torque	oz-in	102.0	113.0	110.0	213.0	198.0	200.0	340.0	290.0	296.0	451.0	413.0	419.0
	Nm	0.7203	0.7979	0.7768	1.5041	1.3982	1.4123	2.4009	2.0478	2.0902	3.1847	2.9164	2.9588
Rated Current	Amps	22.60	11.70	5.90	28.90	16.20	8.20	29.70	19.20	9.80	29.20	20.20	10.20
Rated Power	watts	456.0	497.0	499.0	584.0	690.0	697.0	598.0	824.0	841.0	580.0	861.0	874.0
Torque Sensitivity	oz-in/amp	5.20	11.00	21.40	8.41	14.00	28.00	12.90	17.20	34.30	17.40	23.10	46.30
	Nm/amp	0.0367	0.0777	0.1511	0.0594	0.0989	0.1977	0.0911	0.1215	0.2422	0.1229	0.1631	0.3269
Back EMF	volts/KRPM	3.80	8.20	15.80	6.22	10.40	20.70	9.52	12.70	25.40	12.80	17.10	34.20
	volts/rad/sec	0.0367	0.0777	0.1511	0.0594	0.0989	0.1977	0.0911	0.1215	0.2422	0.1229	0.1631	0.3269
Terminal Resistance	ohms	0.040	0.154	0.584	0.039	0.095	0.364	0.052	0.084	0.320	0.065	0.106	0.408
Terminal Inductance	mH	0.090	0.408	1.540	0.115	0.318	1.270	0.178	0.316	1.260	0.241	0.428	1.710
Motor Constant	oz-in/sq.rt.watt	26.00	28.03	28.00	42.59	45.42	46.41	56.57	59.35	60.63	68.25	70.95	72.49
	Nm/sq.rt.watt	0.18360	0.19794	0.19775	0.30072	0.32075	0.32772	0.39947	0.41907	0.42817	0.48194	0.50102	0.51186
Rotor Inertia	oz-in-sec ² x10 ⁻³	18.00	18.00	18.00	35.00	35.00	35.00	52.00	52.00	52.00	70.00	70.00	70.00
	g-cm ²	1270.3	1270.3	1270.3	2470.0	2470.0	2470.0	3669.6	3669.6	3669.6	4939.9	4939.9	4939.9
Weight	oz	65.0	65.0	65.0	104.0	104.0	104.0	143.0	143.0	143.0	182.0	182.0	182.0
	g	1846.0	1846.0	1846.0	2953.6	2953.6	2953.6	4061.2	4061.2	4061.2	5168.8	5168.8	5168.8
# of Poles		8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Timing		120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°
Mech. Time Constant	ms	3.8	3.2	3.2	2.7	2.4	2.3	2.3	2.1	2.0	2.1	2.0	1.9
Electrical Time Constant	ms	2.25	2.65	2.64	2.95	3.35	3.49	3.42	3.76	3.94	3.71	4.04	4.19
Thermal Resistivity	deg. C/watt	1.2	1.2	1.2	1.0	0.9	0.9	0.9	0.8	0.8	0.9	0.7	0.7
Speed/Torque Gradient	rpm/oz-in	2.0	1.7	1.7	0.7	0.7	0.6	0.4	0.4	0.4	0.3	0.3	0.3

Notes:

- Motor mounted to a 10 x 10 x 1/4 inches aluminum plate, still air.
- Maximum winding temperature of 155°C.
- Typical electrical specifications at 25°C.
- Motor Terminal Voltages are representative only; motors may be operated at voltages other than those listed in the table. For assistance please contact our applications engineer.
- For MS (military style) connector, please specify connector housing and terminal.
- Data for informational purposes only. Should not be considered a binding performance agreement. For specific applications, please contact the factory.

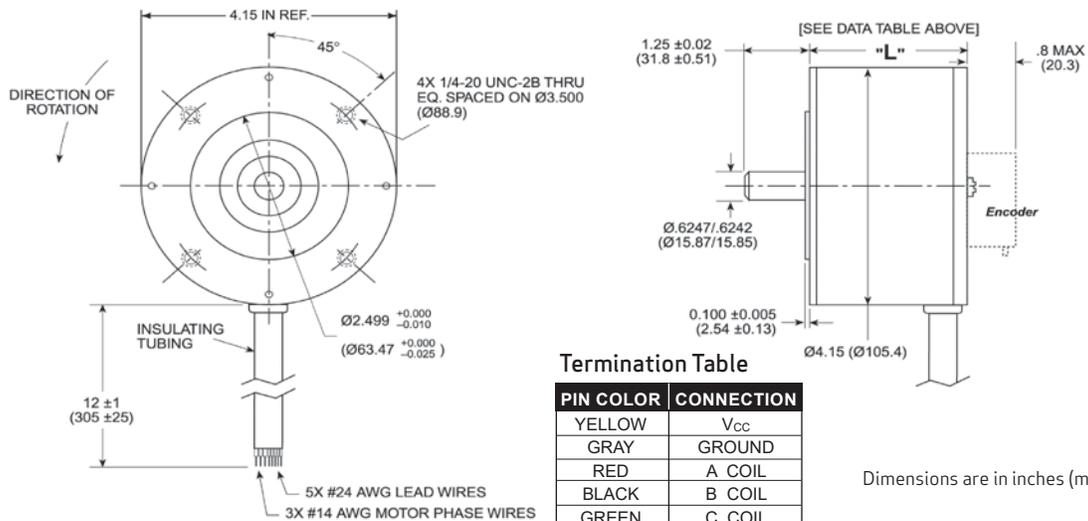
*Many other custom mechanical options are available – consult factory.

**Many other winding options are available – consult factory.

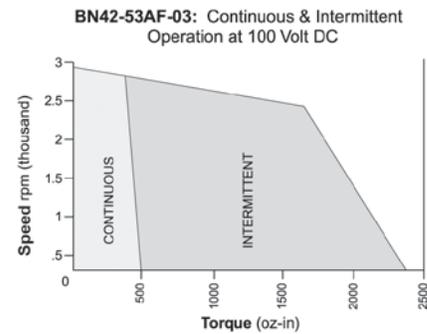
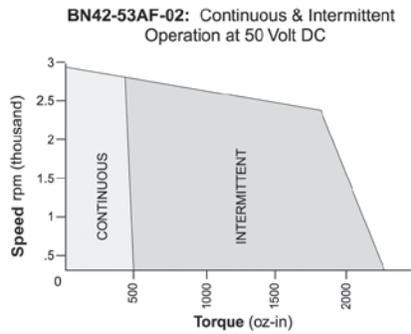
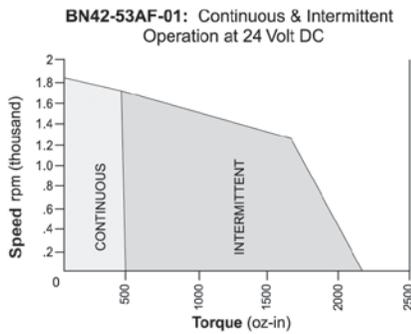
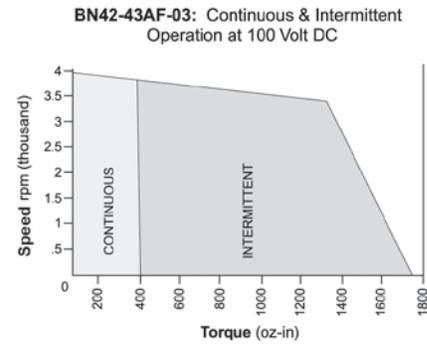
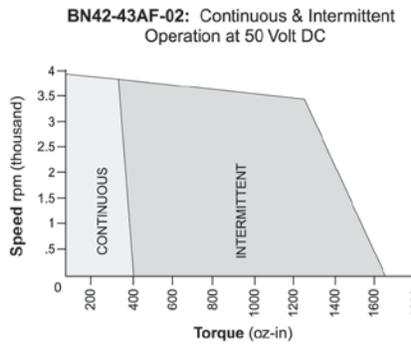
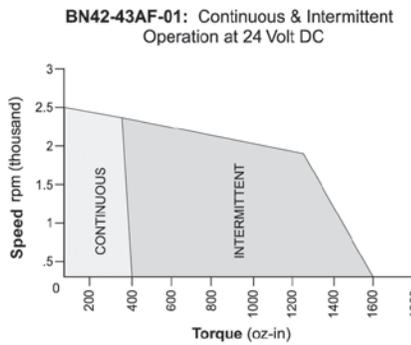
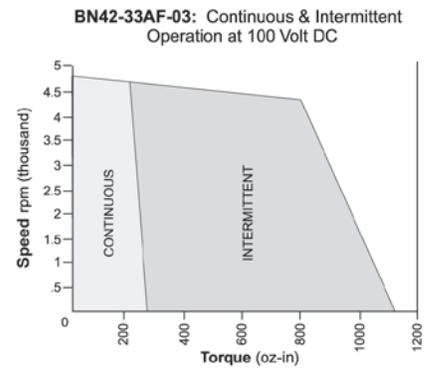
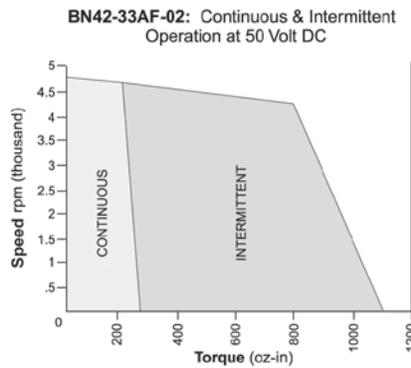
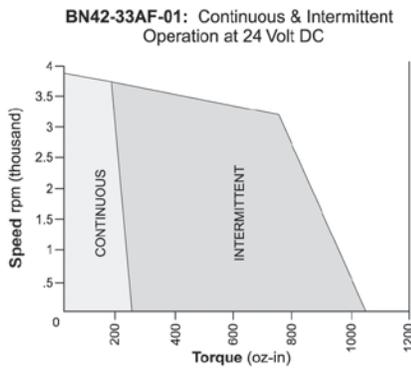
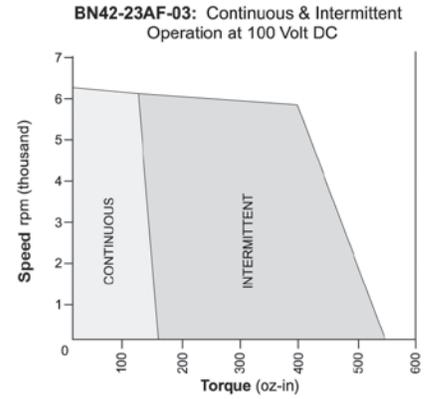
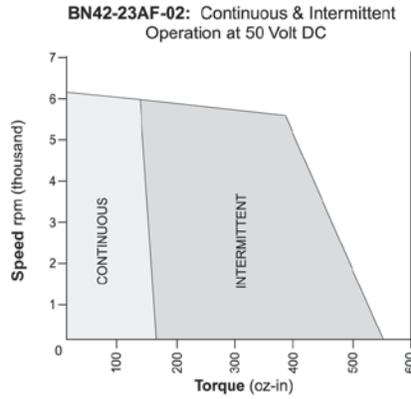
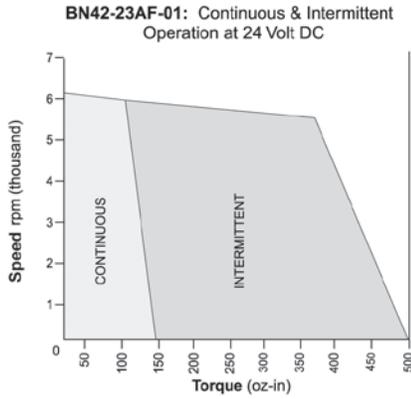
Select your options below and place their code in its corresponding block as shown on page 4.

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|---|--|---|
| <input type="checkbox"/> TERMINATION | <input type="checkbox"/> FEEDBACK OPTIONS | <input type="checkbox"/> OTHER OPTIONS |
| L – Leads (std) | H – Hall Effect (std) | E – Encoder |
| C – Connector | R – Resolver | G – Gearhead |
| M – MS connector | S – Sensorless | |

BN42 TYPICAL OUTLINE



BN42 PERFORMANCE CURVES



Note: Intermittent operation is based on a 20% duty cycle of one minute on, four minutes off. Please contact the factory regarding the duty cycle of your application.

BN42 EU SPECIFICATIONS

Continuous Stall Torque 144 - 519 oz-in (1.02 - 3.67 Nm) / Peak Torque 609 - 2560 oz-in (4.30 - 18.1 Nm)

Part Number*		BN42-23EU- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN42-33EU- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN42-43EU- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN42-53EU- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Winding Code**		01	02	03	01	02	03	01	02	03	01	02	03
L = Length	inches	2.30			3.30			4.30			5.30		
	millimeters	58.5			83.9			109.3			134.7		
Terminal Voltage	volts DC	24	50	100	24	50	100	24	50	100	24	50	100
Peak Torque	oz-in	609	609	609	1248	1248	1248	1906	1906	1906	2560	2560	2560
	Nm	4.30	4.30	4.30	8.82	8.82	8.82	13.5	13.5	13.5	18.1	18.1	18.1
Continuous Stall Torque	oz-in	144	156	155	266	281	287	387	398	407	496	510	519
	Nm	1.02	1.11	1.10	1.88	1.99	2.03	2.74	2.81	2.88	3.51	3.61	3.67
Rated Speed	RPM	6050	5950	6140	3710	4710	4710	2380	3840	3840	1740	2820	2820
	rad/sec	634	623	643	389	494	494	250	403	403	183	296	296
Rated Torque	oz-in	102	113	110	213	198	200	340	290	296	451	413	419
	Nm	0.721	0.798	0.777	1.51	1.40	1.42	2.41	2.05	2.09	3.19	2.92	2.96
Rated Current	Amps	22.6	11.7	5.9	28.9	16.2	8.2	29.7	19.2	9.8	29.2	20.2	10.2
Rated Power	watts	456	497	499	584	690	697	598	824	841	580	861	874
Torque Sensitivity	oz-in/amp	5.20	11.0	21.4	8.41	14.0	28.0	12.9	17.2	34.3	17.4	23.1	46.3
	Nm/amp	0.0363	0.0783	0.151	0.0594	0.0992	0.198	0.0909	0.122	0.243	0.123	0.164	0.327
Back EMF	volts/KRPM	3.80	8.20	15.8	6.22	10.4	20.7	9.52	12.7	25.4	12.8	17.1	34.2
	volts/rad/sec	0.0363	0.0783	0.151	0.0594	0.0992	0.198	0.0909	0.122	0.243	0.123	0.164	0.327
Terminal Resistance	ohms	0.040	0.154	0.584	0.039	0.095	0.364	0.052	0.084	0.320	0.065	0.106	0.408
Terminal Inductance	mH	0.090	0.408	1.54	0.115	0.318	1.27	0.178	0.316	1.26	0.241	0.428	1.71
Motor Constant	oz-in/sq.rt.watt	27.8	28.6	28.2	45.7	46.8	46.8	59.5	61.2	61.1	71.0	73.0	72.9
	Nm/sq.rt.watt	0.197	0.202	0.199	0.323	0.331	0.331	0.421	0.433	0.432	0.502	0.516	0.515
Rotor Inertia	oz-in-sec ²	0.018	0.018	0.018	0.035	0.035	0.035	0.052	0.052	0.052	0.070	0.070	0.070
	g-cm ²	1271	1271	1271	2472	2472	2472	3672	3672	3672	4943	4943	4943
Weight	oz	65	65	65	104	104	104	143	143	143	182	182	182
	g	1843	1843	1843	2949	2949	2949	4054	4054	4054	5160	5160	5160

Notes:

- Motor mounted to a 10 x 10 x 1/4 inches aluminum plate, still air.
- Maximum winding temperature of 155°C.
- Typical electrical specifications at 25°C.
- Motor Terminal Voltages are representative only; motors may be operated at voltages other than those listed in the table. For assistance please contact our applications engineer.
- For MS (military style) connector, please specify connector housing and terminal.
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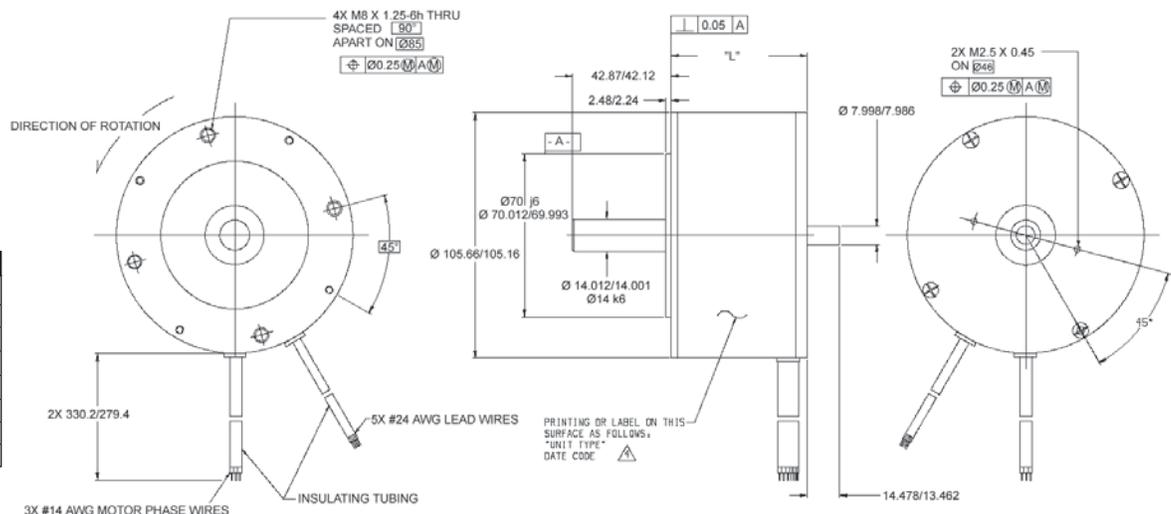
Select your options below and place their code in its corresponding block as shown on page 4.

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|--|---|--|
| <input checked="" type="checkbox"/> TERMINATION | <input checked="" type="checkbox"/> FEEDBACK OPTIONS | <input checked="" type="checkbox"/> OTHER OPTIONS |
| L – Leads (std) | H – Hall Effect (std) | E – Encoder |
| C – Connector | R – Resolver | G – Gearhead |
| M – MS connector | S – Sensorless | |

BN42 EU TYPICAL OUTLINE

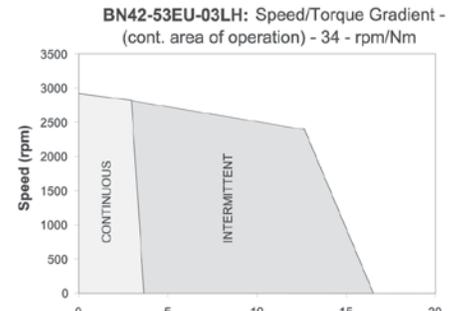
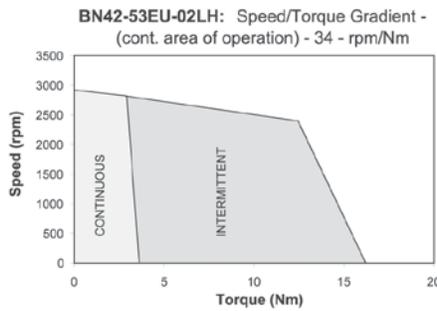
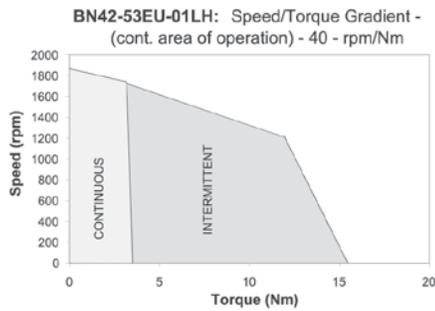
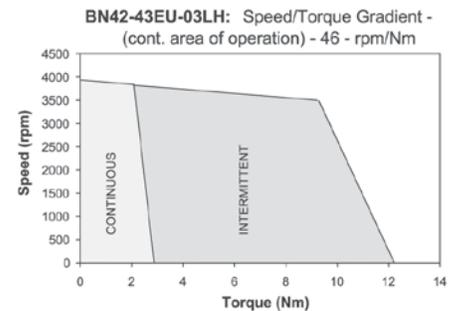
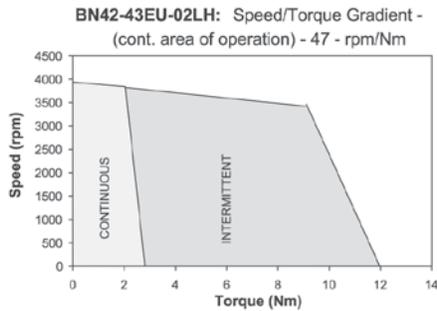
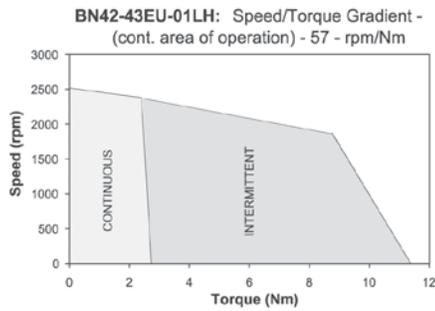
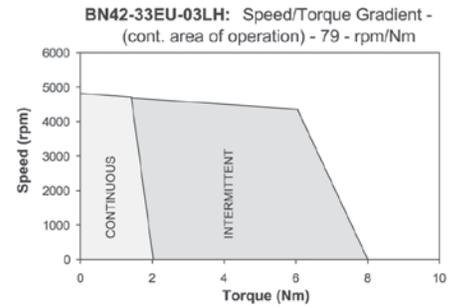
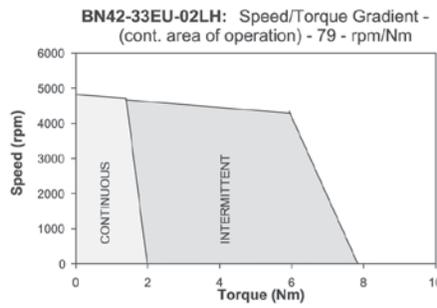
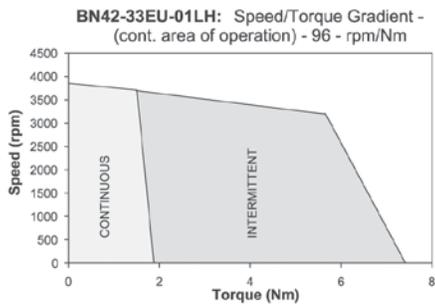
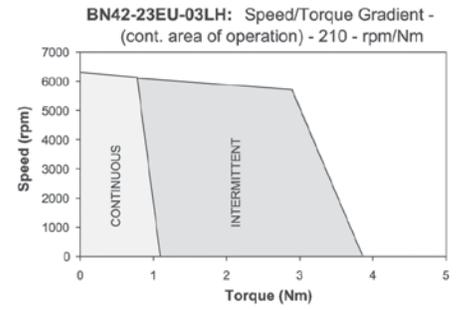
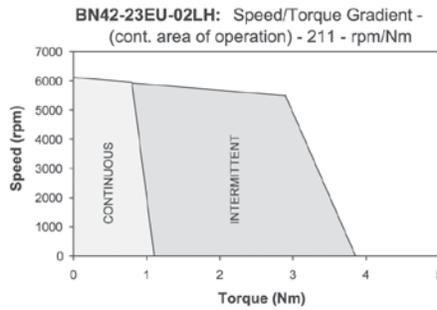
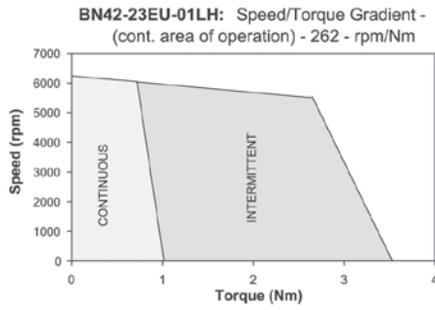
Termination Table

PIN COLOR	CONNECTION
YELLOW	V _{CC}
GRAY	GROUND
RED	A COIL
BLACK	B COIL
GREEN	C COIL
BLUE	S2 OUT
BROWN	S1 OUT
ORANGE	S3 OUT



Dimensions are in inches

BN42 EU PERFORMANCE CURVES



Note: Intermittent operation is based on a 20% duty cycle of one minute on, four minutes off. Please contact the factory regarding the duty cycle of your application.

