AEROTECH

S-Series Motor Hardware Manual

Revision: 2.03.00

Global Technical Support

Go to www.aerotech.com/global-technical-support for information and support about your Aerotech, Inc. products. The website supplies software, product manuals, Help files, training schedules, and PC-to-PC remote technical support. If necessary, you can complete Product Return (RMA) forms and get information about repairs and spare or replacement parts. To get help immediately, contact a service office or your sales representative. Include your customer order number in your email or have it available before you call.

United States (World Headquarters)	
Email: Support@aerotech.com Phone: +1-412-967-6440 Fax: +1-412-967-6870	101 Zeta Drive Pittsburgh, PA 15238-2811 www.aerotech.com
United Kingdom	**Japan**
Email: Support@aerotech.com Phone: +44 (0)1256 855055 Fax: +44 (0)1256 855649	Email: Support@aerotech.com Phone: +81 (0)50 5830 6814 Fax: +81 (0)43 306 3773
Germany	**China**
Email: Support@aerotech.com Phone: +49 (0)911 967 9370 Fax: +49 (0)911 967 93720	Email: Support@aerotech.com Phone: +86 (21) 5508 6731
France	**Taiwan**
Email: Support@aerotech.com Phone: +33 2 37 21 87 65	Email: Support@aerotech.com Phone: +886 (0)2 8751 6690

Table of Contents

List of Figures

List of Tables

EU Declaration of Conformity

Manufacturer	Aerotech, Inc.
Address	101 Zeta Drive Pittsburgh, PA 15238-2811 USA
Product	S-Series Motors
Model/Types	All

This is to certify that the aforementioned product is in accordance with the applicable requirements of the following Directive(s):

2014/35/EU	Low Voltage Directive
2011/65/EU	RoHS 2 Directive

and has been designed to be in conformity with the applicable requirements of the following Standard(s) when installed and used in accordance with the manufacturer's supplied installation instructions.

EN 60204-1	Safety of machinery - electrical equipment of machines
NOTE:	Safe operation of the motor requires over speed and over current protection. This may be done by the connected controller / amplifier combination.

Authorized Representative:	Simon Smith, European Director
Address:	Aerotech Ltd The Old Brick Kiln, Ramsdell, Tadley Hampshire RG26 5PR UK
Name	/ Alex Weibel
Position	Engineer Verifying Compliance
Location	Pittsburgh, PA
Date	5/24/2019

CE

Safety Procedures and Warnings

This manual tells you how to carefully and correctly use and operate the S-Series. Read all parts of this manual before you install or operate the S-Series or before you do maintenance to your system. To prevent injury to you and damage to the equipment, obey the precautions in this manual. The precautions that follow apply when you see a Danger or Warning symbol in this manual. If you do not obey these precautions, injury to you or damage to the equipment can occur. If you do not understand the information in this manual, contact Aerotech Global Technical Support.

This product has been designed for light industrial manufacturing or laboratory environments. The protection provided by the equipment could be impaired if the product is used in a manner not specified by the manufacturer.

NOTE: Aerotech continually improves its product offerings; listed options may be superseded at any time. All drawings and illustrations are for reference only and were complete and accurate as of this manual's release. Refer to www.aerotech.com for the most up-to-date information.

DANGER: This product contains potentially lethal voltages. To reduce the possibility of electrical shock, bodily injury, or death the following precautions must be followed.

1. The user must restrict user access to motor coil / wires while energized. This is accomplished by providing an enclosure around the operating components which, when opened, removes power to the drive. The motor may also be contained in a grounded mechanical system (positioning stage) which restricts direct access to the high voltage motor components.
2. Do not connect or disconnect any electrical components or connecting cables while connected to a power source.
3. Disconnect electrical power before servicing equipment.
4. All components must be properly grounded in accordance with local electrical safety requirements.
5. Motor frame is safety grounded with a conductor equal in size to the phase conductors.
6. The drive must contain a properly-sized fuse, matched to the motor cable wire size.
7. These motors are not rated for use in explosive atmospheres. They are not to be operated in the presence of potentially explosive mixtures of air-borne dust or combustible vapors.
8. Motors and their associated drive, cabling, etc. are sources of electromagnetic fields. Persons with implanted medical devices need to evaluate the risks associated with these devices before entering an area where they are in use.
9. Operator safeguarding requirements must be addressed during final integration of the product.

DANGER: The motor temperature can pose a burn hazard. Do not touch the motor until it has cooled sufficiently.

WARNING: To minimize the possibility of electrical shock, bodily injury or death the following precautions must be followed.

1. Aerotech's motors are meant to be part of a drive package consisting of an amplifier and a controller. The motor relies on the drive package for fault protection. Aerotech, Inc. does not approve of their motors being used in any other way.
2. To prevent electrical shock hazards, allow only qualified persons to install and service this equipment.
3. Equipment grounds must be in place and maintained to reduce the risk of serious or potentially fatal injury from electric shock.
4. Moving parts can cause crushing or shearing injuries. Access to all stage and motor parts must be restricted while connected to a power source.
5. Never install or operate equipment that appears to be damaged.
6. Disconnect electrical power to the motor before performing maintenance procedures. In addition, uncouple or otherwise prevent motor-coupled machinery from moving the motor during service.
7. Motors are capable of very high speeds and acceleration rates. Always avoid being in the direct path of moving machinery.
8. The motor over temperature sensor must be monitored by the drive and used to shut down the drive in the event of excessive motor temperatures.
9. Cables can pose a tripping hazard. Securely mount and position all system cables to avoid potential hazards.
10. Do not expose this product to environments or conditions outside of the listed specifications. Exceeding environmental or operating specifications can cause damage to the equipment.
11. The S-Series motor must be mounted securely. Improper mounting can result in injury and damage to the equipment.
12. Use care when moving the S-Series motor. Lifting or transporting the S-Series motor improperly can result in injury or damage to the S-Series.
13. If the product is used in a manner not specified by the manufacturer, the protection provided by the product can be impaired and result in damage, shock, injury, or death.

Chapter 1: Overview

S-Series torque ring motors include the stator with flying leads, adjustable-phase Hall board, and rotor with magnets.

Table 1-1: Ordering Options

Motor Series	Motor Diameter Code	Motor Length Code (Laminations and Windings)	Winding
S	-50	-39, -52, -86	-A -B
	-76	-35, -85, -149	
	-130	-39, -60, -81, -102, -123	
	-180	-44, -69, -94	
	-240	- 43, -63, -83	

Table 1-2: Slotless Torque Ring Kit Servomotors

Option	Slotless Motor, Rotor, and Stator Description
S-50-39	50.80 mm O.D., Cont. Stall torque: 0.20 N·m
S-50-52	50.80 mm O.D., Cont. Stall torque: 0.33 N·m
S-50-86	50.80 mm O.D., Cont. Stall torque: 0.56 N·m
S-76-35	75.97 mm O.D., Cont. Stall torque: 0.48 N·m
S-76-85	75.97 mm O.D., Cont. Stall torque: 1.60 N·m
S-76-149	75.97 mm O.D., Cont. Stall torque: 2.86 N·m
S-130-39	128.93 mm O.D., Cont. Stall torque: 2.36 N·m
S-130-60	128.93 mm O.D., Cont. Stall torque: 4.18 N·m
S-130-81	128.93 mm O.D., Cont. Stall torque: 5.89 N·m
S-130-102	128.93 mm O.D., Cont. Stall torque: 7.69 N·m
S-130-123	128.93 mm O.D., Cont. Stall torque: 8.65 N·m
S-180-44	180.34 mm O.D., Cont. Stall torque: 5.99 N·m
S-180-69	180.34 mm O.D., Cont. Stall torque: 11.12 N·m
S-180-94	180.34 mm O.D., Cont. Stall torque: 15.93 N·m
S-240-43	239.20 mm O.D., Cont. Stall torque: 10.73 N·m
S-240-63	239.20 mm O.D., Cont. Stall torque: 19.71 N·m
S-240-83	239.20 mm O.D., Cont. Stall torque: 29.09 N·m
NOTE: Custom models are available. Contact Aerotech for more information.	

1.1. Motor Specifications

Table 1-3: S-50 Motor Specifications

		S-50-39		S-50-52		S-50-86	
Performance Specifications (1,5)							
Winding Designation		-A	-B	-A	-B	-A	-B
Stall Torque, Cont. (2)	N·m	0.20		0.33		0.56	
Peak Torque (3)	N·m	0.82		1.31		2.26	
Rated Speed	rpm	4000	8000	4000	8000	3000	8000
Power Output, Continuous	W	82.1	157.1	117.7	198.0	131.9	149.5
Electrical Specifications (5)							
Winding Designation		-A	-B	-A	-B	-A	-B
BEMF Const., line-line, Max	V_{pk}/krpm	10.3	3.4	19.0	6.3	40	13.3
Continuous Current, Stall (2)	A_{pk}	2.4	7.2	2.3	6.9	2.1	6.3
	A_{rms}	1.7	5.1	1.6	4.9	1.5	4.5
Peak Current, Stall (2)	A_{pk}	9.6	28.8	9.2	27.6	8.4	25.2
Torque Constant (4, 9)	N·m/A_{pk}	0.09	0.03	0.14	0.05	0.27	0.09
	N·m/A_{rms}	0.12	0.04	0.20	0.07	0.38	0.13
Motor Constant (2, 4)	N·m/√W	0.034		0.050		0.076	
Resistance, 25°C, line-line	Ω	6.6	0.7	8.4	0.9	12.9	1.4
Inductance, line-line	mH	1.50	0.17	1.30	0.14	2.40	0.27
Maximum Bus Voltage	V_{DC}	340		340		340	
Thermal Resistance	°C/W	2.02	2.02	1.73	1.73	1.35	1.35
Number of Poles	--	8		8		8	
Mechanical Specifications							
Winding Designation		-A	-B	-A	-B	-A	-B
Frameless Motor Weight	kg	0.32		0.48		0.90	
Frameless Rotor Inertia	kg·m^2	1.11x10^{-5}		1.70x10^{-5}		3.40x10^{-5}	
Length of Winding, Frameless Motor	mm	39.1		51.8		85.8	
Outside Diameter, Frameless Motor	mm	50.8		50.8		50.8	
Rotor Bore Diameter	mm	9.5		9.5		9.5	

1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature
2. Values shown @ 75°C rise above a 25 °C ambient temperature, with housed motor mounted to a 250 mm x 250 mm x 6 mm aluminum heat sink
3. Peak force assumes correct rms current; consult Aerotech.
4. Torque constant and motor constant specified at stall
5. All performance and electrical specifications ±10%
6. Specifications given are for the motor only. When integrated into a housing with bearings additional losses should be considered.
7. Maximum winding temperature is 100 °C (thermistor trips at 100 °C)
8. Ambient operating temperature range 0 °C - 25 °C; consult Aerotech for performance in elevated ambient temperatures
9. All Aerotech amplifiers are rated A_{pk}; use torque constant in N·m/A_{pk} when sizing

