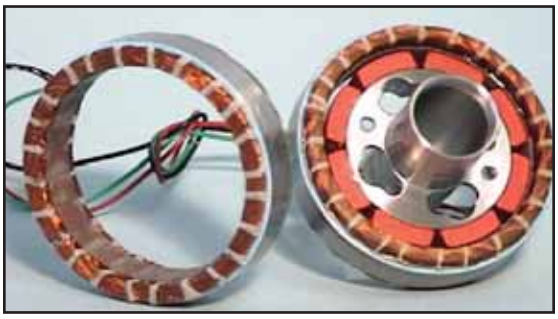
Zero Cogging Motors

Introduction - Zero Cogging Motors



This catalogue is intended as a guide for the user to help select or specify a cog free brushless DC motor. The size, weight and performance characteristics of the motors shown in the data sheets are examples of typical applications. Should the user's requirements fall between the wide variety of sizes and performance characteristics available, Aeroflex will be happy to tailor a motor for a specific application. This customization can include size variations, winding characteristics, performance characteristics and physical mounting requirements.

Constant Reluctance Brushless Motor Description

The constant reluctance brushless motor is designed without the use of laminations employing teeth. The lamination stack is constructed using smooth cylindrical laminations. The rotor "sees" the same magnetic reluctance, which is independent of rotor angle, hence no cogging torque.

The winding configuration can then be integrated with the magnetics of the rotor to give excellent sinusoidal back EMF wave-forms. Typical values of distortion for these motor designs are approximately 2.5% for the third harmonic and 0.3% for the fifth harmonic. The windings are mechanically captured by a non-conductive, non-magnetic structure and then epoxy impregnated. The motors described in this catalogue all have two-phase windings. Three phase windings are also available.

The motors are described with either redundant or non-redundant windings and for internal or external rotor mounting. Both configurations are catalogued for each motor size.

The rotors use high-energy product Neodymium-Boron-Iron magnets to develop the flux density needed across the typically large magnetic air gap. Samarium cobalt magnets are also available for those applications requiring exposure to temperatures in excess of +150° C. The rotor back iron and the stator lamination thickness are designed to just fall below the saturation levels for the materials. The motors are engineered to develop the maximum torque for the lowest power and the lowest weight for a given form factor. The motors use materials which meet the outgassing requirements of < 1%TML and < 0.1% CVCM required for critical space and optical applications.

Other low outgassing materials are available for specific applications, which require lower viscous drag torque, higher torque per unit weight and or higher temperature operation.

Performance Considerations

Most toothed motors have large copper areas available and large air gap flux densities to achieve a high torque to power ratio. The constant reluctance motor, in order to achieve the zero cog advantage, must necessarily have a large magnet air gap into which the windings can be set. This

drops the available gap flux density and hence the constant reluctance motors tend to be physically a bit larger than their toothed counterparts. Their weight, however, is comparable due to the thin construction techniques of the rotor and stator.

The motors typically have low drag torque (hysteresis of the lamination steel) and low inductance, which keeps the electrical time constant low so that the motor will respond rapidly to move requirements. The motors are highly linear (torque/current) from zero through continuous to peak torque levels. The motors run very quietly and smoothly, particularly at slow speeds when high accuracy of positioning is required.

Catalogue Details

The catalogue has motors ranging in size from 1 inch to 20 inches in diameter and up to 4.45 inches long. Torques from in-oz to ft-lb ranges are available. Each motor size has a variety of winding configurations available. The motors are available with external rotors (AZ model numbers) and internal rotors (Z model numbers)

The catalogue has several indices, which can be used to begin the selection process without thumbing through each individual data sheet. Additional detailed information is available by contacting the factory at the address, phone, and email or fax number supplied on the ordering information sheet.

Installation Requirements

The rare earth magnets used on the motors do not require a keeper and the rotor may be assembled or disassembled at will with no loss of performance. The rotors, however, contain very strong magnets, which can easily attract themselves to a foreign magnetic material or vice versa. Therefore, care should be exercised in handling these rotors during the installation process. Installation fixtures are recommended.

The stators are intended to be epoxied to the inside of a smooth cylindrical housing on the host equipment. Individual mounting flanges can be manufactured and installed at Aeroflex is desired. The rotors have round inner diameters as specified in the catalogue. These can be mounted onto the customer's hub as needed. Individual side plates can be added or custom hubs can be machined to customer requirements.

The motor's performance is independent of rotor position within the typical 0.15 radial air gap. Centering the rotor as best as possible is preferred in that "once around" torques on the bearing is eliminated. Commutation with a resolver is a popular commutation method and alignment with this device is necessary during installation.

Explanation of Motor Parameters

Continuous Torque: The continuous torque value is obtained with the motor in a housing or other reasonable heat path. The value is given so that the motor will not exceed 130° C when in a room temperature environment with this torque continually applied.

Peak torque: A torque 2.5 times the continuous rating. The motor can achieve these levels for short periods with no heat sinking from the stator mounting mechanics. The wire current handling capability and the magnetic saturation of the steel have all been considered in this rating.

Peak power: The Peak current squared multiplied by the motor resistance at +20°C.

Km - Motor Constant: A figure of merit which characterizes the size of a motor with respect to the amount of torque vs amount of power available. It is mathematically the peak torque divided by the square root of peak power or it is the torque constant (Kt) divided by the square root of motor resistance (R).

Theoretical No load Speed: The speed at which the motor will operate when Voltage Peak Torque is applied to the motor with no external motor load applied. There are magnetic and bearing drags which will cause the motor to run a bit lower than this published figure.

Temp Rise Per Watt: The TRPW values are experimentally arrived at and are the results of a stable temperature rise due to a steady power dissipated in one phase of the motor while suspended in air with no forced air cooling or conductive paths. This therefore represents the worst case scenario and in actual applications will be less than the published values.

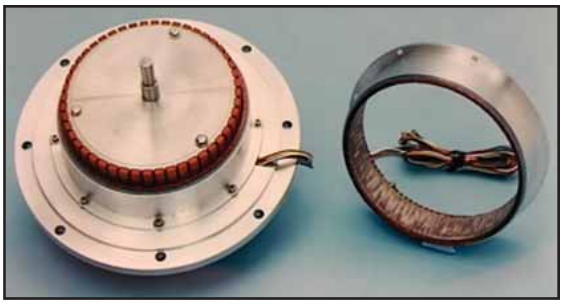
Poles: The number of poles has been chosen to keep the circular magnetic paths of each motor the same regardless of motor diameter. This standardizes the thickness of back irons and ensures a good sinusoidal BEMF wave-form.

Cog Torque: The motor cogging torque is zero due to the absence of lamination teeth and the uniformity of the magnetic paths with respect to angle. There is some drag torque associated with magnetic hysteresis and viscous damping associated with all permanent magnet motors (brush or brushless).

Inertia: The moment of inertia about the axis of rotation.

Weight: The weight of the combined rotor and stator without leads.

Voltage Peak Torque: The nominal voltage required to generate the peak torque when the winding temperature is +20°C. It is nominally Peak current multiplied by R. Since the motor torque is proportional to current, as the motor heats the resistance increases causing the current to drop for a constant voltage source. This should be considered in designing the drive system.



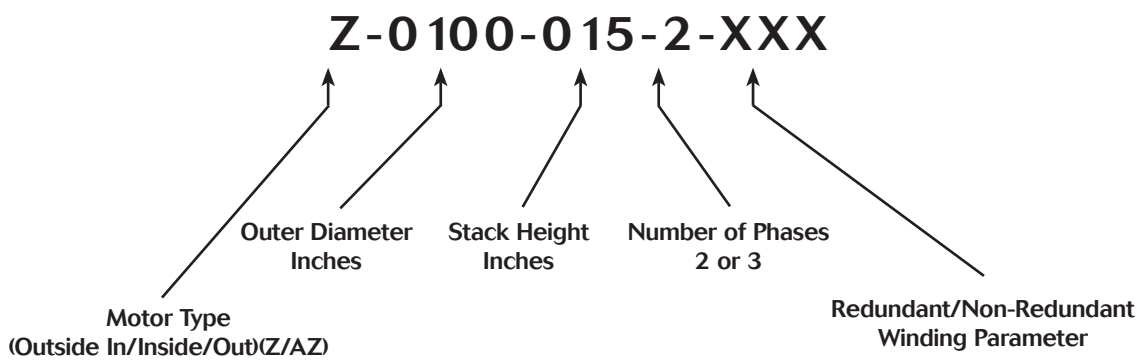
Peak Current: The current required to generate the Peak Torque of the motor. It is Peak voltage divided by motor resistance at +20°C.

Kt - Torque Constant: The amount of torque developed for a given current. It is independent of motor speed.

R - Motor Resistance: The +20°C resistance of each phase of the motor.

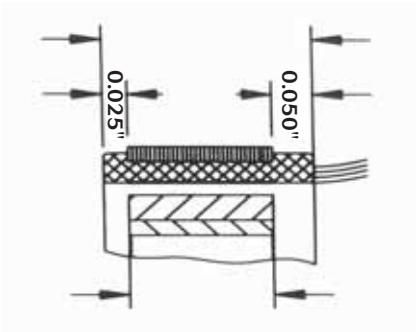
Explanation of Part Numbers

To specify a motor from the catalogue, simply select a part number that corresponds to your application. The part number e.g. Z-0100-015-2-XXX, where Z indicates a regular motor, and an AZ would indicate an inside out motor. The number 0100 indicates a 1 inch outer diameter, the number 015 indicates a 0.150 inch stack



height, the number 2 indicates a 2" winding, and XXX indicates a redundant or non-redundant winding parameter *(see redundant/non-redundant charts on specification pages).*

Please note that the windings will increase the overall length by 0.050" on the top side and by 0.025" on the bottom side.