BN42 IP65 SPECIFICATIONS

Continuous Stall Torque 144 - 519 oz-in (1.02 - 3.67 Nm) / Peak Torque 609 - 2560 oz-in (4.30 - 18.1 Nm)

Part Number*		BN42-23IP - <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN42-33IP - <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN42-43IP - <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN42-53IP - <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Winding Code**		01	02	03	01	02	03	01	02	03	01	02	03
L = Length	inches	2.30			3.30			4.30			5.30		
	millimeters	58.4			83.8			109.2			134.6		
Terminal Voltage	volts DC	24.0	50.0	100.0	24.0	50.0	100.0	24.0	50.0	100.0	24.0	50.0	100.0
Peak Torque	oz-in	609.0	609.0	609.0	1248.0	1248.0	1248.0	1906.0	1906.0	1906.0	2560.0	2560.0	2560.0
	Nm	4.3005	4.3005	4.3005	8.8128	8.8128	8.8128	13.4592	13.4592	13.4592	18.0774	18.0774	18.0774
Continuous Stall Torque	oz-in	144.0	156.0	155.0	266.0	281.0	287.0	387.0	398.0	407.0	496.0	510.0	519.0
	Nm	1.0169	1.1016	1.0945	1.8784	1.9843	2.0267	2.7328	2.8105	2.8740	3.5025	3.6014	3.6649
Rated Speed	RPM	6050.0	5950.0	6140.0	3710.0	4710.0	4710.0	2380.0	3840.0	3840.0	1740.0	2820.0	2820.0
	rad/sec	634	623	643	389	493	493	249	402	402	182	295	295
Rated Torque	oz-in	102.0	113.0	110.0	213.0	198.0	200.0	340.0	290.0	296.0	451.0	413.0	419.0
	Nm	0.7203	0.7979	0.7768	1.5041	1.3982	1.4123	2.4009	2.0478	2.0902	3.1847	2.9164	2.9588
Rated Current	Amps	22.60	11.70	5.90	28.90	16.20	8.20	29.70	19.20	9.80	29.20	20.20	10.20
Rated Power	watts	456.0	497.0	499.0	584.0	690.0	697.0	598.0	824.0	841.0	580.0	861.0	874.0
Torque Sensitivity	oz-in/amp	5.20	11.00	21.40	8.41	14.00	28.00	12.90	17.20	34.30	17.40	23.10	46.30
	Nm/amp	0.0367	0.0777	0.1511	0.0594	0.0989	0.1977	0.0911	0.1215	0.2422	0.1229	0.1631	0.3269
Back EMF	volts/KRPM	3.80	8.20	15.80	6.22	10.40	20.70	9.52	12.70	25.40	12.80	17.10	34.20
	volts/rad/sec	0.0367	0.0777	0.1511	0.0594	0.0989	0.1977	0.0911	0.1215	0.2422	0.1229	0.1631	0.3269
Terminal Resistance	ohms	0.040	0.154	0.584	0.039	0.095	0.364	0.052	0.084	0.320	0.065	0.106	0.408
Terminal Inductance	mH	0.090	0.408	1.540	0.115	0.318	1.270	0.178	0.316	1.260	0.241	0.428	1.710
Motor Constant	oz-in/sq.rt.watt	26.00	28.03	28.00	42.59	45.42	46.41	56.57	59.35	60.63	68.25	70.95	72.49
	Nm/sq.rt.watt	0.18360	0.19794	0.19775	0.30072	0.32075	0.32772	0.39947	0.41907	0.42817	0.48194	0.50102	0.51186
Rotor Inertia	oz-in-sec ² x10 ⁻³	18.00	18.00	18.00	35.00	35.00	35.00	52.00	52.00	52.00	70.00	70.00	70.00
	g-cm ²	1270.3	1270.3	1270.3	2470.0	2470.0	2470.0	3669.6	3669.6	3669.6	4939.9	4939.9	4939.9
Weight	oz	65.0	65.0	65.0	104.0	104.0	104.0	143.0	143.0	143.0	182.0	182.0	182.0
	g	1846.0	1846.0	1846.0	2953.6	2953.6	2953.6	4061.2	4061.2	4061.2	5168.8	5168.8	5168.8
# of Poles		8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Timing		120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°
Mech. Time Constant	ms	3.8	3.2	3.2	2.7	2.4	2.3	2.3	2.1	2.0	2.1	2.0	1.9
Electrical Time Constant	ms	2.25	2.65	2.64	2.95	3.35	3.49	3.42	3.76	3.94	3.71	4.04	4.19
Thermal Resistivity	deg. C/watt	1.2	1.2	1.2	1.0	0.9	0.9	0.9	0.8	0.8	0.9	0.7	0.7
Speed/Torque Gradient	rpm/oz-in	2.0	1.7	1.7	0.7	0.7	0.6	0.4	0.4	0.4	0.3	0.3	0.3

Notes:

- Motor mounted to a 10 x 10 x 1/4 inches aluminum plate, still air.
- Maximum winding temperature of 155°C.
- Typical electrical specifications at 25°C.
- Motor Terminal Voltages are representative only; motors may be operated at voltages other than those listed in the table. For assistance please contact our applications engineer.
- Calculated (theoretical) speed/torque gradient.
- For MS (military style) connector, please specify connector housing and terminal.
- Data for informational purposes only. Should not be considered a binding performance agreement. For specific applications, please contact the factory.

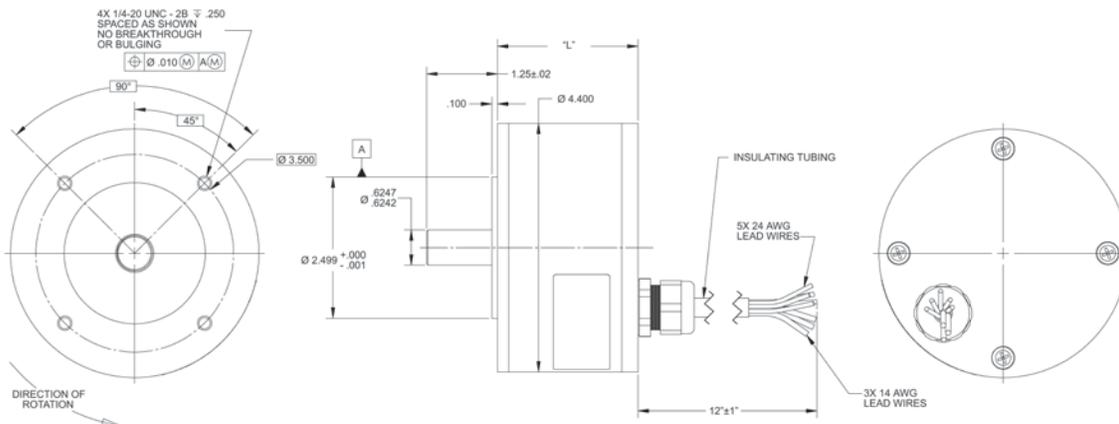
*Many other custom mechanical options are available – consult factory.

**Many other winding options are available – consult factory.

Select your options below and place their code in its corresponding block as shown on page 4.

- | | | |
|--|---|--|
| <input checked="" type="checkbox"/> TERMINATION | <input checked="" type="checkbox"/> FEEDBACK OPTIONS | <input checked="" type="checkbox"/> OTHER OPTIONS |
| L – Leads (std) | H – Hall Effect (std) | E – Encoder |
| C – Connector | R – Resolver | G – Gearhead |
| M – MS connector | S – Sensorless | |

BN42 IP65 TYPICAL OUTLINE



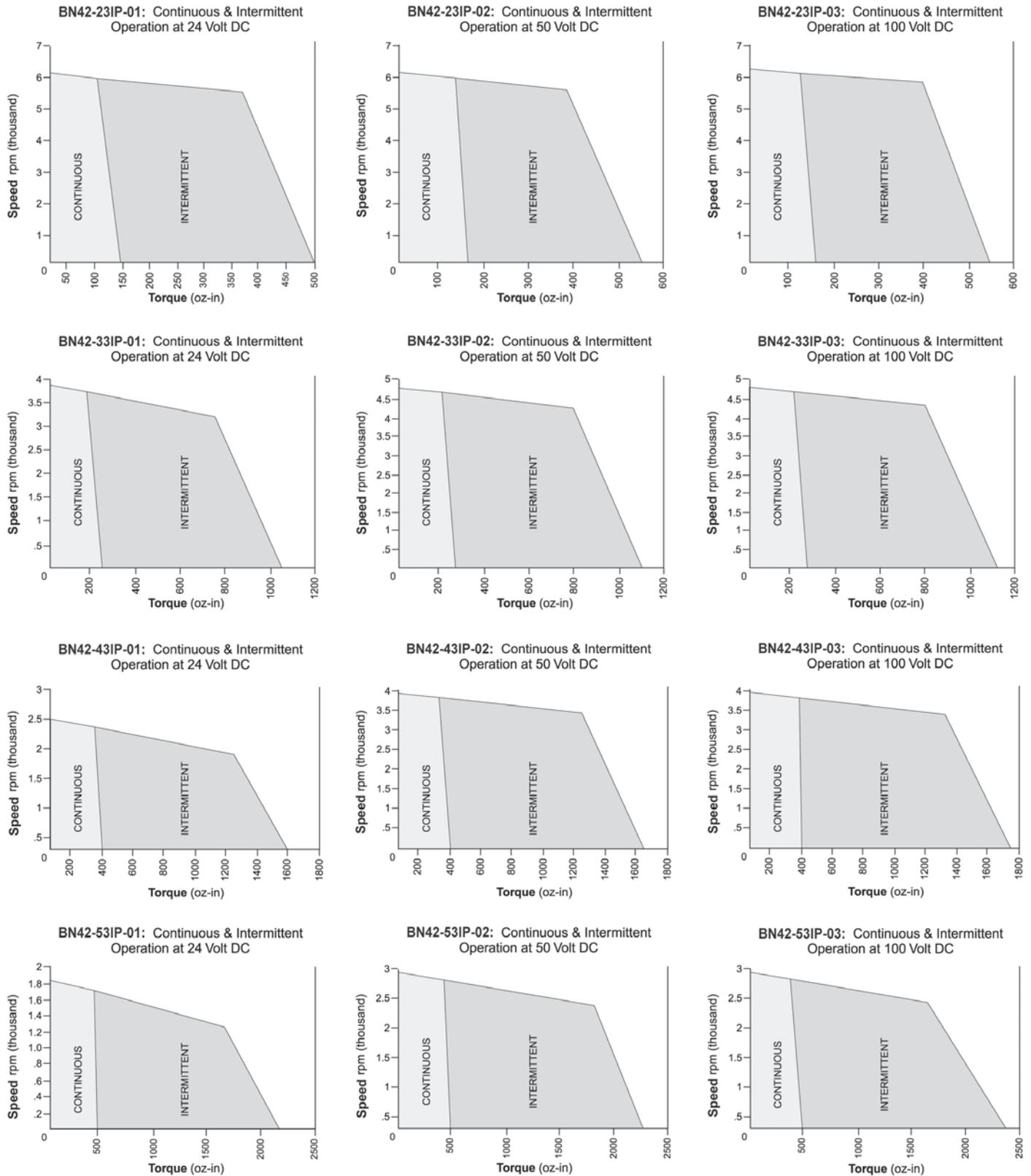
Termination Table

PIN COLOR	CONNECTION
YELLOW	V _{CC}
GRAY	GROUND
RED	A COIL
BLACK	B COIL
GREEN	C COIL
BLUE	S2 OUT
BROWN	S1 OUT
ORANGE	S3 OUT

Dimensions are in inches

Note: An optional 4.15 (105.4) square front end cap is available.

BN42 IP65 PERFORMANCE CURVES



Note: Intermittent operation is based on a 20% duty cycle of one minute on, four minutes off. Please contact the factory regarding the duty cycle of your application.

SILENCER[®] SERIES BRUSHLESS DC MOTORS OVERVIEW

BN12, 23 and 34 High Speed

High Speed Brushless Motors

BN high speed brushless motors offer relatively high speeds in the same BN package size. Ideal for applications involving higher speeds at higher power levels, such as medical centrifuge, pumps and blowers. Utilizing high energy rare earth magnets, these motors provide excellent value in a high speed, high power motor.

Reliable, Low-Cost Operation

The compact BN motors are well-suited for applications demanding low audible noise and long life. An aluminum housing protects the unit in rugged applications and environments. Typical options include electronic drives, encoders and gearheads, as well as Hall effect, resolver and sensorless feedback.

For more information about how this product can be tailored to fit your specific application, contact our applications engineers.

Typical Applications

- Medical equipment - blowers, centrifuges, compressors and pumps
- Scanners
- Packaging equipment and printing products
- HVAC equipment (air handling)

Features

- Inside rotor construction for quick acceleration
- 4 pole motors for high speed applications
- Compact size
- Continuous torque to 78.0 oz-in
- High energy neodymium magnets
- Safe, arcless operation
- High speed capability - up to 35,000 rpm
- High torque per dollar ratio

Benefits

- Operation at any single speed - not limited to AC frequency
- Motor life is not limited to brush or commutator life
- An essentially linear speed / torque curve
- Efficient operation without losses associated with brushes and commutation or armature induction
- Precise, variable speed control
- Extremely quiet operation

- Long-life operation

Encoders

High resolution, high reliability, and state-of-the-art technology in a small package:

- Bidirectional incremental code
- Up to 1024 cycles standard
- Up to 3 channels: A, B, and index
- TTL / CMOS compatible
- Hewlett Packard HEDS-5500 encoder standard, other configurations and resolutions available

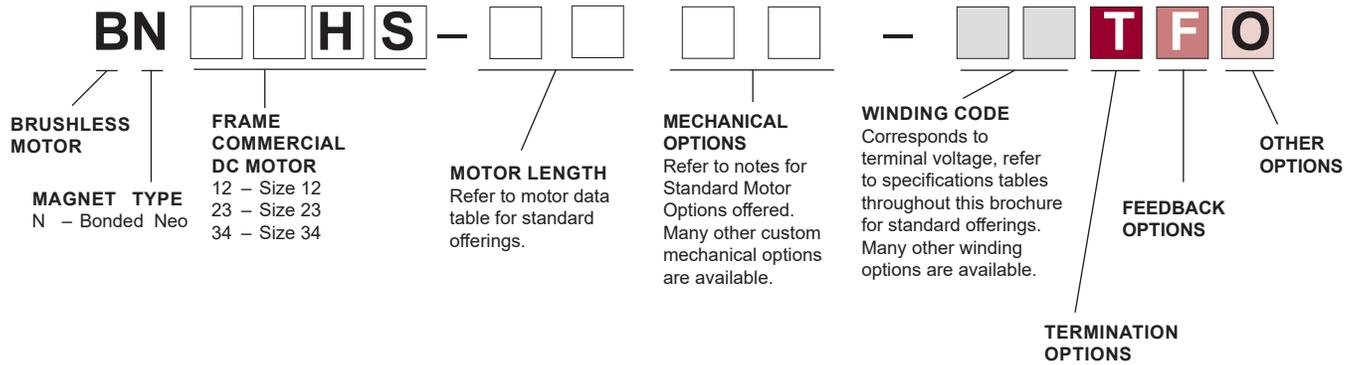
Silencer Brushless Motor Drives

Optimized for use with Silencer Brushless DC motors, these drives provide:

- Multiple operating modes - commutation, velocity, torque, 2 and 4 quadrant
- Feedback using Hall effect sensor or encoder
- Efficient PWM speed control
- CE approved for European applications
- Low cost
- Operating temperatures from -10° to 45°C

SPECIFICATIONS AND NUMBERING SYSTEM

Part Numbering System Guide



BN12HS SPECIFICATIONS

Continuous Stall Torque 1.2 - 4.5 oz-in (0.0088 - 0.0318 Nm) / Peak Torque 5 - 27 oz-in (0.0353 - 0.1907 Nm)

Part Number*		BN12HS-13AF- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> T F O			BN12HS-18AF- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> T F O			BN12HS-23AF- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> T F O			BN12HS-28AF- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> T F O		
Winding Code**		01	02	03	01	02	03	01	02	03	01	02	03
L = Length	inches	1.30			1.80			2.30			2.80		
	millimeters	33.0			45.7			58.4			71.1		
Terminal Voltage	volts DC	12.0	24.0	36.0	12.0	24.0	36.0	12.0	24.0	36.0	12.0	24.0	36.0
Peak Torque	oz-in	5.0	5.0	5.0	11.0	11.0	12.0	18.0	20.0	20.0	27.0	27.0	27.0
	Nm	0.0353	0.0353	0.0353	0.0777	0.0777	0.0847	0.1271	0.1412	0.1412	0.1907	0.1907	0.1907
Continuous Stall Torque	oz-in	1.2	1.3	1.3	2.0	2.0	2.0	3.2	3.6	3.6	4.3	4.4	4.5
	Nm	0.0088	0.0092	0.0092	0.0141	0.0141	0.0141	0.0229	0.0254	0.0254	0.0304	0.0311	0.0318
Rated Speed	RPM	26000.00	35670.0	27570.0	23520.0	22800.0	24520.0	19650.0	20500.0	22740.0	20050.0	20270.0	18450.0
	rad/sec	2723	3735	2887	2463	2388	2568	2058	2147	2381	2100	2123	1932
Rated Torque	oz-in	1.2	1.2	1.2	2.0	2.0	2.0	3.0	3.3	3.3	3.9	4.0	4.2
	Nm	0.0085	0.0083	0.0083	0.0138	0.0141	0.0141	0.0212	0.0233	0.0233	0.0275	0.0282	0.0297
Rated Current	Amps	2.50	1.40	1.00	3.90	2.00	1.40	5.00	2.70	2.00	6.30	3.20	2.10
Rated Power	watts	21.00	22.0	24.00	34.0	34.0	37.0	44.0	50.0	55.0	58.0	60.0	57.0
Torque Sensitivity	oz-in/amp	0.44	0.89	1.27	0.51	1.05	1.50	0.62	1.25	1.72	0.64	1.28	2.07
	Nm/amp	0.0031	0.0063	0.0090	0.0036	0.0074	0.0106	0.0044	0.0088	0.0121	0.0045	0.0090	0.0146
Back EMF	volts/KRPM	0.32	0.66	0.94	0.38	0.78	1.11	0.46	0.92	1.27	0.48	0.95	1.53
	volts/rad/sec	0.0031	0.0063	0.0090	0.0036	0.0074	0.0106	0.0044	0.0088	0.0121	0.0045	0.0090	0.0146
Terminal Resistance	ohms	0.92	3.69	7.45	0.56	2.25	4.52	0.42	1.32	2.54	0.28	1.04	2.63
Terminal Inductance	mH	0.27	1.11	2.28	0.17	0.70	1.43	0.14	0.54	1.01	0.10	0.42	1.08
Motor Constant	oz-in/sq.rt.watt	0.46	0.46	0.47	0.68	0.70	0.71	0.96	1.09	1.08	1.21	1.26	1.28
	Nm/sq.rt.watt	0.00324	0.00327	0.00329	0.00481	0.00494	0.00498	0.00676	0.00768	0.00762	0.00854	0.00886	0.00901
Rotor Inertia	oz-in-sec ² x10 ⁻³	0.02	0.02	0.02	0.04	0.04	0.04	0.06	0.06	0.06	0.08	0.08	0.08
	g-cm ²	1.4	1.4	1.4	2.8	2.8	2.8	4.0	4.2	4.2	5.4	5.6	5.6
Weight	oz	5.0	5.0	5.0	6.0	6.0	6.0	7.0	7.0	7.0	9.0	9.0	9.0
	g	142.0	142.0	142.0	170.4	170.4	170.4	198.8	198.8	198.8	255.6	255.6	255.6
# of Poles		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Timing		120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°
Mech. Time Constant	ms	13.5	13.2	13.1	12.2	11.6	11.4	8.8	7.2	7.3	7.4	7.2	6.9
Electrical Time Constant	ms	0.29	0.30	0.31	0.30	0.31	0.32	0.33	0.41	0.40	0.36	0.40	0.41
Thermal Resistivity	deg. C/watt	15.2	42.5	8.8	8.2	7.4	7.4	6.4	7.1	6.4	5.9	6.2	5.7
Speed/Torque Gradient	rpm/oz-in	6534.1	6281.9	6240.6	2889.6	2747.3	2714.7	1472.7	1147.8	1162.8	911.5	855.3	830.4