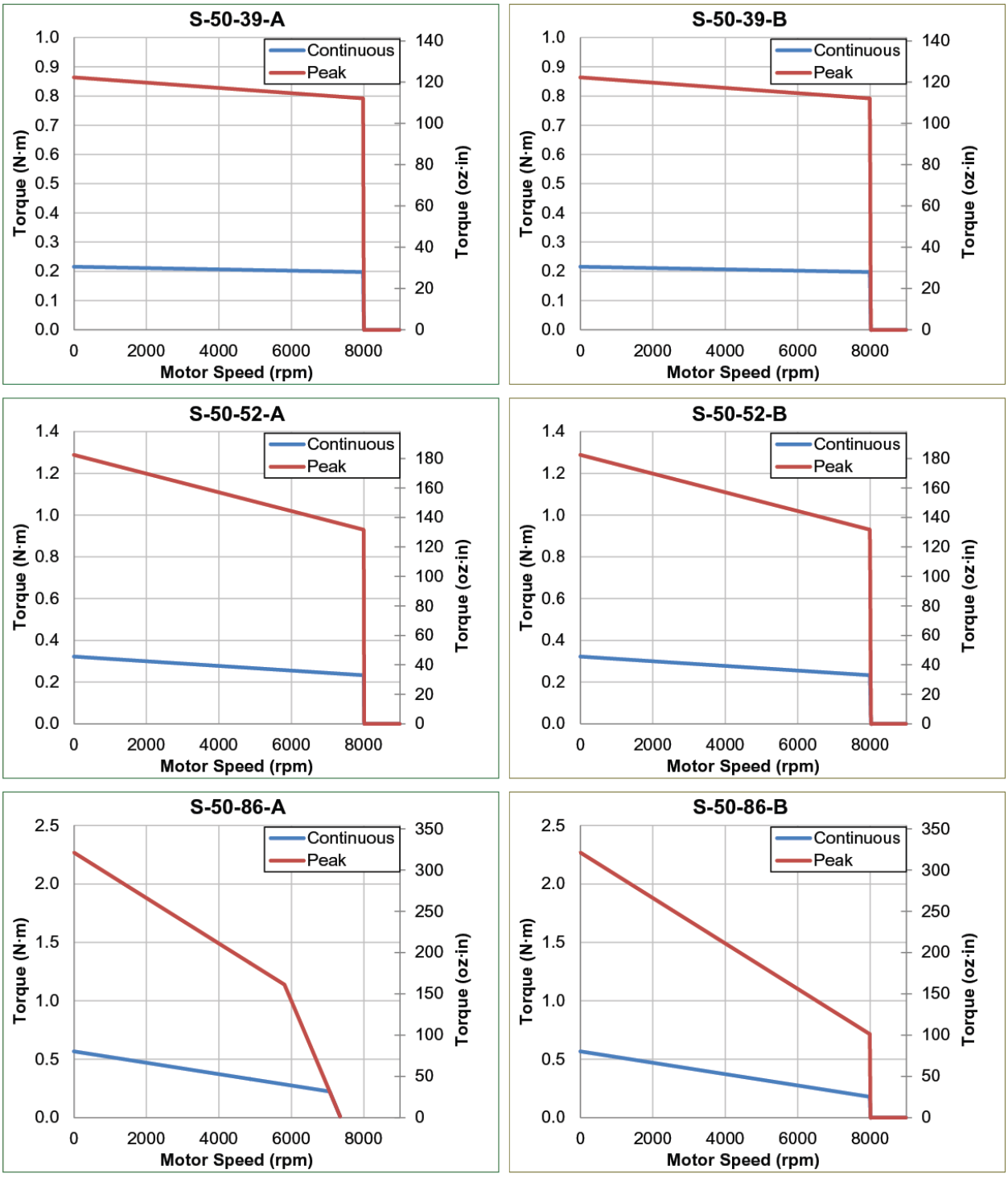


Figure 1-1: Torque Speed Curves (S-50-XX)

Table 1-4: S-76 Motor Specifications

		S-76-35		S-76-85		S-76-149	
Performance Specifications (1,5)							
Winding Designation		-A	-B	-A	-B	-A	-B
Stall Torque, Cont. (2)	N·m	0.48		1.60		2.86	
Peak Torque (3)	N·m	1.92		6.41		11.43	
Rated Speed	rpm	3000	5000	3000	4000	2000	1500
Power Output, Cont.	W	143.3	230.5	381.6	453.2	459.1	369.9
Electrical Specifications (5)							
Winding Designation		-A	-B	-A	-B	-A	-B
BEMF Const., line-line, Max	V_{pk}/krpm	29.1	14.5	57.0	38.0	79.0	118.5
Continuous Current, Stall (2)	A_{pk}	2.0	4.0	3.8	5.7	4.9	3.3
	A_{rms}	1.4	2.8	2.7	4.0	3.5	2.3
Peak Current, Stall (2)	A_{pk}	8.0	16.0	15.2	22.8	19.6	13.1
	A_{rms}	5.7	11.3	10.7	16.1	13.9	9.2
Torque Constant (4, 9)	N·m/A_{pk}	0.24	0.12	0.42	0.28	0.58	0.87
	N·m/A_{rms}	0.34	0.17	0.60	0.40	0.82	1.24
Motor Constant (2, 4)	N·m/√W	0.075		0.179		0.280	
Resistance, 25°C, line-line	Ω	10.5	2.6	5.7	2.5	4.4	10.0
Inductance, line-line	mH	1.40	0.35	1.10	0.49	0.87	1.96
Maximum Bus Voltage	V_{DC}	340		340		340	
Thermal Resistance	°C/W	1.83		0.93		0.72	
Number of Poles	--	14		14		14	
Mechanical Specifications							
Winding Designation		-A	-B	-A	-B	-A	-B
Frameless Motor Weight	kg	0.64		2.20		4.30	
Frameless Rotor Inertia	kg·m^2	1.06x10^{-4}		4.20x10^{-4}		8.30x10^{-4}	
Length of Winding, Frameless Motor	mm	35.0		84.8		149.0	
Outside Diameter, Frameless Motor	mm	76.0		76.0		76.0	
Rotor Bore Diameter	mm	30.0		30.0		30.0	

1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature
2. Values shown @ 75°C rise above a 25 °C ambient temperature, with housed motor mounted to a 250 mm x 250 mm x 6 mm aluminum heat sink
3. Peak force assumes correct rms current; consult Aerotech.
4. Torque constant and motor constant specified at stall
5. All performance and electrical specifications ±10%
6. Specifications given are for the motor only. When integrated into a housing with bearings additional losses should be considered.
7. Maximum winding temperature is 100 °C (thermistor trips at 100 °C)
8. Ambient operating temperature range 0 °C - 25 °C; consult Aerotech for performance in elevated ambient temperatures
9. All Aerotech amplifiers are rated A_{pk}; use torque constant in N·m/A_{pk} when sizing

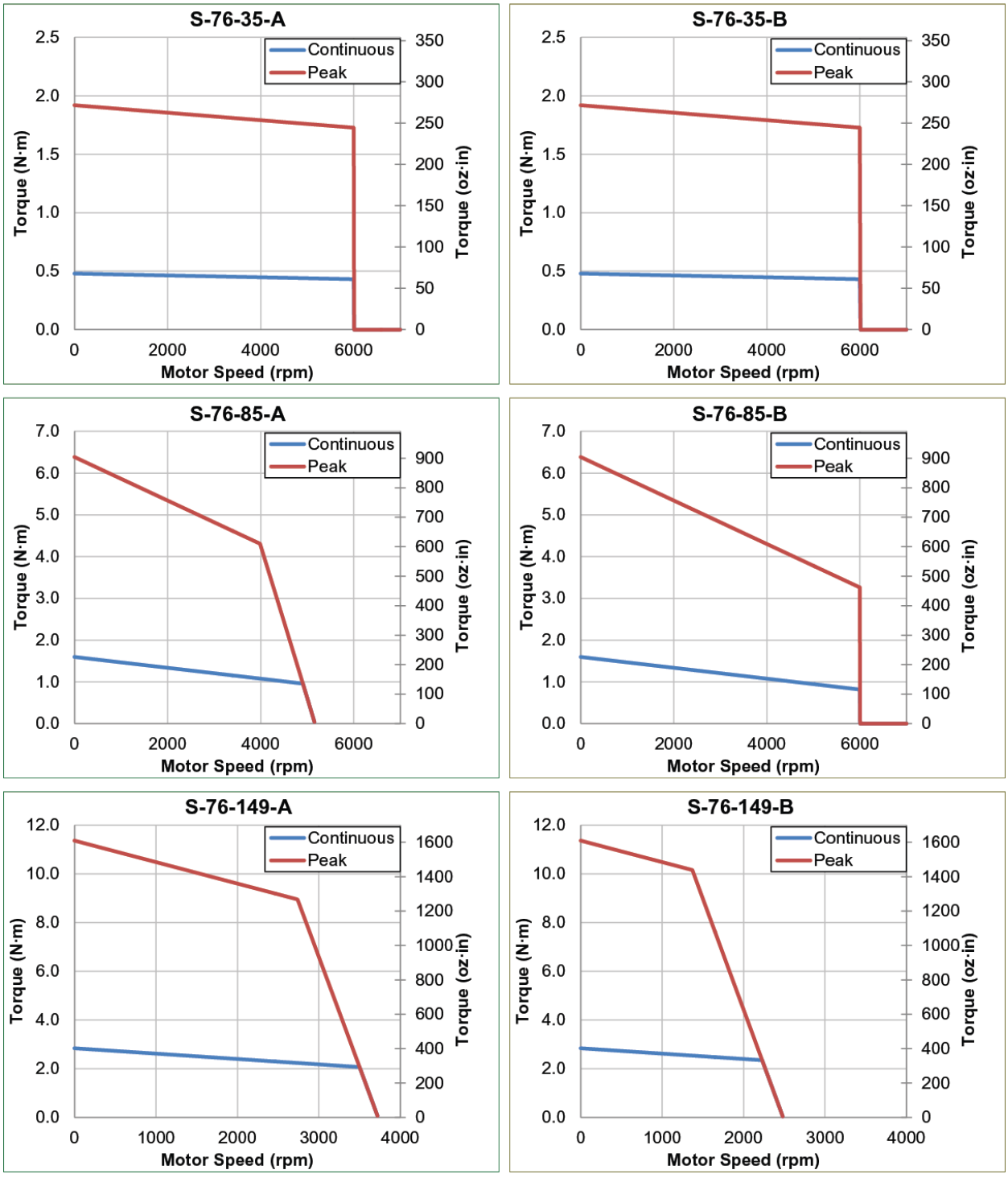


Figure 1-2: Torque Speed Curves (S-76-XX)

Table 1-5: S-130 Motor Specifications

		S-130-39		S-130-60		S-130-81		S-130-102		S-130-123	
Performance Specifications (1,5)											
Winding Designation		-A	-B	-A	-B	-A	-B	-A	-B	-A	-B
Stall Torque, Cont. (2)	N·m	2.36		4.18		5.89		7.69		8.65	
Peak Torque (3)	N·m	9.42		16.73		23.55		30.75		34.61	
Rated Speed	rpm	2000	4000	1000	2000	750	1500	500	1000	375	750
Power Output, Cont.	W	454.5	862.5	412.1	773.4	435.2	815.7	389.7	752.8	327.5	630.6
Electrical Specifications (5)											
Winding Designation		-A	-B	-A	-B	-A	-B	-A	-B	-A	-B
BEMF Const., line-line, Max	V_{pk}/krpm	75.1	37.5	148.9	74.4	222.7	111.4	300.2	150.1	374.1	187.0
Continuous Current, Stall (2)	A_{pk}	3.8	7.6	3.4	6.8	3.2	6.4	3.1	6.2	2.8	5.6
	A_{rms}	2.7	5.4	2.4	4.8	2.3	4.5	2.2	4.4	2.0	4.0
Peak Current, Stall (2)	A_{pk}	15.2	30.4	13.6	27.2	12.8	25.6	12.4	24.8	11.2	22.4
	A_{rms}	10.7	21.5	9.6	19.2	9.1	18.1	8.8	17.5	7.9	15.8
Torque Constant (4, 9)	N·m/A_{pk}	0.62	0.31	1.23	0.62	1.84	0.92	2.48	1.24	3.09	1.55
	N·m/A_{rms}	0.88	0.44	1.74	0.87	2.60	1.30	3.51	1.75	4.37	2.18
Motor Constant (2, 4)	N·m/√W	0.265		0.446		0.586		0.710		0.816	
Resistance, 25°C, line-line	Ω	5.6	1.4	7.8	2.0	10.1	2.5	12.5	3.1	14.7	3.7
Inductance, line-line	mH	1.70	0.43	1.80	0.45	2.80	0.70	3.67	0.92	4.60	1.15
Maximum Bus Voltage	V_{DC}	340		340		340		340		340	
Thermal Resistance	°C/W	0.95		0.85		0.74		0.64		0.67	
Number of Poles	--	18		18		18		18		18	
Mechanical Specifications											
Winding Designation		-A	-B	-A	-B	-A	-B	-A	-B	-A	-B
Frameless Motor Weight	kg	1.87		3.60		5.30		7.00		8.70	
Frameless Rotor Inertia	kg·m^2	1.60x10^{-3}		3.00x10^{-3}		4.70x10^{-3}		6.20x10^{-3}		7.80x10^{-3}	
Length of Winding, Frameless Motor	mm	38.7		59.7		80.7		101.7		122.7	
Outside Diameter, Frameless Motor	mm	128.9		128.9		128.9		128.9		128.9	
Rotor Bore Diameter	mm	50.8		50.8		50.8		50.8		50.8	