General Handling Issues

Initial Handling of the Rotor: The rare earth magnets used for these motors do not require keepers allowing the rotor to be assembled or disassembled at will with no loss of performance. The magnets, however, are easily attracted to other magnetic materials or structures and can easily pull out of ones hands during installation. Care should be exercised in moving the rotor about…installation fixtures for assembly with the stator (to which it is attracted) are recommended.

Great care is taken to insure that the rotor is delivered free of any particulate contaminant. After opening the seal, the rotor should be kept in a clean environment as it easily attracts debris from tables etc.

Initial Handling of the Stator: The motor is designed to have as minimum a mass as possible. Towards this end the radial cross section of the stator is very thin when compared to typical toothed stators. To avoid "egg-shelling" of the stator during shipment it is generally shipped with a support ring. During handling, excess unsymmetrical pressure on the O.D. should be avoided. Although the coil I.D. is protected, the coil end turns are not. Keep all sharp objects away from these wires as in many cases the wire is fine and can be easily cut or abraded by screwdrivers, etc. even though it is impregnated with a hard clear material.

Installation Options

The stator design is primarily intended for epoxy bonding inside of a smooth cylindrical housing. Several epoxy relief slots approximately 0.005 inches deep are recommended for maximum strength.

The stator O.D. can be seated against a shoulder and clamped on the opposite side. Due to the low-mass goals of this design there is only about 0.025 radial wall available for this approach.

The rotors have precision machined inner diameters. This allows the customer to achieve weight goals and meet bearing configuration needs. (Custom hubs can be incorporated where needed). As with the stator, the hub is designed primarily for epoxy bonding. Additional rotational constraints such as a Dutchman pin can also be incorporated if desired.

When mounting the stator or rotor, the concentricity of each element is important.

Centering of the rotor eliminates a once around torque on the bearings. However, the motor operate with a relatively large radial or axial misalignment.

As with any permanent magnet motor, there is a strong attraction of the magnets to the stator laminations. The rotor will tend to pull to the side and jump into the stator during assembly of these components. It is therefore strongly recommended that a guide and jacking system be used to insert the rotor into the stator to prevent accidental contact. This fixturing will be unique to the customer's ultimate design.

Z Motors Non-Redundant

Paramater		0100-015-2	0100-025-2	0100-050-2	0100-075-2	0150-025-2	0150-050-2	0150-100-2	0164-025-3
Peak Torque (in-oz)		1.58	2.8	6.5	10.5	8.7	19.5	43	7
Peak Power (watts)		12	15	25	32	24	40	68	15
Continuous Torque (in-oz)		1.2	2.1	4.5	8	6	13	27	7
Km (in-oz)		0.45	0.73	1.3	1.85	1.78	3.1	5.2	1.8
No Load Speed (rad/sec)		1105	744	545	435	389	287	225	306
Temp Rise Still Air (deg C/W)		34	27	18.5	14	18	12	8	14.6
Temp Rise Housed (deg C/W)		16	13	9	6.6	8.5	6	4	6.9
Poles (each)		4	4	4	4	10	10	10	8
Friction Torque (in-oz)		0.006	0.010	0.019	0.029	0.028	0.06	0.11	0.04
Inertia (in-oz-sec^2)		2.5E-05	4.2E-05	8.5E-05	1.3E-04	4.1E-04	8.2E-04	1.6E-03	6.2E-04
Weight (lbs)		0.03	0.05	0.10	0.14	0.10	0.18	0.35	0.13
O.D. Stator (inches)		1	1	1	1	1.5	1.5	1.5	1.648
O.D. Rotor (inches)		0.632	0.632	0.632	0.632	1.132	1.132	1.132	1.308
I.D. Rotor (inches)		0.0625	0.0625	0.0625	0.0625	0.55	0.55	0.55	0.872
Stack Length (inches)		0.15	0.25	0.5	0.75	0.25	0.5	1	0.25
Winding (Parameter)									
-101	V Peak T Peak I Kt Resistance	25.8 0.48 3.3 54	31.1 0.47 5.9 66	43 0.58 11.2 74	36.5 0.88 11.9 41	42.4 0.56 15.4 75	60.7 0.65 29.9 93	96 0.71 60.4 135	30 0.50 13.9 60
-102	V Peak T Peak I Kt Resistance	17 0.73 2.2 23	20.5 0.72 3.9 29	28.7 0.87 7.5 33	23 1.40 7.5 16	28 0.85 10.2 33	40 0.99 19.7 40	63.5 1.08 39.9 59	
-103	V Peak T Peak I Kt Resistance	6.8 1.81 0.9 4	12.7 1.16 2.4 11	18 1.39 4.7 13	14.7 2.19 4.8 7	17.5 1.37 6.4 13	25 1.58 12.3 16	39.5 1.73 24.8 23	
-104	V Peak T Peak I Kt Resistance		8.2 1.79 1.6 5	11.5 2.17 3.0 5	9.4 3.43 3.1 3	11.2 2.13 4.1 5	16 2.47 7.9 6	25.5 2.68 16.0 10	
-105	V Peak T Peak I Kt Resistance		5.3 2.78 1.0 1.9	7.3 3.42 1.9 2.1		7.1 3.36 2.6 2.1	10 3.96 4.9 2.5	16 4.27 10.1 3.7	

Ordering Note: Part numbers for this section are configured as follows: Z-(parameter from top of page) – (winding parameter). An example would be Z-0100-015-2-101.

Z Motors Non-Redundant

Paramater		0250-025-2	0250-050-2	0250-100-2	0250-150-2	0350-050-2	0350-100-2	0350-150-2	0350-200-2
Peak Torque (in-oz)		29	66	148	234	140	312	505	700
Peak Power (watts)		42	70	120	173	97	170	249	322
Continuous Torque (in-oz)		18	36	93	152	98	212	336	457
Km (in-oz)		4.5	7.9	13.5	17.8	14.2	23.9	32	39
No Load Speed (rad/sec)		203	150	115	105	98	77	70	65
Temp Rise Still Air (deg C/W)		14.3	11	4.8	3.1	5	3	2.2	1.75
Temp Rise Housed (deg C/W)		6.8	5.2	2.3	1.5	2.3	1.4	1	0.8
Poles (each)		16	16	16	16	24	24	24	24
Friction Torque (in-oz)		0.09	0.19	0.38	0.57	0.40	0.79	1.19	1.59
Inertia (in-oz-sec^2)		4.0E-03	7.9E-03	1.6E-02	2.4E-02	2.8E-02	5.6E-02	8.4E-02	0.11
Weight (lbs)		0.20	0.36	0.70	1.00	0.54	1.00	1.55	2.00
O.D. Stator (inches)		2.5	2.5	2.5	2.5	3.5	3.5	3.5	3.5
O.D. Rotor (inches)		2.132	2.132	2.132	2.132	3.13	3.13	3.13	3.13
I.D. Rotor (inches)		1.548	1.548	1.548	1.548	2.57	2.57	2.57	2.57
Stack Length (inches)		0.25	0.5	1	1.5	0.5	1	1.5	2
Winding (Parameter)									
-101	V Peak T Peak I Kt Resistance	79.3 0.52 55.4 151	113 0.62 106.9 183	117 1.03 144.1 114	160 1.08 216.6 148	105 0.93 151.2 113	166 1.03 303.9 162	91 2.74 184.5 33	115 2.80 249.9 41
-102	V Peak T Peak I Kt Resistance	52 0.80 36.3 65	74.5 0.94 70.4 80	73 1.65 89.9 44	99 1.75 134.0 57	65.5 1.48 94.3 44	103 1.65 188.6 62	58 4.29 117.6 14	73 4.41 158.6 17
-103	V Peak T Peak I Kt Resistance	32.5 1.28 22.7 25	46.3 1.51 43.8 31	47 2.56 57.9 18	64 2.70 86.7 24	42 2.31 60.5 18	67 2.54 122.7 26	37 6.73 75.0 5	47 6.85 102.1 7
-104	V Peak T Peak I Kt Resistance	21 1.98 14.7 11	30 2.33 28.4 13	30 4.01 36.9 7	41 4.22 55.5 10	27 3.60 38.9 7	42.5 4.01 77.8 11		30 10.74 65.2 3
-105	V Peak T Peak I Kt Resistance	13.4 3.10 9.4 4.3	19 3.67 18.0 5.2	19 6.33 23.4 3.0	26.2 6.60 35.5 4.0	19.2 5.06 27.7 3.8	27.3 6.24 50.0 4.4		