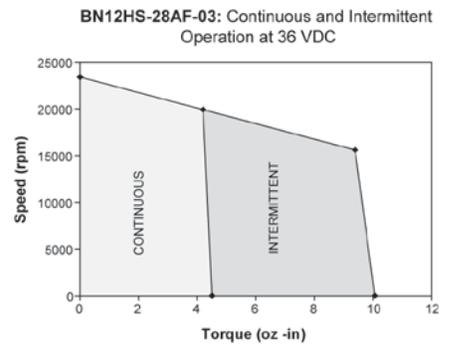
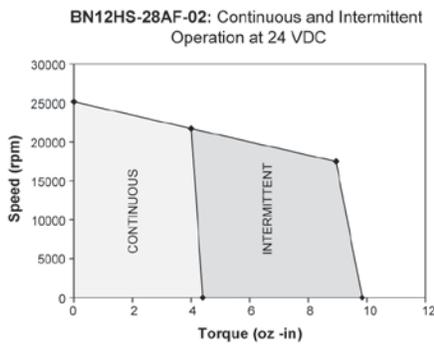
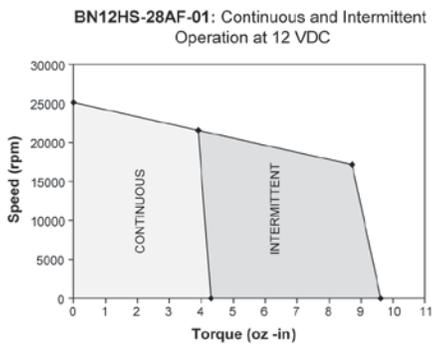
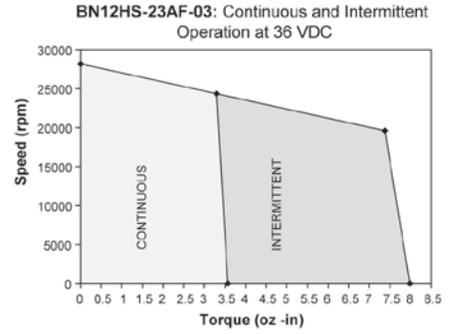
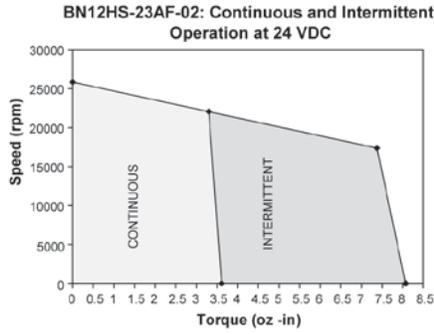
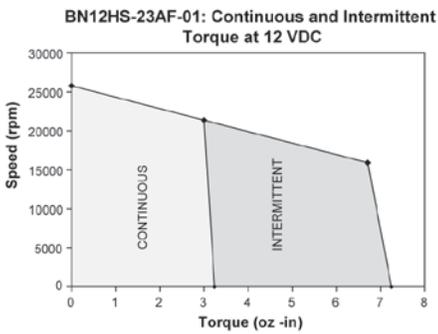
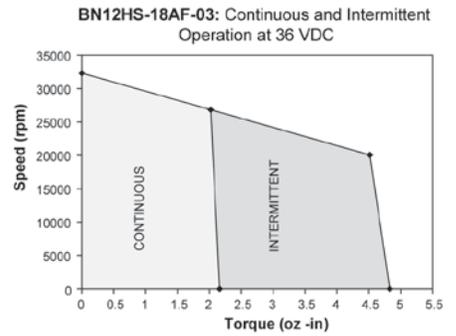
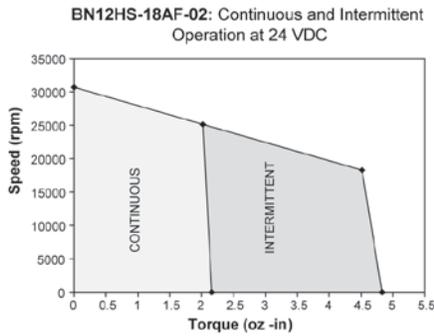
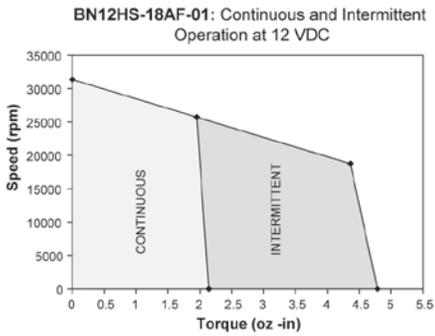
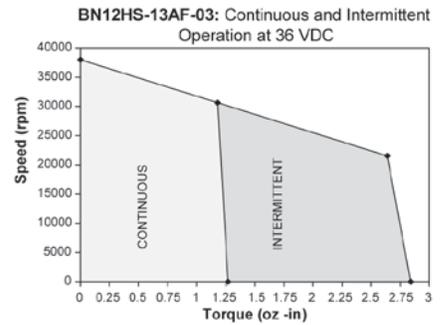
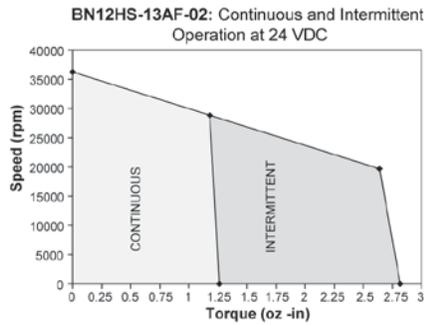
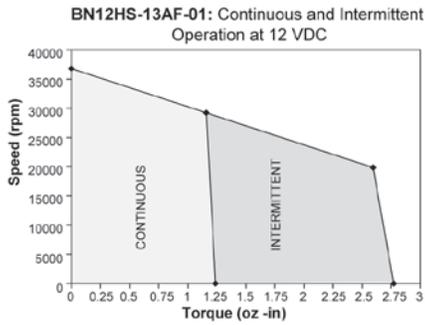
- Notes:
- Motor mounted to a 4 x 4 x 1/4 inches aluminum plate, still air.
 - Maximum winding temperature of 155°C.
 - Typical electrical specifications at 25°C.
 - Motor Terminal Voltages are representative only; motors may be operated at voltages other than those listed in the table. For assistance please contact an applications engineer.
 - For MS (military style) connector, please specify connector housing and terminal.
 - Data for informational purposes only. Should not be considered a binding performance agreement. For specific applications, please contact the factory.

*Many other custom mechanical options are available – consult factory.
**Many other winding options are available – consult factory.

Select your options below and place their code in its corresponding block as shown above.

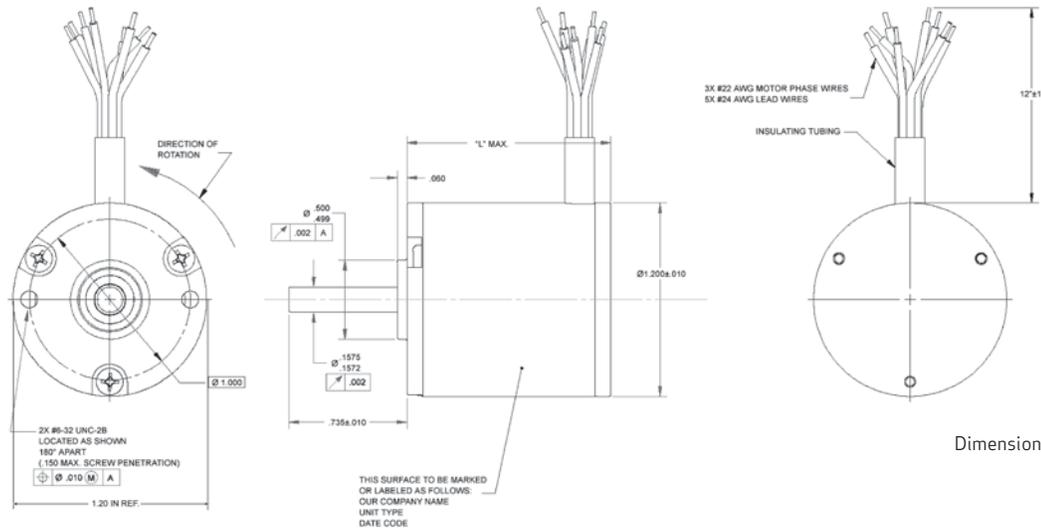
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|----------------------|---------------------------|------------------------|
| T TERMINATION | F FEEDBACK OPTIONS | O OTHER OPTIONS |
| L – Leads (std) | H – Hall Effect (std) | D – Drive |
| C – Connector | R – Resolver | E – Encoder |
| M – MS Connector | S – Sensorless | G – Gearhead |

BN12HS PERFORMANCE CURVES



Note: Intermittent operation is based on a 20% duty cycle of one minute on, four minutes off. Please contact the factory regarding the duty cycle of your application.

BN12HS TYPICAL OUTLINE



Dimensions are in inches

BN23HS SPECIFICATIONS

Continuous Stall Torque 6 - 32 oz-in (0.042 - 0.226 Nm) / Peak Torque 41 - 222 oz-in (0.2895 - 1.5677 Nm)

Part Number*		BN23HS-13HS- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN23HS-18HS- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN23HS-23HS- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN23HS-28HS- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Winding Code**		01	02	03	01	02	03	01	02	03	01	02	03
L = Length	inches	1.41			1.91			2.41			2.91		
	millimeters	35.8			48.5			61.2			73.9		
Terminal Voltage	volts DC	24	36	48	24	36	48	24	36	48	24	36	48
Peak Torque	oz-in	41	41	41	101	101	101	162	162	162	222	222	222
	Nm	0.2895	0.2895	0.2895	0.7132	0.7132	0.7132	1.1440	1.1440	1.1440	1.5677	1.5677	1.5677
Continuous Stall Torque	oz-in	6	6	6	16	16	16	23	25	24	27	32	32
	Nm	0.042	0.042	0.042	0.113	0.113	0.113	0.162	0.177	0.169	0.191	0.226	0.226
Rated Speed	RPM	18991	19048	19531	19644	19818	19225	14702	14875	14908	13285	14917	14629
	rad/sec	1989	1995	2045	2057	2075	2013	1540	1558	1561	1391	1562	1532
Rated Torque	oz-in	3.5	3.5	3.5	8.0	8.0	8.0	16.0	16.0	16.0	21.0	21.0	21.0
	Nm	0.025	0.025	0.025	0.056	0.056	0.056	0.113	0.113	0.113	0.148	0.148	0.148
Rated Current	Amps	2.7	1.8	1.4	5.8	3.9	2.9	8.3	5.6	4.2	9.9	7.3	5.3
Rated Power	watts	49	49	51	116	117	114	174	176	176	206	232	227
Torque Sensitivity	oz-in/amp	1.54	2.31	3.03	1.56	2.34	3.13	2.06	3.09	4.12	2.25	3.10	4.22
	Nm/amp	0.0109	0.0163	0.0214	0.0110	0.0165	0.0221	0.0145	0.0218	0.0291	0.0159	0.0219	0.0298
Back EMF	volts/KRPM	1.14	1.71	2.24	1.15	1.73	2.31	1.52	2.28	3.04	1.66	2.29	3.12
	volts/rad/sec	0.011	0.016	0.021	0.011	0.017	0.022	0.015	0.022	0.029	0.016	0.022	0.030
Terminal Resistance	ohms	0.70	1.65	2.72	0.14	0.30	0.50	0.14	0.28	0.51	0.14	0.19	0.35
Terminal Inductance	mH	0.48	1.08	1.86	0.23	0.52	0.93	0.26	0.59	1.04	0.23	0.44	0.81
Motor Constant	oz-in/sq.rt.watt	1.84	1.80	1.84	4.17	4.27	4.43	5.51	5.84	5.77	6.01	7.11	7.13
	Nm/sq.rt.watt	0.13	0.13	0.13	0.029	0.030	0.031	0.039	0.041	0.041	0.042	0.050	0.050
Rotor Inertia	oz-in-sec ² x10 ⁻³	0.51	0.51	0.51	0.99	0.99	0.99	1.50	1.50	1.50	1.90	1.90	1.90
	g-cm ²	36.0	36.0	36.0	69.9	69.9	69.9	105.9	105.9	105.9	134.1	134.1	134.1
Weight	oz	10.0	10.0	10.0	15.0	15.0	15.0	21.0	21.0	21.0	26.0	26.0	26.0
	g	284.0	284.0	284.0	426.0	426.0	426.0	596.4	596.4	596.4	738.4	738.4	738.4
# of Poles		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Timing		120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°	120°
Mech. Time Constant	ms	21.3	22.3	21.4	8.1	7.7	7.2	7.0	6.2	6.4	7.4	5.3	5.3
Electrical Time Constant	ms	0.69	0.65	0.68	1.64	1.73	1.86	1.86	2.11	2.04	1.64	2.32	2.31
Thermal Resistivity	deg. C/watt	6.7	6.8	6.3	4.6	4.5	4.1	4.2	4.1	4.2	3.4	3.4	3.9
Speed/Torque Gradient	rpm/oz-in	398.7	417.7	400.8	78.0	74.1	69.2	44.7	39.7	40.7	37.5	26.8	26.6

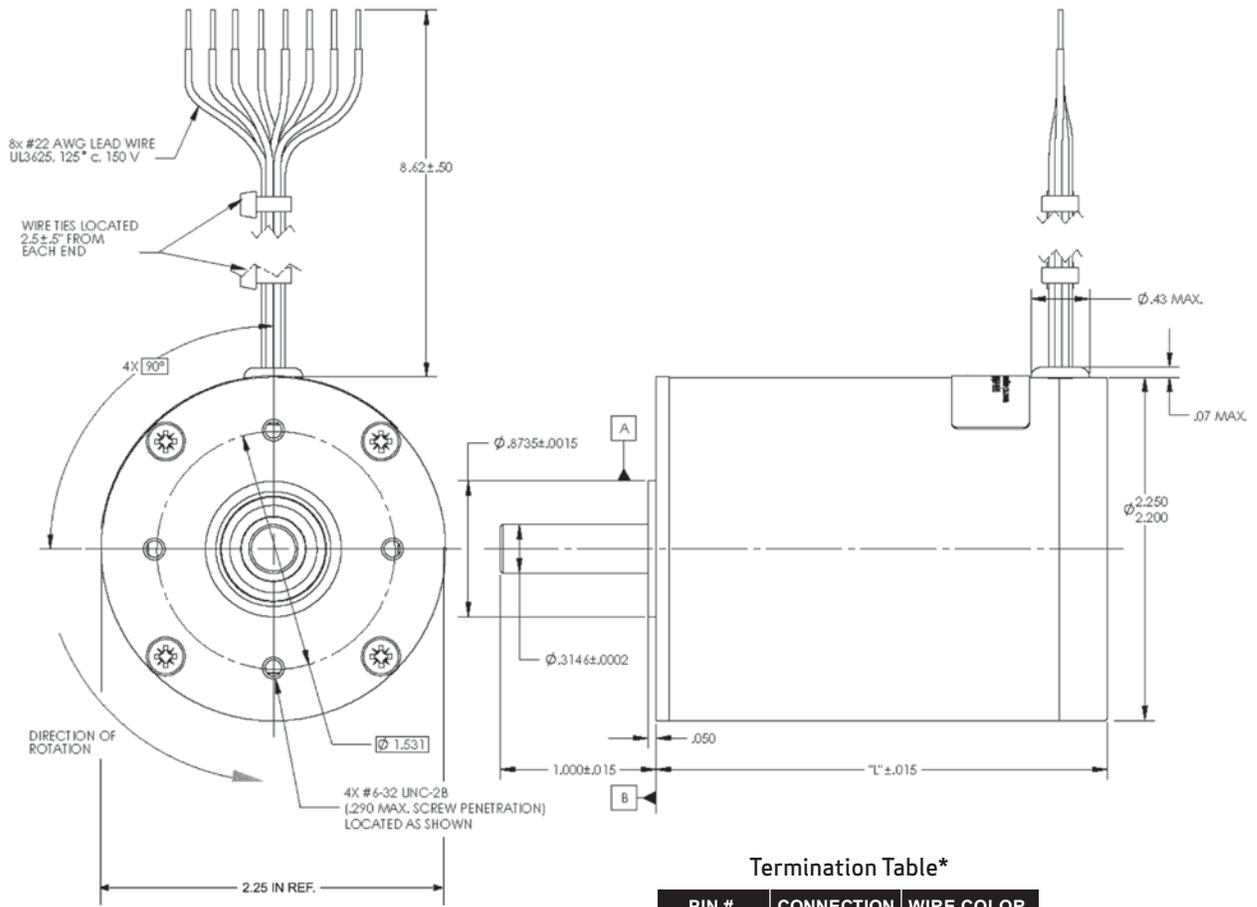
- Notes:
- Motor mounted to a 4 x 4 x 1/4 inches aluminum plate, still air.
 - Maximum winding temperature of 155°C.
 - Typical electrical specifications at 25°C.
 - Motor Terminal Voltages are representative only; motors may be operated at voltages other than those listed in the table. For assistance please contact an applications engineer.
 - For MS (military style) connector, please specify connector housing and terminal.
 - Data for informational purposes only. Should not be considered a binding performance agreement. For specific applications, please contact the factory.

*Many other custom mechanical options are available – consult factory.
 **Many other winding options are available – consult factory.

Select your options below and place their code in its corresponding block as shown on page 42.

- | | | |
|--|---|--|
| <input checked="" type="checkbox"/> TERMINATION | <input checked="" type="checkbox"/> FEEDBACK OPTIONS | <input checked="" type="checkbox"/> OTHER OPTIONS |
| L – Leads (std) | H – Hall Effect (std) | D – Drive |
| C – Connector | R – Resolver | E – Encoder |
| M – MS Connector | S – Sensorless | G – Gearhead |

BN23HS TYPICAL OUTLINE



Dimensions are in inches

Termination Table*

PIN #	CONNECTION	WIRE COLOR
1	V _{CC}	White / Yellow
2	GROUND	White / Gray
3	A COIL	White / Violet
4	B COIL	White / Black
5	C COIL	Green
6	S2 OUT	White / Blue
7	S1 OUT	White / Brown
8	S3 OUT	White

*We reserve the right to use solid color wires or white wires with color trace.

Timing Diagram (4 Pole) CCW Rotation

DEGREES	ELEC															
	0	60	120	180	240	300	360	60	120	180	240	300	360			
	MECH															
	0	30	60	90	120	150	180	210	240	270	300	330	360			
S1 OUT																
S2 OUT																
S3 OUT																
A COIL	-	0	+	+	0	-	-	0	+	+	0	-				
B COIL	+	+	0	-	-	0	+	+	0	-	-	0				
C COIL	0	-	-	0	+	+	0	-	-	0	+	+				

BN34HS SPECIFICATIONS

Continuous Stall Torque 48 - 99 oz-in (0.3390 - 0.6991 Nm) / Peak Torque 177 - 363 oz-in (1.2499 - 2.5633 Nm)

Part Number*		BN34HS-25AF- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			BN34HS-35AF- <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Winding Code**		01	02	03	01	02	03
L = Length	inches	2.50			3.50		
	millimeters	63.5			88.9		
Terminal Voltage	volts DC	24.0	50.0	100.0	24.0	50.0	100.0
Peak Torque	oz-in	177.0	177.0	177.0	363.0	363.0	363.0
	Nm	1.2499	1.2499	1.2499	2.5633	2.5633	2.5633
Continuous Stall Torque	oz-in	48.0	49.0	48.0	91.0	98.0	99.0
	Nm	0.3390	0.3460	0.3390	0.6426	0.6920	0.6991
Rated Speed	RPM	14011.0	13900.0	14640.0	7100.0	9340.0	9400.0
	rad/sec	1467	1456	1533	744	978	984
Rated Torque	oz-in	34.0	34.0	34.0	78.0	78.0	78.0
	Nm	0.2401	0.2401	0.2401	0.5508	0.5508	0.5508
Rated Current	Amps	18.60	8.60	4.50	22.40	13.00	6.50
Rated Power	watts	396.0	381.0	397.0	478.0	591.0	591.0
Torque Sensitivity	oz-in/amp	1.94	4.20	8.08	3.59	6.21	12.42
	Nm/amp	0.0137	0.0297	0.0571	0.0254	0.0439	0.0877
Back EMF	volts/KRPM	1.43	3.10	5.97	2.66	4.59	9.18
	volts/rad/sec	0.0137	0.0297	0.0571	0.0254	0.0439	0.0877
Terminal Resistance	ohms	0.054	0.242	0.920	0.063	0.163	0.638
Terminal Inductance	mH	0.18	0.85	3.14	0.33	0.99	3.95
Motor Constant	oz-in/sq.rt.watts	8.35	8.54	8.42	14.30	15.38	15.55
	Nm/sq.rt.watts	0.05895	0.06029	0.05949	0.10100	0.10862	0.10980
Rotor Inertia	oz-in-sec ² x10 ⁻³	7.30	7.30	7.30	14.00	14.00	14.00
	g-cm ²	515.2	515.2	515.2	988.0	988.0	988.0
Weight	oz	38.0	38.0	38.0	65.0	66.0	66.0
	g	1079.2	1079.2	1079.2	1846.0	1874.4	1874.4
# of Poles		4.0	4.0	4.0	4.0	4.0	4.0
Timing		120°	120°	120°	120°	120°	120°
Mech. Time Constant	ms	14.8	14.2	14.6	9.7	8.4	8.2
Electrical Time Constant	ms	3.33	3.51	3.41	5.24	6.07	6.19
Thermal Resistivity	deg. C/watt	1.1	1.3	1.3	0.8	0.9	1.0
Speed/Torque Gradient	rpm/oz-in	58.5	55.8	57.3	19.8	17.1	16.8

Notes:

- Motor mounted to a 4 x 4 x 1/4 inches aluminum plate, still air.
- Maximum winding temperature of 155°C.
- Typical electrical specifications at 25°C.
- Motor Terminal Voltages are representative only; motors may be operated at voltages other than those listed in the table. For assistance please contact an applications engineer.
- For MS (military style) connector, please specify connector housing and terminal.
- Data for informational purposes only. Should not be considered a binding performance agreement. For specific applications, please contact the factory.

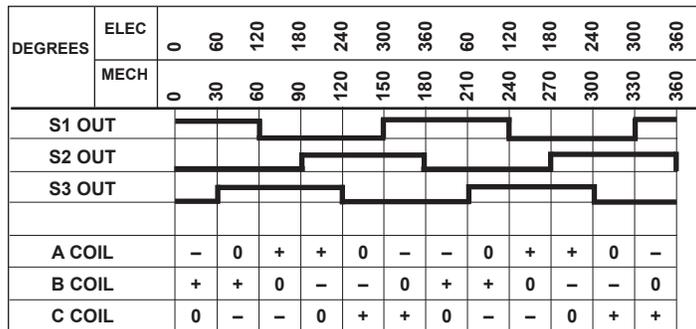
*Many other custom mechanical options are available – consult factory.

**Many other winding options are available – consult factory.

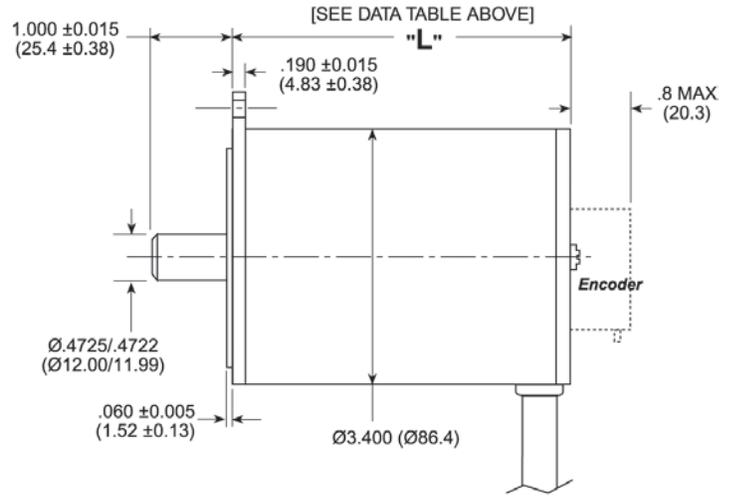
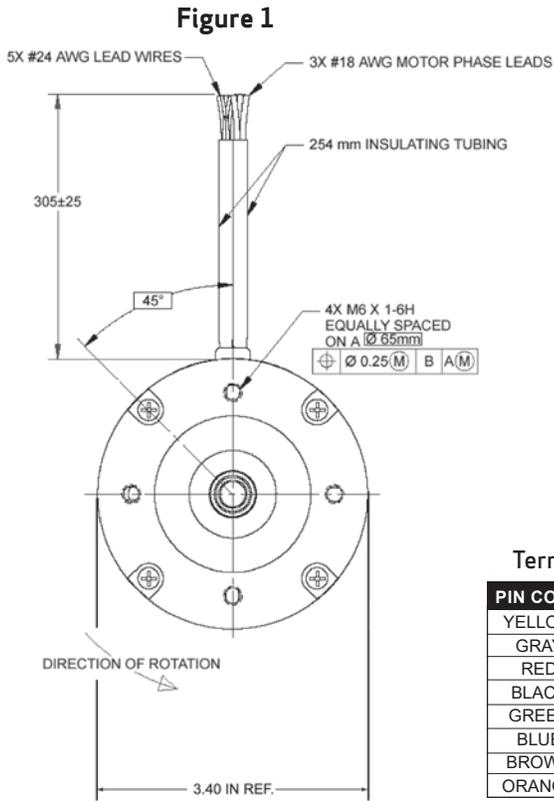
Select your options below and place their code in its corresponding block as shown on page 42.