1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature
2. Values shown @ 75°C rise above a 25 °C ambient temperature, with housed motor mounted to a 330 mm x 330 mm x 13 mm aluminum heat sink
3. Peak force assumes correct rms current; consult Aerotech.
4. Torque constant and motor constant specified at stall
5. All performance and electrical specifications ±10%
6. Specifications given are for the motor only. When integrated into a housing with bearings additional losses should be considered.
7. Maximum winding temperature is 100 °C (thermistor trips at 100 °C)
8. Ambient operating temperature range 0 °C - 25 °C; consult Aerotech for performance in elevated ambient temperatures
9. All Aerotech amplifiers are rated A_{pk}; use torque constant in N·m/A_{pk} when sizing

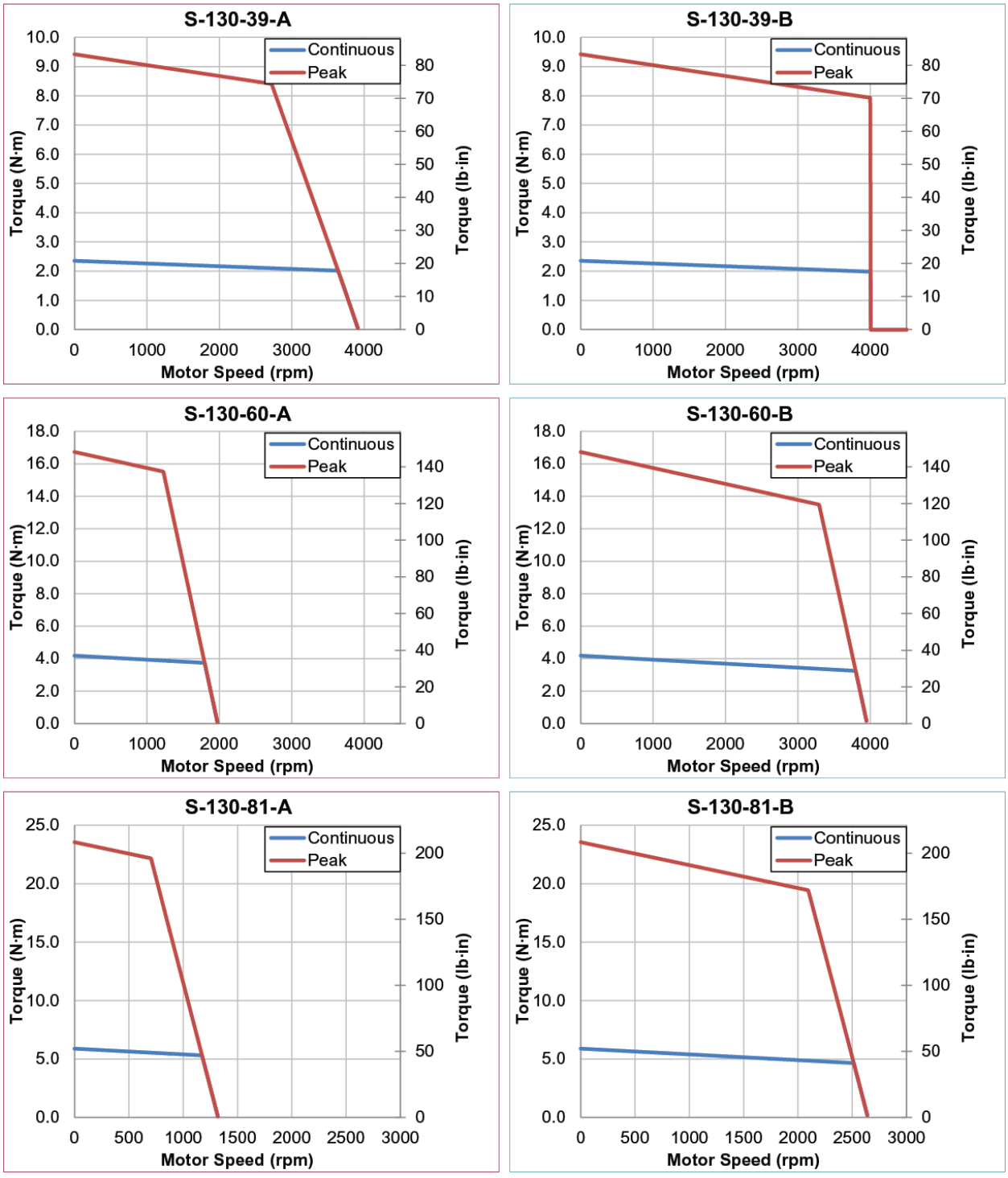


Figure 1-3: Torque Speed Curves (S-130-39, -60, -81)

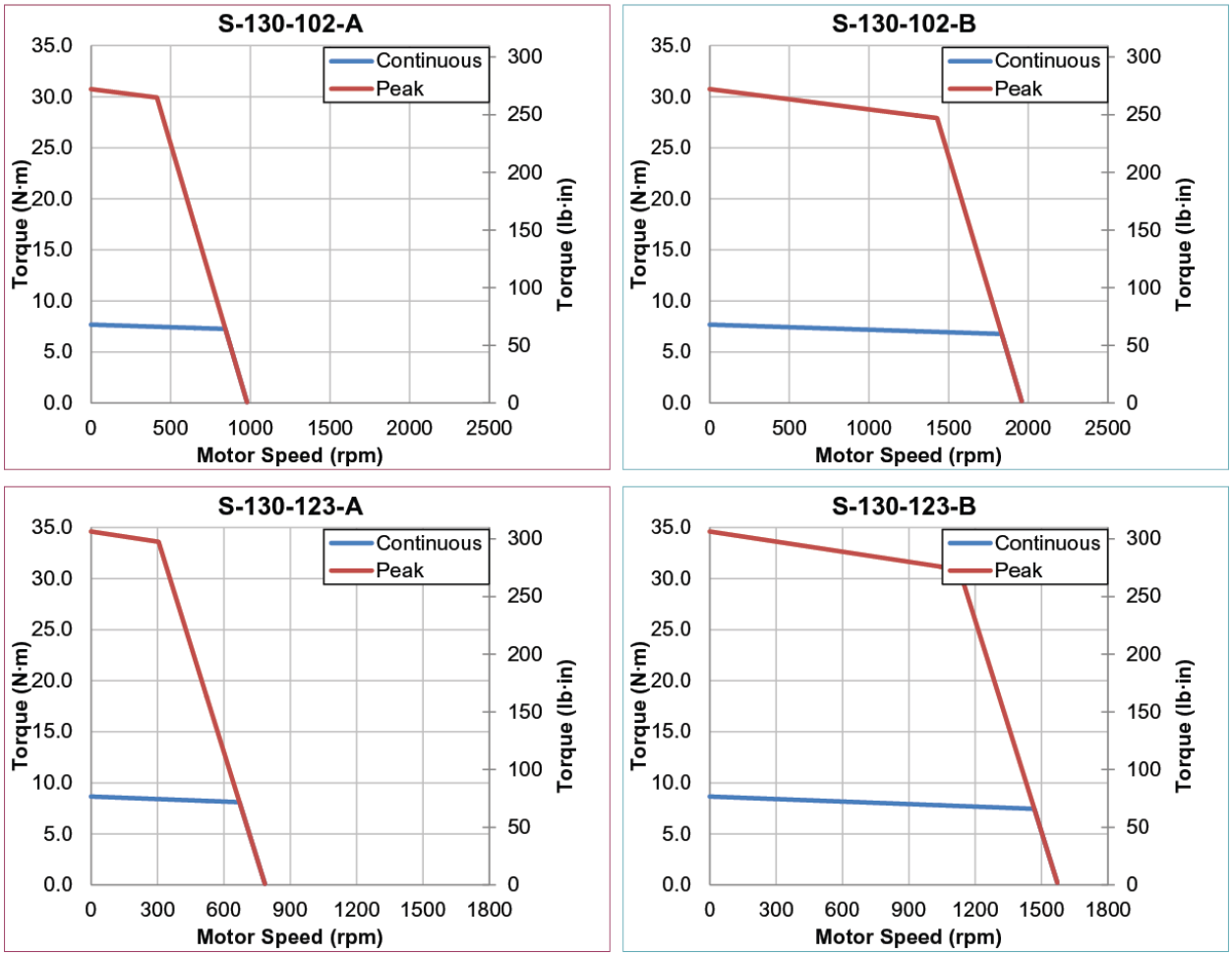


Figure 1-4: Torque Speed Curves (S-130-102, -123)

Table 1-6: S-180 Motor Specifications

		S-180-44		S-180-69		S-180-94	
Performance Specifications (1,5)							
Winding Designation		-A	-B	-A	-B	-A	-B
Stall Torque, Cont. (2)	N·m	5.99		11.12		15.93	
Peak Torque (3)	N·m	23.98		44.47		63.70	
Rated Speed	rpm	500	1000	500	1000	250	500
Power Output, Cont.	W	302.2	581.2	570.5	1117.7	408.6	799.6
Electrical Specifications (5)							
Winding Designation		-A	-B	-A	-B	-A	-B
BEMF Const., line-line, Max	V_{pk}/krpm	268.7	134.4	263.9	131.9	393.4	196.7
Continuous Current, Stall (2)	A_{pk}	2.7	5.4	5.1	10.2	4.9	9.8
	A_{rms}	1.9	3.8	3.6	7.2	3.5	6.9
Peak Current, Stall (2)	A_{pk}	10.8	21.6	20.4	40.8	19.6	39.2
	A_{rms}	7.6	15.3	14.4	28.9	13.9	27.7
Torque Constant (4, 9)	N·m/A_{pk}	2.22	1.11	2.18	1.09	3.25	1.63
	N·m/A_{rms}	3.14	1.57	3.08	1.54	4.60	2.30
Motor Constant (2, 4)	N·m/√W	0.628	0.628	1.053	1.053	1.391	1.391
Resistance, 25°C, line-line	Ω	12.8	3.2	4.4	1.1	5.6	1.4
Inductance, line-line	mH	3.40	0.85	1.70	0.43	2.60	0.65
Maximum Bus Voltage	V_{DC}	340		340		340	
Thermal Resistance	°C/W	0.82		0.67		0.57	
Number of Poles	--	18		18		18	
Mechanical Specifications							
Winding Designation		-A	-B	-A	-B	-A	-B
Frameless Motor Weight	kg	4.24		8.10		11.90	
Frameless Rotor Inertia	kg·m^2	$7.40x10^{-3}$		$1.48x10^{-2}$		$2.20x10^{-2}$	
Length of Winding, Frameless Motor	mm	43.2		68.2		93.2	
Outside Diameter, Frameless Motor	mm	180.0		180.0		180.0	
Rotor Bore Diameter	mm	86.4		86.4		86.4	

1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature
2. Values shown @ 75°C rise above a 25 °C ambient temperature, with housed motor mounted to a 330 mm x 330 mm x 13 mm aluminum heat sink
3. Peak force assumes correct rms current; consult Aerotech.
4. Torque constant and motor constant specified at stall
5. All performance and electrical specifications ±10%
6. Specifications given are for the motor only. When integrated into a housing with bearings additional losses should be considered.
7. Maximum winding temperature is 100 °C (thermistor trips at 100 °C)
8. Ambient operating temperature range 0 °C - 25 °C; consult Aerotech for performance in elevated ambient temperatures
9. All Aerotech amplifiers are rated A_{pk}; use torque constant in N·m/A_{pk} when sizing