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Z Motors Non-Redundant

Paramater		0539-050-2	0539-088-2	0539-125-2	0539-200-2	0649-050-2	0649-088-2	0649-125-2	0649-200-2
Peak Torque (in-oz)		360	690	1000	1700	550	1050	1550	2650
Peak Power (watts)		154	246	319	500	189	291	390	625
Continuous Torque (in-oz)		248	461	657	1029	383	680	984	1657
Km (in-oz)		29	44	56	76	40	61.5	78.5	106
No Load Speed (rad/sec)		61	50	45	42	49	39	36	33
Temp Rise Still Air (deg C/W)		3.2	2.2	1.7	1.3	2.6	1.9	1.4	0.95
Temp Rise Housed (deg C/W)		1.5	1	0.8	0.6	1.2	0.9	0.7	0.45
Poles (each)		48	48	48	48	48	48	48	48
Friction Torque (in-oz)		1.00	1.77	2.51	4.02	1.49	2.61	3.71	5.94
Inertia (in-oz-sec^2)		0.13	0.23	0.32	0.52	0.24	0.43	0.61	0.98
Weight (lbs)		0.87	1.52	2.08	3.30	1.10	1.85	2.58	4.10
O.D. Stator (inches)		5.399	5.399	5.399	5.399	6.499	6.499	6.499	6.499
O.D. Rotor (inches)		5.024	5.024	5.024	5.024	6.131	6.131	6.131	6.131
I.D. Rotor (inches)		4.455	4.455	4.455	4.455	5.555	5.555	5.555	5.555
Stack Length (inches)		0.5	0.88	1.25	2	0.5	0.88	1.25	2
Winding (Parameter)									
-101	V Peak T Peak I Kt Resistance	93.6 1.65 218.7 57	88 2.79 246.9 31	177 1.80 555.1 98	168 2.98 570.8 56	79.6 2.38 231.6 34	115 2.53 414.2 45	149 2.62 592.4 57	217 2.88 920.1 75
-102	V Peak T Peak I Kt Resistance	60.5 2.55 141.3 24	56 4.39 157.1 13	114 2.80 357.5 41	107 4.68 363.5 23	50.6 3.74 147.2 14	73 3.99 263.0 18	95 4.10 377.7 23	138 4.53 585.1 30
-103	V Peak T Peak I Kt Resistance	38.5 4.00 89.9 10	36 6.83 101.0 5	73 4.37 228.9 17	69 7.25 234.4 10	32.5 5.82 94.5 6	47 6.20 169.3 8	61 6.39 242.5 10	89 7.02 377.4 13
-104	V Peak T Peak I Kt Resistance	25 6.16 58.4 4	23 10.69 64.5 2	47 6.78 147.4 7	44 11.37 149.5 4	20.8 9.09 60.5 2	30 9.72 108.1 3	39 10.00 155.1 4	57 10.96 241.7 5
-105	V Peak T Peak I Kt Resistance	15.8 9.75 36.9 1.6		30 10.63 94.1 2.8	28 17.87 95.1 1.6	13.2 14.32 38.4 0.9	19 15.34 68.4 1.2	25 15.59 99.4 1.6	36 17.36 152.6 2.1

Ordering Note: Part numbers for this section are configured as follows: Z-(parameter from top of page) – (winding parameter). An example would be Z-0100-015-2-101.

Z Motors Non-Redundant

Paramater		0831-100-2	0849-050-2	0849-100-2
Peak Torque (in-oz)		1960	960	2100
Peak Power (watts)		362	248	424
Continuous Torque (in-oz)		1395	765	1691
Km (in-oz)		103	61	102
No Load Speed (rad/sec)		26	37	29
Temp Rise Still Air (deg C/W)		1.3	2	0.8
Temp Rise Housed (deg C/W)		0.6	0.7	0.4
Poles (each)		64	64	64
Friction Torque (in-oz)		4.96	2.59	5.17
Inertia (in-oz-sec^2)		1.12	0.61	1.21
Weight (lbs)		2.70	1.47	2.80
O.D. Stator (inches)		8.318	8.499	8.499
O.D. Rotor (inches)		7.95	8.1	8.1
I.D. Rotor (inches)		7.366	7.5	7.5
Stack Length (inches)		1	0.5	1
Winding (Parameter)				
-101	V Peak T Peak I Kt Resistance	20 18.11 108.3 1.1	105 2.36 407.0 45	166 2.55 822.4 65
-102	V Peak T Peak I Kt Resistance		66.8 3.71 258.9 18	106 4.00 525.2 27
-103	V Peak T Peak I Kt Resistance		43 5.76 166.7 7	67.8 6.25 335.9 11
-104	V Peak T Peak I Kt Resistance		27.5 9.01 106.6 3	43.5 9.74 215.5 4
-105	V Peak T Peak I Kt Resistance		17.5 14.15 67.8 1.2	27.5 15.41 136.2 1.8

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Z Motors Non-Redundant

Paramater		0849-200-2	0849-300-2	1050-100-2	1050-150-2	1050-200-2	1050-300-2
Peak Torque (in-lb)		290	440	220	350	480	742
Peak Power (watts)		793	1182	548	760	984	1448
Continuous Torque (in-lb)		153	245	144	225	303	457
Km (in-lb)		10.3	12.8	9.4	12.7	15.3	19.5
No Load Speed (rad/sec)		24	24	22	19	18	17
Temp Rise Still Air (deg C/W)		1	0.7	1	0.75	0.6	0.4
Temp Rise Housed (deg C/W)		0.5	0.3	0.47	0.35	0.28	0.2
Poles (each)		64	64	80	80	80	80
Friction Torque (in-lb)		0.65	0.97	0.50	0.75	1.00	1.50
Inertia (in-lb-sec^2)		0.152	0.227	0.147	0.221	0.295	0.442
Weight (lbs)		5.60	8.30	3.60	5.30	7.00	10.50
O.D. Stator (inches)		8.499	8.499	10.5	10.5	10.5	10.5
O.D. Rotor (inches)		8.1	8.1	10.089	10.089	10.089	10.089
I.D. Rotor (inches)		7.5	7.5	9.5	9.5	9.5	9.5
Stack Length (inches)		2	3	1	1.5	2	3
Winding (Parameter)							
-101	V Peak T Peak I Kt Resistance	182 4.36 66.6 42	165 7.16 61.4 23	220 2.49 88.4 88	122 6.23 56.2 20	155 6.35 75.6 24	219 6.61 112.2 33
-102	V Peak T Peak I Kt Resistance	117 6.78 42.80 17	106 11.15 39.47 10	140 3.91 56.23 36	78.5 9.68 36.18 8	99 9.94 48.28 10	140 10.34 71.75 14
-103	V Peak T Peak I Kt Resistance	75 10.57 27.44 7	67 17.64 24.95 4	90 6.09 36.15 15	49.7 15.28 22.90 3	63 15.62 30.72 4	89 16.27 45.61 5
-104	V Peak T Peak I Kt Resistance	47.5 16.69 17.38 2.8		57.6 9.51 23.13 6.1			
-105	V Peak T Peak I Kt Resistance			36.5 15.01 14.66 2.4			

Ordering Note: Part numbers for this section are configured as follows: Z-(parameter from top of page) – (winding parameter). An example would be Z-0100-015-2-101.

Z Motors Non-Redundant

Paramater		1250-100-2	1250-200-2	1250-300-2	1250-400-2	1450-050-2	1450-100-2	1450-200-2	1450-400-2	2000-125-2	2050-125-2
Peak Torque (ft-lb)		25	54.1	83	115	15.3	34	72.9	154	142	153
Peak Power (watts)		625	1301	1722	2296	416	740	1383	2635	2960	2745
Continuous Torque (ft-lb)		17	35	42	73	10	22	46	91	63	72
Km (ft-lb)		1	1.5	2	2.4	0.75	1.25	1.96	3	2.61	2.92
No Load Speed (rad/sec)		18	18	15	15	20	16	14	13	15	13
Temp Rise Still Air (deg C/W)		0.8	0.5	0.5	0.25	1.2	0.7	0.4	0.25	0.4	0.37
Temp Rise Housed (deg C/W)		0.4	0.2	0.25	0.12	0.6	0.35	0.2	0.12	0.19	0.18
Poles (each)		96	96	96	96	112	112	112	112	120	120
Friction Torque (ft-lb)		0.12	0.24	0.36	0.48	0.08	0.16	0.32	0.65	0.38	0.40
Inertia (ft-lb-sec^2)		0.018	0.036	0.055	0.073	0.017	0.034	0.067	0.135	0.150	0.163
Weight (lbs)		4.30	8.40	12.40	16.60	3.40	6.30	12.10	23.20	18	18.5
O.D. Stator (inches)		12.5	12.5	12.5	12.5	14.5	14.5	14.5	14.5	20	20.5
O.D. Rotor (inches)		12.104	12.104	12.104	12.104	14.1	14.1	14.1	14.1	19.332	19.832
I.D. Rotor (inches)		11.61	11.61	11.61	11.61	13.523	13.523	13.523	13.523	18.532	19.032
Stack Length (inches)		1	2	3	4	0.5	1	2	4	1.25	1.25
Winding (Parameter)											
-101	V Peak T Peak I Kt Resistance	100 6.25 4.0 16	173 7.52 7.2 23	100 17.22 4.8 6	203 11.31 10.2 18	73 5.70 2.7 13	116 6.38 5.3 18	200 6.92 10.5 29	150 17.57 8.8 9	120 24.67 5.8 5	120 22.88 6.7 5
-102	V Peak T Peak I Kt Resistance	64.3 9.72 2.57 7	111 11.72 4.62 9	157 10.97 7.57 14	129 17.80 6.46 7	46.8 8.89 1.72 5	74.4 9.94 3.42 7	128 10.81 6.75 12			
-103	V Peak T Peak I Kt Resistance	40.7 15.36 1.63 3	70.2 18.53 2.92 4	245 7.03 11.81 35	82.4 27.86 4.13 3	29.7 14.01 1.09 2	47.1 15.71 2.16 3	82 16.87 4.32 5			
-104	V Peak T Peak I Kt Resistance	26 24.04 1.04 1.1	45 28.91 1.87 1.6		52.3 43.90 2.62 1.2	19 21.90 0.70 0.9	30 24.66 1.38 1.2				
-105	V Peak T Peak I Kt Resistance	16.5 37.88 0.66 0.4	28.5 45.64 1.19 0.6			12 34.68 0.44 0.3	19 38.94 0.87 0.5				

Ordering Note: Part numbers for this section are configured as follows: Z-(parameter from top of page) – (winding parameter). An example would be Z-0100-015-2-101.