- | | | |
|---|--|---|
| <input type="checkbox"/> TERMINATION | <input type="checkbox"/> FEEDBACK OPTIONS | <input type="checkbox"/> OTHER OPTIONS |
| L – Leads (std) | H – Hall Effect (std) | D – Drive |
| C – Connector | R – Resolver | E – Encoder |
| M – MS Connector | S – Sensorless | G – Gearhead |

Timing Diagram (4 Pole) CCW Rotation



BN34HS TYPICAL OUTLINE



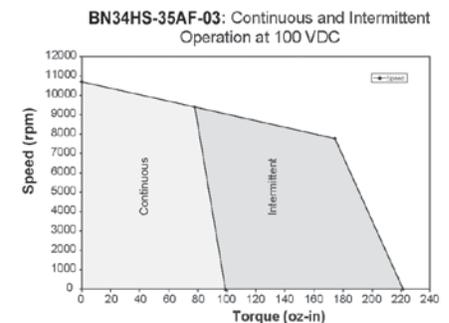
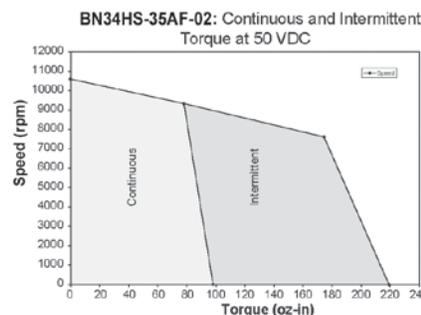
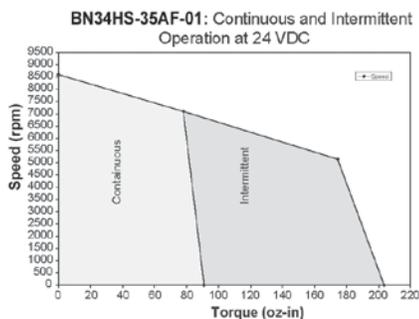
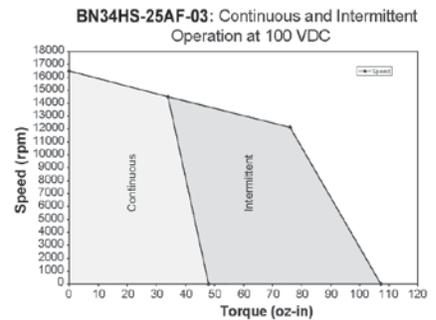
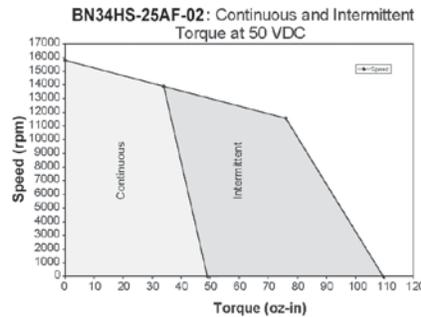
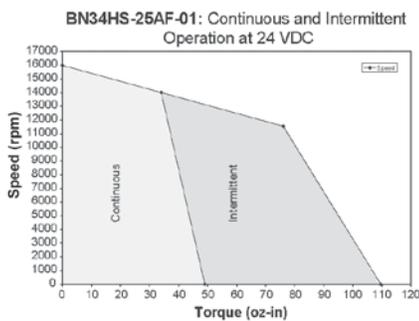
Termination Table

PIN COLOR	CONNECTION
YELLOW	V _{CC}
GRAY	GROUND
RED	A COIL
BLACK	B COIL
GREEN	C COIL
BLUE	S2 OUT
BROWN	S1 OUT
ORANGE	S3 OUT

Dimensions are in inches (millimeters)

Note: Square or Round Cap Available: AF (standard version) comes standard with square cap, see drawing on page 30. For round cap version, see Figure 1 above.

BN34HS PERFORMANCE CURVES



Note: Intermittent region based upon 20% duty cycle - 1 minute on, 4 minutes off.

SILENCER® SERIES BRUSHLESS DC MOTORS OVERVIEW

BS17 High Energy

High Energy Brushless Motors

Silencer® Series BS17 high energy brushless DC motors utilize high energy sintered rare earth magnets, yielding a compact motor with high power density, high efficiency and a high torque / volume ratio. In addition, high power and high efficiency, quality bearing systems and precision rotor balancing makes for smooth and quiet operation. These characteristics make the motor ideal for battery powered medical applications, high power density actuators, pumps, blowers and compressors. Machine wound stators provide economy yet allow this high energy motor to replace more expensive brushless DC servo motors.

For more information about how this product can be tailored to fit your specific application, contact our applications engineers.

Typical Applications

- Portable oxygen concentrators
- Mobility and patient assist
- Medical pumps and compressors
- Laboratory centrifuges
- Commercial / military actuators
- Robotics
- Packaging equipment

Features

- High energy sintered neodymium magnets
- High efficiency
- 8 pole inside rotor construction – high acceleration
- Compact size – excellent torque to volume ratio
- Precision bearings
- Balanced rotors (depending upon rotor configuration)
- Safe, arcless operation
- Precision machined aluminum housings and end caps
- High quality stainless steel shaft

Benefits

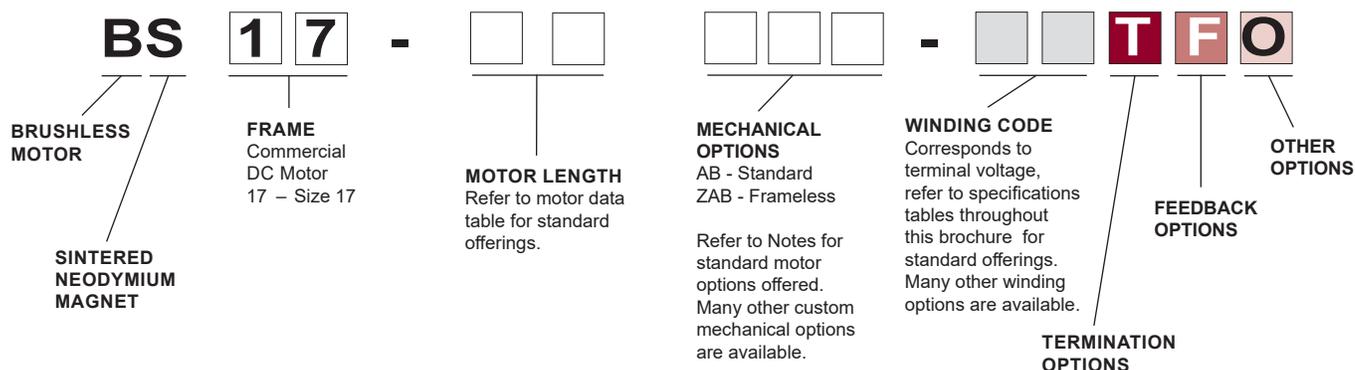
- Precise, variable speed - adjustable via drive electronics
- Linear speed / torque characteristics
- Long life, no brushes to replace and no commutator to wear out
- Low noise / low vibration, smooth and quiet operation
- High torque per dollar ratio

Options

- Custom shafts
- IP65 design
- Motor winding
- Encoders
- Gearheads
- Resolvers
- Sensored or sensorless
- Drives

SPECIFICATIONS AND NUMBERING SYSTEM

Part Numbering System Guide



BS17 SPECIFICATIONS

Continuous Stall Torque 12 - 14 oz-in (0.085 - 0.099 Nm) / Peak Torque 35 oz-in (0.25 Nm)

Part Number*		BS17-15AA- <input type="checkbox"/> <input type="checkbox"/> T F O			BS17-20AA- <input type="checkbox"/> <input type="checkbox"/> T F O		
Winding Code**		01	02	03	01	02	03
L = Length	inches	1.5	1.5	1.5	2	2	2
	millimeters	38.2	38.2	38.2	50.9	50.9	50.9
Terminal Voltage	volts DC	12	24	48	12	24	48
Peak Torque	oz-in	97	106	108	156	256	332
	Nm	0.685	0.749	0.763	1.102	1.808	2.344
Continuous Stall Torque	oz-in	15.8	16.6	16.7	32	32	32
	Nm	0.112	0.117	0.118	0.226	0.226	0.226
Rated Speed	rpm	3605	3609	3550	2014	3876	5737
	rad/sec	377.5	377.9	371.8	210.9	405.9	600.9
Rated Torque	oz-in	14	14.7	14.8	29.5	29.5	27
	Nm	0.099	0.104	0.105	0.208	0.208	0.191
Rated Current	Amps	4.06	2.13	1.07	6.69	4.97	3.24
Rated Power	watts	37	39	39	43	84	115
Torque Sensitivity	oz-in/amp	3.39	6.90	13.79	4.72	6.32	9.34
	Nm/amp	0.024	0.049	0.097	0.033	0.045	0.066
Back EMF	volts/KRPM	2.51	5.10	10.20	3.49	4.67	6.91
	volts/rad/sec	0.024	0.049	0.097	0.033	0.045	0.066
Terminal Resistance	ohms	0.439	1.563	6.120	0.429	0.664	1.527
Terminal Inductance	mH	0.241	1.036	4.144	0.245	0.436	1.01
Motor Constant	oz-in/sq.rt.watts	5.12	5.52	5.57	7.20	7.75	7.56
	Nm/sq.rt.watts	0.036	0.039	0.039	0.051	0.055	0.053
Rotor Inertia	oz-in-sec ² x10 ⁻³	0.26	0.26	0.26	0.42	0.42	0.42
	g-cm ²	18.4	18.4	18.4	29.7	29.7	29.7
Weight	oz	7.4	7.3	7.3	11	11	11
	g	210	207	207	312	312	312
# of Poles		8	8	8	8	8	8
Timing		120°	120°	120°	120°	120°	120°
Mech. Time Constant	ms	1.31	1.20	1.17	1.15	0.99	1.04
Electrical Time Constant	ms	0.61	0.66	0.68	0.57	0.66	0.66
Thermal Resistivity	deg. C/watt	4.10	4.65	4.56	3.58	3.58	3.58
Speed/Torque Gradient	rpm/oz-in	75	75	75	44	38	47

Notes:

- Motor mounted to a 4 x 4 x 1/4 inches aluminum plate, still air.
- Maximum winding temperature of 155°C.
- Typical electrical specifications at 25°C.
- Motor Terminal Voltages are representative only; motors may be operated at voltages other than those listed in the table. For assistance please contact our applications engineer.
- Calculated (theoretical) speed/torque gradient.

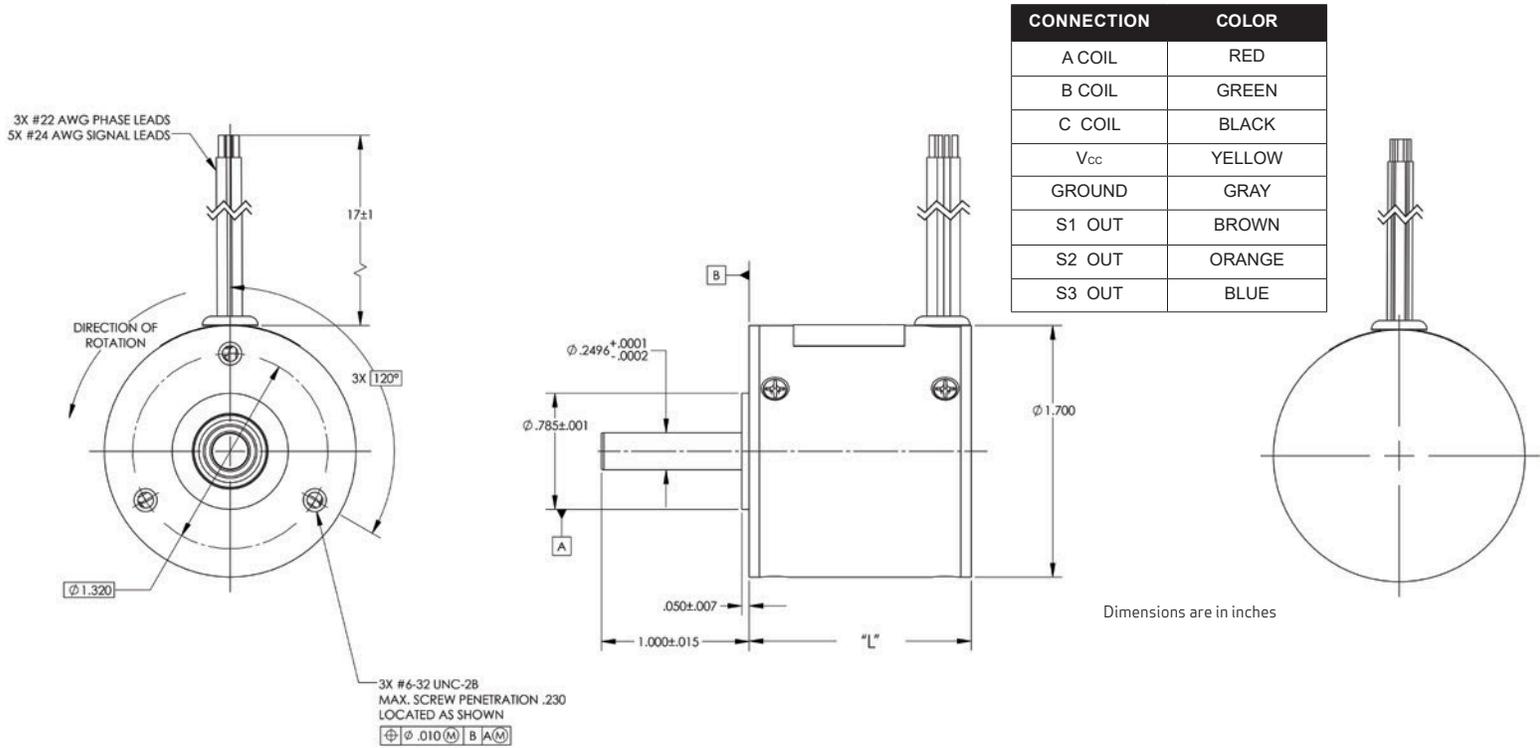
*Many other custom mechanical options are available – consult factory.

**Many other winding options are available – consult factory.

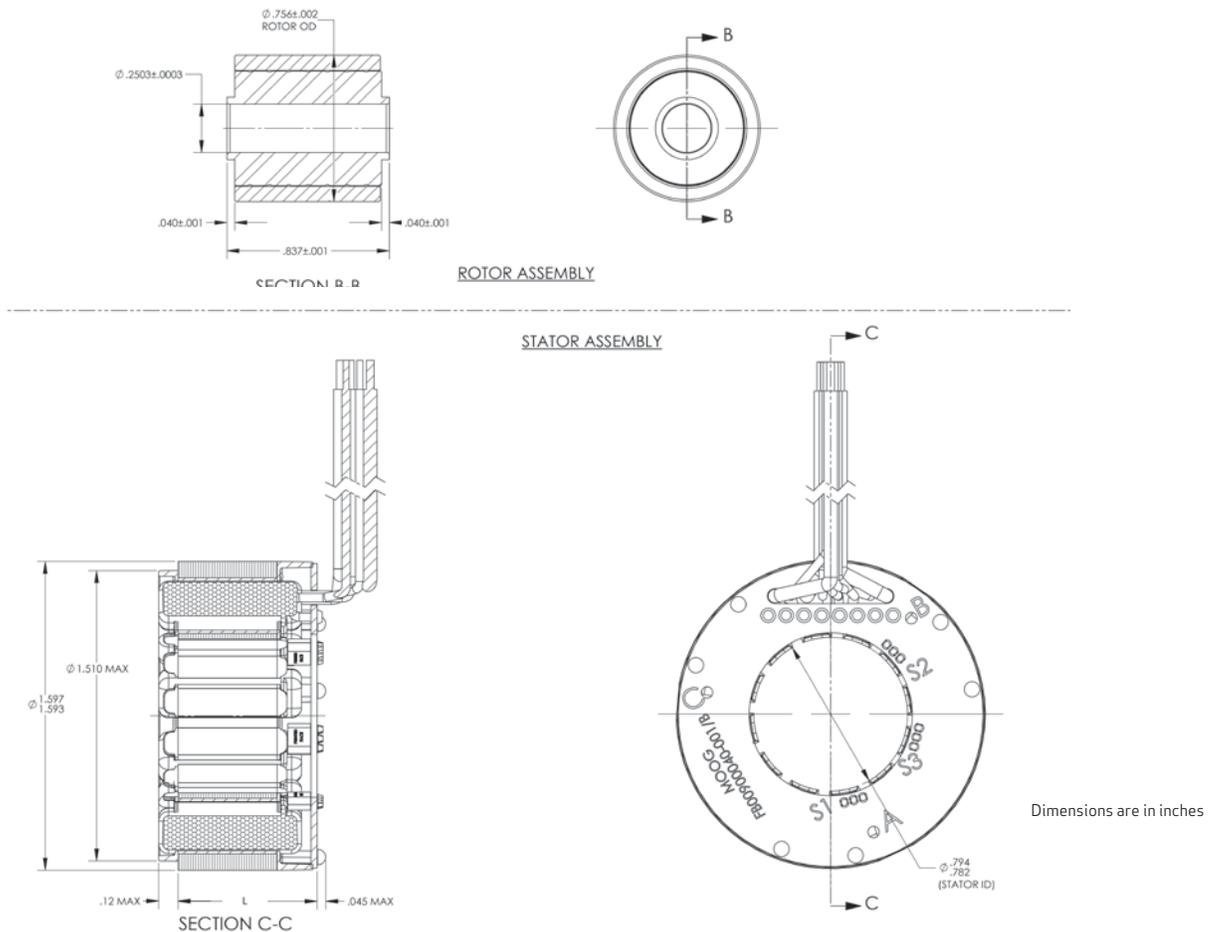
Select your options below and place their code in its corresponding block as shown above.

- | | | |
|----------------------|---------------------------|------------------------|
| T TERMINATION | F FEEDBACK OPTIONS | O OTHER OPTIONS |
| L – Leads (std) | H – Hall Effect (std) | D – Drive |
| C – Connector | R – Resolver | G – Gearhead |
| M – MS connector | S – Sensorless | E – Encoder |

BS17 TYPICAL OUTLINE - HOUSED

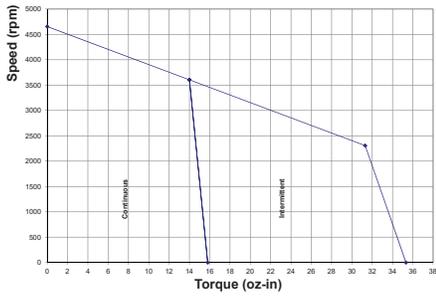


BS17 TYPICAL OUTLINE - FRAMELESS

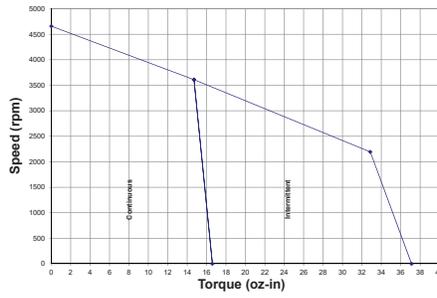


BS17 PERFORMANCE CURVES

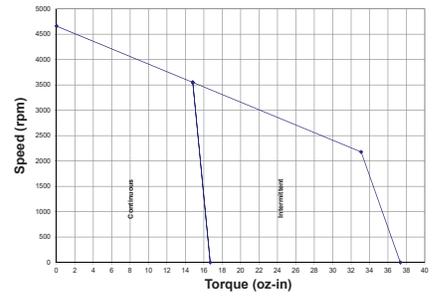
BS17-15AA-01LH: Continuous and Intermittent Operation at 12VDC



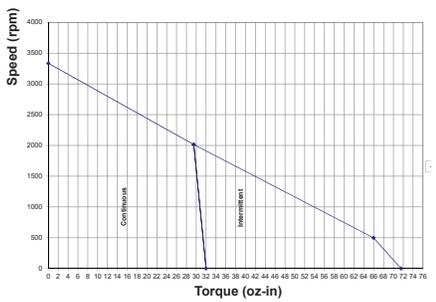
BS17-15AA-02LH: Continuous and Intermittent Operation at 24VDC



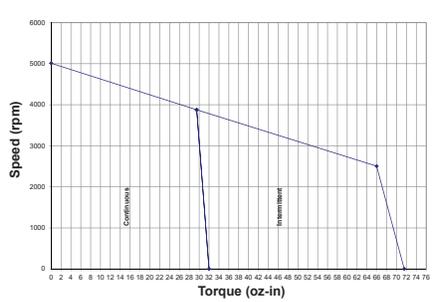
BS17-15AA-03LH: Continuous and Intermittent Operation at 48VDC



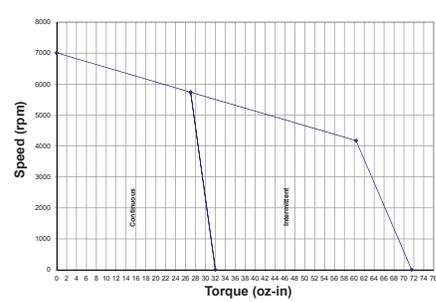
BS17-20AA-01LH: Continuous and Intermittent Operation at 12VDC



BS17-20AA-02LH: Continuous and Intermittent Operation at 24VDC



BS17-20AA-03LH: Continuous and Intermittent Operation at 48VDC



Note: Intermittent operation is based on a 20% duty cycle of 1 minute on, 4 minutes off. Please contact the factory regarding the duty cycle of your application.

SILENCER[®] SERIES BRUSHLESS DC MOTORS OVERVIEW

BS23 High Performance

Utilizing high energy sintered neodymium magnets, the BS23 brushless motor offers almost two times the torque capability of the standard BN23. When maximum performance and minimum size are important, the BS23 offers an effective solution.

Finned black motor housing offers excellent heat transfer characteristics. Typical options include electronic drives, encoders, gearheads, as well as Hall effect, resolvers, and sensorless feedback.

For more information about how this product can be tailored to fit your specific application, contact our application engineers.