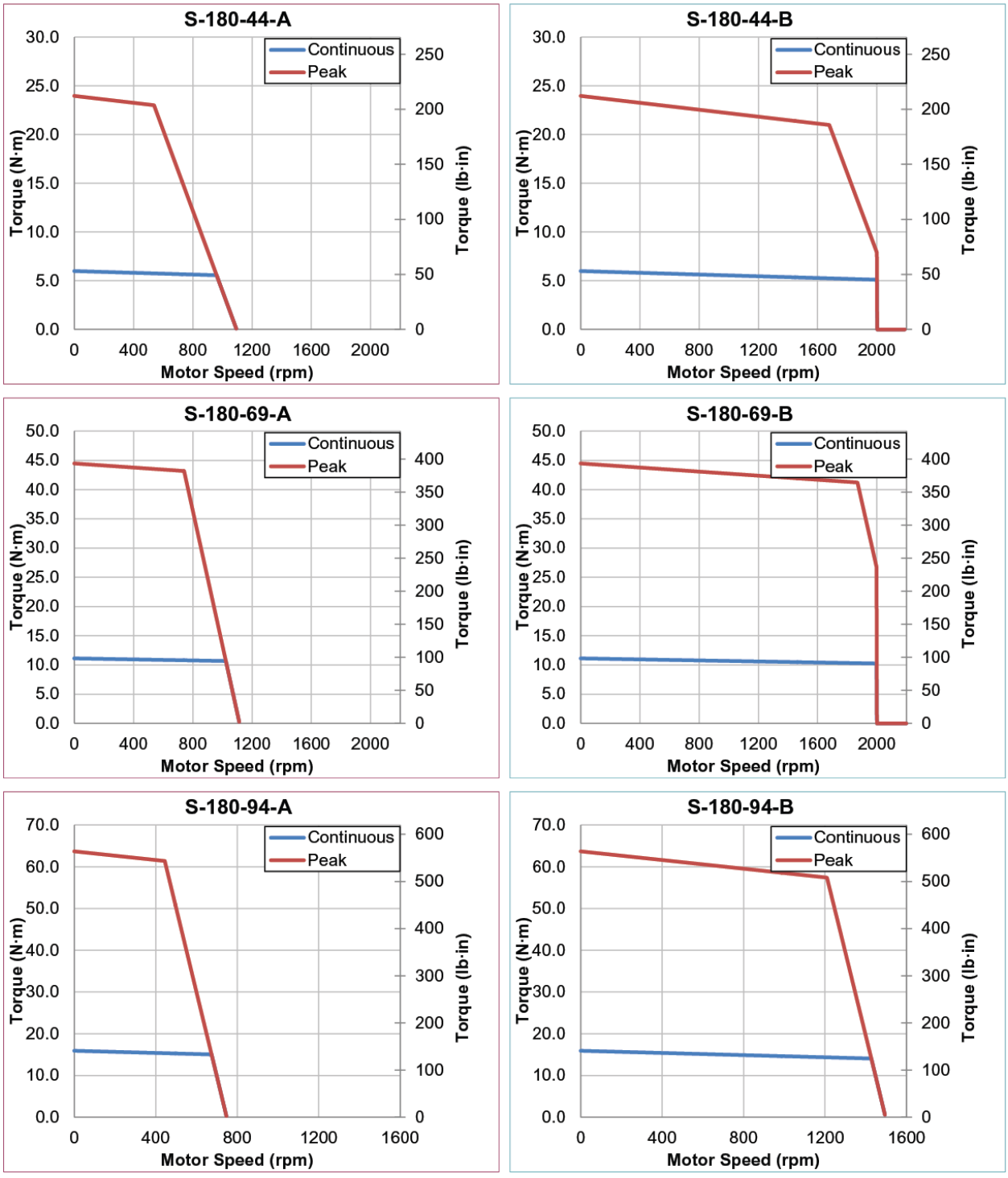


Figure 1-5: Torque Speed Curves (S-180-XX)

Table 1-7: S-240 Motor Specifications

		S-240-43		S-240-63		S-240-83	
Performance Specifications (1,5)							
Winding Designation		-A	-B	-A	-B	-A	-B
Stall Torque, Cont. (2)	N·m	10.73		19.71		29.09	
Peak Torque (3)	N·m	42.90		78.82		116.37	
Rated Speed	rpm	600	1200	250	500	200	400
Power Output, Cont.	W	663.2	1303.4	507.1	996.7	599.0	1177.2
Electrical Specifications (5)							
Winding Designation		-A	-B	-A	-B	-A	-B
BEMF Const., line-line, Max	V_{pk}/krpm	209.4	104.7	404.3	202.2	607.2	303.6
Continuous Current, Stall (2)	A_{pk}	6.2	12.4	5.9	11.8	5.8	11.6
	A_{rms}	4.4	8.8	4.2	8.3	4.1	8.2
Peak Current, Stall (2)	A_{pk}	24.8	49.6	23.6	47.2	23.2	46.4
	A_{rms}	17.5	35.1	16.7	33.4	16.4	32.8
Torque Constant (4, 9)	N·m/A_{pk}	1.73	0.87	3.34	1.67	5.02	2.51
	N·m/A_{rms}	2.45	1.22	4.72	2.36	7.09	3.55
Motor Constant (2, 4)	N·m/√W	0.845	0.845	1.405	1.405	1.893	1.893
Resistance, 25°C, line-line	Ω	4.3	1.1	5.8	1.5	7.2	1.8
Inductance, line-line	mH	2.15	0.54	2.90	0.73	4.30	1.08
Maximum Bus Voltage	V_{DC}	340		340		340	
Thermal Resistance	°C/W	0.47		0.38		0.32	
Number of Poles	--	26		26		26	
Mechanical Specifications							
Winding Designation		-A	-B	-A	-B	-A	-B
Frameless Motor Weight	kg	5.80		11.00		16.20	
Frameless Rotor Inertia	kg·m^2	$2.30x10^{-2}$		$4.50x10^{-2}$		$7.00x10^{-2}$	
Length of Winding, Frameless Motor	mm	42.7		62.7		82.7	
Outside Diameter, Frameless Motor	mm	239.2		239.2		239.2	
Rotor Bore Diameter	mm	120.6		120.6		120.6	

1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature
2. Values shown @ 75°C rise above a 25 °C ambient temperature, with housed motor mounted to a 330 mm x 330 mm x 13 mm aluminum heat sink
3. Peak force assumes correct rms current; consult Aerotech.
4. Torque constant and motor constant specified at stall
5. All performance and electrical specifications ±10%
6. Specifications given are for the motor only. When integrated into a housing with bearings additional losses should be considered.
7. Maximum winding temperature is 100 °C (thermistor trips at 100 °C)
8. Ambient operating temperature range 0 °C - 25 °C; consult Aerotech for performance in elevated ambient temperatures
9. All Aerotech amplifiers are rated A_{pk}; use torque constant in N·m/A_{pk} when sizing

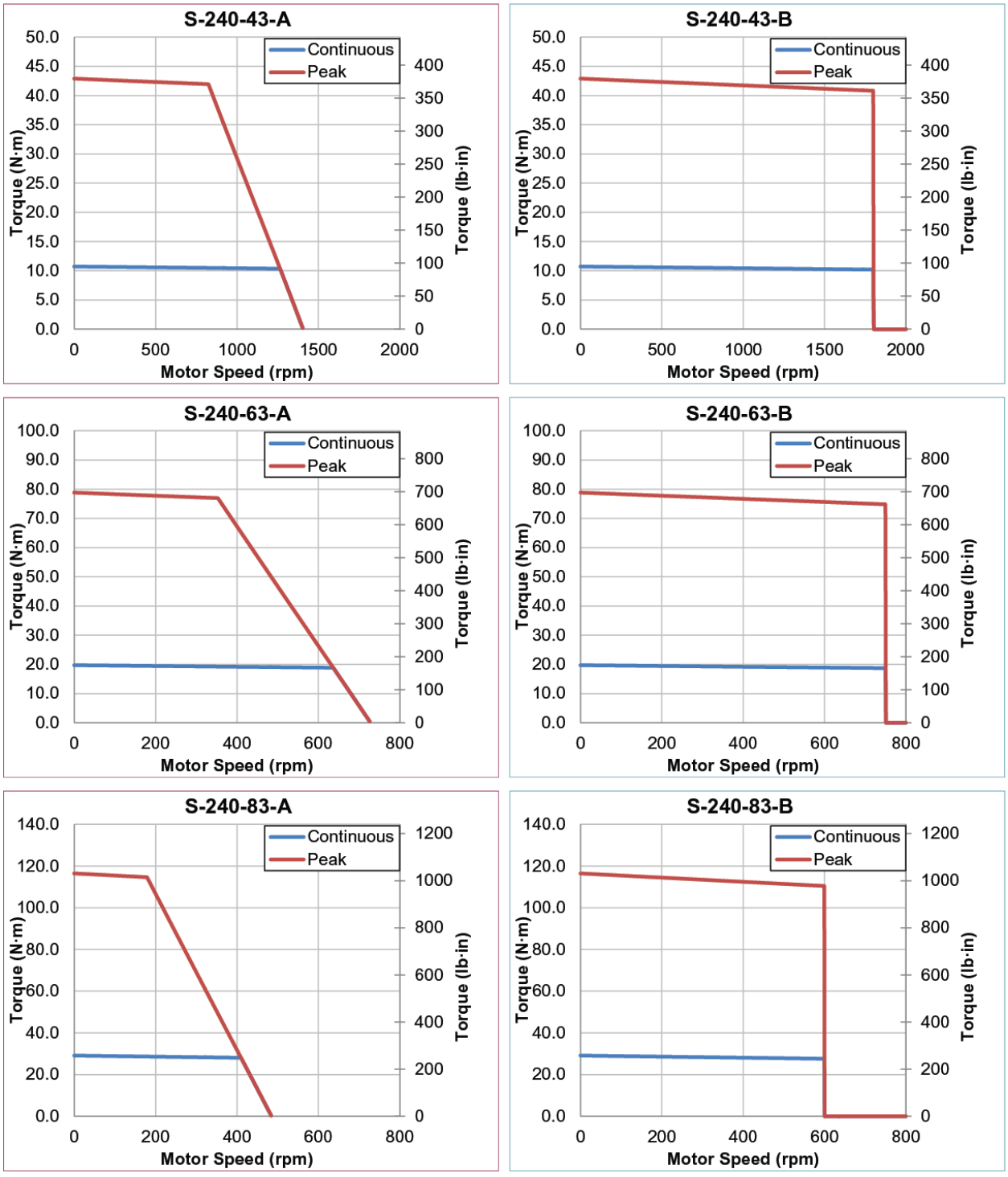


Figure 1-6: Torque Speed Curves (S-240-XX)

1.2. Dimensions

Dimensions - millimeters [inches]

Model No.	A	B	C
S-50-39	21.3 [0.84]	22.0 [0.87]	39.1 [1.54]
S-50-52	34.0 [1.34]	34.8 [1.37]	51.8 [2.04]
S-50-86	67.0 [2.64]	68.8 [2.71]	84.8 [3.34]

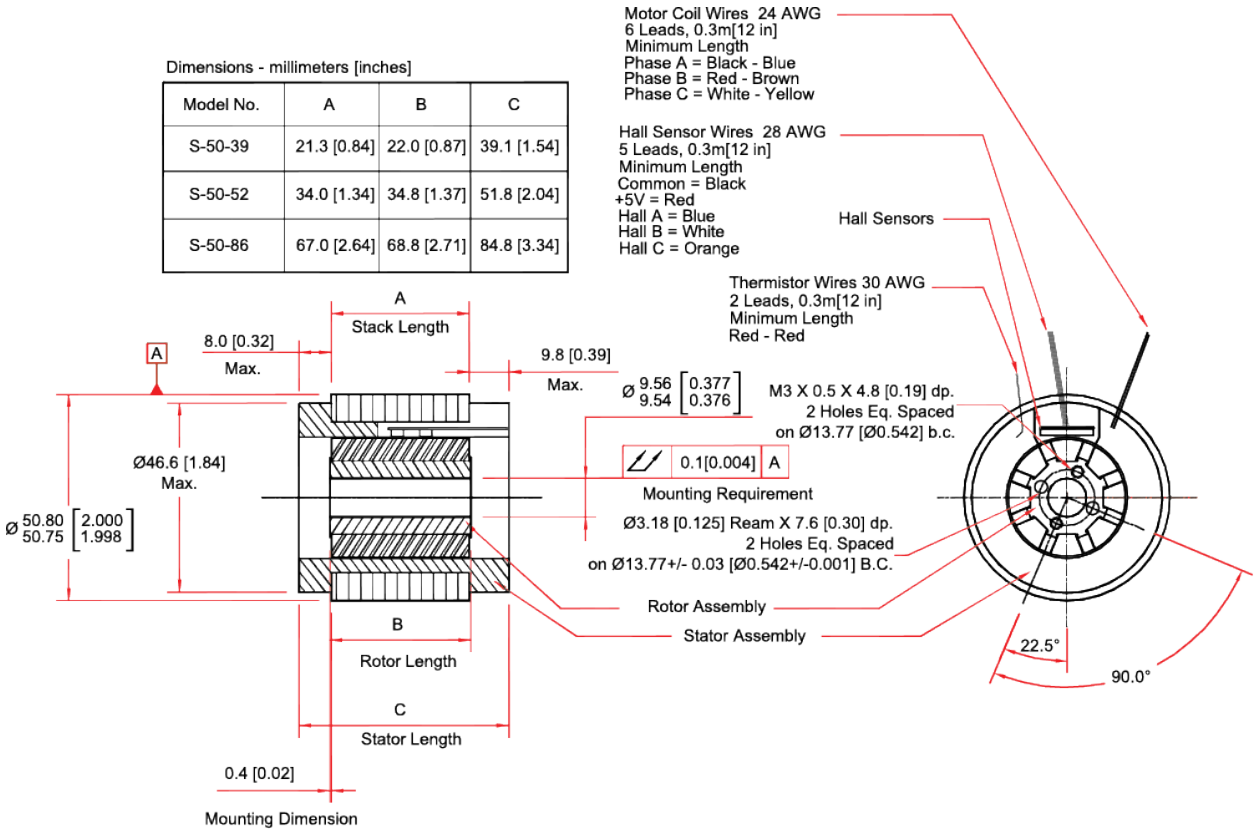


Figure 1-7: S-50 Dimensions

Dimensions - millimeters [inches]