Z Motors Redundant

Paramater		0100-015-2	0100-025-2	0100-050-2	0100-075-2	0150-025-2	0150-050-2	0150-100-2	0250-025-2	0250-050-2
Peak Torque (in-oz)		1	1.7	3.7	5.7	5.1	11	21	17	37
Peak Power (watts)		10	12	15	19	17	25	33	28	44
Continuous Torque (in-oz)		0.7	1.2	3	4	4	7	15	13	26
Km (in-oz)		0.32	0.5	0.95	1.3	1.25	2.2	3.67	3.2	5.6
No Load Speed (rad/sec)		1383	963	581	478	462	322	221	235	167
Temp Rise Still Air (deg C/W)		45	39	24	24	26	20	14.6	14.3	11
Temp Rise Housed (deg C/W)		21.3	19	12	11.4	12	10	7	6.8	5.2
Poles (each)		4	4	4	4	10	10	10	16	16
Friction Torque (in-oz)		0.006	0.010	0.019	0.029	0.028	0.06	0.11	0.09	0.19
Inertia (in-oz-sec^2)		2.5E-05	4.2E-05	8.5E-05	1.3E-04	4.1E-04	8.2E-04	1.6E-03	4.0E-03	7.9E-03
Weight (lbs)		0.03	0.05	0.10	0.14	0.10	0.18	0.35	0.20	0.36
O.D. Stator (inches)		1	1	1	1	1.5	1.5	1.5	2.5	2.5
O.D. Rotor (inches)		0.632	0.632	0.632	0.632	1.132	1.132	1.132	2.132	2.132
I.D. Rotor (inches)		0.0625	0.0625	0.0625	0.0625	0.55	0.55	0.55	1.548	1.548
Stack Length (inches)		0.15	0.25	0.5	0.75	0.25	0.5	1	0.25	0.5
Winding (Parameter)										
201	V Peak T Peak I Kt Resistance	15.9 0.61 1.6 26	18.3 0.63 2.7 29	24.3 0.62 5.9 39	30 0.62 5.9 39	25 0.67 7.7 38	34 0.74 15.0 46	51.3 0.64 32.9 80	46.8 0.60 28.2 78	63 0.69 53.4 91
202	V Peak T Peak I Kt Resistance	6.53 1.50 0.7 4	12.1 0.96 1.8 13	16 0.95 3.9 17	20 0.96 5.9 21	16.5 1.01 5.1 16	22.3 1.12 9.8 20	34 0.96 21.8 35	31 0.91 18.7 34	41 1.06 34.8 39
203	V Peak T Peak I Kt Resistance	2.68 3.64 0.3 0.7	7.5 1.54 1.1 5	10 1.52 2.4 7	12 1.60 3.6 7	10.3 1.62 3.2 6	13.9 1.80 6.1 8	21 1.56 13.5 13	19.2 1.47 11.6 13	26 1.68 22.0 15
204	V Peak T Peak I Kt Resistance		3.1 3.73 0.5 0.8	6.5 2.33 1.6 2.8	5 3.84 1.5 1.3	6.6 2.52 2.0 2.6	9 2.78 4.0 3.2	13.6 2.41 8.7 5.6	12.4 2.28 7.5 5.4	16.7 2.61 14.2 6.4
205	V Peak T Peak I Kt Resistance			4 3.79 1.0 1.1		4.2 3.96 1.3 1.1	5.7 4.39 2.5 1.3	8.65 3.79 5.5 2.3	7.9 3.57 4.8 2.2	10.6 4.12 9.0 2.6

Ordering Note: Part numbers for this section are configured as follows: Z-(parameter from top of page) – (winding parameter). An example would be Z-0100-015-2-201.

Z Motors Redundant

Paramater		0250-100-2	0250-150-2	0350-050-2	0350-100-2	0350-150-2	0350-200-2	0375-190-2	0539-050-2	0539-088-2	0539-125-2	0539-200-2
Peak Torque (in-oz)		78	122	78	167	258	360	400	200	360	530	880
Peak Power (watts)		66	94	61	99	134	178	166	95	154	185	266
Continuous Torque (in-oz)		50	80	54	114	170	224	210	139	223	346	540
Km (in-oz)		9.6	12.6	10	16.8	22.3	27	31	20.5	29	39	54
No Load Speed (rad/sec)		120	109	110	84	73	70	59	67	61	49	43
Temp Rise Still Air (deg C/W)		8.4	5.8	8	5.1	4.1	3.3	4.8	5.1	3.8	3	2.3
Temp Rise Housed (deg C/W)		4	2.7	3.8	2.4	1.9	1.6	2.4	2.4	1.86	1.4	1.1
Poles (each)		16	16	24	24	24	24	16	48	48	48	48
Friction Torque (in-oz)		0.38	0.57	0.40	0.79	1.19	1.59	1.75	1.00	1.77	2.51	4.02
Inertia (in-oz-sec^2)		1.6E-02	2.4E-02	2.8E-02	5.6E-02	8.4E-02	0.11	0.13	0.13	0.23	0.32	0.52
Weight (lbs)		0.70	1.00	0.54	1.00	1.55	2.00	2.00	0.87	1.52	2.08	3.30
O.D. Stator (inches)		2.5	2.5	3.5	3.5	3.5	3.5	3.75	5.399	5.399	5.399	5.399
O.D. Rotor (inches)		2.132	2.132	3.13	3.13	3.13	3.13	3.38	5.024	5.024	5.024	5.024
I.D. Rotor (inches)		1.548	1.548	2.57	2.57	2.57	2.57	2.86	4.455	4.455	4.455	4.455
Stack Length (inches)		1	1.5	0.5	1	1.5	2	1.9	0.5	0.88	1.25	2
Winding (Parameter)												
201	V Peak T	62.7	84	58.8	89	119	92.5	32	52	73	94	87
	Peak I	1.05	1.12	1.03	1.11	1.12	1.92	5.20	1.83	2.11	1.96	3.05
	Kt	74.1	109.3	75.4	150.4	229.4	187.3	76.9	109.3	170.5	269.8	288.3
	Resistance	60	75	57	80	106	48	6	28	35	48	29
202	V Peak T	39	52	36.5	55	74	60		34	61	60	55.5
	Peak I	1.69	1.80	1.67	1.80	1.81	2.96		2.80	2.53	3.08	4.79
	Kt	46.1	67.7	46.8	93.0	142.6	121.5		71.4	142.5	172.2	183.9
	Resistance	23	29	22	31	41	20		12	24	19	12
203	V Peak T	25	33.6	23.6	35.7	48	38		21.5	47	38.5	35.6
	Peak I	2.64	2.79	2.58	2.77	2.79	4.68		4.43	3.28	4.80	7.46
	Kt	29.5	43.7	30.3	60.3	92.5	77.0		45.2	109.8	110.5	118.0
	Resistance	9	12	9	13	17	8		5	14	8	5
204	V Peak T	16	21.3	15	22.7	30	24.5		13.8	30	24.7	22.8
	Peak I	4.13	4.40	4.06	4.35	4.46	7.26		6.90	5.14	7.48	11.65
	Kt	18.9	27.7	19.2	38.4	57.8	49.6		29.0	70.1	70.9	75.6
	Resistance	3.9	4.8	3.7	5.2	6.7	3.4		2.0	5.8	3.3	2.0
205	V Peak T	10.3	13.7	9.7	14.6	19.5	15.6		10.8	19.30	15.8	14.5
	Peak I	6.41	6.84	6.27	6.77	6.86	11.40		8.81	7.98	11.69	18.32
	Kt	12.2	17.8	12.4	24.7	37.6	31.6		22.7	45.1	45.3	48.0
	Resistance	1.6	2.0	1.5	2.2	2.8	1.4		1.2	2.4	1.4	0.8

Ordering Note: Part numbers for this section are configured as follows: Z-(parameter from top of page) – (winding parameter). An example would be Z-0100-015-2-201.