Typical Applications

- Medical equipment - pumps, blowers and electric scooters and wheelchairs
- Automatic door and window openers
- Computer-controlled embroidery machines
- Scanners
- Packaging equipment and printing products
- HVAC equipment (air handling)
- Robotic tape storage and retrieval
- Semiconductor handling and insertion machines
- Actuators

Features

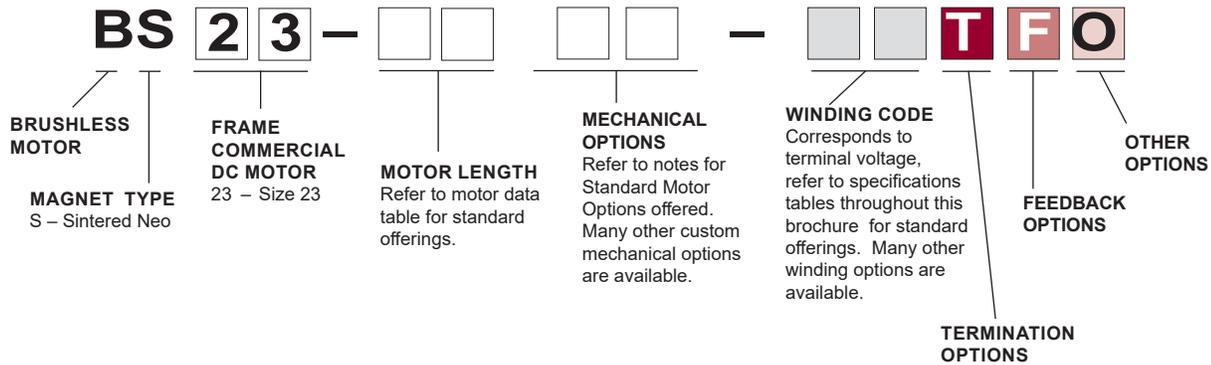
- Inside rotor construction for quick acceleration
- 8 pole motor standard, 4 pole motors optional for high speed applications
- Compact size - lengths from 1.8 to 2.8 inches
- Continuous torques from 29 to 58 oz-in
- High energy sintered neodymium magnets
- Safe, arcless operation
- High torque per dollar ratio

Benefits

- Operation at any single speed - not limited to AC frequency
- Motor life is not limited to brush or commutator life
- An essentially linear speed / torque curve
- Efficient operation without losses associated with brushes and commutation or armature induction
- Precise, variable speed control
- Extremely quiet operation
- Long-life operation

SPECIFICATIONS AND NUMBERING SYSTEM

Part Numbering System Guide



BS23 SPECIFICATIONS

Continuous Stall Torque 36 - 70 oz-in (0.25 - 0.49 Nm) / Peak Torque 238 - 729 oz-in (1.68 - 5.15 Nm)

Part Number*		BS23-18HP- [] [] T F O			BS23-23-HP [] [] T F O			BS23-28HP [] [] T F O		
Winding Code**		01	02	03	01	02	03	01	02	03
L = Length	inches	1.91			2.41			2.91		
	millimeters	48.5			61.2			73.9		
Terminal Voltage	volts DC	24	36	48	24	36	48	24	36	48
Peak Torque	oz-in	238	287	307	514	637	684	556	681	729
	Nm	1.68	2.03	2.17	3.63	4.50	4.83	3.93	4.81	5.15
Continuous Stall Torque	oz-in	36	35	35	52	53	53	68	69	70
	Nm	0.25	0.25	0.25	0.37	0.37	0.37	0.48	0.49	0.49
Rated Speed	RPM	3000	3881	4198	4022	4800	5151	2796	3368	3628
	rad/sec	314	406	440	421	503	539	293	353	380
Rated Torque	oz-in	32	30	29	40	37	36	58	56	55
	Nm	0.23	0.21	0.20	0.28	0.26	0.25	0.41	0.40	0.39
Rated Current	Amps	3.7	2.9	2.3	5.9	4.3	3.3	6.1	4.6	3.6
Rated Power	watts	71	86	90	119	131	137	120	140	148
Torque Sensitivity	oz-in/amp	9.11	11.02	13.71	7.26	9.38	11.76	10.06	12.94	16.37
	Nm/amp	0.064	0.078	0.097	0.051	0.066	0.083	0.071	0.091	0.116
Back EMF	volts/KRPM	6.74	8.15	10.14	5.37	6.94	8.70	7.44	9.57	12.10
	volts/rad/sec	0.064	0.078	0.097	0.051	0.066	0.083	0.071	0.091	0.116
Terminal Resistance	ohms	0.90	1.36	2.13	0.33	0.52	0.82	0.43	0.68	1.06
Terminal Inductance	mH	0.86	1.26	1.98	0.34	0.57	0.90	0.48	0.79	1.25
Motor Constant	oz-in/sq.rt.watt	9.60	9.45	9.39	12.64	13.0	13.0	15.34	15.69	15.90
	Nm/sq.rt.watt	0.068	0.067	0.066	0.089	0.092	0.092	0.108	0.111	0.112
Rotor Inertia	oz-in-sec ² x10 ⁻³	0.99	0.99	0.99	1.50	1.50	1.50	1.90	1.90	1.90
	g-cm ²	69.9	69.9	69.9	105.9	105.9	105.9	134.1	134.1	134.1
Weight	oz	15	15	15	21	21	21	26	26	26
	g	426	426	426	596	596	596	738	738	738
# of Poles		8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Timing		120°	120°	120°	120°	120°	120°	120°	120°	120°
Mech. Time Constant	ms	1.5	1.6	1.6	1.3	1.3	1.3	1.1	1.1	1.1
Electrical Time Constant	ms	0.96	0.93	0.93	1.03	1.10	1.10	1.12	1.16	1.18
Thermal Resistivity	deg. C/watt	5.9	5.7	5.2	4.6	4.5	4.9	4.0	4.0	4.2
Speed/Torque Gradient	rpm/oz-in	14.7	15.1	15.3	8.5	8.0	8.0	5.7	5.5	5.4

Notes:

- Motor mounted to a 4 x 4 x 1/4 inches aluminum plate, still air.
- Maximum winding temperature of 155°C.
- Typical electrical specifications at 25°C.
- Motor Terminal Voltages are representative only; motors may be operated at voltages other than those listed in the table. For assistance please contact an applications engineer.
- For MS (military style) connector, please specify connector housing and terminal.
- Data for informational purposes only. Should not be considered a binding performance agreement. For specific applications, please contact the factory.

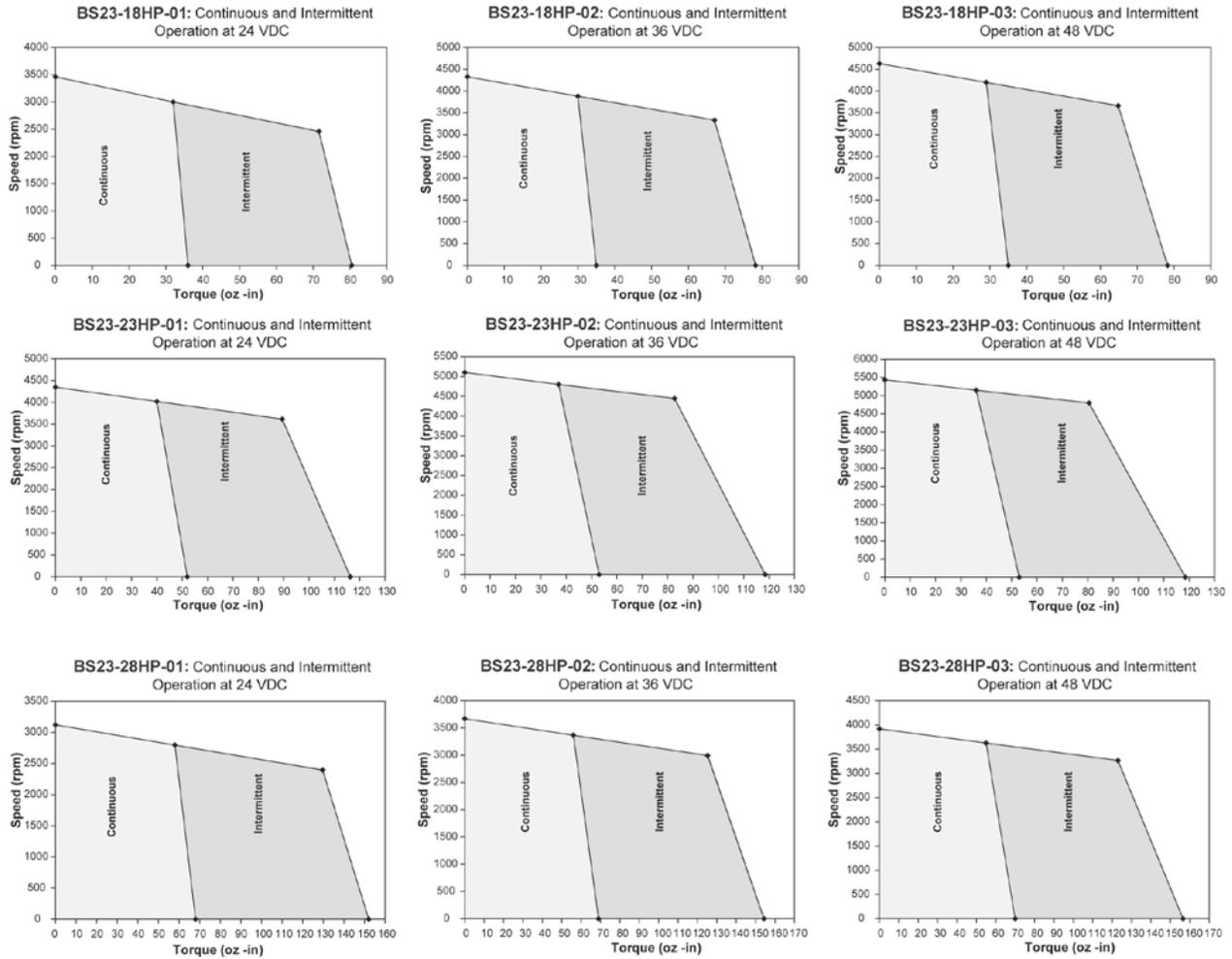
*Many other custom mechanical options are available – consult factory.

**Many other winding options are available – consult factory.

Select your options below and place their code in its corresponding block as shown above.

- | | | |
|----------------------|---------------------------|------------------------|
| T TERMINATION | F FEEDBACK OPTIONS | O OTHER OPTIONS |
| L – Leads (std) | H – Hall Effect (std) | E – Encoder |
| C – Connector | R – Resolver | G – Gearhead |
| M – MS Connector | S – Sensorless | |

BS23 PERFORMANCE CURVES

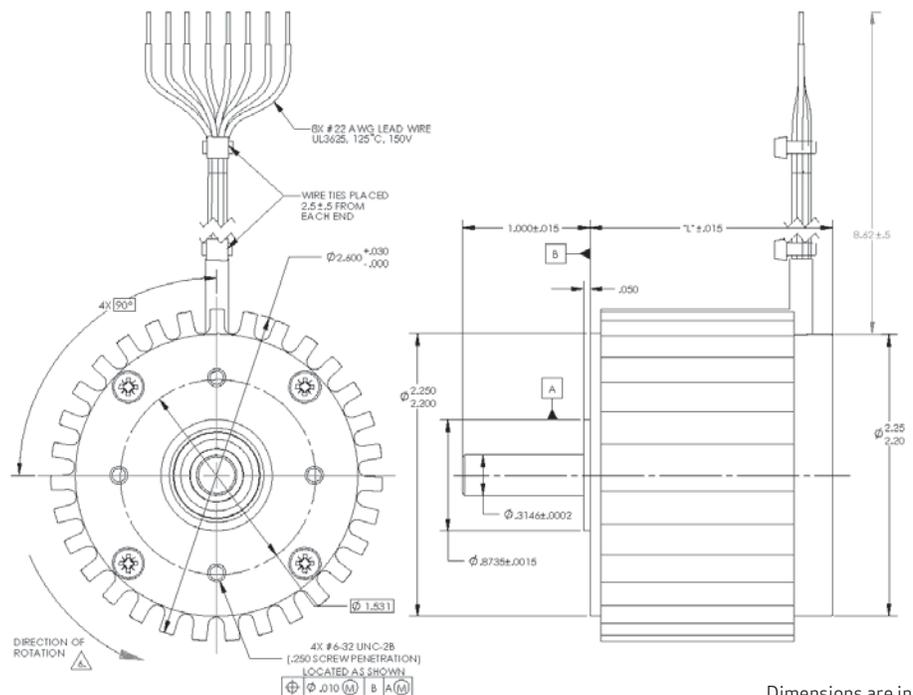


BS23 TYPICAL OUTLINE

Termination Table*

MOTOR LEADS		SENSOR LEADS	
COLOR	CONNECTION	COLOR	CONNECTION
VIOLET	A COIL	YELLOW	Vcc
BLACK	B COIL	BROWN	S1 OUT
GREEN	C COIL	BLUE	S2 OUT
		WHITE	S3 OUT
		GRAY	GROUND

*We reserve the right to use solid color wires or white wires with color trace.



Note: Standard housing Ø2.250 is available.

Dimensions are in inches

SILENCER[®] SERIES BRUSHLESS DC MOTORS OVERVIEW

BSG23 High Performance Unique Stator Design

Quiet, Brushless Motors

Utilizing high energy sintered neodymium magnets and a unique stator design, the BSG23 brushless motor offers over two times the torque capability of our standard BN23 brushless motor. Ideal for applications where maximum performance and compact size are critical. Designed for maximum efficiency, this motor is a viable alternative to costly traditional brushless DC servo motors.

Typical options include electronic drives, encoders, gearheads, as well as Hall effect, resolvers, sensorless feedback and black finned aluminum housing (for additional heat transfer).

For more information about how this product can be tailored to fit your specific application, contact our applications engineers.

Typical Applications

- Commercial and military aerospace
- Computer-controlled embroidery machines
- Scanners
- Packaging equipment and printing products
- HVAC equipment (air moving)
- Robotics applications
- Semiconductor handling and insertion machines
- Actuators
- Battery-powered medical applications
 - Portable oxygen concentrators
 - Mobility and patient assistance

Features

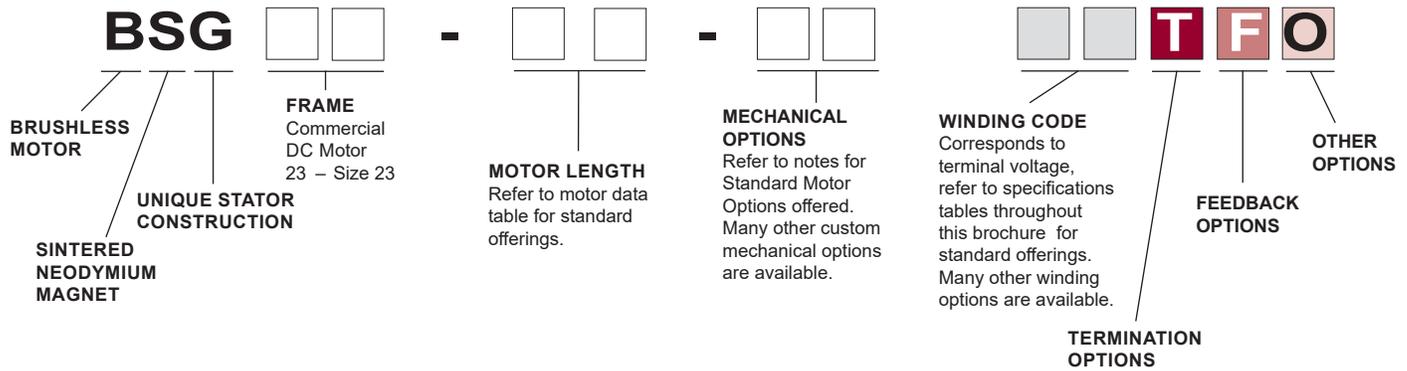
- Inside rotor construction for quick acceleration
- 8 pole motor
- Compact size - 1.9 and 2.9 inches long
- Diameter size - 2.25 inches
- Continuous torque up to 137 oz-in
- High energy sintered neodymium magnets
- Safe, arcless operation
- High torque per dollar ratio
- Unique stator construction - optimal copper slot fill for high motor constant (Km)

Benefits

- Operation at any single speed - not limited to AC frequency
- Motor life is not limited to brush or commutator life
- An essentially linear speed / torque curve
- Efficient operation without losses associated with brushes and commutation or armature induction
- Precise, variable speed control
- Extremely quiet operation
- Long-life operation
- High performance in a compact package

SPECIFICATIONS AND NUMBERING SYSTEM

Part Numbering System Guide

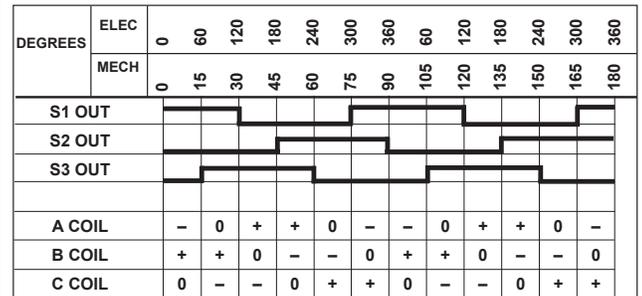


BSG23 SPECIFICATIONS

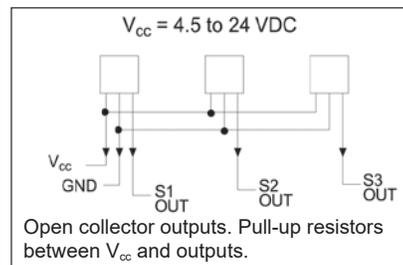
Continuous Stall Torque 47 - 137 oz-in (XX - XX Nm) / Peak Torque 300 - 907 oz-in (2.1 - 6.4 Nm)

		BSG23-18AB - [] [] []			BSG23-28AA - [] [] []		
		01	02	03	01	02	03
L - Length	inches	1.9			2.9		
	millimeters	48.26			73.66		
Terminal Voltage	volts DC	12	24	48	12	24	48
Peak Torque	oz-in	300	300	300	849	896	907
	Nm	2.1	2.1	2.1	5.995	6.32	6.4
Continuous Stall Torque	oz-in	47	56	59	133	137	137
	Nm	0.33	0.40	0.42	0.94	0.97	0.97
Rated Speed	RPM	4000	4000	4000	2255	2411	2319
	rad/sec	419	419	419	236	252	243
Rated Torque	oz-in	45	54	57	109	110	117
	Nm	0.32	0.38	0.40	0.77	0.78	0.83
Rated Current	Amps	14.0	8.4	4.7	19.8	11.0	5.53
Rated Power	watts	133.14	159.76	168.64	182	196	201
Torque Sensitivity	oz-in/amp	3.54	7.08	14.0	4.95	10.1	20.5
	Nm/amp	0.025	0.050	0.099	0.035	0.071	0.15
Back EMF	volts/KRPM	2.62	5.24	10.35	3.64	7.52	15.2
	volts/rad/sec	0.025	0.050	0.099	0.034	0.072	0.145
Terminal Resistance	ohms	0.10	0.28	1.00	0.072	0.232	0.930
Terminal Inductance	mH	0.12	0.46	1.84	0.111	0.448	1.872
Motor Constant	oz-in/sq.rt.watt	11.19	13.38	14.00	18.45	20.97	21.26
	Nm/sq.rt.watt	0.079	0.094	0.099	0.143	0.148	0.149
Rotor Inertia	oz-in-sec ² x10 ⁻³	0.99	0.99	0.99	2.32	2.32	2.32
	g-cm ²	69.9	69.9	69.9	1638	1638	1638
Weight	oz	17	17	17	34	34	34
	g	483	483	483	1417	1417	1417
# of Poles		8	8	8	8	8	8
Timing		120°	120°	120°	120°	120°	120°
Mech. Time Constant	ms	1.12	0.78	0.72	0.79	0.74	0.73
Electrical Time Constant	ms	1.15	1.64	1.84	2.45	2.59	2.62
Thermal Resistivity	deg. C/watt	3.00	3.00	3.00	2.34	1.91	2.00
Speed/Torque Gradient	rpm/oz-in	13.0	10.8	11.2	8.7	7.2	7.5
No Load	rpm	4600	4600	4600	3200	3200	3200

Timing Diagram for Hall Switches



Hall Effect Switches



- Notes:
- Motor mounted to a 4 x 4 x 1/4 inches aluminum plate, still air.
 - Maximum winding temperature of 155°C.
 - Typical electrical specifications at 25°C.
 - Motor Terminal Voltages are representative only; motors may be operated at voltages other than those listed in the table. For assistance please contact our applications engineer.
 - Calculated (theoretical) speed/torque gradient.

*Many other custom mechanical options are available – consult factory.
 **Many other winding options are available – consult factory.

Select your options below and place their code in its corresponding block as shown above.

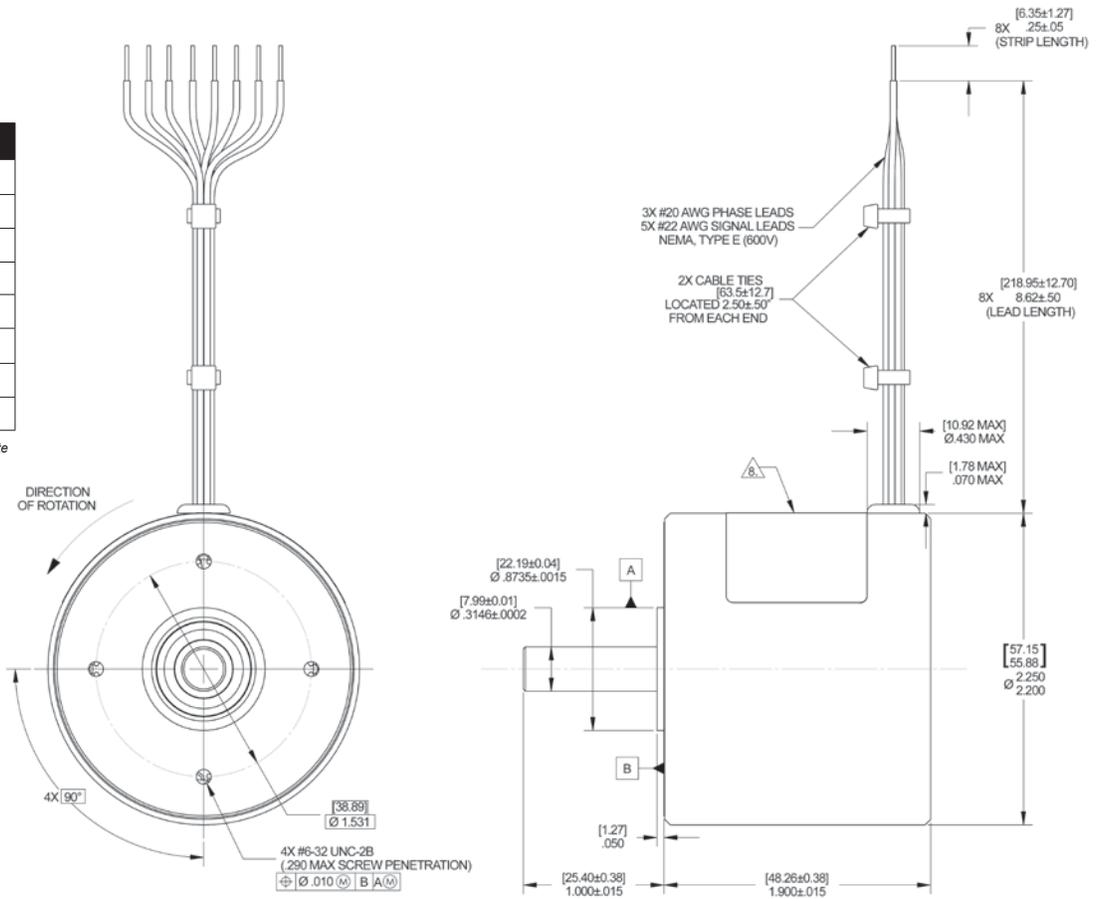
- | | | |
|----------------------|---------------------------|------------------------|
| T TERMINATION | F FEEDBACK OPTIONS | O OTHER OPTIONS |
| L – Leads (std) | H – Hall Effect (std) | D – Drive |
| C – Connector | R – Resolver | G – Gearhead |
| M – MS connector | S – Sensorless | E – Encoder |

BSG23-18 TYPICAL OUTLINE

Termination Table*

CONNECTION	LEAD COLOR
V _{cc}	YELLOW
GROUND	GRAY
A COIL	VIOLET
B COIL	BLACK
C COIL	GREEN
S2 OUT	BLUE
S1 OUT	BROWN
S3 OUT	WHITE

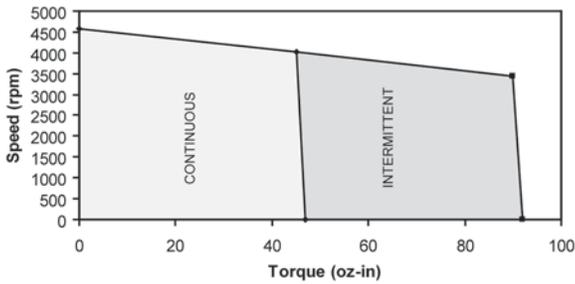
*We reserve the right to use solid color wires or white wires with color trace.