Model No.	A	B	C
S-76-35	17.2[0.68]	18.8[0.74]	35.0[1.38]
S-76-85	67.0[2.64]	68.6[2.70]	84.8[3.34]
S-76-149	131.0[5.16]	135.0[5.31]	148.8[5.86]

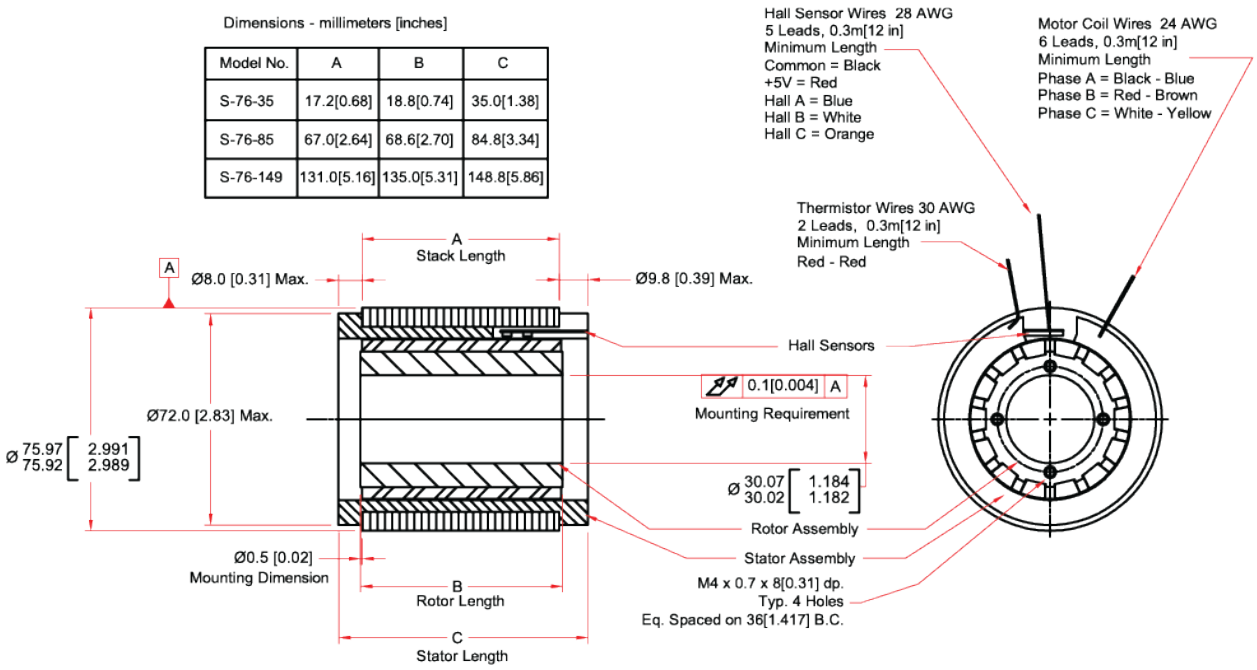


Figure 1-8: S-76 Dimensions

Dimensions - millimeters [inches]

Model No.	A	B	C
S-130-39	21.0 [0.82]	23.1 [0.91]	38.7 [1.52]
S-130-60	42.0 [1.65]	44.1 [1.74]	59.7 [2.35]
S-130-81	63.0 [2.48]	65.1 [2.56]	80.7 [3.18]
S-130-102	84.0 [3.30]	86.1 [3.39]	101.7 [4.00]
S-130-123	105.0 [4.13]	107.1 [4.22]	122.7 [4.83]

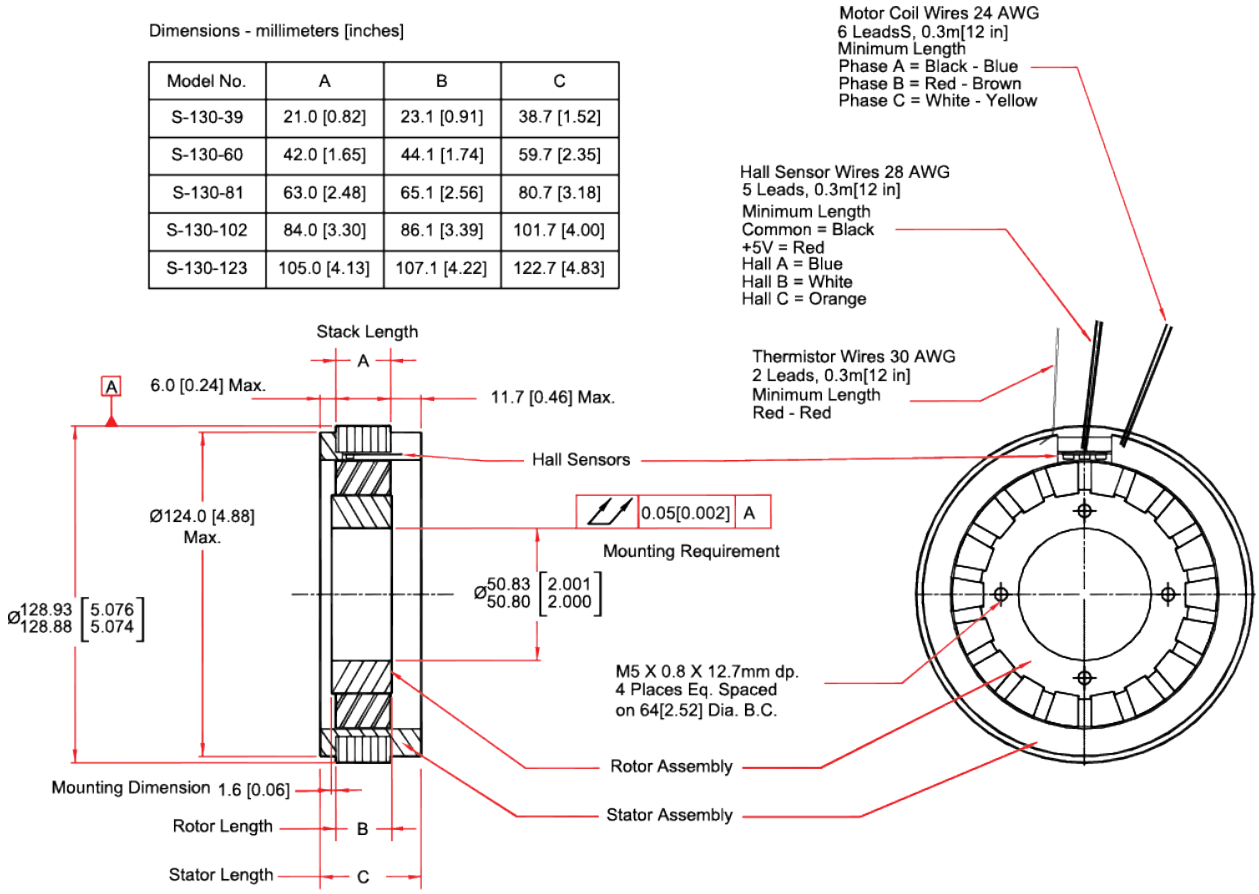


Figure 1-9: S-130 Dimensions

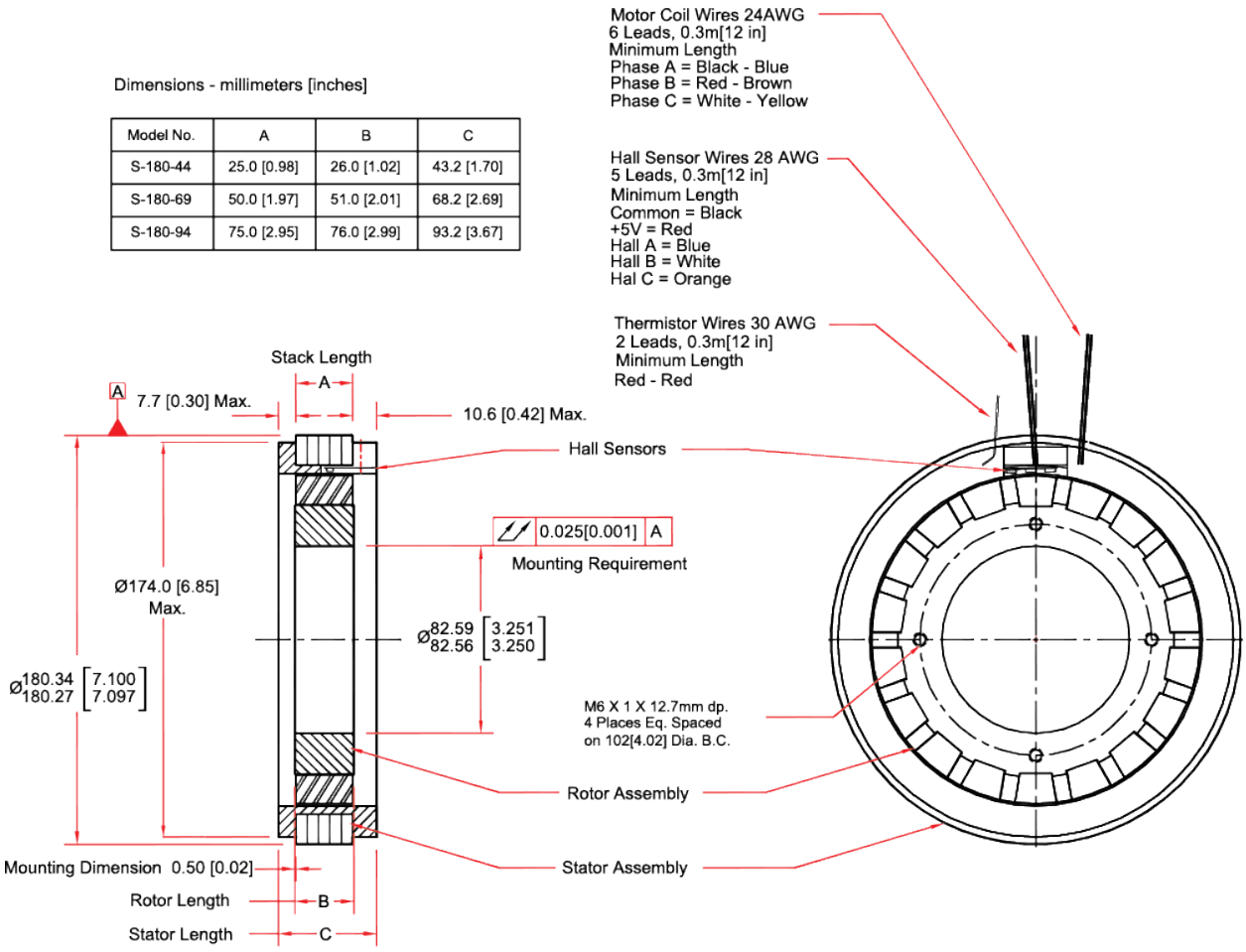
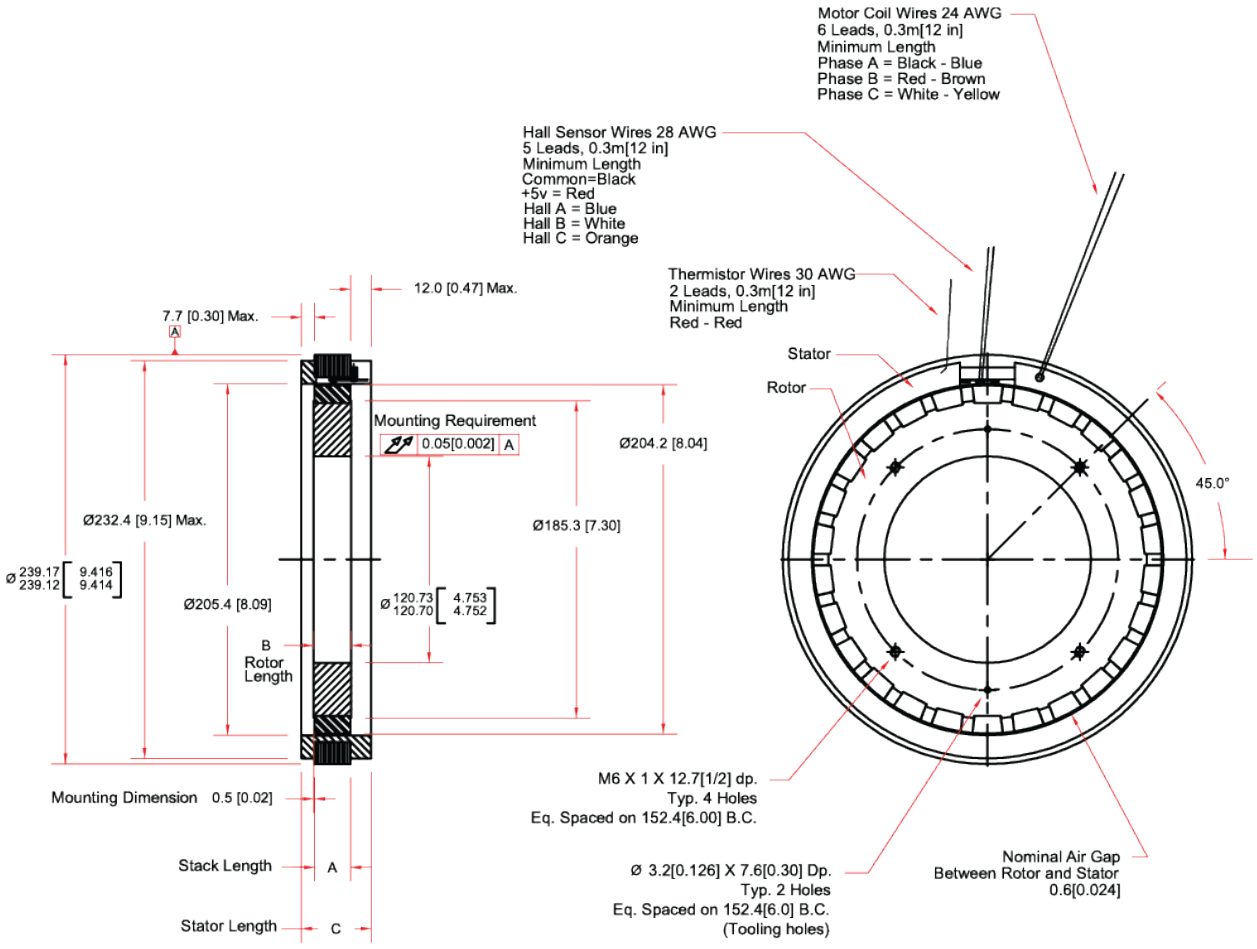