Z Motors Redundant

Paramater		0649-050-2	0649-088-2	0649-125-2	0649-200-2	0849-050-2	0849-100-2
Peak Torque (in-oz)		305	560	825	1350	540	1140
Peak Power (watts)		115	166	221	324	158	251
Continuous Torque (in-oz)		211	361	531	853	368	755
Km (in-oz)		28.5	43.5	55.5	75	43	72
No Load Speed (rad/sec)		53	42	38	34	41	31
Temp Rise Still Air (deg C/W)		4.2	3.3	2.5	1.8	3.2	2.2
Temp Rise Housed (deg C/W)		2	1.6	1.2	0.85	1.5	1
Poles (each)		48	48	48	48	64	64
Friction Torque (in-oz)		1.49	2.61	3.71	5.94	2.59	5.17
Inertia (in-oz-sec^2)		0.24	0.43	0.61	0.98	0.61	1.21
Weight (lbs)		1.10	1.85	2.58	4.10	1.47	2.80
O.D. Stator (inches)		6.499	6.499	6.499	6.499	8.499	8.499
O.D. Rotor (inches)		6.131	6.131	6.131	6.131	8.1	8.1
I.D. Rotor (inches)		5.555	5.555	5.555	5.555	7.5	7.5
Stack Length (inches)		0.5	0.88	1.25	2	0.5	1
Winding (Parameter)							
201	V Peak T Peak I Kt Resistance	44.4 2.58 118.2 17	61.8 2.68 208.8 23	78.7 2.81 293.8 28	113 2.87 470.8 39	59 2.67 202.0 22	71.6 3.50 325.6 20
202	V Peak T Peak I Kt Resistance	28.2 4.06 75.1 7	39.3 4.22 132.8 9	50 4.42 186.7 11	72 4.50 300.0 16	37.4 4.22 128.1 9	56.5 4.44 256.9 13
203	V Peak T Peak I Kt Resistance	18.1 6.33 48.2 3	25 6.63 84.5 4	32.2 6.86 120.2 5	46 7.04 191.7 7	24 6.57 82.2 4	36.3 6.91 165.1 5
204	V Peak T Peak I Kt Resistance	11.6 9.87 30.9 1.2	16.2 10.23 54.7 1.6	20.6 10.73 76.9 1.9	29.5 10.98 122.9 2.7	15.4 10.24 52.7 1.5	23.3 10.76 106.0 2.2
205	V Peak T Peak I Kt Resistance	7.4 15.48 19.7 0.5	10.3 16.09 34.8 0.6	13 17.00 48.5 0.8	18.7 17.33 77.9 1.1	9.8 16.09 33.6 0.6	14.7 17.05 66.8 0.9

Ordering Note: Part numbers for this section are configured as follows: Z-(parameter from top of page) – (winding parameter). An example would be Z-0100-015-2-201.

Z Motors Redundant

Paramater		0849-200-2	0849-300-2	1050-100-2	1050-150-2	1050-200-2	1050-300-2
Peak Torque (in-lb)		148	225	118	180	244	373
Peak Power (watts)		435	611	310	423	530	763
Continuous Torque (in-lb)		74	95	76	114	157	224
Km (in-lb)		7.1	9.1	6.7	8.75	10.6	13.5
No Load Speed (rad/sec)		26	24	23	21	19	18
Temp Rise Still Air (deg C/W)		2	1.4	1.8	1.4	1.1	0.8
Temp Rise Housed (deg C/W)		1	1	0.85	0.65	0.5	0.4
Poles (each)		64	64	80	80	80	80
Friction Torque (in-lb)		0.65	0.97	0.50	0.75	1.00	1.50
Inertia (in-lb-sec^2)		0.152	0.227	0.147	0.221	0.295	0.442
Weight (lbs)		5.60	8.30	3.60	5.30	7.00	10.50
O.D. Stator (inches)		8.499	8.499	10.5	10.5	10.5	10.5
O.D. Rotor (inches)		8.1	8.1	10.089	10.089	10.089	10.089
I.D. Rotor (inches)		7.5	7.5	9.5	9.5	9.5	9.5
Stack Length (inches)		2	3	1	1.5	2	3
Winding (Parameter)							
201	V Peak T Peak I Kt Resistance	149 2.92 50.8 51	208 2.94 76.6 71	118 2.63 44.9 45	157 2.70 66.8 58	197 2.69 90.7 73	275 2.78 134.4 99
202	V Peak T Peak I Kt Resistance	94.5 4.60 32.19 21	132 4.63 48.58 29	75 4.14 28.53 18	100 4.23 42.53 24	125 4.24 57.56 29	175 4.36 85.51 40
203	V Peak T Peak I Kt Resistance	60.7 7.16 20.67 8	85 7.19 31.28 12	48 6.46 18.26 7	64.4 6.57 27.39 10	80.5 6.58 37.07 12	113 6.76 55.21 17
204	V Peak T Peak I Kt Resistance	39 11.14 13.28 3.5	54 11.32 19.87 4.8	31 10.01 11.79 3.1	41.2 10.27 17.52 4.0	51.6 10.27 23.76 5.0	72 10.60 35.18 6.8
205	V Peak T Peak I Kt Resistance	24.6 17.66 8.38 1.39	34.5 17.72 12.70 1.95	19.6 15.83 7.46 1.24	26.1 16.21 11.10 1.61	32.7 16.20 15.06 2.02	46 16.60 22.48 2.77

Ordering Note: Part numbers for this section are configured as follows: Z-(parameter from top of page) – (winding parameter). An example would be Z-0100-015-2-201.

Z Motors Redundant

Paramater		1250-100-2	1250-200-2	1250-300-2	1250-400-2	1450-050-2	1450-100-2	1450-200-2	1450-400-2
Peak Torque (ft-lb)		13.1	28.1	41.6	57.8	8.5	18.1	37.5	78
Peak Power (watts)		350	653	909	1198	257	423	738	1380
Continuous Torque (ft-lb)		9	18	26	36	6	12	23	47
Km (ft-lb)		0.7	1.1	1.38	1.67	0.53	0.88	1.38	2.1
No Load Speed (rad/sec)		20	17	16	15	22	17	15	13
Temp Rise Still Air (deg C/W)		1.5	0.9	0.65	0.5	1.9	1.3	0.8	0.47
Temp Rise Housed (deg C/W)		0.7	0.4	0.3	0.24	0.9	0.6	0.4	0.22
Poles (each)		96	96	96	96	112	112	112	112
Friction Torque (ft-lb)		0.12	0.24	0.36	0.48	0.08	0.16	0.32	0.65
Inertia (ft-lb-sec^2)		0.018	0.036	0.055	0.073	0.017	0.034	0.067	0.135
Weight (lbs)		4.30	8.40	12.40	16.60	3.40	6.30	12.10	23.20
O.D. Stator (inches)		12.5	12.5	12.5	12.5	14.5	14.5	14.5	14.5
O.D. Rotor (inches)		12.104	12.104	12.104	12.104	14.1	14.1	14.1	14.1
I.D. Rotor (inches)		11.61	11.61	11.61	11.61	13.523	13.523	13.523	13.523
Stack Length (inches)		1	2	3	4	0.5	1	2	4
Winding (Parameter)									
201	V Peak T Peak I Kt Resistance	53.7 6.52 2.0 8	90 7.25 3.9 12	51.1 17.78 2.3 3	162 7.39 7.8 22	40.7 6.32 1.3 6	62 6.82 2.7 9	162 4.56 8.2 36	120 11.50 6.8 10
202	V Peak T Peak I Kt Resistance	34.4 10.18 1.29 3	57.6 11.33 2.48 5	80.7 11.26 3.69 7	104 11.52 5.02 9	26 9.89 0.86 3	39.6 10.68 1.69 4	104 7.10 5.28 15	76 18.15 4.30 4
203	V Peak T Peak I Kt Resistance	21.8 16.07 0.82 1.4	36.5 17.88 1.57 2.0	126 7.21 5.77 17.5	65.8 18.21 3.17 3.6	16.5 15.59 0.55 1.1	25.1 16.85 1.07 1.5	67 11.02 3.40 6.1	
204	V Peak T Peak I Kt Resistance	13.9 25.20 0.52 0.6	23.3 28.01 1.00 0.8	196 4.64 8.97 42.3	42 28.52 2.03 1.5	10.5 24.50 0.35 0.4	16 26.44 0.68 0.6	42 17.58 2.13 2.4	
205	V Peak T Peak I Kt Resistance	8.86 39.53 0.33 0.2	14.8 44.09 0.64 0.3		26.7 44.87 1.29 0.6		10.2 41.48 0.44 0.2		

Ordering Note: Part numbers for this section are configured as follows: Z-(parameter from top of page) – (winding parameter). An example would be Z-0100-015-2-201.