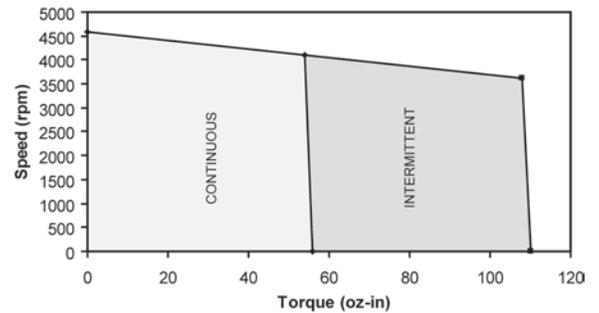
Dimensions are in inches [mm]

BSG23-18 PERFORMANCE CURVES

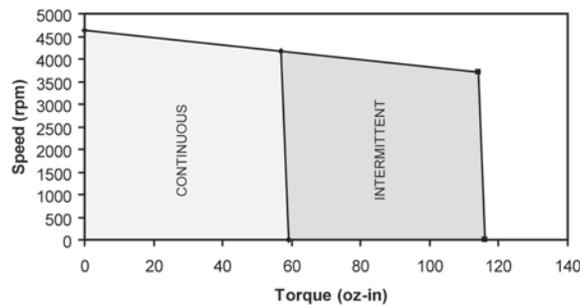
BSG23-18 [] []-01LH: Continuous & Intermittent Operation at 12 Volt DC



BSG23-18 [] []-02LH: Continuous & Intermittent Operation at 24 Volt DC



BSG23-18 [] []-03LH: Continuous & Intermittent Operation at 48 Volt DC



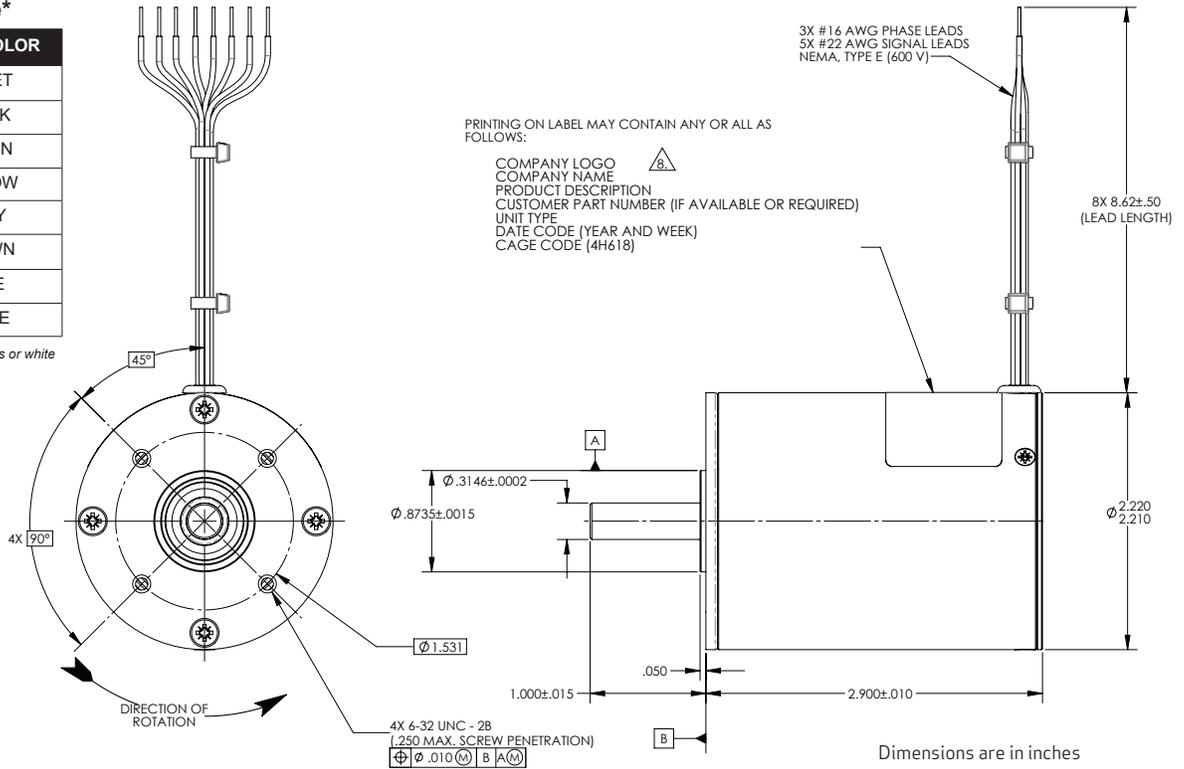
Note: Intermittent operation is based on a 20% duty cycle of one minute on, four minutes off. Please contact the factory regarding the duty cycle of your application.

BSG23-28 TYPICAL OUTLINE

Termination Table*

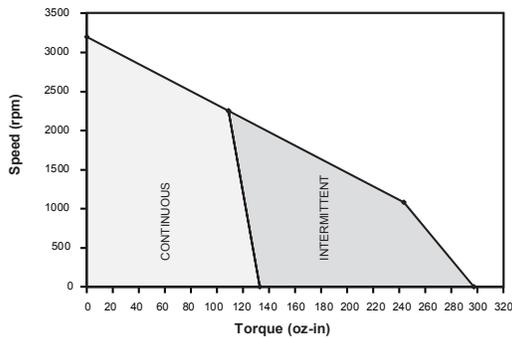
CONNECTION	LEAD COLOR
A COIL	VIOLET
B COIL	BLACK
C COIL	GREEN
V _{cc}	YELLOW
GROUND	GRAY
S1 OUT	BROWN
S2 OUT	BLUE
S3 OUT	WHITE

*We reserve the right to use solid color wires or white wires with color trace.

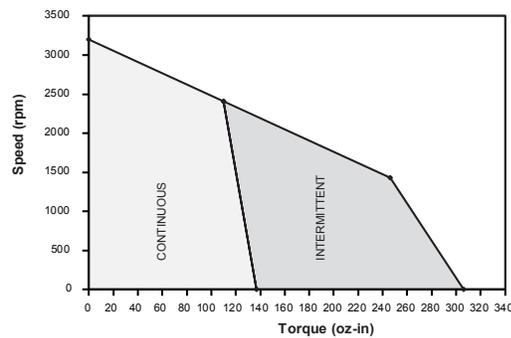


BSG23-28 PERFORMANCE CURVES

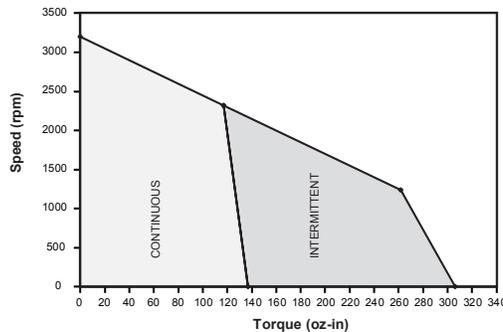
BSG23-28AA-01LH: Continuous and Intermittent Operation at 12 VDC



BSG23-28AA-02LH: Continuous and Intermittent Operation at 24 VDC



BSG23-28AA-03LH: Continuous and Intermittent Operation at 48 VDC



Note: Intermittent operation is based on a 20% duty cycle of one minute on, four minutes off. Please contact the factory regarding the duty cycle of your application.

AIR MOVING PRODUCTS OVERVIEW

Moog offers off-the-shelf products through our Moog AirMax™ series of fans and blowers and utilizes our proven high efficiency Silencer® series brushless DC motors to create tailored solutions for more unique applications. Combining our expertise in thermal management with our innovative motor technology, we have expanded the customer's options for solving difficult thermal, airflow, acoustic and efficiency problems. As an optimum choice for each application, we are offering tailored airflow products that are designed using off-the-shelf components to provide a cost effective solution without compromising performance.

Medical Equipment

- Ventilators
- Particle counters
- Pressure management mattresses

Telecommunications

- Data storage / servers
- Electronic rack cooling
- Power backup systems

PRODUCTS

With our combination of in-house design, development and production, we are able to offer custom products that are cost effective without the compromises associated with the use of off-the-shelf devices. We are dedicated to providing our customers with efficient, high quality and on target solutions.

Blowers

With our sheet metal capabilities, blowers can be tailored to the application. From 1U slot blowers, high pressure multistage blowers, dual centrifugal blowers to radial wheel blowers, we have the experience to help with your application. Our blowers are configurable with virtually any voltage, flow sensors and finger guards. Custom mounting flanges can be fabricated to fit your exact application.

Impellers

Our motorized impellers offer quiet, high pressure airflow in a compact versatile design. Designed for virtually any form factor, any bus voltage, our in-house electronic and sheet metal capabilities allow custom products to be used in cost sensitive, extreme environments and confined space applications.

Fan Trays

Our fan assemblies creatively package axial fans for maximum airflow in a compact footprint. Available with cooling on demand, fan trays can be programmed to sense and evaluate temperature and vary fan speed to maintain an ideal operating environment. Not locked into using any particular off-the-shelf fan allows us to select the best fan for the application or use multiple fan manufacturers when dual sourcing is advantageous. If a standard fan is not available for your application, we can design one for you.

Controllers

The ability to build electronic controls customized to the application means that the designer can select the exact combination of functions necessary to optimize the system.

- AC or DC powered units
- Redundant systems sensing speed to maintain overall airflow in case of fan failure
- Speed synchronization for reduced noise
- Watchdog circuitry
- Digital communication, I²C, RS-232 / 485, CAN Bus
- Soft start and / or sequential start
- Filter blockage sensing
- Wide input voltage compensation
- Local and remote alarms
- Thermal speed control
- Conducted noise filtering

DEVELOPMENT OF MANUFACTURING

With a development process including mechanical and electrical design, airflow analysis, environmental testing, as well as safety and compliance requirements, you can count on our trained CAD design and engineering staff to get you the product that is best suited for your application. Moog provides on-site electronics testing and troubleshooting.

Environmental Testing

Moog has state-of-the-art environmental chambers that can verify whether the designed unit will work reliably at all temperature extremes from -73°C to 175°C. In addition, we can do extended temperature testing on most systems with the air movers installed to ensure overall system reliability. Humidity, salt fog, shock and vibration testing is also available.

Safety and Compliance

Our motorized impellers offer quiet, high pressure airflow in a compact versatile design. Designed for virtually any form factor, any bus voltage, our in-house electronic and sheet metal capabilities allow custom products to be used in cost sensitive, extreme environments and confined space applications.

Manufacturing

- Automation
- Molded parts
- SMT / through-hole prototype to production
- Simple functional to fully automated testing

AIR MOVING PRODUCTS OVERVIEW

CAPABILITIES

- Manufacturing and assembly
- Concept design and modeling
- Rapid prototyping and product development
- System airflow and thermal verification
- Airflow CFD modeling and testing
- Electronic controls experience
- Motor drive experience
- Distribution testing
- Environmental testing
- Electrical testing
- Acoustic and vibration testing
- Accelerated life testing
- Fabrication and assembly
- Precision balancing
- Rugged environment design and testing
- Automated production testing
- Aerodynamics design
- Simulation and analysis
- Thermal and airflow modeling
- Design modeling and verification

DESIGN GUIDE

Determining Airflow Requirements

$$Q = m \cdot c_p \cdot \Delta T$$

Q = heat to be dissipated (watts)

c_p = specific heat of fluid

m = mass flow rate

ΔT = fluid temperature rise through system

kW = kilowatts

For standard air (sea level 25°C ambient)

$$\text{CFM} = \frac{(3170) \cdot \text{kw}}{\Delta T(^{\circ}\text{F})} = \frac{(1760) \cdot \text{kw}}{\Delta T(^{\circ}\text{C})}$$

To ensure adequate cooling at altitude and temperature, additional margin must be added to account for reduced density.

Fan Laws

Along a system curve, airflow, speed, pressure and power requirements can be determined using fan laws:

$$\text{CFM}_2 = \text{CFM}_1 \left(\frac{\text{rpm}_2}{\text{rpm}_1} \right)$$

$$\text{sp}_2 = \text{sp}_1 \left(\frac{\text{rpm}_2}{\text{rpm}_1} \right)^2$$

$$\text{pwr}_2 = \text{pwr}_1 \left(\frac{\text{rpm}_2}{\text{rpm}_1} \right)^3$$

AIRMAX™ P28 SERIES BLOWER OVERVIEW

High Performance, High Efficiency Compact Air Mover

The Moog AirMax™ P28 series of fans and blowers provides excellent output power per unit volume through the use of compact, high energy 3-phase brushless DC motors and efficient airfoil design. The motor utilizes high energy rare earth magnets to provide the blower with the necessary torque to provide maximum airflow in the minimum amount of system space.

These high efficiency compact air movers use high reliability, long-life ball bearings with specially formulated lubrication to extend the life without the need to re-lubricate.

For more information about how this product can be tailored to fit your specific application, contact our applications engineers.

Features

- 24 VDC, other voltages available
- AC input available
- Open collector tach output, weak pull-up on board
- 0 - 5 V or PWM input speed control (0 - 10 V on AC version)
- Internal or external drive electronics
- High efficiency 3-phase brushless DC motor
- Optional external drive with direct access to Halls and phase leads
- UL recognized component

Advantages

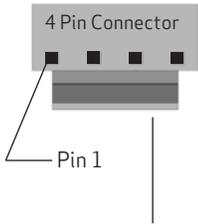
- Low noise
- High efficiency
- Integrated electronics with customizable system interface
- Variable speed
- High power density
- High pressure
- Long life

Applications

- Pressure management mattresses
- Large format printers
- Vacuum systems
- Low noise, high pressure applications

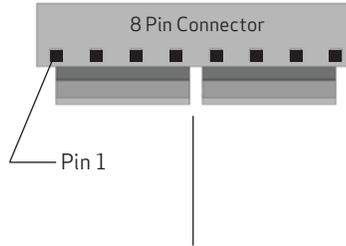
PIN ARRANGEMENTS

DC-ID Option



PIN NUMBER	FUNCTION
1	+V
2	-V
3	V Speed
4	Tach Out

Mating Part Number 640250-4*
Refer to page 4 for electrical interface details

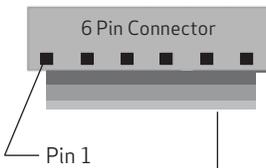


Mating Part Number 640250-8*

EH Option

PIN NUMBER	FUNCTION
1	Phase C
2	Phase B
3	Phase A
4	Signal GND
5	Signal PWR
6	S1
7	S2
8	S3

AC-ID Option

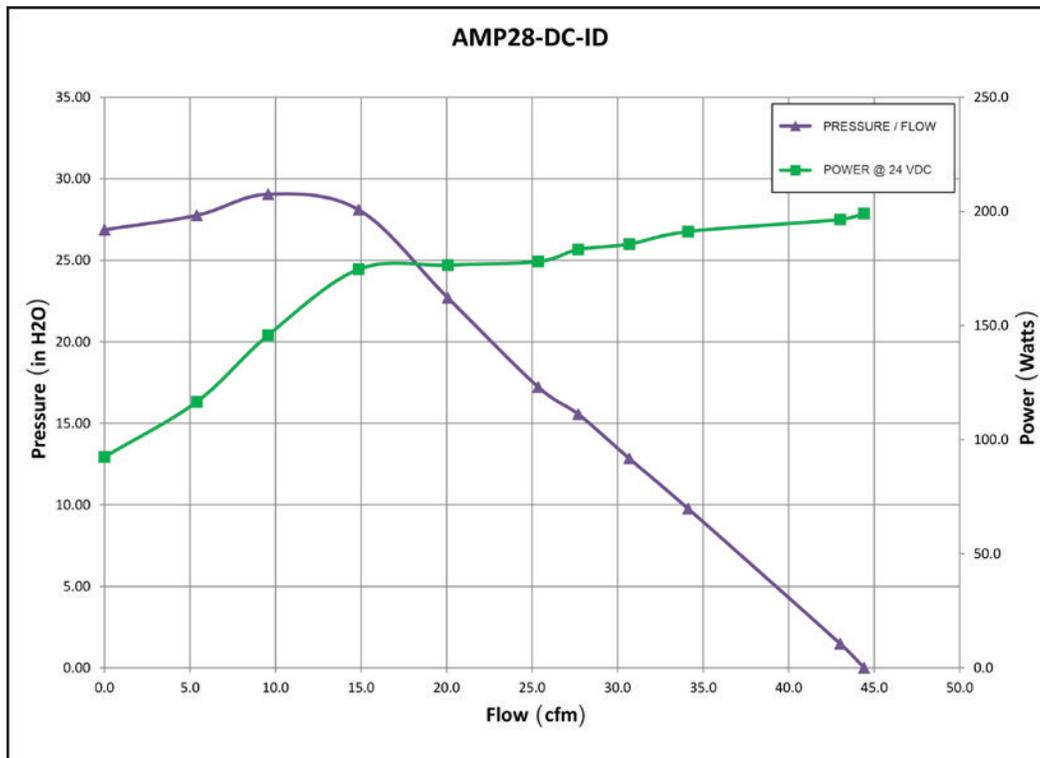


PIN NUMBER	FUNCTION
1	VAC
2	V Neutral
3	+10 V Isolated
4	Tach Isolated
5	V Speed Isolated
6	Isolated GND

Mating Part Number 640250-6*

*TE connectivity with SL-156 style contacts

AMP28 PERFORMANCE CURVES



ELECTRICAL INTERFACE

The AMP28-DC-ID blower is a fully integrated, single stage blower capable of producing up to 28 in H₂O (6.97 kPa) of pressure and delivering up to 45 CFM (21.2 L/S). We have designed the AMP28-DC-ID with the features necessary to interface to a variety of systems, from the simplest power-supply only connection to more complex closed-loop systems.

Basic Specifications

Supply Voltage	13.5 V -30 V
Supply Current	0 A -10 A
Pulses / Rev	2
Maximum Speed	19,000 RPM
Maximum Tach Frequency	633 Hz
Speed Control Range	0 V - 5 V

Physical Interface

The AMP28-DC-ID has a 4-pin connector. Two of the pins are for power and two are for signal. Moog recommends housing part number 640250-4 by TE Connectivity using contacts 3-647406-1 and 18 AWG wire for the power leads.

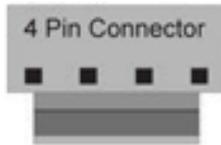


Figure 1 - Pins numbered left to right

PIN NUMBER	FUNCTION
1	+ V Power
2	- V Power
3	V Speed Control
4	Tach Out Signal

Pin 1 must be connected to a power supply voltage between 20 V and 28 V with the return connected to Pin 2. Pin 3 must be connected to a variable or static voltage ranging between 0 V and 28 V. Pin 4 is an output signal representing speed that is not required for operation.

Power

Pins 1 and 2 are the primary power pins of the unit. The power interface should be designed with the capacity to handle the rated 10 A potential current draw of the AMP28-DC-ID. The recommended connector interface is sufficient for ensuring low impedances at the connection points. Additionally, short harness length and larger gauge wire are encouraged in order to reduce impedances and losses during operation.

Tachometer Signal

The tachometer signal output is in the form of a square wave between 0 V and 3.3 V which has a frequency that corresponds to the current speed of the wheel. The relationship between the tachometer signal frequency and the speed of the blower is characterized by:

$$RPM = \text{freqInHz} \times 30$$

The tachometer electrical interface consists of an open-collector transistor pulled up to 3.3 V via a 10 k Ω resistor. This signal must be connected to a high-impedance input in order to remain TTL compatible. The tachometer signal may be pulled up to a higher voltage as long as a relatively low-value resistor is used for the external pull-up. An example connection schematic is shown (Figure 2) which translates the output to a 5 V circuit. This arrangement allows the customer to maintain TTL voltage levels while pulling the tachometer signal to 5 V using the additional pull-up. In this case, the voltage ranges between 4.84 V at the high logic level and 0.06 V at the low logic level, well within the TTL acceptable voltages. The maximum external pull-up voltage is 20 V and the resistance must be chosen such that the current is less than 50 mA.

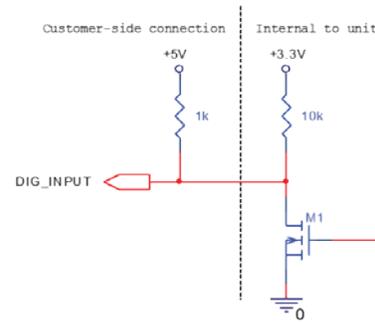


Figure 2

In cases in which isolation is required on the tachometer signal, a slightly more complex circuit (Figure 3) could be used in order to attain the current required to adequately drive an optocoupler.

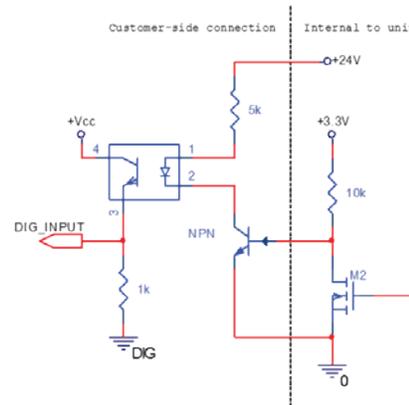


Figure 3

Care must be taken when choosing the optocoupler and resistor values in order to maintain the frequency response of the circuit while also operating in the saturation region of the optocoupler.

Speed Control - ON/OFF Control

The speed control input is flexible in order to increase compatibility across a variety of systems. The simplest speed control configuration involves connecting the harness +V pin (Pin 1) to the speed control pin (Pin 3, Figure 4). This method ensures that the unit is operating at its maximum operating point at all times when it is powered.