Figure 1-10: S-180 Dimensions



Dimensions - milimeters [inches]

Model No.	A	B	C
S-240-43	21.0 [0.827]	22.0 [0.866]	40.7 [1.602]
S-240-63	42.0 [1.653]	43.0 [1.693]	61.7 [2.429]
S-240-83	63.0 [2.480]	64.0 [2.520]	82.7 [3.256]

Figure 1-11: S-240 Dimensions

1.3. Environmental Specifications

WARNING: Do not expose this product to environments or conditions outside of the listed specifications. Exceeding environmental or operating specifications can cause damage to the equipment.

Table 1-8: Environmental Specifications

Ambient Temperature	Operating: 0° to 25° C (32° to 77° F) Contact Aerotech for information regarding your specific application and environment.
	Storage: -10° to 85° C (14° to 185° F) in original shipping packaging
Humidity	Operating: 20% to 60% RH
	Storage: 10% to 70% RH, non-condensing in original packaging.
	Ambient conditions need to be such that condensation on the motor does not occur. The motors are not to be used in wash-down environments.
Altitude	Operating: 0 m to 1,000 m (0 ft to 3280 ft) above sea level Contact Aerotech if your specific application involves use above 1000 m or below sea level.
Atmosphere	Not to be used in a hydrogen atmosphere.
Use	Indoor use only

This page intentionally left blank.

Chapter 2: Assembly and Installation

Aerotech, Inc. supplies the following parts:

1. Stator Assembly
2. Rotor Assembly

The following parts are supplied by the customer:

1. Stator Housing
2. Stator Clamp Ring
3. Shaft Assembly
4. Rotor Clamp Ring
5. Mounting Hardware
6. Mylar Shim Stock

Refer to the general installation guidelines given in this chapter. Specific details of your particular installation also apply.

NOTE: Devices need to be in place so that intentional or unintentional disruption of electrical power doesn't result in unexpected motion. The motion could possibly result in bodily injury or damage to equipment. This is especially important in vertical applications where the use of a fail-safe brake needs to be incorporated in the event of a power disruption.

2.1. Stator Housing Requirements

The housing needs to be a structurally strong rigid body that will not deform when mounting the stator in place. The housing bore diameter needs to be 0.001 inches to 0.002 inches larger than the stator outside diameter. The bore depth must be less than the height of the lamination stack so the laminations of the stator can be clamped without bottoming out the clamp (refer to Figure 2-1). The housing should also include a shoulder perpendicular to the bore for locating the motor. The ID of this shoulder must provide clearance for the motor coils.

The stator must be clamped in the axial direction with a stator clamp ring. The clamp must have adequate surface area to retain the motor lamination stack. The ID of the ring must also allow for clearance of the motor coils. Multiple screws (4 or more) should be used to bolt the clamp ring to the housing. For added strength the stator can be bonded in place and/or radial setscrews can be used in addition to the stator clamp ring.

2.2. Rotor Shaft Requirements

The rotor shaft diameter should be no more than 0.003 inches smaller than the rotor hub ID. The shaft should also have a shoulder perpendicular to the OD of the shaft for locating the rotor.

The rotor can be clamped in the axial direction via a bolted clamp ring, see Figure 2-1. The clamp ring OD must not interfere with the stator ID. Multiple screws (4 or more) should be used to bolt the clamp ring to the shaft.

As shown in Figure 2-2, the rotor can also be bolted to the shaft via the tapped holes in the rotor hub . When the rotor is bolted to the shaft use thread locker on the attachment screws.

For added strength the rotor can be bonded onto the shaft and/or a keyway can be used in addition to mechanically attaching the rotor to the shaft.

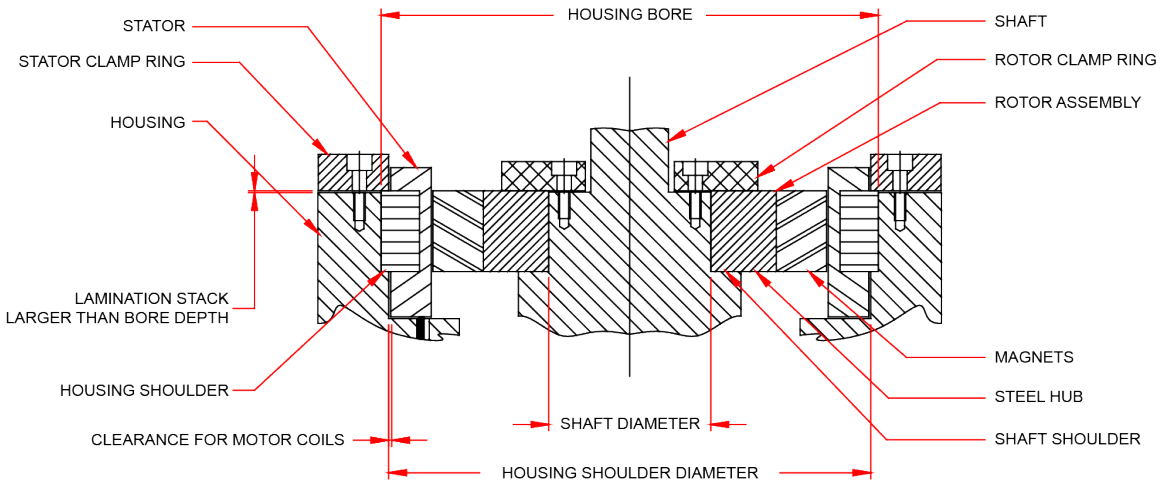


Figure 2-1: Motor Mounting Using Stator and Rotor Clamp Rings

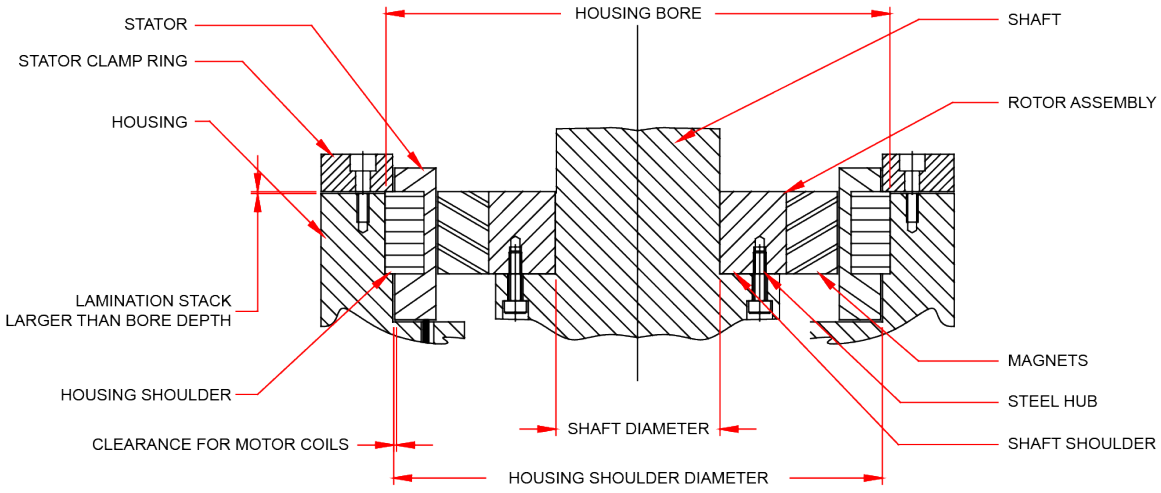


Figure 2-2: Motor Mounting Using Direct Bolting of the Rotor to the Shaft

2.3. Alternative Stator Mounting Method

An alternative stator mounting method may be used when the recommended mounting method cannot be used and where the application requires both a low duty cycle and low torque.

The housing needs to be a structurally strong rigid body that will not deform when mounting the stator in place. The housing bore diameter needs to be 0.001 inches larger than the OD of the stator. The housing should also include a shoulder perpendicular to the bore for locating the motor. The ID of this shoulder must provide clearance for the motor coils. The housing must also have tapped holes at the axial height corresponding to the stator's lamination stack centerline.

The motor must be glued into the housing with an appropriate thermally conductive adhesive (Aerotech recommends Loctite 383) and cured as per the specified schedule, see Figure 2-3. Radial set screws with an appropriate thread-locker must be used to clamp to the ID of the stator housing to secure the stator in place.

Be careful not to damage the coil if the stator is pressed into a bore with an interference/shrink fit.

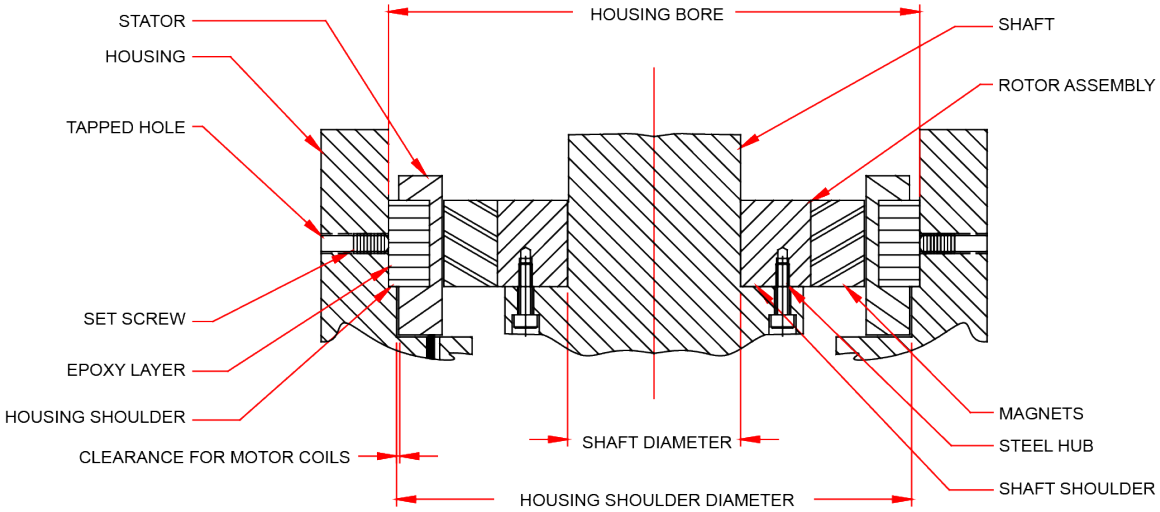


Figure 2-3: Motor Mounting by Gluing the Stator to the Housing

2.4. Motor Assembly

Listed below is a very general check-off style guide to the motor assembly. Specific details of your particular installation also apply.