AZ Motors Non-Redundant

Paramater		0175-012-2	0175-025-2	0175-050-2	0175-075-2	0225-025-2	0225-050-2	0225-100-2	0325-025-2	0325-050-2	0325-100-2	0425-050-2
Peak Torque (in-oz)		3.7	8.2	18.2	28.9	17.2	38.5	85.7	46	103	228	203
Peak Power (watts)		12	18	29	39	27	43	78	46	72	126	102
Continuous Torque (in-oz)		2	4	9	15	8	20	43	23	53	117	103
Km (in-oz)		1.05	1.94	3.4	4.6	3.3	5.9	9.7	6.8	12.1	20.3	20.1
No Load Speed (rad/sec)		475	309	223	193	224	157	129	141	100	78	71
Temp Rise Still Air (deg C/W)		68.91	48	29.9	22	34	19.7	11.2	18.7	11.7	6.6	8.3
Temp Rise Housed (deg C/W)		34	24	15	11	17	9.8	5.6	9.4	5.8	3.3	4.2
Poles (each)		10	10	10	10	12	12	12	20	20	20	28
Friction Torque (in-oz)		0.010	0.020	0.040	0.061	0.048	0.10	0.19	0.13	0.26	0.53	0.51
Inertia (in-oz-sec^2)		1.0E-03	2.0E-03	4.0E-03	6.0E-03	4.8E-03	9.6E-03	1.9E-02	1.6E-02	3.3E-02	6.5E-02	7.8E-02
Weight (lbs)		0.08	0.13	0.25	0.38	0.19	0.36	0.70	0.30	0.57	1.11	0.78
O.D. Stator (inches)		0.8	0.8	0.8	0.8	1.3	1.3	1.3	2.3	2.3	2.3	3.3
O.D. Rotor (inches)		1.752	1.752	1.752	1.752	2.252	2.252	2.252	3.252	3.252	3.252	4.252
I.D. Rotor (inches)		1.168	1.168	1.168	1.168	1.668	1.668	1.668	2.668	2.668	2.668	3.668
Stack Length (inches)		0.125	0.25	0.5	0.75	0.25	0.5	1	0.25	0.5	1	0.5
Winding (Parameter)												
101	V Peak T	2.87	3.72	5.37	6.98	5.96	8.52	13.47	9.82	14.04	22.2	12.5
	Peak I	4.33	4.80	5.34	5.65	4.56	5.00	5.79	4.66	5.16	5.68	8.16
	Kt	0.9	1.7	3.4	5.1	3.8	7.7	14.8	9.9	20.0	40.1	24.9
	Resistance	0.7	0.8	1.0	1.2	1.3	1.7	2.3	2.1	2.7	3.9	1.5
102	V Peak T	4.4	5.8	8.35	10.86	9.28	13.25	20.96	15.28	21.9	34.6	19.6
	Peak I	2.82	30.8	3.43	3.63	2.93	3.21	3.72	2.99	3.31	3.65	5.20
	Kt	1.3	2.7	5.3	8.0	5.9	12.0	23.0	15.4	31.1	62.5	39.0
	Resistance	2	2	2	3	3	4	6	5	7	9	4
103	V Peak T	7.03	9.12	13.13	17.07	14.59	20.84	32.95	24	34.3	54.4	30.5
	Peak I	1.77	1.96	2.18	2.31	1.86	2.04	2.37	1.91	2.11	2.32	3.34
	Kt	2.1	4.2	8.3	12.5	9.2	18.8	36.2	24.1	48.8	98.3	60.7
	Resistance	4	5	6	7	8	10	14	13	16	23	9
104	V Peak T	10.89	14.12	20.34	26.44	22.6	32.27	51.03	37.2	53.2	84.2	47.9
	Peak I	1.14	1.27	1.41	1.49	1.20	1.32	1.53	1.23	1.36	1.50	2.13
	Kt	3.2	6.5	12.9	19.4	14.3	29.2	56.0	37.4	75.6	152.2	95.3
	Resistance	10	11	14	18	19	24	33	30	39	56	22
105	V Peak T	17.52	22.71	32.72	42.53	36.35	51.91	82.08	59.8	85.6	135.6	74.15
	Peak I	0.71	0.79	0.88	0.93	0.75	0.82	0.95	0.77	0.85	0.93	1.38
	Kt	5.2	10.4	20.8	31.1	23.0	46.9	90.1	60.1	121.7	245.1	147.6
	Resistance	25	29	37	46	49	63	86	78	101	146	54

Ordering Note: Part numbers for this section are configured as follows: Z-(parameter from top of page) – (winding parameter). An example would be AZ-0175-012-2-101.

AZ Motors Non-Redundant

Paramater		0425-100-2	0425-150-2	0425-200-2	0615-050-2	0615-100-2	0615-150-2	0615-200-2	0725-050-2	0725-100-2
Peak Torque (in-oz)		450	705	966	478	1058	1664	2280	697	1524
Peak Power (watts)		179	254	331	158	273	392	510	187	332
Continuous Torque (in-oz)		227	366	498	243	548	840	1184	353	770
Km (in-oz)		33.6	44.2	53.1	38	64	84	101	51	83.7
No Load Speed (rad/sec)		56	51	49	47	37	33	32	38	31
Temp Rise Still Air (deg C/W)		4.7	3.3	2.5	5.37	3.06	2.1	1.6	4.5	2.5
Temp Rise Housed (deg C/W)		2.4	1.6	1.25	2.7	1.5	1.1	0.8	2.3	1.3
Poles (each)		28	28	28	42	42	42	42	48	48
Friction Torque (in-oz)		1.01	1.52	2.03	1.18	2.37	3.55	4.73	1.70	3.40
Inertia (in-oz-sec^2)		1.6E-01	2.3E-01	3.1E-01	0.25	0.50	0.75	1.00	0.42	0.84
Weight (lbs)		1.22	2.25	2.90	1.19	2.30	3.40	4.51	1.43	2.75
O.D. Stator (inches)		3.3	3.3	3.3	5.199	5.199	5.199	5.199	6.299	6.299
O.D. Rotor (inches)		4.252	4.252	4.252	6.151	6.151	6.151	6.151	7.251	7.251
I.D. Rotor (inches)		3.668	3.668	3.668	5.567	5.567	5.567	5.567	6.667	6.667
Stack Length (inches)		1	1.5	2	0.5	1	1.5	2	0.5	1
Winding (Parameter)										
101	V Peak T	19.9	14.2	34.3	12.3	19.5	26.6	33.66	9.61	23.75
	Peak I	9.01	17.92	9.65	12.86	14.01	14.75	15.14	19.44	13.96
	Kt	49.9	39.3	100.1	37.2	75.5	112.8	150.6	35.9	109.2
	Resistance	2.2	0.8	3.6	1.0	1.4	1.8	2.2	0.5	1.7
102	V Peak T	31.03	22.1	53.6	19.3	30.8	41.97	53.11	15.03	37.47
	Peak I	5.78	11.51	6.17	8.20	8.87	9.35	9.60	12.43	8.85
	Kt	77.8	61.2	156.5	58.3	119.2	178.0	237.6	56.1	172.2
	Resistance	5	2	9	2	3	4	6	1	4
103	V Peak T	48.2	34.5	83.4	30.3	48	65.49	82.88	23.72	58.45
	Peak I	3.72	7.37	3.97	5.22	5.69	5.99	6.15	7.87	5.67
	Kt	120.9	95.6	243.4	91.5	185.8	277.7	370.8	88.5	268.7
	Resistance	13	5	21	6	8	11	13	3	10
104	V Peak T	75.9	54.2	131	47.1	74.7	101.92	128.97	37.02	91
	Peak I	2.36	4.69	2.53	3.36	3.66	3.85	3.95	5.05	3.64
	Kt	190.4	150.2	382.4	142.3	289.2	432.2	577.0	138.1	418.3
	Resistance	32	12	52	14	20	26	33	7	25
105	V Peak T	117.5	84.01	202.9	74.1	117.4	160.21	202.73	57.61	143.05
	Peak I	1.53	3.03	1.63	2.14	2.33	2.45	2.51	3.24	2.32
	Kt	294.8	232.8	592.2	223.9	454.5	679.4	907.0	215.0	657.6
	Resistance	77	28	124	35	50	65	81	18	62

Ordering Note: Part numbers for this section are configured as follows: Z-(parameter from top of page) – (winding parameter). An example would be AZ-0175-012-2-101.

AZ Motors Non-Redundant

Paramater		0725-150-2	0725-200-2	0925-050-2	0925-100-2	0925-200-2	0925-300-2	1125-100-2	1125-200-2	1125-300-2	1125-400-2
Peak Torque (in-lb)		146	206	73.6	163	356	550	251	540	835	1132.7
Peak Power (watts)		475	627	253	448	811	1182	550	1009	1467	1927
Continuous Torque (in-lb)		74	103	37	82	125	284	130	315	432	577
Km (in-lb)		6.7	8.23	4.63	7.7	12.5	16	10.7	17	21.8	25.8
No Load Speed (rad/sec)		29	27	30	24	20	19	19	17	16	15
Temp Rise Still Air (deg C/W)		1.8	1.4	3.4	1.92	2.2	0.71	1.55	0.64	0.57	0.43
Temp Rise Housed (deg C/W)		0.9	0.7	1.7	0.96	1.1	0.35	0.75	0.32	0.28	0.22
Poles (each)		48	64	64	64	64	64	80	80	80	80
Friction Torque (in-lb)		0.32	0.43	0.18	0.36	0.72	1.08	0.55	1.09	1.64	2.18
Inertia (in-lb-sec^2)		0.079	0.105	0.056	0.112	0.224	0.335	0.205	0.409	0.614	0.818
Weight (lbs)		4.06	5.40	1.89	3.64	7.16	10.67	4.48	8.79	13.10	17.40
O.D. Stator (inches)		6.299	6.299	8.278	8.278	8.278	8.278	10.279	10.279	10.279	10.279
O.D. Rotor (inches)		7.251	7.251	9.251	9.251	9.251	9.251	11.252	11.252	11.252	11.252
I.D. Rotor (inches)		6.667	6.667	8.667	8.667	8.667	8.667	10.668	10.668	10.668	10.668
Stack Length (inches)		1.5	2	0.5	1	2	3	1	2	3	4
Winding (Parameter)											
101	V Peak T	79.64	40.96	19.66	31	34.08	48.27	24.39	41.98	59.49	76.96
	Peak I	5.96	15.30	12.85	14.46	23.80	24.48	22.56	24.04	24.66	25.05
	Kt	24.5	13.5	5.7	11.3	15.0	22.5	11.1	22.5	33.9	45.2
	Resistance	13.4	2.7	1.5	2.1	1.4	2.0	1.1	1.7	2.4	3.1
102	V Peak T	123.93	64.52	31.02	48.9	53.32	75.53	38.16	65.69	93.08	120.42
	Peak I	3.83	9.71	8.15	9.16	15.21	15.64	14.42	15.36	15.76	16.01
	Kt	38.1	21.2	9.0	17.8	23.4	35.2	17.4	35.2	53.0	70.8
	Resistance	32	7	4	5	4	5	3	4	6	8
103	V Peak T	194.81	100.69	48.41	76.32	84.12	119.16	60.2	103.64	146.84	189.97
	Peak I	2.44	6.22	5.22	5.87	9.64	9.92	9.14	9.74	9.99	10.15
	Kt	59.9	33.1	14.1	27.8	36.9	55.5	27.5	55.5	83.6	111.6
	Resistance	80	16	9	13	9	12	7	11	15	19
104	V Peak T		156.69	75.33	118.76	131.28	185.96	93.95	161.73		
	Peak I		4.00	3.35	3.77	6.18	6.35	5.86	6.24		
	Kt		51.5	21.9	43.2	57.6	86.6	42.9	86.6		
	Resistance		39	22	31	21	29	16	26		
105	V Peak T			118.42	186.67	204.29		146.2	251.67		
	Peak I			2.13	2.40	3.97		3.76	4.01		
	Kt			34.5	67.9	89.7		66.7	134.7		
	Resistance			55	78	51		39	63		

Ordering Note: Part numbers for this section are configured as follows: Z-(parameter from top of page) – (winding parameter). An example would be AZ-0175-012-2-101.