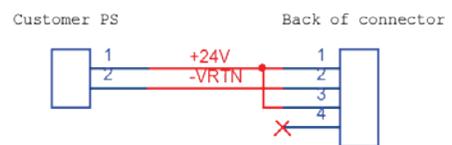


Figure 4

ELECTRICAL INTERFACE

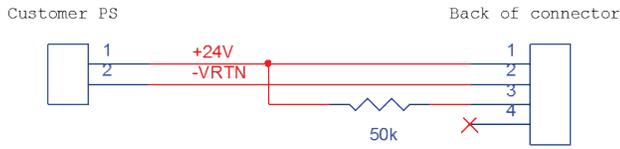


Figure 5

Figure 5 shows a variation on this method that allows the speed to be set using a single resistor. As the resistor value is increased, the speed of the unit is decreased.

A slightly more complex method allows the unit to be turned on or off using a single digital output (Figure 6).

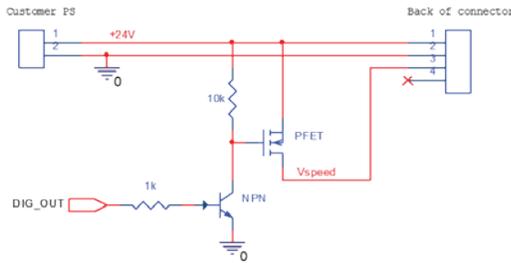


Figure 6

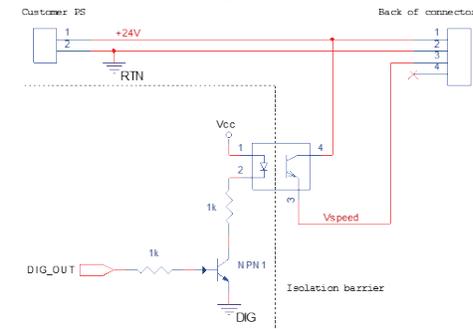


Figure 7

In this circuit, a high state on DIG_OUT will result in applying +24 V to the speed control circuit. This simple, cost-effective circuit allows the customer power supply and control to be operating while maintaining discrete on/off control of the blower and without having to resort to more expensive high current devices. If isolation is required, a similar circuit using an optocoupler could be utilized (Figure 7). In both of these circuits, a series resistor may be added to reduce the set point of the speed similar to the technique used in Figure 5.

Speed Control – Variable Speed

The speed control voltage input may also be controlled linearly between 0 V and 5 V using a low-impedance source to control the voltage. Ideally, an operational amplifier capable of driving a minimum of 2 mA would be connected directly to the speed control input (Figure 8).

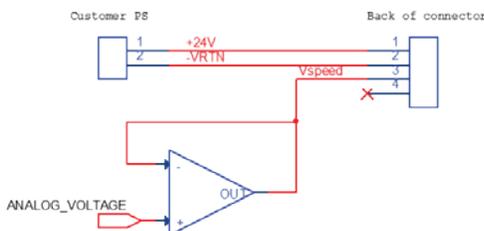


Figure 8

Driving the speed control input directly with a 0 V - 5 V pulse-width modulated signal with a frequency of 500 Hz or greater is also possible. This is the most cost-effective method of variable speed control since the digital output of the system controller may be connected directly to the speed control input (Figure 9). Note that the output impedance of the PWM signal should not exceed 1 k Ω .

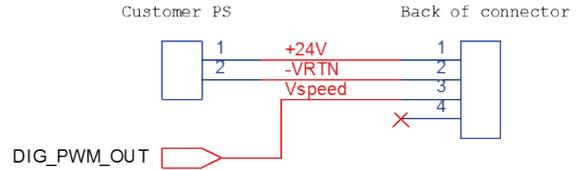


Figure 9

This connection method requires that the digital system ground be the same as the power supply ground, so care must be taken in the system to isolate any power supply electrical noise from the digital side. For full-range speed control, the driving PWM signal must be 0 V to 5 V and range from 0% duty cycle to 100% duty cycle. Other combinations of voltage and duty cycle are possible as well.

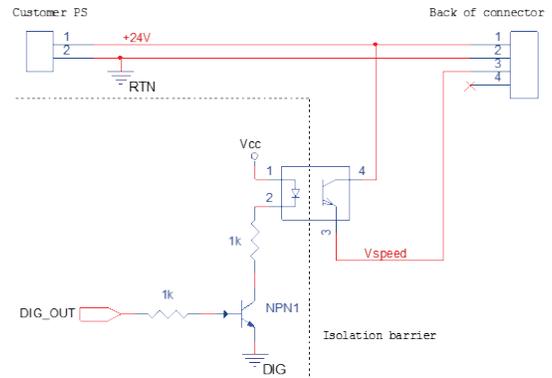


Figure 10

The user may require isolated PWM speed control. The circuit outlined in Figure 11 may be implemented should the system designer wish to utilize pulse-width modulation for linear speed control while maintaining isolation between the digital and power supply circuits. Care must be exercised that the optocoupler chosen has the frequency characteristic to adequately pass a 500 Hz square wave and that the resistor values chosen will allow the optocoupler to saturate when active and turn off when inactive. Low duty cycles may also be required for linear range control since the linear range is 0 V to 5 V while the high-level voltage on the blower side will be 24 V.

Assuming that the circuit in Figure 6 is implemented, a generic speed verses voltage relationship may be realized for a particular system. This relationship is equally valid for PWM duty cycle, with 0% duty cycle at the 0 V point and 100% duty cycle at 5 V.

Between 0 V and 0.4 V, the AMP28-DC-ID is not operating. The unit begins operation at 0.45 V and, as the control voltage is increased, the speed of the blower increases proportionally. Hysteresis has been added to the starting point in order to prevent oscillation between the operating and non-operating conditions. The AMP28-DC-ID is limited to a maximum speed of 19,000 RPM

AIRMAX™ P45 SERIES BLOWER OVERVIEW

The Moog AirMax™ P45 series of fans and blowers provides excellent output power per unit volume through the use of compact, high energy 3-phase brushless DC motors and efficient airfoil design. The motor utilizes high energy rare earth magnets to provide the blower with the necessary torque to provide maximum airflow in the minimum amount of system space.

These high efficiency compact air movers use high reliability, long-life ball bearings with specially formulated lubrication to extend the life without the need to re-lubricate.

For more information about how this product can be tailored to fit your specific application, contact our applications engineers.

Features

- 24 VDC nominal input
- Open collector tach output, weak pull-up on board
- 0 - 5 V or PWM input speed control
- Internal drive electronics or hall effect outputs
- High efficiency 3-phase brushless DC motor
- UL recognized component

Advantages

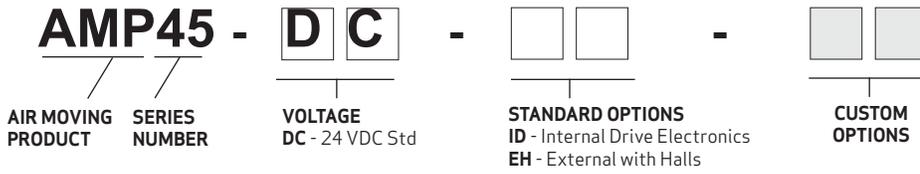
- Low noise
- High efficiency
- Integrated electronics with customizable system interface
- Variable speed
- High power density
- High pressure
- Long life
- Smallest in the industry
- ESD protection
- External drive version possible
- Low inertia

Applications

- Pressure management mattresses
- Medical ventilators
- Vacuum systems
- Low noise, high pressure applications
- Smoke extraction
- Vacuum systems
- Low noise, high pressure applications

SPECIFICATIONS AND NUMBERING SYSTEM

Part Numbering System Guide



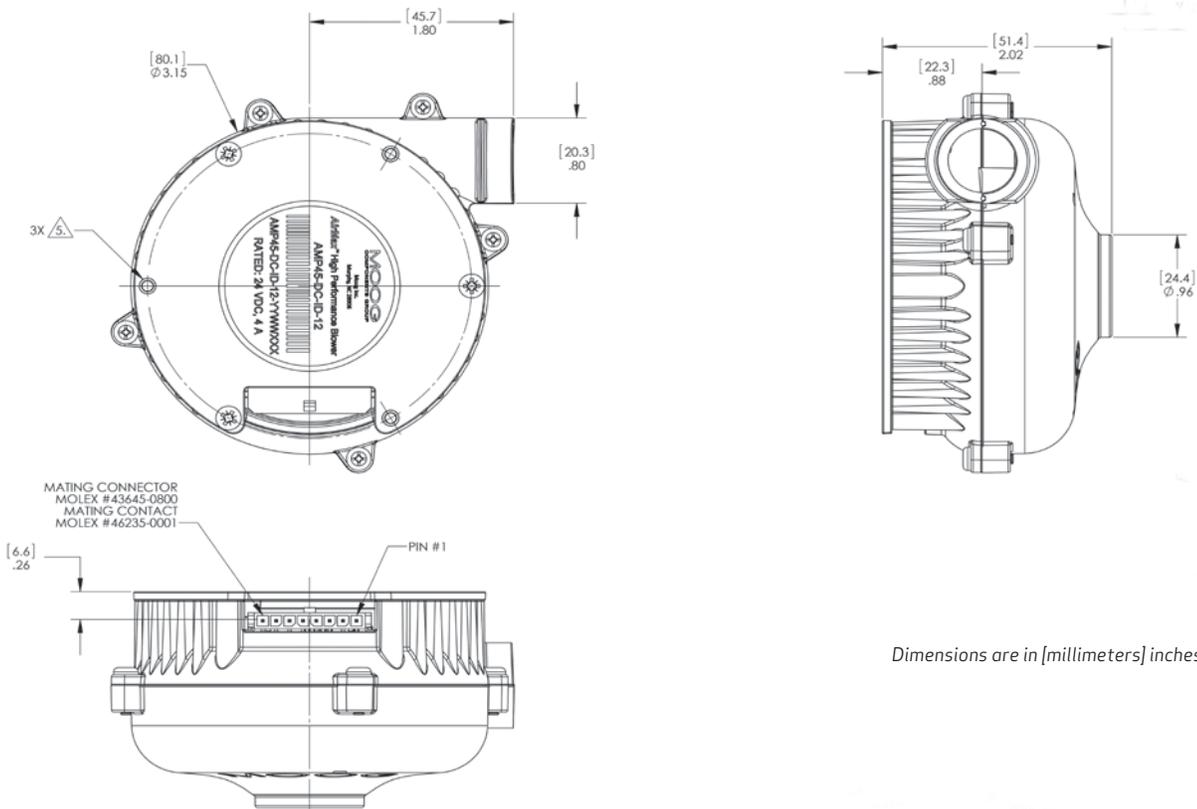
AMP45 DC-ID TECHNICAL DATA

PARAMETER	UNITS	VALUE
Input Voltage	Volts	10.5 - 30.0
Rated Current	Amps	5
Operating Temperature	Degrees C / F	0 - 50 / 32 - 122
Weight	lbs / grams	0.68 / 310
Tach Out		Open collector
Speed Control	Volts	0 - 5

Timing diagram for EH option (4 Pole) CCW rotation.

		TIMING DIAGRAM												
DEGREES	ELEC.	0	60	120	180	240	300	360	60	120	180	240	300	360
	MECH.	0	30	60	90	120	150	180	210	240	270	300	330	360
S1 OUT		0	1	1	0	0	1	1	0	0	1	1	0	0
S2 OUT		0	0	1	1	0	0	1	1	0	0	1	1	0
S3 OUT		0	0	0	1	1	0	0	1	1	0	0	1	1
C COIL		0	0	1	1	0	0	1	1	0	0	1	1	0
B COIL		1	1	0	0	1	1	0	0	1	1	0	0	1
A COIL		0	1	1	0	0	1	1	0	0	1	1	0	0

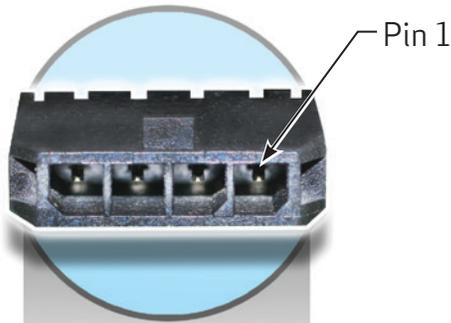
AMP45 TYPICAL OUTLINE



Dimensions are in [millimeters] inches.

PIN ARRANGEMENTS

ID - Internal Drive Option

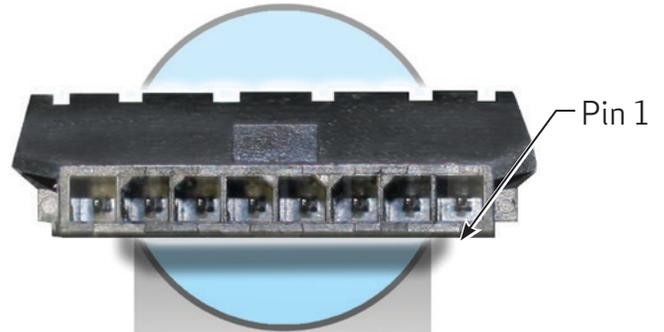


4-Pin Mating Connector - Molex® # 43645-0400*
Refer to page 4 for electrical interface details

4-Pin Connection Table

PIN NUMBER	FUNCTION
1	Tach Out
2	V Speed, 0-5V
3	Return
4	+24V

EH - External Drive Option



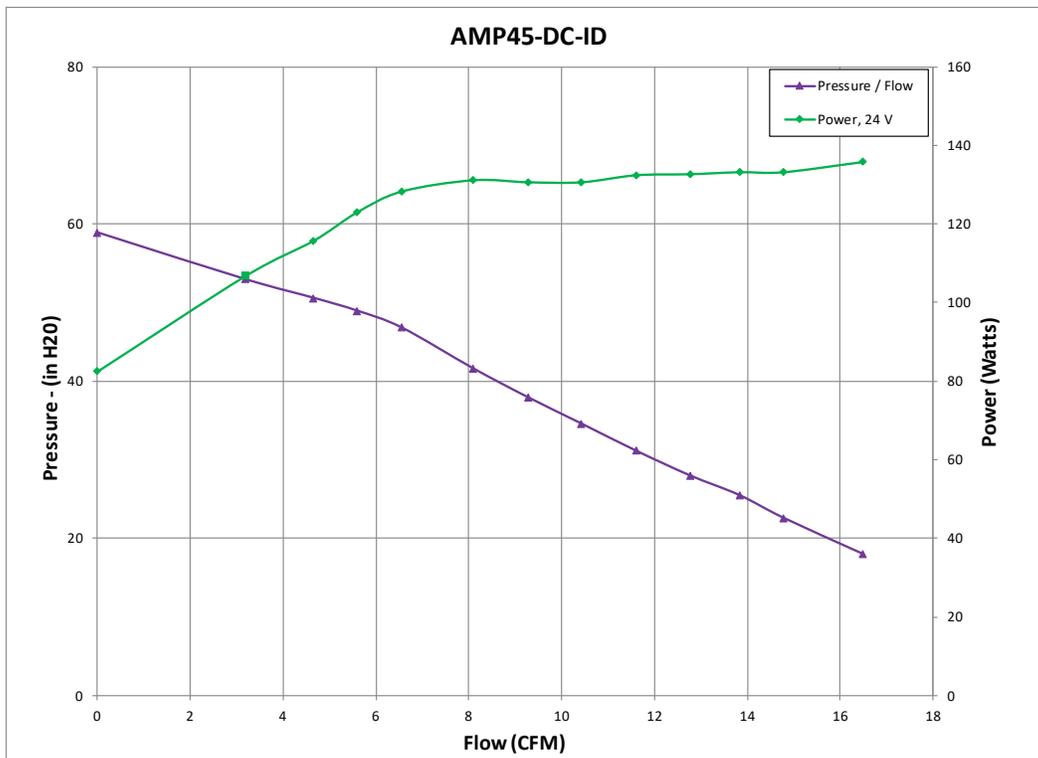
8-Pin Mating Connector - Molex® # 43645-0800*

8-Pin Connection Table

PIN NUMBER	FUNCTION
1	Hall PWR
2	Hall RTN
3	S1
4	S2
5	S3
6	C
7	B
8	A

*Molex® Contact: 43030-0001-Tin or 46235-0001-Au

AMP45 PERFORMANCE CURVES



ELECTRICAL INTERFACE

The AMP45-DC-ID is a fully integrated, single stage blower capable of producing up to 60 in H2O of pressure and delivering up to 25 CFM. There are a variety of possible configurations for powering and controlling the unit described herein.

Basic Specifications

Supply Voltage	10.5 VDC - 30.0 VDC
Rated Current	5 A
Pulses / Rev	2
Maximum Speed	60,000 RPM
Maximum Tach Frequency	2 kHz
Speed Control Range	0 V - 5 V

Physical Interface

The AMP45-DC-ID has a 4-pin connector. Two of the pins are for power and two are for signal. Moog recommends Molex® part number 43645-0400 using contacts 43030-0038 and 18 AWG wire for the V+ and V- leads. A smaller gauge wire may be utilized for the signal leads.

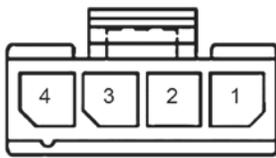


Figure 1

The power supply must be connected between V+ and V-. The speed control voltage and tachometer signals are measured with reference to V-.

PIN NUMBER	FUNCTION
1	Tach Out
2	V Speed 0-5 VDC
3	Return
4	+ 24 VDC

ESD

The TACH and V+ lines are protected from ESD events using components specifically designed for ESD suppression. Passive techniques protect V Speed from ESD events. As a result of this ESD suppression, it is important for the customer to note that operation above 30 V is NOT recommended and will result in damage to the blower.

Power

Pins 3 and 4 are the primary power pins of the unit. The power interface should be designed with the capacity to handle the rated 5 A potential current draw of the AMP45-DC-ID. The recommended connector interface is sufficient for ensuring low impedances at the connection points. Additionally, a short harness length and large gauge wires are encouraged in order to reduce impedances and losses during operation.

Tachometer Signal

The tachometer signal output is in the form of an open-collector output. The output is pulled-up to 3.3 V through a 100 k Ω resistor. This output may be pulled up to any voltage up to 30 V. If voltage is pulled up to a different voltage, then it is recommended to use a resistor value of 10 k Ω or less.

There are two pulses per revolution. The RPM may be calculated using the relationship defined by

$$RPM = freqInHz \times 30$$

The signal must be connected to a high-impedance input in order to remain TTL-compatible.

An example arrangement is shown in Figure 2. The internal 100 k Ω resistor is shown pulled up to 3.3 V. The customer-side connection shows the tach pulled up to 12 V through a 10 k Ω resistor.

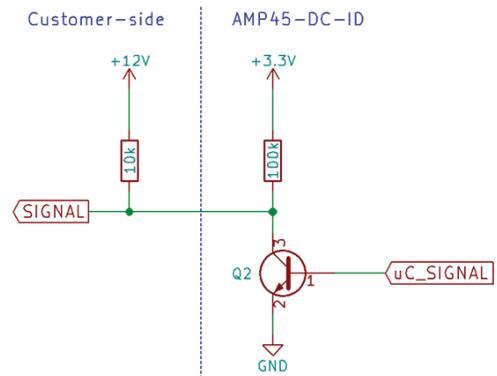


Figure 2

In cases in which isolation is required on the tachometer, a slightly more complex arrangement, demonstrated in Figure 3, may be required.

ELECTRICAL INTERFACE

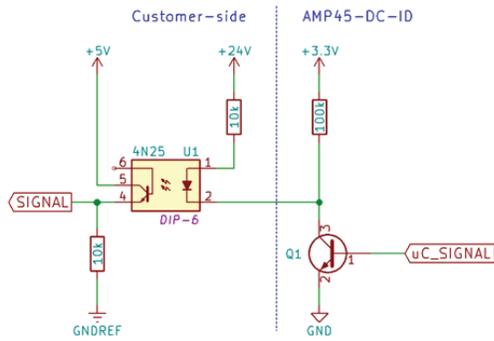


Figure 3

Care must be taken when choosing the optocoupler and resistor values in order to maintain the frequency response of the circuit while also operating within the saturation region of the optocoupler.

Speed Control

The speed control input may be operated in a variety of ways to provide maximum flexibility. At its most fundamental, 0 V results in 0% duty cycle while 5 V or greater results in 100% duty cycle being applied to the motor.

Single Speed/Duty Cycle

The simplest connection is the speed control which is simply attached to the power connection.

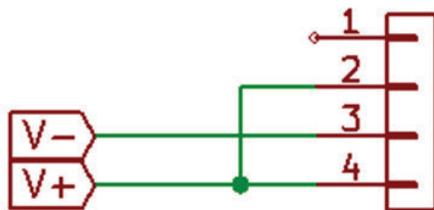


Figure 4

This connection will result in 100% duty cycle when the unit is powered up. Another variation on this connection is to apply a resistor in series with the speed control. This can be a low-wattage resistor.

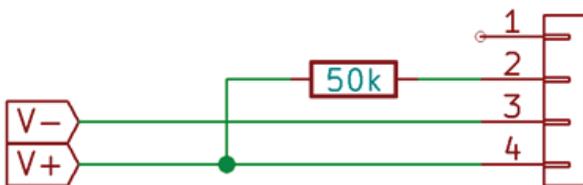


Figure 5

To determine the initial set point, one might model the input impedance as a 30 k Ω resistance. When a voltage of 5.0 V is present on the V Speed pin, then the duty cycle will be 100%.

A simple procedure for determining the correct value for the input resistance is to attach a variable resistor of 100 k Ω and adjust until the desired duty cycle is achieved. Power down the circuit and measure the resistance across the resistor in order to determine the correct value to achieve the desired duty cycle.

Variable Speed/Duty Cycle

The speed control is designed to take an analog or PWM voltage to control the duty cycle. The simplest control is simply to apply a continuous voltage through a buffer or similar output with a low output impedance characteristic. The duty cycle applied to the motor is proportional to the voltage applied up to 5.0 V, with reference to the V- pin.

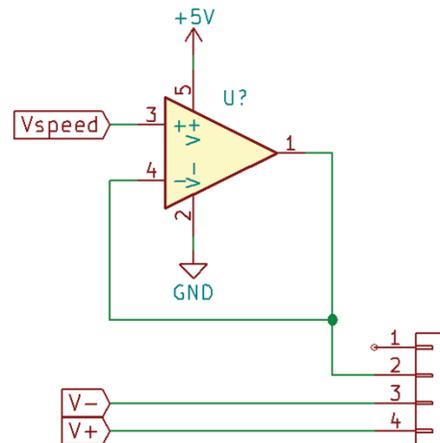


Figure 6

PWM may also be utilized to control the duty cycle applied to the motor. Figure 7 shows a configuration which provides isolation between the blower and the PWM signal. The minimum recommended frequency is 1 kHz.

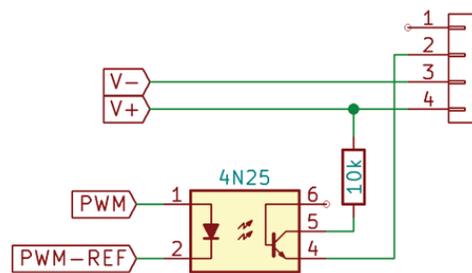


Figure 7

SILENCER® SERIES BRUSHLESS CONTROLLERS OVERVIEW

BDO-Q2-40-05-01, BDO-Q2-50-40 and BDP-Q2-50-10

2-quadrant speed controller for brushless motors

Silencer® brushless controllers are available in a variety of voltage and current ratings. Their compact packaging minimizes space demands. All controllers have generous terminal blocks to facilitate ease of wiring.