WARNING: Keep the rotor away from ferrous materials during handling and installation. Unexpected attraction and clamping to ferrous surfaces can result in injury.

NOTE: Before assembling the motor, verify that the Hall sensor card is in the correct position for the desired commutation offset. Moving the card requires disassembly of the motor. The standard Aerotech Hall sensor commutation offset is 0˚. A 30˚ offset requires moving the card. Refer to the Hall Card Placement section (Section 2.5.) to change the offset.

- Insert the stator into the stator housing.
- Clamp the stator in the housing with the stator clamp ring.
- Cut mylar shim stock to be placed around the inside diameter of the stator. Shims need to be long enough to allow removal after the rotor is installed. Their thickness needs to be less than the air gap between the rotor and stator. Place the shims so the rotor OD will not contact the stator ID during motor assembly.
- Insert screws, all thread, or custom tooling in the threaded holes on the rotor face. The hardware or tooling will be used to lower the rotor into the stator.
- Lower the rotor onto the shaft and into the stator. An ideal shaft and housing design will restrain the rotor from radial movement so as not to be magnetically attracted to the stator during insertion. **CAUTION**: Rotor will be “pulled” axially into stator.
- Clamp the rotor to the shaft with the rotor clamp ring.
- Remove the shims.
- Verify the rotor does not contact the stator during rotation.
- Verify the air gap between the rotor and stator for a full 360° of rotation.

2.5. Hall Card Placement

Aerotech motors are supplied with a 0˚ offset between the Hall signals and corresponding Line-to-Neutral BEMF voltages. This can be changed to a 30˚ offset by removing the mounting screws and remounting the card in the position shown in Figure 2-4. Moving the card requires disassembly of the motor.

Figure 2-5 shows the motor BEMF to Hall signal relationships for both 0 and 30° commutation offsets for a counterclockwise (CCW) rotation. Note that with 30° offset, the Hall signals align with the Line-to-Line BEMF voltages. The correct CCW rotation is with the motor viewed from the cable-side exit, which corresponds to the positive motor rotation.

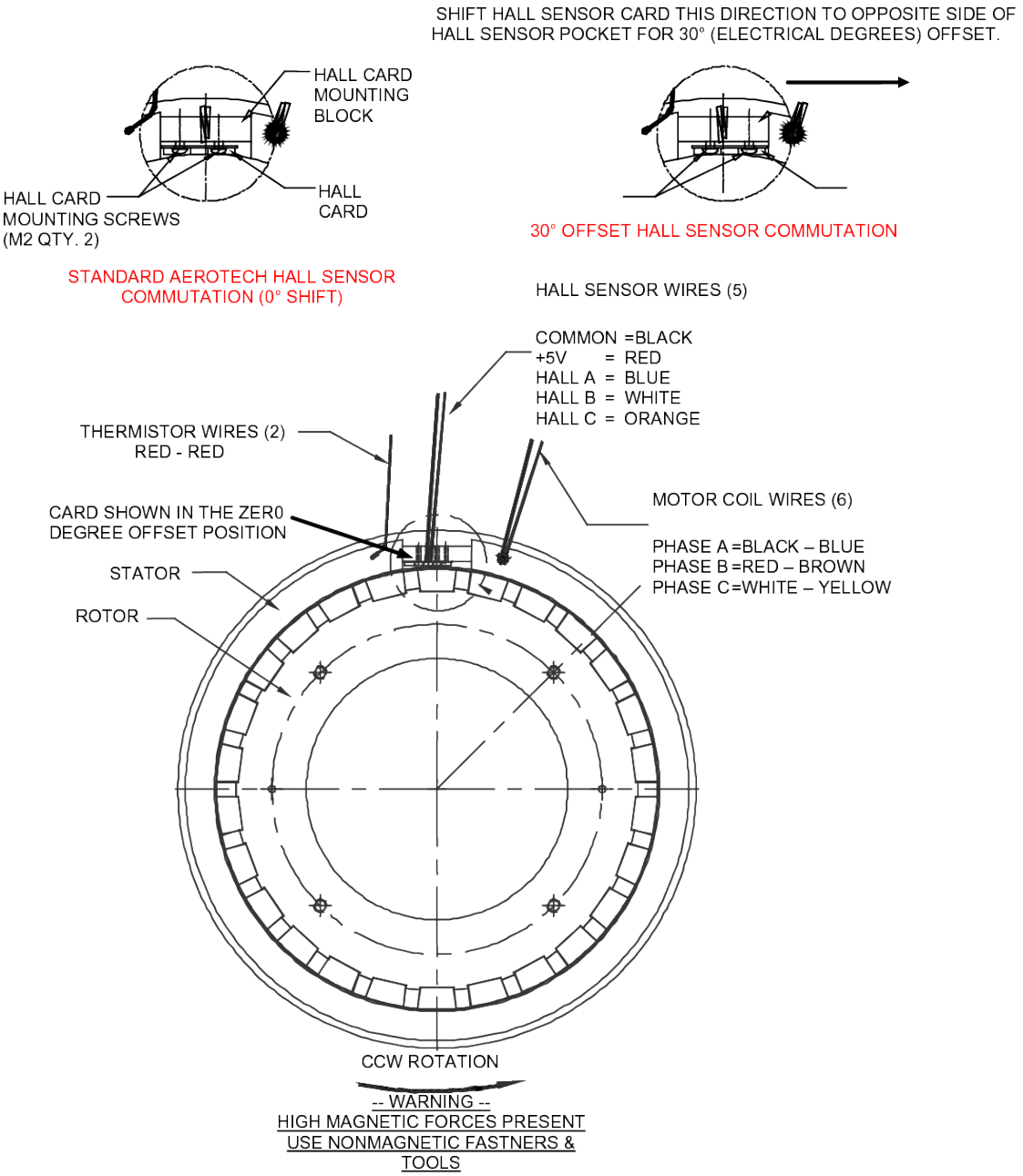
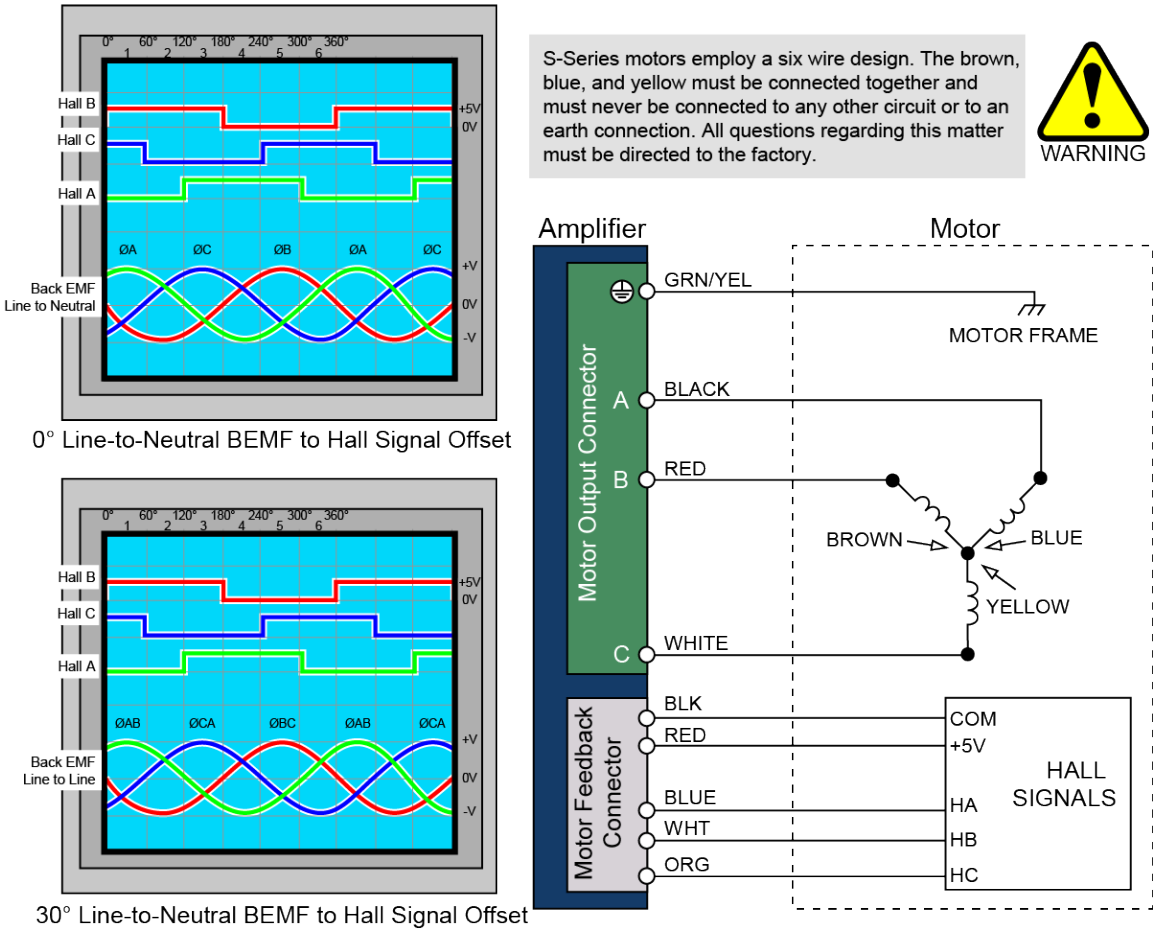


Figure 2-4: Hall Board Placement



NOTES:
1. Hall signal measurements are made with reference to signal common.
2. For counterclockwise rotation, the motor is viewed from the cable side exit
3. Listed wire colors are for Aerotech supplied cables.

Figure 2-5: Motor BEMF and Hall Signal Relationship

2.6. Motor Wiring

The stator is supplied with flying leads for the motor winding, Hall effect devices, and thermal overload sensor. The customer supplies all external wiring to interface with these devices. This supplied wiring must meet certain requirements to provide for safe and reliable operation.

The wiring must be able to supply the rated current without overheating. The wire insulation must be rated for the voltage and temperature at which the motor is operating. Efforts must also be made to reduce EMI emissions and to increase EMI immunity through proper cable selection and installation. In addition to supplying the external wiring, the customer is also responsible for providing over-current protection for the motor.

Guidelines are given in this chapter to help both in the selection and installation of the wiring.

Table 2-1: Connector Wire Gauge

Motor Leads	Feedback Leads	Thermistor Leads
24 AWG [.21 mm^2]	28 AWG [.08 mm^2]	30 AWG [.05 mm^2]

2.6.1. Motor Power Conductors

The motor power conductors must be sized to handle the electrical current requirements of the motor. The motor data sheets list the required values for the various motors. The wire insulation voltage rating is chosen based on the maximum voltage that will be applied to the motor.

WARNING: The S-series motors employ a six-wire design. It is necessary to connect the Brown-Blue-Yellow wires together. This connection must never be connected to any other circuit or to an earth connection

2.6.2. Protective Ground

The protective ground is a safety conductor used to ground the motor case. The protective ground conductor must have a current carrying capacity at least equal to that of the motor wires. The insulation is standard Green/Yellow and must be rated for the maximum voltage applied to the motor winding. The protective ground wire is usually bundled along with the motor wires, but system requirements may be that a separate protective ground wire is needed.

2.6.3. Over Current Protection

Motors need to be provided with over current protection to prevent motor overheating. Over current protection can be accomplished using programmable current limits, protection faults, over current protection circuitry, or fusing. Fuse values should be selected according to the RMS current rating of the motor. For most applications slow-blow type fuses should be used.