AZ Motors Non-Redundant

Paramater		1325-100-2	1325-200-2	1325-300-2	1325-400-2	1525-050-2	1525-100-2	1525-200-2
Peak Torque (ft-lb)		29.6	64	99	134	18	40	86
Peak Power (watts)		651	1210	1745	2290	428	740	1398
Continuous Torque (ft-lb)		15	33	51	45	9	21	44
Km (ft-lb)		1.16	1.84	2.37	2.8	0.87	1.47	2.3
No Load Speed (rad/sec)		16	14	13	13	18	14	12
Temp Rise Still Air (deg C/W)		1.3	0.7	0.48	0.86	2	1.1	0.61
Temp Rise Housed (deg C/W)		0.65	0.35	0.24	0.43	1	0.55	0.3
Poles (each)		96	96	96	96	112	112	112
Friction Torque (ft-lb)		0.06	0.13	0.19	0.26	0.04	0.09	0.17
Inertia (ft-lb-sec^2)		0.028	0.056	0.084	0.113	0.028	0.057	0.114
Weight (lbs)		5.27	10.42	15.54	20.65	3.10	6.00	11.70
O.D. Stator (inches)		12.28	12.28	12.28	12.28	14.28	14.28	14.28
O.D. Rotor (inches)		13.252	13.252	13.252	13.252	15.252	15.252	15.252
I.D. Rotor (inches)		12.668	12.668	12.668	12.668	14.468	14.468	14.468
Stack Length (inches)		1	2	3	4	0.5	1	2
Winding (Parameter)								
101	V Peak T	28.96	49.88	44.92	58.12	13.35	21.18	36.61
	Peak I	22.48	24.25	38.84	39.41	32.06	34.96	38.19
	Kt	1.3	2.6	2.5	3.4	0.6	1.1	2.3
	Resistance	1.3	2.1	1.2	1.5	0.4	0.6	1.0
102	V Peak T	45.31	78.04	70.69	91.47	21.01	33.34	57.61
	Peak I	14.37	15.50	24.68	25.04	20.37	22.21	24.27
	Kt	2.06	4.13	4.01	5.35	0.88	1.80	3.54
	Resistance	3	5	3	4	1	2	2
103	V Peak T	71.48	123.13	110.61	143.12	32.88	52.17	90.15
	Peak I	9.11	9.83	15.78	16.00	13.02	14.19	15.51
	Kt	3.25	6.51	6.28	8.37	1.38	2.82	5.55
	Resistance	8	13	7	9	3	4	6
104	V Peak T	111.56		174.5		51.87	82.31	142.22
	Peak I	5.84		10.00		8.25	9.00	9.83
	Kt	5.07		9.90		2.18	4.45	8.75
	Resistance	19		17		6	9	14
105	V Peak T	173.6				80.95	128.45	
	Peak I	3.75				5.29	5.76	
	Kt	7.89				3.40	6.94	
	Resistance	46				15	22	

Ordering Note: Part numbers for this section are configured as follows: Z-(parameter from top of page) – (winding parameter). An example would be AZ-0175-012-2-101.

AZ Motors Redundant

Paramater		0175-012-2	0175-025-2	0175-050-2	0175-075-2	0225-025-2	0225-050-2	0225-100-2	0325-025-2	0325-050-2	0325-100-2
Peak Torque (in-oz)		2.3	4.8	10.2	15.7	10.2	21.6	45.8	27	58	122
Peak Power (watts)		10	12	18	23	18	26	43	32	45	72
Continuous Torque (in-oz)		1.4	2.5	5	10	5	11	24	14	30	62
Km (in-oz)		0.74	1.37	2.4	3.3	2.4	4.2	7	4.8	8.6	14.4
No Load Speed (rad/sec)		595	362	251	204	251	173	132	166	111	83
Temp Rise Still Air (deg C/W)		61	69	48	27	45.3	31.6	19.7	27	18.7	11.7
Temp Rise Housed (deg C/W)		30	34	24	13	22	16	9	13	9	6
Poles (each)		10	10	10	10	12	12	12	20	20	20
Friction Torque (in-oz)		0.010	0.020	0.040	0.061	0.048	0.10	0.19	0.13	0.26	0.53
Inertia (in-oz-sec^2)		1.0E-03	2.0E-03	4.0E-03	6.0E-03	4.8E-03	9.6E-03	1.9E-02	1.6E-02	3.3E-02	6.5E-02
Weight (lbs)		0.08	0.13	0.25	0.38	0.19	0.36	0.70	0.30	0.57	1.11
O.D. Stator (inches)		0.8	0.8	0.8	0.8	1.3	1.3	1.3	2.3	2.3	2.3
O.D. Rotor (inches)		1.752	1.752	1.752	1.752	2.252	2.252	2.252	3.252	3.252	3.252
I.D. Rotor (inches)		1.168	1.168	1.168	1.168	1.668	1.668	1.668	2.668	2.668	2.668
Stack Length (inches)		0.125	0.25	0.5	0.75	0.25	0.5	1	0.25	0.5	1
Winding (Parameter)											
201	V Peak T Peak I Kt Resistance	1.79 5.40 0.4 0.3	2.2 5.58 0.9 0.4	2.99 6.04 1.7 0.5	3.78 5.99 2.6 0.6	3.52 5.13 2.0 0.7	4.75 5.57 3.9 0.9	7.19 5.95 7.7 1.2	5.8 5.46 4.9 1.1	7.8 5.83 9.9 1.3	11.9 6.03 20.2 2.0
202	V Peak T Peak I Kt Resistance	2.8 3.45 0.7 0.8	3.42 3.59 1.3 1	4.66 3.88 2.6 1	5.89 3.84 4.1 2	5.48 3.30 3.1 2	7.39 3.58 6.0 2	11.19 3.83 12.0 3	9 3.52 7.7 3	12.2 3.73 15.6 3	18.4 3.90 31.3 5
203	V Peak T Peak I Kt Resistance	4.4 2.20 1.0 2	5.38 2.28 2.1 2	7.33 2.46 4.1 3	9.26 2.44 6.4 4	8.61 2.10 4.9 4	11.63 2.27 9.5 5	17.59 2.43 18.8 7	14.2 2.23 12.1 6	19.1 2.38 24.4 8	29 2.48 49.3 12
204	V Peak T Peak I Kt Resistance	6.81 1.42 1.6 5	8.33 1.47 3.3 6	9.6 1.88 5.4 5	14.35 1.58 10.0 9	13.34 1.35 7.5 10	18.01 1.47 14.7 12	27.24 1.57 29.1 17	21 1.51 17.9 14	29.7 1.53 37.9 19	45 1.60 76.5 28
205	V Peak T Peak I Kt Resistance	10.96 0.88 2.6 12	13.41 0.92 5.2 15	18.26 0.99 10.3 18	23.08 0.98 16.0 24	21.46 0.84 12.1 25	28.97 0.91 23.7 32	43.82 0.98 46.9 45	25.3 1.25 21.6 20	47.8 0.95 61.0 50	72.3 0.99 122.9 73

Ordering Note: Part numbers for this section are configured as follows: Z-(parameter from top of page) – (winding parameter). An example would be AZ-0175-012-2-201.