Silencer drives are compatible with Silencer Series Brushless DC Motors. Silencer motors are available in sizes 12, 17, 23, 28, 34 and 42 in standard frames with 1.2 to 4.15 inch diameters. They offer speeds up to 20,000 rpm and continuous torques ranging from 1.2 to 519 oz-in. Standard options include gearheads, resolvers and encoders.

If you have questions about Silencer drives or would like to speak to an applications engineer, please call us or visit our web site.

Typical Applications

Control of Brushless Motors for:

- Medical pumps and blowers
- Air-handling equipment
- Packaging and printing products
- Semiconductor handling and insertion machines
- Industrial automation equipment
- Office automation and equipment

Features

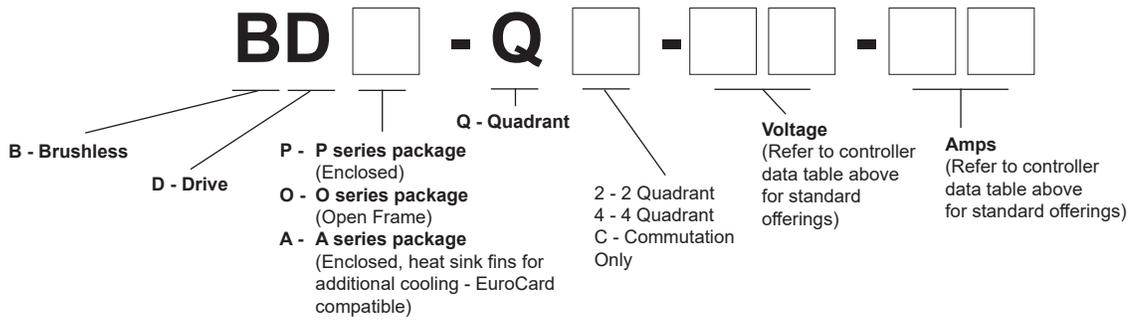
- 2-quadrant speed controllers for brushless motors
- Feedback using Hall effect sensors
- Motor speed is set by either an internal or external potentiometer
- Motor rotation direction can be present by the direction control input; the controller output stage can be activated and deactivated by the disable control input and brake input
- Maximum constant current can be adjusted via an on-board potentiometer
- Internal thermal cutoff prevents heat overload
- Very high efficiency is achieved by using POWER-MOSFET technology in the controller output stage
- Efficient PWM speed control
- Operating temperatures from -10 to 45°C and storage temperatures from -40 to 85°C

Benefits

- Compact packaging minimizes space demands
- Matched drives and motors from a single supplier
- Complete system testing provides high reliability
- Terminal block connections for ease of wiring
- Multiple methods of speed control
 - Input voltage
 - Internal potentiometer
 - External potentiometer
 - External voltage reference

SPECIFICATION AND NUMBERING SYSTEM

Part Numbering System



BDO-Q2-40-05-01 SPECIFICATIONS

Electrical Data		
Operating voltage --input and Gnd	12 - 40 VDC	
Residual voltage < 5 %		
Maximum constant current (adjustable)		
• Without additional cooling surfaces (free convection)	0.5 - 3.5 A	
• With additional convection (< 1,8 K / W)	0.5 - 5.0 A	
Peak current limitation (cycle by cycle)	10.0 A	
Supply voltage for Hall sensors	6 V / 20 mA	
Mechanical Data		
Weight	4.37 oz / 124 gm	
Dimensions - (L x W x H) - 3.54 x 1.97 x 1.18 in (90 x 50 x 30 mm)		
Mounting - 4 x M4 with a distance between holes of 3.15 x 1.18 in (80 x 30 mm)		
Termination Table		
Terminal #	Nomenclature	Description
1	REV	Reverse Motor Direction
2	GND	Signal Ground
3	SV	External Speed Input
4	+6V	Reference Voltage for Control Inputs
5	GND	Supply Voltage - Ground
6	+INPUT	Supply Voltage - Positive
7	DIS	Controller Disable Input
8	BRAKE	Controller Brake Input
9	S1	Hall Switch #1
10	S2	Hall Switch #2
11	S3	Hall Switch #3
12	VCC	Hall Switch Supply Voltage
13	GND	Hall Switch Ground
14	ØB	Motor Phase B
15	ØC	Motor Phase C
16	ØA	Motor Phase A

Inputs

- Direction of rotation – (REV) open collector / TTL / CMOS / switch
- Brake - (BRAKE) open collector / TTL / CMOS / switch
- Disable output stage – (DIS) open collector / TTL / CMOS / switch

Moisture Range

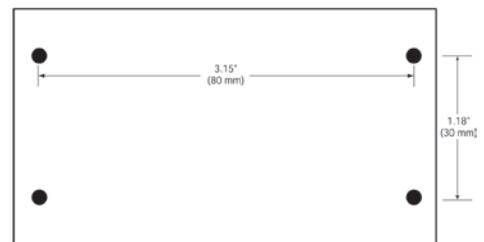
20 to 80% non-condensed

Temperature Range

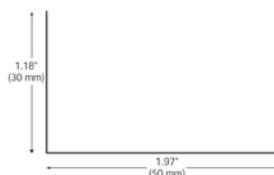
Storage -40 to +85°C
 Operation -10 to +45°C

BDO-Q2-40-05-01 OUTLINE - THREE VIEWS

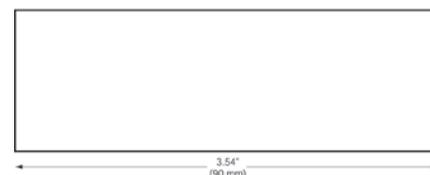
TOP (MOUNTING)



END VIEW



SIDE VIEW



Dimensions are in inches

BDO-Q2-50-40 SPECIFICATIONS

Electrical Data		BDO-Q2-50-40
Operating voltage -+input and Gnd		20-50 VDC
Residual voltage < 5 %		
Maximum constant current (adjustable)		40 A
Mechanical Data		BDO-Q2-50-40
Weight		13.76 oz / 390 gm
Dimensions - (L x W x H) - 6.69 x 3.54 x 1.73 in (170 x 90 x 44 mm)		
Mounting - 4 x M4 with a distance between holes of 6.30 x 2.52 in (160 x 64 mm)		
Diameter - 4.5 mm - (4) places - M4 screw		

Inputs

- Direction of rotation – (REV) open collector / TTL / CMOS / switch
- Disable output stage – (DIS) open collector / TTL / CMOS / switch

Moisture Range

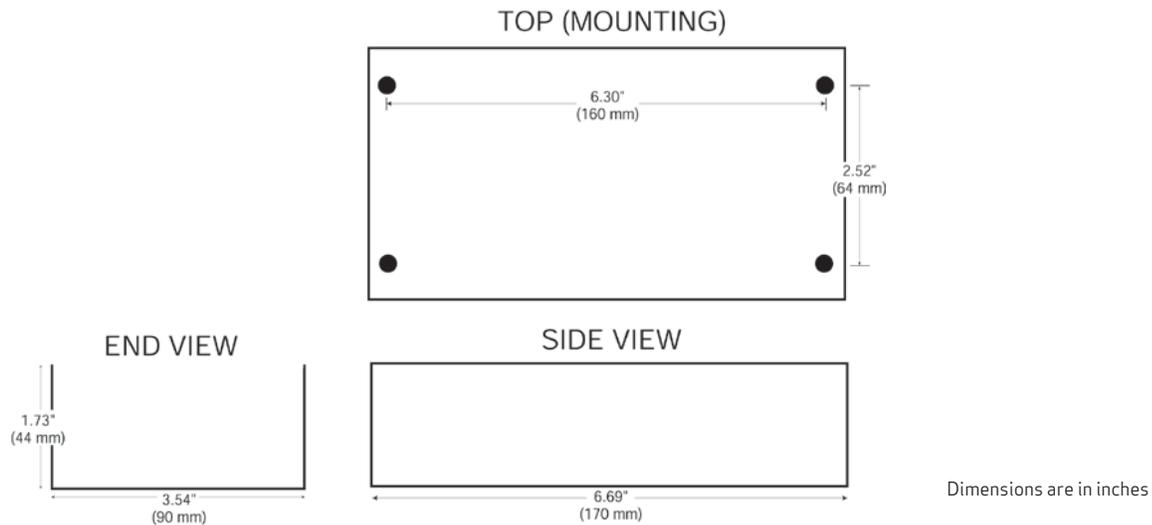
20 to 80% non-condensed

Temperature Range

Storage -40 to +85°C
 Operation -10 to +45°C

Termination Table					
Signal			Power		
Terminal #	Nomenclature	Description	Terminal #	Nomenclature	Description
1	S1	Hall Switch #1	1	Positive Input	Positive Supply Voltage
2	S2	Hall Switch #2	2	Phase B	Motor Phase B
3	S3	Hall Switch #3	3	Phase C	Motor Phase C
4	VCC	Supply for Hall Switches	4	Phase A	Motor Phase A
5	Gnd	Gnd for Hall Switches	5	Gnd	Gnd for Supply Voltage
6	DIS	Control Input - Disable			
7	REV	Control Input - Reverse			
8	GND	Gnd for Dis and Rev			
9	SPD	Set value input for speed			

BDO-Q2-50-40 OUTLINE - THREE VIEWS



BDP-Q2-50-10 SPECIFICATIONS

Electrical Data	
Operating voltage -+input and Gnd Residual voltage < 5 %	20 - 50 VDC
Maximum constant current (adjustable)*	10 A
Supply voltage for Hall sensors	6 V / 20 mA

*At higher input voltages, additional heat-sinking may be required for maximum current.

Mechanical Data	
Weight	4.93 oz / 140 gm
Dimensions - (L x W x H) -	2.17 x 3.70 x 1.54 in (55 x 94 x 39 mm)
Mounting -	4 x M3 with a distance between holes of 1.54 x 3.43 in (39 x 87 mm)
Drill Diameter -	4.0 mm - (4) places

Termination Table		
Terminal #	Nomenclature	Description
1	GND	Gnd for Supply Voltage
2	Positive Input	Positive Supply Voltage
3	Phase A	Motor Phase A
4	Phase C	Motor Phase C
5	Phase B	Motor Phase B
6	S3	Hall Switch #3
7	S2	Hall Switch #2
8	S1	Hall Switch #1
9	VCC	Supply for Hall Switches
10	GND	Gnd for Hall Switches
11	DIS	Control Input - Disable
12	REV	Control Input - Reverse
13	GND	Gnd for Dis and Rev
14	SPD	Set value input for speed

Inputs

- Direction of rotation – (REV) open collector / TTL / CMOS / switch
- Disable output stage – (DIS) open collector / TTL / CMOS / switch

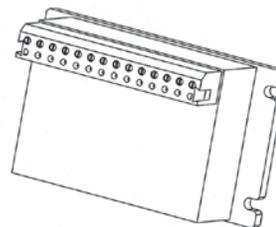
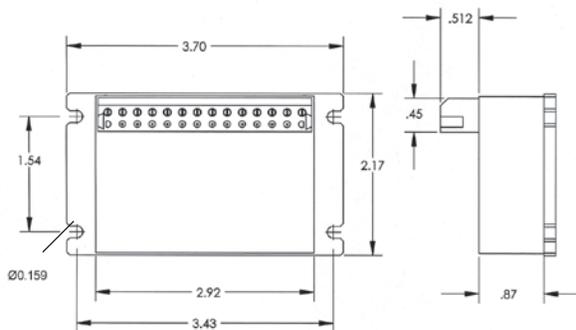
Moisture Range

20 to 80% non-condensed

Temperature Range

Storage -40 to +85°C
Operation -10 to +45°C

BDP-Q2-50-10 OUTLINE - THREE VIEWS



Dimensions are in inches

Please complete this form to tell us about your motor specifications. We'll contact you with information about the motor that matches your application.

Please provide the following information:

First Name _____ Last Name _____

Function: Procurement Engineering Other: _____

Organization _____

Street Address _____

City _____ State / Province _____ Zip / Postal Code _____ Country _____

Work Phone _____ Fax _____ E-mail _____

Please provide as much information as possible, enter NA for those questions that are not critical or important to you. Do not be concerned if you do not have all of the specifications that are requested, we are happy to work with as much information as you can provide. However, the more complete your response, the more thorough our analysis.

Select which category best describes your application:

- | | | | |
|--|---|---|--|
| <input type="checkbox"/> Actuators | <input type="checkbox"/> Food Processing | <input type="checkbox"/> Medical Equipment | <input type="checkbox"/> Machining Tools |
| <input type="checkbox"/> Material Handling | <input type="checkbox"/> Printing | <input type="checkbox"/> Military / Aerospace | <input type="checkbox"/> Packaging Equipment |
| <input type="checkbox"/> Textile Machinery | <input type="checkbox"/> Semiconductor Mfg. | <input type="checkbox"/> DFARS Alt 1 | <input type="checkbox"/> Robotics |
| <input type="checkbox"/> Industrial Automation | <input type="checkbox"/> Other: _____ | | |

Technical Information

Please give us a description of your application:

Type Of Motor:

- | | | | |
|---------------------------------------|-----------------------------------|----------------------------------|---------------------------------------|
| <input type="checkbox"/> Brushless DC | <input type="checkbox"/> Brush DC | <input type="checkbox"/> Stepper | <input type="checkbox"/> Torque Motor |
| <input type="checkbox"/> Other: _____ | | | |

This Application Is:

- | | |
|------------------------------|---|
| <input type="checkbox"/> New | <input type="checkbox"/> Retrofit / Replacement |
| | Current Supplier _____ |
| | Part Number _____ |

Moog can also provide you with an electronic driver to go with your brushless motor. Would you like more information on our electronic drivers?

- | | |
|------------------------------|-----------------------------|
| <input type="checkbox"/> Yes | <input type="checkbox"/> No |
|------------------------------|-----------------------------|

Do you require: Brake Encoder

If Yes, please specify:

- | | | | |
|---------|---------------------------------------|---|-----------------------------|
| Brake | <input type="checkbox"/> Fail Safe | <input type="checkbox"/> Dynamic Stopping | Static Holding Torque _____ |
| Encoder | <input type="checkbox"/> Single Ended | <input type="checkbox"/> Differential | Voltage _____ |
| | | | Line Count _____ |
| | | | Number of Channels _____ |

Life And Usage:

Estimated annual usage _____ Estimated life of program _____
 Price target _____ Production start date _____
 Delivery time frame _____

Regulatory / Environmental Requirements: UL CE IP

RoHS Compliance? Yes No Comments: _____

Environmental Operating Conditions:

Submersion in water Extreme temperatures Excessive amounts of dust and / or dirt
 Humidity Other: _____

Heat Removal:

Application is in free air Heat sink Fan-cooled

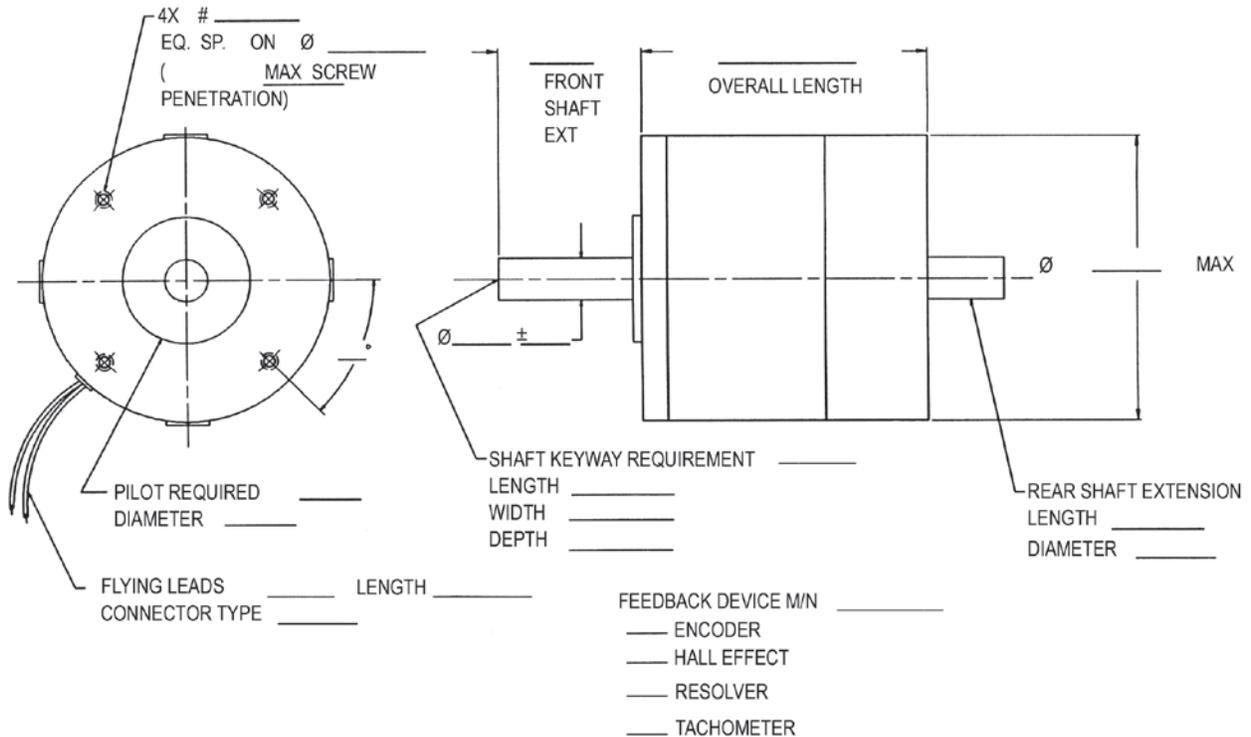
Electromechanical Specifications

Max. loaded speed (RPM) _____ Max. continuous torque (oz-in) _____ Peak torque (oz-in) _____
 Duty Cycle _____ Minutes on, _____ Minutes off _____
 Operating temp range (°C) _____ Ambient temp in application (°C) _____
 Max terminal voltage (Vdc) _____ Rated current (A) _____
 Load Inertia _____ Radial Shaft Load _____ Axial Shaft Load _____

If a new design is required, is funding available to cover non-recurring engineering and tooling costs?

Non-recurring engineering costs Yes No

Tooling costs Yes No



STANDARD MOTOR OPTIONS

Moog offers significant engineering design resources to customize your component. As a vertically integrated manufacturer, we can add many options to a baseline selection to ensure that it meets your requirements and minimizes your vendor base. Please refer to the following list of modifications that we routinely encounter, and contact us for additional requirements. Commercially available standard options include, but are not limited to:

1. Mechanical Options

- a. Shaft Options, i.e., diameter / length (0-6 inches), precision tolerances, dual shaft extensions, flats, keyways, threads, splines / pinions, tapers, grooves, chamfers, fillets, steps, holes, hollow core, material, finish, hardness (For unhused parts sets, similar machining modifications apply to rotor core mounting configuration)
- b. End Cap Options, i.e., mounting boss diameter / depth, flange mounting, bolt circle diameter, material, finish
- c. Housing Options, i.e., mounting boss diameter, bolt circle diameter, frameless, material, finish
- d. Electrical Interface Options, i.e., flying leads, custom wire harnesses, connectors, terminals, shielding
- e. Environmental Options, i.e., high / low temperature, IP ratings, autoclavable, conformal coatings, potting / encapsulating, radiation hardened, EMI / RFI mitigation, low outgassing, RoHS / Non RoHS compliance
- f. Special printing, marking, labeling
- g. *Bearing and bearing lube options

2. Electromagnetic Options

- a. Motor Winding Options; (Km 1.0 to 100 oz.-in. / sq.rt. watt)
- b. Sensored, sensorless
- c. Hi-pot
- d. *Wire
- e. *Brush
- f. *Magnet

3. Accessories

- a. Temp sensing
- b. Pulleys
- c. Flywheels
- d. Integral and external drives (2,000 watts max.)
- e. Resolvers
- f. *Encoders
- g. *Gear heads
- h. *Clutches and brakes

4. Avionics Specific Options

- a. Contact Options, i.e., brush, brushless, hairspring, flex-lead
- b. Electrical Performance, i.e., input voltage (1 to 120 volt), current, power, null voltage, phase shift, accuracy ($\pm 2'$ to ± 2 degrees, to 15 inches on multi-speed units), transformation ratio (up to 5)
- c. Mechanical Performance, i.e., low friction, end-play, limited rotation features

5. Blower Specific Options

- a. Speed control – via - PWM, DC voltage, temperature, closed loop, open loop or other standard interface
- b) Serial bus communications – I2C, CANbus, RS232, RS485 and other common communication buses
- c) Inlet and outlet features for mounting to hoses, plenums, etc.
- d) Speed feedback via serial communications, tach out and alarms for speed thresholds
- e) Specialized aerodynamically designed impellers / blades to reduce noise, improve efficiency, withstand harsh environments and special finishes

*All commercially available components can be incorporated into our standard catalog products.

OTHER MOOG PRODUCTS

Today, Moog's core business is motion. Product lines include slip rings, fiber optic rotary joints, motors, position sensors, actuators, fluid rotary unions, fiber optic components and air moving systems. There are seven manufacturing operations with locations in Virginia (Blacksburg and Galax), North Carolina (Murphy), Pennsylvania (Springfield), Canada (Halifax), England (Reading) and Florida, (Naples) with over 1,800 employees worldwide. Recent additions to the product portfolio are Moog Aspen Motion Technologies, Moog Protokraft and Moog Tritech.

Slip Rings

Moog is the world leader in slip ring design and manufacturing -- offering thousands of models. Slip rings are used in systems that require continuous rotation while transmitting power and data from a stationary unit to a rotating device.

Fiber Optic Rotary Joints

Moog's fiber optic rotary joints are to optical signals what electrical slip rings are to electrical signals, a means to pass signals across rotating interfaces, particularly when transmitting large amounts of data.

Actuators

Moog offers high technology and utility electromechanical rotary and linear actuators for aerospace and industrial applications. These actuators utilize brush and brushless DC motors, planetary gears, modulated smart servo amplifiers, PWM amplifiers, multi-speed resolvers and potentiometers.

Fluid Rotary Unions

Moog's expanded line of fluid rotary unions offer reliable transmission of life support, process, power and control fluids. Fluid rotary unions can be combined with slip rings, fiber optic rotary joints, motors and resolver.

Matrix Motors

Rugged direct drive, frameless, brushless motors. Designed to operate, with high torque-to-power and torque-to-inertia ratios, high linearity and low electrical time constants, over a range of different speeds and for a wide variety of industrial, military and aerospace applications.

Fiber Optics

Moog expands and enhances its motion capabilities with expertise in fiber optic design. From MEMS-based fiber optic switches to large rotary joints and multiplexers to fiber optic modems, we offer an array of solutions for today's demanding applications.

Custom Solutions

Moog does not stop with just standard models. Over the years, we have learned that many projects require a product that has unique specifications - either designed from scratch or modified from another design. One of Moog's strong points is providing exactly the right custom solution.

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

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