When the motor is part of an Aerotech system using an Aerotech controller and drive, the motor over-current protection fault must be set to whichever is lower: the peak continuous current rating of the motor or the drive continuous current rating.

2.6.4. Hall-Effect Device and Thermistor Wiring

The insulation of these wires should have a rating for at least the maximum voltage applied to the motor winding. The temperature rating of the wire insulation must also be sufficiently high to withstand the operating temperatures specific to the application.

2.6.5. Wiring Guidelines

The wiring guidelines given below can help to reduce EMI related problems, which can result in poor overall system performance.

- Keep cable lengths as short as possible. Long cable runs are more susceptible to EMI pickup than short runs.
- Use shielded cables for both the motor power and signal wiring with the shield connected to a low impedance earth ground connection at each end.
- The use of twisted pair shielded cabling can help reduce magnetically induced currents.
- Braided shield has a slightly better low frequency shielding capability than a foil shield. Foil is often used where RF shielding is necessary.
- Do not bundle signal, motor power cables, or ac power lines within the same protective shield or conduit. Rather use separate protective shields or conduits.
- The use of EMI suppression devices may be necessary where the EMI environment warrants their use.

2.6.6. Thermal Protective Device

S-Series motors incorporate a positive-temperature coefficient (PTC) thermistor as a thermal protection device. The nominal resistance of the thermistor is 100 ohms at 25°C. The thermistor exhibits a rapid increase in resistance to 1,000 ohms as the motor temperature approaches the thermistor's transition temperature of 100°C.

WARNING: The thermal protective device used in the motor must be incorporated in an external shutdown circuit to provide protection to the motor.

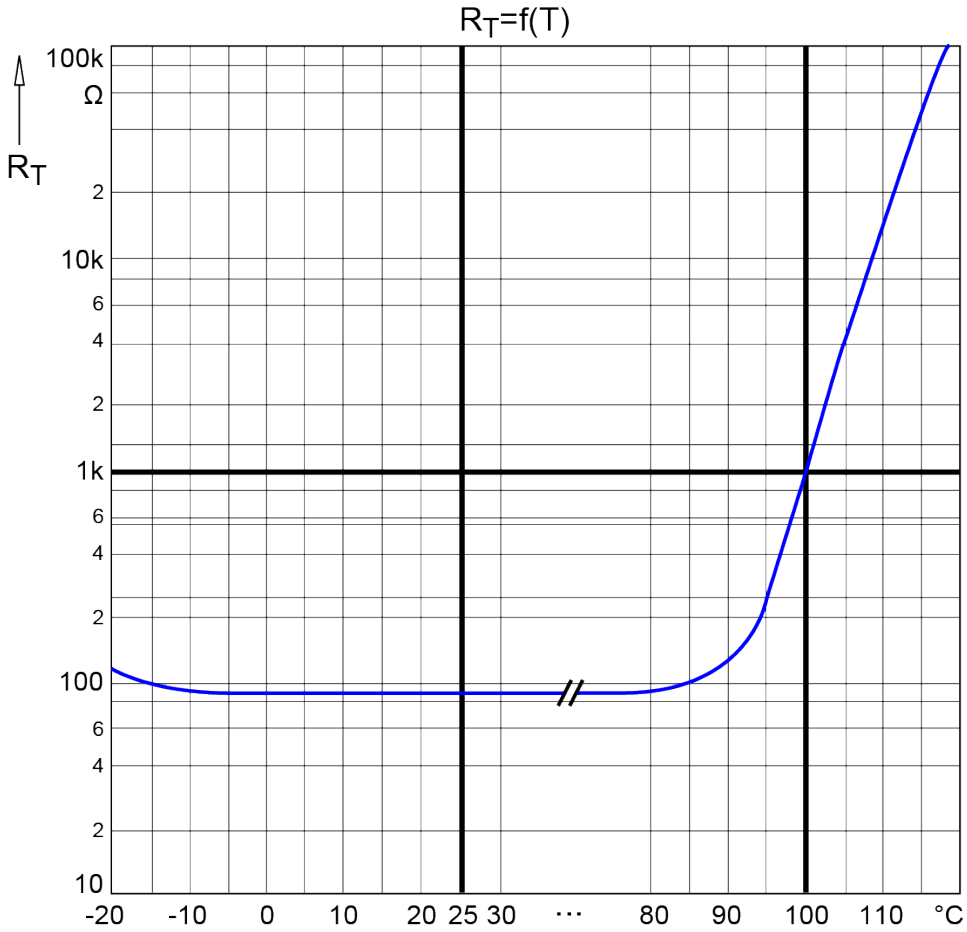


Figure 2-6: Thermal Sensor Resistance as a Function of Temperature

This thermistor can be used in a variety of different electronic interfaces. A precaution when using this type of device in an interface circuit is to avoid self-heating effects. An excessive amount of current through the thermistor will cause its temperature to rise and a false triggering will occur.

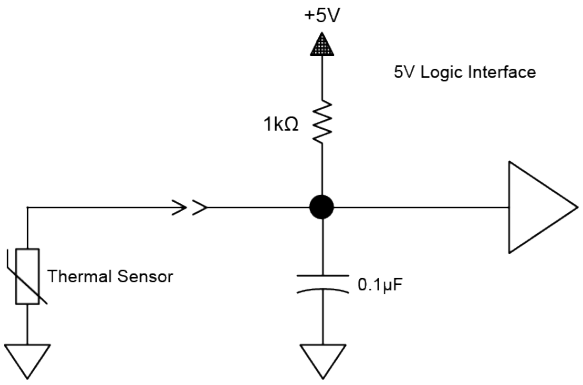


Figure 2-7: Typical Thermistor Interface Circuit

2.7. Motor Heating

The motor's temperature rise above ambient establishes a limit on the amount of torque producing current allowed through the motor winding. The thermal characteristics of the motor, the effectiveness of the surrounding medium to transfer heat away from the motor, and any supplemental cooling determine the operating conditions.

The motor's torque speed curve shows the safe operating region for the motor (refer to Section 1.1.). The curves are generated under a single set of operating conditions, and the motor's operating specifications are generated under these conditions, see the Motor Specifications section of this manual. If the motor is operated within the safe operating region, that region bounded by the Continuous Operating Curve, then the motor's thermal limit will not be exceeded so long as the minimum environmental and thermal conditions exist. Motor operation in the region bounded by the Peak Operating Curve has to be limited in time or the motor's thermal limit will be exceeded.

Poor heat transfer away from the motor, excessive torque loading, elevated ambient temperatures, etc. are situations that will cause excessive motor heating and failure. The importance of motor overload and thermal protection devices as described in previous sections becomes apparent.

This page intentionally left blank.

Chapter 3: Maintenance

Installation problems usually reveal themselves early in the installation. Regular preventative maintenance should include but is not limited to the following: make frequent checks for excessive or abnormal motor heating, excessive motor vibrations, loose motor to machine couplers, obstructed air flow to the motor, burning smells, an accumulation of debris on the motor, etc.

Motors should be wiped with a clean dry cloth to remove any grease, dirt, or other material that has accumulated on the motor. Fluids and sprays are not recommended for chance of internal motor contamination. Cleaning labels should be avoided to prevent their removal.

Non-ferrous tools should be used when working around the rotor magnets.

This page intentionally left blank.

Appendix A: Warranty and Field Service

Aerotech, Inc. warrants its products to be free from harmful defects caused by faulty materials or poor workmanship for a minimum period of one year from date of shipment from Aerotech. Aerotech's liability is limited to replacing, repairing or issuing credit, at its option, for any products that are returned by the original purchaser during the warranty period. Aerotech makes no warranty that its products are fit for the use or purpose to which they may be put by the buyer, whether or not such use or purpose has been disclosed to Aerotech in specifications or drawings previously or subsequently provided, or whether or not Aerotech's products are specifically designed and/or manufactured for buyer's use or purpose. Aerotech's liability on any claim for loss or damage arising out of the sale, resale, or use of any of its products shall in no event exceed the selling price of the unit.

THE EXPRESS WARRANTY SET FORTH HEREIN IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, BY OPERATION OF LAW OR OTHERWISE. IN NO EVENT SHALL AEROTECH BE LIABLE FOR CONSEQUENTIAL OR SPECIAL DAMAGES.

Return Products Procedure

Claims for shipment damage (evident or concealed) must be filed with the carrier by the buyer. Aerotech must be notified within thirty (30) days of shipment of incorrect material. No product may be returned, whether in warranty or out of warranty, without first obtaining approval from Aerotech. No credit will be given nor repairs made for products returned without such approval. A "Return Materials Authorization (RMA)" number must accompany any returned product(s). The RMA number may be obtained by calling an Aerotech service center or by submitting the appropriate request available on our website (www.aerotech.com). Products must be returned, prepaid, to an Aerotech service center (no C.O.D. or Collect Freight accepted). The status of any product returned later than thirty (30) days after the issuance of a return authorization number will be subject to review.

Visit https://www.aerotech.com/global-technical-support.aspx for the location of your nearest Aerotech Service center.

Returned Product Warranty Determination

After Aerotech's examination, warranty or out-of-warranty status will be determined. If upon Aerotech's examination a warranted defect exists, then the product(s) will be repaired at no charge and shipped, prepaid, back to the buyer. If the buyer desires an expedited method of return, the product(s) will be shipped collect. Warranty repairs do not extend the original warranty period.

Fixed Fee Repairs - Products having fixed-fee pricing will require a valid purchase order or credit card particulars before any service work can begin.

All Other Repairs - After Aerotech's evaluation, the buyer shall be notified of the repair cost. At such time the buyer must issue a valid purchase order to cover the cost of the repair and freight, or authorize the product(s) to be shipped back as is, at the buyer's expense. Failure to obtain a purchase order number or approval within thirty (30) days of notification will result in the product(s) being returned as is, at the buyer's expense.

Repair work is warranted for ninety (90) days from date of shipment. Replacement components are warranted for one year from date of shipment.

Rush Service

At times, the buyer may desire to expedite a repair. Regardless of warranty or out-of-warranty status, the buyer must issue a valid purchase order to cover the added rush service cost. Rush service is subject to Aerotech's approval.

On-site Warranty Repair

If an Aerotech product cannot be made functional by telephone assistance or by sending and having the customer install replacement parts, and cannot be returned to the Aerotech service center for repair, and if Aerotech determines the problem could be warranty-related, then the following policy applies:

Aerotech will provide an on-site Field Service Representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs. For warranty field repairs, the customer will not be charged for the cost of labor and material. If service is rendered at times other than normal work periods, then special rates apply.

If during the on-site repair it is determined the problem is not warranty related, then the terms and conditions stated in the following “On-Site Non-Warranty Repair” section apply.

On-site Non-Warranty Repair

If any Aerotech product cannot be made functional by telephone assistance or purchased replacement parts, and cannot be returned to the Aerotech service center for repair, then the following field service policy applies:

Aerotech will provide an on-site Field Service Representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs and the prevailing labor cost, including travel time, necessary to complete the repair.

Service Locations

http://www.aerotech.com/contact-sales.aspx?mapState=showMap

USA, CANADA, MEXICO	CHINA	GERMANY
Aerotech, Inc. Global Headquarters Phone: +1-412-967-6440 Fax: +1-412-967-6870	Aerotech China Full-Service Subsidiary Phone: +86 (21) 5508 6731	Aerotech Germany Full-Service Subsidiary Phone: +49 (0)911 967 9370 Fax: +49 (0)911 967 93720

JAPAN	TAIWAN	UNITED KINGDOM
Aerotech Japan Full-Service Subsidiary Phone: +81 (0)50 5830 6814 Fax: +81 (0)43 306 3773	Aerotech Taiwan Full-Service Subsidiary Phone: +886 (0)2 8751 6690	Aerotech United Kingdom Full-Service Subsidiary Phone: +44 (0)1256 855055 Fax: +44 (0)1256 855649

Have your customer order number ready before calling.

Appendix B: Revision History

Revision	Description
2.03.00	• Updated the EU Declaration of Conformity • Updated Motor Specifications: Section 1.1. • Updated Dimension drawings: Section 1.2. • Added wire gauge information: Table 2-1
2.02.00	Revision changes have been archived. If you need a copy of this revision, contact Aerotech Global Technical Support.
2.01.00	
2.00.00	
1.01.00	
1.00.00	

This page intentionally left blank.

Index