AZ Motors Redundant

Paramater		0425-050-2	0425-100-2	0425-150-2	0425-200-2	0615-050-2	0615-100-2	0615-150-2	0615-200-2	0725-050-2	0725-100-2
Peak Torque (in-oz)		113	224	370	502	266	565	872	1182	380	808
Peak Power (watts)		63	89	140	178	97	158	218	277	118	189
Continuous Torque (in-oz)		58	115	190	260	137	287	438	589	193	406
Km (in-oz)		14.2	23.8	31.3	37.6	27	45	59	71	35	58.7
No Load Speed (rad/sec)		79	56	53	50	52	40	35	33	44	33
Temp Rise Still Air (deg C/W)		13.3	9.5	6	4.7	8.6	5.3	3.9	3.1	7.2	4.5
Temp Rise Housed (deg C/W)		6.5	4.75	3	2.3	4.3	2.7	2	1.6	3.6	2.3
Poles (each)		28	28	28	28	42	42	42	42	48	48
Friction Torque (in-oz)		0.51	1.01	1.52	2.03	1.18	2.37	3.55	4.73	1.70	3.40
Inertia (in-oz-sec^2)		7.8E-02	1.6E-01	2.3E-01	3.1E-01	0.25	0.50	0.75	1.00	0.42	0.84
Weight (lbs)		0.78	1.22	2.25	2.90	1.19	2.30	3.40	4.51	1.43	2.75
O.D. Stator (inches)		3.3	3.3	3.3	3.3	5.199	5.199	5.199	5.199	6.299	6.299
O.D. Rotor (inches)		4.252	4.252	4.252	4.252	6.151	6.151	6.151	6.151	7.251	7.251
I.D. Rotor (inches)		3.668	3.668	3.668	3.668	5.567	5.567	5.567	5.567	6.667	6.667
Stack Length (inches)		0.5	1	1.5	2	0.5	1	1.5	2	0.5	1
Winding (Parameter)											
201	V Peak T	7	9.9	27.1	17.8	6.8	10.4	13.93	17.45	13.24	20
	Peak I	9.05	8.95	5.16	10.01	14.27	15.16	15.68	15.88	8.90	9.47
	Kt	12.5	25.0	71.8	50.1	18.6	37.3	55.6	74.4	42.7	85.3
	Resistance	0.8	1.1	5	1.8	0.5	0.7	0.9	1.1	1.5	2.1
202	V Peak T	10.9	15.4	42.3	27.7	10.8	16.4	21.99	27.53	20.66	31.22
	Peak I	5.81	5.75	3.30	6.44	8.99	9.61	9.93	10.07	5.71	6.07
	Kt	19.5	38.9	112.0	78.0	29.6	58.8	87.8	117.4	66.6	133.1
	Resistance	2	3	13	4	1	2	2	3	4	5
203	V Peak T	17	24.1	65.8	43.2	16.92	25.6	34.31	42.97	32.15	48.58
	Peak I	3.73	3.68	2.12	4.13	5.74	6.16	6.37	6.45	3.67	3.90
	Kt	30.3	60.9	174.2	121.7	46.4	91.8	137.0	183.3	103.6	207.2
	Resistance	5	7	31	10	3	4	5	7	9	12
204	V Peak T	26.7	37.9	103.5	67.9	26.3	39.9	53.4	66.87	50.54	76.37
	Peak I	2.37	2.34	1.35	2.63	3.69	3.95	4.09	4.14	2.33	2.48
	Kt	47.6	95.8	274.0	191.2	72.1	143.0	213.2	285.2	162.9	325.7
	Resistance	11	16	77	26	7	10	13	16	22	31
205	V Peak T	41.4	58.6	160.3	105.2	41.3	62.7	83.93	105.11	78.26	118.26
	Peak I	1.53	1.51	0.87	1.69	2.35	2.51	2.60	2.64	1.51	1.60
	Kt	73.9	148.2	424.4	296.3	113.2	224.7	335.0	448.3	252.3	504.3
	Resistance	27	39	184	62	18	25	32	40	52	74

Ordering Note: Part numbers for this section are configured as follows: Z-(parameter from top of page) – (winding parameter). An example would be AZ-0175-012-2-201.

AZ Motors Redundant

Paramater		0725-150-2	0725-200-2	0925-050-2	0925-100-2	0925-200-2	0925-300-2	1125-100-2	1125-200-2	1125-300-2	1125-400-2
Peak Torque (in-lb)		76	107	41.2	87	185	282	135	280	429	578
Peak Power (watts)		261	340	156	250	442	623	316	544	776	1009
Continuous Torque (in-lb)		39	53	21	44	65	142	67	141	228	295
Km (in-lb)		4.7	5.8	3.3	5.5	8.8	11.3	7.6	12	15.4	18.2
No Load Speed (rad/sec)		30	28	34	25	21	20	21	17	16	15
Temp Rise Still Air (deg C/W)		3.2	2.5	5.3	3.35	1.9	1.4	2.71	1.6	1.09	0.84
Temp Rise Housed (deg C/W)		1.6	1.3	2.6	1.7	2	0.7	1.4	0.8	0.5	0.42
Poles (each)		48	64	64	64	64	64	80	80	80	80
Friction Torque (in-lb)		0.32	0.43	0.18	0.36	0.72	1.08	0.55	1.09	1.64	2.18
Inertia (in-lb-sec^2)		0.079	0.105	0.056	0.112	0.224	0.335	0.205	0.409	0.614	0.818
Weight (lbs)		4.06	5.40	1.89	3.64	7.16	10.67	4.48	8.79	13.10	17.40
O.D. Stator (inches)		6.299	6.299	8.278	8.278	8.278	8.278	10.279	10.279	10.279	10.279
O.D. Rotor (inches)		7.251	7.251	9.251	9.251	9.251	9.251	11.252	11.252	11.252	11.252
I.D. Rotor (inches)		6.667	6.667	8.667	8.667	8.667	8.667	10.668	10.668	10.668	10.668
Stack Length (inches)		1.5	2	0.5	1	2	3	1	2	3	4
Winding (Parameter)											
201	V Peak T	41.72	22	11.02	16.6	17.7	24.78	13.06	21.81	30.54	39.27
	Peak I	6.27	15.47	14.14	15.07	24.97	25.13	24.16	24.96	25.41	25.68
	Kt	12.1	6.9	2.9	5.8	7.4	11.2	5.6	11.2	16.9	22.5
	Resistance	7	1.4	0.8	1.1	0.7	1.0	0.5	0.9	1.2	1.5
202	V Peak T	64.93	33.45	17.39	26.19	27.7	38.78	20.44	34.13	47.7	61.44
	Peak I	4.03	10.17	8.96	9.55	15.96	16.06	15.44	15.95	16.27	16.42
	Kt	18.9	10.5	4.6	9.1	11.6	17.6	8.7	17.6	26.4	35.2
	Resistance	16	3	2	3	2	2	1	2	3	4
203	V Peak T	102.07	52.21	27.14	40.88	43.71	61.18	32.25	53.84	75.4	96.94
	Peak I	2.56	6.52	5.74	6.12	10.11	10.18	9.78	10.11	10.29	10.40
	Kt	29.7	16.4	7.2	14.2	18.3	27.7	13.8	27.7	41.7	55.6
	Resistance	40	8	5	7	4	6	3	5	7	9
204	V Peak T	158.05	81.24	42.24	63.61	68.21	95.48	50.33	84.03	117.67	151.28
	Peak I	1.65	4.19	3.69	3.93	6.48	6.52	6.27	6.48	6.59	6.67
	Kt	45.9	25.5	11.2	22.1	28.6	43.2	21.5	43.2	65.1	86.7
	Resistance	96	19	11	16	11	15	8	13	18	23
205	V Peak T		127.71	66.4	100	106.14	148.53	78.32	130.76	183.1	
	Peak I		2.66	2.35	2.50	4.16	4.19	4.03	4.16	4.24	
	Kt		40.2	17.6	34.8	44.4	67.3	33.5	67.2	101.2	
	Resistance		48	28	40	25	35	19	31	43	

Ordering Note: Part numbers for this section are configured as follows: Z-(parameter from top of page) – (winding parameter). An example would be AZ-0175-012-2-201.

AZ Motors Redundant

Paramater		1325-100-2	1325-200-2	1325-300-2	1325-400-2	1525-050-2	1525-100-2	1525-200-2
Peak Torque (ft-lb)		15.2	33	51	69	9.9	21	45
Peak Power (watts)		380	644	933	1190	263	441	791
Continuous Torque (ft-lb)		8	17	26	35	5	10	23
Km (ft-lb)		0.78	1.3	1.67	2	0.61	1	1.6
No Load Speed (rad/sec)		18	14	13	13	20	15	13
Temp Rise Still Air (deg C/W)		2.3	1.3	0.91	0.7	3.2	2	1.14
Temp Rise Housed (deg C/W)		1.15	0.65	0.45	0.35	1.6	1	0.55
Poles (each)		96	96	96	96	112	112	112
Friction Torque (ft-lb)		0.06	0.13	0.19	0.26	0.04	0.09	0.17
Inertia (ft-lb-sec^2)		0.028	0.056	0.084	0.113	0.028	0.057	0.114
Weight (lbs)		5.27	10.42	15.54	20.65	3.10	6.00	11.70
O.D. Stator (inches)		12.28	12.28	12.28	12.28	14.28	14.28	14.28
O.D. Rotor (inches)		13.252	13.252	13.252	13.252	15.252	15.252	15.252
I.D. Rotor (inches)		12.668	12.668	12.668	12.668	14.468	14.468	14.468
Stack Length (inches)		1	2	3	4	0.5	1	2
Winding (Parameter)								
201	V Peak T Peak I Kt Resistance	59.76 6.35 2.4 9	25.91 24.87 1.3 1.0	23.06 40.44 1.3 0.6	29.65 40.14 1.7 0.7	11.7 22.51 0.4 0.5	11.29 39.06 0.5 0.3	18.96 41.72 1.1 0.5
202	V Peak T Peak I Kt Resistance	92.98 4.08 3.72 23	40.54 15.89 2.08 3	36.29 25.70 1.98 1	46.67 25.50 2.71 2	18.31 14.39 0.69 1	17.77 24.82 0.85 1	29.84 26.51 1.70 1
203	V Peak T Peak I Kt Resistance	146.15 2.60 5.85 56	63.96 10.07 3.28 6	56.79 16.42 3.11 3	73.02 16.30 4.23 4	28.89 9.12 1.09 3	27.81 15.86 1.32 2	46.7 16.94 2.66 3
204	V Peak T Peak I Kt Resistance		99.82 6.46 5.11 15	89.59 10.41 4.90 9	115.21 10.33 6.68 11	45.08 5.84 1.69 8	43.88 10.05 2.09 4	73.67 10.74 4.19 7
205	V Peak T Peak I Kt Resistance		155.34 4.15 7.96 37	136.82 6.82 7.48 20	179.79 6.62 10.42 27		68.97 6.39 3.28 11	114.97 6.88 6.54 17

Ordering Note: Part numbers for this section are configured as follows: Z-(parameter from top of page) – (winding parameter). An example would be AZ-0175-012-2-201.